

## APPENDIX

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**Table A.1: Genus Based Algal Palmer Pollution Index (APPI)**  
(Palmer, 1969, Nandan and Patel, 1986)

<b>Genus</b>	<b>Pollution Index</b>	<b>Genus</b>	<b>Pollution Index</b>
Anacystis	1	Micractinium	1
Ankistrodesmus	2	Navicula	3
Chlamydomonas	4	Nitzschia	3
Chlorella	3	Oscillatoria	5
Closterium	1	Pandorina	1
Cyclotella	1	Phacus	2
Euglena	5	Phormidium	1
Gomphonema	1	Scenedesmus	4
Lepocinclis	1	Stigeoclonium	2
Melosira	1	Synedra	2
Anabaena	1		

Pollution classification of Palmer (1969) suggest that APPI =0-10 represents lack of organic pollution, 10-15 indicates moderate pollution, 15-20 marks probable high organic pollution, and 20 or more confirms high organic pollution.

**Table A.2: Biological Monitoring Working Party (BMWP) Score**  
(De Zwart & Trivedi, 1994)

<b>Taxonomical Class</b>	<b>Taxonomical Families</b>	<b>BMWP Score</b>
Ephemeroptera	Heptogeniidae, Leptophlebiidae, Ephemerellidae, Ephemeridae, Potoamintidae, Siphonuridae	<b>10</b>
Plecoptera	Leuctridae, Capniidae, Perlodidae, Perlidae, Taeniopterygidae	
Hemiptera	Aphelocheiridae	
Trichoptera	Leptoceridae, Goeridae, Lepidostomatidae, Brachycentridae, Sericostomatidae	
Odonato	Lestidae, Gomphidae, Cordulegasteridae, Aeschnidae, Corduliidae, Libellulidae, Plathycnemididae	<b>8</b>
Trichoptera	Psychomyiidae, Philopotomidae	
Ephemeroptera	Caenidae	<b>7</b>
Plecoptera	Nemouridae	
Trichoptera	Rhyacophilidae, Polycentropodidae, Limnephilidae	
Mollusca	Ancylidae, Hydrobiidae, Neritidae, Viviparidae, Thiaridae, Bithynidae, Unionidae	<b>6</b>
Trichoptera	Hydroptilidae	
Crustacea	Palaemonidae, Atyidae, Gammaridae	
Polychaeta	Nereidae, Nephthyidae	
Odonata	Coenagriidae, Agriidae	
Hemiptera	Mesovelidae, Hydrometridae, Gerridae, Nepidae, Naucoridae, Notonectidae, Pleidae, Corixidae, Veliidae, Hebridae, Belestomatidae	<b>5</b>
Coleoptera	Haliplidae, Hygrobiidae, Dytiscidae, Gyrinidae, Hydrophilidae, Noteridae, Helodidae, Dryopidae, Elminthidae, Psephenidae	
Trichoptera	Hydropsychidae	
Diptera	Tipulidae, Culicidae, Blepharoceridae, Simuliidae	
Planaria	Planariidae, Dendrocoelidae	
Ephemeroptera	Baetidae	<b>4</b>
Megaloptera	Sialidae	
Hirudinea	Piscicodidae	
Mollusca	Lymnaeidae, Planorbidae, Sphaeridae	<b>3</b>
Hirudinea	Glossiphonidae, Hirudidae, Erpobdellidae	
Planaria	Dugesidae	
Crustacea	Asselidae	
Diptera	Chironomidae, Syrphidae	<b>2</b>
Oligochaeta	All families	<b>1</b>

**Table A.3: Observed Values of Parameters/Indices for River Ganga near Varanasi (India) (Sep 2016-May 2017 and Sep 2017- May 2018)**

		Observed value of Parameter/Index												
		Organo-Electrolytic-Bacterial (OEB)					Nutrient (NT)			Algae (A)	Macroinvertebrates (MI)		Fish (F)	
2016-17		EC µS/cm	DO mg/l	BOD mg/l	COD mg/l	FC MPN/ 100ml	NH3-N mg/l	TN mg/l	TP mg/l	APPI	MSW	MBMWP	FS	FSW
Post Monsoon (16Sep-15Nov)	V1	609	6.5	4.3	34	1100	0.40	0.91	0.160	13	0.68	4.5	70	2.23
	V2	700	3.9	7.0	72	4200	1.48	2.34	0.359	16	0.84	3.7	70	2.23
	V3	600	6.2	5.0	52	2100	0.90	1.83	0.250	13	1.09	4.5	70	2.23
	V4	630	6.0	5.2	60	2400	1.19	1.62	0.290	13	0.70	4.3	70	2.23
	V5	680	5.9	5.5	70	2600	1.48	1.73	0.320	15	1.03	3.0	70	2.23
Winter (16Nov-15Jan)	V1	265	6.3	4.2	38	1500	0.50	1.35	0.195	13	1.59	4.4	70	2.23
	V2	300	4.0	6.2	68	3200	1.15	2.50	0.351	18	1.40	3.8	70	2.23
	V3	280	5.9	4.2	50	1800	0.86	1.68	0.268	13	1.32	4.3	70	2.23
	V4	280	5.5	4.4	45	2100	1.02	1.78	0.320	14	1.18	4.0	70	2.23
	V5	294	4.9	4.8	65	2300	1.50	1.83	0.378	13	1.41	3.8	70	2.23
Spring (16Jan-15Mar)	V1	300	6.3	4.0	58	1300	0.45	1.15	0.145	13	1.56	4.8	70	2.23
	V2	350	4.1	6.0	82	2100	1.04	1.68	0.410	17	1.33	4.4	70	2.23
	V3	320	6.0	4.2	55	1600	0.46	1.08	0.252	13	1.56	4.5	70	2.23
	V4	380	5.7	4.9	60	1800	0.53	1.21	0.258	14	1.35	4.3	70	2.23
	V5	400	5.0	5.2	68	2200	0.56	1.52	0.320	13	1.58	3.8	70	2.23
Summer (16Mar-15May)	V1	420	5.8	4.3	60	1800	0.90	1.37	0.210	15	1.27	5.2	70	2.23
	V2	900	2.9	6.8	92	3600	2.01	2.40	0.320	18	0.64	3.0	70	2.23
	V3	450	5.2	5.6	65	2000	1.11	1.43	0.265	16	1.24	4.3	70	2.23
	V4	800	4.9	6.4	85	2200	1.20	1.75	0.248	16	0.89	4.3	70	2.23
	V5	850	3.8	6.7	100	2800	1.45	1.85	0.300	18	1.25	3.2	70	2.23

		Organo-Electrolytic-Bacterial (OEB)					Nutrient (NT)			Algae (A)	Macroinvertebrates (MI)		Fish (F)	
2017-18		EC μS/cm	DO mg/l	BOD mg/l	COD mg/l	FC MPN/ 100ml	NH <sub>3</sub> - N mg/l	TN mg/l	TP mg/l	APPI	MSW	MBMWP	FS	FSW
Post Monsoon (16Sep-15Nov)	V1	650	6.0	5.0	40	1200	0.60	1.48	0.202	13	1.32	4.2	70	2.23
	V2	633	4.2	6.8	65	3100	1.18	1.50	0.280	16	1.00	4.3	70	2.23
	V3	572	6.7	4.7	48	1680	0.90	1.35	0.220	13	1.03	4.3	70	2.23
	V4	603	6.4	4.9	55	2200	1.12	1.58	0.217	13	1.20	4.2	70	2.23
	V5	615	5.4	5.2	68	2500	1.18	1.65	0.271	15	1.06	4.3	70	2.23
Winter (16Nov-15Jan)	V1	297	6.5	3.9	42	1600	0.53	1.05	0.195	13	1.64	4.6	70	2.23
	V2	308	4.6	6.0	78	2200	0.60	1.38	0.291	16	1.18	3.6	70	2.23
	V3	293	6.5	4.2	45	1200	0.38	0.68	0.238	14	1.16	4.8	70	2.23
	V4	294	5.9	4.3	42	1600	0.43	0.91	0.298	14	0.88	4.2	70	2.23
	V5	372	5.8	4.5	68	2100	0.60	1.33	0.248	15	1.04	4.8	70	2.23
Spring (16Jan-15Mar)	V1	332	6.3	4.0	52	1200	0.31	0.78	0.125	13	1.65	4.8	70	2.23
	V2	340	4.2	6.4	80	1800	0.30	0.72	0.210	15	1.41	4.2	70	2.23
	V3	348	6.0	4.3	52	1400	0.19	0.55	0.152	13	1.53	5.0	70	2.23
	V4	346	5.9	4.5	55	1500	0.20	0.52	0.158	13	1.53	4.2	70	2.23
	V5	390	5.2	4.8	68	1900	0.56	1.32	0.220	15	1.60	4.3	70	2.23
Summer (16Mar-15May)	V1	420	5.9	4.4	52	1600	0.89	1.35	0.160	15	1.33	4.2	70	2.23
	V2	1000	2.9	6.9	90	3300	1.50	2.00	0.290	21	1.18	2.7	70	2.23
	V3	500	5.4	5.6	58	1800	1.15	1.45	0.210	15	1.24	4.5	70	2.23
	V4	600	4.9	6.3	80	2400	1.18	1.65	0.288	17	1.11	3.3	70	2.23
	V5	1100	3.9	6.8	110	2400	1.19	1.95	0.260	18	1.14	2.7	70	2.23

**Table A.4: Observed Algal Genera for River Ganga near Varanasi (India) (Sep 2016-May 2017 and Sep 2017- May 2018)**

Site	Group	2016-17 (Genus)			
		Post Monsoon (16Sep-15Nov)	Winter (16Nov-15Jan)	Spring (16Jan-15Mar)	Summer (16Mar-15May)
V1	Bacillariophyceae	Cyclotella (1)	Cyclotella (1)	Cyclotella (1) Flagilaria	Nitzschia (3) Synedra (2)
	Chlorophyceae	Ankistrodesmus (2) Pediastrum Scenedesmus (4) Spirogyra Tribonema	Chlorella (3) Scenedesmus (4) Spirogyra Tribonema	Ankistrodesmus (2) Scenedesmus (4) Spirogyra Tribonema	Ankistrodesmus (2) Chlorella (3) Pediastrum Oedogonium Tribonema
	Cyanophyceae	Anabaena (1) Oscillatoria (5)	Oscillatoria (5)	Anabaena (1) Nodularia Oscillatoria (5)	Oscillatoria (5)
	Palmer Pollution Index (PPI)	13	13	13	15
V2	Bacillariophyceae	Nitzschia (3) Synedra (2)	Navicula (3) Nitzschia (3)	Asterionella Flagilaria Synedra (2)	Nitzschia (3)
	Chlorophyceae	Ankistrodesmus (2) Oedogonium Scenedesmus (4) Spirogyra Tribonema	Ankistrodesmus (2) Scenedesmus (4) Spirogyra Tribonema	Actinastrum Ankistrodesmus (2) Chlorella (3) Scenedesmus (4) Spirogyra Tribonema	Ankistrodesmus (2) Chlorella (3) Crucigenia Hydrodictyon Pediastrum Scenedesmus (4) Tetraspora Tribonema
	Cyanophyceae	Oscillatoria (5)	Anabaena (1) Nodularia Oscillatoria (5)	Anabaena (1) Oscillatoria (5)	Anabaena (1) Oscillatoria (5)
	Palmer Pollution Index (PPI)	16	18	17	18

<b>V3</b>	Bacillariophyceae	Synedra (2)		Asterionella Synedra (2)	Cyclotella (1) Synedra (2)
	Chlorophyceae	Ankistrodesmus (2) Chlorella (3) Pediastrum Tribonema	Chlorella (3) Oedogonium Scenedesmus (4) Spirogyra Tribonema	Ankistrodesmus (2) Oedogonium Scenedesmus (4) Tribonema	Ankistrodesmus (2) Oedogonium Scenedesmus (4)
	Cyanophyceae	Anabaena (1) Oscillatoria (5)	Anabaena (1) Oscillatoria (5)	Gamphosperia Oscillatoria (5)	Anabaena (1) Anacystis (1) Oscillatoria (5)
	Palmer Pollution Index (PPI)	13	13	13	16
<b>V4</b>	Bacillariophyceae	Flagilaria Nitzschia (3)	Nitzschia (3)	Cyclotella (1) Nitzschia (3)	Navicula (3) Synedra (2)
	Chlorophyceae	Scenedesmus (4) Spirogyra Tribonema	Ankistrodesmus (2) Scenedesmus (4) Spirogyra Tribonema	Scenedesmus (4) Spirogyra Staurastrum Tribonema	Ankistrodesmus (2) Pediastrum Scenedesmus (4) Spirogyra Staurastrum Tribonema
	Cyanophyceae	Anabaena (1) Gamphosperia Oscillatoria (5)	Nodularia Oscillatoria (5)	Anabaena (1) Gamphosperia Oscillatoria (5)	Oscillatoria (5)
	Palmer Pollution Index (PPI)	13	14	14	16

<b>V5</b>	Bacillariophyceae	Navicula (3)	Navicula (3)	Navicula (3)	Navicula (3) Nitzschia (3)
	Chlorophyceae	Ankistrodesmus (2) Pediastrum Scenedesmus (4) Tribonema	Hydrodictyon Oedogonium Scenedesmus (4) Tribonema	Pediastrum Scenedesmus (4) Tribonema	Ankistrodesmus (2) Pediastrum Scenedesmus (4) Spirogyra
	Cyanophyceae	Anabaena (1) Gamphosperia Merismopedia Oscillatoria (5) Spirulina	Anabaena (1) Oscillatoria (5)	Anabaena (1) Oscillatoria (5)	Anabaena (1) Oscillatoria (5)
	Palmer Pollution Index (PPI)	15	13	13	18
<b>2017-18 (Genus)</b>					
<b>V1</b>	Bacillariophyceae	Cyclotella (1)	Cyclotella (1)	Cyclotella (1), Flagilaria	Cyclotella (1) Navicula (3) Synedra (2)
	Chlorophyceae	Actinastrum Ankistrodesmus (2) Scenedesmus (4) Spirogyra	Ankistrodesmus (2) Chlorella (3) Spirogyra Staurastrum	Ankistrodesmus (2) Chlorella (3) Coelastrum Hydrodictyon Spirogyra Pediastrum Staurastrum	Oedogonium Scenedesmus (4) Spirogyra
	Cyanophyceae	Anabaena (1) Oscillatoria (5)	Anabaena (1) Anacystis (1) Nodularia Oscillatoria (5)	Anabaena (1) Anacystis (1) Gamphosperia Merismopedia Oscillatoria (5)	Oscillatoria (5)
	Palmer Pollution Index (PPI)	13	13	13	15

<b>V2</b>	Bacillariophyceae	Nitzschia (3) Synedra (2)	Navicula (3) Nitzschia (3)	Nitzschia (3) Synedra (2)	Cyclotella (1) Nitzschia (3) Synedra (2)
	Chlorophyceae	Ankistrodesmus (2) Hydrodictyon Oedogonium Scenedesmus (4) Tribonema	Actinastrum Hydrodictyon Oedogonium Scenedesmus (4) Tribonema	Actinastrum Oedogonium Pediastrum, Scenedesmus (4) Tribonema	Ankistrodesmus (2) Chlorella (3) Crucigenia Oedogonium Pediastrum Scenedesmus (4) Tribonema
	Cyanophyceae	Oscillatoria (5)	Anabaena (1) Nodularia Oscillatoria (5) Spirulina	Anabaena (1) Nodularia Oscillatoria (5)	Anacystis (1) Oscillatoria (5)
	Palmer Pollution Index (PPI)	16	16	15	21
<b>V3</b>	Bacillariophyceae	Navicula (3) Synedra (2)	Synedra (2)	Cyclotella (1)	Cyclotella (1) Synedra (2)
	Chlorophyceae	Ankistrodesmus (2) Hydrodictyon Oedogonium Pediastrum Spirogyra	Ankistrodesmus (2) Hydrodictyon Oedogonium Scenedesmus (4) Tribonema	Ankistrodesmus (2) Oedogonium Pediastrum Scenedesmus (4) Staurastrum	Ankistrodesmus (2) Hydrodictyon Oedogonium Scenedesmus (4)
	Cyanophyceae	Anabaena (1) Oscillatoria (5)	Anabaena (1) Nodularia Oscillatoria (5)	Anabaena (1) Gamphospheria Oscillatoria (5) Spirulina	Anabaena (1) Oscillatoria (5)
	Palmer Pollution Index (PPI)	13	14	13	15

<b>V4</b>	Bacillariophyceae	Cyclotella (1) Flagilaria Nitzschia (3)	Nitzschia (3)	Cyclotella (1) Nitzschia (3)	Navicula (3) Synedra (2)
	Chlorophyceae	Hydrodictyon Scenedesmus (4) Tribonema	Actinastrum Ankistrodesmus (2) Scenedesmus (4) Spirogyra Tribonema	Actinastrum, Oedogonium Pediastrum Scenedesmus (4) Spirogyr Staurastrum Volvox	Actinastrum Ankistrodesmus (2) Hydrodictyon Oedogonium Pediastrum Scenedesmus (4) Tribonema
	Cyanophyceae	Gamphospheria Oscillatoria (5) Spirulina	Nodularia Oscillatoria (5)	Oscillatoria (5)	Anabaena (1) Oscillatoria (5)
	Palmer Pollution Index (PPI)	13	14	13	17
<b>V5</b>	Bacillariophyceae	Navicula (3) Synedra(2)	Cyclotella (1) Navicula (3)	Navicula (3)	Navicula (3) Nitzschia (3) Synedra (2)
	Chlorophyceae	Hydrodictyon Pediastrum Scenedesmus (4) Tribonema	Actinastrum Ankistrodesmus (2) Oedogonium Scenedesmus (4)	Ankistrodesmus (2) Scenedesmus (4) Tetraspora Tribonema	Oedogonium Pediastrum Scenedesmus (4) Tribonema
	Cyanophyceae	Anabaena (1) Oscillatoria (5)	Nodularia Oscillatoria (5) Spirulina	Anacystis (1) Oscillatoria (5)	Anabaena (1) Oscillatoria (5)
	Palmer Pollution Index (PPI)	15	15	15	18

**Table A.5: Observed Macroinvertebrate Family for River Ganga near Varanasi (India) (Sep 2016-May 2017 and Sep 2017- May 2018)**

Site	Sensitivity	2016-17			
		Post Monsoon (16Sep-15Nov)	Winter (16Nov-15Jan)	Spring (16Jan-15Mar)	Summer (16Mar-15May)
V1	Sensitive				
	Moderately Sensitive	Dytiscidae (5) Psychodidae (5) Simuliidae (5)	Culicidae (5) Dytiscidae (5) Hydrophilidae (5) Psychodidae (5)	Baetidae (4) Culicidae (5) Dytiscidae (5) Elmidae (5) Psychodidae (5)	Culicidae (5) Dytiscidae (5) Hydrophilidae (5) Tipulidae (5) Viviparidae (6)
	Tolerant	Physidae (3)	Chironomidae (2)		
	SW Diversity Index	0.68	1.59	1.56	1.27
	BMWP Score	4.5	4.4	4.8	5.2
V2	Sensitive				
	Moderately Sensitive	Psychodidae (5) Tabanidae (5)	Culicidae (5) Hydrophilidae (5) Tabanidae (5) Tipulidae (5)	Baetidae (4) Culicidae (5) Psychodidae (5) Tipulidae (5)	Baetidae (4)
	Tolerant	Muscidae (2) Physidae (3)	Chironomidae (2) Tubificidae (1)	Physidae (3)	Chironomidae (2) Lymnaeidae (3) Physidae (3)
	SW Diversity Index	0.84	1.40	1.33	0.64
	BMWP Score	3.75	3.83	4.4	3.0

<b>V3</b>	Sensitive				
	Moderately Sensitive	Dytiscidae (5) Psychodidae (5) Simuliidae (5)	Baetidae (4) Dytiscidae (5) Elmidae (5) Hydrophilidae (5) Psychodidae (5)	Culicidae (5) Dytiscidae (5) Elmidae (5) Hydrophilidae (5) Psychodidae (5)	Dytiscidae (5) Tipulidae (5)
	Tolerant	Lymnaeidae (3)	Chironomidae (2)	Chironomidae (2)	Physidae (3)
	SW Diversity Index	1.09	1.32	1.56	1.24
	BMWP Score	4.5	4.33	4.5	4.33
<b>V4</b>	Sensitive				
	Moderately Sensitive	Dytiscidae (5) Tabanidae (5)	Baetidae (4) Dytiscidae (5) Psychodidae (5) Tabanidae (5) Tipulidae (5)	Baetidae (4) Culicidae (5) Hydrophilidae (5) Simuliidae (5) Tipulidae (5)	Culicidae (5) Dytiscidae (5)
	Tolerant	Physidae (3)	Chironomidae (2) Muscidae (2)	Syrphidae (2)	Physidae (3)
	SW Diversity Index	0.70	1.18	1.35	0.89
	BMWP Score	4.33	4.0	4.33	4.33
<b>V5</b>	Sensitive				
	Moderately Sensitive	Dytiscidae (5) Psychodidae (5)	Culicidae (5) Dytiscidae (5) Elmidae (5) Psychodidae (5)	Culicidae (5) Dytiscidae (5) Psychodidae (5) Tabanidae (5)	Hydrophilidae (5)
	Tolerant	Chironomidae (2) Muscidae (2) Tubificidae (1)	Chironomidae (2) Tubificidae (1)	Chironomidae (2) Tubificidae (1)	Chironomidae (2) Physidae (3) , Sphaeridae (3)
	SW Diversity Index	1.03	1.41	1.58	1.25
	BMWP Score	3.0	3.83	3.83	3.25

2017-18					
<b>V1</b>	Sensitive				
	Moderately Sensitive	Dytiscidae (5) Hydrophilidae (5) Tabanidae (5)	Culicidae (5) Dytiscidae (5) Elmidae (5) Hydrophilidae (5) Psychodidae (5)	Baetidae (4) Culicidae (5) Dytiscidae (5) Elmidae (5) Hydrophilidae (5) Psychodidae (5)	Culicidae (5) Dytiscidae (5) Tipulidae (5)
	Tolerant	Chironomidae (2)	Physidae (3)		Chironomidae (2)
	SW Diversity Index	1.32	1.64	1.65	1.33
	BMWP Score	4.25	4.66	4.83	4.25
<b>V2</b>	Sensitive				
	Moderately Sensitive	Dytiscidae (5) Tabanidae (5)	Hydrophilidae (5) Psychodidae (5) Tabanidae (5)	Baetidae (4) Hydrophilidae (5) Psychodidae (5) Tabanidae (5)	Baetidae (4)
	Tolerant	Physidae (3)	Chironomidae (2) Tubificidae (1)	Chironomidae (2)	Chironomidae (2) Physidae (3) Muscidae (2)
	SW Diversity Index	1.00	1.18	1.41	1.18
	BMWP Score	4.33	3.6	4.2	2.75

<b>V3</b>	Sensitive				
	Moderately Sensitive	Hydrophilidae (5) Pleuroceridae (6)	Baetidae (4) Dytiscidae (5) Elmidae (5) Hydrophilidae (5) Psychodidae (5)	Culicidae (5) Dytiscidae (5) Elmidae (5) Hydrophilidae (5) Psychodidae (5)	Culicidae (5) Simuliidae (5) Tipulidae (5)
	Tolerant	Syrphidae (2)			Physidae (3)
	SW Diversity Index	1.03	1.16	1.53	1.24
	BMWP Score	4.3	4.8	5.0	4.5
<b>V4</b>	Sensitive				
	Moderately Sensitive	Hydrophilidae (5) Psychodidae (5) Tabanidae (5)	Baetidae (4) Culicidae (5) Elmidae (5) Psychodidae (5)	Baetidae (4) Culicidae (5) Psychodidae (5) Simuliidae (5)	Hydrophilidae (5)
	Tolerant	Syrphidae (2)	Syrphidae (2)	Chironomidae (2)	Muscidae (2) Physidae (3)
	SW Diversity Index	1.20	0.88	1.53	1.11
	BMWP Score	4.25	4.2	4.2	3.33
<b>V5</b>	Sensitive				
	Moderately Sensitive	Hydrophilidae (5) Tabanidae (5)	Baetidae (4) Dytiscidae (5) Hydrophilidae (5) Psychodidae (5) Tabanidae (5)	Baetidae (4) Culicidae (5) Dytiscidae (5) Psychodidae (5) Tabanidae (5)	Tipulidae (5)
	Tolerant	Physidae (3)		Chironomidae (2)	Chironomidae (2) Physidae (3) Tubificidae (1)
	SW Diversity Index	1.06	1.04	1.6	1.14
	BMWP Score	4.33	4.8	4.33	2.75

**Table A.6: Observed Values of Parameters/Indices from Rishikesh to Patna (2017-18)**  
(a) Post Monsoon (16 Sep 2017-15 Nov 2017)

Monsoon		Organo-Electrolytic-Bacterial (OEB)					Nutrient (NT)			Algae (A)	Macroinvertebrates (MI)		Fish (F)	
S	Site	EC $\mu$ S/cm	DO mg/l	BOD mg/l	COD mg/l	FC MPN/100ml	NH3-N mg/l	TN mg/l	TP mg/l	APPI	MSW	MBMWP	FS	FSW
1	R1	110	8.8	3.0	8	550	0.10	0.52	0.248	11	1.27	4.2	14	2.47
2	R2	156	7.0	3.5	12	650	0.35	1.12	0.279	13	1.52	4.2	14	2.47
3	H1	155	8.3	4.2	18	850	0.48	0.77	0.111	14	1.33	4.0	28	1.29
4	H2	196	8.0	4.5	10	950	0.38	0.85	0.150	13	1.21	4.0	28	1.29
5	H3	160	6.9	4.8	14	1000	0.58	0.97	0.150	13	1.58	4.0	28	1.29
6	K1	320	6.6	4.8	66	1350	1.08	1.56	0.241	15	1.05	4.0	57	2.92
7	K2	322	4.9	6.5	88	2300	1.14	1.51	0.361	20	1.32	3.2	57	2.92
8	K3	392	5.5	5.2	86	1600	1.20	1.83	0.341	17	1.35	3.2	57	2.92
9	A1	410	6.8	3.5	55	1300	1.04	1.32	0.256	17	1.52	3.6	52	2.55
10	A2	430	6.9	4.3	52	1600	1.15	1.46	0.160	15	1.33	4.2	52	2.55
11	A3	450	5.9	4.7	60	2100	1.20	1.77	0.242	15	1.56	4.4	52	2.55
12	V1	650	6.0	5.0	40	1200	0.60	1.48	0.202	13	1.32	4.2	70	2.23
13	V2	633	4.2	6.8	65	3100	1.18	1.50	0.280	16	1.00	4.3	70	2.23
14	V3	572	6.7	4.7	48	1680	0.90	1.35	0.220	13	1.03	4.3	70	2.23
15	V4	603	6.4	4.9	55	2200	1.12	1.58	0.217	13	1.20	4.2	70	2.23
16	V5	615	5.4	5.2	68	2500	1.18	1.65	0.271	15	1.06	4.3	70	2.23
17	P1	306	6.6	4.3	48	1150	0.35	0.85	0.197	13	1.70	3.8	72	1.63
18	P2	739	4.6	6.6	68	1550	0.62	1.47	0.376	17	1.32	2.7	72	1.63
19	P3	336	5.7	5.1	70	1400	0.90	1.54	0.248	14	1.28	3.0	72	1.63

(b) Winter (16 Nov 2017-15 Jan 2018)

Winter		Organo-Electrolytic-Bacterial (OEB)					Nutrient (NT)			Algae (A)	Macroinvertebrates (MI)		Fish (F)	
S	Site	EC $\mu$ S/cm	DO mg/l	BOD mg/l	COD mg/l	FC MPN/100ml	NH3-N mg/l	TN mg/l	TP mg/l	APPI	MSW	MBMWP	FS	FSW
1	R1	100	9.8	3.1	32	550	0.35	0.55	0.026	11	1.52	6.0	14	2.47
2	R2	140	9.2	3.5	36	650	0.46	0.88	0.093	14	1.55	4.8	14	2.47
3	H1	152	8.8	3.9	32	650	0.35	0.48	0.090	11	1.72	4.0	28	1.29
4	H2	180	8.5	4.3	38	850	0.40	0.97	0.110	14	1.56	4.2	28	1.29
5	H3	150	8.5	4.8	42	950	0.31	1.13	0.160	12	1.70	4.0	28	1.29
6	K1	340	5.5	4.3	52	1600	0.75	1.73	0.120	15	1.35	4.2	57	2.92
7	K2	342	5.8	5.2	70	1800	0.90	2.04	0.210	15	1.28	4.0	57	2.92
8	K3	360	5.8	4.8	65	2100	0.42	2.10	0.196	16	1.08	4.0	57	2.92
9	A1	342	6.8	3.8	42	2300	1.20	1.53	0.149	13	1.37	4.2	52	2.55
10	A2	334	6.3	3.5	48	4600	0.56	1.31	0.135	15	1.28	3.5	52	2.55
11	A3	336	6.7	4.2	48	3400	0.80	1.80	0.124	15	1.48	3.4	52	2.55
12	V1	297	6.5	3.9	42	1600	0.53	1.052	0.195	13	1.64	4.6	70	2.23
13	V2	308	4.6	6.0	78	2200	0.60	1.38	0.291	16	1.18	3.6	70	2.23
14	V3	293	6.5	4.2	45	1200	0.38	0.68	0.238	14	1.16	4.8	70	2.23
15	V4	294	5.9	4.3	42	1600	0.43	0.91	0.298	14	0.88	4.2	70	2.23
16	V5	372	5.8	4.5	68	2100	0.60	1.33	0.248	15	1.04	4.8	70	2.23
17	P1	334	6.9	3.5	42	1300	0.31	0.80	0.123	15	1.56	4.2	72	1.63
18	P2	350	5.2	3.7	55	1600	0.31	1.72	0.186	15	1.34	3.5	72	1.63
19	P3	386	6.6	3.1	32	1800	0.25	1.40	0.189	13	1.36	4.0	72	1.63

## (c) Spring (16 Jan 2018-15 Mar 2018)

Spring		Organo-Electrolytic-Bacterial (OEB)					Nutrient (NT)			Algae (A)	Macroinvertebrates (MI)		Fish (F)	
S	Site	EC $\mu$ S/cm	DO mg/l	BOD mg/l	COD mg/l	FC MPN/100ml	NH3-N mg/l	TN mg/l	TP mg/l	APPI	MSW	MBMWP	FS	FSW
1	R1	128	9.7	3.8	20	590	0.31	0.45	0.065	10	1.55	6.0	14	2.47
2	R2	234	9.2	4.0	30	750	0.31	0.52	0.134	13	1.56	4.2	14	2.47
3	H1	170	8.3	4.3	40	850	0.35	0.80	0.100	11	1.56	4.2	28	1.29
4	H2	180	8.5	4.2	38	1000	0.40	0.97	0.110	14	1.56	4.8	28	1.29
5	H3	164	8.5	4.6	58	1100	0.42	0.87	0.112	12	1.49	4.2	28	1.29
6	K1	331	5.6	4.3	55	1600	0.40	1.21	0.165	15	1.37	4.5	57	2.92
7	K2	366	4.9	5.6	85	1800	0.90	1.71	0.230	15	1.32	4.7	57	2.92
8	K3	356	5.4	5.8	80	1600	1.18	1.86	0.250	14	1.31	4.2	57	2.92
9	A1	377	5.5	3.4	48	1300	0.40	1.32	0.146	14	1.56	4.4	52	2.55
10	A2	398	6.0	4.3	55	1700	0.52	1.04	0.110	15	1.35	4.2	52	2.55
11	A3	388	5.8	4.5	70	2000	0.45	1.58	0.140	16	1.56	4.0	52	2.55
12	V1	332	6.3	4.0	52	1200	0.31	0.78	0.125	13	1.65	4.8	70	2.23
13	V2	340	4.2	6.4	80	1800	0.30	0.72	0.210	15	1.41	4.2	70	2.23
14	V3	348	6.0	4.3	52	1400	0.19	0.55	0.152	13	1.53	5.0	70	2.23
15	V4	346	5.9	4.5	55	1500	0.20	0.52	0.158	13	1.53	4.2	70	2.23
16	V5	390	5.2	4.8	68	1900	0.56	1.32	0.220	15	1.60	4.3	70	2.23
17	P1	394	6.7	3.1	42	1100	0.42	1.20	0.163	13	1.56	5.0	72	1.63
18	P2	469	5.4	4.9	60	2300	0.31	0.96	0.153	17	1.58	4.8	72	1.63
19	P3	397	6.5	4.3	55	1900	0.35	1.56	0.148	14	1.59	5.2	72	1.63

(d) Summer (16 Mar 2018-15 May 2018)

Summer		Organo-Electrolytic-Bacterial (OEB)					Nutrient (NT)			Algae (A)	Macroinvertebrates (MI)		Fish (F)	
S	Site	EC $\mu$ S/cm	DO mg/l	BOD mg/l	COD mg/l	FC MPN/100ml	NH3-N mg/l	TN mg/l	TP mg/l	APPI	MSW	MBMWP	FS	FSW
1	R1	128	7.9	3.5	35	780	0.14	0.95	0.071	12	1.33	4.0	14	2.47
2	R2	163	6.6	3.9	38	850	0.90	1.87	0.082	13	1.49	3.8	14	2.47
3	H1	150	6.7	4.0	40	1000	0.32	0.97	0.079	16	1.32	4.0	28	1.29
4	H2	125	7.1	4.3	42	1300	0.32	1.03	0.084	15	1.04	4.6	28	1.29
5	H3	161	7.6	4.4	40	1600	0.42	1.14	0.073	15	1.04	3.6	28	1.29
6	K1	800	4.9	4.5	68	1600	0.32	0.95	0.261	18	1.35	3.0	57	2.92
7	K2	1200	3.9	5.9	90	3000	0.90	2.10	0.337	22	1.52	3.4	57	2.92
8	K3	1100	3.5	5.6	120	2500	0.50	1.75	0.300	21	1.33	3.2	57	2.92
9	A1	480	5.8	5.6	80	1200	0.90	1.35	0.210	15	1.52	3.2	52	2.55
10	A2	795	5.9	4.5	80	1500	1.20	1.92	0.16	15	1.61	3.2	52	2.55
11	A3	820	5.4	5.8	120	2000	1.90	2.36	0.246	16	1.55	3.2	52	2.55
12	V1	420	5.9	4.4	52	1600	0.89	1.35	0.160	15	1.33	4.2	70	2.23
13	V2	1000	2.9	6.9	90	3300	1.50	2.00	0.290	21	1.18	2.7	70	2.23
14	V3	500	5.4	5.6	58	1800	1.15	1.45	0.210	15	1.24	4.5	70	2.23
15	V4	600	4.9	6.3	80	2400	1.18	1.65	0.288	17	1.11	3.3	70	2.23
16	V5	1100	3.9	6.8	110	2400	1.19	1.95	0.260	18	1.14	2.7	70	2.23
17	P1	500	5.2	4.3	55	1300	0.90	1.2	0.155	15	1.52	3.8	72	1.63
18	P2	1100	3.9	6.8	85	2200	0.90	1.38	0.586	18	1.56	3.4	72	1.63
19	P3	800	4.5	6.5	60	1600	0.35	1.39	0.260	15	1.27	4.0	72	1.63

**Table A.7: Observed Algal Genera from Rishikesh to Patna (2017-18)**

Site	Group	2017-18 (Genus)			
		Post Monsoon (16Sep-15Nov)	Winter (16Nov-15Jan)	Spring (16Jan-15Mar)	Summer (16Mar-15May)
<b>R1</b>	Bacillariophyceae	Cyclotella (1) Flagilaria Synedra (2)	Cyclotella (1) Flagilaria Synedra (2)	Synedra (2) Flagilaria	Synedra (2) Flagilaria
	Chlorophyceae	Ankistrodesmus (2) Spirogyra	Ankistrodesmus (2) Spirogyra	Ankistrodesmus (2) Spirogyra	Ankistrodesmus (2) Chlorella (3) Spirogyra
	Cyanophyceae	Anabaena (1) Merismopedia Oscillatoria (5)	Anabaena (1) Oscillatoria (5)	Anabaena (1) Merismopedia Oscillatoria (5)	Oscillatoria (5)
	Palmer Pollution Index (PPI)	11	11	10	12
<b>R2</b>	Bacillariophyceae	Cyclotella (1) Flagilaria Synedra (2)	Cyclotella (1)	Cyclotella (1) Synedra (2)	Navicula (3) Synedra (2)
	Chlorophyceae	Scenedesmus (4) Staurastrum	Botryococcus Chlorella (3) Scenedesmus (4) Spirogyra	Scenedesmus (4) Spirogyra	Chlorella (3) Spirogyra
	Cyanophyceae	Anacystis (1) Oscillatoria (5)	Anabaena (1) Oscillatoria (5)	Anabaena (1) Oscillatoria (5)	Nodularia Oscillatoria (5)
	Palmer Pollution Index (PPI)	13	14	13	13

<b>H1</b>	Bacillariophyceae	Flagilaria	Cyclotella (1)	Cyclotella (1) Meridian Nitzschia (3)	Cyclotella (1)
	Chlorophyceae	Chlorella (3) Clostridium (1) Scenedesmus (4) Spirogyra	Scenedesmus (4) Spirogyra	Mougeotia Spirogyra Ulothrix	Ankistrodesmus (2) Chlorella (3) Scenedesmus (4) Spirogyra
	Cyanophyceae	Anabaena (1) Oscillatoria (5)	Anabaena (1) Oscillatoria (5)	Anabaena (1) Anacystis (1) Oscillatoria (5)	Anabaena (1) Oscillatoria (5)
	Palmer Pollution Index (PPI)	14	11	11	16
<b>H2</b>	Bacillariophyceae	Asterionella Flagilaria	Cyclotella (1) Synedra (2)	Cyclotella (1) Synedra (2)	Cyclotella (1) Synedra (2)
	Chlorophyceae	Ankistrodesmus (2) Scenedesmus (4) Spirogyra	Ankistrodesmus (2) Chlorella (3) Staurastrum	Ankistrodesmus (2) Chlorella (3) Mougeotia Spirogyra	Ankistrodesmus (2) Scenedesmus (4) Spirogyra Staurastrum
	Cyanophyceae	Anabaena (1) Phormidium (1) Oscillatoria (5)	Anabaena (1) Oscillatoria (5)	Anabaena (1) Oscillatoria (5)	Anabaena (1) Oscillatoria (5)
	Palmer Pollution Index (PPI)	13	14	14	15
<b>H3</b>	Bacillariophyceae	Cyclotella (1)	Cyclotella (1) Synedra (2)	Meridian Synedra (2)	Cyclotella (1) Navicula (3) Synedra (2)
	Chlorophyceae	Clostridium (1) Scenedesmus (4) Spirogyra	Chlorella (3) Scenedesmus (4) Spirogyra	Scenedesmus (4) Spirogyra	Chlorella (3) Spirogyra Staurastrum
	Cyanophyceae	Anabaena (1) Phormidium (1) Oscillatoria (5)	Anabaena (1) Anacystis (1)	Anabaena (1) Oscillatoria (5)	Anabaena (1) Oscillatoria (5)
	Palmer Pollution Index (PPI)	13	12	12	15

<b>K1</b>	Bacillariophyceae	Flagilaria Synedra (2)	Flagilaria Synedra (2)	Asterionella Synedra (2)	Synedra (2)
	Chlorophyceae	Ankistrodesmus (2) Scenedesmus (4) Spirogyra Staurastrum Tribonema	Actinastrum Ankistrodesmus (2) Pediastrum Scenedesmus (4) Spirogyra Tetraspora	Actinastrum Ankistrodesmus (2) Crucigenia Pediastrum Scenedesmus (4) Spirogyra Tribonema	Actinastrum Ankistrodesmus (2) Chlorella (3) Pediastrum Scenedesmus (4) Spirogyra Tetraspora Tribonema Ulothrix
	Cyanophyceae	Anabaena (1) Anacystis (1) Merismopedia Oscillatoria (5)	Anabaena (1) Anacystis (1) Oscillatoria (5)	Anabaena (1) Anacystis (1) Oscillatoria (5)	Anabaena (1) Anacystis (1) Oscillatoria (5)
	Palmer Pollution Index (PPI)	15	15	15	18
<b>K2</b>	Bacillariophyceae	Cyclotella (1) Flagilaria Nitzschia (3)	Cyclotella (1) Flagilaria	Asterionella Flagilaria Nitzschia (3)	Cyclotella (1) Nitzschia (3) Synedra (2)
	Chlorophyceae	Ankistrodesmus (2) Chlorella (3) Coelastrum Pediastrum Scenedesmus (4) Spirogyra Tribonema	Ankistrodesmus (2) Chlorella (3) Crucigenia Pediastrum Scenedesmus (4) Spirogyra Tribonema	Ankistrodesmus (2) Crucigenia Pediastrum Scenedesmus (4) Spirogyra Tribonema Ulothrix	Ankistrodesmus (2) Chlorella (3) Hydrodictyon Pediastrum Scenedesmus (4) Tetraspora Tribonema
	Cyanophyceae	Anabaena (1) Anacystis (1) Gamphospheria Oscillatoria (5)	Oscillatoria (5)	Anabaena (1) Nodularia Oscillatoria (5)	Anabaena (1) Anacystis (1) Oscillatoria (5)
	Palmer Pollution Index (PPI)	20	15	15	22

<b>K3</b>	Bacillariophyceae	Asterionella Nitzschia (3) Synedra (2)	Asterionella Nitzschia (3)	Asterionella Flagilaria	Nitzschia (3) Synedra (2)
	Chlorophyceae	Ankistrodesmus (2) Microspora Palmella Scenedesmus (4) Spirogyra Tribonema	Ankistrodesmus (2) Scenedesmus (4) Spirogyra Tribonema	Actinastrum Chlorella (3) Scenedesmus (4) Spirogyra Tribonema Ulothrix	Ankistrodesmus (2) Chlorella (3) Crucigenia Hydrodictyon Pediastrum Scenedesmus (4) Tetraspora Tribonema Volvox
	Cyanophyceae	Anacystis (1) Merismopedia Oscillatoria (5) Spirulina	Anabaena (1) Anacystis (1) Nodularia Oscillatoria (5) Spirulina	Anabaena (1) Anacystis (1) Nodularia Oscillatoria (5) Spirulina	Anabaena (1) Anacystis (1) Oscillatoria (5)
	Palmer Pollution Index (PPI)	17	16	14	21
	<b>A1</b>				
Bacillariophyceae	Pinularia Synedra (2)		Asterionella Synedra (2)	Synedra (2)	
Chlorophyceae	Ankistrodesmus (2) Chlorella (3) Pediastrum Scenedesmus (4) Tetraspora Tribonema	Chlorella (3) Oedogonium Scenedesmus (4) Spirogyra Tetraspora Tribonema	Ankistrodesmus (2) Hydrodictyon Coelastrum Scenedesmus (4) Tribonema Westella	Ankistrodesmus (2) Coelastrum Pediastrum Scenedesmus (4) Schroederia Sphaerocystis Zygnema	
Cyanophyceae	Anabaena (1) Gamphospheria Merismopedia Oscillatoria (5)	Anabaena (1) Nodularia Oscillatoria (5)	Anabaena (1) Gamphospheria Merismopedia Nodularia Oscillatoria (5)	Anabaena (1) Anacystis (1) Merismopedia Oscillatoria (5) Spirulina	
Palmer Pollution Index (PPI)	17	13	14	15	

<b>A2</b>	Bacillariophyceae	Asterionella			
	Chlorophyceae	Ankistrodesmus (2) Chlorella (3) Pediastrum Scenedesmus (4) Spirogyra Tetraspora Tribonema	Ankistrodesmus (2) Chlorella (3) Crucigenia Hydrodictyon Scenedesmus (4) Spirogyra Tribonema	Ankistrodesmus (2) Chlorella (3) Coelastrum Scenedesmus (4) Spirogyra Staurastrum Tribonema	Ankistrodesmus (2) Chlorella (3) Coelastrum Pediastrum Scenedesmus (4) Spirogyra Staurastrum Tribonema
	Cyanophyceae	Anabaena (1) Gamphosperia Merismopedia Oscillatoria (5)	Anabaena (1) Nodularia Oscillatoria (5)	Anacystis (1) Gamphosperia Oscillatoria (5)	Anabaena (1) Oscillatoria (5)
	Palmer Pollution Index (PPI)	15	15	15	15
<b>A3</b>	Bacillariophyceae	Asterionella	Asterionella	Asterionella	
	Chlorophyceae	Ankistrodesmus (2) Chlorella (3) Coelastrum Pediastrum Scenedesmus (4) Tetraspora Tribonema	Ankistrodesmus (2) Chlorella (3) Hydrodictyon Scenedesmus (4) Tribonema	Ankistrodesmus (2) Chlorella (3) Coelastrum Pediastrum Scenedesmus (4) Tribonema	Ankistrodesmus (2) Chlorella (3) Coelastrum Pediastrum Scenedesmus (4) Spirogyra
	Cyanophyceae	Anabaena (1) Gamphosperia Merismopedia Oscillatoria (5) Spirulina	Anabaena (1) Oscillatoria (5) Merismopedia	Anabaena (1) Anacystis (1) Merismopedia Oscillatoria (5)	Anabaena (1) Anacystis (1) Merismopedia Oscillatoria (5)
	Palmer Pollution Index (PPI)	15	15	16	16

<b>V1</b>	Bacillariophyceae	Cyclotella (1)	Cyclotella (1)	Cyclotella (1) Flagilaria	Cyclotella (1) Navicula (3) Synedra (2)
	Chlorophyceae	Actinastrum Ankistrodesmus (2) Scenedesmus (4) Spirogya	Ankistrodesmus (2) Chlorella (3) Spirogya Staurastrum	Ankistrodesmus (2) Chlorella (3) Coelastrum Hydrodictyon Spirogya Pediastrum Staurastrum	Oedogonium Scenedesmus (4) Spirogya
	Cyanophyceae	Anabaena (1) Oscillatoria (5)	Anabaena (1) Anacystis (1) Nodularia Oscillatoria (5)	Anabaena (1) Anacystis (1) Gamphospheria Merismopedia Oscillatoria (5)	Oscillatoria (5)
	Palmer Pollution Index (PPI)	13	13	13	15
<b>V2</b>	Bacillariophyceae	Nitzschia (3) Synedra (2)	Navicula (3) Nitzschia (3)	Nitzschia (3) Synedra (2)	Cyclotella (1) Nitzschia (3) Synedra (2)
	Chlorophyceae	Ankistrodesmus (2) Hydrodictyon Oedogonium Scenedesmus (4) Tribonema	Actinastrum Hydrodictyon Oedogonium Scenedesmus (4) Tribonema	Actinastrum Oedogonium Pediastrum, Scenedesmus (4) Tribonema	Ankistrodesmus (2) Chlorella (3) Crucigenia Oedogonium Pediastrum Scenedesmus (4) Tribonema
	Cyanophyceae	Oscillatoria (5)	Anabaena (1) Nodularia Oscillatoria (5) Spirulina	Anabaena (1) Nodularia Oscillatoria (5)	Anacystis (1) Oscillatoria (5)
	Palmer Pollution Index (PPI)	16	16	15	21

<b>V3</b>	Bacillariophyceae	Navicula (3) Synedra (2)	Synedra (2)	Cyclotella (1)	Cyclotella (1) Synedra (2)
	Chlorophyceae	Ankistrodesmus (2) Hydrodictyon Oedogonium Pediastrum Spirogyra	Ankistrodesmus (2) Hydrodictyon Oedogonium Scenedesmus (4) Tribonema	Ankistrodesmus (2) Oedogonium Pediastrum Scenedesmus (4) Staurastrum	Ankistrodesmus (2) Hydrodictyon Oedogonium Scenedesmus (4)
	Cyanophyceae	Anabaena (1) Oscillatoria (5)	Anabaena (1) Nodularia Oscillatoria (5)	Anabaena (1) Gamphospheria Oscillatoria (5) Spirulina	Anabaena (1) Oscillatoria (5)
	Palmer Pollution Index (PPI)	13	14	13	15
<b>V4</b>	Bacillariophyceae	Cyclotella (1) Flagilaria Nitzschia (3)	Nitzschia (3)	Cyclotella (1) Nitzschia (3)	Navicula (3) Synedra (2)
	Chlorophyceae	Hydrodictyon Scenedesmus (4) Tribonema	Actinastrum Ankistrodesmus (2) Scenedesmus (4) Spirogyra Tribonema	Actinastrum, Oedogonium Pediastrum Scenedesmus (4) Spirogyra Staurastrum Volvox	Actinastrum Ankistrodesmus (2) Hydrodictyon Oedogonium Pediastrum Scenedesmus (4) Tribonema
	Cyanophyceae	Gamphospheria Oscillatoria (5) Spirulina	Nodularia Oscillatoria (5)	Oscillatoria (5)	Anabaena (1) Oscillatoria (5)
	Palmer Pollution Index (PPI)	13	14	13	17

<b>V5</b>	Bacillariophyceae	Navicula (3) Synedra(2)	Cyclotella (1) Navicula (3)	Navicula (3)	Navicula (3) Nitzschia (3) Synedra (2)
	Chlorophyceae	Hydrodictyon Pediastrum Scenedesmus (4) Tribonema	Actinastrum Ankistrodesmus (2) Oedogonium Scenedesmus (4) Tribonema	Ankistrodesmus (2) Oedogonium Scenedesmus (4) Tetraspora Tribonema	Oedogonium Pediastrum Scenedesmus (4) Tribonema
	Cyanophyceae	Anabaena (1) Oscillatoria (5)	Nodularia Oscillatoria (5) Spirulina	Anacystis (1) Oscillatoria (5)	Anabaena (1) Oscillatoria (5)
	Palmer Pollution Index (PPI)	15	15	15	18
<b>P1</b>	Bacillariophyceae	Cyclotella (1) Synedra (2)	Asterionella Synedra (2)	Asterionella	Stauroneis
	Chlorophyceae	Scenedesmus (4) Tribonema Zygnema	Chlorella (3) Crucigenia Hydrodictyon Scenedesmus (4) Spirogyra	Chlorella (3) Crucigenia Hydrodictyon Scenedesmus (4) Spirogyra Tetrastrum	Ankistrodesmus (2) Botryococcus Chlorella (3) Pediastrum Scenedesmus (4) Spirogyra Tetrastrum Tribonema
	Cyanophyceae	Anabaena (1) Oscillatoria (5)	Anabaena (1) Nodularia Oscillatoria (5)	Anabaena (1) Nodularia Oscillatoria (5)	Anabaena (1) Nodularia Oscillatoria (5)
	Palmer Pollution Index (PPI)	13	15	13	15

<b>P2</b>	Bacillariophyceae	Navicula (3)	Cyclotella (1) Navicula (3) Tabellaria	Asterionella Synedra (2)	Navicula (3) Synedra (2)
	Chlorophyceae	Ankistrodesmus (2) Chlorella (3) Scenedesmus (4) Spirogyra Tribonema	Ankistrodesmus (2) Pediastrum Scenedesmus (4) Spirogyra	Actinastrum Ankistrodesmus (2) Botryococcus Chlorella (3) Oedogonium Scenedesmus (4) Spirogyra Tetrastrum	Botryococcus Chlorella (3) Closterium (1) Hydrodictyon Scenedesmus (4) Staurastrum Tribonema
	Cyanophyceae	Merismopedia Nodularia Oscillatoria (5)	Oscillatoria (5)	Anabaena (1) Cylindrospermium Oscillatoria (5)	Gomphosphaeria Oscillatoria (5)
	Palmer Pollution Index (PPI)	17	15	17	18
<b>P3</b>	Bacillariophyceae	Cyclotella (1) Navicula (3)	Cyclotella (1) Synedra (2)	Synedra (2)	Synedra (2)
	Chlorophyceae	Scenedesmus (4) Spirogyra Tribonema	Hydrodictyon Pediastrum Scenedesmus (4) Spirogyra Tribonema	Actinastrum Chlorella (3) Pediastrum Scenedesmus (4) Spirogyra	Botryococcus Chlorella (3) Hydrodictyon Pediastrum Scenedesmus (4) Spirogyra Tribonema
	Cyanophyceae	Anacystis (1) Merismopedia Oscillatoria (5)	Anacystis (1) Oscillatoria (5)	Cylindrospermium Gomphosphaeria Oscillatoria (5)	Anacystis (1) Oscillatoria (5) Spirulina
	Palmer Pollution Index (PPI)	14	13	14	15

**Table A.8: Observed Macroinvertebrate Family from Rishikesh to Patna (2017-18)**

Site	Sensitivity	2017-18			
		Post Monsoon (16Sep-15Nov)	Winter (16Nov-15Jan)	Spring (16Jan-15Mar)	Summer (16Mar-15May)
<b>R1</b>	Sensitive		Perlodidae(10)	Perlodidae (10)	
	Moderately Sensitive	Dytiscidae (5) Hydropsychidae (5) Tipulidae (5)	Hydrophilidae (5) Psychodidae (5) Tabanidae (5) Tipulidae (5)	Hydropsychidae (5) Psychodidae (5) Tabanidae (5) Tipulidae (5)	Baetidae (4) Dytiscidae (5) Tipulidae (5)
	Tolerant	Chironomidae (2)			Chironomidae (2)
	BMWP Score	4.25	6.0	6.0	4.0
	SW Diversity Index	1.27	1.52	1.55	1.33
<b>R2</b>	Sensitive				
	Moderately Sensitive	Baetidae (4) Hydropsychidae (5) Simuliidae (5) Tipulidae (5)	Baetidae (4) Dytiscidae (5) Hydropsychidae (5) Simuliidae (5) Tipulidae (5)	Baetidae (4) Dytiscidae (5) Simuliidae (5) Tipulidae (5)	Baetidae (4) Dytiscidae (5) Tipulidae (5)
	Tolerant	Chironomidae (2)		Chironomidae (2)	Chironomidae (2) Physidae (3)
	BMWP Score	4.2	4.8	4.2	3.8
	SW Diversity Index	1.52	1.55	1.56	1.49

<b>H1</b>	Sensitive				
	Moderately Sensitive	Baetidae (4) Tabanidae (5) Tipulidae (5)	Baetidae (4) Culicidae (5) Hydropsychidae (5) Tipulidae (5)	Baetidae (4) Hydropsychidae (5) Tabanidae (5) Tipulidae (5)	Baetidae (4) Tabanidae (5) Tipulidae (5)
	Tolerant	Chironomidae (2)	Chironomidae (2) Physidae (3)	Chironomidae (2)	Chironomidae (2)
	BMWP Score	4.0	4.0	4.2	4.0
	SW Diversity Index	1.33	1.72	1.56	1.32
<b>H2</b>	Sensitive				
	Moderately Sensitive	Baetidae (4) Hydropsychidae (5) Simuliidae (5)	Baetidae (4) Hydropsychidae (5) Simuliidae (5) Tipulidae (5)	Baetidae (4) Dytiscidae (5) Gyrinidae (5) Tabanidae (5) Tipulidae (5)	Baetidae (4) Dytiscidae (5) Tabanidae (5)
	Tolerant	Chironomidae (2)	Chironomidae (2)		
	BMWP Score	4.0	4.2	4.8	4.66
	SW Diversity Index	1.21	1.56	1.56	1.04
<b>H3</b>	Sensitive				
	Moderately Sensitive	Baetidae (4) Culicidae (5) Dytiscidae (5) Tipulidae (5)	Baetidae (4) Dytiscidae (5) Hydropsychidae (5) Tipulidae (5)	Baetidae (4) Dytiscidae (5) Tabanidae (5) Tipulidae (5)	Baetidae (4) Tabanidae (5)
	Tolerant	Chironomidae (2) Physidae (3)	Chironomidae (2) Physidae (3)	Chironomidae (2)	Chironomidae (2)
	BMWP Score	4.0	4.00	4.2	3.67
	SW Diversity Index	1.58	1.70	1.49	1.04

<b>K1</b>	Sensitive				
	Moderately Sensitive	Culicidae (5) Dytiscidae (5)	Culicidae (5) Dytiscidae (5) Hydrophilidae (5)	Bithynidae (6) Dytiscidae (5) Hydrophilidae (5)	Baetidae (4)
	Tolerant	Chironomidae (2)	Chironomidae (2)	Chironomidae (2)	Chironomidae (2) Physidae (3) Planorbidae (3)
	BMWP Score	4.0	4.25	4.5	3.0
	SW Diversity Index	1.05	1.35	1.37	1.35
<b>K2</b>	Sensitive			Libellulidae (8)	
	Moderately Sensitive	Baetidae (4) Culicidae (5)	Baetidae (4) Culicidae (5) Dytiscidae (5)	Baetidae (4) Dytiscidae (5)	Hydrophilidae (5) Nepidae (5)
	Tolerant	Chironomidae (2) Syrphidae (2)	Chironomidae (2)	Chironomidae (2)	Chironomidae (2) Physidae (3) Syrphidae (2)
	BMWP Score	3.25	4.0	4.75	3.4
	SW Diversity Index	1.32	1.28	1.32	1.52
<b>K3</b>	Sensitive				
	Moderately Sensitive	Baetidae (4) Dytiscidae (5)	Dytiscidae (5) Hydrophilidae (5)	Culicidae (5) Dytiscidae (5) Hydrophilidae (5)	Baetidae (4) Culicidae (5)
	Tolerant	Chironomidae (2) Muscidae (2)	Chironomidae (2)	Chironomidae (2)	Chironomidae (2) Muscidae (2)
	BMWP Score	3.25	4.0	4.25	3.25
	SW Diversity Index	1.35	1.08	1.31	1.33

<b>A1</b>	Sensitive				
	Moderately Sensitive	Baetidae (4) Simuliidae (5) Viviparidae (6)	Culicidae (5) Dytiscidae (5) Hydropsychidae (5)	Culicidae (5) Dytiscidae (5) Hydrophilidae (5) Hydropsychidae (5)	Culicidae (5) Hydrophilidae (5)
	Tolerant	Chironomidae (2) Tubificidae (1)	Chironomidae (2)	Chironomidae (2)	Chironomidae (2) Sphaeriidae (3) Tubificidae (1)
	BMWP Score	3.6	4.25	4.4	3.2
	SW Diversity Index	1.52	1.37	1.56	1.52
<b>A2</b>	Sensitive				
	Moderately Sensitive	Baetidae (4) Dytiscidae (5) Hydrophilidae (5)	Baetidae (4) Dytiscidae (5)	Baetidae (4) Dytiscidae (5) Hydrophilidae (5)	Baetidae (4) Hydrophilidae (5)
	Tolerant	Physidae (3)	Chironomidae (2) Physidae (3)	Physidae (3)	Chironomidae (2) Muscidae (2) Physidae (3)
	BMWP Score	4.25	3.5	4.25	3.2
	SW Diversity Index	1.33	1.28	1.35	1.61

<b>A3</b>	Sensitive				
	Moderately Sensitive	Baetidae (4) Culicidae (5) Dytiscidae (5) Pleuroceridae (6)	Baetidae (4) Viviparidae (6)	Baetidae (4) Dytiscidae (5) Viviparidae (6)	Unionidae (6)
	Tolerant	Chironomidae (2)	Chironomidae (2) Muscidae (2) Physidae (3)	Chironomidae (2) Physidae (3)	Chironomidae (2) Lymnaeidae (3) Muscidae (2) Physidae (3)
	BMWP Score	4.4	3.4	4.0	3.2
	SW Diversity Index	1.56	1.48	1.56	1.55
<b>V1</b>	Sensitive				
	Moderately Sensitive	Dytiscidae (5) Hydrophilidae (5) Tabanidae (5)	Culicidae (5) Dytiscidae (5) Elmidae (5) Hydrophilidae (5) Psychodidae (5)	Baetidae (4) Culicidae (5) Dytiscidae (5) Elmidae (5) Hydrophilidae (5) Psychodidae (5)	Culicidae (5) Dytiscidae (5) Tipulidae (5)
	Tolerant	Chironomidae (2)	Physidae (3)		Chironomidae (2)
	BMWP Score	4.25	4.66	4.83	4.25
	SW Diversity Index	1.32	1.64	1.65	1.33

<b>V2</b>	Sensitive				
	Moderately Sensitive	Dytiscidae (5) Tabanidae (5)	Hydrophilidae (5) Psychodidae (5) Tabanidae (5)	Baetidae (4) Hydrophilidae (5) Psychodidae (5) Tabanidae (5)	Baetidae (4)
	Tolerant	Physidae (3)	Chironomidae (2) Tubificidae (1)	Chironomidae (2)	Chironomidae (2) Physidae (3) Muscidae (2)
	BMWP Score	4.33	3.6	4.2	2.75
	SW Diversity Index	1.00	1.18	1.41	1.18
<b>V3</b>	Sensitive				
	Moderately Sensitive	Hydrophilidae (5) Pleuroceridae (6)	Baetidae (4) Dytiscidae (5) Elmidae (5) Hydrophilidae (5) Psychodidae (5)	Culicidae (5) Dytiscidae (5) Elmidae (5) Hydrophilidae (5) Psychodidae (5)	Culicidae (5) Simuliidae (5) Tipulidae (5)
	Tolerant	Syrphidae (2)			Physidae (3)
	BMWP Score	4.3	4.8	5.0	4.5
	SW Diversity Index	1.03	1.16	1.53	1.24
<b>V4</b>	Sensitive				
	Moderately Sensitive	Hydrophilidae (5) Psychodidae (5) Tabanidae (5)	Baetidae (4) Culicidae (5) Elmidae (5) Psychodidae (5)	Baetidae (4) Culicidae (5) Psychodidae (5) Simuliidae (5)	Hydrophilidae (5)
	Tolerant	Syrphidae (2)	Syrphidae (2)	Chironomidae (2)	Muscidae (2) Physidae (3)
	BMWP Score	4.25	4.2	4.2	3.33
	SW Diversity Index	1.20	0.88	1.53	1.11

<b>V5</b>	Sensitive				
	Moderately Sensitive	Hydrophilidae (5) Tabanidae (5)	Baetidae (4) Dytiscidae (5) Hydrophilidae (5) Psychodidae (5) Tabanidae (5)	Baetidae (4) Culicidae (5) Dytiscidae (5) Psychodidae (5) Tabanidae (5)	Tipulidae (5)
	Tolerant	Physidae (3)		Chironomidae (2)	Chironomidae (2) Physidae (3) Tubificidae (1)
	BMWP Score	4.33	4.8	4.33	2.75
	SW Diversity Index	1.06	1.04	1.6	1.14
<b>P1</b>	Sensitive				
	Moderately Sensitive	Culicidae (5) Dytiscidae (5) Viviparidae (6)	Dytiscidae (5) Hydrophilidae (5) Viviparidae (6)	Baetidae (4) Culicidae (5) Dytiscidae (5) Hydrophilidae (5) Viviparidae (6)	Baetidae (4) Dytiscidae (5) Viviparidae (6)
	Tolerant	Chironomidae (2) Muscidae (2) Physidae (3)	Chironomidae (2) Physidae (3)		Chironomidae (2) Muscidae (2)
	BMWP Score	3.8	4.2	5.0	3.8
	SW Diversity Index	1.70	1.56	1.56	1.52
<b>P2</b>	Sensitive			Libellulidae (8)	
	Moderately Sensitive	Hydropsychidae (5)	Hydropsychidae (5) Viviparidae (6)	Dytiscidae (5) Pleuroceridae (6)	Hydropsychidae (5) Pleuroceridae (6)
	Tolerant	Chironomidae (2) Physidae (3) Tubificidae (1)	Chironomidae (2) Tubificidae (1)	Chironomidae (2) Physidae (3)	Chironomidae (2) Physidae (3) Tubificidae (1)
	BMWP Score	2.75	3.5	4.8	3.4
	SW Diversity Index	1.32	1.34	1.58	1.56

<b>P3</b>	Sensitive			Libellulidae (8)	
	Moderately Sensitive	Viviparidae(6)	Hydrophilidae (5) Viviparidae (6)	Hydrophilidae (5) Tabanidae (5) Viviparidae (6)	Dytiscidae (5) Viviparidae (6)
	Tolerant	Chironomidae (2) Physidae (3) Tubificidae (1)	Chironomidae (2) Physidae (3)	Chironomidae (2)	Physidae (3) Syrphidae (2)
	BMWP Score	3.0	4.0	5.2	4.0
	SW Diversity Index	1.28	1.36	1.59	1.27