

Chapter-1 INTRODUCTION

1.1 Preamble

Punjab is the most populous and industrialized province of Pakistan. Rapid urbanization, haphazard industrial development, and continuous population explosion have resulted in degradation of natural resources to an alarming stage. In Punjab municipal wastewater from almost all major towns in addition to industrial effluents are discharged into various streams without treatment which ultimately reach the rivers. This has given rise to serious water pollution and human health problems. Municipal wastes contaminate water bodies with pathogens whereas industrial wastes introduce a variety of chemicals of concern to environment and human health. In addition the biodegradable organic matter in municipal and industrial wastewaters results in the depletion of dissolved oxygen in water necessary for fish life. In agricultural areas of the country excessive use of fertilizers and pesticides also adds to surface and groundwater pollution. In particular, during rainfalls the surface overflows reach the rivers carrying large quantities of the two pollutants. Discharge of excessive quantities of fertilizers may give rise to Eutrophication in the receiving water bodies whereas fish may accumulate excess concentrations of heavy metals to affect consumers' health. Certain heavy metals may also badly harm the aquatic life.

Although during high flow season the effect of pollution of municipal and industrial discharges in rivers is not pronounced, during low flow conditions it becomes hazardous in certain reaches resulting in the depletion of dissolved oxygen.

Increasing trends of pollution of water bodies has become a matter of great concern, yet no systematic studies have been undertaken to assess the levels of prevailing pollution and to anticipate the future trends to this effect. Regular monitoring of river water (Quality analysis is not being done in the country except for GEMS water

quality project (Aziz, 2001). Many reasons to this effect include lack of laboratory facilities, non-availability of laboratory staff and financial constraints.

The problem of pollution of surface water bodies due to anthropogenic activities is so severe that EPA, Punjab planned to evaluate the quality of surface water sources in a systematic way with the objective of combat their respective pollution problem(s).

Environment Protection Department Government of Punjab decided to monitor the quality of River Chenab under its ADP Project **“Monitoring of Surface Water Bodies in Punjab”**. The river was decided to be monitored right from its entry point in Pakistan near Kalyal Ranger’s post Sialkot to its point of its joining with river Sindh and to suggest the various options for improvement of environment of River Chenab.

1.2 Objectives

The over all objectives of the study are as followings:

- 1.2.1 To study pollution status of River Chenab from head Marala District Sialkot to River Chenab at Punjnad Head Works, District Muzaffar Ghar before mixing into River Sindh.
- 1.2.2 To carry out the laboratory analysis regarding water quality of the river and various point sources adding pollution to the river Chenab and comparison with NEQS.
- 1.2.3 To describe the threats posed to environment arid communities due to the present water quality situation in the Chenab River.
- 1.2.4 To present the statistical evidences of events causing hazards to environment and communities.
- 1.2.5 To assess various mitigation measures and provide different options available for controlling river water pollution.

- 1.2.6 Analyze and provide recommendations for each option based on environmental considerations and its social acceptability by the communities.
- 1.2.7 Sharing reports with concerned agencies to prepare action plan for control of deterioration of water bodies.
- 1.2.8 Involve all stakeholders including provincial and district governments, community representatives, NGOs and activists in development of options through consultative workshops.
- 1.2.9 Suggest concerned District Government for preparation of detailed project (PC-I) to control pollution of River Chenab/ Surface water source(s) in their respective Districts.

1.3 Scope of Work

- 1.3.1 Conducting field visits to identify sampling points on various tributaries and in the river along with selection of groundwater and soil sampling locations.
- 1.3.2 Sampling of river water and its tributaries to determine the existing water quality.
- 1.3.3 Estimation of pollution loads entering the river through its tributaries, various sewage out falls, nullahs and drains.
- 1.3.4 Assessment of the prevailing environmental pollution based on the sample analyses.
- 1.3.5 Impact studies of River Chenab pollution on the ambient environment including aquatic, human health and soil.
- 1.3.6 Propose strategic and technical measures to combat environmental pollution in the study area along with feasibility and economical analysis of different treatment options.

Chapter-2 Project Implementation Methodology

2.1 Introduction

This chapter presents the methodology followed for monitoring the quality of the all types of point sources of pollution of surface water as well as the water quality of the surface water body with object to ascertain the effect of pollution on the respective water source. This chapter also presents requirement for sampling program, guideline for sampling program including sampling site location, the list of pollution parameters.

2.2 Methodology

Methodology to achieve the aforementioned objectives comprised of but not limited to followings:

2.2.1 Stakeholder consultative workshop

Methodology for implementation of the scheme was shared with line departments in a consultative seminar. The objective involved was to make necessary improvements in the project implementation methodology, if necessary.

2.2.2 Lesion with Line Departments

EPA representative visited various Government Departments to hold meetings for collection of relevant data on matters of river pollution and its control. This Department/Organization included the followings

- ◆ Irrigation and Power Department, Government of Punjab
- ◆ Directorate of land Reclamation Irrigation & Power Department
- ◆ Office of Executive Engineer, Drainage Section, I&P Department.

- ◆ Town Municipal Administration,(TMAs), Chenab
- ◆ Institute of Environmental Engineering and Research, University of Engineering & Technology, Lahore.

Data collected from various research reports on Chenab water quality and its assimilative capacity and stream pollution control was studied to be benefited for achievement of aforementioned objectives.

2.2.3 Identification of Pollution Sources

Task of identification of the sources of pollution that affect the river water quality was accomplished by literature review and a detailed field survey. EPA field offices were asked to identify the points of disposal of effluent of all types into the river passing in their respective districts. Later on detailed physical surveys were conducted to mark their location on the maps. Based on the field survey and literature review following sources of pollution were identified:

a) Sewage pumping station

Sewage pumping stations that discharge untreated municipal sewage.

b) Irrigation Canals & Lakes

Following irrigation canal of Irrigation and Power Department join river Chenab to augment flow of river at various locations along its length:

- i) Upper Jhelum Canal before mixing with Bimber Nullah near Shadiwal Hydro Power station Gujrat
- ii) Bimber Nullah & Upper Jhelum Link Canal before mixing with River Chenab Kot Ghulam, Gujrat

- iii) T.P Link Canal before mixing with River Chenab, Muhammad Wala Head works, Muzaffar Garh

c) Wastewater Drains

In addition to disposal points marked as pumping stations, various wastewater carrying drains dispose off effluent into the river Chenab. These mainly include the followings:

- i) Hulsee/ Bollay Wala Drain
- ii) Bimber Nullah
- iii) Wastewater of Small Industrial Estate / Mola Khurd Drain
- iv) Hulki Nullah Lower Drain
- v) Budhi Nullah Out Fall Drain
- vi) Ahmad Pur Nakka Drain
- vii) Marh Chiniot Drain
- viii) Paharang Drain
- ix) Ahmed Wala Drain
- x) Khare Wala Drain
- xi) Buddi Nullah
- xii) Nawab Pur Drain
- xiii) Suraj Miani Drain
- xiv) Muzaffar Abad Insustrial Estate Drain

2.2.4 Sampling

EPA laboratory staff and concerned District Officers Environment conducted physical survey (areas of their

jurisdiction) to undertake the sampling. Following sampling methodology was adopted:

- a. Sampling of point sources
- b. River Chenab sampling U/S of the point source
- c. River Chenab Sampling D/S of the point source after mixing

Based on the physical survey and numbers of point sources disposing effluent into the River Chenab, forty nine (49) sampling points were identified for sampling. **Figure 2.1** indicates the location of the sampling points along the river Chenab and point sources of pollution. **Table 2.1** indicates the locations of the various sampling points fixed along the river length and on the point sources of the river Chenab.



The sampling was conducted by qualified staff of EPA Punjab Laboratories. Measurements of Dissolved Oxygen (DO), temperature and pH were made on the site during sampling. The samples were collected in



polystyrene bottles ranging in capacity from 0.5 to 1.5 L. The bottles were thoroughly washed with water, before taking samples.

Sulfuric acid and Nitric acid were used as preservatives in sampling bottles for trace elements and Nitrate determination respectively. All samples were brought to the lab and kept in refrigeration at a temperature of 4°C till analysis.

2.2.5 Analysis

Analysis of the wastewater samples was carried out in EPA Laboratory, Lahore. Samples were analyzed according to the standard procedure as described in **“Standard Methods for Examination of Water and Wastewater”** by WPCF, AWWF & APHA 18th edition was followed, to obtain base line information on industrial effluent along with pollution load study.

Table 2.1

Sampling Points along River Chenab and Sources of Pollution

Sample No.	Location of Sampling Points
S-1	Head Marala Originating Point Of River Chenab District Sialkot
S-2	River Chenab Before Mixing With Dawara Drain & Entry Point Into District Gujrat & Exit Point of District Sialkot Shahbaz Pur, Jalal Pur Jattan, District Gujrat.
S-3	Hulsee/ Bolly Wala Drain before mixing into River Chenab, near Gorali Village, District Gujrat.
S-4	River Chenab before mixing with Small Industrial Estate / Mola Khurd drain & after mixing with Hulsee/ Bolly Wala drain near G.T. Roads Gujrat.
S-5	Wastewater of Small Industrial Estate / Mola Khurd drain before mixing with River Chenab Mola Kalan Gujrat.
S-6	River Chenab before mixing with Bimber Nullah & Upper Jhelum Link Canal & After mixing with Small Industrial Estate / Mola Khurd drain Kot Ghulam, Gujrat.
S-7	Bimber Nullah before mixing with Upper Jhelum Link Canal near Shadiwal Hydro Power station Gujrat
S-8	Upper Jhelum Canal before mixing with Bimber Nullah near Shadiwal Hydro Power station Gujrat
S-9	Bimber Nullah & Upper Jhelum Link Canal before mixing with River Chenab Kot Ghulam, Gujrat.
S-10	River Chenab after mixing with Bimber Nullah & Upper Jhelum Link Canal Kayyari Wala, Gujrat
S-11	River Chenab entry point into District Mandi Bahau Din & before mixing with Hulki Nullah Lower Drain, Qadir Abad Head Works Mandi Bahau Din
S-12	Hulki Nullah Lower Drain before mxing with River Chenab near Village Bari Randyali, Tehsil Phalia, District Mandi Bahau Din
S-13	River Chenab after mixing with Hulki Nullah Lower Drain, Qadir Abad Head Works, Mandi Bahau Din
S-14	Rivere Chenab before mixing with Budhi Nullah Out Fall Drain near Village Noshera, Tehsil Phalia, District Mandi Bahau Din.

- S-15 Budhi Nullah Out Fall Drain before mixing into Rivere Chenab Near Village Noshera, Tehsil Phalia, District Mandi Bahau Din.
- S-16 Rivere Chenab after mixing with Budhi Nullah Out Fall Drain near Village Noshera, Tehsil Phalia, District Mandi Bahau Din.
- S-17 River Chenab Entry Point into District Hafizabad.
- S-18 River Chenab before mixing with Ahmad Pur Nakka Drain at Jalib Wala Bridge, Tehsil Pindi Bhattian, District Hafizabad.
- S-19 Ahmad Pur Nakka Drain before mixing into River Chenab, Moza Miraj Bhattian , Tehsil Pindi Bhattian, District Hafizabad.
- S-20 River Chenab after mixing with Ahmad pur Nakka Drain, Moza Jhanghar, Tehsil Pindi Bhattian, District Hafizabad.
- S-21 Rivere Chenab before mixing with Marh Cchniot Drain, near Moza Jasrat, Tehsil Chiniot, District Jhang.
- S-22 Marh Chiniot Drain before mixing into River Chenab near Moza Jasrat, Tehsil Chiniot, District Jhang.
- S-23 River Chenab after mixing with Marh Chniot Drain & before mixing with Paharang Drain, near Kot Sahab, Tehsil Chiniot, District Jhang.
- S-24 Paharang Drain before mixing with River Chenab near Thatha Muhammad Shah, Tehsil Chiniot, District Jhang.
- S-25 River Chenab after mixing with Paharang Drain near Thatha Muhammad Shah, Tehsil Chiniot, District Jhang.
- S-26 Ahmed Wala Drain before mixing into River Chenab near Moza Ahmed Wala, Lalian Road, Tehsil & District Jhang.
- S-27 River Chenab after mixing Ahmed Wala Drain, near Riwarz Bridge Chund Bharwana Sargodha Road, Tehsil & District Jhang.
- S-28 River Chenab before mixing with Khare Wala Drain near Moza Dhedowana, Tehsil & District Jhang.
- S-29 Khare Wala Drain before mixing with River Chenab, Moza Maghyana Chenab Road, Tehsil & District Jhang.
- S-30 Buddi Nullah before mixing into River Chenab.
- S-31 River Chenab before mixing with River Jhelum near Moza Mansoor Sial, Tehsil and District Jhang.

- S-32 River Chenab after mixing with River Jhelum at Trimmu Head Works, Tehsil & District Jhang.
- S-33 River Chenab Entry Point into District Muzaffar Garh, Pattan Rangpur, District Muzaffar Garh
- S-34 River Chenab Entry Point into District Multan Near Moza Sardar Pur, Bund Bosan. Multan.
- S-35 T.P Link Canal before mixing with River Chenab, Muhammmad Wala Head works, Muzaffar Garh
- S-36 River Chenab after mixing with T.P Link Canal, near Muhammmad Wala Head Works, Muzaffar Garh
- S-37 River Chenab before mixing with Nawab Pur Drain, Multan
- S-38 Nawab Pur Drain before mixing into River Chenab near Nawab Pur Rest House, Multan.
- S-39 River Chenab after mixing With Nawab Pur Drain, Multan.
- S-40 River Chenab before mixing with Suraj Miani Drain, Multan.
- S-41 Suraj Miani Drain at Paka Sandelay Wala, Multan before mixing with River Chenab
- S-42 River Chenab after mixing with Suraj Miani Drain, Multan.
- S-43 River Chenab before mixing with Muzaffar Abad Industrial Estate Drain, Multan.
- S-44 Muzaffar Abad Industrial Estate Drain before mixing with River Chenab, at Jhok Haji Abbas Sher Shah, Multan.
- S-45 River Chenab after mixing with Muzaffar Abad Industrial Estate Drain, Multan.
- S-46 River Chenab at Multan, Muzaffar Garh Bridge, District Muzaffar Garh.
- S-47 River Chenab Exit Point of District Multan at Beat Kage Moza Lord Janubi, Multan.
- S-48 River Chenab near Moza Murad Pur Sheher Sultan, District Muzaffar Garh
- S-49 River Chenab at Punjnad Head Works, District Muzaffar Garh

2.3 Project Area Description

2.3.1 Project Area Description

One of the most important Indian rivers, the Chenab River is formed as the result of conflux of the rivers - Chandra and Bhaga. The rivers meet at Tandi in the lap of Upper Himalayas. The Chenab River also called as the Chandrabhaga in its initial



stages.

Although it commences its journey from Himachal Pradesh, it has become one of the major Rivers & Lakes of Jammu and Kashmir. Chenab River enters the state of Jammu and Kashmir at Tandi at an altitude of 9,090 feet. The river gains momentum on the way with contributions from numerous branches.

It also enters the state of Punjab. It rises in the snowy Himalayan ranges of Kashmir, enters in the Sialkot district, and flows through the plains of the Punjab, forming the boundary between the Rechna and the Jech Doabs. Finally it joins the Jhelum River at Trimmu Head Work in District Jhang. The Chenab River meets several other rivers at different places. These rivers are: -

- Jhelum
- Ravi
- Sutlej

Chenab River is about 605 miles (974 km) long and feeds several irrigation canals. It supplies water for an important irrigation system. It joins the Indus River at Uch Sharif in District Bahawalpur to form Panjnad, a tributary of the Indus. The total length of the Chenab is approximately 960 kilometers. The water

of the Chenab is shared by India and Pakistan as per the terms of the Indus Water Treaty. Catchments area is approximately 26000 square miles.

Chapter-3 Pollution of River Chenab

This chapter describes the results of the analysis of the samples collected during November 2008 to November 2009 from the various sampling points along the river and its point sources of pollution. Details of the analysis of individual samples is given below whereas **Table 3.1** presents the summary of the results of analysis of samples collected along the river Chenab and its sources of pollution.

3.1 Water Quality of the River Chenab

Analysis reports of the individual samples indicates the following results

3.1.1 Head Marala Originating Point of River Chenab District Sialkot.

The Dissolved Oxygen level at this sampling point was found as 10.3 mg/l. Biochemical Oxygen Demand (BOD₅) and Chemical Oxygen Demand (COD) of the River were found to be 4.2 mg/l and 12.4 mg/l respectively. The detailed analysis report of the sample collected from this point is given in Table-3.1

Table-3.1
Wastewater analysis report of the Head Marala Originating Point of River Chenab District Sialkot

S#	PARAMETERS	N.E.Q.S.	RESULTS
1	Temperature	=<3° C	14.5
2	Value of pH	6-9	8.5
3	Dissolved Oxygen	-	10.3
4	Biochemical Oxygen	80 mg/l	4.2
5	Chemical Oxygen Demand	150 mg/l	12.4
6	Total Dissolved Solids	3500 mg/l	140
7	Total Suspended Solids	200 mg/l	40
8	Chloride (Cl ⁻¹)	1000 mg/l	25
9	Sulphate (SO ₄) ⁻²	600 mg/l	28
10	Sulfide	1.0 mg/l	0.0
11	Fluoride (As F ['])	10 mg/l	0.253
12	Cyanide (As CN ['])	1.0 mg/l	0.0

13	Manganese	1.5 mg/l	0.909
14	Copper	1.0 mg/l	0.086
15	Cadmium	0.1 mg/l	0.909
16	Chromium	1.0 mg/l	0.01
17	Zinc	5.0 mg/l	0.099
18	Iron	8.0 mg/l	0.403
19	Nickel	1.0 mg/l	0.014
20	Oil & Grease	10 mg/l	0.0
21	Sodium (Na)	-	06
22	Calcium (Ca)	-	31
23	Potassium (K)	-	2.3

Remarks: The parameters analyzed are within the NEQS limits.

3.1.2 River Chenab before mixing with Dawara Drain & Entry Point into District Gujrat & Exit Point of District Sialkot Shahbaz Pur, Jalal Pur Jattan, District Gujrat.

The Dissolved Oxygen level at this sampling point was found as 7.05 mg/l. Biochemical Oxygen Demand (BOD₅) and Chemical Oxygen Demand (COD) of the River were found to be 4.4 mg/l and 15.6 mg/l respectively. The detailed analysis report of the sample collected from this point is given in Table-3.2

Table-3.2

Wastewater analysis report of the Chenab before mixing With Dawara Drain & Entry Point into District Gujrat & Exit Point of Disyriect Sialkot Shahbaz Pur, Jalal Pur Jattan, District Gujrat

S#	PARAMETERS		RESULTS
1	Temperature	=<3° C	15.46
2	Value of pH	6-9	8.3
3	Dissolved Oxygen	-	7.05
4	Biochemical Oxygen	80 mg/l	4.4
5	Chemical Oxygen Demand	150 mg/l	15.6
6	Total Dissolved Solids (TDS)	3500 mg/l	160
7	Total Suspended Solids (TSS)	200 mg/l	40
8	Chloride (Cl ⁻¹)	1000 mg/l	15
9	Sulphate (SO ₄) ⁻²	600 mg/l	40
10	Sulfide	1.0 mg/l	0.0

11	Fluoride (As F')	10 mg/l	0.220
12	Cyanide (As CN')	1.0 mg/l	0.182
13	Manganese	1.5 mg/l	0.05
14	Copper	1.0 mg/l	0.056
15	Cadmium	0.1 mg/l	0.018
16	Chromium	1.0 mg/l	0.0
17	Zinc	5.0 mg/l	0.011
18	Iron	8.0 mg/l	0.916
19	Nickel	1.0 mg/l	0.009
20	Oil & Grease	10 mg/l	0.0
21	Sodium (Na)	-	06
22	Calcium (Ca)	-	31
23	Potassium (K)	-	2.6

Remarks: The parameters analyzed are within the NEQS limits.

3.1.3 Hulsee/Bollay Wala drain before mixing into River Chenab, near Gorali Village, District Gujrat.

The Dissolved Oxygen level at this sampling point was found as 1.4 mg/l. Biochemical Oxygen Demand (BOD₅) and Chemical Oxygen Demand (COD) of the River were found to be 9.0 mg/l and 40 mg/l respectively. This drain is responsible for adding 0.3390 ton/day of organic load to the river. The detailed analysis report of the sample collected from this point is given in Table-3.3.

Table-3.3

Wastewater analysis report of the Hulsee/Bollay Wala Drain before mixing into River Chenab, near Gorali Village, District Gujrat.

S#	PARAMETERS	N.E.Q.S.	RESULTS
1	Temperature	=<3° C	16.9
2	Value of pH	6-9	7.4
3	Dissolved Oxygen	-	1.4
4	Biochemical Oxygen	80 mg/l	9
5	Chemical Oxygen Demand	150 mg/l	40
6	Total Dissolved Solids (TDS)	3500 mg/l	580

7	Total Suspended Solids	200 mg/l	30
8	Chloride (Cl ⁻¹)	1000 mg/l	55
9	Sulphate (SO ₄) ⁻²	600 mg/l	112
10	Sulfide	1.0 mg/l	0.0
11	Fluoride (As F ['])	10 mg/l	0.431
12	Cyanide (As CN ['])	1.0 mg/l	0.184
13	Manganese	1.5 mg/l	0.154
14	Copper	1.0 mg/l	0.088
15	Cadmium	0.1 mg/l	0.022
16	Chromium	1.0 mg/l	0.0
17	Zinc	5.0 mg/l	0.070
18	Iron	8.0 mg/l	0.231
19	Nickel	1.0 mg/l	0.012
20	Oil & Grease	10 mg/l	0.3
21	Sodium (Na)	-	87
22	Calcium (Ca)	-	27
23	Potassium (K)	-	10.9

Remarks: The parameters analyzed are within the NEQS limits

3.1.4 River Chenab before mixing with Small Industrial Estate / Mola Khurd Drain & after mixing with Hulsee/ Bollay Wala drain, G.T. Road Gujrat.

The Dissolved Oxygen level at this sampling point was found as 7.08 mg/l. Biochemical Oxygen Demand (BOD₅) and Chemical Oxygen Demand (COD) of the River were found to be 5.0 mg/l and 12.8 mg/l respectively. The detailed analysis report of the sample collected from this point is given in Table-3.4.

Table-3.4

Wastewater analysis report of the River Chenab before mixing with Small Industrial Estate / Mola Khurd Drain & after mixing with Hulsee/ Bollay Wala drain near G.T. Road Gujrat.

S#	PARAMETERS	N.E.Q.S.	RESULTS
1	Temperature	=<3° C	16.34
2	Value of pH	6-9	8.2

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3	Dissolved Oxygen	-	7.08
4	Biochemical Oxygen	80 mg/l	5
5	Chemical Oxygen Demand	150 mg/l	12.8
6	Total Dissolved Solids (TDS)	3500 mg/l	160
7	Total Suspended Solids	200 mg/l	80
8	Chloride (Cl ⁻¹)	1000 mg/l	10
9	Sulphate (SO ₄) ⁻²	600 mg/l	40
10	Sulfide	1.0 mg/l	0.0
11	Fluoride (As F')	10 mg/l	0.240
12	Cyanide (As CN')	1.0 mg/l	0.436
13	Manganese	1.5 mg/l	0.126
14	Copper	1.0 mg/l	0.054
15	Cadmium	0.1 mg/l	0.012
16	Chromium	1.0 mg/l	0.0
17	Zinc	5.0 mg/l	0.027
18	Iron	8.0 mg/l	1.512
19	Nickel	1.0 mg/l	0.020
20	Oil & Grease	10 mg/l	0.0
21	Sodium (Na)	-	06
22	Calcium (Ca)	-	30
23	Potassium (K)	-	2.8

Remarks: The parameters analyzed are within the NEQS limits.

3.1.5 Wastewater of Small Industrial Estate / Mola Khurd drain before mixing with River Chenab, Mola Kalan, Gujrat.

The Dissolved Oxygen level at this sampling point was found as 0.6 mg/l. Biochemical Oxygen Demand (BOD₅) and Chemical Oxygen Demand (COD) of the River were found to be 18 mg/l and 96 mg/l respectively. This drain is responsible for adding 0.5945 ton/day of organic load to the river. The detailed analysis report of the sample collected from this point is given in Table-3.5.

Table-3.5

Wastewater analysis report of the Small Industrial Estate / Mola Khurd drain before mixing with River Chenab, Mola Kalan Gujrat

S#	PARAMETERS	N.E.Q.S.	RESULTS
1	Temperature	=<3° C	18.9
2	Value of pH	6-9	7.9
3	Dissolved Oxygen	-	0.6
4	Biochemical Oxygen	80 mg/l	18
5	Chemical Oxygen Demand	150 mg/l	96
6	Total Dissolved Solids (TDS)	3500 mg/l	680
7	Total Suspended Solids	200 mg/l	40
8	Chloride (Cl ⁻¹)	1000 mg/l	85
9	Sulphate (SO ₄) ⁻²	600 mg/l	193
10	Sulfide	1.0 mg/l	0.0
11	Fluoride (As F ['])	10 mg/l	0.482
12	Cyanide (As CN ['])	1.0 mg/l	0.003
13	Manganese	1.5 mg/l	0.230
14	Copper	1.0 mg/l	0.084
15	Cadmium	0.1 mg/l	0.007
16	Chromium	1.0 mg/l	0.28
17	Zinc	5.0 mg/l	0.075
18	Iron	8.0 mg/l	0.970
19	Nickel	1.0 mg/l	0.047
20	Oil & Grease	10 mg/l	0.0

21	Sodium (Na)	-	96
22	Calcium (Ca)	-	30
23	Potassium (K)	-	6.2

Remarks: The parameters analyzed are within the NEQS limits.

3.1.6 River Chenab up Stream of Bimber Nullah & Upper Jhelum Link Canal & Down Stream of Small Industrial Estate / Mola Khurd drain

The Dissolved Oxygen level at this sampling point was found as 6.9 mg/l. Biochemical Oxygen Demand (BOD₅) and Chemical Oxygen Demand (COD) of the River were found to be 4.8 mg/l and 11.4 mg/l respectively. The detailed analysis report of the sample collected from this point is given in Table-3.6

Table-3.6

Wastewater analysis report of the River Chenab Up Stream of Bimber Nullah & Upper Jhelum Link Canal & Down Stream of Small Industrial Estate / Mola Khurd Drain

S#	PARAMETERS	N.E.Q.S.	RESULTS
1	Temperature	=<3° C	15.8
2	Value of pH	6-9	8.3
3	Dissolved Oxygen	-	6.9
4	Biochemical Oxygen	80 mg/l	4.8
5	Chemical Oxygen Demand	150 mg/l	11.4
6	Total Dissolved Solids (TDS)	3500 mg/l	200
7	Total Suspended Solids	200 mg/l	10
8	Chloride (Cl ⁻¹)	1000 mg/l	25
9	Sulphate (SO ₄) ⁻²	600 mg/l	41
10	Sulfide	1.0 mg/l	0.0
11	Fluoride (As F ['])	10 mg/l	0.241
12	Cyanide (As CN ['])	1.0 mg/l	0.0
13	Manganese	1.5 mg/l	0.089
14	Copper	1.0 mg/l	0.082
15	Cadmium	0.1 mg/l	0.024
16	Chromium	1.0 mg/l	0.0

17	Zinc	5.0 mg/l	0.118
18	Iron	8.0 mg/l	0.774
19	Nickel	1.0 mg/l	0.018
20	Oil & Grease	10 mg/l	0.0
21	Sodium (Na)	-	13
22	Calcium (Ca)	-	32
23	Potassium (K)	-	3.4

Remarks: The parameters analyzed are within the NEQS limits.

3.1.7 Bimber Nullah before mixing with Upper Jhelum Link Canal near Shadiwal Hydro Power station Gujrat

The Dissolved Oxygen level at this sampling point was found as 8.99 mg/l. Biochemical Oxygen Demand (BOD₅) and Chemical Oxygen Demand (COD) of the River were found to be 6.6 mg/l and 24.6 mg/l respectively. This drain is responsible for adding 17.762 ton/day of organic load to the river. The detailed analysis report of the sample collected from this point is given in Table-3.7

Table-3.7

Wastewater analysis report of the Bimber Nullah before mixing with Upper Jhelum Link Canal near Shadiwal Hydro Power station Gujrat

S#	PARAMETERS	N.E.Q.S.	RESULTS
1	Temperature	=<3°	18.09
2	Value of pH	6-9	9.4
3	Dissolved Oxygen	-	8.99
4	Biochemical Oxygen	80 mg/l	6.6
5	Chemical Oxygen Demand	150 mg/l	24.6
6	Total Dissolved Solids (TDS)	3500 mg/l	200
7	Total Suspended Solids	200 mg/l	40
8	Chloride (Cl ⁻¹)	1000 mg/l	20
9	Sulphate (SO ₄) ⁻²	600 mg/l	41
10	Sulfide	1.0 mg/l	0.0
11	Fluoride (As F ⁻)	10 mg/l	0.167

12	Cyanide (As CN ⁻)	1.0 mg/l	0.842
13	Manganese	1.5 mg/l	0.043
14	Copper	1.0 mg/l	0.071
15	Cadmium	0.1 mg/l	0.064
16	Chromium	1.0 mg/l	0.0
17	Zinc	5.0 mg/l	0.139
18	Iron	8.0 mg/l	0.198
19	Nickel	1.0 mg/l	0.021
20	Oil & Grease	10 mg/l	0.0
21	Sodium (Na)	-	34
22	Calcium (Ca)	-	31
23	Potassium (K)	-	3.9

Remarks: The parameters analyzed are within the NEQS limits.

3.1.8 Upper Jhelum Canal before mixing with Bimber Nullah near Shadiwal Hydro Power station Gujrat

The Dissolved Oxygen level at this sampling point was found as 6.51 mg/l. Biochemical Oxygen Demand (BOD₅) and Chemical Oxygen Demand (COD) of the River were found to be 4.6 mg/l and 10.6 mg/l respectively. This canal is responsible for adding 124.246 ton/day of organic load to the river. The detailed analysis report of the sample collected from this point is given in Table-3.8

Table-3.8

Wastewater analysis report of the Upper Jhelum Canal before mixing with Bimber Nullah near Shadiwal Hydro Power station Gujrat

S#	PAMRAETERS	N.E.Q.S.	RESULTS
1	Temperature	=<3° C	19.9
2	Value of pH	6-9	8.05
3	Dissolved Oxygen	-	6.51
4	Biochemical Oxygen	80 mg/l	4.6
5	Chemical Oxygen Demand	150 mg/l	10.6
6	Total Dissolved Solids (TDS)	3500 mg/l	120

7	Total Suspended Solids	200 mg/l	40
8	Chloride (Cl ⁻¹)	1000 mg/l	15
9	Sulphate (SO ₄) ⁻²	600 mg/l	27
10	Sulfide	1.0 mg/l	04
11	Fluoride (As F ⁻)	10 mg/l	0.121
12	Cyanide (As CN ⁻)	1.0 mg/l	0.487
13	Manganese	1.5 mg/l	0.083
14	Copper	1.0 mg/l	0.073
15	Cadmium	0.1 mg/l	0.078
16	Chromium	1.0 mg/l	0.002
17	Zinc	5.0 mg/l	0.1
18	Iron	8.0 mg/l	0.593
19	Nickel	1.0 mg/l	0.027
20	Oil & Grease	10 mg/l	0.1
21	Sodium (Na)	-	06
22	Calcium (Ca)	-	31
23	Potassium (K)	-	1.8

Remarks: The value Of Sulfide exceeds the NEQS limits.

3.1.9 Bimber Nullah & Upper Jhelum Link Canal before mixing with River Chenab Kot Ghulam, Gujrat

The Dissolved Oxygen level at this sampling point was found as 6.54 mg/l. Biochemical Oxygen Demand (BOD₅) and Chemical Oxygen Demand (COD) of the River were found to be 3.2 mg/l and 8.8 mg/l respectively. This canal is responsible for adding 35.230 ton/day of organic load to the river. The detailed analysis report of the sample collected from this point is given in Table-3.9

Table-3.1.9

Wastewater analysis report of Bimber Nullah & Upper Jhelum Link Canal before mixing with River Chenab Kot Ghulam, Gujrat

S#	PARAMETERS	N.E.Q.S.	RESULTS
1	Temperature	=<3° C	18.87

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2	Value of pH	6-9	7.36
3	Dissolved Oxygen	-	6.54
4	Biochemical Oxygen	80 mg/l	3.2
5	Chemical Oxygen Demand	150 mg/l	8.8
6	Total Dissolved Solids (TDS)	3500	140
7	Total Suspended Solids	200 mg/l	160
8	Chloride (Cl ⁻¹)	1000	25
9	Sulphate (SO ₄) ⁻²	600 mg/l	32
10	Sulfide	1.0 mg/l	0.0
11	Fluoride (As F ['])	10 mg/l	0.137
12	Cyanide (As CN ['])	1.0 mg/l	1.28
13	Manganese	1.5 mg/l	0.119
14	Copper	1.0 mg/l	0.085
15	Cadmium	0.1 mg/l	0.046
16	Chromium	1.0 mg/l	0.0
17	Zinc	5.0 mg/l	0.1184
18	Iron	8.0 mg/l	1.937
19	Nickel	1.0 mg/l	0.033
20	Oil & Grease	10 mg/l	0.1
21	Sodium (Na)	-	97
22	Calcium (Ca)	-	30
23	Potassium (K)	-	02

Remarks: The value Of Cyanide exceeds the NEQS limits.

3.1.10 River Chenab after mixing with Bimber Nullah & Upper Jhelum Link Canal Kayyari Wala, Gujrat.

The Dissolved Oxygen level at this sampling point was found as 6.25 mg/l. Biochemical Oxygen Demand (BOD₅) and Chemical Oxygen Demand (COD) of the River were found to be 4.6 mg/l and 11.5 mg/l respectively. The detailed analysis report of the sample collected from this point is given in Table-3.10

Table-3.10

**Waste water Analysis Report of River Chenab
after mixing with Bimber Nullah & Upper Jhelum Link Canal
Kayyari Wala, Gujrat**

S#	PARAMETERS	N.E.Q.S.	RESULTS
1	Temperature	=<3° C	18.67
2	Value of pH	6-9	7.16
3	Dissolved Oxygen	-	6.25
4	Biochemical Oxygen	80 mg/l	4.6
5	Chemical Oxygen Demand	150 mg/l	11.5
6	Total Dissolved Solids	3500 mg/l	170
7	Total Suspended Solids	200 mg/l	140
8	Chloride (Cl ⁻¹)	1000 mg/l	25
9	Sulphate (SO ₄) ⁻²	600 mg/l	27
10	Sulfide	1.0 mg/l	0.0
11	Fluoride (As F ¹)	10 mg/l	0.126
12	Cyanide (As CN ¹)	1.0 mg/l	1.05
13	Manganese	1.5 mg/l	0.118
14	Copper	1.0 mg/l	0.089
15	Cadmium	0.1 mg/l	0.055
16	Chromium	1.0 mg/l	0.003
17	Zinc	5.0 mg/l	0.098
18	Iron	8.0 mg/l	1.869
19	Nickel	1.0 mg/l	0.037
20	Oil & Grease	10 mg/l	0.0

21	Sodium (Na)	-	07
22	Calcium (Ca)	-	30
23	Potassium (K)	-	2.1

Remarks: The parameters analyzed are within the NEQS limits.

3.1.11 River Chenab Entry Point into District Mandi Bahau Din & before mixing with Hulki Nullah Lower Drain, Qadir Abad Head Works Mandi Bahau Din

The Dissolved Oxygen level at this sampling point was found as 9.55 mg/l. Biochemical Oxygen Demand (BOD₅) and Chemical Oxygen Demand (COD) of the River were found to be 5.2 mg/l and 10.4 mg/l respectively. The detailed analysis report of the sample collected from this point is given in Table-3.11

Table-3.11

**Wastewater analysis report of the River Chenab
Entry Point into District Mandi Bahau Din & before mixing
with Hulki Nullah Lower Drain, Qadir Abad Head Works Mandi
Bahau Din**

S#	PARAMETERS	N.E.Q.S.	RESULTS
1	Temperature	=<3° C	12.8
2	Value of pH	6-9	7.5
3	Dissolved Oxygen	-	9.55
4	Biochemical Oxygen	80 mg/l	5.2
5	Chemical Oxygen	150 mg/l	10.4
6	Total Dissolved Solids	3500 mg/l	220
7	Total Suspended Solids	200 mg/l	380
8	Chloride (Cl ⁻¹)	1000 mg/l	15
9	Sulphate (SO ₄) ⁻²	600 mg/l	36
10	Sulfide	1.0 mg/l	0.0
11	Fluoride (As F ['])	10 mg/l	0.340
12	Cyanide (As CN ['])	1.0 mg/l	0.0
13	Manganese	1.5 mg/l	0.121
14	Copper	1.0 mg/l	0.051
15	Cadmium	0.1 mg/l	0.019

16	Chromium	1.0 mg/l	0.0
17	Zinc	5.0 mg/l	0.012
18	Iron	8.0 mg/l	0.857
19	Nickel	1.0 mg/l	0.016
20	Oil & Grease	10 mg/l	0.0
21	Sodium (Na)	-	09
22	Calcium (Ca)	-	26
23	Potassium (K)	-	3.7

Remarks: The parameters analyzed are within the NEQS limits.

3.1.12 Hulki Nullah Lower drain before mixing with River Chenab near Village Bari Randyali, Tehsil Phalia, District Mandi Bahau Din

The Dissolved Oxygen level at this sampling point was found as 5.25 mg/l. Biochemical Oxygen Demand (BOD₅) and Chemical Oxygen Demand (COD) of the River were found to be 2.1 mg/l and 8.6 mg/l respectively. This drain is responsible for adding 0.2193 ton/day of organic load to the river. The detailed analysis report of the sample collected from this point is given in Table-3.12

Table-3.12

Wastewater analysis report of the Hulki Nullah Lower Drain before mixing With River Chenab near Village Bari Randyali, Tehsil Phalia, District Mandi Bahau Din

S#	PARAMETERS	N.E.Q.S.	RESULTS
1	Temperature	=<3° C	15.29
2	Value of pH	6-9	7.3
3	Dissolved Oxygen	-	5.25
4	Biochemical Oxygen	80 mg/l	2.1
5	Chemical Oxygen	150 mg/l	8.6
6	Total Dissolved Solids	3500 mg/l	280
7	Total Suspended Solids	200 mg/l	20
8	Chloride (Cl ⁻¹)	1000 mg/l	20
9	Sulphate (SO ₄) ⁻²	600 mg/l	42
10	Sulfide	1.0 mg/l	0.0
11	Fluoride (As F ['])	10 mg/l	0.353

12	Cyanide (As CN ⁻)	1.0 mg/l	0.0
13	Manganese	1.5 mg/l	0.181
14	Copper	1.0 mg/l	0.071
15	Cadmium	0.1 mg/l	0.026
16	Chromium	1.0 mg/l	0.0
17	Zinc	5.0 mg/l	0.107
18	Iron	8.0 mg/l	0.699
19	Nickel	1.0 mg/l	0.024
20	Oil & Grease	10 mg/l	1.1
21	Sodium (Na)	-	15
22	Calcium (Ca)	-	17
23	Potassium (K)	-	3.9

Remarks: The parameters analyzed are within the NEQS limits.

3.1.13 River Chenab after mixing with Hulki Nullah Lower Drain, Qadir Abad Head Works, Mandi Bahau Din

The Dissolved Oxygen level at this sampling point was found as 8.33 mg/l. Biochemical Oxygen Demand (BOD₅) and Chemical Oxygen Demand (COD) of the River were found to be 3.8 mg/l and 8.4 mg/l respectively. The detailed analysis report of the sample collected from this point is given in Table-3.13

**Table-3.13
Wastewater analysis report of the River River Chenab
after mixing with Hulki Nullah Lower Drain, Qadir Abad Head,
Mandi Bahau Din**

S#	PARAMETERS	N.E.Q.S.	RESULTS
1	Temperature	=<3° C	15.07
2	Value of pH	6-9	8.23
3	Dissolved Oxygen	-	8.33
4	Biochemical Oxygen	80 mg/l	3.8
5	Chemical Oxygen	150 mg/l	8.4
6	Total Dissolved Solids	3500 mg/l	380
7	Total Suspended Solids	200 mg/l	20
8	Chloride (Cl ⁻¹)	1000 mg/l	25
9	Sulphate (SO ₄) ⁻²	600 mg/l	42
10	Sulfide	1.0 mg/l	0.0
11	Fluoride (As F ⁻)	10 mg/l	0.337

12	Cyanide (As CN')	1.0 mg/l	0.0
13	Manganese	1.5 mg/l	0.129
14	Copper	1.0 mg/l	0.077
15	Cadmium	0.1 mg/l	0.003
16	Chromium	1.0 mg/l	0.0
17	Zinc	5.0 mg/l	0.013
18	Iron	8.0 mg/l	0.855
19	Nickel	1.0 mg/l	0.017
20	Oil & Grease	10 mg/l	0.0
21	Sodium (Na)	-	15
22	Calcium (Ca)	-	21
23	Potassium (K)	-	3.9

Remarks: The parameters analyzed are within the NEQS limits.

3.1.14 River Chenab before mixing with Budhi Nullah outfall drain near Village Noshera, Tehsil Phalia, District Mandi Bahau Din.

The Dissolved Oxygen level at this sampling point was found as 8.6 mg/l. Biochemical Oxygen Demand (BOD₅) and Chemical Oxygen Demand (COD) of the River were found to be 5.1 mg/l and 16.3 mg/l respectively. The detailed analysis report of the sample collected from this point is given in Table-3.14

**Table-3.14
Wastewater analysis report of the River Chenab
before mixing with Budhi Nullah out falldrain near Village
Noshera, Tehsil Phalia, District Mandi Bahau Din**

S#	PARAMETERS	N.E.Q.S.	RESULTS
1	Temperature	=<3° C	13.5
2	Value of pH	6-9	8.3
3	Dissolved Oxygen	-	8.6
4	Biochemical Oxygen Demand	80 mg/l	5.1
5	Chemical Oxygen Demand	150 mg/l	16.3
6	Total Dissolved Solids (TDS)	3500 mg/l	240
7	Total Suspended Solids (TSS)	200 mg/l	20
8	Chloride (Cl ⁻¹)	1000 mg/l	30
9	Sulphate (SO ₄) ⁻²	600 mg/l	36
10	Sulfide	1.0 mg/l	0.0
11	Fluoride (As F')	10 mg/l	0.28
12	Cyanide (As CN')	1.0 mg/l	0.031

13	Manganese	1.5 mg/l	0.102
14	Copper	1.0 mg/l	0.064
15	Cadmium	0.1 mg/l	0.018
16	Chromium	1.0 mg/l	0.0
17	Zinc	5.0 mg/l	0.014
18	Iron	8.0 mg/l	0.831
19	Nickel	1.0 mg/l	0.016
20	Oil & Grease	10 mg/l	0.0
21	Sodium (Na)	-	10
22	Calcium (Ca)	-	25
23	Potassium (K)	-	05

Remarks: The parameters analyzed are within the NEQS limits.

3.1.15 Budhi Nullah Outfall drain before mixing into Rivere Chenab near Village Noshera, Tehsil Phalia, District Mandi Bahau Din.

The Dissolved Oxygen level at this sampling point was found as 0.7 mg/l. Biochemical Oxygen Demand (BOD₅) and Chemical Oxygen Demand (COD) of the River were found to be 96 mg/l and 240 mg/l respectively. This drain is responsible for adding 5.7543 ton/day of organic load to the river. The detailed analysis report of the sample collected from this point is given in Table-3.15

Table-3.15

Wastewater analysis report of the Budhi Nullah Outfall drain before mixing into Rivere Chenab near Village Noshera, Tehsil Phalia, District Mandi Bahau Din

S#	PARAMETERS	N.E.Q.S.	RESULTS
1	Temperature	=<3° C	14.4
2	Value of pH	6-9	7.8
3	Dissolved Oxygen	-	0.7
4	Biochemical Oxygen	80 mg/l	96
5	Chemical Oxygen Demand	150 mg/l	240
6	Total Dissolved Solids (TDS)	3500 mg/l	1240

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7	Total Suspended Solids	200 mg/l	40
8	Chloride (Cl ⁻¹)	1000 mg/l	125
9	Sulphate (SO ₄) ⁻²	600 mg/l	325
10	Sulfide	1.0 mg/l	16
11	Fluoride (As F ⁻)	10 mg/l	0.352
12	Cyanide (As CN ⁻)	1.0 mg/l	2.07
13	Manganese	1.5 mg/l	0.13
14	Copper	1.0 mg/l	0.068
15	Cadmium	0.1 mg/l	0.069
16	Chromium	1.0 mg/l	0.0
17	Zinc	5.0 mg/l	0.021
18	Iron	8.0 mg/l	0.982
19	Nickel	1.0 mg/l	0.021
20	Oil & Grease	10 mg/l	1.7
21	Sodium (Na)	-	140
22	Calcium (Ca)	-	48
23	Potassium (K)	-	150

Remarks: - The values of BOD, COD, TSS, Sulfide and Cyanide exceed the NEQS limits.

3.1.16 River Chenab after mixing with Budhi Nullah outfall drain near Village Noshera, Tehsil Phalia, District Mandi Bahau Din.

The Dissolved Oxygen level at this sampling point was found as 8.8 mg/l. Biochemical Oxygen Demand (BOD₅) and Chemical Oxygen Demand (COD) of the River were found to be 5.0 mg/l and 19.2 mg/l respectively. The detailed analysis report of the sample collected from this point is given in Table-3.16

**Table-3.16
Wastewater analysis report of the River Chenab
after mixing with Budhi Nullah outfall drain near Village
Noshera, Tehsil Phalia, District Mandi Bahau Din**

S#	PARAMETERS	N.E.Q.S.	RESULTS
1	Temperature	=<3° C	13.0
2	Value of pH	6-9	7.9
3	Dissolved Oxygen	-	8.8
4	Biochemical Oxygen	80 mg/l	5.0
5	Chemical Oxygen Demand	150 mg/l	19.2
6	Total Dissolved Solids	3500 mg/l	220
7	Total Suspended Solids	200 mg/l	180
8	Chloride (Cl ⁻¹)	1000 mg/l	25
9	Sulphate (SO ₄) ⁻²	600 mg/l	36
10	Sulfide	1.0 mg/l	0.0
11	Fluoride (As F')	10 mg/l	0.293
12	Cyanide (As CN')	1.0 mg/l	0.49
13	Manganese	1.5 mg/l	0.119
14	Copper	1.0 mg/l	0.069
15	Cadmium	0.1 mg/l	0.014
16	Chromium	1.0 mg/l	0.0
17	Zinc	5.0 mg/l	0.015
18	Iron	8.0 mg/l	0.870
19	Nickel	1.0 mg/l	0.017

20	Oil & Grease	10 mg/l	0.0
21	Sodium (Na)	-	10
22	Calcium (Ca)	-	28
23	Potassium (K)	-	6.5

Remarks: - The parameters analyzed are within the NEQS limits.

3.1.17 River Chenab Entry Point into District Hafizabad.

The Dissolved Oxygen level at this sampling point was found as 10.4 mg/l. Biochemical Oxygen Demand (BOD₅) and Chemical Oxygen Demand (COD) of the River were found to be 3.6 mg/l and 8.5 mg/l respectively. The detailed analysis report of the sample collected from this point is given in Table-3.17

Table-3.17

Wastewater analysis report of River Chenab entry point into District Hafizabad

S#	PARAMETERS	N.E.Q.S.	RESULTS
1	Temperature	=<3° C	15.5
2	Value of pH	6-9	7.6
3	Dissolved Oxygen	-	10.4
4	Biochemical Oxygen	80 mg/l	3.6
5	Chemical Oxygen Demand	150 mg/l	8.5
6	Total Dissolved Solids (TDS)	3500 mg/l	180
7	Total Suspended Solids	200 mg/l	160
8	Chloride (Cl ⁻¹)	1000 mg/l	15
9	Sulphate (SO ₄) ⁻²	600 mg/l	32
10	Sulfide	1.0 mg/l	0.0
11	Fluoride (As F')	10 mg/l	0.509
12	Cyanide (As CN')	1.0 mg/l	0.0
13	Manganese	1.5 mg/l	0.122
14	Copper	1.0 mg/l	0.042
15	Cadmium	0.1 mg/l	0.003
16	Chromium	1.0 mg/l	0.0

17	Zinc	5.0 mg/l	0.018
18	Iron	8.0 mg/l	0.072
19	Nickel	1.0 mg/l	0.0012
20	Oil & Grease	10 mg/l	0.0
21	Sodium (Na)	-	08
22	Calcium (Ca)	-	26
23	Potassium (K)	-	3.1

Remarks: The parameters analyzed are within the NEQS limits.

3.1.18 River Chenab before mixing with Ahmad Pur Nakka drain at Jalib Wala Bridge, Tehsil Pindi Bhattian, District Hafizabad.

The Dissolved Oxygen level at this sampling point was found as 10.4 mg/l. Biochemical Oxygen Demand (BOD₅) and Chemical Oxygen Demand (COD) of the River were found to be 3.4 mg/l and 8.5 mg/l respectively. The detailed analysis report of the sample collected from this point is given in Table-3.18.

Table-3.18

Wastewater analysis report of the River Chenab before mixing with Ahmad Pur Nakka drain at Jalib Wala Bridge, Tehsil Pindi Bhattian, District Hafizabad

S#	PARAMETERS	N.E.Q.S.	RESULTS
1	Temperature	=<3° C	15.2
2	Value of pH	6-9	7.9
3	Dissolved Oxygen	-	10.4
4	Biochemical Oxygen	80 mg/l	3.4
5	Chemical Oxygen Demand	150 mg/l	8.5
6	Total Dissolved Solids (TDS)	3500 mg/l	260
7	Total Suspended Solids	200 mg/l	400
8	Chloride (Cl ⁻¹)	1000 mg/l	15
9	Sulphate (SO ₄) ⁻²	600 mg/l	68
10	Sulfide	1.0 mg/l	0.0
11	Fluoride (As F')	10 mg/l	0.436

12	Cyanide (As CN')	1.0 mg/l	0.0
13	Manganese	1.5 mg/l	0.123
14	Copper	1.0 mg/l	0.04
15	Cadmium	0.1 mg/l	0.003
16	Chromium	1.0 mg/l	0.0
17	Zinc	5.0 mg/l	0.017
18	Iron	8.0 mg/l	0.27
19	Nickel	1.0 mg/l	0.001
20	Oil & Grease	10 mg/l	0.0
21	Sodium (Na)	-	24
22	Calcium (Ca)	-	32
23	Potassium (K)	-	4.4

Remarks: The value of TSS exceeds the NEQS limits

3.1.19 Ahmad Pur Nakka Drain before mixing into River Chenab, Moza Miraj Bhattian, Tehsil Pindi Bhattian, District Hafizabad.

The Dissolved Oxygen level at this sampling point was found as 3.8 mg/l. Biochemical Oxygen Demand (BOD₅) and Chemical Oxygen Demand (COD) of the River were found to be 30 mg/l and 66 mg/l respectively. This drain is responsible for adding 1.4679 ton/day of organic load to the river. The detailed analysis report of the sample collected from this point is given in Table-3.19.

Table-3.19

Ahmad Pur Nakka drain before mixing into River Chenab, Moza Miraj Bhattian, Tehsil Pindi Bhattian, District Hafizabad

S#	PARAMETERS	N.E.Q.S.	RESULTS
1	Temperature	=<3° C	18.4
2	Value of pH	6-9	8.9
3	Dissolved Oxygen	-	3.8
4	Biochemical Oxygen	80 mg/l	30

5	Chemical Oxygen Demand	150 mg/l	66
6	Total Dissolved Solids (TDS)	3500 mg/l	1640
7	Total Suspended Solids	200 mg/l	120
8	Chloride (Cl ⁻¹)	1000 mg/l	315
9	Sulphate (SO ₄) ⁻²	600 mg/l	337
10	Sulfide	1.0 mg/l	0.0
11	Fluoride (As F')	10 mg/l	0.469
12	Cyanide (As CN')	1.0 mg/l	0.817
13	Manganese	1.5 mg/l	0.271
14	Copper	1.0 mg/l	0.067
15	Cadmium	0.1 mg/l	0.005
16	Chromium	1.0 mg/l	0.0
17	Zinc	5.0 mg/l	0.035
18	Iron	8.0 mg/l	0.075
19	Nickel	1.0 mg/l	0.001
20	Oil & Grease	10 mg/l	1.9
21	Sodium (Na)	-	688
22	Calcium (Ca)	-	24
23	Potassium (K)	-	28

Remarks: The parameters analyzed are within the NEQS limits.

3.1.20 River Chenab after mixing with Ahmad pur Nakka Drain, Moza Jhanghar, Tehsil Pindi Bhattian, District Hafizabad.

The Dissolved Oxygen level at this sampling point was found 10.2 mg/l. Biochemical Oxygen Demand (BOD₅) and Chemical Oxygen Demand (COD) of the River were found to be 3.5 mg/l and 8.5 mg/l respectively. The detailed analysis report of the sample collected from this point is given in Table-3.20.

Table-3.20

Wastewater analysis report of the River Chenab after mixing with Ahmad pur Nakka Drain, Moza Jhanghar, Tehsil Pindi Bhattian, District Hafizabad

S#	PARAMETERS	N.E.Q.S.	RESULTS
1	Temperature	=<3° C	16.4
2	Value of pH	6-9	8.3
3	Dissolved Oxygen	-	10.2
4	Biochemical Oxygen	80 mg/l	3.5
5	Chemical Oxygen Demand	150 mg/l	8.5
6	Total Dissolved Solids (TDS)	3500 mg/l	240
7	Total Suspended Solids	200 mg/l	660
8	Chloride (Cl ⁻¹)	1000 mg/l	20
9	Sulphate (SO ₄) ⁻²	600 mg/l	68
10	Sulfide	1.0 mg/l	0.0
11	Fluoride (As F ['])	10 mg/l	0.670
12	Cyanide (As CN ['])	1.0 mg/l	0.0
13	Manganese	1.5 mg/l	0.125
14	Copper	1.0 mg/l	0.043
15	Cadmium	0.1 mg/l	0.003
16	Chromium	1.0 mg/l	0.0
17	Zinc	5.0 mg/l	0.015
18	Iron	8.0 mg/l	0.074
19	Nickel	1.0 mg/l	0.001
20	Oil & Grease	10 mg/l	0.0
21	Sodium (Na)	-	13
22	Calcium (Ca)	-	28
23	Potassium (K)	-	3.9

Remarks: The value of TSS exceeds the NEQS limits.

3.1.21 River Chenab before mixing with Marh Chiniot drain, near Moza Jasrat, Tehsil Chiniot, District Jhang.

The Dissolved Oxygen level at this sampling point was found as 8.4 mg/l. Biochemical Oxygen Demand (BOD₅) and Chemical Oxygen Demand (COD) of the River were found to be 4.9 mg/l and 11.6mg/l respectively. The detailed analysis report of the sample collected from this point is given in Table-3.21.

Table-3.21

Wastewater analysis report of the River Chenab before mixing with Marh Chiniot Drain, near Moza Jasrat, Tehsil Chiniot, District Jhang

S#	PARAMETERS	N.E.Q.S.	RESULTS
1	Temperature	=<3° C	18.0
2	Value of pH	6-9	8.1
3	Dissolved Oxygen	-	8.4
4	Biochemical Oxygen	80 mg/l	4.9
5	Chemical Oxygen Demand	150 mg/l	11.6
6	Total Dissolved Solids (TDS)	3500 mg/l	780
7	Total Suspended Solids	200 mg/l	20
8	Chloride (Cl ⁻¹)	1000 mg/l	10
9	Sulphate (SO ₄) ⁻²	600 mg/l	176
10	Sulfide	1.0 mg/l	0.0
11	Fluoride (As F ['])	10 mg/l	0.455
12	Cyanide (As CN ['])	1.0 mg/l	0.331
13	Manganese	1.5 mg/l	0.016
14	Copper	1.0 mg/l	0.058
15	Cadmium	0.1 mg/l	0.005
16	Chromium	1.0 mg/l	0.0
17	Zinc	5.0 mg/l	0.014
18	Iron	8.0 mg/l	0.808
19	Nickel	1.0 mg/l	0.015
20	Oil & Grease	10 mg/l	0.0
21	Sodium (Na)	-	12
22	Calcium (Ca)	-	26

23	Potassium (K)	-	4.9
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Remarks: The parameters analyzed are within the NEQS limits.

3.1.22 Marh Chiniot drain before mixing into River Chenab near Moza Jasrat, Tehsil Chiniot, District Jhang.

The Dissolved Oxygen level at this sampling point was found as 0.8 mg/l. Biochemical Oxygen Demand (BOD₅) and Chemical Oxygen Demand (COD) of the River were found to be 48 mg/l and 136 mg/l respectively. This drain is responsible for adding 4.1102 ton/day of organic load to the river. The detailed analysis report of the sample collected from this point is given in Table-3.22

Table-3.22

Wastewater analysis report of Marh Chiniot drain before mixing into River Chenab near Moza Jasrat, Tehsil Chiniot, District Jhang

S	PARAMETERS	N.E.Q.S.	RESULTS
1	Temperature	=<3° C	17.4
2	Value of pH	6-9	7.7
3	Dissolved Oxygen	-	0.8
4	Biochemical Oxygen	80 mg/l	48
5	Chemical Oxygen Demand	150 mg/l	136
6	Total Dissolved Solids	3500 mg/l	1480
7	Total Suspended Solids	200 mg/l	60
8	Chloride (Cl ⁻¹)	1000 mg/l	160
9	Sulphate (SO ₄) ⁻²	600 mg/l	297
10	Sulfide	1.0 mg/l	4.0
11	Fluoride (As F ⁻)	10 mg/l	1.44
12	Cyanide (As CN ⁻)	1.0 mg/l	0.001
13	Manganese	1.5 mg/l	0.112
14	Copper	1.0 mg/l	0.065

15	Cadmium	0.1 mg/l	0.067
16	Chromium	1.0 mg/l	0.0
17	Zinc	5.0 mg/l	0.117
18	Iron	8.0 mg/l	0.366
19	Nickel	1.0 mg/l	0.014
20	Oil & Grease	10 mg/l	3.1
21	Sodium (Na)	-	290
22	Calcium (Ca)	-	26
23	Potassium (K)	-	10.8

Remarks: The value of Sulfide exceeds the NEQS limits.

3.1.23 River Chenab after mixing with Marh Chniot drain & before mixing with Paharang drain, near Kot Sahab, Tehsil Chiniot, District Jhang.

The Dissolved Oxygen level at this sampling point was found as 8.0 mg/l. Biochemical Oxygen Demand (BOD₅) and Chemical Oxygen Demand (COD) of the River were found to be 4.1 mg/l and 12.8 mg/l respectively. The detailed analysis report of the sample collected from this point is given in Table-3.23

Table-3.23

Wastewater analysis report of the River Chenab after mixing with Marh Chniot drain & before mixing with Paharang Drain, near Kot Sahab, Tehsil Chiniot, District Jhang.

S#	PARAMETERS	N.E.Q.S.	RESULTS
1	Temperature	=<3° C	16.6
2	Value of pH	6-9	8.0
3	Dissolved Oxygen	-	8.0
4	Biochemical Oxygen	80 mg/l	4.1
5	Chemical Oxygen Demand	150 mg/l	12.8
6	Total Dissolved Solids (TDS)	3500 mg/l	320

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7	Total Suspended Solids	200 mg/l	320
8	Chloride (Cl ⁻¹)	1000 mg/l	60
9	Sulphate (SO ₄) ⁻²	600 mg/l	78
10	Sulfide	1.0 mg/l	0.0
11	Fluoride (As F ⁻)	10 mg/l	0.263
12	Cyanide (As CN ⁻)	1.0 mg/l	0.204
13	Manganese	1.5 mg/l	0.019
14	Copper	1.0 mg/l	0.040
15	Cadmium	0.1 mg/l	0.007
16	Chromium	1.0 mg/l	0.0
17	Zinc	5.0 mg/l	0.016
18	Iron	8.0 mg/l	0.805
19	Nickel	1.0 mg/l	0.015
20	Oil & Grease	10 mg/l	0.0
21	Sodium (Na)	-	36
22	Calcium (Ca)	-	20
23	Potassium (K)	-	2.7

Remarks: The value of TSS exceeds the NEQS limits.

3.1.24 Paharang Drain before mixing with River Chenab near Thatha Muhammad Shah, Tehsil Chiniot, District Jhang.

The Dissolved Oxygen level at this sampling point was found as 1.3 mg/l. Biochemical Oxygen Demand (BOD₅) and Chemical Oxygen Demand (COD) of the River were found to be 210 mg/l and 496 mg/l respectively. This drain is responsible for adding 14.7967 ton/day of organic load to the river. The detailed analysis report of the sample collected from this point is given in Table-3.24

Table-3.24

Wastewater analysis report of Paharang Drain before mixing with River Chenab near Thatha Muhammad Shah, Tehsil Chiniot, District Jhang.

S#	PARAMETERS	N.E.Q.S.	RESULTS
1	Temperature	=<3° C	15.3
2	Value of pH	6-9	7.4
3	Dissolved Oxygen	-	1.3
4	Biochemical Oxygen	80 mg/l	210
5	Chemical Oxygen Demand	150 mg/l	496
6	Total Dissolved Solids (TDS)	3500 mg/l	2480
7	Total Suspended Solids	200 mg/l	150
8	Chloride (Cl ⁻¹)	1000 mg/l	250
9	Sulphate (SO ₄) ⁻²	600 mg/l	502
10	Sulfide	1.0 mg/l	08
11	Fluoride (As F ['])	10 mg/l	0.432
12	Cyanide (As CN ['])	1.0 mg/l	1.33
13	Manganese	1.5 mg/l	0.390
14	Copper	1.0 mg/l	0.171
15	Cadmium	0.1 mg/l	0.028
16	Chromium	1.0 mg/l	0.02
17	Zinc	5.0 mg/l	0.026
18	Iron	8.0 mg/l	0.886
19	Nickel	1.0 mg/l	0.020

20	Oil & Grease	10 mg/l	2.1
21	Sodium (Na)	-	520
22	Calcium (Ca)	-	42
23	Potassium (K)	-	28

Remarks: The value of BOD, COD, Sulfide and Cyanide exceed the NEQS limits

3.1.25 River Chenab after mixing with Paharang drain near Thatha Muhammad Shah, Tehsil Chiniot, District Jhang.

The Dissolved Oxygen level at this sampling point was found as 8.2 mg/l. Biochemical Oxygen Demand (BOD₅) and Chemical Oxygen Demand (COD) of the River were found to be 6.0 mg/l and 24.8 mg/l respectively. The detailed analysis report of the sample collected from this point is given in Table-3.25

Table-3.25

Wastewater analysis report of the River Chenab after mixing with Paharang drain near Thatha Muhammad Shah, Tehsil Chiniot, District Jhang

S#	PARAMETERS	N.E.Q.S.	RESULTS
1	Temperature	=<3° C	15.5
2	Value of pH	6-9	7.9
3	Dissolved Oxygen	-	8.2
4	Biochemical Oxygen	80 mg/l	6.0
5	Chemical Oxygen Demand	150 mg/l	24.8
6	Total Dissolved Solids (TDS)	3500 mg/l	280
7	Total Suspended Solids	200 mg/l	150
8	Chloride (Cl ⁻¹)	1000 mg/l	15
9	Sulphate (SO ₄) ⁻²	600 mg/l	44
10	Sulfide	1.0 mg/l	0.0
11	Fluoride (As F ⁻)	10 mg/l	0.101
12	Cyanide (As CN ⁻)	1.0 mg/l	0.287
13	Manganese	1.5 mg/l	0.021

14	Copper	1.0 mg/l	0.047
15	Cadmium	0.1 mg/l	0.081
16	Chromium	1.0 mg/l	0.0
17	Zinc	5.0 mg/l	0.015
18	Iron	8.0 mg/l	0.880
19	Nickel	1.0 mg/l	0.020
20	Oil & Grease	10 mg/l	0.0
21	Sodium (Na)	-	37
22	Calcium (Ca)	-	27
23	Potassium (K)	-	5.4

Remarks: The parameters analyzed are within the NEQS limits.

3.1.26 Ahmed Wala drain before mixing into River Chenab near Moza Ahmed Wala, Lalian Road Tehsil & District Jhang.

The Dissolved Oxygen level at this sampling point was found as 1.2 mg/l. Biochemical Oxygen Demand (BOD₅) and Chemical Oxygen Demand (COD) of the River were found to be 312 mg/l and 776 mg/l respectively. This drain is responsible for adding 225.181 ton/day of organic load to the river. The detailed analysis report of the sample collected from this point is given in Table-3.26

Table-3.26

Wastewater analysis report of the Ahmed Wala Drain before mixing into River Chenab near Moza Ahmed Wala, Lalian Road Tehsil & District Jhang

S#	PARAMETERS	N.E.Q.S.	RESULTS
1	Temperature	=<3° C	17.7
2	Value of pH	6-9	7.4
3	Dissolved Oxygen	-	1.2
4	Biochemical Oxygen	80 mg/l	312
5	Chemical Oxygen Demand	150 mg/l	776
6	Total Dissolved Solids (TDS)	3500 mg/l	7030

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7	Total Suspended Solids	200 mg/l	310
8	Chloride (Cl ⁻¹)	1000 mg/l	705
9	Sulphate (SO ₄) ⁻²	600 mg/l	781
10	Sulfide	1.0 mg/l	08
11	Fluoride (As F ⁻)	10 mg/l	0.385
12	Cyanide (As CN ⁻)	1.0 mg/l	3.92
13	Manganese	1.5 mg/l	0.279
14	Copper	1.0 mg/l	0.074
15	Cadmium	0.1 mg/l	0.004
16	Chromium	1.0 mg/l	0.0
17	Zinc	5.0 mg/l	0.016
18	Iron	8.0 mg/l	0.078
19	Nickel	1.0 mg/l	0.004
20	Oil & Grease	10 mg/l	4.7
21	Sodium (Na)	-	1660
22	Calcium (Ca)	-	120
23	Potassium (K)	-	54

Remarks: The values of BOD, COD, TDS, TSS, Sulfate, Sulfide and Cyanide exceed the NEQS limits.

3.1.27 River Chenab after mixing Ahmed Wala drain near Riwarz Bridge, Chund Bharwana, Sargodha Road Tehsil & District Jhang.

The Dissolved Oxygen level at this sampling point was found as 8.2 mg/l. Biochemical Oxygen Demand (BOD₅) and Chemical Oxygen Demand (COD) of the River were found to be 3.5 mg/l and 9.7 mg/l respectively. The detailed analysis report of the sample collected from this point is given in Table-3.27

Table-3.27

Wastewater analysis report of the River Chenab after mixing Ahmed Wala drain near Riwarz Bridge, Chund Bharwana, Sargodha Road Tehsil & District Jhang.

S#	PARAMETERS	N.E.Q.S.	RESULTS
1	Temperature	=<3° C	16.9
2	Value of pH	6-9	7.8
3	Dissolved Oxygen	-	8.2
4	Biochemical Oxygen	80 mg/l	3.5
5	Chemical Oxygen Demand	150 mg/l	9.7
6	Total Dissolved Solids (TDS)	3500 mg/l	560
7	Total Suspended Solids	200 mg/l	70
8	Chloride (Cl ⁻¹)	1000 mg/l	140
9	Sulphate (SO ₄) ⁻²	600 mg/l	188
10	Sulfide	1.0 mg/l	0.0
11	Fluoride (As F ['])	10 mg/l	0.117
12	Cyanide (As CN ['])	1.0 mg/l	0.149
13	Manganese	1.5 mg/l	0.125
14	Copper	1.0 mg/l	0.054
15	Cadmium	0.1 mg/l	0.005
16	Chromium	1.0 mg/l	0.0
17	Zinc	5.0 mg/l	0.008
18	Iron	8.0 mg/l	0.075

19	Nickel	1.0 mg/l	0.002
20	Oil & Grease	10 mg/l	0.0
21	Sodium (Na)	-	106
22	Calcium (Ca)	-	30
23	Potassium (K)	-	6.5

Remarks: The parameters analyzed are within the NEQS limits

3.1.28 River Chenab before mixing with Khare Wala drain near Moza Dhadowana, Tehsil & District Jhang.

The Dissolved Oxygen level at this sampling point was found as 8.7 mg/l. Biochemical Oxygen Demand (BOD₅) and Chemical Oxygen Demand (COD) of the River were found to be 4.2 mg/l and 11.5 mg/l respectively. The detailed analysis report of the sample collected from this point is given in Table-3.28

Table-3.28

Wastewater analysis report of the River Chenab before mixing with Khare Wala drain near Moza Dhadowana, Tehsil & District Jhang.

S#	PARAMETERS	N.E.Q.S.	RESULTS
1	Temperature	=<3° C	15.8
2	Value of pH	6-9	7.9
3	Dissolved Oxygen	-	8.7
4	Biochemical Oxygen	80 mg/l	4.2
5	Chemical Oxygen Demand	150 mg/l	11.5
6	Total Dissolved Solids (TDS)	3500 mg/l	560
7	Total Suspended Solids	200 mg/l	20
8	Chloride (Cl ⁻¹)	1000 mg/l	120
9	Sulphate (SO ₄) ⁻²	600 mg/l	188
10	Sulfide	1.0 mg/l	0.0
11	Fluoride (As F ['])	10 mg/l	0.0814
12	Cyanide (As CN ['])	1.0 mg/l	0.631
13	Manganese	1.5 mg/l	0.121
14	Copper	1.0 mg/l	0.055
15	Cadmium	0.1 mg/l	0.004
16	Chromium	1.0 mg/l	0.0
17	Zinc	5.0 mg/l	0.011

18	Iron	8.0 mg/l	0.077
19	Nickel	1.0 mg/l	0.003
20	Oil & Grease	10 mg/l	0.0
21	Sodium (Na)	-	76
22	Calcium (Ca)	-	29
23	Potassium (K)	-	6.8

Remarks: The parameters analyzed are within the NEQS limits.

3.1.29 Khare Wala drain before mixing with River Chenab, Moza Maghyana Chenab Road Tehsil & District Jhang.

The Dissolved Oxygen level at this sampling point was found as 2.2 mg/l. Biochemical Oxygen Demand (BOD₅) and Chemical Oxygen Demand (COD) of the River were found to be 56 mg/l and 136 mg/l respectively. The drain is responsible for adding 6.1653 ton / day of organic load into the river. The detailed analysis report of the sample collected from this point is given in Table-3.29

**Table-3.29
Wastewater analysis report of the Khare Wala drain before mixing with River Chenab, Moza Maghyana Chenab Road, Tehsil & District Jhang**

S#	PARAMETERS	N.E.Q.S.	RESULTS
1	Temperature	=<3° C	15.3
2	Value of pH	6-9	7.1
ss	Dissolved Oxygen	-	2.2
4	Biochemical Oxygen	80 mg/l	56
5	Chemical Oxygen Demand	150 mg/l	136
6	Total Dissolved Solids (TDS)	3500 mg/l	1120
7	Total Suspended Solids (TSS)	200 mg/l	20
8	Chloride (Cl ⁻¹)	1000 mg/l	350
9	Sulphate (SO ₄) ⁻²	600 mg/l	267
10	Sulfide	1.0 mg/l	04
11	Fluoride (As F ¹)	10 mg/l	0.0
12	Cyanide (As CN ¹)	1.0 mg/l	0.883
13	Manganese	1.5 mg/l	0.277
14	Copper	1.0 mg/l	0.062

15	Cadmium	0.1 mg/l	0.003
16	Chromium	1.0 mg/l	0.0
17	Zinc	5.0 mg/l	0.015
18	Iron	8.0 mg/l	0.063
19	Nickel	1.0 mg/l	0.002
20	Oil & Grease	10 mg/l	1.6
21	Sodium (Na)	-	150
22	Calcium (Ca)	-	44
23	Potassium (K)	-	47

Remarks: The value Of Sulfide exceeds the NEQS limits.

3.1.30 Buddi Nullah before mixing into River Chenab

The Dissolved Oxygen level at this sampling point was found as 2.4 mg/l. Biochemical Oxygen Demand (BOD₅) and Chemical Oxygen Demand (COD) of the River were found to be 460 mg/l and 1120 mg/l respectively. This drain is responsible for adding 22.508 ton/day of organic load to the river. The detailed analysis report of the sample collected from this point is given in Table-3.30

Table-3.30

Wastewater analysis report of the Buddi Nullah before mixing into River Chenab

S	PARAMETERS	N.E.Q.S.	RESULTS
1	Temperature	=<3° C	25
2	Value of pH	6-9	6.9
3	Dissolved Oxygen	-	2.4
4	Biochemical Oxygen	80 mg/l	460
5	Chemical Oxygen Demand	150 mg/l	1120
6	Total Dissolved Solids	3500 mg/l	640
7	Total Suspended Solids	200 mg/l	60
8	Chloride (Cl ⁻¹)	1000 mg/l	30
9	Sulphate (SO ₄) ⁻²	600 mg/l	210
10	Sulfide	1.0 mg/l	08

11	Fluoride (As F')	10 mg/l	1.67
12	Cyanide (As CN')	1.0 mg/l	0.0
13	Manganese	1.5 mg/l	0.669
14	Copper	1.0 mg/l	0.062
15	Cadmium	0.1 mg/l	0.004
16	Chromium	1.0 mg/l	0.002
17	Zinc	5.0 mg/l	0.036
18	Iron	8.0 mg/l	0.088
19	Nickel	1.0 mg/l	0.002
20	Oil & Grease	10 mg/l	0.9
21	Sodium (Na)	-	48
22	Calcium (Ca)	-	40
23	Potassium (K)	-	40

Remarks: The values of BOD, COD and Sulfide exceed the NEQS limits.

3.1.31 River Chenab before mixing with River Jhelum near Moza Mansoor Sial, Tehsil and District Jhang.

The Dissolved Oxygen level at this sampling point was found as 8.6 mg/l. Biochemical Oxygen Demand (BOD₅) and Chemical Oxygen Demand (COD) of the River were found to be 6.5 mg/l and 15 mg/l respectively. The detailed analysis report of the sample collected from this point is given in Table-3.31

Table-3.31

Wastewater analysis report of the river Chenab before mixing with River Jhelum near Moza Mansoor Sial, Tehsil and District Jhang.

S	PARAMETERS	N.E.Q.S.	RESULTS
1	Temperature	=<3° C	17.9
2	Value of pH	6-9	8.0
3	Dissolved Oxygen	-	8.6
4	Biochemical Oxygen	80 mg/l	6.5
5	Chemical Oxygen Demand	150 mg/l	15

6	Total Dissolved Solids	3500 mg/l	540
7	Total Suspended Solids	200 mg/l	1720
8	Chloride (Cl ⁻¹)	1000 mg/l	160
9	Sulphate (SO ₄) ⁻²	600 mg/l	128
10	Sulfide	1.0 mg/l	0.0
11	Fluoride (As F ['])	10 mg/l	0.012
12	Cyanide (As CN ['])	1.0 mg/l	0.518
13	Manganese	1.5 mg/l	0.126
14	Copper	1.0 mg/l	0.059
15	Cadmium	0.1 mg/l	0.005
16	Chromium	1.0 mg/l	0.002
17	Zinc	5.0 mg/l	0.127
18	Iron	8.0 mg/l	0.392
19	Nickel	1.0 mg/l	0.011
20	Oil & Grease	10 mg/l	0.0
21	Sodium (Na)	-	115
22	Calcium (Ca)	-	28
23	Potassium (K)	-	6.4

Remarks: The value of TSS exceeds the NEQS limits.

3.1.32 River Chenab after mixing with River Jhelum at Trimmu Head Works, Tehsil & District Jhang.

The Dissolved Oxygen level at this sampling point was found as 8.8 mg/l. Biochemical Oxygen Demand (BOD₅) and Chemical Oxygen Demand (COD) of the River were found to be 4.2 mg/l and 11.5 mg/l respectively. The detailed analysis report of the sample collected from this point is given in Table-3.32

Table-3.32

**Wastewater analysis report of the River Chena
after mixing with River Jhelum at Trimmu Head Works,
Tehsil & District Jhang**

S	PARAMETERS	N.E.Q.S.	RESULTS
1	Temperature	=<3° C	17.4

2	Value of pH	6-9	8.1
3	Dissolved Oxygen	-	8.8
ss	Biochemical Oxygen	80 mg/l	4.2
5	Chemical Oxygen Demand	150 mg/l	11.5
6	Total Dissolved Solids	3500 mg/l	560
7	Total Suspended Solids	200 mg/l	840
8	Chloride (Cl ⁻¹)	1000 mg/l	220
9	Sulphate (SO ₄) ⁻²	600 mg/l	166
10	Sulfide	1.0 mg/l	0.0
11	Fluoride (As F ['])	10 mg/l	0.965
12	Cyanide (As CN ['])	1.0 mg/l	0.583
13	Manganese	1.5 mg/l	0.123
14	Copper	1.0 mg/l	0.060
15	Cadmium	0.1 mg/l	0.005
16	Chromium	1.0 mg/l	0.001
17	Zinc	5.0 mg/l	0.108
18	Iron	8.0 mg/l	0.089
19	Nickel	1.0 mg/l	0.003
20	Oil & Grease	10 mg/l	0.0
21	Sodium (Na)	-	130
22	Calcium (Ca)	-	32
23	Potassium (K)	-	06

Remarks: The value of TSS **exceeds** the NEQS limits.

3.1.33 River Chenab entry point into District Muzaffar Garh, Pattan Rangpur, District Muzaffar Garh

The Dissolved Oxygen level at this sampling point was found as 10.4 mg/l. Biochemical Oxygen Demand (BOD₅) and Chemical Oxygen Demand (COD) of the River were found to be 4.0 mg/l and 8.5 mg/l respectively. The detailed analysis report of the sample collected from this point is given in Table-3.33

Table-3.33

**Wastewater analysis report of the River Chenab entry point
into District Muzaffar Garh, Pattan Rangpur, District
Muzaffar Garh**

S	PARAMETERS	N.E.Q.S.	RESULTS
1	Temperature	=<3° C	17.0
2	Value of pH	6-9	7.5
3	Dissolved Oxygen	-	10.4
4	Biochemical Oxygen	80 mg/l	4.0
5	Chemical Oxygen Demand	150 mg/l	8.5
6	Total Dissolved Solids	3500 mg/l	580
7	Total Suspended Solids	200 mg/l	20
8	Chloride (Cl ⁻¹)	1000 mg/l	165
9	Sulphate (SO ₄) ⁻²	600 mg/l	158
10	Sulfide	1.0 mg/l	0.0
11	Fluoride (As F ['])	10 mg/l	0.854
12	Cyanide (As CN ['])	1.0 mg/l	0.764
13	Manganese	1.5 mg/l	0.132
14	Copper	1.0 mg/l	0.055
15	Cadmium	0.1 mg/l	0.006
16	Chromium	1.0 mg/l	0.002
17	Zinc	5.0 mg/l	0.089
18	Iron	8.0 mg/l	0.971
19	Nickel	1.0 mg/l	0.025
20	Oil & Grease	10 mg/l	0.0
21	Sodium (Na)	-	104
22	Calcium (Ca)	-	36
23	Potassium (K)	-	2.6

Remarks: The parameters analyzed are within the NEQS limits.

3.1.34 River Chenab Entry Point into District Multan near Moza Sardar Pur, Bund Bosan.Multan.

The Dissolved Oxygen level at this sampling point was found as 8.7 mg/l. Biochemical Oxygen Demand (BOD₅) and Chemical Oxygen Demand (COD) of the River were found to be 4.2 mg/l and 8.8 mg/l respectively. The detailed analysis report of the sample collected from this point is given in Table-3.34.

Table-3.34

Wastewater analysis report of River Chenab entry point into District Multan near Moza Sardar Pur, Bund Bosan, Multan.

S#	PARAMETERS	N.E.Q.S.	RESULTS
1	Temperature	=<3° C	18.2
2	Value of pH	6-9	8.1
3	Dissolved Oxygen	-	8.7
4	Biochemical Oxygen	80 mg/l	4.2
5	Chemical Oxygen Demand	150 mg/l	8.8
6	Total Dissolved Solids (TDS)	3500 mg/l	600
7	Total Suspended Solids	200 mg/l	100
8	Chloride (Cl ⁻¹)	1000 mg/l	210
9	Sulphate (SO ₄) ⁻²	600 mg/l	155
10	Sulfide	1.0 mg/l	0.0
11	Fluoride (As F ['])	10 mg/l	0.062
12	Cyanide (As CN ['])	1.0 mg/l	0.39
13	Manganese	1.5 mg/l	0.211
14	Copper	1.0 mg/l	0.055
15	Cadmium	0.1 mg/l	0.005
16	Chromium	1.0 mg/l	0.003
17	Zinc	5.0 mg/l	0.022
18	Iron	8.0 mg/l	0.098
19	Nickel	1.0 mg/l	0.003
20	Oil & Grease	10 mg/l	0.0
21	Sodium (Na)	-	140
22	Calcium (Ca)	-	32
23	Potassium (K)	-	5.4

Remarks: The parameters analyzed are within the NEQS limits

**3.1.35 T.P Link Canal before mixing with River Chenab,
Muhammad Wala Head works, Muzaffar Garh.**

The Dissolved Oxygen level at this sampling point was found as 9.2 mg/l. Biochemical Oxygen Demand (BOD₅) and Chemical Oxygen Demand (COD) of the River were found to be 2.5 mg/l and 6.6 mg/l respectively. The detailed analysis report of the sample collected from this point is given in Table-3.35

Table-3.35

**Wastewater analysis report of T.P Link Canal before
mixing with River Chenab, Muhammad Wala Head works,
Muzaffar Garh**

S#	PARAMETERS	N.E.Q.S.	RESULTS
1	Temperature	=<3° C	17.4
2	Value of pH	6-9	7.9
3	Dissolved Oxygen	-	9.2
4	Biochemical Oxygen	80 mg/l	2.5
5	Chemical Oxygen Demand	150 mg/l	6.6
6	Total Dissolved Solids (TDS)	3500 mg/l	280
7	Total Suspended Solids	200 mg/l	30
8	Chloride (Cl ⁻¹)	1000 mg/l	240
9	Sulphate (SO ₄) ⁻²	600 mg/l	56
10	Sulfide	1.0 mg/l	0.0
11	Fluoride (As F ⁺)	10 mg/l	0.68
12	Cyanide (As CN ['])	1.0 mg/l	0.0
13	Manganese	1.5 mg/l	0.139
14	Copper	1.0 mg/l	0.046
15	Cadmium	0.1 mg/l	0.003
16	Chromium	1.0 mg/l	0.002
17	Zinc	5.0 mg/l	0.041
18	Iron	8.0 mg/l	0.056
19	Nickel	1.0 mg/l	0.002
20	Oil & Grease	10 mg/l	0.0
21	Sodium (Na)	-	46
22	Calcium (Ca)	-	20
23	Potassium (K)	-	3.1

Remarks: The parameters analyzed are within the NEQS limits

3.1.36 River Chenab after mixing with T.P Link Canal, near Muhammad Wala Head Works, Muzaffar Garh

The Dissolved Oxygen level at this sampling point was found as 10.0 mg/l. Biochemical Oxygen Demand (BOD₅) and Chemical Oxygen Demand (COD) of the River were found to be 3.5 mg/l and 8.0 mg/l respectively. The detailed analysis report of the sample collected from this point is given in Table-3.36

Table-3.36

Wastewater analysis report of River Chenab after mixing with T.P Link Canal, near Muhammad Wala Head Works, Muzaffar Garh.

S#	PARAMETERS	N.E.Q.S.	RESULTS
1	Temperature	=<3° C	18.0
2	Value of pH	6-9	7.5
3	Dissolved Oxygen	-	10.0
4	Biochemical Oxygen	80 mg/l	3.5
5	Chemical Oxygen Demand	150 mg/l	8.0
6	Total Dissolved Solids (TDS)	3500 mg/l	460
7	Total Suspended Solids	200 mg/l	40
8	Chloride (Cl ⁻¹)	1000 mg/l	125
9	Sulphate (SO ₄) ⁻²	600 mg/l	122
10	Sulfide	1.0 mg/l	0.0
11	Fluoride (As F ['])	10 mg/l	0.435
12	Cyanide (As CN ['])	1.0 mg/l	0.355
13	Manganese	1.5 mg/l	0.137
14	Copper	1.0 mg/l	0.054
15	Cadmium	0.1 mg/l	0.005
16	Chromium	1.0 mg/l	0.002
17	Zinc	5.0 mg/l	0.085
18	Iron	8.0 mg/l	0.891
19	Nickel	1.0 mg/l	0.002
20	Oil & Grease	10 mg/l	0.0
21	Sodium (Na)	-	74
22	Calcium (Ca)	-	32

23	Potassium (K)	-	4.2
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Remarks: The parameters analyzed are within the NEQS limits.

3.1.37 River Chenab before mixing with Nawab Pur drain, Multan

The Dissolved Oxygen level at this sampling point was found as 8.8 mg/l. Biochemical Oxygen Demand (BOD₅) and Chemical Oxygen Demand (COD) of the River were found to be 4.8 mg/l and 8.8 mg/l respectively. The detailed analysis report of the sample collected from this point is given in Table-3.37

Table-3.37

Wastewater analysis report of the River Chenab before mixing with Nawab Pur drain, Multan

S#	PARAMETERS	N.E.Q.S.	RESULTS
1	Temperature	=<3° C	18.0
2	Value of pH	6-9	8.2
3	Dissolved Oxygen	-	8.8
4	Biochemical Oxygen	80 mg/l	4.8
5	Chemical Oxygen Demand	150 mg/l	8.8
6	Total Dissolved Solids (TDS)	3500 mg/l	660
7	Total Suspended Solids	200 mg/l	20
8	Chloride (Cl ⁻¹)	1000 mg/l	215
9	Sulphate (SO ₄) ⁻²	600 mg/l	188
10	Sulfide	1.0 mg/l	0.0
11	Fluoride (As F ['])	10 mg/l	0.003
12	Cyanide (As CN ['])	1.0 mg/l	0.204
13	Manganese	1.5 mg/l	0.21
14	Copper	1.0 mg/l	0.053
15	Cadmium	0.1 mg/l	0.004
16	Chromium	1.0 mg/l	0.002
17	Zinc	5.0 mg/l	0.021
18	Iron	8.0 mg/l	0.088
19	Nickel	1.0 mg/l	0.003
20	Oil & Grease	10 mg/l	0.0
21	Sodium (Na)	-	130
22	Calcium (Ca)	-	32

23	Potassium (K)	-	5.5
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Remarks: The parameters analyzed are within the NEQS

3.1.38 Nawab pur drain before mixing into River Chenab, near Nawab pur Rest House, Multan.

The Dissolved Oxygen level at this sampling point was found as 0.8 mg/l. Biochemical Oxygen Demand (BOD₅) and Chemical Oxygen Demand (COD) of the Drain were found to be 210 mg/l and 520 mg/l respectively. The detailed analysis report of the sample collected from this point is given in Table-3.38

Table-3.38

Nawab pur drain before mixing into River Chenab, near Nawab pur Rest House, Multan.

S#	PARAMETERS	N.E.Q.S.	RESULTS
1	Temperature	=<3° C	18.1
2	Value of pH	6-9	7.0
3	Dissolved Oxygen	-	0.8
4	Biochemical Oxygen Demand	80 mg/l	210
5	Chemical Oxygen Demand	150 mg/l	520
6	Total Dissolved Solids (TDS)	3500 mg/l	740
7	Total Suspended Solids (TSS)	200 mg/l	280
8	Chloride (Cl ⁻¹)	1000 mg/l	230
9	Sulphate (SO ₄) ⁻²	600 mg/l	196
10	Sulfide	1.0 mg/l	4.0
11	Fluoride (As F')	10 mg/l	0.001
12	Cyanide (As CN')	1.0 mg/l	0.074
13	Manganese	1.5 mg/l	0.464
14	Copper	1.0 mg/l	0.089
15	Cadmium	0.1 mg/l	0.008
16	Chromium	1.0 mg/l	0.021
17	Zinc	5.0 mg/l	0.038
18	Iron	8.0 mg/l	0.188
19	Nickel	1.0 mg/l	0.004
20	Oil & Grease	10 mg/l	2.4
21	Sodium (Na)	-	138
22	Calcium (Ca)	-	40

23	Potassium (K)	-	44
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Remarks: The values of BOD, COD, TSS and Sulfide exceed the NEQS Limits

3.1.39 River Chenab after Mixing With Nawab Pur Drain, Multan

The Dissolved Oxygen level at this sampling point was found as 6.4 mg/l. Biochemical Oxygen Demand (BOD₅) and Chemical Oxygen Demand (COD) of the River were found to be 4.6 mg/l and 10.0 mg/l respectively. The detailed analysis report of the sample collected from this point is given in Table-3.39

Table-3.39
River Chenab after mixing with Nawab pur drain, Multan.

S#	PARAMETERS	N.E.Q.S.	RESULTS
1	Temperature	=<3° C	18.1
2	Value of pH	6-9	8.1
3	Dissolved Oxygen	-	6.4
4	Biochemical Oxygen Demand	80 mg/l	4.6
5	Chemical Oxygen Demand	150 mg/l	10
6	Total Dissolved Solids (TDS)	3500 mg/l	670
7	Total Suspended Solids (TSS)	200 mg/l	10
8	Chloride (Cl ⁻¹)	1000 mg/l	210
9	Sulphate (SO ₄) ⁻²	600 mg/l	196
10	Sulfide	1.0 mg/l	0.0
11	Fluoride (As F')	10 mg/l	0.001
12	Cyanide (As CN')	1.0 mg/l	0.113
13	Manganese	1.5 mg/l	0.226
14	Copper	1.0 mg/l	0.058
15	Cadmium	0.1 mg/l	0.006
16	Chromium	1.0 mg/l	0.003
17	Zinc	5.0 mg/l	0.025
18	Iron	8.0 mg/l	0.117
19	Nickel	1.0 mg/l	0.004
20	Oil & Grease	10 mg/l	0.0
21	Sodium (Na)	-	125

22	Calcium (Ca)	-	36
23	Potassium (K)	-	5.8

Remarks: The parameters analyzed are within the NEQS

3.1.40 River Chenab before mixing with Suraj Miani Drain, Multan

The Dissolved Oxygen level at this sampling point was found as 8.4 mg/l. Biochemical Oxygen Demand (BOD₅) and Chemical Oxygen Demand (COD) of the River were found to be 3.8 mg/l and 9.8 mg/l respectively. The detailed analysis report of the sample collected from this point is given in Table-3.40

Table-3.40

Wastewater analysis report of the River Chenab before mixing with Suraj Miani drain, Multan

S#	PARAMETERS	N.E.Q.S.	RESULTS
1	Temperature	=<3° C	18.1
2	Value of pH	6-9	7.4
3	Dissolved Oxygen	-	8.4
4	Biochemical Oxygen	80 mg/l	3.8
5	Chemical Oxygen Demand	150 mg/l	9.8
6	Total Dissolved Solids (TDS)	3500 mg/l	540
7	Total Suspended Solids	200 mg/l	180
8	Chloride (Cl ⁻¹)	1000 mg/l	130
9	Sulphate (SO ₄) ⁻²	600 mg/l	158
10	Sulfide	1.0 mg/l	04
11	Fluoride (As F ['])	10 mg/l	0.854
12	Cyanide (As CN ['])	1.0 mg/l	0.0
13	Manganese	1.5 mg/l	0.22
14	Copper	1.0 mg/l	0.056
15	Cadmium	0.1 mg/l	0.005
16	Chromium	1.0 mg/l	0.002
17	Zinc	5.0 mg/l	0.021
18	Iron	8.0 mg/l	0.009
19	Nickel	1.0 mg/l	0.002
20	Oil & Grease	10 mg/l	0.0

21	Sodium (Na)	-	102
22	Calcium (Ca)	-	40
23	Potassium (K)	-	08

Remarks: The parameters analyzed are within the NEQS limits.

3.1.41 Suraj Miani drain at Paka Sandelay Wala, Multan before mixing with River Chenab

The Dissolved Oxygen level at this sampling point was found as 1.2 mg/l. Biochemical Oxygen Demand (BOD₅) and Chemical Oxygen Demand (COD) of the drain were found to be 240 mg/l and 560 mg/l respectively. The detailed analysis report of the sample collected from this point is given in Table-3.41

Table-3.41

Wastewater analysis report of the Suraj Miani drain at Paka Sandelay Wala, Multan Before Mixing With River Chenab

S#	PARAMETERS	N.E.Q.S.	RESULTS
1	Temperature	=<3° C	18.3
2	Value of pH	6-9	6.8
3	Dissolved Oxygen	-	1.2
4	Biochemical Oxygen Demand	80 mg/l	240
5	Chemical Oxygen Demand	150 mg/l	560
6	Total Dissolved Solids (TDS)	3500 mg/l	920
7	Total Suspended Solids (TSS)	200 mg/l	140
8	Chloride (Cl ⁻¹)	1000 mg/l	165
9	Sulphate (SO ₄) ⁻²	600 mg/l	176
10	Sulfide	1.0 mg/l	12
11	Fluoride (As F')	10 mg/l	0.052
12	Cyanide (As CN')	1.0 mg/l	0.059
13	Manganese	1.5 mg/l	0.475
14	Copper	1.0 mg/l	0.095
15	Cadmium	0.1 mg/l	0.007
16	Chromium	1.0 mg/l	0.002
17	Zinc	5.0 mg/l	0.029
18	Iron	8.0 mg/l	0.151
19	Nickel	1.0 mg/l	0.003
20	Oil & Grease	10 mg/l	3.5
21	Sodium (Na)	-	180

22	Calcium (Ca)	-	52
23	Potassium (K)	-	24

Remarks: The value of BOD, COD, Sulfide exceed the NEQS limits

3.1.42 River Chenab after mixing with Suraj Miani drain, Multan.

The Dissolved Oxygen level at this sampling point was found as 7.1 mg/l. Biochemical Oxygen Demand (BOD₅) and Chemical Oxygen Demand (COD) of the River were found to be 3.4 mg/l and 9.5 mg/l respectively. The detailed analysis report of the sample collected from this point is given in Table-3.42

Table-3.42

Wastewater analysis report of the River Chenab after mixing with Suraj Miani drain, Multan

S#	PARAMETERS	N.E.Q.S.	RESULTS
1	Temperature	=<3° C	18.2
2	Value of pH	6-9	7.0
3	Dissolved Oxygen	-	7.1
4	Biochemical Oxygen	80 mg/l	3.4
5	Chemical Oxygen Demand	150 mg/l	9.5
6	Total Dissolved Solids (TDS)	3500 mg/l	600
7	Total Suspended Solids	200 mg/l	160
8	Chloride (Cl ⁻¹)	1000 mg/l	130
9	Sulphate (SO ₄) ⁻²	600 mg/l	195
10	Sulfide	1.0 mg/l	0.0
11	Fluoride (As F')	10 mg/l	0.732
12	Cyanide (As CN')	1.0 mg/l	0.0
13	Manganese	1.5 mg/l	0.227
14	Copper	1.0 mg/l	0.058
15	Cadmium	0.1 mg/l	0.004
16	Chromium	1.0 mg/l	0.002
17	Zinc	5.0 mg/l	0.026
18	Iron	8.0 mg/l	0.101
19	Nickel	1.0 mg/l	0.002
20	Oil & Grease	10 mg/l	0.0

21	Sodium (Na)	-	107
22	Calcium (Ca)	-	44
23	Potassium (K)	-	127

Remarks: The parameters analyzed are within the NEQS limits.

3.1.43 River Chenab before mixing with Muzaffar Abad Estate drain, Multan.

The Dissolved Oxygen level at this sampling point was found as 7.9 mg/l. Biochemical Oxygen Demand (BOD₅) and Chemical Oxygen Demand (COD) of the River were found to be 4.2 mg/l and 9.8 mg/l respectively. The detailed analysis report of the sample collected from this point is given in Table-3.43

Table-3.43

Wastewater analysis report of the River Chenab before mixing with Muzaffar Abad Industrial Estate drain, Multan

S#	PARAMETERS	N.E.Q.S.	RESULTS
1	Temperature	=<3° C	18.1
2	Value of pH	6-9	7.5
3	Dissolved Oxygen	-	7.9
4	Biochemical Oxygen	80 mg/l	4.2
5	Chemical Oxygen Demand	150 mg/l	9.8
6	Total Dissolved Solids (TDS)	3500 mg/l	520
7	Total Suspended Solids	200 mg/l	180
8	Chloride (Cl ⁻¹)	1000 mg/l	125
9	Sulphate (SO ₄) ⁻²	600 mg/l	130
10	Sulfide	1.0 mg/l	0.0
11	Fluoride (As F ['])	10 mg/l	0.545
12	Cyanide (As CN ['])	1.0 mg/l	0.0
13	Manganese	1.5 mg/l	0.225
14	Copper	1.0 mg/l	0.057
15	Cadmium	0.1 mg/l	0.006
16	Chromium	1.0 mg/l	0.002
17	Zinc	5.0 mg/l	0.024
18	Iron	8.0 mg/l	0.311

19	Nickel	1.0 mg/l	0.002
20	Oil & Grease	10 mg/l	0.0
21	Sodium (Na)	-	106
22	Calcium (Ca)	-	40
23	Potassium (K)	-	9.6

Remarks: The parameters analyzed are within the NEQS limits.

3.1.44 Muzaffar Abad Insustrial Estate drain before mixing with River Chenab, at Jhok Haji Abbas Sher Shah, Multan.

The Dissolved Oxygen level at this sampling point was found as 1.8 mg/l. Biochemical Oxygen Demand (BOD₅) and Chemical Oxygen Demand (COD) of the River were found to be 120 mg/l and 256 mg/l respectively. The detailed analysis report of the sample collected from this point is given in Table-3.44

**Table-3.44
Wastewater analysis report of Muzaffar Abad Insustrial Estate drain before mixing with River Chenab, at Jhok Haji Abbas Sher Shah, Multan**

S#	PARAMETERS	N.E.Q.S.	RESULTS
1	Temperature	=<3° C	18.4
2	Value of pH	6-9	7.3
3	Dissolved Oxygen	-	1.8
4	Biochemical Oxygen	80 mg/l	120
5	Chemical Oxygen Demand	150 mg/l	256
6	Total Dissolved Solids (TDS)	3500 mg/l	1700
7	Total Suspended Solids	200 mg/l	20
8	Chloride (Cl ⁻¹)	1000 mg/l	615
9	Sulphate (SO ₄) ⁻²	600 mg/l	407
10	Sulfide	1.0 mg/l	12.0
11	Fluoride (As F ['])	10 mg/l	0.736
12	Cyanide (As CN ['])	1.0 mg/l	0.659

13	Manganese	1.5 mg/l	0.679
14	Copper	1.0 mg/l	0.088
15	Cadmium	0.1 mg/l	0.011
16	Chromium	1.0 mg/l	0.004
17	Zinc	5.0 mg/l	0.042
18	Iron	8.0 mg/l	0.785
19	Nickel	1.0 mg/l	0.004
20	Oil & Grease	10 mg/l	5.1
21	Sodium (Na)	-	380
22	Calcium (Ca)	-	44
23	Potassium (K)	-	46

Remarks:The values of BOD and COD and Sulfide exceed the NEQS limits

3.1.45 River Chenab after mixing with Muzaffar Abad Industrial Estate drain, Multan

The Dissolved Oxygen level at this sampling point was found as 6.3 mg/l. Biochemical Oxygen Demand (BOD₅) and Chemical Oxygen Demand (COD) of the River were found to be 4.5 mg/l and 10.0 mg/l respectively. The detailed analysis report of the sample collected from this point is given in Table-3.45

**Table-3.45
Wastewater analysis report of the River Chenab after mixing
with Muzaffar Abad Industrial Estate drain, Multan**

S#	PARAMETERS	N.E.Q.S.	RESULTS
1	Temperature	=<3° C	18.2
2	Value of pH	6-9	7.4
3	Dissolved Oxygen	-	6.3
4	Biochemical Oxygen	80 mg/l	4.5
5	Chemical Oxygen Demand	150 mg/l	10.0
6	Total Dissolved Solids (TDS)	3500 mg/l	600
7	Total Suspended Solids	200 mg/l	160
8	Chloride (Cl ⁻¹)	1000 mg/l	165
9	Sulphate (SO ₄) ⁻²	600 mg/l	182
10	Sulfide	1.0 mg/l	0.0
11	Fluoride (As F ['])	10 mg/l	0.602

12	Cyanide (As CN')	1.0 mg/l	0.0
13	Manganese	1.5 mg/l	0.26
14	Copper	1.0 mg/l	0.062
15	Cadmium	0.1 mg/l	0.009
16	Chromium	1.0 mg/l	0.003
17	Zinc	5.0 mg/l	0.025
18	Iron	8.0 mg/l	0.299
19	Nickel	1.0 mg/l	0.003
20	Oil & Grease	10 mg/l	0.04
21	Sodium (Na)	-	127
22	Calcium (Ca)	-	36
23	Potassium (K)	-	10.6

Remarks: The parameters analyzed are within the NEQS limits.

3.1.46 River Chenab at Multan, Muzaffar Garh Bridge, District Muzaffar Garh.

The Dissolved Oxygen level at this sampling point was found as 9.9 mg/l. Biochemical Oxygen Demand (BOD₅) and Chemical Oxygen Demand (COD) of the River were found to be 4.0 mg/l and 9.5 mg/l respectively. The detailed analysis report of the sample collected from this point is given in Table-3.46

Table-3.46

Wastewater analysis report River Chenab at Multan, Muzaffar Garh Bridge, District Muzaffar Garh.

S#	PARAMETERS	N.E.Q.S.	RESULTS
1	Temperature	=<3° C	18.0
2	Value of pH	6-9	7.6
3	Dissolved Oxygen	-	9.9
4	Biochemical Oxygen	80 mg/l	4.0
5	Chemical Oxygen Demand	150 mg/l	9.5
6	Total Dissolved Solids (TDS)	3500 mg/l	480
7	Total Suspended Solids	200 mg/l	60
8	Chloride (Cl ⁻¹)	1000 mg/l	130
9	Sulphate (SO ₄) ⁻²	600 mg/l	96
10	Sulfide	1.0 mg/l	0.0

11	Fluoride (As F ⁻)	10 mg/l	0.0
12	Cyanide (As CN ⁻)	1.0 mg/l	0.0
13	Manganese	1.5 mg/l	0.245
14	Copper	1.0 mg/l	0.06
15	Cadmium	0.1 mg/l	0.007
16	Chromium	1.0 mg/l	0.003
17	Zinc	5.0 mg/l	0.087
18	Iron	8.0 mg/l	0.980
19	Nickel	1.0 mg/l	0.002
20	Oil & Grease	10 mg/l	0.0
21	Sodium (Na)	-	76
22	Calcium (Ca)	-	41
23	Potassium (K)	-	3.8

Remarks: The parameters analyzed are within the NEQS limits.

3.1.47 River Chenab exit point of District Multan at Beat Kage Moza Lord Janubi, Multan.

The Dissolved Oxygen level at this sampling point was found as 8.7 mg/l. Biochemical Oxygen Demand (BOD₅) and Chemical Oxygen Demand (COD) of the River were found to be 3.8 mg/l and 9.5 mg/l respectively. The detailed analysis report of the sample collected from this point is given in Table-3.47

**Table-3.47
Wastewater analysis report of the River Chenab Exit Point
of District Multan at Beat Kage Moza Lord Janubi, Multan**

S#	PARAMETERS	N.E.Q.S.	RESULTS
1	Temperature	=<3° C	17.0
2	Value of pH	6-9	7.4
3	Dissolved Oxygen	-	8.7
4	Biochemical Oxygen	80 mg/l	3.8
5	Chemical Oxygen Demand	150 mg/l	9.5
6	Total Dissolved Solids (TDS)	3500 mg/l	580
7	Total Suspended Solids	200 mg/l	100
8	Chloride (Cl ⁻¹)	1000 mg/l	150
9	Sulphate (SO ₄) ⁻²	600 mg/l	148
10	Sulfide	1.0 mg/l	0.0

11	Fluoride (As F ⁻)	10 mg/l	0.496
12	Cyanide (As CN ⁻)	1.0 mg/l	0.0
13	Manganese	1.5 mg/l	0.221
14	Copper	1.0 mg/l	0.055
15	Cadmium	0.1 mg/l	0.005
16	Chromium	1.0 mg/l	0.002
17	Zinc	5.0 mg/l	0.021
18	Iron	8.0 mg/l	0.285
19	Nickel	1.0 mg/l	0.002
20	Oil & Grease	10 mg/l	0.0
21	Sodium (Na)	-	136
22	Calcium (Ca)	-	40
23	Potassium (K)	-	08

Remarks: The parameters analyzed are within the NEQS limits.

3.1.48 River Chenab near Moza Murad Pur Sheher Sultan, District Muzaffar Garh

The Dissolved Oxygen level at this sampling point was found as 9.5 mg/l. Biochemical Oxygen Demand (BOD₅) and Chemical Oxygen Demand (COD) of the River were found to be 3.5 mg/l and 8.0 mg/l respectively. The detailed analysis report of the sample collected from this point is given in Table-3.48

Table-3.48

Wastewater analysis report of the River Chenab near Moza Murad Pur Sheher Sultan, District Muzaffar Garh

S	PARAMETERS	N.E.Q.S.	RESULTS
1	Temperature	=<3° C	17.6
2	Value of pH	6-9	7.5
3	Dissolved Oxygen	-	9.5
4	Biochemical Oxygen	80 mg/l	3.5
5	Chemical Oxygen Demand	150 mg/l	8.0
6	Total Dissolved Solids	3500 mg/l	480
7	Total Suspended Solids	200 mg/l	70

8	Chloride (Cl ⁻¹)	1000 mg/l	125
9	Sulphate (SO ₄) ⁻²	600 mg/l	132
10	Sulfide	1.0 mg/l	0.0
11	Fluoride (As F ⁻)	10 mg/l	0.336
12	Cyanide (As CN ⁻)	1.0 mg/l	0.167
13	Manganese	1.5 mg/l	0.133
14	Copper	1.0 mg/l	0.057
15	Cadmium	0.1 mg/l	0.004
16	Chromium	1.0 mg/l	0.002
17	Zinc	5.0 mg/l	0.085
18	Iron	8.0 mg/l	0.98
19	Nickel	1.0 mg/l	0.002
20	Oil & Grease	10 mg/l	0.0
21	Sodium (Na)	-	69
22	Calcium (Ca)	-	42
23	Potassium (K)	-	4.2

Remarks: The parameters analyzed are within the NEQS limits.

3.1.49 River Chenab at Punjnad Head Works, District Muzaffar Garh

The Dissolved Oxygen level at this sampling point was found as 8.8 mg/l. Biochemical Oxygen Demand (BOD₅) and Chemical Oxygen Demand (COD) of the River were found to be 5.0 mg/l and 10.5 mg/l respectively. The detailed analysis report of the sample collected from this point is given in Table-3.47

Table-3.49

Wastewater analysis report of the River Chenab at Punjnad Head Works, District Muzaffar Garh

S	PARAMETERS	N.E.Q.S.	RESULTS
1	Temperature	=<3° C	18.0

2	Value of pH	6-9	7.4
3	Dissolved Oxygen	-	8.8
4	Biochemical Oxygen	80 mg/l	5.0
5	Chemical Oxygen Demand	150 mg/l	10.5
6	Total Dissolved Solids	3500 mg/l	490
7	Total Suspended Solids	200 mg/l	20
8	Chloride (Cl ⁻¹)	1000 mg/l	125
9	Sulphate (SO ₄) ⁻²	600 mg/l	132
10	Sulfide	1.0 mg/l	0.0
11	Fluoride (As F ⁺)	10 mg/l	0.0
12	Cyanide (As CN ⁺)	1.0 mg/l	0.0
13	Manganese	1.5 mg/l	0.210
14	Copper	1.0 mg/l	0.059
15	Cadmium	0.1 mg/l	0.004
16	Chromium	1.0 mg/l	0.002
17	Zinc	5.0 mg/l	0.08
18	Iron	8.0 mg/l	0.978
19	Nickel	1.0 mg/l	0.002
20	Oil & Grease	10 mg/l	0.0
21	Sodium (Na)	-	76
22	Calcium (Ca)	-	39
23	Potassium (K)	-	4.6

Remarks: The parameters analyzed are within the NEQS limits.

3.2 Sources of Pollution of River Chenab

The pollution sources of the River Chenab and the groundwater in the project comprise of municipal sewage, industrial effluents, sources related to agricultural activities and solid waste disposal

3.2.1 Municipal Sewage

The disposal of untreated municipal wastewaters into the river is main cause of deterioration of river water quality. Sewage water impregnated with heavy organic load add greater fraction to deoxygenating of water. It carries with its huge organic loads to heavily tax the oxygen resources of the river. In addition municipal wastewaters contain pathogenic organisms and their disposal results in contamination of the river which is used as a source of drinking water supplies downstream.

3.2.2 Wastewater Carrying Drains

There are about many drains in Chenab city which collects the sewage and industrial wastewater in the urban areas. Numbers of drain join each other and carry all the collected sewage and industrial wastewater generated within the urban areas and dispose off in the river Chenab through various pumping stations. Discharge in the drains is subjected to seasonal variation and mostly depends upon the weather conditions. In winter discharge is minimum and impregnated with heavy load due to less use of water.

Catchments areas and average flow of these drains is given as below:

i. Hulsee/ Bollay Wala Drain

It comes from Azad Kashmir. It has an average discharge of 15.4 cusecs and carries domestic water as well as storm water

ii. Bimber Nullah

It comes from Azad Kashmir. It has an average discharge of 1100 cusecs and carries Domestic waste water and Storm water.

iii. Small Industrial Estate / Mola Khurd Drain

It comes from Gujrat. It has an average discharge of 13.5 cusecs and it carries industrial wastewater. This drain also carries domestic waste of locality Mola Khurd.

iv. Marh Chiniot Drain

It comes from Ahmadabad. It has an average discharge of 35 cusecs and it carries domestic wastewater and storm water.

v. Paharang Drain

It originates from Sangla hills and near Chakbandia it falls into river Chenab. It has an average discharge of 28.8 cusecs and it carries domestic and industrial wastewater.

vi. Ahmadwala Drain

It comes from Sargodha road and near Ahmadwala village it falls into river Chenab. It has an average discharge of 28.8 cusecs and it carries industrial wastewater and wastewater of Ahmadwala.

vii. Kharewala Drain

It comes from Pansera District Faisalabad and falls into river Chenab near village Maghyana. It has an average discharge of 45 cusecs. It also carries industrial wastewater and domestic waste waters.

About drains after joining to some major drains /trunk sewers ultimately dispose of the collected sewage/wastewater into the river Chenab.

3.2.3 Industrial Effluents

The industrial effluents contain pollutants including dissolved and suspended



organic matter, heavy metals, and other toxic chemicals. With the exception of few industrial units discharge their untreated wastewaters on land, in rivers, or nullahs and drains to ultimately reach the river or groundwater.

The discharge of industrial effluents in the river results in depletion of oxygen resources. Harmful industrial chemicals disposed off in the river through its havey potential to pose serious health problems. In addition, such discharges may result in adverse effects on downstream agriculture.

Industrial wastewater contains toxic chemicals. It is alarming that most industries have been started without proper planning and waste treatment plants. They just dispose off untreated toxic waste into nearby drains, canals or rivers. Automobile service stations are another major contributor to surface water pollution. Untreated oil, grease and dirt find its way into nearby canals and drains ultimately falling into Chenab, where it critically damages the ecosystem.

3.2.4 Agricultural Runoff

Agriculture runoff is another source of pollution of Chenab.

Extensive and indiscriminate use of pesticides and fertilizers to support agricultural activities in surrounding areas, results

in leaching of such chemical during heavy rainfall. No specific data are available on



the quantities of pesticides and fertilizers being used in the surrounding areas of River Chenab.

Since agriculture sector in Punjab is largest contributor to its GDP, there has been observed significant increase in use of fertilizers during the past few years. The excessive and indiscriminate use of pesticides results in its leaching to the ground water as well as to surface water through run off during rainy season.

3.2.5 Solid Wastes Disposal

Very small part of solid waste generated in Chenab finds its way into the sewer system and a part of it appears in the outfall drains to ultimately reach the River Chenab resulting in its unaesthetic appearance and degraded water quality.

3.3 Quality of the wastewater Carrying Drains

Individual results of the analysis of the wastewater samples collected from the waste carrying drains have been given in the section 3.1. The summary of the analysis is given as below.

3.3.1 Near Gujrat, during low flow season, amongst wastewater carrying drains, Hulsee/ Bollay Wala drain is being responsible for adding 0.3390 tons per day of organic load. Then comes Bimber Nullah which contributing 33.909 tons per day of organic load into the river Chenab. Small Industrial Estate / Mola Khurd drain is conveying wastewater having organic load of 0.5945 tons per day.

3.3.2 Near Jhang, Marh Chiniot drain is disposing 4.1102 tons per day of organic load whereas Paharang drain is adding 14.7967 tons per day of organic load into Chenab. Ahmed Wala Drain is responsible for adding 225.181 tons per day of organic load. Khare Wala Drain and Buddi Nullah are adding 6.1653 & 22.508 tons of organic waste respectively into the River Chenab.

3.3.3 During low flow season near Multan, Nawab Pur Drain is adding 2.569 tons and Suraj Miani Drain is adding 2.642 tons of organic loads. Muzaffar Abad Industrial Estate drain is adding 2.936 tons on daily basis into River Chenab.

3.3.4 Near Mandi Bahau Din, during low flow season, amongst wastewater carrying drains, Hulki Nullah Lower drain is being responsible for adding 0.2193 tons per day of organic load. Then comes Budhi Nullah outfall drain which contributing 5.7543 tons per day of organic load into the river Chenab. Near District Hafizabad, Ahmad Pur Nakka Drain conveying wastewater having organic load of 1.4679 tons per day.

Chapter-4 Conclusions and Recommendations

This chapter describes the conclusions of the monitoring of river Jhelum during low flow season. Conclusions and recommendations of the monitoring exercise are given as below:

4.1 Conclusions

- 4.1.1 The discharge of municipal and industrial wastewaters is causing the deterioration of the river water quality.
- 4.1.2 The river water quality is almost acceptable for irrigation point.
- 4.1.3 River Jhelum and River Ravi both are tributaries of River Chenab.
- 4.1.4 The river water quality is good near Sialkot district because of excessive amount of dissolved oxygen. The average amount of dissolved oxygen from the starting point of sampling to the end point is founded almost same which is almost 7.

4.2 Recommendations

- 4.2.1 The population of concerned Districts (Sialkot, Gujrat, Mandi Bahauddin, Hafzabad, Jhang, Khanewal, Multan, Muzafabad) is increasing day by day due to which water consumption is also increasing resulting in causing more sewage production. So the concerned District Governments must plan for installation of sewage treatment plants so it may be properly disposed off.
- 4.2.2 Government of concerned Districts of River Chenab must take measures to control/ reduce upstream pollution control measures for Hulsee/ Bollay Wala drain, Bimber Nullah, Waste Water of Small Industrial Estate / Mola Khurd drain, Hulki Nullah Lower Drain, Budhi Nullah outfall drain, Ahmad

Pur Nakka Drain, Marh Chiniot Drain, Paharang Drain, Ahmed Wala Drain, Khare Wala Drain, Buddi Nullah, Nawab Pur Drain, Suraj Miani Drain and Muzaffar Abad Industrial Estate Drain by installation of sewage treatment plants.

- 4.2.3 Irrigation Department of concerned districts may be requested to direct the industries to dispose off their effluents after proper treatment. Industries should also be restricted to have EIA examination. So that all the parameters of industries should lie within the NEQS levels.
- 4.2.4 Dumping of the solid waste along the banks of river Chenab must be avoided near Multan and Jhang.

Table 4.1

Summary of Issues of River Chenab, proposed Measures, Roles and Responsibilities

Issue	Measures	Responsible Organizations
<p>Pollution of River Chenab due to industrial effluent carrying drains like Mola Khurd Drain, Ghag Drain, Darkanwala drain</p>	<p align="center">Industrial Pollution Control</p> <ul style="list-style-type: none"> • Wastewater Reduction through cleaner production practices • Conservative use of industrial water • Installation of in-house wastewater treatment 	<ul style="list-style-type: none"> • Industrial establishments in catchments areas of drains • Chamber of Commerce and Industries • Industrial establishment • I&P Department • Individual industrial establishments

	<ul style="list-style-type: none"> • Installation of common industrial effluent treatment plant • Shifting of most polluted industrial sector to designated areas equipped with common effluent treatment plants 	<ul style="list-style-type: none"> • Industrial organization • Industries Department GOP • Chamber of Commerce and Industries • EPD, Punjab • Industrial organization • Industries Department GOP • Chamber of Commerce and Industries • EPD, Punjab
<p>Pollution of River Chenab due to Domestic sewage of Sialkot, Gujrat, Hafizabad, Multan, Jhang, Muzaffrabad, Khanewal, Mandi bahau din.</p>	<p>Pollution Control caused by untreated sewage</p> <ul style="list-style-type: none"> • Public awareness for conservative use of domestic water • In house preliminary treatment • Installation of common sewage treatment plants 	<ul style="list-style-type: none"> • TMAs (Town Municipal Administration) • Mandatory provision of three compartment septic tanks in new housing schemes and where possible in existing scheme. • Concerned Development Authority (ies) • Private Housing Schemes • Development Authorities
<p>Pollution of River Chenab due to Improper Management of Domestic Solid Waste</p>	<p>Control of Pollution caused by Solid wastes</p>	

	<ul style="list-style-type: none"> • Public Awareness for Waste Minimization at sources • Introduce the benefits of Recycling, Reuse, Recover, Refuse and Repaired • Conversion of domestic solid waste into compost • Installation of Waste Disposal facilities i.e. Landfill facilities and RDF facilities etc. 	TMA's, EPD and CDG (City District Government) Jhelum and Jhang
Pollution of River Chenab due Agriculture Run Off	Control of Agriculture Run Off	
	<ul style="list-style-type: none"> • Environment Friendly use of pesticides and fertilizers 	<ul style="list-style-type: none"> • Agriculture Department • EPD, Punjab