UWR Rainwater Offset Unit Standard

(UWR RoU Standard)

Concept & Design: Universal Water Registry

www.uwaterregistry.io

UWR Project Concept Note & Monitoring Report (PCNMR)

Project Name: CETP Wastewater Recycling by ZIPL, Gujarat, India

PCNMR Version 1.0

Date of PCNMR: 30/12/2023

1st RoU Crediting Period: 01/01/2014 to 30/11/2023 (09 years, 11 months)

1st RoU Monitoring Period: 01/01/2014 to 31/11/2023 (09 years, 11 months)

UWR RoU Scope: Scope 5

UNDP Human Development Indicator: 0.645 (India)

RoUs Generated During 1st Monitored Period: 4657311 RoUs

A.1 Location & Details of Project Activity

Title	**CETP Wastewater Recycling by ZIPL, Gujarat, India**
Type and Scope of RoU Project Activity	Small Scale Project Type *Scope 5: Conservation measures taken to recycle and/or reuse water, spent wash, wastewater etc across or within specific industrial processes and systems, including wastewater recycled/ reused in a different process, but within the same site or location of the project activity. Recycled wastewater used in off-site landscaping, gardening or tree plantations/forests activity are also eligible under this Scope*. The project activity is a CETP followed by RO & MEE which recycles and reuses wastewater from member units within the project boundary for captive gainful industrial use (e.g. cooling towers and boilers) and gardening/horticulture purposes. The project activity reduces groundwater extraction in the region and showcases efficient reuse of industrial wastewater as a key corporate environmental intervention towards a more water secure India.
Number of CETPs	1
Address of Project Activities	PHARMEZ Special Economic Zone, Zydus Infrastructure Pvt. Ltd., Village: Matoda, Taluka: Sanand Latitude: 22°52'49.25"N Longitude: 72°24'23.60"E
State	Gujarat
District	Ahmedabad
Country	India
Block Basin/Sub Basin/Watershed	Cambay Basin
Project Commissioning Date	2006
Rivers and water bodies near the project activity	Sabarmati River: 9 km to the East
SDG Impacts	1 – SDG 1 End poverty in all its forms everywhere 2 – SDG 3 Ensure good health and well-Being for all at all ages 3 – SDG 6 Ensure access to water and sanitation for all 4 – SDG 7 Ensure access to affordable and clean energy for all 5 – SDG 8 Promote economic growth and decent work for all

	6 – SDG 11 Make cities and settlements sustainable 7 – SDG 17 Strengthen global partnership for sustainable development 8 – SDG 13 Climate Action
Climatic Conditions	Annual Mean Maximum Temperature: 34.4°C Annual Mean Minimum Temperature: 21°C Annual Mean Maximum Rainfall: 62.6 mm
Calculated RoUs per year	see table below

Period (DD/MM/YYY-DD/MM/YYYY)	Total RoUs (1000 litres) /yr UCR Cap (1 million RoUs/yr)
01/01/2014-31/12/2014	166984
01/01/2015-31/12/2015	226904
01/01/2016-31/12/2016	312424
01/01/2017-31/12/2017	408846
01/01/2018-31/12/2018	487998
01/01/2019-31/12/2019	621819
01/01/2020-31/12/2020	591430
01/01/2021-31/12/2021	630210
01/01/2022-31/12/2022	622990
01/01/2023-30/11/2023	587707
Total RoUs	**4657311**

A.2. Project owner information, key roles and responsibilities

Project Proponent (PP):	**Project Owner**: Zydus Infrastructure Pvt. Ltd (ZIPL), Ahmedabad, Gujarat
UWR Project Aggregator	**Aggregator**: Kapil Acharya **UCR ID**: 623322759
Contact Information:	kapilacharya@zydusinfra.com
Date PCNMR Prepared	30/12/2023

External Links and Reports	ENVIRONMENTAL IMPACT ASSESSMENT AND EMP REPORT FOR Proposed Expansion of Special Economic Zone AT "PHARMEZ", Pharmaceutical SEZ, 2018 Analysis reports of audit report, Annexures (source)

Purpose of the project activity:

Zydus Cadila, group of companies, is a fully integrated global healthcare and pharmaceutical provider, which has set up a Pharmaceutical Special Economy Zone (SEZ) called "Pharmez", about 25 kilometers from Ahmedabad, Gujarat. The Zydus group has undertaken focused efforts towards water and wastewater recycling and reuse across all of its operations in India.

The project proponent is M/s. Zydus Infrastructure Pvt. Ltd (ZIPL or PP) who has setup a Common Effluent Treatment Plant (CETP) within the SEZ since it was difficult for each industrial member units within the SEZ to provide and operate individual wastewater treatment plants. The CETP currently **also collects** wastewater from formulation units located outside the SEZ.

The project activity currently involves a single CETP unit of installed primary treatment capacity of **3 MLD while the secondary treatment capacity is 4.5 MLD**. There are 17 registered members sending their effluent to the CETP.

CETP treats wastewater effluents by means of a collective effort mainly for a cluster of small scale industrial units at reasonable cost. Wastewater of individual industries often contains significant concentration of pollutants; and to reduce them by individual treatment up to the desired concentration, become techno - economically difficult – CETP is better and economical option. To overcome the issue of inadequate treatment of waste water, the concept of CETPs were introduced in early 1990s in the state of Gujarat.

Individual member units within the SEZ also faced difficulties due to lack of space and technical manpower to operate individual wastewater treatment systems. The PP observed that the quantum of pollutants emitted by the member units within the SEZ were more than or equivalent to large scale industry, hence keeping in view the key role played by their member units and constraints in complying with pollution control norms individually by these units, the PP setup a CETP for treatment of wastewater effluents generated from these member units located within the SEZ.

Gujarat has a total hydraulic capacity of approximately 767 MLD of 35 operational CETPs serving approximately 6483 individual units in the entire state as per latest 2021 data. Industries in Gujarat produce 575 million litres per day (MLD) of effluents and 60 MLD (11 per cent), is discharged directly into the sea, and the remaining 515 MLD, or 89 per cent, is let into various rivers and creeks *(source)*.

The state regulator of the CETP is the Gujarat Pollution Control Board (GPCB), which has recently assessed the requirement of CETPs in terms of augmentation of existing as well as new CETPs as of 2021.

Almost 09 operational CETPs are under planning of augmenting their existing capacity and 10 new CETPs across the state are planning to increase their capacity by 288.3 MLD in addition to existing capacity of 767 MLD as per 2021 data.

(As on March 2021) https://gpcb.gujarat.gov.in/webcontroller/viewpage/status-of-cetps-in-gujarat

Sr. No.	Name & Address of CETP	Hydraulic Load (MLD)	Actual Load (MLD)	No. of Members
9	Zydus Infrastructure Pvt.Ltd, Plot No. Pharmez-Special Economic Zone, Sarkhej-Bavla Highway, N.H. 8A, Vill. Matoda, Ta. Sanand, District Ahmedabad	3.5	2	43

GPCB Records of Project Activity (March 2021)

GUJARAT POLLUTION CONTROL BOARD
Paryavaran Bhavan
Sector-10-A, Gandhinagar - 382 010.
Phone : 23222756, 23222095, 23222096
Gram : CLEANWATER Fax : (079) 23232156
Website : www.gpcb.gov.in

Shweta

NO:ABD/NOC-GEN-1114/ 82121

To

14 SEP 2006

M/s. ZYDUS INFRASTRUCTURE PVT. LTD.
ZYDUS TOWER,
SATELLITE CROSS ROAD,
AHMEDABAD-380015.

Sub : **NO OBJECTION CERTIFICATE.**
Ref : Your Application No. – dated :-2/5/2006 & letters dt.12/7/2006 & 4/9/2006.

Sir,

Without prejudice to the powers of this Board under the Water (Prevention and Control of Pollution) Act-1974, the Air Act-1981 and the Environment (Protection) Act-1986 and without reducing your responsibilities under the said Acts in any way, this is to inform you that this Board has **No Objection** to your setting up of a pharmaceutical park-SEZ (for approximately -32 formulation units only) at vill: MATODA, SARI, CHACHARWDI-VASNA, TA:SANAND, DIST:AHMEDABAD (Total area = 49 Ha) for the manufacture of the following items .The Validity period of the NOC will be five years from date of issue of the order:-

Sr.No	Product	Capacity MT/M
1	TABLETS	1150
2.	CAPSULES-ANTIBIOTIC (DRY POWDER/ DRY SYRUP)	66
3.	CAPSULES (NON ANTIBIOTICS)	3.25
4.	SOFT GELATINE CAPSULES	400
5.	LIQUIDS	1300
6.	INJECTION (VIALS/AMPOULES/OPTHALMIC VIALS/VACCCINE VIALS)	200

SUBJECT TO THE FOLLOWING CONDITIONS :-

SPECIFIC CONDITIONS:

1. Only pharmaceutical formulation units limiting to the total aggregate production capacity as mentioned above shall be allowed at the proposed park.

2. Individual units as per the applicability, has to obtain the necessary permission of the Board.

NOC for SEZ from GPCB dated 14/09/2006

The CETP is located on northeast side of the SEZ, and NOC was obtained from the authorities to install a 1.121 MLD capacity plant in the year 2006.

Between 2006 and 2017, the CETP collected industrial wastewater from 12 pharmaceutical members within the SEZ, treating it via clarification, followed by a 750 KLD membrane bioreactor (MBR) process. Due to operational issues, the MBR modules required replacement.

However, a Zero Liquid Discharge (ZLD) process would be integrated to meet the increasing demand for clean water within the SEZ and compliance with environmental policies. The CETP was expanded in 2017 using reverse osmosis (RO), nanofiltration (NF), and MBR membrane technologies.

In 2017, The PP commissioned a new MBR system with 1.5 MLD capacity using flat-sheet MBR modules. A year later (2018), the existing 750 KLD MBR system expanded to 3.0 MLD to meet production capacity and ensure the continuous production of filtered water should one of the MBR systems require downtime for maintenance.

The project activity currently involves a single CETP unit of installed primary treatment capacity of **3 MLD while the secondary treatment capacity is 4.5 MLD**. There are 17 registered members sending their effluent to the CETP. The main source of raw water supply is via 3 (three) borewells for the entire SEZ. The average daily withdrawal of groundwater over the last three years is between **151.7 - 42.2 m^3/day**.

The reported average water consumption is **42.2 m^3/day** while the average wastewater generation is **41.5 m^3/day** (period October 2022-March 2023).

Every member unit has their own treatment scheme for upto acceptable effluent characteristics. Member units do not have the requirements to segregate the sewage and effluent wastewater, hence the CETP receives the sewage from member units along with industrial wastewater effluent. Average domestic wastewater is 10 KL/d. The PP ensures that effluent received from member units are well within the prescribed inlet GPCB norms. If the wastewater effluent is not confirming to these standards it is sent back to the member units. CETP recycled wastewater effluent is sent to member units via pipelines to reuse in various applications such as in cooling towers and boilers.

The project activity showcases **best-in-class wastewater treatment technologies that can replace the equivalent freshwater demand in different sectors for non-potable purposes, while reducing the proportion of untreated wastewater and substantially increasing recycling and safe reuse in India.**

Magnetic flow meters are provided at the inlet and outlet of the CETP and records of the same are maintained and being submitted to the GPCB regularly.

Amneal Life Sci Pvt Ltd

Zydus Hospira Onco. Pvt Ltd

Member units online flow meters, pH & TDS meters

Flow Meter Inlet

Flow Meter at Outlet

Installation of flow meter
at inlet & outlet of CETP

Flow Meter Installed at various Stage of Treatment of CETP

Water is metered through the entire process of extraction and delivery within the SEZ to ensure no wastage of water and further wastewater treatment for reuse. Wastewater is metered at every stage of processing that take place within CETP. After recycling the wastewater, it is distributed back to industries for captive water requirements, horticulture and landscape irrigation purposes.


HIGH TDS
STORAGE TANK

The mode of receiving wastewater is via 6 (six) wastewater storage tankers to the CETP.

The CETP provides primary, secondary and tertiary wastewater treatment along with Multiple Effect Evaporator (MEE) technology. The recycled effluent is reused by the member units for captive industrial cooling/boiler purposes and is also used within the SEZ for gardening, horticulture and landscaping purposes.

In the absence of the UWR project activity, the captive industrial and gardening water requirements would have been met by groundwater extraction from the existing bore well/s.

Over the recent years, increasing abstraction to meet rising demand for domestic supplies and irrigation has raised concerns for the sustainability of the resource and the livelihoods it supports. Consequences of overexploitation of groundwater include declining water levels and increasing competition for scarce water resources between domestic and agricultural users and rural and urban communities. Ground water level range from 5 to 10 m bgl at the project site.

Logbook is being maintained and also manifest is generated for effluent quantity received from member units for the following parameters:

- Quantity and quality of effluent received.
- Quantity and quality of effluent supplied to member units for recycle/reuse.
- Quality of effluent at each stage of treatment

- Chemicals used at each stage of treatment
- MLSS / MLVSS & DO concentrations in Aeration Tanks
- Quantity of sludge generated

RO treatment of the wastewater

RO: Reverse Osmosis is a filtration process that produces 80-85 % pure water from wastewater. The pressurized effluent is forced through semi permeable membranes of size 0.0001 micron to the fresh water recovery side. The membrane rejects the salt ions present in the effluent water and allows the pure water to pass through the thin membrane material

Government of India
Central Ground Water Authority (CGWA)
Ministry of Water Resources, River Development and Ganga Rejuvenation
Applications for Issue of NOC to Abstract Ground Water (NOCAP)

Application for Permission to Abstract Ground Water for Infrastructure Use
(Application for New NOC)

Application Number : 21-4/2304/GJ/INF/2017

SNo.	Type of Structure Name / Year of Construction	Depth (Meter) / Diameter (mm)	Depth to Water Level (Meters below Ground Level)	Discharge (m3/Hour)	Operational Hours (day) / days (year)	Mode of Lift Name	Horse Power of Pump	Whether fitted with Water Meter	Whether Permission Registered with CGWA / If so Details Thereof

(g) Particulars (i-a) is yes (Fill details of Dewatering Proposed Structures)

Number of Proposed Structures 0

SNo.	Type of Structure Name / Year of Construction	Depth(Meter) / Diameter (mm)	Depth to Water Level (Meters below Ground Level)	Discharge (m3/Hour)	Operational Hours (day) / days (year)	Mode of Lift Name	Horse Power of Pump	Whether fitted with Water Meter	Whether Permission Registered with CGWA / If so Details Thereof

(ii) Breakup of Water Requirement and Usage:

Activity	Existing Requirement (m3/day)	Proposed Requirement (m3/day)	Total Requirement (m3/day)	No. of Operational Days in a Year	Annual Requirement (m3/year)
Residential/Domestic	402.00	0.00	402.00	365	146730.00
Commercial Activity	0.00	0.00	0.00	0	0.00
Industrial Activity	6594.00	0.00	6594.00	313	2063922.00
Greenbelt Development /Environment Maintenance	158.00	0.00	158.00	280	44240.00
Other Use	0.00	0.00	0.00	0	0.00
Grand Total	7154.00	0.00	7154.00		2254892.00

(iii) Whether ETP/STP Proposed, if so furnish following details: Yes

Breakup of Recycled Water Usage	(m3/day)	(Days)	(m3/year)
a) Total Waste Water Generated:	2609.80	365	952577.00
b) Quantity of Treated Water Available :	1160.00		
(i) Reuse in Commercial Activity:	0.00	0	0.00
(ii) Reuse in Industrial Activity	1002.00	313	313626.00
(iii) Reuse in Greenbelt Development :	158.00	280	44240.00
(iv) Other Uses	0.00	0	0.00
c) Total Treated Water Utilised:	1160.00		357866.00

Net Ground Water Requirement : 5994.00 (m3/day)

Groundwater extraction NOC (2017)

Central Ground Water Authority (CGWA)
Ministry of Water Resources, River Development and Ganga Rejuvenation
Applications for Issue of NOC to Abstract Ground Water (NOCAP)

Application for Permission to Abstract Ground Water for Infrastructure Use
(Application for New NOC)

Application Number : 21-4/2304/GJ/INF/2017

4.	**Whether Local Goverment Water Supply Network Exists in the Area, if yes, provide details.**	No
5.	**(i) Water Supply Application Status**	Applied
	(ii) Water Supply Agency	Goverment
	a) Whether Water Supply Committed	No
	b) Whether Water Supply Denied	No
6.	**(a) Groundwater Abstraction Structure- Existing**	
	Number of Existing Structures:	8

SNo.	Type of Structure Name / Year of Construction	Depth (Meter) / Diameter (mm)	Depth to Water Level (Meters below Ground Level)	Discharge (m3/Hour)	Operational Hours (Day) / Days (Year)	Mode of Lift Name	Horse Power of Pump	Whether fitted with Water Meter	Whether Permission Registered with CGWA / If so Details Thereof
1	Tubewell / 2006	292.00 / 250	70.00	80.00	10 / 365	Submersible Pump	52.00	Yes	No / -
2	Tubewell / 2006	292.00 / 250	70.00	80.00	10 / 365	Submersible Pump	52.00	Yes	No / -
3	Tubewell / 2008	285.00 / 250	70.00	80.00	10 / 365	Submersible Pump	52.00	Yes	No / -
4	Tubewell / 2008	286.00 / 250	70.00	80.00	10 / 365	Submersible Pump	52.00	Yes	No / -
5	Tubewell / 2008	290.00 / 250	70.00	80.00	10 / 365	Submersible Pump	52.00	Yes	No / -
6	Tubewell / 2008	290.00 / 250	70.00	80.00	10 / 365	Submersible Pump	52.00	Yes	No / -
7	Tubewell / 2010	290.00 / 250	70.00	80.00	8 / 365	Submersible Pump	52.00	Yes	No / -
8	Tubewell / 2010	290.00 / 250	70.00	80.00	8 / 365	Submersible Pump	52.00	Yes	No / -

(b) Groundwater Abstraction Structure- Proposed

Number of Proposed Structures: 0

SNo.	Type of Structure Name / Year of Construction	Depth (Meter) / Diameter (mm)	Depth to Water Level (Meters below Ground Level)	Discharge (m3/Hour)	Operational Hours (Day) / Days (Year)	Mode of Lift Name	Horse Power of Pump	Whether fitted with Water Meter	Whether Permission Registered with CGWA / If so Details Thereof

<u>Borewells within the project boundary are used for raw water supply to the SEZ as per the NOC (2017)</u>

High TDS effluent stream is directly treated in the RO and further in the MEE whereas the low TDS effluent stream in the plant premises is first treated in the CETP followed by RO and MEE.

INLET NORMS FOR MEMBERS UNITS

PARAMETERS	CETP INLET NORMS
pH	6 to 8
Suspended solids	300 mg/l
Oil & Grease	5 mg/l
Phenolic Compound	0.3 mg/l
Ammonical Nitrogen	50 mg/l
BOD (5 dayat 20^0C)	400 mg/l
COD	850 mg/l
Fix Dissolved Solids	2100mg/l

CETP has online pH meter, TDS meter, COD & BOD meter and TOC meter at the outlet and all meters are connected with the server of Gujarat Pollution Control Board and Central Pollution Control Board for compliance. Online flow meters are installed at each stage of treatment. Minimum one sample is collected in one shift and tested.

EFFLUENT ANALYSIS REPORT

Sampling Date	:	16-03-2023
Sample drawn by	:	GITCO Ltd
Type of sample	:	Grab

Parameter	Results		
	I	II	III
pH	7.44	7.38	7.04
FDS	1872	1192	376
TSS	134	22	BDL
COD	760	80	BDL
BOD	326	21	BDL
Ammonical Nitrogen	10.8	4.8	4.0

Note: All parameters except pH and Colour are expressed in mg/L.

I : Equalization tank
II : PVA Gel O\L
III : R.O.Permeate (final O\L)

NAME AND SIZES OF ETP UNITS WITH IT'S ADEQUACY:

Sr. No.	Name of the unit	No. of Units	Dimensions (m)	Design Flow (MLD)	Design Parameters	Remark
1	Equalization Tank – 1	01	15.00 X 10.00 X 3.00 + 0.50 FB	0.75	D.T. = 14.4 h	Adequate
2	Equalization Tank – 2	01	9.00 X 10.00 X 3.50 + 0.50FB	2.25	D.T. = 3.36 h	Adequate
3	Neutralization Tank - 1 & 2	02	2.70 X 2.70 X 1.50 + 0.50 + 0.30	0.75	D.T. = 42 min	Adequate
4	Neutralization Tank - 3 & 4	02	2.70 X 2.70 X 1.50 + 0.50 + 0.30	2.25	D.T. = 14 min	Adequate
5	Dosing Tank-1 & 2	02	1.50 X 1.50 X 1.00 + 0.30	0.75	--	--
6	Dosing Tank-3 & 4	02	1.00 X 1.00 X 1.00 + 0.30	2.25	--	--
7	Clariflocculator – 1	01	10.00 DIA X 2.50 SWD X 0.50 FB	0.75	D.T. = 6.3 h SOR = 9.6 m^3/m^2. day	Adequate
8	Clariflocculator – 2	01	10.00 DIA X 2.50 SWD X 0.50 FB	2.25	D.T. = 2 h SOR= 28.7 m^3/m^2. day	Adequate
9	Pre Air Chamber – 1	01	15.40 X 13.30 X 2.30 + 0.50	0.75	D.T. = 15.1 h	Adequate
10	Pre Air Chamber – 2	01	15.40 X 13.65 X 2.30 + 0.50	0.75	D.T. = 15.5 h	Adequate
11	MBR Basin – 1	02	6.40 X 4.30 X 2.60 + 0.50	0.75	D.T. = 4.6 h	Adequate
12	MBR Basin – 2	02	6.72 X 4.30 X 2.60 + 0.50	0.75	D.T. = 4.8 h	Adequate
13	Fine Screen – 1	01	5.00 X 3.00	0.75	--	--

Sr. No.	Name of the unit	No. of Units	Dimensions (m)	Design Flow (MLD)	Design Parameters	Remark
14	Fine Screen – 2	01	1.00 x 1.00	0.75	--	--
15	MBR Permeate Sump – 1	01	13.30 X 11.20 X 3.00 + 0.50	0.75	D.T. =14 h	
16	Sludge Sump	01	9.00 X 9.00 X 3.00 + 0.50 FB	3.0	--	--
17	Stores	01	15.00 X 10.00	--	--	--
18	Decanter Shed	01	10.00 X 6.00 × 3.50	--	--	--
19	Chemical Storage Area	01	14.00 X 6.00 × 3.50	--	--	--
20	Blower Room	01	17.00 X 5.00 × 3.50	--	--	--
21	RO Block	01	31.00 X 12.50	--	--	--
22	MEE Block	01	19.5 x 14	--	--	--
23	Offline Lagoon	01	5250 m^3	--	--	--
24	MCC /PLC/ Maintenance Room	01	31.00 X 10.00 X 4.50	--	--	--
25	Office / Laboratory Building	01	12.00 X 8.00	--	--	--
26	Fresh water Sump	01	14.00 X 14.00 X 2.50 + 0.50	--	--	--
27	Watchman Cabin	01	3.00 X 3.00	--	--	--
28	Toilet Block	01	9.00 x 3.00	--		
29	Leachate Collection Tank -1	01	2.00 x 2.00	--	--	--
30	Leachate Collection Tank – 2	01	3.00 x 3.00	--	--	--
31	R.O. Reject Tank	02	10.00 X 10.00 X 2.75	--	--	--
32	MBR permeate Sump -2	1	11.00 x 6.72 x 2.80 + 0.50 FB	2.25	--	--
33	Double Decker MBR	1	8.00 x 5.2 x 6.00	--	--	--
34	PVA GEL Tank	1	6.00 x 5.2 x 6.00	1.5	D.T = 3.0 h	Adequate
35	Intermittent Holding Tank	1	2.00 x 2.00 x 1.9	1.5	D.T = 7.3 min	Adequate
36	MBR Permeate Tank -3	1	250 KL	3.0	--	--
37	RO Reject Tank-2	1	10.00 x 10.00 x 2.75	--	--	--
38	Activated Carbon Filter	1	3.3 x 2.2	3.0	--	--
39	Septic Tank	01	8.00 x 3.00 x 2.50 + 0.60	--	--	--
40	Over Head Tank	01	5.00 x 20.00 x 2.30	--		--

Note: - Adequacy is calculated based on Design flow rate.

The PP has installed SCADA (Supervisory Control and Data Acquisition) online system to monitor and control each movement of water supplied to industries within the project boundary in real time. Through SCADA, monitoring of infrastructure facilities such as power, transport, water, waste, etc. take place.

Water supplied is retained in over-head tank and further metered when distributed to the individual industries for their use. After the required consumption of water by each industrial unit, all units are required to treat their sewage water following the guidelines to dispose wastewater. This partially treated water is collected in tankers and brought to CETP for further treatment.

Water is metered through the entire process mentioned above to ensure no wastage of water and further waste water treatment for reuse. Wastewater is metered at every stage of processing that take place in CETP. After recycling the wastewater, it is distributed back to industries for captive water requirements, horticulture and landscape irrigation purposes.

Extent of Deviation from CETP Inlet Limit:

Parameter	CETP Inlet Limit	A	% D	B	% D
pH	6.5-8.5	7.00	*	7.44	*
FDS	2100	2490	18.6	1872	*
TSS	300	44	*	134	*
COD	850	272	*	760	*
BOD	400	63	*	326	*
Ammonical Nitrogen	50	7.6	*	10.8	*

Note : All parameters except pH are expressed in mg/L
BDL : Bellow Detectable Limit
* : Indicates the concentration is within the permissible limit as per the above stated Water Consent
A : Second Monitoring on 30-11-2022
B : Third Monitoring on 16-03-2023
% D : % Deviation

Latest Sampling CETP lab results 2023

This CETP is backed up by 270 kWh solar power generator system thus further contributing to lowering of the carbon footprint within the project boundary. Quality of treated effluent is monitored continuously for TOC, TDS, COD, BOD, flow & pH on SCADA system; data is recorded and maintained. Also samples are collected and tested as per frequency.

The formal approval for the SEZ was received in June 2006 and the permission from Gujarat Ground Water Authority and Gujarat Pollution Control Board was received in September 2006, as per available records.

In the absence of the project activity, the PP could have extracted an equivalent amount of fresh groundwater from the installed bore wells within the project boundary that would have depleted the local groundwater resources and/or continued to use existing drinking water resources in the surrounding area and/or discharged the CETP effluent without recycling the same for gainful captive purposes.

The project activity qualifies under the UWR RoU program since the PP has undertaken water conservation measures to recycle and reuse wastewater for gainful end use. Wastewater is a highly potential source of water for various purposes and is highly underutilized in the country. If India can utilize 80% of its untreated wastewater from 110 of its most populous cities, then 75% of the projected industrial water demand can be met by 2025 (*source: Whitepaper URBAN WASTEWATER SCENARIO IN INDIA, August 2022, by IITB, AIM-NITI Aayog, ICDK and NMCG*).

While it is mandatory for any industrial unit to have a suitable ETP for industrial wastewater treatment to meet the required discharge standard, recycling and reusing industrial effluents in the same industry or in industries or establishments nearby post treatment (as per the prescribed discharge standard) is costly, and hence is not the norm in the industry. There is no incentive today for any industry or centralized ETP (CETP) for implementation of Zero Liquid Discharge (ZLD) other than getting environmental clearance or avoiding complaints on pollution issues from public and courts.

The design principles of most ETPs do not consider the possibility of recycling and reusing the treated ETP wastewater. Inevitably, in all industries, the wastewater discharged is seldom suitable for reuse within the industry, though industry expects users to reuse its wastewater because it is 'treated'. Most industries have their water intake points upstream of their wastewater discharge points. This itself exemplifies the quality and interest of wastewater treatment by the Indian industry.

The project activity showcases an integrated approach involving wastewater treatment, source reduction, reuse of process water, effluent treatment, recycling of treated ETP effluent and waste-minimisation that is urgently required to be followed by other industries.

The project activity showcases clean and advanced process technologies which can help industry reduce its industrial water demand. By selling water credits from such conservation and recycling activities, industries (even those outside the pharmaceutical industry) can overcome the cost barrier to successful implementation and scale of such water conservation and recycling projects. For instance, by replacing the conventional bleaching process with totally chlorine bleaching process, pulp and paper companies can almost close their water cycle, however the treatment methods for the same are costly, and hence water credits can be used as an added incentive for such industries to adopt cleaner wastewater treatment technologies.

Even in the context of wastewater generated across India, a majority comes from the Indian Thermal Power Plants (TPPs) via their cooling processes. In once-through cooling system approximately 100 litres of water is required to produce 1 Kwh electricity. In badly managed TPPs this could go up to 200 litres. By comparison, in a closed-cycle system, about 2-3 litres water is required to generate 1 Kwh electricity. The UWR RoU makes such closed cycle systems eligible to generate water credits as opposed to the common and wasteful once-through cooling system. There is a trade-off between the cost of water technology and the water that could be saved, however, with revenue from water credits, such barriers can be overhauled. Such recycling measures, especially for the power industry, are crucial since studies have showcased that in India, water consumption, for relatively low growth future projections, would lead to two and-a-half-fold rise as compared to 2015 levels, whereas a higher growth projection situation would lead to approximately four folds rise. If environmental mandates to improve cooling tower water recycling technologies are not implemented or enforced in the power generation sector, then water withdrawals will significantly rise from 34 billion cubic metres (bcm) in 2015 to 145 bcm in 2050 (source). This increase reflects the increase in power production for meeting the electricity demands of an increasing population and GDP. Water consumption also increases at a similar rate across all industrial sectors. The project activity by the PP is one such positive step in the adoption of cleaner recycling wastewater treatment technologies required to build scale at the speed the climate crisis demands before 2030.

Between January 2014 and November 2023, the project activity has reused 4657 million litres of recycled wastewater from the CETP successfully. The PP highlights the catalytic role that corporate India must play in reducing industrial water consumption as well as water pollution per unit of industrial output.

Wastewater Usage Scenario:

While there is a scarcity of freshwater resources in India, it is observed that a potential source of water, which is wastewater, is largely underutilised. According to reports, if India reuses 80 per cent of its untreated wastewater from 110 of its most populous cities, 75 per cent of projected industrial fresh water demand can be met by 2025 replacing fresh water use. The UN Waste Water Assessment Programme report states that high-income countries treat approximately 70% of the wastewater that is generated. The ratio drops to 38% in upper-middle-income countries, 28% in lower-middle-income countries and 8% in low-income countries. This only adds up to around 20% of the wastewater being treated globally.

The entire domestic waste water from Ahmedabad equal to a volume of around 880 million litres per day (MLD) and industrial effluent around 120.88 MLD is discharged into the Sabarmati river which is the source of water for industrial, agriculture and domestic activities (source).

Wastewater being discharged into the Sabarmati in Ahmedabad

The industrial sector is the second highest user of water after agriculture. India's annual fresh water withdrawals were about 500 billion cubic meters and the Indian industry consumed about 10 billion cubic meter of water as process water and 30 billion cubic meters as cooling water • As per the World Bank studies, the water demand for industrial uses and energy production will grow at a rate of 4.2 percent /year, rising from 67 billion cubic meter in 1999 to 228 billion cubic meter by 2025. Therefore, according to World Bank the current industrial water use in India is about 13 per cent of the total fresh water withdrawal in the country. Cost of water supply varies widely and can be in the range of Rs. 0.09 to 50.0 per cubic meter (source)

In India, the sewage generation in the urban centres, as per the recent assessment by Central Pollution Control Board (CPCB), was 72,368 Million Litres per Day (MLD) for the year 2020-21. Currently, the installed sewage treatment capacity is 31,841 MLD, but the operational capacity is 26,869 MLD, which are much lower than the load generated. Of the total urban sewage generated, only 28% (20,236 MLD) was the actual quantity of wastewater treated. This implies that 72% of the wastewater remains untreated and is disposed of in rivers/lakes/groundwater. There are some increases in infrastructure e.g., another 4,827 MLD sewage treatment capacity, has been proposed. If this is added to the existing installed capacity, even then, there is a gap of 35,700 MLD (i.e., 49%) between the wastewater generated and the capacity available for treatment (CPCB, 2021b).

Poor functioning and monitoring of CETPs and flouting of effluent treatment norms by industries are the precise reasons that the rivers in Gujarat are severely polluted.

The key disadvantages are related to the operational process complexity and the cost for installation for recycling and reuse, hence the PP hopes that the sale of RoUs from this project activity will offset the installation costs, increase the capacity of the CETP and help make such projects viable for the industrial sector across the state.

A.2.1 UWR RoU Scope & Project Details

UWR **RoU Scope 5**	*Conservation measures taken to recycle and/or reuse water, spent wash, wastewater etc across or within specific industrial processes and systems, including wastewater recycled/ reused in a different process, but within the same site or location of the project activity. Recycled wastewater used in off-site landscaping, gardening or tree plantations/forests activity are also eligible under this Scope.*

Being a leading pharmaceutical and a socially responsible corporate with excellent ESG credentials, the PP decided not to consume/burden the village's existing clean drinking water resources or construct deep bore wells to further deplete the surrounding groundwater aquifers, but instead opted to voluntarily treat, recycle and reuse wastewater for the captive water requirements of all units within the SEZ.

In the absence of the project activity, the PP would have continued to extract groundwater from the bore wells that would have depleted the local groundwater resources and/or continued to use existing drinking water resources in the surrounding area and/or discharged the CETP effluent without recycling for gainful captive purposes.

The a**nnual** recycled water consumption in SEZ is in the range of **3,21,978 KL to 4,21,989 KL while the daily treated water consumption is in range of 882 KL to 1,156 KL).**

Baseline scenario

The baseline scenario is the situation where, in the absence of the project activity, the PP would have discharged the ETP effluent without further treatment, recycling and reuse.

Hence the baseline scenario is:

*"the net quantity of treated ETP effluent / wastewater that would be discharged directly into the local drain/sewer without being further recycled and/or reused **post treatment** per year"*

The project activity achieves the following key water and sanitation related Sustainable Development Goals under the United Nation (UN-SDGDs):

- ensures universal and equitable access to safe and affordable drinking water for all by 2030,
- ensures halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally by 2030,
- substantially increases water-use efficiency across all sectors and ensures sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity by 2030, and;
- expands capacity-building support within India in water and sanitation-related activities and programs, including water efficiency, wastewater treatment, recycling and reuse technologies by 2030.

Water Conservation Limitations within Industry:

The following are the highlights from CPCB's latest presentation on industrial wastewater ETPs:

- Indiscriminate water uses in most of the industries
- Inadequate control on quantity of water used and wastewater discharged from industries

- Lack of pollution tax except for water cess
- Low water cess rates do not tempt industry for water conservation
- Lack of penalty on defaulters

Most Industrial Effluents have high salinity/TDS- polluting industries such as Pharma, Pulp & Paper, Tanneries, Textile Dyeing, Chemicals, and Power Plants etc. The TDS content is well above the statutory limit of 2100 mg/l. Discharge of saline but treated wastewater pollutes ground and surface waters. The conventional 'Physico-chemical-biological' treatment does not remove salinity in the treated effluent. This requires membrane processes like Reverse Osmosis (RO) and Nano Filtration (NF). This also means that the membrane reject also need to be managed. Achieving COD of 250 mg/l at the secondary treatment stage is also a challenge as most polluting industry wastewaters are not easily biodegradable. This requires additional tertiary treatment like Advanced chemical oxidation systems or electro-oxidation etc. Assistance to Pharmaceuticals Industry for setting up ETPs under common facility centres is currently available in the form of grants of 70% of project cost (of Rs. 20 crore), which is less from Dept. of Pharmaceuticals, Govt. of India.

Many of the industrial polluting companies fall under the SME category and some are even in the tiny sector. Therefore the capex towards ZLD can be a burden. However, the additional cost for treatment does not justify the expensive treated wastewater from being discharged in many small scale industries, **hence UWR water credits can provide the much needed incentive for recycling and reusing post providing expensive treatment systems to achieve such discharge standards.**

Also, detailed break-up of treated water usage by 14 operational industrial units confirms the unit level consumption of treated water for non-potable applications. Based on the trend shared for 2019 and 2020-21, it is observed that 2-3 companies who were not taking treated water for their consumption has started taking treated water. One of the attributable reasons was the need for increased hygiene requirements on account of the COVID pandemic for an increase in the potable water usage (for hand washing and cleaning applications), so treated water demand has increased for all non-potable applications within the project boundary. The project activity showcases best-in-class wastewater treatment technology that can replace the equivalent freshwater demand in different sectors for non-potable purposes while reducing the proportion of untreated wastewater and substantially increasing recycling and safe reuse in India.

Economic and market potential of treated wastewater (TWW) reuse:

Almost 11,622 million cubic metres (MCM) is the estimated amount of treated wastewater that was available in India for reuse in 2021. Based on projected sewage generation and treatment capacities in the future, this will become 15,288 MCM by 2025 and 35,178 MCM by 2050. Nine times the area of New Delhi could have been irrigated using the available TWW in 2021. Based on studies, about 8,603 MCM of treated wastewater was available for reuse in the irrigation sector in 2021; which could have replaced the equivalent freshwater demand for irrigation. It had the potential to irrigate 1.38 million hectares (Mha) of land, which is equivalent to about nine times the area of New Delhi. By 2050, this would is estimated to increase by up to about twenty-six times the area of New Delhi. **Reusing TWW for irrigation in 2021 could have generated INR 966 billion in revenue.** Reusing TWW in irrigation could have reduced greenhouse gas (GHG) emissions by 1.3 million tonnes in 2021. Studies suggests that the available treated wastewater would have irrigated 1.38 Mha in 2021, which would have reduced pumping in 3.5 per cent of the groundwater-irrigated area. Further, this would have led to a reduction of 1 million tonnes of GHG emissions.

Additionally, on account of the inherent nutrient value of TWW, fertiliser consumption would have reduced, resulting in further reduction of GHG emissions by 0.3 million tonnes. INR 630 million would have been the market value of treated wastewater in 2021. The UWR RoU is the only alternate viable voluntary water credits program for the PP in the current scenario to generate revenue to build climate resilience before 2030.

Despite the overall apparent shortage of water, there are few incentives for efficient use of water in many parts of the world, the UWR RoU program is the only voluntary water incentive program for such project activities.

Most countries have not developed instruments (either regulations or economic incentives) and related institutional structures for reallocating water between sectors, or for internalizing the externalities which arise when one user affects the quantity and quality of water available to another group.

Project Location

A.3. Land use and Drainage Pattern

HYDROGEOLOGY

As per CGWB 1997 report, part of Taluka -Sanand is categorized in overexploited block. As per collected inventory quality of ground water is good at Kavitha, Moraiya & Chacharvadi Vasna; while slightly saline at Changodar, Modasar, Moti Devti, Bhat, Bavla, Sanand, Pipan & villagers are using it for domestic utilization. At Bavla, Sanand & Piapan bore well water gets mixed with Narmada water pipe line in underground/overhead tank before it is supplied to village.

Over recent years, increasing abstraction to meet rising demand for domestic supplies and irrigation has raised concerns for the sustainability of the resource and the livelihoods it supports. Additionally, changing land use as well as hydrological interventions and climate change will have impacts on natural recharge and groundwater storage.

Consequences of over-exploitation include declining water levels and increasing competition for scarce water resources between domestic and agricultural users and rural and urban communities.

The district forms a part of the Cambay Basin.

WATER LEVEL

The project area falls under South Gujarat heavy rainfall Agro Climatic Zone (GJ-4)Agro Ecological Sub Region-2.3, characterized by 1-3 % soil slope, soil depth >1 m. The annual average rainfall is 700-800 mm. The main sources of irrigation are Bore well (44.98 %), Canal (23.77 %) & Open Well (20.0 %).

Quality of groundwater is mixed (good and slightly saline) as per existing sources in core/buffer zone of studied area. Ground water movement is towards south and south west area which is towards Gulf of Khambhat. The area is covered by the unconsolidated alluvial deposits whose alternate sand and clay formations form the multi-aquifer systems. Ground water occurs both under phreatic as well as confined conditions. The water level in the studied area is shallow below ground level in post monsoon season. The average seasonal fluctuation is 4 m as per hydro geological inventory of the wells and as per regional data of CGWB. The subsurface strata of the area reveal that thickness of unconsolidated formation persisting upto deeper depth helps in seepage and underground movement. So lateral as well as vertical movement of seepage will be more (more permeable formation, approx K= 10-2 cm/sec), therefore effective measures should be taken during environmental activities. As per hydro inventory data, the quality of ground water in the dug well zone (up to 20 mbgl) is fresh, having TDS < 1000 ppm in post monsoon. The semi-confined aquifers encountered in the depth range of 75 to 130 m bgl have ground water with TDS around 2000 ppm.

However, CGWB data show that during pre-monsoon period, deeper aquifer quality is reported even up to 3000 ppm in some isolated cases. The regional confined aquifers between the depth ranges of 130 m bgl to a maximum depth of 350 m bgl have potable water with TDS less than 2000 ppm. The normal average rainfall of Ahmedabad region is around 557 mm for month of July and September as per IMD data. However, the rainfall recorded at nearest Sanand Rain Gauge Station during the period 2007- 2009 shows that average rainfall is 795 mm. Based on geomorphic and hydro geological studies, it was found that the existing ponds in Matoda gram panchayat of Sanand block are suitable for harvesting additional rainwater runoff.

A.4. Rainfall

While the project activity is not a rainwater harvesting project, and rainfall data is not relevant, it should be noted that as part of rainwater harvesting initiative, the PP has created channels for storm water drainage along the cycle tracks and planters via a 1000mm x 1500mm underground storm water channel on the road edges after the driveway & cycle lane. The storm water channel have precast drain covers with gratings flushed at the road level. The storm water drains are facilitating the collection of rainwater run-off from the hardscape areas (roads, pedestrian pathways). The slope of storm water drain is directed from the far ends of the SEZ towards main gate. Storm water drain meets the city storm drain at the main road. Apart from the overflow of run-off from storm water drains are diverted to the artificial reservoirs created at the SEZ. The PP has deliberately left many plots to create artificial reservoirs to recharge rainwater through natural percolation. On all these vacant plots, the PP has made several artificial recharge pits for retaining rainwater in the premises. These recharge pits now function as good as any natural lake and attracts various species of migratory birds. These lakes act as natural habitat and ornithologists and enthusiastic birdwatchers from across the state are invited to glance at these birds. The PP realizes that rainwater harvesting with gainful end use is just a small part of this big biodiversity ecosystem and takes upon itself to take such initiatives for restoration of declining migratory bird species.

A.5. Alternate methods to the Project Activity

The level of Ground Water Development at Bavla Taluka is 36.74 %. The overall development in the district is 78.36 %, and as a whole the Ahmedabad district is in Semi Critical category. In the semi critical blocks the ground water may be developed along with rain water harvesting measures.

The suitable recharge structures feasible in the Ahmedabad district are Percolation tanks/ponds, Recharge wells, recharge shaft, check dams, nallah bunds etc. depending on the terrain conditions. In the phreatic aquifers with deep water levels and desaturation, spreading channels, recharge pits, recharge ponds etc. are suitable to utilize surplus runoff and tail end releases from the canals.

In the confined aquifers artificial recharge by indirect injection technique is suitable that is dual purpose connector wells. These recharge wells should have screens against upper saturated aquifer and also against the targeted confined aquifer. It would function under gravity since the piezometric level of confined aquifer is much below phreatic water level.

Various rainwater harvesting schemes depending on the suitable hydro geological conditions have been constructed in the district viz. Check dams, Recharge tube wells , deepening of the village ponds etc. and have shown good impact on the groundwater scenario.

In 2022, the high courts in India directed some state pollution control boards to act strictly against the industrial units that illegally discharge trade effluents into the sewer network, damaging the STPs (source). Though wastewater reuse is endorsed in many policies and programmes, there is a lack of clear guidelines and frameworks to support the implementation of such projects. As a result, the reuse of reclaimed water for non-potable purposes continues to face challenges. The problem is further exacerbated by limited enforcement of the restriction to extract groundwater for non-potable purposes. More detailed policies and stronger enforcement is needed for wastewater reuse projects to be viable (source).

If all goes as planned, Gujarat over the next decade will have an extensive network of deep-sea pipelines to discharge effluents from its seven industrial clusters—Ahmedabad, Vadodara, Ankleshwar, Surat, Vapi, Sarigam and Jetpur—into the Arabian Sea. Aiming to save the Sabarmati and other critically polluted rivers of the state, the Gujarat government informed the Vidhan Sabha in September 2023 that seven such deep-sea pipelines, also known as marine outfalls, are in various stages of planning and execution. The state's first such major pipeline was made operational in 2016 in Bharuch district—from Jhagadia industrial estate to the coastal village of Kantiyajal about 60 km away—which disperses treated effluents into the Gulf of Khambhat at a depth of 11 metres, 9.4 km from the shore.

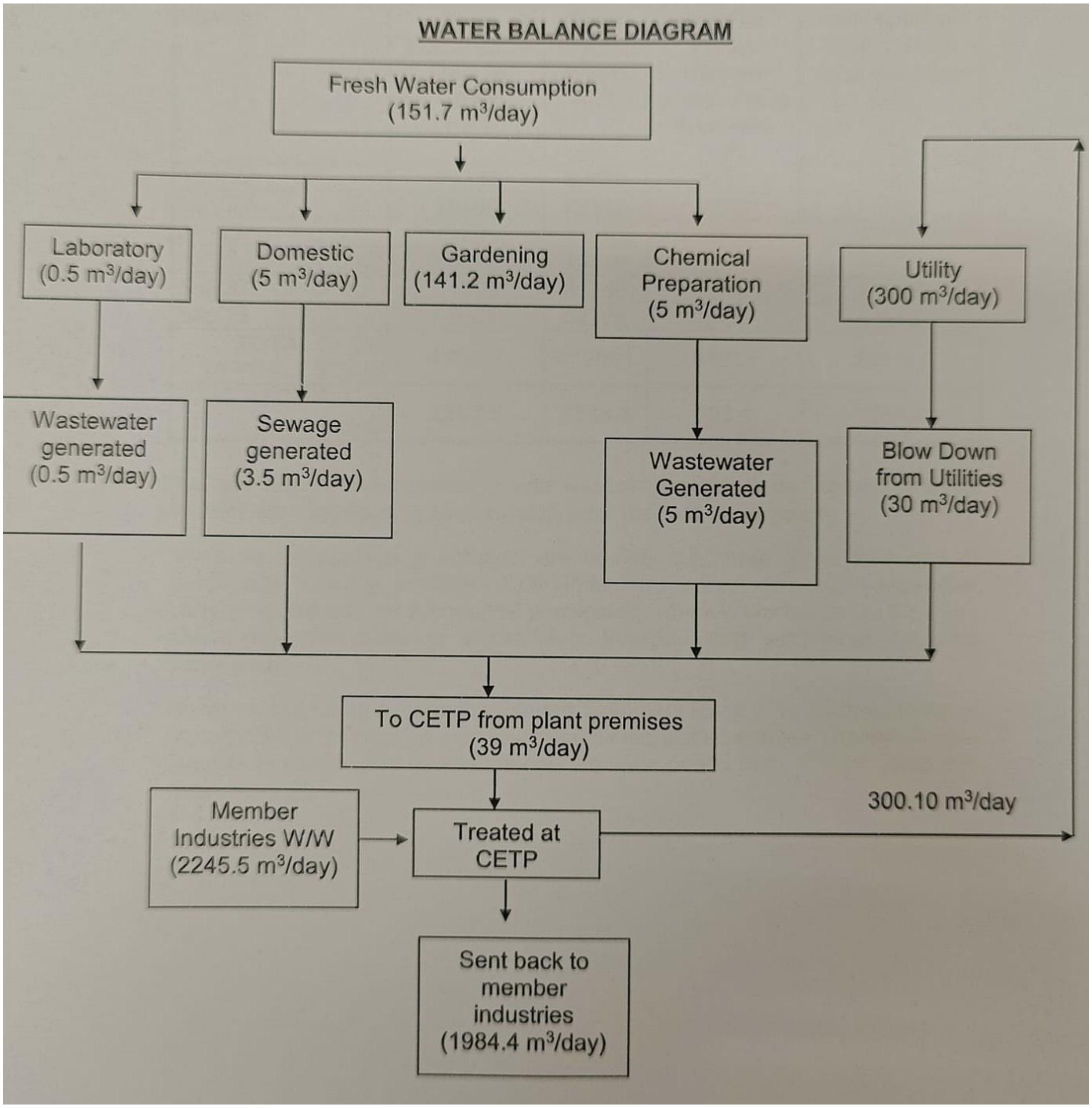
While the Rs 8,000 crore-plus project is expected to give rivers flowing through the state a new lease of life, **environmentalists have raised concern over its possible impact on marine ecosystems and coastal habitations**. Industries in Gujarat produce 575 million litres per day (MLD) of effluents. Of this, 60 MLD, or 11 per cent, is discharged directly into the sea, and the remaining 515 MLD, or 89 per cent, is let into various rivers and creeks.

Moreover, not being perennial, the Sabarmati and other rivers in Gujarat fail to dilute the industrial discharge. So, the industries in Gujarat, are left with two options: deep-sea discharge or zero liquid discharge. The latter process, wherein all water is recovered and contaminants reduced to solids, "is not financially viable for small- and medium-scale industries" so deep-sea discharge is the only solution currently being promoted in Gujarat.

Eventually, it all boils down to the effective working of CETPs, set up to help small- and medium-scale enterprises—which are unable to afford the installation of pollution-control equipment—dispose of the effluents safely and economically. Poor functioning and monitoring of CETPs and flouting of effluent treatment norms by industries are the precise reasons that the rivers in Gujarat are severely polluted. A 27-km-long pipeline, which discharged treated effluents from three industrial clusters around Ahmedabad into the Sabarmati, had to be shut down earlier this year, after the detection of illegal connections.

The revenue for the PP from the UWR RoU program would encourage similar high quality treatment alternatives for recycling and reusing wastewater for industrial units in the country and could possibly be an alternative to deep-sea discharge in Gujarat.

A.6. Design Specifications

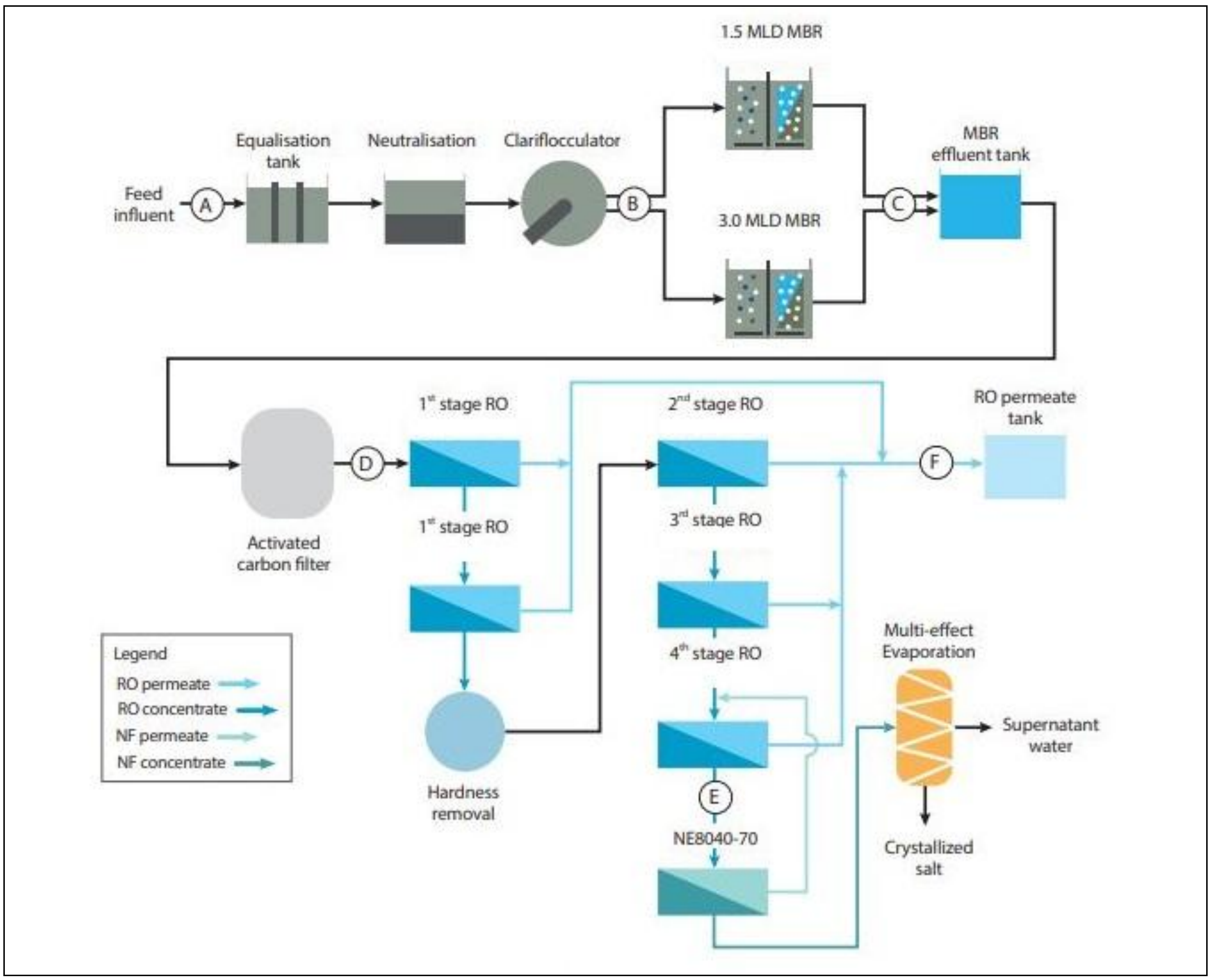


The CETP provides primary, secondary and tertiary wastewater treatment along with Multiple Effect Evaporator (MEE) technology. The recycled effluent is reused by the member units for captive industrial cooling/boiler purposes and is also used within the SEZ for gardening, horticulture and landscaping purposes.

Treatment Process

Description	Date of Operation	Consented Flow (Industrial+ Domestic +Inhouse) m^3/d	Actual Flow (m^3/d)
CETP	2009 (As per Audit Report)	3585	1790.5

Description	Wastewater From Member Units (m^3/d)			Wastewater generated from within the plant premise (m^3/d)	Total wastewater Flow to CETP (m^3/d)
Average Operating Load CETP	Low TDS Effluent	High TDS Effluent	Total	41.5	1790.5
Period: 2022-2023	1721.6	27.3	1748.9		



CETP Process Flow Chart

The wastewater received by the CETP involves the following treatment processes:

Primary Treatment Units:

Raw effluent from member units within the SEZ as well as leachate is transferred to equalization tanks where air is mixed and supplied to the effluent. The equalized effluent is then transferred to neutralization tanks where lime, alum and PAC (Polyaluminium Chloride) is added and the effluent is then transferred to the clarifloculator.

Secondary Treatment Units:

There are two types of secondary treatment units installed by the PP:

- ***Type 1: (Pre-air and MBR):*** Mixed effluent flows via gravity from the clarifloculator to the pre-aeration tank after passing through a fine screen where air is further supplied to the incoming effluent and recycled mixed liquor from the MBR for carbonaceous BOD reduction and conversion of ammonia to nitrates via nitrification. The partially stabilized mixed liquor from Pre-Aeration Basins is then pumped into the MBRs. The MBRs employ flat plate membranes, which provide several advantages over other membrane separation systems, including reduced fouling, reduced cleaning cycles and gravity operation capability. For each membrane unit in the MBR, integral diffusers furnish air to membrane cleaning and mixing requirements. The added air also supplements the oxygen supplied in the Pre-Aeration Basin for biological treatment. The part of the mixed liquor is recycled back to the Pre-Aeration Basins by gravity.

  The MBR is designed to produce permeate using pumps. Permeate is pumped from the membrane units via the permeate pumps. Permeate flow is controlled using modulating control valves and regulated to match hydraulic demand. Permeate is then sent to Advanced Separation System for further treatment. Membranes provide greater than 6-log removal of bacteria and 4-log removal of viruses, so disinfection requirements are greatly reduced from that required with conventional activated sludge technologies.

- ***Type 2 (PVA Gel & MBR***): The clarified effluent from Clarifier-2 is divided in two parts i.e. one part goes to the 0.75 MLD capacity pre air & MBR basin-2 system, while 1.5

MLD to PVA Gel & MBR system. PVA GEL Media is added to the aeration tank for improving the biological treatment and is used for BOD removal. The tank is known as aeration cum PVA GEL tank as the media is being added to it. The process is same that of aeration continuous air flow is required to maintain the bacterial growth but the benefit of the media is that it increases the surface area of the aeration tank and 1 m^3 of media can reduce 30 kg of BOD load hence lower construction footprint is required as compared with conventional system. The size of each PVA GEL bead is 4 mm in diameter and is insoluble in water. PVA GEL media has very high water content due to its extensive porosity which allows high permeability of oxygen and nutrients to bacteria colonized inside the beads. From the aeration cum PVA GEL tank effluent or sewage flows to the MBR tank with gravity. The purpose of MBR is to reduce the TSS load in the waste water and continuous aeration or air flow is required for its operation.

Tertiary Treatment Units

- Recycled wastewater effluent from the MBR basins is taken to sumps and then to MBR permeate tank. The effluent is then pumped to the RO system after passing through the activated carbon filter. The effluent from the final sump is taken to the fresh water sump without the RO systems only if the quality of the effluent meets the incoming water quality norms. The RO reject is taken to the Multiple-Effect Evaporator (MEE) which uses heat from steam to evaporate water.

  In the MEE (total installed capacity 150 m^3/day + 150 m^3/day standby), water is boiled in a sequence of vessels each held at a lower pressure than the last. Since the boiling point of water decreases as the pressure increase, only the first vessel requires an external source of heat. The concentrate from the MEE is taken to the equalization tank again for recycling while the condensate from the MEE and RO permeate is taken to an offline lagoon and the same is transferred to member units within the SEZ via a pipeline.

Further extraction of wastewater from RO TDS (offline lagoon)

Design Details of MEE:

Sr. No.	Description	Unit	Value
1.	Feed Quantity	m^3/d	150
2.	Initial Concentration		
	pH	-	6 - 8
3.	Steam Pressure Available	$kg/cm^2(g)$	4.5 - 6

Sr. No.	Description	Unit	Value
1.	Feed	-	--
2.	Feed rate	m^3/d	60
3.	Specific Gravity	-	1.045
4.	Operating hours	-	48
5.	Feed Rate	kg/h	2.6125
6.	Analytical Data (Design Basis)		
	TDS (Approx.)	%	30000-50000
7.	Concentrate Outlet (wet solid with 10-12% free moisture)	kg/h	5
UTILITY DATA			
8.	Motive Steam Pressure to MEE Plant	kg/cm^2 (g)	9

Primary Treatment

Pumps and Blowers:

Sr. No.	Name of Equipment	Nos.	Capacity (m^3/h)	Pressure/ Head (m)
1	Equalization Blower	4	750	0.40
2	Equalization Pump	8	70	10

Secondary Treatment

Blowers:

Sr. No.	Name of Equipment	Nos.	Capacity (m^3/h)	Pressure/ Head (m)
1	MBR Blower Aeration	16	750	0.40

Agitators:

Sr. No.	Name of Equipment	No.	RPM
1	Neutralization	3	1500

Secondary Sludge Recirculation Pump House:

Sr No	Name of Equipment	No.	RPM	KW
1	Recycle Pump	01	1440	3.0

Sludge Handling Facilities:

Sr. No.	Name of Equipment	Nos.	Capacity	HP
Pumps				
1	Decanter	02	250 kg/h	10

The PP has installed MBR modules which uses durable PVDF microfiltration flat-sheets with uniformly sized pores (0.08 µm) densely distributed along the membrane surface. This MBR provided the following benefits to the CETP:

- Enhanced fouling and chemical resistance;
- Elimination of a backwash process, simplifying maintenance and energy savings;
- Conversion from a suction pump to a gravity flow process further minimizing energy costs;
- Approximately 70% reduction in sludge.

Before the MBR process, PVA (polyvinyl alcohol) gels are added to the aeration tank to reduce the volume of sludge, improve MBR outlet parameters, and minimize system footprint

HIGH-RECOVERY RO/NF DESIGN

The MBR filtrate is chlorinated, treated by activated carbon, and dechlorinated before entering the RO system. Due to elevated levels of Chemical Oxygen Demand (COD) in the RO feed, the 1st-stage RO system uses "Durable" D-Family low-fouling RO membrane elements to combat membrane degradation and maintain performance for day-to-day operations and cleanings.

The RO membranes are designed to operate reliably under high salinity feedwater conditions, reduce the TDS content from 13,000 to 200 ppm in the 2nd-stage.

CSM membranes maximize water recovery by concentrating the brine from 75,000 ppm (4th-stage RO concentrate) to 92,000 ppm. Lastly, multi-effect evaporation crystallizes the salts and completing the ZLD process for a total water recovery of 97.1%.

The exponential increase of salt concentrations heightens the risk of membrane scaling within the high-recovery RO/NF system. As a result, the RO system is dosed with anti-scalants to prevent irreversible scaling, minimize system downtime, and optimize the membranes' recovery performance. Compared to the previously used anti-scalants, only half the dosage is required further contributing to cost savings for the CETP.

RCC offline pond

The PP has also constructed an RCC offline pond of capacity 5250 m^3 (retention time = 42 hrs.) to hold the wastewater effluent in case of either maintenance of the CETP or disturbances in CETP operations.

The project activity showcases **best-in-class wastewater treatment technologies that can replace the equivalent freshwater demand in different sectors for non-potable purposes, while reducing the proportion of untreated wastewater and substantially increasing recycling and safe reuse in India.**

Hence the project activity is pre-approved under the UWR RoU program for the following scope:

- *Scope 5: Conservation measures taken to recycle and/or reuse water, spent wash, wastewater etc across or within specific industrial processes and systems, including wastewater recycled/ reused in a different process, but within the same site or location of the project activity. Recycled wastewater used in off-site landscaping, gardening or tree plantations/forests activity are also eligible under this UWR Scope.*

Cooling towers within the SEZ, are an essential component in the industrial processes, however, recycling cooling tower water improperly can have a significant impact on the environment if not treated properly.

The effluent from cooling towers is often contaminated with suspended solids, dissolved solids, and microorganisms, which must be removed before discharge or recycling within the processes.

A.7. Implementation Benefits to Water Security and/or SDG Impact

Access to safe water, sanitation and hygiene is the most basic human need for health and well-being. Billions of people will lack access to these basic services in 2030 unless progress quadruples. Demand for water is rising owing to rapid population growth, urbanization and increasing water needs from agriculture, industry, and energy sectors.

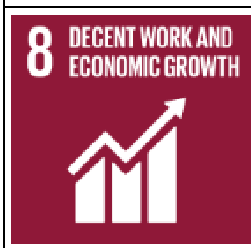
Several states in India are water stressed 54% of India faces High to extremely high water stress and 54% of ground water wells are decreasing (source WRI). The report also says that there would be no ground water for irrigation by 2025 in Delhi, Rajasthan and Haryana. UNESCO Report says India holds the number 1 spot for the annual Ground water extraction at 251 cu.km as against 112 cu.km in China and USA, a distant second. Competing demands for water from agriculture and domestic use has limited industrial growth (source).

Based on the calculations provided, 100% treated wastewater generated from ~5 MLD CETP is reused for irrigation purposes and 100% treated wastewater is reused - 53% treated water sent to individual industrial units, 13% sent to Common Utility (Cooling Tower + Boiler + Washing) and the balance 34% treated water is sent for garden applications and other utility purposes. Therefore it is demonstrated that there has been more than 15% increase in reuse of treated wastewater generated in the city, with 2010 as base year.

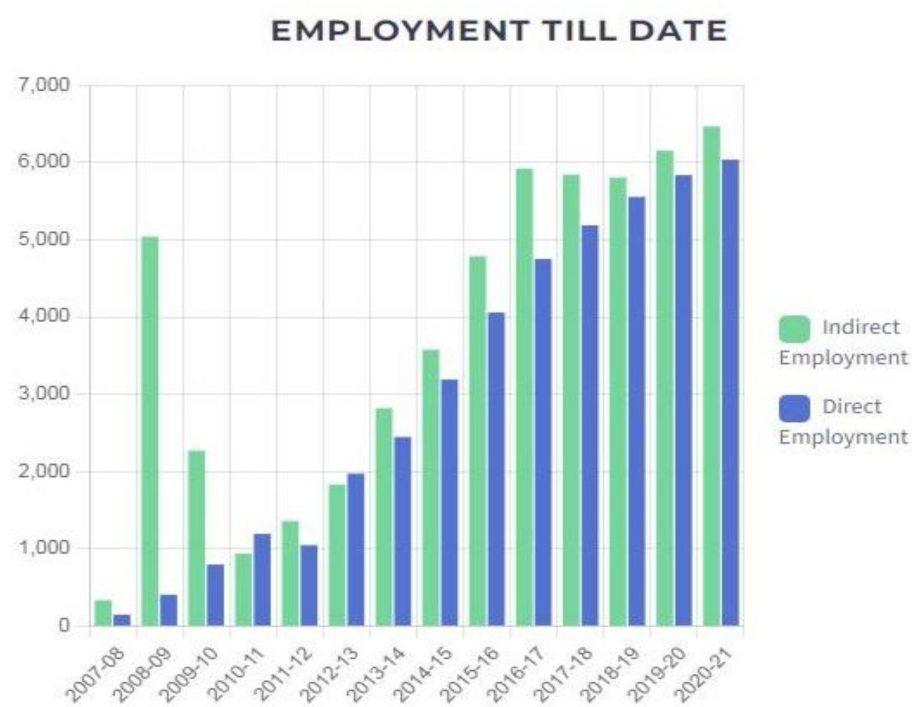
At present Ministry of Textiles provides 50% grants towards ZLD CETP up to a ceiling limit of 75 crores under the Integrated Processing Development Scheme (IPDS). The earlier MoEF scheme for CETPs is not available any more. Ministry of Commerce under the Assistance to States for Infrastructure Development of Exports (ASIDE) scheme provides for CETPs including ZLD. However, there seems to be no funding support for individual ETPs/ industry. Therefore, the UWR water credits incentive model can provide fiscal support via the voluntary water offset and footprint market.

Sustainable Development Goals Targeted	Most relevant SDG Target/Impact	Indicator (SDG Indicator)
	13.2: Integrate climate change measures into national policies, strategies and planning	Recycling and reusing wastewater is an effective solution for climate change adaptation because it helps mitigate the impacts of droughts, floods, and other extreme weather events that are becoming increasingly common due to climate change. The

13 Climate Action (mandatory)		quantity of wastewater recycled and reused by the PP is the SDG indicator.
1 - End poverty in all its forms everywhere	1.4: By 2030, ensure that all men and women, in particular the poor and the vulnerable, have equal rights to economic resources, as well as access to basic services, ownership and control over land and <u>other forms of property, inheritance, natural resources</u>, appropriate new technology and financial services, including microfinance	The PP prevents unequal distribution of natural groundwater resources- which prevents <u>poverty of natural economic resources</u> (groundwater). The PP ensures that the citizens of Ahmedabad get a chance to preserve their natural groundwater resources for future generations since PP recycling and reusing wastewater for gardening and captive processes, which is currently unutilized by the local industry. The PP could have alternately dug fresh borewells or used existing drinking water sources for their captive water and gardening requirements.
3 – Ensure healthy lives and promote well-being for all at all ages	3.9: By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination	The PP showcases how recycling and reusing wastewater can prevent depletion of natural water reserves and prevent water scarcity during droughts. The PP ensures water availability in water-scarce zones that help promotes healthy lives and well-being.
7- Ensure access to affordable, reliable, sustainable and modern energy for all	7.a by 2030 enhance international cooperation to facilitate access to clean energy research and technologies, including renewable energy, energy efficiency, and advanced and cleaner fossil fuel technologies, and promote investment in energy infrastructure and clean energy technologies	The PP facilitate access to clean energy research and technology and promotes investment in energy infrastructure and clean energy technologies related to water and wastewater treatment.

 11-Make cities and human settlements inclusive, safe, resilient and sustainable	11.A**:** Support positive economic, social and environmental links between urban, peri-urban and rural areas by strengthening national and regional development planning	The PP enhancing inclusive and sustainable urbanization via the project activity.
 **6-**Ensure access to water and sanitation for all	6.3: By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally	The PP has showcased recycling and safe reuse of **4657 million litres** within the industry during this monitored period.
 8 – Promote inclusive and sustainable economic growth, employment and decent work for all	8.5: By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value 8.6 By 2020, substantially reduce the proportion of youth not in employment, education or training	Number of jobs created by the CETP: Number of people trained: 88

17 PARTNERSHIPS FOR THE GOALS 17 – Strengthen the means of implementation and revitalize the global partnership for sustainable development	17.7: Promote the development, transfer, dissemination and diffusion of environmentally sound technologies to developing countries on favourable terms including on concessional and preferential terms, as mutually agreed	PP will monetize the water credits via the virtual water footprint market internationally.



Several states in India are water stressed 54% of India faces High to extremely high water stress and 54% of ground water wells are decreasing– WRI. The report also says that there would be no ground water for irrigation by 2025 in Delhi, Rajasthan and Haryana. UNESCO Report says India holds the number 1 spot for the annual Ground water extraction at 251 cu.Km as against 112 cu.km in China and USA, a distant second. c. Competing demands for water from agriculture and domestic use has limited industrial growth.

Decades of misuse, poor management, over extraction of groundwater and contamination of freshwater supplies have exacerbated water stress worldwide. In addition, countries are facing growing challenges linked to degraded water-related ecosystems, water scarcity caused by climate change, underinvestment in water and sanitation and insufficient cooperation on trans boundary waters.

The project activity also encourages companies, especially large and transnational companies in the biotechnology and biopharmaceuticals sector, to adopt similar sustainable practices in regards to captive water requirements and groundwater management.

A.7.1 Objectives or Outcomes

The impact assessment or objectives of this project activity can generally be enumerated as follows:

- The project activity highlights the catalytic role that corporate India must play in reducing industrial water consumption as well as water pollution per unit of industrial output.

- The PP has showcased technology that **creates industrial grade water from an effluent source and has overcome the challenges faced by the alternate methods implemented and/or being proposed for the same.**

- The PP has showcased the successful wastewater treatment of industrial effluent, thus saving millions of litres of safe drinking water for the city dwellers from existing resources.

- The project activity showcases best-in-class wastewater treatment technology that can replace the equivalent freshwater and industrial demand in different sectors for non-potable purposes while reducing the proportion of untreated wastewater and substantially increasing recycling and safe reuse in India.

A.7.2 Interventions by Project Owner / Proponent / UCR Member

The National Guidelines on Zero Liquid Discharge developed by CPCB, India, for industrial sectors highlights the zero effluent discharge norms. The CGWB Master Plan for Artificial Recharge to Ground Water in India, 2013 emphasizes careful monitoring for regarding the treated urban wastewater in order to avoid any possibility of contamination of ground water. The Prime Minister's Krishi Sinchayi Yojana emphasises exploring the feasibility of reusing treated municipal used water for peri-urban agriculture. The vision expressed in the National Framework on the Safe Reuse of Treated Water, 2021 is – "widespread and safe reuse of treated used water in India that reduces the pressure on scarce freshwater resources, reduces pollution of the environment and risks to public health, and achieves socio-economic benefits by adopting a sustainable circular economy approach" (MoJS, 2020) and accordingly requisite recommendations are made in the framework. The intervention by the PP meets the National Framework on the Safe Reuse of Treated Water, 2021 guidelines.

The project activity hence achieves the sustainable management and efficient use of India's natural resources since the PP had the option to install bore wells that would have depleted the local groundwater resources and/or continued to use existing drinking water resources in the surrounding area. The PP has instead intervened and chosen to treat and reuse ETP effluent voluntarily at significant costs, thus saving millions of liters of safe drinking water for the city.

Increase in population density and improvement in quality of life has resulted in an increase in demand of natural resources like water. Groundwater being the major source of water supply catering to about 85% of rural water supply, the stress on groundwater is ever increasing. It has resulted in over-exploitation of the resources at places. The situation demands for a reorientation of the strategy for its development and management.

The intervention of the PP has had a direct impact on the water security of the area. Over-development of the ground water resources results in declining ground water levels, shortage in water supply, intrusion of saline water in coastal areas and increased pumping lifts necessitating deepening of ground water structures and increase in power costs.

Based on the calculations provided, 100% treated wastewater generated from ~5 MLD CETP is reused for industrial purposes and 100% treated wastewater is reused - 53% treated water sent to individual industrial units, 13% sent to Common Utility (Cooling Tower + Boiler + Washing) and the balance 34% treated water is sent for garden applications and other landscaping purposes. Therefore it is demonstrated that there has been more than 15% increase in reuse of treated wastewater generated in the city, with 2010 as base year.

A.8. Feasibility Evaluation

The installed CETP and recycling systems by the PP are robust and can handle wastewater effluent fluctuations in load easily.

A.9. Ecological Aspects:

The project activity achieves the sustainable management and efficient use of India's natural resources since the PP had the option to install bore wells that would have depleted the local groundwater resources and/or continued to use existing drinking water resources in the surrounding area. The PP has instead chosen to treat and reuse the CETP effluent, thus saving millions of liters of safe drinking water for the city.

The project activity also encourages companies, especially large and transnational companies in the biotechnology and pharmaceuticals sector, to adopt similar sustainable practices in regards to captive water requirements and groundwater management.

The effluent generated from domestic and utilities is treated in the CETP. Impervious flooring is done in CETP area to avoid any type of leakage that can be percolated into the surrounding soil.

Ecological Issues addressed by the project activity in terms of	
Inundation of habitated land	The project does not lead to inundation of residential land.
Creation of water logging and vector disease prevention mitigation	The CETP effluent is zero discharge plant. Impervious flooring is done in CETP area to avoid any type of leakage that can be percolated into the surrounding soil.
Deterioration of quality of groundwater	By avoiding the use of borewells the project activity does not deplete aquifers and hence prevents the depletion of groundwater resources.

A.10. Recharge Aspects :

Hydro geological setup indicates that alluvium forms a slightly better potential aquifer in Zydus and surrounding area. Number of individuals‟ bore wells is yielding in house and used for domestic purpose, same as in cultivated land also. In the studied area Narmada irrigation canal water supply system spread all over the area. As the slope is low, runoff becomes less and as a result the seep rate increases as per flat topographical condition of the area, water seeps through top brown yellow clay mixed sandy soil with few silt, below that kankar concentration /yellow sticky non permeable clay/silt with gravel/ sand at depth below ground level and lowering of casing (blind & slotted) up to drilled depth.

As per collected inventory quality of ground water is good at Kavitha, Moraiya & Chacharvadi Vasna; while slightly saline at Changodar, Modasar, Moti Devti, Bhat, Bavla, Sanand, Pipan &

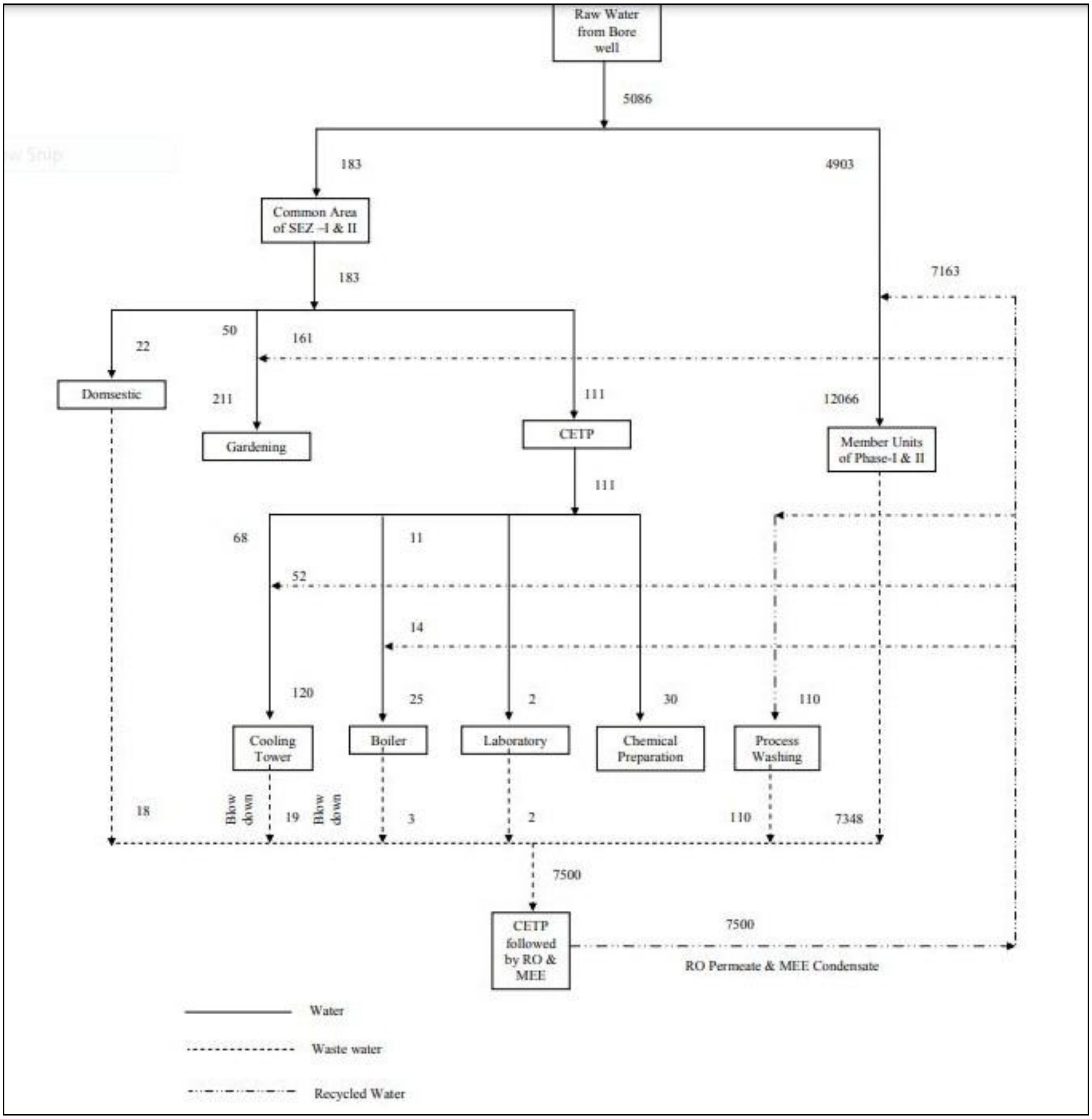
villagers are using it for domestic utilization. At Bavla, Sanand & Piapan bore well water gets mixed with Narmada water pipe line in underground/overhead tank before it is supplied to village.

A.10.1 Solving for Recharge

Water Budget Component	Typical Estimated Uncertainty (%)	Description
Surface Inflow	NA	The total quantity of treated CETP wastewater is measured via flow meters and recorded daily.
Precipitation	NA	NA
Surface Outflow	NA	NA.
Evapotranspiration	NA	NA
Deep Percolation	NA	NA

A.11. Quantification Tools

As regards Water Flow Distribution Diagram, the PP has installed SCADA (Supervisory Control and Data Acquisition) to monitor and control water usage in real time. Through SCADA, water is metered at all stages of its processing and distribution. The PP has submitted a detailed narrative on Water Flow Distribution. At the Over-head tank of the project boundary, water is metered when it is taken from over-head tank to the CETP, where it is metered and stored for various non potable purposes, after which it is distributed to individual industries for their use.



The water is distributed to industries by tankers that fill water from the CETP. These tankers deliver water for supply to individual units. After the required consumption of water by each industry, all industries are required to treat their sewage water following the guidelines to dispose waste water. This partially treated water is collected in tankers and brought to CETP for further treatment. Water is metered through the entire process mentioned above to ensure waste water treatment. At CETP, wastewater is metered at every stage of processing. After proper treatment of the wastewater it is distributed back to industries, or used for landscape maintenance and cooling tower. Wastewater is metered through-out the entire distribution process while any remaining wastewater is used to irrigate the landscaped areas, other miscellaneous purposes within the project boundary.

Baseline scenario

The baseline scenario is the situation where, in the absence of the project activity, the PP would have **one or all** of the below options:

- (a) installed multiple bore wells within the project boundary which would have depleted the local groundwater resources (aquifers); ***and/or***
- (b) diverted existing safe drinking water resources from the surrounding residential area; **and/or**
- *(c) discharged the CETP effluent without further treatment, recycling and reuse.*

Hence the baseline scenario applicable is:

"the net quantity of treated CETP effluent / wastewater that would be discharged directly into the local drain/sewer without further being recycled and/or reused daily post treatment per year"

The net quantity of treated water used is measured via flow meters installed at the site.

(Figures in KL)

Year	Raw Water	Effluent	Recycled Quantity supplied to Member unit	Recycled Quantity reused by ZIPL	Treatment Process Loss
2014	423816	174032	54635	112349	7048
2015	455050	237720	78448	148456	10816
2016	581547	327660	87976	224448	15236
2017	626369	425660	106556	302290	16814
2018	670358	511260	193703	294295	23262
2019	946139	648066	157695	464124	26247
2020	971686	622886	190469	400961	31456
2021	764953	662333	183806	446404	32123
2022	988090	648610	178591	444399	25620
2023 till Nov'23	915960	620271	169738	417969	32564
Total	**73,43,968**	**48,78,498**	**14,01,617**	**32,55,694**	**221187**

Quantification

Year	Total RoUs (1000 litres) /yr UWR Cap (1 Million RoUs/yr)
2014	166984
2015	226904
2016	312424
2017	408846
2018	487998
2019	621819
2020	591430
2021	630210
2022	622990
01/01/2023 till 30/11/2023	587707
Total	4657311

A.12. UWR Rainwater Offset Do No Net Harm Principles

Since the project activity falls under Area Development clause No.8 (b) of category “B1” as stated in Environment Impact Assessment Notification published on 14th September 2006 & its amendments and hence the PP is required has to obtain the Environmental Clearance from SEIAA, Gujarat.

The PP has obtained membership of

- TSDF site of Nandesari Environment Control Limited for disposal of ETP sludge and MEE/Decanter salts wide letter no. 922 dated 24.11.2014 for 50 MT quantity.

- Provisional membership certificate no. ECIPL/TSDF/001 dated 06-04-2016 is issued by Eco-care Infrastructure Private Limited.

The quantity of waste (CETP sludge + MEE/ decanter salts) for land filling is 385 MT/Year. Designated area of 15 m x 10 m is provided for storage of solid waste. The area is having pucca flooring and leachate collection system. Leachate is sent back to CETP for treatment.

The project activity is located in notified industrial area hence no displacement of population has taken place. There is no protected area notified under the Wild Life (Protection) Act (1972) &

Eco-sensitive area notified under Section 3 of the Environment (Protection) Act- 1986 within 10 km radius areas from the project boundary.

According to the UWR RoU Standard principles, the project activity accomplishes the following:

• *Increases the sustainable water yield in areas where over development has depleted the aquifer*
According to the data released by the Central Groundwater Board in 2021, the total amount of groundwater that can be utilised in India in a year is 398 billion cubic meters (BCM), of which, approximately 245 BCM is currently being utilised, which is about 62 per cent of the total. But the level of exploitation of groundwater is very high in States like Punjab, Rajasthan, Haryana, Delhi and Tamil Nadu. This project activity was commissioned in 2012, and the PP has reduced the proportion of untreated wastewater that future generations would need to recycle and has showcased recycling and safe reuse within the industry from unutilized water resources. Revenue from the sale of UWR RoUs will enable scaling up of such project activities.
• *Collect unutilized water or rainwater and preserve it for future use*
In India, at the district level, in 24 states/UTs, as many as 267 districts had stages of groundwater extraction more than 63 per cent, ranging from 64 per cent to 385 per cent (source: https://www.business-standard.com/article/current-affairs/from-58-to-63-india-pumped-more-groundwater-between-2004-and-2017-121122101377_1.html). This project activity serves as an example to recycle and reuse wastewater and encourages companies, especially large and transnational companies in the biotechnology and pharmaceuticals sector, to adopt similar sustainable practices in regards to captive water requirements and groundwater management.
• *Conserve and store excess water for future use*
The project activity decreases the dependence on groundwater, thereby preventing excessive depletion. Between 2014 and 2023, the project activity has reused **4657 million litres** of CETP effluent successfully post treatment with gainful end use of the same.

Ecological and Environmental Sensitivity (Within 10 Km):- WLS-Wild Life Species; NPA-Notified Protected Area; ESAs-Eco Sensitive Areas; ESZs-Eco Sensitive Zones			
S. No.	**Details of Ecological Sensitivity**	**Name**	**Distance from the Project (Km)**
(1.)	ESAs	none	0
(2.)	Critically Polluted Area	none	0
(3.)	NPA	none	0

(4.)	Corridors	none	0
(5.)	ESZs	none	0
(6.)	WLS	Nal Sarovar Bird Sanctuary	36.7
(7.)	Wildlife Corridors	none	0

Notification	Date
FORMAL APPROVAL BY BOA, NEW DELHI:	21/06/2006
NOTIFICATION GOI New Delhi :	28/09/2006
PERMISSION FROM GUJARAT GROUND WATER AUTHORITY, GoG, Gandhinagar	05/09/2006
N.O.C. FROM G.P.C.B. Gandhinagar	14/09/2006
DEMARCATION OF AREAS by DEVELOPMENT COMMISSIONER KASEZ	06/11/2006
AUTHORISED OPERATIONS, Director, SEZ, New Delhi :	13/02/2007
Addition of 1.4585 hectares land	06/10/2016
Addition of 64.4823 hectares land in PHASE-II	04/09/2017

A.13. Scaling Projects

The AMC had disconnected 33 drainage lines that pumped untreated waste into domestic sewage lines of the city Nov 23, 2021,
Ahmedabad Municipal Corporation (AMC)

While cities in India are facing water supply and demand issues, India's water sources – groundwater, rivers and other water bodies – are facing contamination from domestic and industrial pollution leading to deteriorating water quality. Direct disposal of untreated wastewater and fecal sludge into the open, increases the burden of cities to provide drinking water supply to its residents.

The Central Pollution Control Board (CPCB) in 2018 identified 20 polluted river stretches in Gujarat, of which five—Sabarmati, Bhadar, Bhogavo, Amlakhadi and Vishwamitri—are classified as 'critically polluted'.

The pollution in the Sabarmati in Ahmedabad and Mahi near Vadodara has, in particular, become unbearable due to its detrimental impact on aquatic life and the lingering stench. Untreated and illegal discharge of industrial wastewater and domestic sewage into these non-perennial rivers has been identified as the root cause.

According to the Comprehensive Environment Pollution Index (CEPI), the industrial clusters of Vatva and Narol in Ahmedabad, Ankleshwar in central Gujarat and Vapi in south Gujarat have been among the ‘critically polluted areas’ since 2018—leading to a CPCB moratorium on any expansion in these clusters.

Looking for a solution at the time, representatives of multiple industrial estates had urged the government to construct a network of marine outfalls in the state. This is because the norms for effluent discharge into the deep sea are relaxed in comparison to those for rivers, thus reducing the cost of treatment.

Take, for instance, the permissible limit for biochemical oxygen demand (BOD) and chemical oxygen demand (COD)—both used to determine the amount of organic pollution in liquid waste. While the CPCB mandates a maximum BOD of 30 milligrams per litre and COD of 250 mg per litre in the case of treated effluents being discharged into rivers, the norms have been relaxed to 100 mg and 500 mg, respectively, when it comes to deep-sea discharge.

The Central Pollution Control Board (CPCB) has identified 351 polluted river stretches on 323 rivers across the country that do not meet the water quality criteria. According to CPCB’s national inventory of Sewage Treatment Plants (STP) published in March 2021, urban India treats only 37 per cent of the 72,368 million liters of sewage generated every day, with about two-thirds of the wastewater ending up polluting the environment.

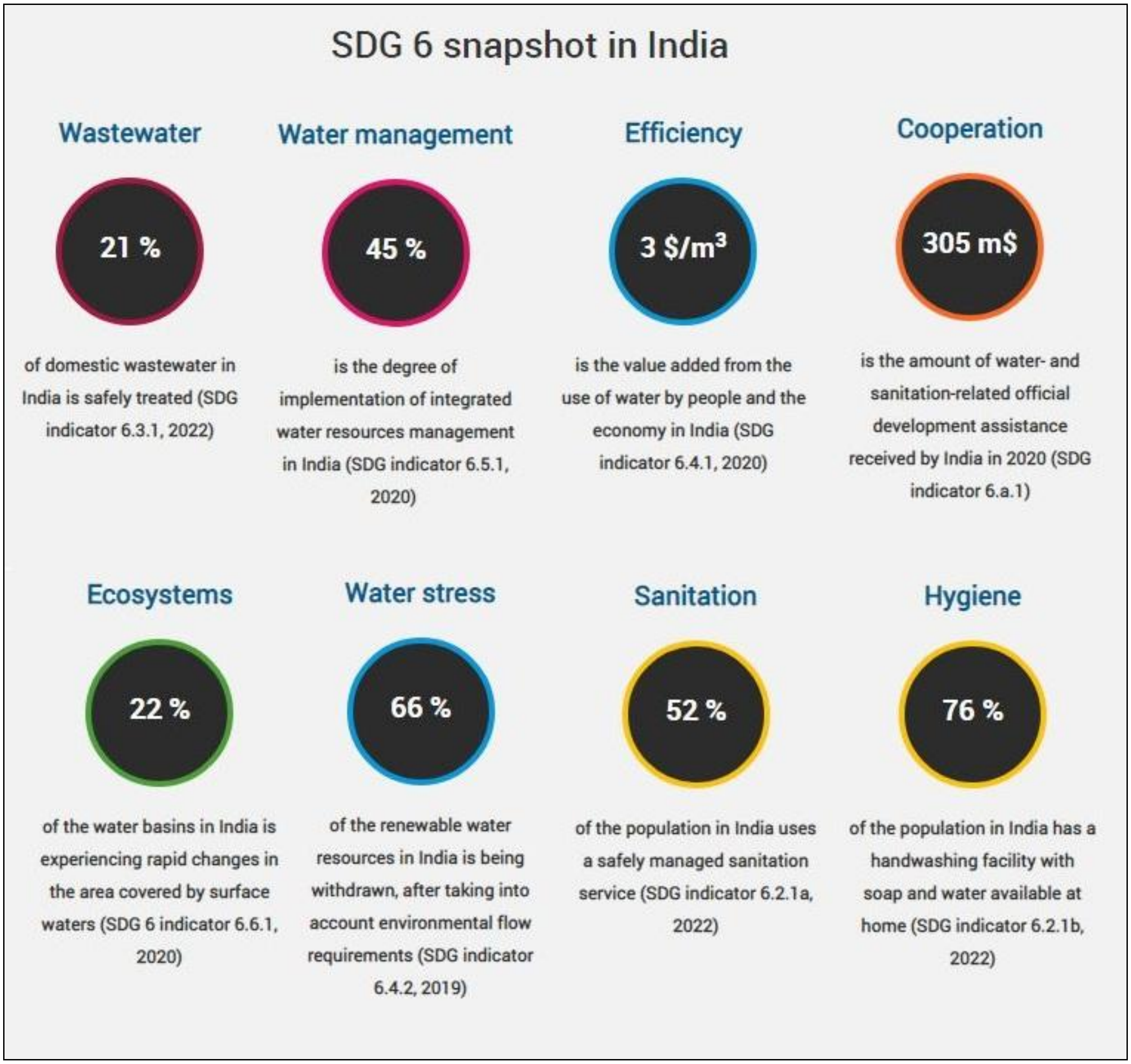
If India could implement 100 percent treatment and reuse of treated wastewater and fecal sludge from Indian cities by 2025, it can potentially meet over 70 percent of water requirement of industry and energy sector and irrigate 2 to 6 million hectares of land annually while yielding benefits from reduced fertilizer usage. Nutrient recovery from wastewater can yield up to 4,000 to 5,500 tons per day which can meet the demand for integrated nutrient management for about 400,000 ha of farmland annually. Reuse of wastewater in agriculture has the potential to reduce greenhouse gas emissions by over 2 million tons of CO_{2e} annually through decreased groundwater pumping and replacing chemical fertilizer (source: *https://timesofindia.indiatimes.com/blogs/voices/wastewater-and-faecal-sludge-reuse-to-address-indias-water-and-food-security/?source=app&frmapp=yes*)

While several studies highlight the potential of various water–demand management interventions (*Chakraborti, Kaur, and Kaur 2019*), one area that researchers have begun to explore only of late is the reuse of treated wastewater (*Goyal and Kumar 2022*). It is receiving increasing traction given that India generates about **72,368 million litres of wastewater per day** in urban areas alone (CPCB 2021); if treated (to the desired quality standard) and reused, this offers tremendous potential in addressing the water supply and demand gap on one hand and reducing the pressure on freshwater resources on the other.

However, the reuse and recycling of treated wastewater has still not become mainstream in India. Only a few Indian states have framed policies and guidelines to promote the reuse of TWW (Goyal and Kumar 2022). Further, a national-level framework on the safe reuse of treated water that provides guidelines on preparing reuse policies was launched only as recently as January 2023. Therefore, the existing state policies might also require a thorough revision to make them comprehensive and channel the financial and technical support available through national programmes, such as the Atal Mission for Rejuvenation and Urban Transformation (AMRUT) and Namami Gange. While the augmentation and rehabilitation of the existing sewerage systems and recycling of water for beneficial purposes, including the reuse of TWW, are important components of AMRUT, creating additional sewerage treatment capacity in the states sharing the Ganga river basin is a priority under the Namami Gange programme.

In the developing world, cities in Brazil, Mexico, Kuwait, and India have constructed or are planning projects, for potable water reuse. Their possibilities to succeed are limited as projects would have to be implemented within regulatory, institutional, governance, management, financial and technological frameworks that are robust and promote innovation, and utilities would have to ensure technical, managerial and financial capacities in the long-term. A serious limitation is that water management in general, and collection and conventional treatment of municipal and industrial wastewater in particular, are still challenging; often water quality standards and monitoring are poorly enforced, and risk assessment frameworks are lacking. Irrespective of how important potable water reuse is for clean water and sanitation goals at local, regional and national levels, challenges remain for its extended implementation.

Revenue from water credits (RoUs) provides a much needed incentive to encourage voluntary treatment and reuse of similar ETP effluents across industries, enabling them to be built at the scale and speed demanded by the present climate and global heating crisis.


SDG 6 snapshot in India
Wastewater
21 %
of domestic wastewater in India is safely treated (SDG indicator 6.3.1, 2022)
Water management
45 %
is the degree of implementation of integrated water resources management in India (SDG indicator 6.5.1, 2020)
Efficiency
3 $/m³
is the value added from the use of water by people and the economy in India (SDG indicator 6.4.1, 2020)
Cooperation
305 m$
is the amount of water- and sanitation-related official development assistance received by India in 2020 (SDG indicator 6.a.1)
Ecosystems
22 %
of the water basins in India is experiencing rapid changes in the area covered by surface waters (SDG 6 indicator 6.6.1, 2020)
Water stress
66 %
of the renewable water resources in India is being withdrawn, after taking into account environmental flow requirements (SDG indicator 6.4.2, 2019)
Sanitation
52 %
of the population in India uses a safely managed sanitation service (SDG indicator 6.2.1a, 2022)
Hygiene
76 %
of the population in India has a handwashing facility with soap and water available at home (SDG indicator 6.2.1b, 2022)

Source

Appendix 1

Human Development Index (HDI) Ranking

From the 2020 Human Development Report

India

-	Rank	Country	HDI value (2019)	Life expectancy at birth (years) SDG3	Expected years of schooling (years) SDG 4.3	Mean years of schooling (years) SDG 4.6	Gross national income (GNI) per capita (PPP $) SDG 8.5
	131	India	0.645	69.7	12.2	6.5	6,681

Source: **Human Development Report Office 2020.** • Created with **Datawrapper**