

EDITORIAL

The concept of Bio-mapping water quality of rivers in the country has been establishment by Central Pollution Control Board using Biological Water Quality Criteria (BWQC). The information from Bio-mapping helps in collection of baseline data on taxonomical distribution of benthic macro-invertebrates, which are natural indicator for water quality assessment of various rivers in a river basin. Such information can be utilized for classification and zoning of water bodies according to their level of ecological sustenance and degradation.

Bio-mapping of rivers in Meghalaya among North-Eastern states has been accomplished earlier. The findings of the studies of Bio-mapping of perennial rivers of Assam have been compared with the studies undertaken for Meghalaya State in the present issue of 'Parivesh' Newsletter.

The information for the issue of Parivesh has been collected, collated and compiled by Dr. (Mrs.) Pratima Akolkar in collaboration with Mrs. Gayatri Devi and Mr. Manoj Saikia, Scientists of Assam State Pollution Control Board. The project has been coordinated at Central Pollution Control Board by Dr. C. S. Sharma under the supervision of Dr. S. D. Makhijani and Dr. B. Sengupta. The manuscript has been typed by Sh. K. P. Shrivastava.

The bio-map of perennial rivers of Assam has been prepared by Mrs. Bonya Basu and Sh. Surajmal.

(V. Rajagopalan)
Chairman, CPCB

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1.0 INTRODUCTION

1.1 RIVERS BIO-MAPPING CONCEPT

The concept of water quality mapping had been initiated with the identification of beneficial uses of water in terms of primary water quality criteria. CPCB has prepared Water Quality Atlas of the Indian Rivers System on the basis of five major uses of river water such as:

- a) Drinking water source without conventional treatment but after disinfection;
- b) Outdoor bathing organized;
- c) Drinking water source with conventional treatment followed by disinfection;
- d) Propagation of wildlife, fisheries;
- e) Irrigation, industrial cooling, controlled waste disposal.

The concept of bio-mapping originated alongwith use of biological system for classification and zoning of water bodies according to their level of ecological degradation.

- Bio-mapping is classification of biological water quality data of river basin in the form of a colour map of various biological classes of water bodies. Different colours such as Blue, Light Blue, Green, Orange and Red, on a river basin map indicate various grades of water quality in terms of clean, slight pollution, moderate pollution, high pollution and severe pollution in the water body respectively.
- Bio-mapping is a continuous bio-monitoring programme of river basin, which should be carried out every year to obtain information on changes in biological water quality maintaining an inventory of the biological life sustained by the river.
- Bio-mapping is carried out effectively for the rivers and tributaries of a river basin, where as bio-monitoring can be done for all surface water bodies and the water quality class can be depicted by colour comparison.
- Bio-mapping of water quality has become significantly important exercise for pollution control activities because:
 - a) It gives an immediate impression of the quality of a water body, subjected to multiple designated-best-uses.
 - b) It helps in the identification of water bodies, in need of improvement.
 - c) To know the extent of pollution control needed for restoration of water quality.

- d) To collect the information on long-term cumulative effects of all adverse environmental factors.
- e) To maintain and restore the ecological sustainability of the water body in terms of its wholesomeness.
- f) Action plans can be prepared by simple colour comparison of the colour maps of water quality drawn for previous years.
- g) It may also help in performing the formulation of national pollution control programme.

1.2 RIVERS BIO-MAPPING TECHNIQUES

- Benthic macro-invertebrates are the best suitable biological marker among the biotic communities in an aquatic ecosystem for bio-mapping.
- Locations on a river basin map are selected for biological sampling.
- Biological sampling is undertaken at about 0 to 5 cm depth of bottom substratum layer with the help of nets, shovels, dredges, artificial substratum etc.
- Taxonomic identification of benthic macro-invertebrates up to family level is undertaken at sampling locations itself.
- Collection of relevant environmental information according to field protocols.
- Biological water quality evaluation by – a) Saprobic score; b) Diversity score.
- Assigning the water quality class to each sampling location with respect to combinations of saprobic and diversity score of benthic macro-invertebrates collected from selected sampling locations.
- Biological water quality assessment with the help of Biological Water Quality Criteria (BWQC).
- Translating the biological water quality class of each location on river basin map to respective colours assigned in BWQC.
- Grouping the benthic macro-invertebrate families collected from various locations of river stretch with respect to Biological Water Quality Class and Indicator Colours.

1.3 BIOLOGICAL WATER QUALITY CRITERIA (BWQC)

This BWQC criteria is based on the range of saprobic values and diversity of benthic macro-invertebrate families with respect to water quality (Table 1). To indicate changes in water quality according to pollution levels, the taxonomic groups of benthic macro-invertebrate families with their saprobic score range from 0 to 10, in combination with the range of diversity score from 0 to 1 have been classified into five different classes. The abnormal combination of saprobic

score and diversity score indicates sudden change in environmental conditions and poor substratum of water body.

Table 1: Biological Water Quality Criteria (BWQC)

| S. No. | Taxonomic groups | Range of saprobic score (BMWP) | Range of Diversity Score | Water quality Characteristic | Water quality Class | Indicator Colour |
|--------|--|--------------------------------|--------------------------|------------------------------|---------------------|------------------|
| 1. | Ephemeroptera, Plecoptera, Trichoptera, Hemiptera, Diptera | 7 and more | 0.2 - 1 | Clean | A | Blue |
| 2. | Ephemeroptera, Plecoptera, Trichoptera, Hemiptera, Planaria, Odonata, Diptera | 6 – 7 | 0.5 - 1 | Slight Pollution | B | Light blue |
| 3. | Ephemeroptera, Plecoptera, Trichoptera, Hemiptera, Odonata, Crustacea, Mollusca, Polychaeta, Coleoptera, Diptera, Hirudinea, Oligochaeta | 3 – 6 | 0.3 - 0.9 | Moderate Pollution | C | Green |
| 4. | Mollusca, Hemiptera, Coleoptera, Diptera, Oligochaeta | 2 – 5 | 0.4 & less | Heavy Pollution | D | Orange |
| 5. | Diptera, Oligochaeta No animals | 0 – 2 | 0 - 0.2 | Severe Pollution | E | Red |

2.0 BIO-MAPPING OF IMPORTANT PERENNIAL RIVERS OF ASSAM STATE

The North-Eastern state of Assam is generously endowed with water resources. The project on Bio-mapping of important perennial rivers of Assam State had been initiated at following rivers in the state since April, 2003:

- The Brahmaputra River
- The Buridihing River
- The Disang River
- The Jhanji River
- The Dhansiri River
- The Elenga Beel System Pond
- The Subansiri River
- The Borak River

Information regarding the sources, the districts through which the rivers flow and name of the major industries on their banks are given in the Table 2:

Table 2: Major river systems, their origin and flow pattern of various rivers of Assam State

| S. No. | River | Source of the river | Confluence Point | Major Districts on the course of the river | Major industries on the course |
|--------|-----------------------------|--|-----------------------------|---|--|
| 1. | The Brahmaputra River | The river flows through Tibet and enter India at Arunachal Pradesh United with several rivers like Dibang, Lohit, Siang, Kundil etc. and flows through the Assam Valley to fall in the bay of Bengal | Bay of Bengal | Tinsukia, Dibrugarh, Dhemaji, North Lakhimpur, Sibsagar, Jorhat, Golaghat, Sonitpur, Darrang, Nagaon, Kamrup, Barpeta, Goalpara, Bongaigaon, Dhubri | No major industries are situated at the river bank. Guwahati Refinery at Guwahati, Kamrup discharges their treated effluent directly into the river. |
| 2. | The Buridihing River | Arunachal Pradesh | Brahmaputra at Dihingmukh | Tinsukia, Dibrugarh | Coal India Ltd., Margherita; Oil India Ltd., Duliajan; Assam Oil Division, Digboi |
| 3. | The Disang River | Arunachal Pradesh | Brahmaputra at Disangmukh | Dibrugarh, Sibsagar | Brahmaputra Valley Fertilizer, Namrup, Assam Petrochemicals Ltd., Namrup; ONGCL drilling site are located at the site of the river bank. |
| 4. | The Jhanji River | Nagaland | Brahmaputra at Jhanjimukh | Sibsagar, Jorhat | - |
| 5. | The Dhansiri River | Nagaland | Brahmaputra at Dhansirimukh | Golaghat | Numaligarh Refinery (NRL) |
| 6. | The Elenga Beel System Pond | Natural water body | - | Morigaon | HPC, Nagoon Paper Mill at Jagiroad |
| 7. | The Subansiri River | Arunachal Pradesh | Brahmaputra at Alichiga | Dhemaji, North Lakhimpur | Construction of 2000 MW National Hydroelectric Power Corporation is going on |
| 8. | The Borak River | Manipur | Meghna | Silchar, Karimganj, Badarpur | HPC, Cachar Paper Mill at Panchgram |

2.1 SURFACE WATER RESOURCES AND THEIR USES

The water use status of perennial rivers of Assam is presented ahead.

| S. No. | Districts/State | City/Town/Sampling period | Surface water resources | Water use status of surface water bodies |
|--------|---|---|-------------------------|--|
| 1. | Miao, Arunachal Pradesh | Miao April, 2003 | River Buridihing | No human influences. |
| 2. | Assam Distt. Tinsukia | Margherita April, 2003 | River Buridihing | Sand recovery, bathing, washing, stone crushing unit, domestic sewage disposal through surface run offs, Tea gardens on opposite bank. |
| 3. | Assam Distt. Dibrugarh | Gammon Dullang, Khowang April, 2003 | River Buridihing | Grazing, bathing, run offs from upper Assam Industrial areas of oil and coal fields, vegetable farming, paddy cultivation, fishing, sand recovery, Jokai Reserve wildlife. |
| 4. | Assam Distt. Sibsagar | Dihingmukh, Dibrugarh April, 2003 | River Buridihing | Vegetable farming, bathing, washing, fishing, boating etc., paddy fields. |
| 5. | Assam – Arunachal Pradesh | Dillighat May, 2003 | River Disang | Raw water intake for drinking water supply, raw water intake of Industrial and coal mining on opposite bank of river. Forest area, HFC Tea garden, wildlife. |
| 6. | Namrup, Assam Distt. Dibrugarh | Lalpagarighat May, 2003 | River Disang | Water body receives effluents of HFC, surface run offs from Namrup Industrial township, vegetable cultivation, stone collection, ferry services. |
| 7. | Sibsagar, Assam | Rajabari May, 2003 | River Disang | Cattle wading, sand recovery, washing, bathing, fishing, grazing cattle |
| 8. | Sibsagar, Assam | Sepaigaon, Disangmukh | River Disang | Receives HFC effluents, vegetable cultivation, cattle wading, sand recovery, boat transport, bathing and washing activities, wildlife, paddy cultivation |
| 9. | Assam - Nagaland Border Distt. Sibsagar | Amguri Tea Estate Rajabari May, 2003 | River Jhanji | Vegetable, mustard farming, cattle wading, tea gardens and bamboo forest. |
| 10. | Sibsagar, Assam | Jhanji May, 2003 | River Jhanji | Effluent discharge from Tuli Paper Mill (Presently closed), cattle wading, sand recovery, bathing, washing, drinking, grazing. Canals joining the water body, surface run offs from Amboori Town at opposite bank. |
| 11. | Jorhat, Assam | Jhangi Mukh, Kumargaon May, 2003 | River Jhanji | Vegetable and paddy farming, boating, fishing, washing, wildlife etc. grazing animals and forest. |
| 12. | Karbi-Anglong Assam and Nagaland Border | Kesharidubi, Tengani, Nambar May, 2003 | River Dhansiri | Sugarcane and maize cultivation, vegetable farming, cattle wading, boating, bathing and washing, wild life. |
| 13. | Numaligarh, Assam Distt. Golaghat | Numaligarh May, 2003 | River Dhansiri | Drinking water intake, sand recovery, bathing, washing, fishing, discharge of NRL (Refinery) effluents. |

| S. No. | Districts/State | City/Town/Sampling period | Surface water resources | Water use status of surface water bodies |
|--------|---|--|------------------------------|---|
| 14. | Golaghat – Nagaon District Border | Dhansirimukh May, 2003 | River Dhansiri | Boating, cattle wading, washing, bathing, fishing and drinking. |
| 15. | Belguri, Assam Nowgong/ Morigong | Jagiroad, Belguri May, 2003 | Ellenga Beel, System pond | Back flow of Jagiroad Paper Mill effluents join the beel, vegetable and paddy cultivation, washing |
| 16. | Morigaon | Jagiroad, Morigaon May, 2003 | Ellenga Beel, System pond | Receives Hindustan Paper Mills effluent. |
| 17. | Assam – Arunachal Pradesh Border, North Lakhimpur | Gerukamukh May, 2003 | River Subansiri | Dam construction for Hydro-electric power generation. |
| 18. | North Lakhimpur Assam | Chaowlohoaghat May, 2003 | River Subansiri | Cattle wading, sand recovery, washing, bathing and fishing etc. |
| 19. | Lakhimpur Assam | Alichiga, Bordubi May, 2003 | River Subansiri | Fishing, paddy farming, forestry, melon farming, cattle wading |
| 20. | Assam-Manipur Border | Phuler Tal, Jiribam May, 2003 | River Borak | Tea gardens cultivation activities, cattle wading, sand recovery, washing, bathing and ferry transport, forestry. |
| 21. | Silchar, Assam | Katakhal May, 2003 | River Borak | Panchgram HPC township, cattle wading, sand recovery, bathing, washing, municipal waste discharge. |
| 22. | Silchar, Assam | Badarpur ghat, Badarpur May, 2003 | River Borak | HPC Panchgram effluent discharge, cattle wading, bathing, washing, fishing, drinking etc. |
| 23. | Karimganj, Assam-Bangladesh Border | Kalibarighat May, 2003 | River Borak | Bathing, washing, fishing and ferry transport, cattle wading |
| 24. | Tinsukia, Assam | Sakhowa ghat April, 2003 | River Brahmaputra | Ferry services, melon farming, cattle wading, transport |
| 25. | Dibrugarh, Assam | Nagaghholi, Maizan | River Brahmaputra | Cultivation of tea garden, cattle wading, dredging, sand recovery, ferry ghat, fishing, transport, forestry. |
| 26. | Sibsagar, Assam | Desangmukh | River Brahmaputra | Vegetable cultivation, cattle wading, bathing, washing, fishing |
| 27. | Jorhat, Assam | Nimatighat | River Brahmaputra | Cattle wading, ferry services, bathing, washing, Kakilamukh Bird Sanctuary, Forestry |
| 28. | Golaghat, Assam | Dhanbari camp | River Brahmaputra | Sand recovery, fishing, bathing, boating etc. cultivation, forestry, discharge of NRL effluents |
| 29. | Nagaon, Assam | Bhomoraguri, Silghat | River Brahmaputra | Sand recovery, fishing, bathing, washing |
| 30. | Guwahati, Assam | Saraighat | River Brahmaputra | Ferry services, cattle wading, sand recovery, fishing, bathing, washing, boating and human settlement. |
| 31. | Bongaigaon, Assam | Goalpara near Panchratna bridge May, 2003 | River Brahmaputra | Cattle wading, sand recovery, fishing, bathing, washing, drinking, ferry transport. |

| S. No. | Districts/State | City/Town/Sampling period | Surface water resources | Water use status of surface water bodies |
|--------|----------------------------------|---|---------------------------------|--|
| 32. | Dhubri, Assam | Dhubri May, 2003 | River Brahmaputra | Cattle wading, sand recovery, fishing, bathing, washing, cultivation. |
| 33. | Guwahati, Assam | Sadilapur near Savaighat bridge, Pandu ghat November, 2003 | River Brahmaputra | Discharge of Refinery effluents (NRL) open defaecation, town runoffs, water discharge, vegetable cultivation, cattle wading, cremation, fishing, jetty, boating, bathing. |
| 34. | Karimganj, Assam | Badarpur ghat November, 2003 | River Borak | Water intake of railway, sand dredging, vegetable cultivation, bathing, boating, paddy cultivation, sand recovery, fishing |
| 35. | Karimganj, Assam | Karimganj, Kalighat November, 2003 | River Borak d/s | Fishing, vegetable cultivation, washing, bathing |
| 36. | Cachar, Assam | Kathakhal on NH-44 November, 2003 | River Borak | Vegetable cultivation, fishing, sand recovery, paddy cultivation |
| 37. | Cachar, Assam | Dilkhush Tea Estate, Opp. to Fooler Tal November, 2003 | River Borak Upstream | Vegetable cultivation, ferry services, water intake, boating, bathing and washing, tea gardens. |
| 38. | Assam Meghalaya Border | New-Malidor, Jalalpur November, 2003 | River Malidor | Dredging, sand recovery, stone collection. |
| 39. | Silchar – Manipur Border | Fooler Tal November, 2003 | River Borak upstream | Ferry services, Dilkhush Tea Estate, Vegetable cultivation, bathing, washing, and drinking water intake. |
| 40. | Sonitpur, Assam | Bukagaon, Balipara November, 2003 | River Jia-Bharali | Water Intake, cultivation, religious activities, dredging and sand recovery, fishing, bathing, paddy cultivation, and brick formation. |
| 41. | Lower Subansiri Lakhimpur, Assam | Gerukamukh November, 2003 | River Subansiri u/s | Dredging, sand recovery, transport, stone collection from river bed and transport to dam site, fishing, washing, bathing, open defaecation, mining, drilling at upstream. |
| 42. | Arunachal Pradesh Border | Dhulumukh November, 2003 | River Subansiri upstream | Washing, bathing, boating, drinking water for wildlife transport of the River stones by motorboats to dam construction site. |
| 43. | North Lakhimpur, Assam | Chauldhua village November, 2003 | River Subansiri d/s | Vegetable cultivation, cattle wading, dredging, sand recovery, stone collection from River bed for road construction, boating, fishing, open defaecation, village settlement. |
| 44. | North Lakhimpur, Assam | Chauldhuaghat November, 2003 | River Subansiri d/s (midstream) | Fishing |
| 45. | Lakhimpur, Assam | Alichiga November, 2003 | River Subansiri d/s | Cattle wading, transport by motor boats, fishing, birds habitat, cultivation |
| 46. | Lakhimpur, Assam | Pahumara, Lakhimpur November, 2003 | River Ranganadi | Hydro-electric power generation at upstream, paddy cultivation, cattle wading, drinking water source, dredging and sand recovery, vehicle washing, bathing, fishing and transport by boat, religious activities, idol immersion, cremations. |

| S. No. | Districts/State | City/Town/Sampling period | Surface water resources | Water use status of surface water bodies |
|--------|----------------------------------|--|-------------------------|---|
| 47. | Lakhimpur, Assam | Bogi Nadi, Milanpur November, 2003 | River Boginadi | Drinking water, vegetable cultivation, cattle wading, dredging and sand recovery, bathing, washing and fishing, human settlement, paddy cultivation. |
| 48. | Assam – Arunachal Pradesh Border | Parbati Nagar, Harmutty Tea Estate Bandardua – Itanagar Border November, 2003 | River Dikrong | Cattle wading, dredging, sand recovery, fishing, bathing, boating. |
| 49. | Sonitpur, Assam | Bhoomuraguri, Tejpur | River Brahmaputra | Vegetable, paddy cultivation, bathing, washing, fishing and boating, open defaecation, wildlife. |
| 50. | Bongaigaon, Assam | Jogighopa November, 2003 | River Brahmaputra | Water Intake of Jogighopa Paper Mill, coal transport by ship and boats, cremation, mustard vegetable cultivation, fishing, open defaecation, paddy field, human settlement. |

2.2 HYDROLOGICAL STATUS AND ENVIRONMENTAL PROBLEMS

Hydrological status of a water body is an important factor, which determines the status of establishment of biological communities of Benthic macro-invertebrate families. A mature colonization of benthic macro-invertebrate communities in a water body is essential for actual water quality assessment. A number of human activities such as melon farming on River bank, cultivation, brick kilns and brick formation on catchment of river sand dredging, stone collection from river bed for road construction and stone crushers etc. are detrimental activities responsible for habitat destruction in terms of change in flow, depth, self purification capacity of water body and alteration in substratum type, which in turn determine the establishment of fauna and flora in a water body. The tributaries River Brahmaputra viz. River Buridihing, River Disang and River Subansiri possess natural substratum in their upstream reaches in Assam State. Their substratum composed of mainly Boulders, Cobbles, Pebbles and Gravel with comparatively less percentage of sand. The flow of water in these reaches ranges from 0.6 to 1.0 m/s. These habitats are suitable for biological establishments. Other rivers generally have sandy and clay substratum providing poor habitat for proper colonization of biological communities.

Table 3: Hydrological status of perennial rivers of Assam (2003)

| S. No. | Name of Rivers | Location | District/State | Period of Sampling | Approx. Depth (Meters) | Approx. width Mts/Kmts | Approx. velocity of Flow m/s | Substratum composition | |
|------------|------------------|--------------------------------|---|--------------------|------------------------|------------------------|------------------------------|---------------------------|----------------------|
| | | | | | | | | Substratum type | Percentage approx. |
| 1. | River Buridihing | Bed camp | Miaow, Arunachal Pradesh | April, 2003 | 3.0 | 25.0 | 1.0 | Boulders Cobbles | 20 20 |
| | | | | December, 2003 | 2.0 | 20.0 | 0.9 | Pebbles Gravels | 30-40 20-30 |
| | | Dihing, Ferry ghat | Margherita | April, 2003 | 6.1 | 200.0 | 0.6 | Sand | 70 |
| | | | | December, 2003 | 5.185 | 200.0 | 0.4 | Clay | 30 |
| | | Gammon, Dullang | Khowang | April, 2003 | 9.15 | 115.0 | 0.5 | Sand | 70-80 |
| | | | | December, 2003 | 7.32 | 150.0 | 0.4 | Clay | 20-30 |
| Dihingmukh | Dibrugarh | April, 2003 | 3.66 | 80.0 | 0.4 | Sand | 70 | | |
| | | December, 2003 | 8.0 | 150.0 | 0.6 | Clay | 30 | | |
| 2. | River Disang | Lalpagarighat | Namrup | May, 2003 | 2.135 | 200.0 | 0.5 | Boulders Cobbles | 10 20 |
| | | | | December, 2003 | 1.525 | 180.0 | 0.3 | Pebbles Gravel Clay | 10-30 30-40 20 |
| | | Dillighat | Assam-Arunachal Pradesh Border | May, 2003 | 3.355 | 200.0 | 0.6 | Boulders Cobbles | 50-70 20 |
| | | | | | | | | Pebbles Clay | 10 20 |
| | | Rajabari | Sibsagar | May, 2003 | 3.66 | 200.0 | 0.4 | Sand Silt | 30-40 10 |
| | | | | December, 2003 | 3.05 | 200.0 | 0.3 | Clay | 70 |
| | | Sepaigaon Disangmukh | Sibsagar | May, 2003 | 6.1 | 200.0 | 0.5 | Sand Silt | 10 20-30 |
| | | | | December, 2003 | 4.88 | 200.0 | 0.4 | Clay | 70 |
| 3. | River Jhanji | Amghri Tea Estate Rajabari | Assam-Nagaland Border | May, 2003 | 0.915 | 30.0 | - | Gravel Sand | 40 40-50 |
| | | | | December, 2003 | 1.525 | 50.0 | 0.3 | Clay | 10-20 |
| 4. | River Jhanji | NH-Crossing Jhanji | Sibsagar | May, 2003 | 3.0 | 200.0 | 0.2 | Sand Silt | 60 20 |
| | | | | December, 2003 | 4.0 | 200.0 | 0.3 | Clay | 20 |
| | | Jhanjimukh, Kumargaon | Jorhat | May, 2003 | 3.66 | 30.0 | 0.4 | Sand | 50-60 |
| | | | | December, 2003 | 3.05 | 50.0 | 0.3 | Clay | 40-50 |
| 5. | River Dhansiri | Kesharidubi Tengani, Nambar | Karbi-Anglong District Assam-Nagaland Border | May, 2003 | 4.0 | 70.0 | 0.2 | Sand Clay | 50-60 40 |
| | | | | December, 2003 | 3.0 | 80.0 | 0.3 | Silt | 50 |
| | | NRL Jetty at NH-Crossing | Numaligarh | May, 2003 | 5.0 | 300.0 | 0.7 | Sand Silt | 30 10 |
| | | | | December, 2003 | 5.0 | 250.0 | 0.5 | Clay | 40-60 |
| | | Dhansiri Mukh | Golaghat Nagaon District Border | May, 2003 | 3.0 | 200.0 | 0.6 | Sand Silt | 40-50 10 |
| | | | | December, 2003 | 3.0 | 220.0 | 0.5 | Clay | 40-50 |

| S. No. | Name of Rivers | Location | District/State | Period of Sampling | Approx. Depth (Meters) | Approx. width Mts/Kmts | Approx. velocity of Flow m/s | Substratum composition | | | |
|---|------------------------------------|--|---|-----------------------------|-----------------------------|------------------------|------------------------------|--|-------------------------------|--|----------------------|
| | | | | | | | | Substratum type | Percentage approx. | | |
| 6. | Ellenga Beel System Pond | Belguri | Jagiroad | May, 2003 | 1.0 | 20.0 | - | Clay | 100 | | |
| | | | | December, 2003 | 1.0 | 20.0 | - | | | | |
| | | Jogiroad other side of Bridge | Morigaon | May, 2003 | - | - | - | Clay | 100 | | |
| | | | | December, 2003 | 1.0 | 20.0 | - | | | | |
| 7. | River Subansiri River Subansiri | Gerukamukh Subansiri lower HE. Project | North Lakhimpur, Assam-Arunachal Pradesh Border | May, 2003 | 6.0 | 200.0 | 0.9 | Boulders Cobbles Pebbles Gravel Sand | 20 10 10 20 30-85 | | |
| | | | | November, 2003 | 1-20.0 | 300.0 | 0.227 | Clay Detritus | 10 5 | | |
| | | | | Opposite Bank of Gerukamukh | Dhulumukh Arunachal Pradesh | May, 2003 | - | - | - | Boulders Cobbles Pebbles Sand | 5 5 30 60 |
| | | | | | | November, 2003 | 20.0 | 1.5 | 0.24 | | |
| | | Chaolohoa ghat | North Lakhimpur | May, 2003 | 4.0 | 300.0 | 0.9 | Boulders | 10 | | |
| | | | | November, 2003 | 1-3.0 | 250.0 | 0.18 | Cobbles Pebbles Gravel Sand | 20 10-50 10-60 40-50 | | |
| | | | | | 0.305 | 150.0 | 0.43 | Clay Silt Detritus | 10 5 5 | | |
| | | | | Alichiga, Bordubi | North Lakhimpur | May, 2003 | 6.1 | 250.0 | 0.7 | Sand | 50-100 |
| | | November, 2003 | 1-3.0 | | | 200.0 | 0.15-0.25 | Clay | 50 | | |
| | | 8. | River Borak | Fooler Tal, Jiribam | Assam-Manipur Border | May, 2003 | - | - | - | Sand | 75 |
| | | | | | | November, 2003 | 4.0 | 250.0 | 0.13 | Clay | 25 |
| | | | | | | May, 2003 | 7.0 | 80.0 | 0.6 | Boulders Sand Clay | 30 30-50 20-40 |
| Badarpurghat | Karimganj / Assam | | | November, 2003 | 10.0 | 200.0 | 0.21 | Detritus | 10 | | |
| | | | | May, 2003 | 8.0 | 150.0 | 0.6 | Sand | 20-60 | | |
| Kalibarighat | Karimganj Assam-Bangladesh Border | | | November, 2003 | 8.0 | 400-500 | 0.13 | Clay | 40-70 | | |
| | | | | May, 2003 | 10.0 | 100.0 | 0.7 | Boulders Pebbles Sand Clay | 40 10 15-20 20-70 | | |
| | | | | November, 2003 | 3-4 | 300.0 | 0.117 | Detritus | 5 | | |
| Dilkhush Tea Estate Opposite bank to Fooler Tal | Assam – Manipur Border | | | May, 2003 | - | - | - | Clay | 100 | | |
| | | | | November, 2003 | 2.0 | 250.0 | 0.23 | - | - | | |

| S. No. | Name of Rivers | Location | District/State | Period of Sampling | Approx. Depth (Meters) | Approx. width Mts/Kmts | Approx. velocity of Flow m/s | Substratum composition | |
|---|-------------------|--|--|--------------------|------------------------|------------------------|------------------------------|--------------------------------------|----------------------|
| | | | | | | | | Substratum type | Percentage approx. |
| 9. | River Brahmaputra | Saikhowaghat | Tinsukia | April, 2003 | 9.15 | 1.609 | 1.2 | Gravel Sand | 5-10 70-75 |
| | | | | December, 2003 | 9.76 | 1.609 | 1.0 | Clay | 20 |
| | | Nagagholti, Maizan | Dibrugarh | April, 2003 | 7.625 | 1.609 | 1.0 | Sand | 70-80 |
| | | | | December, 2003 | 6.1 | - | 1.0 | Clay | 20-30 |
| | | Desangmukh | Sibsagar | May, 2003 | - | - | - | Sand | 60 |
| | | | | December, 2003 | 8.235 | 500.0 | 1.0 | Clay | 40 |
| | | Nimatighat | Jorhat | May, 2003 | 9.0 | 400.0 | 1.0 | Sand | 70 |
| | | | | December, 2003 | 10.0 | 400.0 | 1.0 | Clay | 30 |
| | | Dhanbari Camp | Golaghat | May, 2003 | 3.965 | 2.5 | 1.0 | Sand | 70-80 |
| | | | | December, 2003 | 3.05 | 2.0 | 0.9 | Clay | 20-30 |
| | | Bhomuraguri Silighat on NH-37A | Sonitpur district | May, 2003 | 12.0 | 400.0 | 1.0 | Sand | 80-100 |
| | | | | December, 2003 | 2.0 | 2.8 | 0.18-0.30 | Clay | 20 |
| | | Saraighat Bridge Sadilapur Pandy ghat | Guwahati | May, 2003 | 20.0 | 500.0 | 1.0 | Sand | 30-90 |
| | | | | November, 2003 | 6.1-15.25 | 1.5 | 0.125 | Clay | 10-70 |
| Joghigopa near Panchratna Bridge on NH-37 | Goalpara Town | May, 2003 | 20.0 | 400.0 | 1.0 | Sand | 40-100 | | |
| | | November, 2003 | >100 | 2.0 | 0.142 | Clay | 0-60 | | |
| Balasur | Dhubri | May, 2003 | 3.66 | 3.0 | 1.0 | Sand | 70 | | |
| | | December, 2003 | 3.05 | - | 1.0 | Clay | 30 | | |
| 10. | River Malidor | Jalalpur New Malidor | Assam- Meghalaya border | November, 2003 | 0.305 | 150.0 | 0.3-0.133 | Cobbles Pebbles Gravel Sand | 20 50 10 10 |
| 11. | River Jia Bhorali | Bukagaon | Balipara | November, 2003 | 10-15 | 200.0 | 0.27 | Pebbles Sand Clay | 10 80 10 |
| 12. | River Ranganadi | Pahumara Road Bridge on NH-52 | Lakhimpur | November, 2003 | 0.2 | 150.0 | 0.76 | Sand | 100 |
| 13. | River Boginadi | Boginadi Milanpur | Lakhimpur district | November, 2003 | 0.2-0.3 | 100.0 | 0.66 | Cobbles Pebbles Sand | 10 5 85 |
| 14. | River Dikrong | Harmutty Tea Estate on NH-52, near Higher Secondary School | Parbati Nagar Bandardua Assam-Arunachal Pradesh Border | November, 2003 | 0.5-1.5 | 200.0 | 0.71 | Pebbles Gravel Sand | 20 10 70 |

Table 3.1: Hydrological status of perennial rivers of Assam (2004)

| | Name of Rivers | Location | District/State | Period of Sampling | Approx. Depth (Meters) | Approx. width Mts/Kmts | Approx. velocity of Flow m/s | Type of water body | Substratum composition | |
|----|------------------|-----------------------|--------------------------------|--------------------|------------------------|------------------------|------------------------------|---|--|----------------------|
| | | | | | | | | | Substratum type | Percentage approx. |
| 1. | River Buridihing | Dihing, Ferry ghat | Margherita | October, 2004 | 5.795 | 200.0 | 0.5 | Run Depositing Eroding Canalized | Sand Clay | 80 20 |
| | | Bed Camp | Miao, Arunachal Pradesh | October, 2004 | 2.5 | 30.0 | 1.0 | Run | Boulders Cobbles Pebbles Gravel | 30 10 40 20 |
| | | Gammon, Dullang | Khowang | October, 2004 | 6.1 | 200.0 | 0.5 | Run Eroding Canalized | Sand Clay | 80 20 |
| | | Dihingmukh | Dibrugarh | October, 2004 | 10.0 | 150-200 | 0.7 | Run Depositing Eroding Canalized | Sand Clay | 70 30 |
| 2. | River Disang | Lalpagarighat | Namrup | October, 2004 | 2.745 | 200.0 | 0.4 | Run Depositing Eroding Canalized | Sand Clay | 30 70 |
| | | Dillighat | Assam-Arunachal Pradesh Border | October, 2004 | 3.05 | 200.0 | 0.5 | Run Canalized | Boulders Cobbles Pebbles Clay | 50 20 20 10 |
| | | Rajabari | Sibsagar | October, 2004 | 2.745 | 200.0 | 0.4 | Run Depositing Eroding Canalized | Sand Clay | 30 70 |
| | | Sapaigaon Disangmukh | Sibsagar | November, 2004 | 3.66 | 200.0 | 0.5 | Run Depositing Eroding Canalized | Sand Silt Clay | 10 20 70 |
| 3. | River Jhanji | Amguri Tea Estate | Assam-Nagaland Border | November, 2004 | 1.22 | 50-100 | 0.4 | Run Eroding | Gravel Sand Clay | 40 50 10 |
| | | NH-Crossing Jhanji | Sibsagar | November, 2004 | 1.22 | 200.0 | 0.4 | Run Depositing Eroding Canalized | Sand Silt Clay | 60 20 20 |
| | | Jhanjimukh, Kumargaon | Jorhat | November, 2004 | 2.745 | 50-100 | 0.3 | Run Depositing Eroding Canalized | Sand Clay | 70 30 |

| | Name of Rivers | Location | District/State | Period of Sampling | Approx. Depth (Meters) | Approx. width Mts/Kmts | Approx. velocity of Flow m/s | Type of water body | Substratum composition | |
|----|--------------------------|---|---|--------------------|------------------------|------------------------|------------------------------|----------------------------------|------------------------|--------------------|
| | | | | | | | | | Substratum type | Percentage approx. |
| 4. | River Dhansiri | Kesharidubi Tengani, Nambar | Karbi-Anglong | November, 2004 | 4.0 | 100.0 | 0.4 | Run Eroding Canalized | Sand Clay | 70 30 |
| | | NRL Jetty at NH-Crossing | Numaligarh | November, 2004 | 4.0 | 100.0 | 0.4 | Run Eroding Canalized | Sand Clay | 70 30 |
| | | Dhansiri Mukh | Golaghat Nagaon District Border | November, 2004 | 4.0 | 250.0 | 0.4 | Run Depositing Eroding Canalized | Sand Silt Clay | 60 10 20 |
| 5. | Ellenga Beel System Pond | Belguri | Jagiroad | December, 2004 | 1.0 | 20.0 | No flow | Pool Depositing Canalized | Clay | 100 |
| | | Belguri | Jagiroad | December, 2004 | 1.0 | 20.0 | No flow | Pool Depositing Canalized | Clay | 100 |
| 6. | River Subansiri | Gerukamukh Subansiri lower HE. Project | North Lakhimpur, Assam-Arunachal Pradesh Border | December, 2004 | 10.0 | 300.0 | 0.4 | Run | Pebbles Sand | 20 80 |
| | | Opposite Bank | Dhulumukh Arunachal Pradesh | - | - | - | - | - | - | - |
| | | Chaolohoa ghat | North Lakhimpur | December, 2004 | 4.0 | 250.0 | 0.2 | Run Depositing Eroding Canalized | Pebbles Gravel Silt | 30 60 10 |
| | | Alichiga | North Lakhimpur | December, 2004 | 3.0 | 200.0 | 0.4 | Run | Sand Clay | 90 10 |
| 7. | River Borak | Fooler Tal, Jiribam | Assam-Manipur Border | November, 2004 | 5.0 | 250.0 | 0.2 | Run | Cobbles Sand Clay | 80 20 |
| | | Kathakal on NH-44 u/s of Badarpur | Cachar / Assam | November, 2004 | 8.0 | 200.0 | 0.3 | Run Canalized | Cobbles Sand Clay | 10 60 30 |
| | | Badarpurghat | Karimganj / Assam | November, 2004 | 6.0 | 300-400 | 0.2 | Run Depositing Canalized | Sand Clay | 30 70 |
| | | Kalibarighat | Karimganj Assam-Bangladesh Border | November, 2004 | 3.0 | 300.0 | 0.2 | Run Canalized | Sand Clay | 30 70 |
| | | Dilkhush Tea Estate Opposite bank to Fooler Tal | Assam – Manipur Border | - | - | - | - | - | - | - |

| | Name of Rivers | Location | District/State | Period of Sampling | Approx. Depth (Meters) | Approx. width Mts/Kmts | Approx. velocity of Flow m/s | Type of water body | Substratum composition | |
|-----|-------------------|---|-------------------------|--------------------|------------------------|------------------------|------------------------------|----------------------------------|--|----------------------|
| | | | | | | | | | Substratum type | Percentage approx. |
| 9. | River Brahmaputra | Saikhowa ghat | Tinsukia | October, 2004 | 10.675 | Very wide | 1.2 | Run Eroding Canalized | Gravel Sand Clay | 10 80 10 |
| | | Nagaghल्ली, Maizan | Dibrugarh | October, 2004 | 6.1 | Very wide | 1.0 | Run Eroding Canalized | Sand Clay | 80 20 |
| | | Desangmukh | Sibsagar | November, 2004 | 9.15 | 500-700 | 1.0 | Run Eroding Canalized | Sand Clay | 70 30 |
| | | Nimatighat | Jorhat | November, 2004 | 15.0 | Very wide | 1.0 | Run Eroding Canalized | Sand Clay | 80 20 |
| | | Dhanbari Camp | Golaghat | November, 2004 | 3.05 | Very wide | 1.0 | Run Eroding Canalized | Sand Clay | 80 20 |
| | | Bhomuraguri Silighat on NH-37A | Sonitpur district | November, 2004 | 3.0 | 2 km | 0.4 | Run Eroding Canalized | Sand Clay | 90 10 |
| | | Saraighat Bridge Sadilapur Pandu ghat | Guwahati | December, 2004 | 4.575 | Very wide | 0.2 | Run Depositing Eroding Canalized | Sand Clay | 80 20 |
| | | Joghigopa near Panchratna Bridge on NH-37 | Goalpara Town | December, 2004 | 1.0 | 20.0 | No flow | Depositing Canalized | Clay | 100 |
| | | Balapur | Dhubri | November, 2004 | 3.05 | Very wide | 1.0 | Run Eroding Canalized | Sand Clay | 80 20 |
| 10. | River Malidor | Jalalpur | Assam- Meghalaya border | November, 2004 | - | 100.0 | 0.2 | Run Canalized | Boulders Cobbles Pebbles Gravel | 20 20 40 20 |
| 11. | River Lubha | Near Lubha bridge | Sonapur, Meghalaya | November, 2004 | 2.0 | 80.0 | 0.4 | Run Canalized | Boulders Cobbles | 80 20 |

Table 4: Environmental Problems related to various activities in vicinity of Perennial Rivers in Assam

| S. No. | Rivers/Water bodies | Location of Stretch | Activities | Environmental Problems |
|--------|---------------------|--|--|---|
| 1. | River Buridihing | Bed camp at Miao in Arunachal Pradesh | Forest Miaow, stone collection from catchment of River, Birds habitat | Habitat destruction due to stone removal from riverbed. |
| | | Dihing, ferry ghat at Margherita | Sand recovery, bathing, washing, urban activities, grazing, stone crusher units, Tea gardens, surface drainage discharge. | Habitat destruction due to stones removal for stone crushing, silting in river, nutrient run offs through tea garden and sewage discharge affect water quality. |
| | | Gammon, Dullang at Khawang, NH-37 | Grazing, farming, bathing, activities of upper Assam Industrial area of Oil and Coal fields, vegetable, paddy cultivation, fishing, sand recovery, Jokai Reserve Wildlife, forest. | Industrial activities affect the water and air quality and sensitive zone of wildlife reserve. |
| | | Dihingmukh at Dibrugarh | Vegetable farming, bathing, washing, fishing, boating, paddy fields, human settlement | Silting in water body through surface run offs, water quality gets affected. |
| 2. | River Disang | Dillighat at Assam-Arunachal Pradesh Border | Drinking water supply Industrial and Coal mining activities, Tea gardens, wildlife. | Water quality affected due to surface run offs from Industrial and Coal mining activities and Tea gardens. |
| | | Lalpagari ghat at Namrup Industrial Township | Activities of Industrial township of Namrup. Vegetable cultivation, stone collection, ferry transport of Hindustan Fertilizer Corporation. | Habitat destruction due to stone removal from Riverbed, silting in water body through surface run offs, water quality affected due to HFC effluents. |
| | | Rajabari, Sibsagar | Cattle wading, sand recovery, washing, bathing and fishing. | Silting in water body from surface run offs. |
| | | Sepaigaon, Disangmukh, Sibsagar | Vegetable cultivation, cattle wading, sand recovery, boat transport, bathing, washing wildlife, paddy fields, human settlement. | Silting in water body, fish kills reported by villagers. Water quality affected due to HFL effluent discharge. |
| 3. | River Jhanji | Amgwa Tea Estate, Rajabari Assam-Nagaland border | Nagaland Paper Mill (presently un-operated), vegetable, mustard, Tea garden, cultivation in catchment, bamboo forest, deforestation. | Muddy colour water, silting in water body through surface runoff. Deforestation due to use of bamboo as raw material for paper manufacturing. |
| | | NH-Crossing, Jhanji at Sibsagar | Tuli Paper Mill (Presently unoperated) cattle wading, sand recovery, bathing, washing, drinking etc. grazing land etc. | Water quality problems. |
| | | Jhanjimukh, Kumargaon at Jorhat near Teok | Vegetable and paddy farming, boating, fishing,, washing, boating wildlife. | Habitat destruction for wildlife. |

| S. No. | Rivers/Water bodies | Location of Stretch | Activities | Environmental Problems |
|--------|-------------------------|--|---|---|
| 4. | River Dhansiri | Kesharidubi, Tengani Nambar, Assam-Nagaland border | Sugarcane, vegetable and maize cultivation in the catchment, cattle wading, boating, bathing, washing wildlife. | Habitat destruction for wildlife. |
| | | NRL Jetty at NH-Crossing, Numaligarh | Numaligarh Refinery activities, drinking water intake, sand recovery, bathing, washing, fishing, discharge of NRL effluents. | Water quality problems. |
| | | Dhansirimukh, Golaghat, Nagaon District border | Wildlife of Kaziranga National Park, receiving NRL effluents, cattle wading, washing, bathing, fishing and drinking. | Drinking water quality problems. |
| 5. | Elenga Beel System Pond | Belguri, Jagi Road | Jagi Road Paper Mill, vegetable and paddy cultivation, washing. | Water quality problems due to discharge of Paper Mill effluents. Deforestation due to use of bamboo as raw material for paper manufacturing. |
| | | Jagiroad, other side of bridge, Morigaon | HPC Jagiroad activities. Deforestation of Bamboo forest | Discharge of effluents of Hindustan Paper Mill effluents, water quality problems. |
| 6. | River Subansiri | Gerukamukh, Subansiri Lower H.E. Project, North Lakhimpur District | Dam construction activities for Hydroelectric power generation project of NHPC, Deforestation, extensive sand, stone dredging activities, sand recovery, transport of river stones by motor boats to dam site, fishing, washing, bathing, open defaecation, mining, drilling at dam site. | River Bed habitat destruction, silting in water body, loss of biodiversity, poor quality of road, national highway due to use of river stones, silting on vegetation. |
| | River Subansiri u/s | Dhulumukh, Arunachal Pradesh border | Washing, bathing, boating, drinking water for wildlife, river stones transport to dam site on motor boats, mining and drilling of NHPC on dam site. | River Bed habitat destruction, loss of biodiversity, silting in water body. |
| | River Subansiri m/s | Chaowldhoa ghat N. Lakhimpur | Cattle wading, sand recovery, washing, bathing, fishing, vegetable cultivation, dredging, river bed stones are removed for road construction, open defaecation grazing, forest, village settlement. | River bed habitat destruction, water quality problems, silting in water body. |
| | River Subansiri d/s | Alichiga | Deforestation, cattle wading, transport by motor boats, fishing, boating, birds habitat, pumping river water for cultivation. | Soil erosion of river banks water quality problems due to surface run offs. Habitat destruction for resting birds. |
| 7. | River Ranganadi | Pahumara Lakhimpur | Ranganadi Hydal Project of NEPCO, Kemang in Arunachal Pradesh, settlement of Bamundaloni village on the bank of river paddy cultivation, cattle wading, drinking water, dredging, sand recovery, vehicle washing, bathing, and fishing, transport by boat, religious activities, idol immersion, cremation etc. | Silting in water body, water quality problems. |
| 8. | River Boginadi | Boginadi Milanpur Lakhimpur District | Drinking water for local residents, village settlement on the River bank, vegetable cultivations, cattle wading, dredging, sand recovery, stone collection from river bed, bathing, washing and fishing, grazing, paddy cultivations. | Water quality problems through surface run offs. River bed habitat destruction. |

| S. No. | Rivers/Water bodies | Location of Stretch | Activities | Environmental Problems |
|--------|---------------------|--|--|---|
| 9. | River Dikrong | Parbati Nagar Bandardua | Tea estate on opposite bank, cattle wading, dredging, sand recovery, fishing, bathing, boating, river stones, removed for construction material, grazing land, paddy cultivation. | Water quality problems through surface run offs. Riverbed habitat destruction. Silting in water body. |
| 10. | River Barak | Fooler Tal, Jiribam Assam-Manipur border | Ferry services, Tea gardens, cattle wading, sand recovery washing, bathing, forestry. | Water quality problems due to surface run offs. Silting in water body. |
| | | Fooler Tal opposite bank, Dilkhush Tea estate | Water Intake, vegetable cultivation, transport by ferry service, boating, bathing, washing, Tea gardens | Silting in water body, water quality due to surface run offs. |
| | | Badarpur, Badarpurghat | Construction of new railway bridge, water intake of railways, vegetable cultivation, bathing, boating, paddy cultivation, dredging and sand recovery, discharge of HPC effluents, deforestation of bamboo forest. | Water quality problem, habitat destruction of riverbed. Deforestation due to use of bamboo as sole raw material for paper manufacturing, silting in water body. |
| | | Kalibarighat, Karimganj, Assam-Bangladesh border | Bathing, washing, fishing, ferry transport cattle wading, religious activities, BSF camp water intake of Bangladesh, vegetable cultivations, solid waste disposal. | Water quality problems, water hyacinth. |
| | | Kathakhal, Silchar | Sewage discharge of township Panchgram Hindustan Paper Mill, cattle wading, sand recovery, bathing, washing, fishing, vegetable, paddy cultivation. | Water quality problems, habitat destruction of river catchment. |
| 11. | River Malidor | New Malidor, Jalalpur, Assam-Meghalaya Border | Stone crushing, stone collection from river bed and transport by truck, deforestation, dredging, sand recovery. | Habitat destruction of river bed silting in water body. |
| 12. | River Jiabharali | Bukagaon, Balipara Division | Water intake for drinking water supply, cultivation, religious activities, dredging, sand recovery, fishing, bathing, paddy cultivation, brick kiln. | Water quality problems due to surface run offs, habitat destruction of river catchment. |
| 13. | River Brahmaputra | Saikhowaghat, Tinsukia | Ferry services, melon farming, cattle wading | Soil erosion, silting in water body, floods, sandy substratum. |
| | | Nagaghholi, Maizan, Dibrugarh | Tea garden, cattle wading, dredging, sand recovery, ferry ghat, fishing & transport. | Water quality problems through surface run offs, floods, sandy substratum |
| | | Desangmukh, Sibsagar | Vegetable cultivation, cattle wading, bathing, washing, fishing | Floods, sandy substratum. |
| | | Nimatighat, Jorhat | Ferry services, bathing, washing, Kakilamukh Bird's sanctuary | Floods, sandy substratum. |
| | | Dhanbari Camp, Golaghat | Sand recovery, fishing, bathing, boating, cultivation, NRL effluent discharge. | Water quality problems, floods, sandy substratum. |
| | | Bhomoraguri Silighat, Sonitpur District | Sand recovery, fishing, bathing, washing, vegetable, paddy cultivation, open defaecation, Kala Bhomoraguri wildlife, Teak forest, deforestation. | Floods, soil erosion, tree falling due to desilting, habitat destruction. |
| | | Saraighat, Sadilapur, Guwahati | Discharge of Guwahati Refinery effluent, ferry services, cattle wading, sand recovery, bathing, washing, fishing & human settlements, Town, run offs vegetable cultivation open defaecation. | Water quality problems, sandy substratum. |
| | | Jogighopa near Panchratna bridge Golpara | Bongaigaon industrial township, coal storage on the river bank and transport of coal through motor boats, cremation ground, cultivation, fishing, open defaecation, water intake of Joghghopa Paper Mill, Paddy fields, coal depot, human settlements, brick kiln. | Water quality problems, soil erosion, sandy substratum, habitat destruction of river bank, use of bamboo as sole raw material for paper manufacturing, deforestation in the area. |
| | | Dhubri | Bongaigaon on the opposite bank, cattle wading, washing, sand recovery, fishing, bathing. | Floods |

Table 5: Water Quality Status of River Brahmaputra & its Tributaries

| S. No. | Parameters | | Values | Location |
|--------|-------------------------------|---------|--------|--|
| 1. | pH | Average | 7.44 | - |
| | | Minimum | 5.44 | Buridihing at Margherita |
| | | Maximum | 11.2 | Elenga Beel at Jagi Road |
| 2. | Conductivity (µmhos/cm) | Average | 272.13 | - |
| | | Minimum | 48.0 | River Borak at Panchgram |
| | | Maximum | 2590.0 | Elenga Beel at Jagi Road |
| 3. | DO (mg/l) | Average | 6.29 | - |
| | | Minimum | 0.6 | Elenga Beel at Jagi Road |
| | | Maximum | 10.3 | River Subansiri at Gerukamukh |
| 4. | BOD (mg/l) | Average | 4.13 | - |
| | | Minimum | 0.3 | River Borak at Panchgram |
| | | Maximum | 46.0 | Elenga Beel at Jagi Road |
| 5. | Chloride (mg/l) | Average | 27.5 | - |
| | | Minimum | 2.0 | River Borak at Panchgram, River Disang at Gudamghat, R. Brahmaputra at Pandughat |
| | | Maximum | 406.0 | Elenga Beel at Jagi Road |
| 6. | Total Dissolved Solids (mg/l) | Average | 210.36 | - |
| | | Minimum | 46.0 | River Disang at Gudamghat |
| | | Maximum | 1718.0 | Elenga Beel at Jagi Road |
| 7. | Sulphate (mg/l) | Average | 23.81 | - |
| | | Minimum | 0.72 | River Subansiri at Gerukamukh |
| | | Maximum | 175.2 | Elenga Beel at Jagi Road |
| 8. | Nitrate (mg/l) | Average | 0.309 | - |
| | | Minimum | BDL | River Brahmaputra at Maizan |
| | | Maximum | 2.25 | River Disang at Gudamghat |
| 9. | Boron (mg/l) | Average | 1.218 | - |
| | | Minimum | BDL | 10 times out of 22 observations |
| | | Maximum | 2.37 | River Borak at Panchgram |
| 10. | Amm. Nitrogen (mg/l) | Average | 0.049 | - |
| | | Minimum | BDL | 10 times BDL, 10 times in Traces |
| | | Maximum | 1.0 | Elenga Beel at Jagi Road |
| 11. | Total coliforms MPN/100 ml | Average | - | - |
| | | Minimum | 300.0 | River Buridihing at Margherita |
| | | Maximum | 24,000 | River Disang, Elenga Beel, River Borak and River Dhansiri |
| 12. | Faecal coliforms MPN/100 ml | Average | - | - |
| | | Minimum | 30.0 | River Dhansiri at Golaghat |
| | | Maximum | 14,000 | River Disang at Gudamghat |

BDL = Below detection limit

2.3 PERENNIAL RIVERS OF ASSAM – LOCATION AND MORPHOLOGICAL FEATURES

RIVER BURIDIHING

River Buridihing is major tributary of the Brahmaputra in Assam, which arises from the eastern part of Assam and Arunachal Pradesh border.

a. *River Buridihing at Bed Camp, Miao (Arunachal Pradesh)*

This sampling site is located at upstream of River Buridihing at Miao in Arunachal Pradesh. There is not much human influence on water body except for the removal of River bed stones. The water body is covered on both the banks by Miao Forests.

b. *River Buridihing at Dihing Ferryghat, Margherita*

The sampling location on Buridihing River is situated on the border of Assam at Margherita near the Railway bridge and NH Road bridge. Margherita is located at downstream of coal mining activities. Hillocks are present on the opposite bank of River. The catchment of opposite bank is covered with Tea gardens. The water body gets influenced by several human activities after entering the Assam border. N.E. Coalfields of Tikak, Tirap etc. are situated upstream of this location.

c. *River Buridihing at Gammon, Dullang at Khowang*

The sampling site of River Buridihing at Khowang is located near National Highway No. 37. The water body has crossed the entire Upper Assam Industrial areas of Oil and Coal fields. Jokai Reserve Wildlife is located in vicinity of sampling location.

d. *River Buridihing at Dihingmukh, Dibrugarh*

At downstream of this location, River Buridihing joins River Brahmaputra, a number of small streams join River Buridihing. Wild Ducks and common birds are quite often observed at this location.

RIVER DISANG

River Disang is another major tributary confluencing with the River Brahmaputra at its south bank carrying discharge of Namrup Fertilizer and Assam Petrochemicals Ltd. and its basin covers the catchment area of ONGC Ltd. activities in Sibsagar District. The Disang River originates from Patki Bunn (Naga Hills). The maximum altitude near the source is 2594.15 mtr. The Tisa (original name of the river) after moving 60.8 km towards north, meets its first tributary Towaizo. The combined flow moves further north and meets tributary Tiratjo.

Moving further north, the river appears in the plains near Namrup, a place of historic as well as of industrial importance (Nam means water and rup means silver). The name refers to water shining like silver. From Namrup, the River flows towards north – western direction through the plains of Dibrugarh District. The River flows through the alluvial plains of Dibrugarh and Sibsagar District. After flowing further in west-south-west direction to about 86.4 km, the River meets another tributary Bor Timak Nadi, which originates from the foothills, on the left bank. After crossing a distance of about 22.4 km towards south-west, the River meets, with main tributary Safrai then passes through Nangala – maraghat and turns north. Following a further course, river meets the Diroi and the Dimou tributaries on its right bank. Finally, the river meets Brahmaputra, after a total course of 572 km (including the course of tributaries) near Disangmukh at a distance of 11.2 km from the sub-divisional town Sibsagar.

a. *River Disang at Dillighat*

Dillighat is the starting point of River Disang at Assam-Arunachal Pradesh Border. At this location, river Disang enters into plains towards upstream of Namrup industrial area. The water body possess pristine water quality at this locations. The coal mining areas are located on the opposite bank of River. The sampling station is located towards coal mining site. Water intake for drinking water supply is towards Arunachal Pradesh. The water intake point is surrounded by Forest and HFC. Tea gardens are located on either side of Dillighat Bridge on River Disang. The area inhabits wildlife such as Tiger, Deer, wild Boar and Elephant. This stretch of river is used for drinking without treatment.

b. *River Disang at Lalpagri Ghat, Namrup*

The River Disang passes through the Namrup Industrial township before reaching to this location, the River gets all possible effluent drains from industrial town and municipal waste. HFC effluents are also discharged in the River. The sampling site is located near Bamboo bridge. This stretch of River Disang is used for outdoor bathing. Namrup Tea estate is also situated in the vicinity of this location.

c. *River Disang at Rajabari, Sibsagar*

The sampling site is located by the side of the NH-37. Sibsagar, Rajabari and Dimow towns are located on the bank of River around this location. The opposite bank of River is a grazing land. ONGC drilling operation is done at upstream of Bhojo. An important tributary River Diroi joins River Disang at National Highway crossing.

d. *River Disang at Disangmukh, Sibsagar*

This is the end point of the River before mixing with the Brahmaputra. Tea gardens are located in nearby areas. The sampling stations on River Disang is located at Sapaigaon. Wild ducks, common birds and wild elephants are often observed at this location. Fish kills are often reported by villagers.

RIVER JHANJI

a. *River Jhanji*

River Jhanji originates from hills of Nagaland and flows through upper Assam. Jhanji river is one of the major south bank tributaries joining at the middle stretch of the River Brahmaputra. Earlier, the river Jhanji used to carry the discharge from the Tuli Paper Mill at Nagaland. River Jhanji arises from Naga hills and enters Assam-Nagaland border at Tuli where the Nagaland Paper Mills is located. Bamboo forests surrounds the Tea garden surrounding the sampling location. Amghri Tea Estate is located on the opposite bank of River towards Nagaland border.

b. *River Jhanji at Amguri Tea Estate, Rajabari*

At this location River Jhanji enters the border of Assam from Nagaland. Amguri Tea Estate is located on the opposite bank of River towards Nagaland border.

c. River Jhanji at Sibsagar

The sampling site on River Jhanji was selected at NH-37 crossing of Jhanji. Earlier at this location River Jhanji carried the wastewater discharge from Tuli Paper Mills in Nagaland. Now this industry is not operational.

d. River Jhanji at Jhanji Mukh, Jorhat

River Jhanji joins River Brahmaputra at upstream of this location at Kumargaon near Teok. The surrounding land is used for grazing and forest.

RIVER DHANSIRI

A major south bank tributary to the river Brahmaputra flowing through Golaghat District and supposed to carry the discharge from Numaligarh refinery. River Dhansiri rises from Karbi-Anglong District of Assam and Nagaland Border.

a. *River Dhansiri at Keshardubi*

The sampling site on River Dhansiri is located near the bamboo bridge across the River connecting villages of Tengani and Nambar etc. Sampling site at Keshardubi is situated in between Dimapur and Golaghat. The opposite bank of River Dhansiri is closed to Nagaland and North Cachar Hills. Wildlife of Elephant, Tiger and Deer are found in this area.

b. *River Dhansiri at NRL Jetty, Numaligarh*

The sampling site is near Jetty of Numaligarh Refinery Ltd. (NRL) at NH-Crossing. NRL effluents are discharged here.

c. *River Dhansiri at Dhansirimukh*

Dhansirimukh is the confluence point to River Brahmaputra. The sampling site on river Dhansiri was selected before confluence at boating ghat near Golaghat and Nagaon District border. Common birds and wild ducks are observed here. Surrounding land is used for grazing. Kaziranga National Park ranges are located towards Nagaon on the riverbank. Sampling site is towards Golaghat bank.

ELLENGA BEEL SYSTEM POND

This is a beel system with low lying lands and becomes a small rivulet in lean season but during rainy season the entire low lying area becomes inundated and takes the shape of a beel. This system receives ETP discharge and wastewater from Nagaon Paper Mill of HPC Ltd. Two drains from the paper mill containing different types of sludge ultimately reach the beel systems and causes siltation problem. The water quality of this beel reach the River Kapili / Kalong as a small stream.

a. *Ellenga Beel at Belguri, Jagiroad*

The water body is stagnant in the village area. Vegetable and paddy cultivation is done in the vicinity. Water hyacinth growth throughout the surface of water body. Surrounding land is covered by forest Kapili River flows in close vicinity.

b. *Ellenga Beel System Pond, Jagiroad, Morigaon*

This is a vast ecosystem comprising beel water. The site is nearby the HPC Nagaon Paper Mill outlet. Sampling site was selected on the other side of bridge on Elenga beel system pond towards HPC Jagiroad. Water Hyacinth grows throughout the water body.

RIVER SUBANSIRI

This River is one of the major north bank tributaries of Brahmaputra. The River enters into Assam to confluence with the River Brahmaputra after flowing through the hills and forest of Arunachal Pradesh. Dam construction of NHPC is the major activity here. Dam is yet to be constructed. The surrounding of opposite bank is covered by forest. Subansiri is named due to having gold in its sand many years ago.

a. *River Subansiri at Gerukamukh*

The sampling site on River Subansiri is located at Gerukamukh Subansiri lower Hydro-electric project, near Kendriya Vidyalaya, and between upstream of stone bridge under construction on river and downstream of dam site. NHPC, HE project of 2000 MW is under construction. Earlier the entire area was under Brahmaputra Board. Three months ago the area was inhabited by township, which was taken over by NHPC. Now NHPC township exists alongwith schools and medical centre with 20 beds. Dept. of Forest of Assam Govt. takes care of afforestation activities.



River Subansiri at Gerukamukh

b. *River Subansiri at Dhulumukh*

Dhulumukh is located in Arunachal Pradesh towards opposite bank of Gerukamukh. Extensive stone harvesting from River bed of Subansiri is carried out transporting through motor boats towards Dam site, where

mining and drilling of NHPC Dam site is done. The surrounding land is grazing and forest.

c. *River Subansiri at Chauldhoaghat*

The sampling site is located near the NH Bridge at Chauldhua village in North Lakhimpur. Thakaraguri village is located on the opposite bank of River Sugansiri. Sampling site was selected in between Road Bridge and Rail Bridge Opp. to J. K. Hotel on National Highway. Arunachal Pradesh hills are located towards Rail Bridge. The backwater of the river is used for various purposes like washing, bathing etc.



River Subansiri at Chauldhoaghat

d. *River Subansiri at Alichiga, Bordubi*

Alichiga is located 90 km downstream from Gerukamukh near Trinayan Mandir at Nutal, Tinali. Morolia village is located on the opposite bank of River Subansiri. The sampling site was selected before confluence of River Subansiri with River Brahmaputra. Lakhimpur town is about 20-25 km from this location. The sampling was carried out on the Subansirimukh bank towards ferry ghat and also at opposite bank towards Morolia village. The forest is covered on the other bank towards Jorhat. River Subansiri joins River Brahmaputra in Majulighat at a distance of about 4 km downstream from this location.



Bio-monitoring at River Subansiri at Alichiga

RIVER BORAK

River Borak is one of the important River in Borak valley of Assam state. River Borak comes from Manipur and passes through Silchar, Kathakal, Badarpur, Karimganj and then enters the Bangladesh territory.

1. River Borak at Fuler Tal, Jiribam

Through Fuler Tal sampling location river enters the Assam-Manipur border. The transport activity for crossing border is through ferry ghat services. The entire area is covered mainly by Tea gardens in the catchment. The other bank of river is towards Silchar, Sonbari and Manipur. Tea gardens start from Assam border.

2. River Borak at Dilkhush Tea Estate

This is the opposite bank of River Borak at Fooler Tal. The water body comes from the Manipur Border. The sampling site is located at upstream of water intake point. Borak valley starts from Assam border. From Ratachera Assam border is about 10 km on NH-44 and Badarpur is located at 44 km.

b. River Borak at Kathakal

The sampling site on River Borak is located adjacent to NH-44 at the outskirts of Silchar township. The sampling site is towards Anandpur, Kathakal of Silchar town. Panchgram H.P.C. is also located on this bank

at upstream. Gonirgram Siripur Part-I is located on the opposite bank. The surrounding area is urban, Drain from Chachapra from Tukargram joins at upstream of this sampling location. Sampling location is in between Badarpur and Silchar. Chorangji Bazar is located on the opposite bank.



River Borak at Jiribam



River Borak at Kathkal



Bio-monitoring of River Borak, Kathakal

c. River Borak at Badarpurghat, Badarpur

This monitoring station was chosen on Borak river in the Borak Valley to assess the effect of effluent discharged in it from the Cachar Paper Mills at Panchgram in Cachar district. The sampling site on the River Borak is located after the confluence of HPC Panchgram effluents at Badarpur ghat. The sampling site is between the Old Railway Bridge and Road Bridge. The entire stretch is subjected to construction activities of the New Railway Bridge. The water intake of railway is located near the sampling site. Panchgram HPC effluents join before Gamoh Bridge on River Borak. Katighra is on the opposite bank of River. River Dhansiri also joins River Borak at this point.

d. River Borak Downstream at Kalibarighat, Karimganj

The sampling site is at the border area of Assam and Bangladesh. The sampling site on River Borak is located between Steamerghat and Kalibarighat near Kalibari town in Karimganj. Charbazar is located at upstream. Bamboo boats float on the bank of River Borak to be used for various human activities. The BSF camp is located at upstream and Jakhiganj of Bangladesh is located towards opposite bank.

BRAHMAPUTRA BASIN

The Brahmaputra Basin extends over an area of nearly 5,80,000 km² and traverses a distance of about 2900 km through Tibet (China), India and

Bangladesh. In India, the basin lies in the states of Arunachal Pradesh, Assam, Nagaland, Meghalaya and North Bengal. The Brahmaputra Basin is bounded on the north by the Himalayas, on the east by the Patkai range of hills running along the Assam-Myanmar Border, on the south by the Assam range of hills and on the west by the Himalayas. The ridge separates it from the Ganga Basin. The Basin has a maximum east-west length of about 1,540 km and a maximum north-south width of about 682 km along 93⁰ east longitude.

The River rises in the great glacier in the northern – most chain of the Himalayas in the Kailash range at an elevation of about 5,510 m at a latitude of 30'-31' N, longitude of 82'-10'E just south of the lake called Konggyu Tsho. It enters India across the Sadiya frontiers tract, west of Sadiya town into the Assam valley. Here it is joined by two more tributaries viz. the Dibang or Siang and the Lohit, from here onwards the River is known as the Brahmaputra. The River then descends down into the Assam valley from east to west for a distance of about 720 km with its channels meandering from side to side and forming several islands, one of these islands, Majuli covers an area of 1,250 km². During its course the River receives many more tributaries both from the north and the south while some of them are trans-Himalayan Rivers with considerable discharge.

The Brahmaputra has the highest discharge of all the Rivers, because of heavy annual average rainfall in the catchment area. The River has eight significant tributaries in India; three from the north are the Manas, the Kameng (or the Jia Bhoireili) and the Subansiri and three from the east are the Dibang or Siang, the Lohit and the Buri Dihing and two from the north west are the Tista and the Jaldhaka.

a. *River Brahmaputra at Saikowaghat, Tinsukia*

River Brahmaputra started from the eastern end of Assam, Tinsukia and Dibrugarh Districts. These Districts are having maximum number of small, medium and a few large-scale industries like Digboi Refinery, Oil and Namrup Fertilizers alongwith the coal mining activities by north Eastern Coal Fields at Margherita and Ledo etc. At Saikowaghat, Tinsukia the River Dibang, Dihing, Kundil, Lohit from Arunachal Pradesh and Dhola, join together to River Brahmaputra. The sampling site is erosion prone and a ferry ghat is located near the sampling station.

b. *River Brahmaputra at Nagaghल्ली, Maizan, Dibrugarh*

Maizan is situated at the upstream of major townships of upper Assam. The sampling site is located in between Dibrugarh and Tea gardens. Digboi nullah carries the confluence with Dihing River, which is a major tributary to the Brahmaputra.

c. *River Brahmaputra at Disangmukh, Sibsagar*

The major activity that has direct bearing on the environment is the drilling of crude oil in Sibsagar district by ONGC Ltd. The ONGC Ltd has four major Oil fields at Gelaki, Lakwa, Demalgaon and Rudrasagar, which are continuously kept under vigilance by PCBA (Board). The sampling site is situated at about 16 km from the Sibsagar township.

d. *River Brahmaputra at Nimatighat, Jorhat*

The sampling site on River Brahmaputra is located at Nimatighat of Jorhat town. Majuli is located on the opposite bank of River at Lakhimpur. Kakilamukh Bird Sanctuary is located at this point. Wild elephants are also found in the sanctuary.

e. *River Brahmaputra at Dhanbari Camp, Golaghat*

At this location a major tributary River Dhansiri joins on the south bank of River Brahmaputra. River Dhansiri mostly cover the District of Golaghat and supposed to carry the wastewater from Numaligarh Refinery and contribute water quality to River Brahmaputra. Kaziranga ranges are located on the bank of River Brahmaputra.

f. *River Brahmaputra at Bhomuraguri, Silighat*

Bhomuraguri is located in between Silighat and Nagaon in Sonitpur District. The sampling location on River Brahmaputra is situated at a distance of 6 km from Tejpur town on NH-37A, which joins NH-37 at Kaliabar to NH-52 at Mission Chariali, crossing the River after Brahmaputra Road Bridge. Before construction of the Road Bridge on River, it was a ferry ghat with human settlement on the bank. The ferry and motor boats were used to transport people from one place to other through River. Ari fishes (*Mystus Singhala*) are collected from River Brahmaputra and sold here. The forest department of Assam also maintained the Teak forest. River Buridihing, Disang, Dikrong, Jhanji, Subansiri, Dhansiri and other tributaries join River Brahmaputra at upstream of this location. Further, ahead River goes downstream to Bangladesh. Tejpur is located on the opposite bank of sampling site.

g. *River Brahmaputra at Saraighat, Guwahati*

Saraighat Bridge connects both the north & south bank of River Brahmaputra near Sadilapur at Guwahati. The sampling site is located at Pandughat before the Road Bridge. The Refinery effluents are discharged at upstream of this location. The Refinery is located at Noonmati. This is the downstream of Central Guwahati.



River Brahmaputra at Guwahati



Bio-monitoring of River Brahmaputra at Bhomuraguri

h. River Brahmaputra at Joghigopa

Situated at the downstream of Assam, Jogighopa is about 20 km from Bongaigaon, Industrial Township of Assam. Golpara is the nearest town to this location. Jogighopa is situated across the Panchratna Bridge also known as Naranarayan Setu on River Brahmaputra on NH-37. This town is located at a distance of 168 km from Guwahati. The sampling site is located near water intake point of Jogighopa Paper Mill in District Bongaigaon. Central Govt.'s Archaeological Department has developed historic site on the hill side. The entire catchment of River Brahmaputra at this location is used for coal storage, transport from Garo Hills of Meghalaya state. 2.8 km long rail cum Road Bridge is also present parallel to NH-37. Bamboo boats are used for various human activities on the bank. Pine tree shrubs have been planted on the bank. Beetle nut and Palm trees are common at this place. A big wetland has been formed from the flood water of Brahmaputra, which extends parallel to NH-37. After Guwahati, a number of tributaries like Manas, Puthimari, Pagladia, and Beki etc. join the Brahmaputra before Jogighopa.



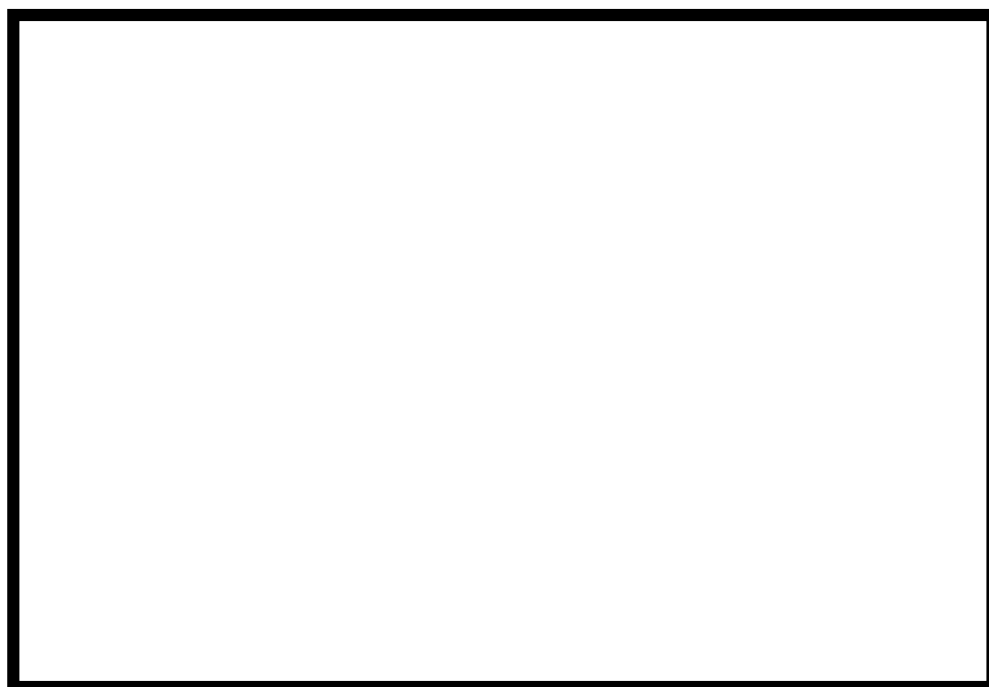
River Brahmaputra at Joghigopa

i. River Brahmaputra at Dhubri

This is situated further downstream of Assam. Dhubri is the last monitoring station on River Brahmaputra before entering the territory of Bangladesh. After crossing the Dhubri District, the River takes its way to the Bangladesh. A match factory existed earlier at this location. Bongaigaon is located on the opposite bank of River.

j. River Jia-Barali at Bukagaon

River Jia-Barali before entering the Assam border, known as River Kameng in Arunachal Pradesh. Sampling locations on River Jia-Barali at Bukagaon is about 345 km from Jonai and 16 km from Jamuguri of Balipara Division on NH-52. The sampling site is located on River Jia-Barali near Road Bridge of NH-52. Department of Irrigation is located on the opposite bank at Towbhanga village. The sampling site is in between Rail Bridge and Road Bridge on River Jia-Barali. River Jia-Barali originates from the hills of Arunachal Pradesh and joins to River Brahmaputra. Fishing competition is held every year among N-E-States for maximum fish catch. The maximum weight reported for fish catch is 17 kg.



Bio-monitoring of River Jia-Barali

RIVER MALIDOR, NEW MALIDOR, JALALPUR

River Malidor passes through Meghalaya State and Karbi Anglong Tea Estate of Assam at Assam-Meghalaya border. River goes downstream to Bangladesh. The sampling location is situated near New Malidor, Jalalpur at Jaintia Hill Border Road. Sonapur is 48 km and Shillong is 145 km from this location. The sampling site on River Malidor was selected on NH-44 near Shiv Temple. Kalain is at 18 km from this location. Beetle nut plantation is common vegetation. Badarpur is 44 km and Umkiang is located at 3 km distance. Tea cultivation is done on hills near Kalain. White Rhododendrons are planted all along the forest. Borak valley starts from the Assam border at this location.

RIVER RANGANADI AT PAHUMARA, LAKHIMPUR

River Ranganadi is an important tributary of River Subansiri. Ranganadi originates from Arunachal Pradesh and joins River Subansiri at Pabori Reserve Forest, about 10-20 km from sampling site. Hydro-electric power generation is the major activity of Ranganadi Hydrel Project of NEPCO Kameng in Arunachal Pradesh. The sampling site on Ranganadi is located near Road Bridge of NH-52, and 6 km from North Lakhimpur at Pahumara village. Bamundoloni village is situated on the opposite bank of River. Railway Bridge is parallel to Road Bridge on River Ranganadi. Egrets are observed quite often at this location.



River Ranganadi at Lakhimpur

RIVER BOGINADI AT MILANPUR, LAKHIMPUR

Boginadi comes from hills of Arunachal Pradesh and joins to River Subansiri at downstream at a distance of 3-4 km at Ghaggerghat. The sampling site is located at 16 km from Lakhimpur district on a bypass from NH-52 near Namghar. The opposite bank of River Boginadi is inhabited by Lalpari village. Ratanpur nullah from Hills join River Boginadi about 300-500 mtrs upstream from sampling site.

RIVER DIKRONG AT BANDARDUA

River Dikrong is a tributary of River Brahmaputra. River Dikrong arises from Arunachal Pradesh and joins River Brahmaputra at Majuli in Assam. The River Dikrong passes through border of Bandardua in Assam and Arunachal Pradesh. Itanagar is 25 km from NH-52 crossing. The sampling site on River Dikrong was selected at Harmutty Tea Estate near Higher Secondary School, Parbati Nagar, Bandardua. Harmutty Tea Estate is located towards the opposite bank of River Dikrong.



River Boginadi



Bio-monitoring of River Boginadi

2.4 BIO-MONITORING OF PERENNIAL RIVERS IN ASSAM STATE

The bio-assessment of Perennial Rivers in Assam State was undertaken using Biological Water Quality Criteria (BWQC) using Saprobic Score and Diversity Score of water quality (Table 6).

Fig 1 : Bio-Mapping of Some Important Perennial Rivers of Assam (Year 2003)

Fig 2 : Bio-Mapping of Some Important Perennial Rivers of Assam (Year 2004)

Table 6: Bio-monitoring of Perennial Rivers in Assam State

| S. No. | Rivers/ Sampling Period | Location of Stretch | Temperature °C | | Dissolved oxygen mg/l | pH | Saprobic Score | Diversity Score | Biological Water Quality Class | Biological Water Quality |
|--------|--|--|-------------------|-------|-----------------------------|-------------|-------------------|--------------------|---|---|
| | | | Air | Water | | | | | | |
| 1. | River Buridihing | Bed Camp at Miao in Arunachal Pradesh | 32.0 | 20.0 | 7.9 | 7.7 | 8.2 | 0.5 | A | Clean |
| | | | 20.0 | 17.0 | 9.3 | 7.5- 7.8 | 9.5 | 0.5 | A | |
| | April, 2003 | Dihing, Ferryghat at Margherita | 24.0 | 23.0 | 6.3 | 6.5 | 5.3 | 0.37 | C | Moderate Pollution |
| | | | 24.0 | 23.0 | 6.9 | 6-6.5 | 4.8 | 0.42 | C | |
| | October, 2004 | Gammon, Dullang at Khowang, NH-37 | 23.0 | 21.0 | 5.9 | 6.7 | 5.3 | 0.48 | C | Moderate Pollution |
| | | | 24.0 | 22.0 | 6.7 | 6-7 | 5.2 | 0.40 | C | |
| | Dihingmukh at Dibrugarh | 22.0 | 22.0 | 6.9 | 6.0 | 5.8 | 0.43 | C | Moderate Pollution | |
| | | 22.0 | 20.0 | 6.5 | 6-7 | 5.6 | 0.40 | C | | |
| 2. | River Disang | Dillighat, Assam- Arunachal Pradesh border | 26.0 | 21.0 | 7.6 | 6.8 | 7.3 | 0.5 | A | Clean |
| | | | 19.0 | 16.0 | 8.6 | 7-8 | 8.7 | 0.5 | A | |
| | May, 2003 | Lalpagari ghat at Namrup Industrial township | 22.0 | 18.0 | 6.6 | 6.0 | 5.0 | 0.44 | C | Moderate Pollution Heavy Pollution |
| | | | 22.0 | 18.0 | 6.0 | 7-7.5 | 5.0 | 0.29 | D | |
| | November, 2004 | Rajabari, Sibsagar | 30.0 | 26.0 | 6.0 | 6.8 | 4.8 | 0.41 | C | Moderate Pollution |
| | | | 22.0 | 19.0 | 7.1 | 6-7 | 6.0 | 0.45 | C | |
| | Sepaigaon, Disangmukh Sibsagar | 30.0 | 25.0 | 5.8 | 6.4 | 5.7 | 0.39 | C | Moderate Pollution | |
| | | 22.0 | 20.0 | 6.8 | 6-7 | 5.3 | 0.44 | C | | |
| 3. | River Jhanji | Amguri, Tea Estate, Rajabari, Assam- Nagaland Border | 31.0 | 24.0 | 6.2 | 6.8 | 6.2 | 0.51 | B | Slight pollution |
| | | | 20.0 | 18.0 | 7.4 | 7-7.5 | 6.6 | 0.53 | B | |
| | May, 2003 | NH-Crossing, Jhanji at Sibsagar | 30.0 | 26.0 | 6.7 | 6.5 | 5.7 | 0.39 | C | Moderate Pollution |
| | | | 23.0 | 21.0 | 6.7 | 6-7 | 5.3 | 0.42 | C | |
| | November, 2004 | Jhanjimukh, Kumargaon at Jorhat near Teok | 30.0 | 24.0 | 6.0 | 6.5 | 5.7 | 0.43 | C | Moderate Pollution |
| | | | 22.0 | 20.0 | 6.7 | 6-7 | 5.2 | 0.30 | C | |
| 4. | River Dhansiri | Kesharidubi, Tengani Nambar, Assam-Nagaland border | 26.0 | 22.0 | 5.9 | 7.0 | 6.5 | 0.54 | B | Slight pollution |
| | | | 20.0 | 17.0 | 7.4 | 7-8 | 6.5 | 0.55 | B | |
| | May, 2003 | NRL Jetty at NH-Crossing, Numaligarh | 30.0 | 27.0 | 6.8 | 6.4 | 5.7 | 0.3 | C | Moderate Pollution |
| | | | 22.0 | 20.0 | 6.9 | 6-7 | 5.2 | 0.45 | C | |
| | November, 2004 | Dhansirimukh, Golaghat Nagaon district border | 29.0 | 26.0 | 6.9 | 6.3 | 5.2 | 0.42 | C | Moderate Pollution |
| | | | 20.0 | 17.0 | 7.0 | 7-7.5 | 4.7 | 0.35 | C | |
| 5. | Ellenga Beel System Pond | Belguri, Jagi Road | 32.0 | 29.0 | 1.4 | 7.9 | 5.0 | 0.31 | D | Heavy pollution Moderate Pollution |
| | | | 23.0 | 21.0 | 0.8 | 7-8 | 3.5 | 0.36 | C | |
| | May, 2003 | Jagi road, other side of Bridge, Morigaon | 33.0 | 29.0 | 0.6 | 8.0 | 2.7 | 0.37 | D | Heavy pollution |
| | | | 23.0 | 20.0 | 0.2 | 8.9 | 2.4 | 0.37 | D | |
| 6. | River Subansiri | Gerukamukh, Subansiri lower H.E. Project, North Lakhimpur District | 24.0 | 16.0 | 7.5 | 7.7 | 7.0 | 0.43 | A | Clean |
| | | | 27.0 | 17.0 | 7.1 | 7.3 | 6.7 | 0.5 | B | |
| | May, 2003 | Chaowlohoa ghat North Lakhimpur | 29.0 | 22.0 | 6.3 | 7.0 | 5.0 | 0.33 | C | Moderate Pollution |
| | | | 29.0 | 22.0 | 6.3 | 7.0 | 5.0 | 0.33 | C | |
| | | Alichiga, Bordubi | 29.0 | 22.0 | 6.3 | 7.0 | 5.0 | 0.33 | C | Moderate Pollution |
| | | | 29.0 | 22.0 | 6.3 | 7.0 | 5.0 | 0.33 | C | |
| 7. | River Borak | Fuler Tal, Jirbam, Assam- Manipur Border | 30.0 | 28.0 | 6.3 | 7.2 | 6.1 | 0.5 | B | Slight pollution |
| | | | 29.0 | 27.0 | 6.0 | 6.8 | 5.8 | 0.5 | C | |
| | May, 2003 | Katakhal, Silchar | 29.0 | 27.0 | 6.0 | 6.8 | 5.8 | 0.5 | C | Moderate Pollution |
| | | | 29.0 | 27.0 | 6.0 | 6.8 | 5.8 | 0.5 | C | |
| | Badarpurghat, Badarpur | 32.0 | 29.0 | 6.1 | 5.7 | 5.2 | 0.43 | C | Moderate Pollution | |
| | | 32.0 | 29.0 | 6.1 | 5.7 | 5.2 | 0.43 | C | | |
| | Kalibarighat, Karimganj, Assam-Bangladesh border | 31.0 | 28.0 | 6.4 | 5.9 | 5.8 | 0.47 | C | Moderate Pollution | |

| S. No. | Rivers/ Sampling Period | Location of Stretch | Temperature °C | | Dissolved oxygen mg/l | pH | Saprobic Score | Diversity Score | Biological Water Quality Class | Biological Water Quality |
|-----------------------|----------------------------------|---|----------------|-------|-----------------------|-------|----------------|--------------------|--------------------------------|--------------------------|
| | | | Air | Water | | | | | | |
| 8. | River Brahmaputra | Saikhowaghat, Tinsukia | 26.0 | 24.0 | 6.9 | 6.7 | 7.2 | 0.5 | A | Clean |
| | | | 19.0 | 17.0 | 8.2 | 7-7.5 | 7.8 | 0.5 | A | |
| | November, 2004 | Nagagholti, Maizan, Dibrugarh | 24.0 | 19.0 | 7.6 | 7.0 | 6.0 | 0.5 | B | Slight pollution |
| | | | 20.0 | 18.0 | 7.8 | 7.0 | 5.7 | 0.45 | C | |
| | | Disangmukh, Sibsagar | 30.0 | 24.0 | 6.7 | 6.6 | 5.6 | 0.5 | C | Moderate Pollution |
| | | | 23.0 | 20.0 | 7.9 | 6-7 | 6.0 | 0.5 | C | |
| | Nimatighat, Jorhat | 28.0 | 20.0 | 7.4 | 7.6 | 5.3 | 0.39 | C | Moderate Pollution | |
| | | 22.0 | 19.0 | 7.5 | 7.0 | 5.7 | 0.50 | C | | |
| | December, 2004 | Dhanbari Camp, Golaghat | 30.0 | 26.0 | 6.3 | 6.2 | 5.7 | 0.36 | C | Moderate Pollution |
| 21.0 | | | 18.0 | 7.9 | 7-8 | 5.8 | 0.5 | C | | |
| Bhumuraguri, Silighat | 28.0 | 28.0 | 6.6 | 7.2 | 5.7 | 0.44 | C | Moderate Pollution | | |
| | 22.0 | 20.0 | 7.8 | 6-7 | 6.0 | 0.56 | C | | | |
| April-May, 2003 | Saraighat, Guwahati | 29.0 | 27.0 | 7.5 | 7.8 | 5.2 | 0.46 | C | Moderate Pollution | |
| | | | | | | | | | | |
| | Jogighopa near Panchratna Bridge | 32.0 | 30.0 | 7.7 | 7.9 | 5.4 | 0.44 | C | Moderate Pollution | |
| 22.0 | | 20.0 | 7.8 | 7.0 | 5.0 | 0.45 | C | | | |
| Dhubri | 31.0 | 27.0 | 6.7 | 6.9 | 5.6 | 0.35 | C | Moderate Pollution | | |
| | 22.0 | 20.0 | 7.7 | 6-7 | 6.2 | 0.50 | B | | | |
| 9. | River Brahmaputra | Pandu ghat, Sadilapur near Saraighat Bridge | 20.0 | 23.0 | 6.9 | 7.0 | 5.0 | 0.56 | C | Moderate Pollution |
| | | | 22.0 | 20.0 | 7.4 | 7.0 | 5.7 | 0.46 | C | |
| November, 2003 | December, 2004 | | | | | | | | | |
| | | | | | | | | | | |
| 10. | River Borak | Badarpur, Badarpurghat | 29.0 | 25.0 | 6.7 | 6-7 | 6.16 | 0.43 | C | Moderate Pollution |
| | | | 23.0 | 20.0 | 6.9 | 6-7 | 5.7 | 0.47 | C | |
| | November, 2003 | Kalighat, Karimganj | 26.5 | 22.5 | 6.9 | 6-7 | 5.3 | 0.45 | C | Moderate Pollution |
| | | | 22.0 | 20.0 | 7.0 | 6-7 | 5.8 | 0.47 | C | |
| November, 2004 | Katakhal on NH-44 | 26.0 | 23.5 | 7.4 | 6-7 | 5.7 | 0.61 | C | Moderate Pollution | |
| | | 23.0 | 21.0 | 7.6 | 6-7 | 5.7 | 0.58 | C | | |
| 11. | River Malidor | New Malidor, Jalalpur, Assam-Meghalaya Border | 27.0 | 23.0 | 8.5 | 7.0 | 7.8 | 0.26 | A | Clean |
| | | | 21.0 | 19.0 | 8.4 | 7.0 | 9.2 | 0.32 | A | |
| November, 2003 | November, 2004 | | | | | | | | | |
| | | | | | | | | | | |
| 12. | River Borak Upstream | Fuler Tal | 26.5 | 24.0 | 7.0 | 6-7 | 5.0 | 0.31 | C | Moderate Pollution |
| | | | 23.0 | 20.0 | 7.3 | 6-7 | 5.2 | 0.33 | C | |
| November, 2003 | November, 2004 | | | | | | | | | |
| | | | | | | | | | | |
| 13. | River Jia-Bharali | Bukagaon on NH-52 | 24.0 | 23.0 | 6.7 | 6-6.5 | 4.8 | 0.7 | C | Moderate Pollution |
| 14. | River Subansiri upstream | Gerukamukh, Subansiri lower H.E. Project | 28.0 | 19.0 | 8.8 | 7-7.5 | 8.1 | 0.5 | A | Clean |
| | | | 19.0 | 17.0 | 8.5 | 7-8 | 8.2 | 0.5 | A | |
| | November, 2003 | Dhulumukh, Arunachal Pradesh border | 26.5 | 16.5 | 8.7 | 7-7.5 | 9.3 | 0.5 | A | Clean |
| 22.0 | | | 20.0 | 7.9 | 6-7 | 8.7 | 0.5 | A | | |
| December, 2004 | Chauldhuaghat north Lakhimpur | 25.5 | 21.0 | 8.2 | 6-7 | 9.0 | 0.57 | A | Clean | |
| | | 22.0 | 20.0 | 7.9 | 6-7 | 8.7 | 0.5 | A | | |

| S. No. | Rivers/ Sampling Period | Location of Stretch | Temperature °C | | Dissolved oxygen mg/l | pH | Saprobic Score | Diversity Score | Biological Water Quality Class | Biological Water Quality |
|--------|---------------------------------------|---|----------------|-------|-----------------------|-------|----------------|-----------------|--------------------------------|--------------------------|
| | | | Air | Water | | | | | | |
| 15. | River Subansiri Downstream | Alichiga, 90 km from Gerukamukh | 24.0 | 18.5 | 7.4 | 6-7 | 5.3 | 0.33 | C | Moderate Pollution |
| | | | 22.0 | 19.0 | 7.9 | 6-7 | 5.5 | 0.37 | C | |
| 16. | River Ranganadi November, 2003 | Pahumara, Lakhimpur | 31.0 | 25.0 | 7.1 | 6.0 | 4.0 | 0.32 | D | Heavy Pollution |
| 17. | River Boginadi | Boginadi, Milanpur, Lakhimpur District | 28.5 | 29.0 | 6-9 | 6.0 | 6.16 | 0.52 | B | Slight pollution |
| 18. | River Dikrong November, 2003 | Harmutty Tea Estate on NH-52, near Higher Secondary School, Bandardua | 22.5 | 19.5 | 7.3 | 7-7.5 | 6.8 | 0.6 | B | Slight pollution |
| 19. | River Brahmaputra | Bhomuraguri Sonitpur District | 27.0 | 21.5 | 7.6 | 6-7 | 6.0 | 0.2 | C | Moderate Pollution |
| | | Jogighopa on NH-37 Panchratna Bridge | 27.0 | 26.0 | 7.6 | 7.0 | 5.1 | 0.48 | C | Moderate Pollution |
| 20. | River Lubha November, 2004 | Near Lubha Bridge Sonapur, Meghalaya | 22.0 | 20.0 | 8.6 | 7.0 | 10.0 | 0.4 | A | Clean |

Table 7: Clean Water (Class `A') Stretches of Rivers in Assam State (2003)

| S. No. | Rivers/Water Bodies | District/Town/Village | Location of stretch | Taxa/Families of benthic macro-invertebrates available from Rivers |
|--------|--|---|--------------------------------------|--|
| 1. | River Buridihing April & December, 2003 | Miao (Arunachal Pradesh) | Bed Camp | <i>EPHEMEROPTERA/Heptageniidae, Ephemeridae, Pothaminthidae, Caenidae, Baetidae, Leptophlebiidae</i> |
| 2. | River Disang May & December, 2003 | Assam-Arunachal Pradesh Border | Dillighat | <i>PLECOPTERA/Perlidae</i> <i>TRICHOPTERA/Goeridae, Rhyacophilidae</i> |
| 3. | River Subansiri May & November, 2003 | Gerukamukh, North Lakhimpur | Subansiri Lower H.E. Project | <i>ODONATA/Lestidae, Gomphidae, Corduliidae</i> |
| | | Dhulumukh Arunachal Pradesh Border | Opposite Bank of River at Gerukamukh | <i>MOLLUSCA/Viviparidae, Thiaridae, Bithynidae</i> <i>COLEOPTERA/Hygrobidae, Noteridae</i> |
| | | North Lakhimpur | Chauldhuaghat | <i>CRUSTACEA/Atydae</i> |
| 4. | River Brahmaputra May & December, 2003 | Tinsukia | Saikowaghat | <i>HEMIPTERA/Nepidae</i> <i>PLANARIA/Planariidae</i> |
| 5. | River Malidor November, 2003 | New Malidor Jalalpur, Assam-Meghalaya Border | Shiv temple near NH-44 | |

Table 7a: Clean Water (Class `A') Stretches of Rivers in Assam during 2004

| S. No. | Rivers/Water Bodies | District/Town/Village | Location of stretch | Taxa/Families of benthic macro-invertebrates available from Rivers |
|------------------------------------|---------------------|--------------------------------------|-------------------------------------|--|
| 1. | River Buridihing | Miao (Arunachal Pradesh) | Bed Camp | <i>EPHEMEROPTERA/Heptageniidae, Ephemeridae, Caenidae</i> |
| 2. | River Disang | Assam-Arunachal Pradesh Border | Dillighat | <i>PLECOPTERA/Perlidae</i> |
| 3. | River Subansiri | Gerukamukh, North Lakhimpur | Subansiri Lower H.E. Project | <i>TRICHOPTERA/Goeridae</i> |
| Dhulumukh Arunachal Pradesh Border | | Opposite Bank of River at Gerukamukh | <i>ODONATA/ Gomphidae, Lestidae</i> | |
| North Lakhimpur | | Chauldhuaghat | <i>MOLLUSCA/ Thiaridae</i> | |
| 4. | River Lubha | Near Lubha Bridge | Sonapur, Meghalaya | <i>CRUSTACEA/Atydae</i> |
| 5. | River Malidor | Jalalpur | Assam Meghalaya Border | |

Table 7b: Slightly Polluted Water (Class `B') Stretches of Rivers in Assam State (2004)

| S. No. | Rivers/Water Bodies | District/Town/Village | Location of stretch | Taxa/Families of benthic macro-invertebrates available from Rivers |
|--------|-------------------------------------|-----------------------------------|-------------------------|--|
| 1. | River Jhanji November, 2004 | Rajabari, Assam – Nagaland Border | Amguri Tea Estate | <i>ODONATA/ Lestidae, Gomphidae</i> <i>MOLLUSCA/ Thiaridae</i> <i>CRUSTACEA/Atydae, Gammaridae</i> |
| 2. | River Dhansiri November, 2004 | Kesharidubi, Tengani, Nambar | Assam – Nagaland Border | <i>HEMIPTERA/Nepidae</i> |
| 3. | River Brahmaputra December, 2004 | Balasur | Dhubri | |

Table 7c: Moderately Polluted Water (Class `C') Stretches of Rivers in Assam State (2004)

| S. No. | Rivers/Water Bodies | District/Town/Village | Location of stretch | Taxa/Families of benthic macro-invertebrates available from Rivers |
|--------|--|-------------------------------|--------------------------|--|
| 1. | River Buridihing October, 2004 | Dihing, Margherita | Ferry ghat | <i>TRICHOPTERA/Hydropsychidae</i> <i>ODONATA/ Lestidae, Gomphidae, Libellulidae</i> <i>CRUSTACEA/Atyidae, Gammaridae</i> <i>MOLLUSCA/Thiaridae, Sphaeridae, Viviparidae, Unionidae, Planorbidae, Lymnaeidae,</i> <i>HEMIPTERA/Nepidae</i> <i>COLEOPTERA/ Gyrinidae, Hydrophilidae</i> <i>OLIGOCHAETA/Oligochaetes</i> <i>DIPTERA/Chironomidae</i> |
| | | Gommon | Dullang at Khowang NH-37 | |
| | | Dibrugarh | Dihingmukh | |
| 2. | River Disang November, 2004 | Rajabari, | Sibsagar | |
| | | Sipaigaon, Disangmukh | Sibsagar | |
| 3. | River Jhanji November, 2004 | Jhanji | NH-Crossing at Sibesar | |
| | | Jorhat, Jhanjhimukh | Kumargaon near Teok | |
| 4. | River Dhansiri November, 2004 | Numaligarh | NRL Jetty at NH-Crossing | |
| | | Golaghat, Dhansirimukh Nagaon | Nagaon district border | |
| 5. | Ellenga Beel System Pond December, 2004 | Belguri | Jagi Road | |
| 6. | River Brahmaputra November-December, 2004 | Dibrugarh | Nagaghholi, Maizan | |
| | | Disangmukh | Sibsagar | |
| | | Jorhat | Nimatighat | |
| | | Golaghat | Dhanbari Camp | |
| | | Bhomuraguri | Silighat | |
| | | Guwahati | Saraighat | |
| | | Jogighopa | Near Panchratna Bridge | |
| 7. | River Borak November, 2004 | Badarpur | Badarpur Ghat | |
| | | Karimganj | Kalighat | |
| | | Katakhal | On NH-44 | |
| | | Fuler Tal | Fuler Tal | |
| 8. | River Subansiri downstream | Alichiga | 80 km from Gerukamukh | |

Table 7d: Highly Polluted Water (Class `D') Stretches of Rivers in Assam State (2004)

| S. No. | Rivers/Water Bodies | District/Town/Village | Location of stretch | Taxa/Families of benthic macro-invertebrates available from Rivers |
|--------|--|-----------------------|--|--|
| 1. | River Disang November, 2004 | Namrup | Lalpagari Ghat at Namrup Industrial township | <i>CRUSTACEA/Atyidae</i> <i>ODONATA/ Gomphidae</i> <i>MOLLUSCA/ Sphaeridae, Thiaridae</i> |
| 2. | Ellenga Beel System Pond December, 2004 | Jagi Morigaon road, | Other side of Bridge | <i>HIRUDINEA/Glossiphonidae, Hirudidae</i> <i>DIPTERA/Chironomidae</i> <i>OLIGOCHAETA/Oligochaetes</i> |

Table 8: Slightly Polluted Water (Class `B') Stretches of Rivers in Assam State (2003)

| S. No. | Rivers/Water Bodies & Sampling period | District/Town/Village | Location of stretch | Taxa/Families of benthic macro-invertebrates available from Rivers |
|--------|---|---------------------------------|--|--|
| 1. | River Jhanji May & December, 2003 | Rajabari, Assam-Nagaland border | Amghri Tea Estate | <i>EPHEMEROPTERA/Leptophlebiidae</i> <i>PLECOPTERA/Perlidae</i> |
| 2. | River Dhansiri May & December, 2003 | Assam-Nagaland Border | Kesharidubi, Tengani, Nambar | <i>TRICHOPTERA/Hydropsychidae</i> <i>ODONATA/Lestidae, Gomphidae, Libellulidae, Corduliidae</i> |
| 3. | River Brahmaputra May & December, 2003 | Maizan, Dibrugarh | Nagaghल्ली | <i>MOLLUSCA/Viviparidae, Thiaridae, Bithynidae, Unionidae, Planorbidae</i> |
| | | Dhubri | Dhubri | |
| 4. | River Subansiri May, 2003 | North Lakhimpur | Chaowlohoaghat | <i>CRUSTACEA/Atyidae, Gammaridae</i> <i>HEMIPTERA/Nepidae</i> |
| 5. | River Borak May, 2003 | Jirbam, Assam-Nagaland Border | Fuler Tal | <i>COLEOPTERA/Gyrinidae, Haliplidae, Hygrobiidae</i> <i>DIPTERA/Chironomidae</i> |
| 6. | River Boginadi November, 2003 | Milanpur, Lakhimpur District | Boginadi Pul | |
| 7. | River Dikrong November, 2003 | Bandardua, Harmutty Tea Estate | Parbati Nagar, Near Higher Secondary School, NH-52 | |
| 8. | River Disang December, 2003 | Sepaigaon, Sibsagar | Desangmukh | |

Table 9: Moderately Polluted Water (Class `C') Stretches of Rivers in Assam State (2003)

| S. No. | Rivers/Water Bodies | District/Town/Village | Location of stretch | Taxa/Families of benthic macro-invertebrates available from Rivers |
|--------|--|------------------------------------|--|--|
| 1. | River Buridihing April & December, 2003 | Dihing, Margherita | Ferry ghat | <i>TRICHOPTERA/Hydropsychidae</i> |
| | | Gomman, Dullang at Khowang | Near NH-37 Road Bridge | <i>ODONATA/Gomphidae, Lestidae, Libellulidae</i> |
| | | Dibrugarh, Sibsagar | Near NH-Road Bridge, Maizan Tea Estate | <i>MOLLUSCA/Thiaridae, Sphaeridae, Viviparidae, Planorbidae, Hydrobiidae, Ancyliidae, Bithynidae, Lymnaeidae, CRUSTACEA/Atydae, Gammaridae</i> |
| 2. | River Disang May & December, 2003 | Namrup Industrial Township | Lalpagari ghat | <i>HEMIPTERA/Nepidae, Belastomatidae</i> |
| | | Rajabari, Sibsagar | Near NH-37 Road Bridge | <i>COLEOPTERA/Heliplidae, Gyrinidae, Hydrophilidae, Dytiscidae, Noteridae</i> |
| | | Sipaigaon, Sibsagar | Disangmukh | <i>HIRUDINEA/Glossiphonidae</i> <i>OLIGOCHAETA/Oligochaetes</i> <i>DIPTERA/Chironomidae</i> |
| 3. | River Jhanji May & December, 2003 | Jhanji at Sibsagar | NH-Crossing | |
| | | Kumargaon at Jorhat | Jhanjimukh near Teok | |
| 4. | River Dhansiri May & December, 2003 | Golaghat / Numaligarh | NRL Jetty at NH-Crossing | |
| | | Golaghat-Nagaon District border | Dhansirimukh | |
| 5. | River Subansiri May & November, 2003 | Bordubi, Lakhimpur | Alichiga | |
| 6. | River Borak May, 2003 | Golaghat / Silchar | Katakhal | |
| | | Karimganj / Badarpur | Badarpurghat | |
| | | Karinganj, Assam-Bangladesh Border | Kalibarighat | |
| | | Kathakal | On NH-44 | |
| | | Dilkhush Tea Estate | Opposite to Fuler Tal | |
| | | Assam-Manipur border | Fuler Tal | |

| S. No. | Rivers/Water Bodies | District/Town/Village | Location of stretch | Taxa/Families of benthic macro-invertebrates available from Rivers |
|--------|---|-----------------------|------------------------|--|
| 7. | River Brahmaputra May, November & December, 2003 | Sibsagar | Disangmukh | |
| | | Jorhat | Nimatighat | |
| | | Golaghat | Dhanbari camp | |
| | | Silighat | Bhomuraguri | |
| | | Guwahati | Saraighat | |
| | | Jogighopa | Near Panchratna Bridge | |
| | | Dhubri | Dhubri | |
| 8. | River Jia-Bharali November, 2003 | Sonitpur | On NH-52 Road Bridge | |
| 9. | Ellenga Beel System Pond December, 2003 | Nowgaon | Jagiroad | |

Table 10: Highly Polluted Water (Class `D') Stretches of Rivers in Assam State (2003)

| S. No. | Rivers/Water Bodies | District/Town/Village | Location of stretch | Taxa/Families of benthic macro-invertebrates available from Rivers |
|--------|--------------------------------------|----------------------------|----------------------------------|--|
| 1. | Ellenga Beel May & December, 2003 | Morigaon / Jagiroad | Jagi Road | <i>EPHEMEROPTERA/Baetidae</i> |
| | | | Jagiroad, other side of Jagiroad | <i>CRUSTACEA/Atydae</i> <i>MOLLUSCA/Viviparidae, Planorbidae, Sphoeridae, Thiaridae</i> |
| 2. | River Ranganadi November, 2003 | Lakhimpur | Pahumara | <i>COLEOPTERA/Haliplidae</i> |
| 3. | River Disang December, 2003 | Namrup Industrial Township | Lalpagari ghat | <i>HEMIPTERA/Pleidae</i> |
| | | | | <i>HIRUDINEA/Glossiphonidae, Hirudidae</i> |
| | | | | <i>DIPTERA/Chironomidae</i> <i>OLIGOCHAETA/Oligochaetes</i> |

Table 11: Taxonomic Composition of Benthic Macro-Invertebrates collected from Rivers of Assam

| S. No. | Taxa | % Taxonomic composition of Benthic Macro-invertebrates in Biological Water Quality Class | | | | |
|--------|-----------------|--|-----------|-----------|-----------|-----------|
| | | Class `A` | Class `B` | Class `C` | Class `D` | Class `E` |
| 1. | Arthropoda | 80.0 | 73.68 | 58.33 | 41.66 | 0.0 |
| | (i) Insecta | 93.75 | 63.45 | 85.71 | 33.33 | 0.0 |
| | (ii) Crustacea | 6.25 | 14.28 | 14.28 | 20.0 | 0.0 |
| 2. | Mollusca | 15.0 | 26.31 | 33.33 | 33.33 | 0.0 |
| 3. | Platyhelminthes | 5.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 4. | Annelida | 0.0 | 0.0 | 8.33 | 25.0 | 0.0 |

Table 12: Development of Biological Water Quality Criteria for Rivers of Assam State

| S. No. | Taxonomic Group | Range of Saprobic score (1-10) | Range of Diversity Score (0-1) | Water quality characteristics | Water Quality Class | Indicator Colour |
|--------|---|--------------------------------|--------------------------------|-------------------------------|---------------------|------------------|
| 1. | EPHEMEROPTERA, PLECOPTERA, TRICHOPTERA, ODONATA, MOLLUSCA, COLEOPTERA, CRUSTACEA, HEMIPTERA, PLANARIA | 7.0 - 9.3 | 0.26 - 0.57 | Clean | A | Blue |
| 2. | EPHEMEROPTERA, PLECOPTERA, TRICHOPTERA, ODONATA, MOLLUSCA, CRUSTACEA, HEMIPTERA, COLEOPTERA, DIPTERA | 6.0 - 6.8 | 0.5 - 0.6 | Slight pollution | B | Light Blue |
| 3. | TRICHOPTERA, ODONATA, MOLLUSCA, CRUSTACEA, HEMIPTERA, COLEOPTERA, HIRUDINEA, OLIGOCHAETA, DIPTERA | 3.5 - 6.16 | 0.2 - 0.7 | Moderate pollution | C | Green |
| 4. | EPHEMEROPTERA, CRUSTACEA, MOLLUSCA, COLEOPTERA, HEMIPTERA, HIRUDINEA, DIPTERA, OLIGOCHAETA | 2.2 - 5.0 | 0.3 - 0.37 | Heavy pollution | D | Orange |
| 5. | No benthic macro-invertebrates | 0.0 - 0.0 | 0.0 - 0.0 | Severe pollution | E | Red |

3.0 BIOLOGICAL WATER QUALITY ASSESSMENT OF PERENNIAL RIVERS IN ASSAM STATE

In Assam State, 46 numbers of river stretches have been assessed for bio-mapping of 14 rivers and tributaries. Out of 46 rivers stretches, 7 river stretches belonging to 5 major rivers namely, River Buridihing at Miaow, River Disang at Dillighat, River Subansiri at Gerukamukh, Dhulumukh, in North Lakhimpur, River Brahmaputra at Tinsukia and River Malidor at New Malidor were indicating the clean water quality (Class `A`). Nine river stretches of total 8 numbers of Rivers

such as River Jhanji at Rajabari, River Dhansiri at Nambar, River Brahmaputra at Dibrugarh, River Subansiri at, River Borak at Fuler Tal, River Boginadi at Lakhimpur District, River Dikrong at Bandardua and River Disang at Desangmukh were slightly polluted (Class `B'). Moderate pollution in water quality of Class `C' was observed in 26 number of river stretches of 9 rivers and tributaries like River Buridihing, River Jhanji, River Dhansiri, River Subansiri, Borak River, River Brahmaputra, River Jia-Bharali and Ellenga Beel Pond System at various locations and different seasons (Table 9). Water quality of Ellenga Beel System Pond at Belguri and Morigaon in May and December was found polluted. Therefore, 4 river stretches of 3 number of water bodies including River Ranganadi and River Disang at Namrup Industrial Township were lying in Class `D' of highly polluted water quality. None of the water bodies showed severe pollution Class `E' of water quality.

River Brahmaputra from its origin to its downstream reaches exhibits different classes of water quality at nine locations (A to I) as shown in Fig. 1. River Brahmaputra water quality is clean only in its upstream stretches at Saikowaghat in Tinsukia. At downstream of this location River Brahmaputra gets slightly polluted at Maizan in Dibrugarh. Rest of the seven locations from downstream Dibrugarh, the water quality of River Brahmaputra remains moderately polluted in Class `C' of water quality. These locations are at Sibsagar, Jorhat, Golaghat, Silighat, Guwahati, Jogighopa and Dhubri. At Dhubri, the water quality of River Brahmaputra gets diluted by the confluence of several tributaries and thus regains its water quality from moderate to slightly polluted water quality class `B' specially during month of December, 2003.

The taxonomic composition of Benthic macro-invertebrates collected from clean water quality stretches (Class `A') of Rivers (Table 7) in Assam supported 20 number of families whereas slightly polluted (Class `B') river stretches were indicated by 19 numbers of families (Table 8). Maximum of 24 numbers of families showed moderate pollution (Class `C') of water quality (Table 9). Highly polluted (Class `D') water quality inhabited only 10 numbers of families (Table 10). 80% of Arthropods dominated the clean water quality stretches. Their population gradually reduced with the increase in pollution of water quality of Class `B, C & D. Molluscs and Annelids were maximum in highly polluted water of Class `D'. No benthic animals belonging to Class `E' were observed (Table 12).

A comparison of Bio-map (Fig. 1 & 2) of year 2003 & 2004 indicates no change in water quality at most of the locations on River Brahmaputra & its tributaries except for few locations. For example, the biological water quality of River Disang at Lalpagari Ghat at Namrup Industrial Township has changed, from Moderate Pollution (Class `C') in 2003 to Heavy Pollution (Class `D') in year 2004. Similarly, the biological water quality of River Brahmaputra at Nagaghल्ली, Maizan in Dibrugarh was slightly polluted in year 2003 and degraded to Heavy Pollution (Class `D') in year 2004.

Water quality of River Brahmaputra at Nagaghholli Maizan in Dibrugarh was slightly polluted (Class `B') in 2003 and shifted to Moderate Pollution (Class `C') in 2004. On the other hand, water quality of Ellenga Beel System Pond at Jagiroad, Belguri indicates improvement in year 2004 indicating Moderate Pollution and upgrading from Heavy Pollution during year 2003. Dhubri Station is the last sampling location on River Brahmaputra, which depicts the overall water quality of River Brahmaputra at downstream of Assam State. The biological water quality of River Brahmaputra improved to slight pollution (Class `D') in 2004 compared to Moderate Pollution (Class `C') in year 2003. Following table indicates the total number of families of benthic macro-invertebrates collected during year 2003 and 2004:

| Biological Water Quality Class | Total Number of Families of Benthic Macro-Invertebrates | |
|--------------------------------|---|-----------|
| | Year 2003 | Year 2004 |
| A | 19 | 9 |
| B | 19 | 6 |
| C | 24 | 17 |
| D | 12 | 8 |

An actual water quality assessment relies on collection of mature colonization of benthic macro-invertebrates. Quite often the change in observations of water quality could be due to insufficient biological sampling.

4.0 COMPARISION OF BIOLOGICAL STATUS OF RIVERS IN MEGHALAYA AND ASSAM STATE

Although, Assam and Meghalaya are the sister states of North-Eastern India, their rivers differ from each other with respect to Taxonomical composition of biota (Table 13 & 14) and Biological Water Quality Criteria evolved from the saprobic score and diversity score of water quality (Table 15). Diptera and Megaloptera Taxonomic group of benthic macro-invertebrate families, were totally absent in clean water quality class `A' Rivers of Assam. Plecoptera group was absent in Class `B' water quality and Ephemeroptera and Megaloptera were absent in Class `C' Water Quality Rivers of Assam compared to taxonomic groups of water quality classes of Meghalaya State.

Taxonomic groups of Crustacea, Hemiptera and Ephemeroptera were the additional Taxa existed in the water quality class `D' of highly polluted rivers of Assam. Taxonomic groups of benthic macro-invertebrates of `E' Class water quality were not observed in Rivers of Assam and Meghalaya.

Table 13: Comparison of Taxonomic composition of Benthic Macro-invertebrates in Assam & Meghalaya

| S. No. | Group/Taxa | % Taxonomic composition of Benthic Macro-invertebrates | | | | | | | | | |
|--------|-----------------|--|-------|----------------|-------|----------------|-------|----------------|-------|----------------|-------|
| | | BWQC Class `A` | | BWQC Class `B` | | BWQC Class `C` | | BWQC Class `D` | | BWQC Class `E` | |
| | | Meghalaya | Assam | Meghalaya | Assam | Meghalaya | Assam | Meghalaya | Assam | Meghalaya | Assam |
| 1. | Arthropoda | 86.95 | 80.0 | 87.5 | 73.68 | 77.14 | 58.33 | 57.14 | 41.66 | 0.0 | 0.0 |
| | Insecta | 97.5 | 93.75 | 89.28 | 63.45 | 96.29 | 85.71 | 100.0 | 33.33 | 0.0 | 0.0 |
| | Crustacea | 2.5 | 6.25 | 7.15 | 14.28 | 3.7 | 14.28 | - | 20.0 | 0.0 | 0.0 |
| 2. | Mollusca | 10.86 | 15.0 | 9.37 | 26.31 | 11.428 | 33.33 | 14.28 | 33.33 | 0.0 | 0.0 |
| 3. | Platyhelminthes | 2.17 | 5.0 | 3.12 | 0.0 | - | 0.0 | - | 0.0 | 0.0 | 0.0 |
| 4. | Annelida | - | 0.0 | - | 0.0 | 11.42 | 8.33 | 28.57 | 25.0 | 0.0 | 0.0 |

Table 14: Comparison of Biological Status of Rivers of Meghalaya and Assam

| S. No. | Taxonomic Group | | Range of Saprobic score | | Range of Diversity Score | | Water quality | Water Quality Class | Indicator Colour |
|--------|---|--|-------------------------|----------|--------------------------|-----------|--------------------|---------------------|------------------|
| | Meghalaya | Assam | Meghalaya | Assam | Meghalaya | Assam | | | |
| 1. | EPHEMEROPTERA PLECOPTERA TRICHOPTERA ODONATA MOLLUSCA CRUSTACEA HEMIPTERA COLEOPTERA DIPTERA PLANARIA MEGALOPTERA | EPHEMEROPTERA PLECOPTERA TRICHOPTERA ODONATA MOLLUSCA CRUSTACEA HEMIPTERA COLEOPTERA PLANARIA - | 7.0-8.6 | 7.0-9.3 | 0.2-0.8 | 0.26-0.57 | Clean | A | Blue |
| 2. | EPHEMEROPTERA PLECOPTERA TRICHOPTERA ODONATA MOLLUSCA CRUSTACEA HEMIPTERA COLEOPTERA DIPTERA PLANARIA | EPHEMEROPTERA PLECOPTERA TRICHOPTERA ODONATA MOLLUSCA CRUSTACEA HEMIPTERA COLEOPTERA DIPTERA - | 6.0-6.7 | 6.0-6.8 | 0.47-0.72 | 0.5-0.6 | Slight pollution | B | Light Blue |
| 3. | EPHEMEROPTERA TRICHOPTERA ODONATA MOLLUSCA CRUSTACEA HEMIPTERA COLEOPTERA DIPTERA MEGALOPTERA HIRUDINEA OLIGOCHAETA | TRICHOPTERA ODONATA MOLLUSCA CRUSTACEA HEMIPTERA COLEOPTERA DIPTERA HIRUDINEA OLIGOCHAETA - | 3.4-6.2 | 4.2-6.16 | 0.2-0.8 | 0.2-0.7 | Moderate pollution | C | Green |
| 4. | MOLLUSCA DIPTERA HIRUDINEA COLEOPTERA OLIGOCHAETA - - - | MOLLUSCA DIPTERA HIRUDINEA COLEOPTERA OLIGOCHAETA CRUSTACEA HEMIPTERA EPHEMEROPTERA | 2.6-6.0 | 2.2-5.0 | 0.2-0.3 | 0.3-0.37 | Heavy pollution | D | Orange |
| 5. | No benthic macro-invertebrates | | 0.0 | 0.0 | 0.0 | 0.0 | Severe pollution | E | Red |

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