



# Action Plan for Damanganga River



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U.T. Administration of Daman & Diu

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# 1. Introduction:

The Damanganga River originates from Sahyadri Hills near Valveri village in Nasik district of Maharashtra. The river flows a distance of ~131.30 km from East to West along with its tributaries and passing through the hilly areas of Maharashtra, Gujarat and Union Territories (UT) of Dadra & Nagar Haveli (DNH) and Daman & Diu (DD) before draining into the Arabian Sea. The river basin is situated in the Western Ghats region between 19°51' to 20°28'N latitude and 72°50' to 73°38'E longitude. The Madhuban Dam, constructed on the upstream of the river in Gujarat state is the major water resource. The stretch of the river from Madhuban Dam upto its confluence with the Arabian sea is ~41.56 km. Large, medium and small scale industries are located along the stretch of the river in the industrial cluster of Dadra & Nagar Haveli, Vapi (Gujarat) and Daman. Domestic wastewater from the catchment area is also discharged into the river.

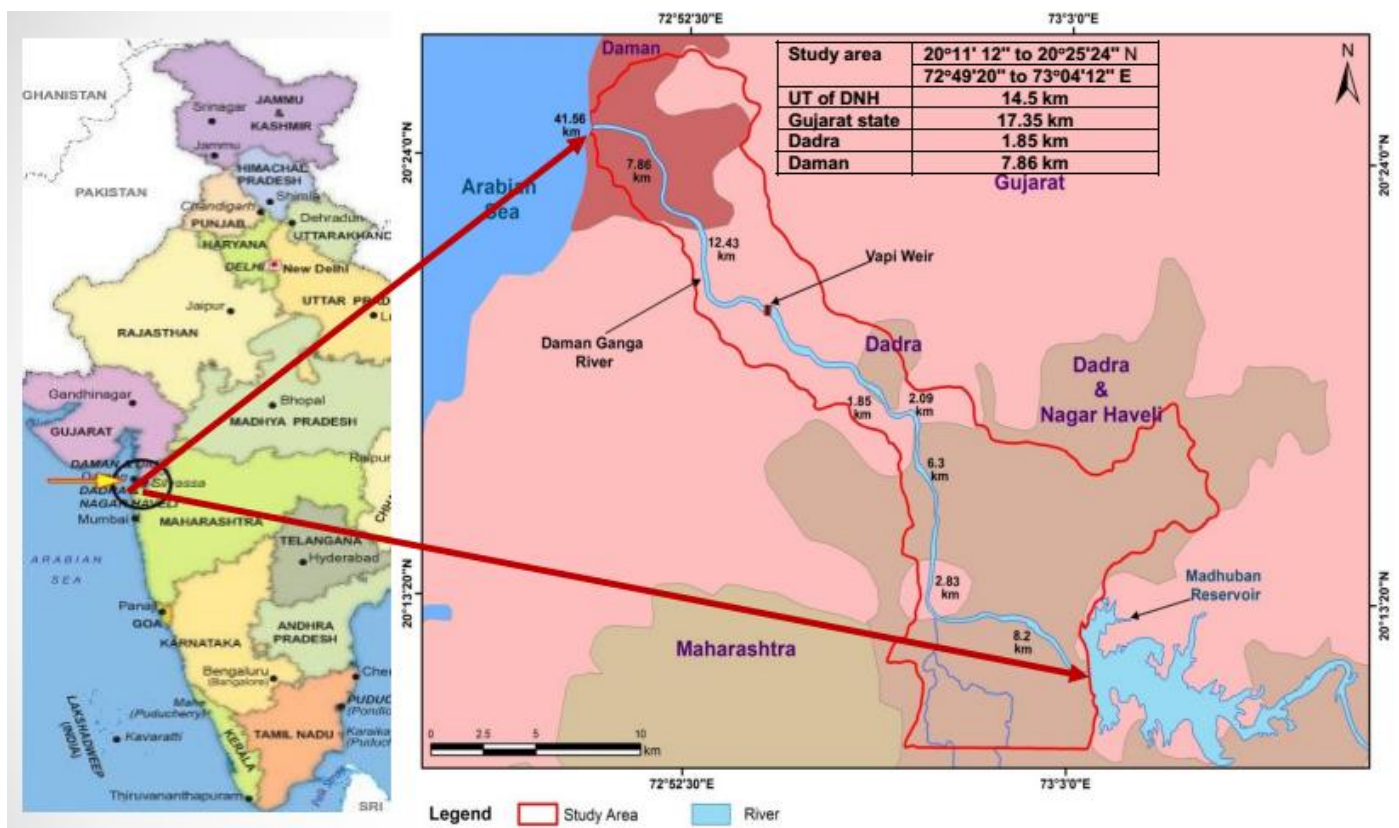


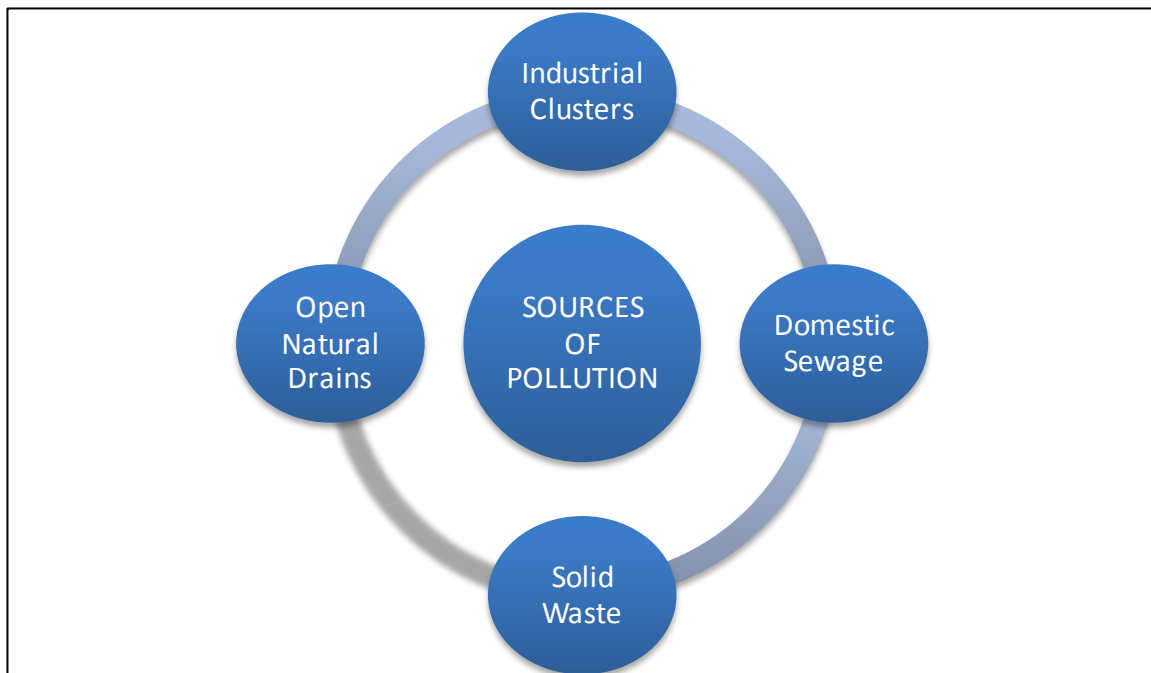
Fig 1: Location of River Damanganga

The level of pollution in the river is of major concern from the point of view of healthy flow of stream and the flora and fauna supported by the river. The major sources of wastewater discharges into Damanganga River through various drains include the disposal of industrial effluents from the industrial units/clusters in DNH, Vapi (Gujarat), and Daman as well as domestic sewage from towns/cities and settlements along the bank of the river. The major industrial effluents discharged into river and its estuary are from the Common Effluent Treatment Plant (CETP) of the GIDC, Vapi and Gujarat Heavy Chemicals Limited (GHCL), Bhilad. The treated effluent from CETP, Vapi is discharged into the river, downstream of the check dam constructed on the river at Vapi. The river water downstream of CETP, Vapi discharge location is highly coloured, an indicator of severe pollution, which persists till the confluence of the river with Arabian sea.

The UT Administration of Daman, Diu and Dadra & Nagar Haveli through CSIR National Environmental Engineering Research Institute (CSIR-NEERI), Nagpur conducted a study on the pollution status of Damanganga River for the river stretch of ~42 km starting from Madhuban Dam to its confluence with Arabian Sea at Daman and prepare a feasibility report for delineating pollution abatement strategies for rejuvenation of the river. This action plan is prepared largely on the base of NEERI report and the monitoring carried out by the PCC subsequently from time to time.

## 2. Identifying Issues:

The major source of wastewater discharged into River Damanganga is through various drains including the disposal of industrial effluents from the industrial units / clusters in Dadra Nagar Haveli, Gujarat Industrial Development Corporation (GIDC), Vapi and Daman as well as untreated domestic sewage from the towns/ cities and settlements along with the bank of the river.



**Fig. 2 : Major Sources of Pollution of River Damanganga**

The major industrial effluents discharged into river Damanganga and its estuary are the Common Effluent Treatment Plant (CETP), Vapi, Gujarat; and Gujarat Heavy Chemical Limited (GHCL), Bhilad, Gujarat. There was a discharge of industrial effluent from Khemani Distilleries Pvt. Ltd., Kachigam, Daman, which was discontinued and the pipeline was removed from the river. In addition to this, they have upgraded and installed a Zero Liquid Discharge (ZLD) system, hence there is no discharge from their plant into Damanganga River now.

It is widely observed that the river water downstream of the CETP, Vapi discharge location has a high colour intensity that persists further downstream till the confluence of the river with Arabian Sea. Dumping of solid waste on the bank of river and nearby open natural drains (which ultimately meet the river) is also a major problem.

### 3. Municipal Sewage Generation and Treatment:

Much of the water quality deterioration is caused by disposal of sewage from the townships of Silvassa (DNH), Vapi (Gujarat), Daman and nearby settlements of the River Damanganga. The domestic wastewater generated from the towns is disposed directly into the river, without any treatment. But, it is of particular importance that in the above mentioned townships, projects on establishment of sewage treatment plants are under process. Once established, they will considerably decrease the prevalence of major pollutants which are presently being dumped into the River untreated.

**Table 1: Status of STPs near River Damanganga**

Sr. No	District/Town	Total Sewage Generation	Details of Sewage Treatment Plant
1	Dadra Nagar Haveli (DNH)	-	13 MLD near River Damanganga is under construction
2	Vapi, Gujarat (Vapi Nagarpalika)	-	1. Capacity - 14 MLD. Under Construction at Namdha village, will be completed by December, 2019. 2. Capacity - 29 MLD. Under planning stage (Land allotment issue)
3	GIDC Notified Area	-	1. Capacity – 10 MLD 2. Capacity – 05 MLD Both are under planning stage and have land allotment issue.
3	Daman, Daman Municipal Council	7.5 MLD	1. 4.2 MLD at Moti Daman. (Started in January, 2019). 2. 16 MLD at Nani Daman, (Under planning stage).

#### 4 Status of Industrial Wastewater:

No industrial units are permitted to discharge treated or untreated wastewater within or outside their premises. For the compliance of this condition, regular monitoring of wastewater generating industries is carried out. Regular sampling of treated and untreated wastewater is also carried out to check the adequacy of the installed effluent treatment plant (ETP).

Industries, situated in Daman and Dadra Nagar Haveli are strictly directed to reuse or utilize the wastewater generated within the premises. If any industry fails to comply the directions and consent conditions, strict actions taken on immediate bases.

In spite of this, there are two major industrial discharges present in river Damanganga, 1) Common Effluent Treatment Plant (CETP), Vapi, Gujarat; and 2) Gujarat Heavy Chemical Limited (GHCL), Bhilad, Gujarat.

**Table2: Status of industrial wastewater discharged in River Damanganga.**

<b>Sr. No.</b>	<b>Location detail</b>	<b>Flow per day (in MLD)</b>
1	Treated effluent discharge from CETP, Vapi, Gujarat	55-60
2	Treated effluent discharge from ETP of GHCL, Vapi, Gujarat	2.5





**Fig. 3: Industrial discharge in River Damanganga**

**Table 3: Quality of industrial Wastewater discharged in River Damanganga.**

Sr. No	Year	Location detail	Parameters			
			pH	BOD	COD	FC
1	Aug-18	Treated effluent discharge from CETP, Vapi, Gujarat	7.49	52	290	350
	Sep-18		7.36	131	434	240
	Oct-18		7.24	42	262	220
	Nov-18		7.41	48	282	94
	Dec-18		7.53	32	242	1600
2	Aug-18	Treated effluent discharge from ETP of GHCL, Vapi, Gujsarat	7.5	44	276	540
	Sep-18		7.34	38	183	350
	Oct-18		7.53	12	46	920
	Nov-18		7.42	65	316	220
	Dec-18		7.83	38	152.2	1600

## 5 Drain Outfalls in River Damanganga:

The towns/ cities and settlements located nearby the river are discharging untreated sewage to the river. There are three major towns located on the bank of River Damanganga, UT of Dadra Nagar Haveli (DNH); Vapi, Gujarat; and UT of Daman.

Based on the reconnaissance survey of the river stretch, 20 drains were identified in River Damanganga along the 41.56 km stretch from Madhuban Dam to its confluence with Arabian sea. Out of these 20 drains, 05 fall in UT of DNH, 07 fall in Gujarat (Vapi), and 08 fall in Daman. Details of drains along with its flow is provided in Table-4.



**Fig. 4: Drain from Nani Daman, Near Bus Stand**



**Fig. 5: Drain near Kabra Industrial Estate**

**Table 4: Status of drain-out falls in River Damanganga.**

Sr. No	District/ Town	Location number	Location detail	Flow per day(in MLD)
1.	Dadra Nagar Haveli (DNH)	D-01	Drain from Rakholi industrial Estate, Silvassa, DNH	43
2.		D-02	Drain from Masat village, Silvassa, DNH	06
3.		D-03	Drain from near Govt. industrial estate, Masat Ambapadia village, Silvassa, DNH	66
4.		D-04	Drain from Govt. Industrial Estate, Piparia Silvassa, DNH	65
5.		D-05	Drain from Piparia Industrial Estate, Piparia Silvassa, DNH	161
6	Gujarat (Vapi)	D-06	Drain from Lawachha village flowing adjacent to Rameshwari temple, Lawachha	31
7		D-07	Drain from Dadra at Dungra village, Vapi, Gujarat	6
8		D-08	Drain from Borigaon village opp. Dungra village, Gujarat	1
9		D-09	Pipe discharge at Vapi weir, Vapi, Gujarat	
10		D-10	Drain from Nani Sulpad, Khanki Phalia, Vapi, Gujarat	57
11		D-12	Drain from Nahuli village flowing adjacent to industry Neestech Pvt. Ltd, Vapi,	1.12
12		D-13	Drain from Vapi Industrial Area, Vapi, Gujarat	
13	Daman	D-14	Drain from Shree Ganesh Industrial Estate and Daman Industrial Estate, Daman	19
14		D-15	Drain from Kabra Industrial Estate, 50 m u/s of Zari Cause Way, Daman	
15		D-16	Drain from Kachigam village, Daman	
16		D-17	Drain from Nalia Pardi village Daman, Tribute Jharia Ashram School, Daman	Seasonal
17		D-18	Pipe discharge from Khemani Distillery, Daman.	Removed
18		D-19	Drain from Makat Falia village, Daman	Seasonal
19		D-20	Drain from Varkhund village, Daman (Somnath Industrial Estate, Bhenslore Industrial Estate, Ringanwada Industrial Estate)	2.43
20		D-21	Drain from Nani Daman Near bus stand, Daman	
21		D-22	Drain from Moti Daman near Rajiv Gandhi bridge, Daman	

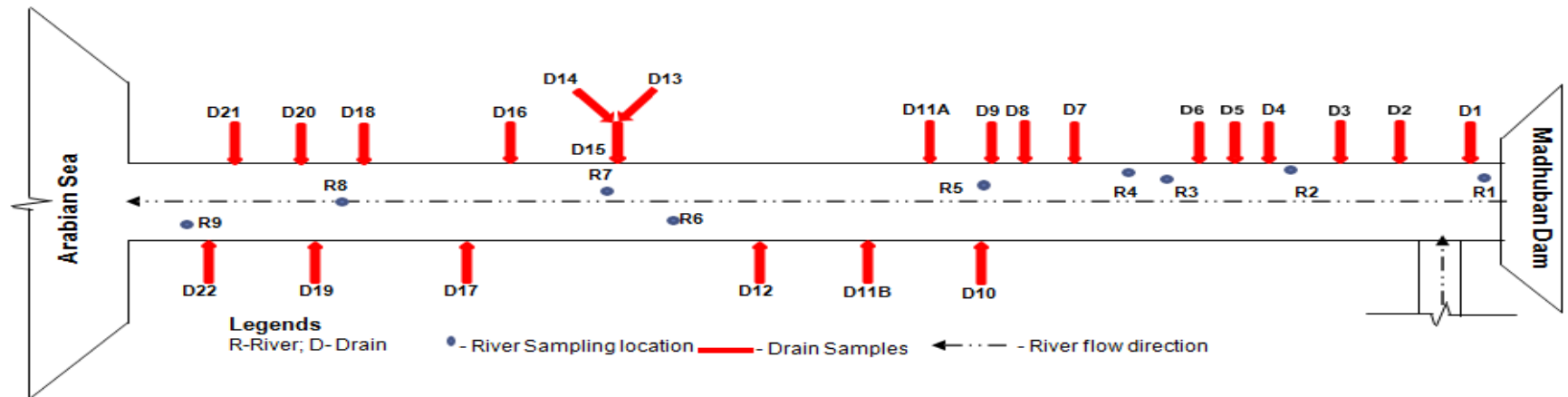
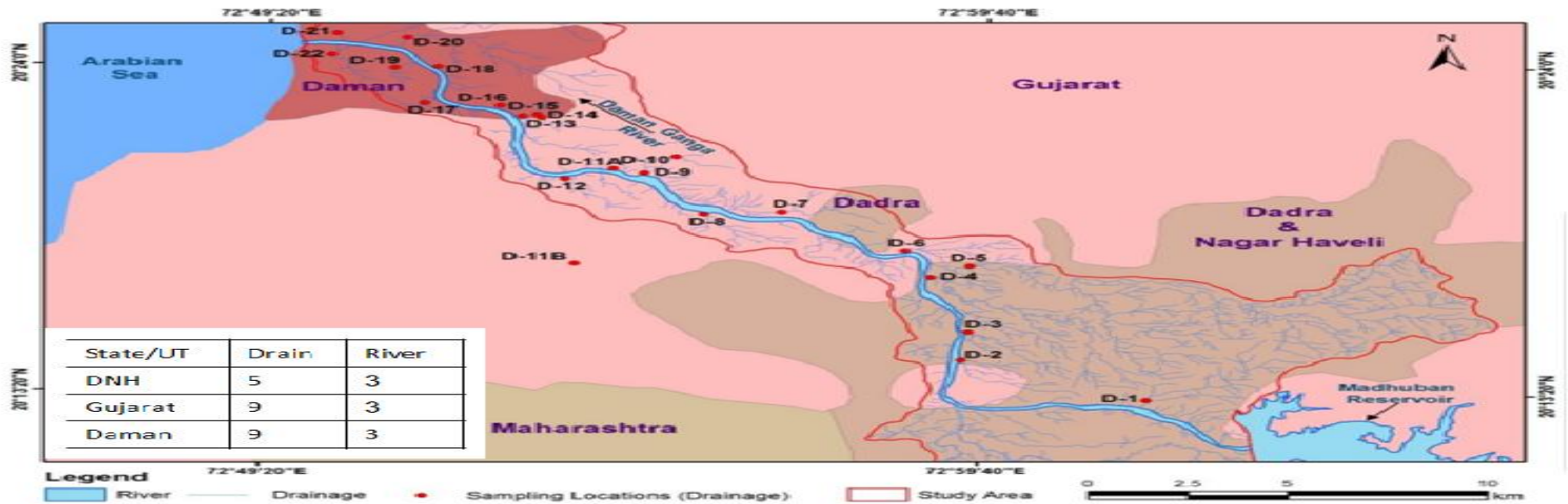


Fig. 6: Location of Drain out-fall in Damanganga River

**Table 5: Status of water quality of drains**

Sr. No	District / Town	Location number	Location detail	Parameters				Remarks
				pH	BOD	COD	FC	
1.	Dadra Nagar Haveli (DNH)	D-01	Drain from Rakholi industrial Estate, Silvassa, DNH	7.4	<1	<5	120	Low Concentration wastewater Drains
2.		D-02	Drain from Masat village, Silvassa, DNH	7.5	6	31	540	
3.		D-03	Drain from near Govt. industrial estate, Masat Ambapadia village, Silvassa, DNH	7.98	<1	<5	240	
4.		D-04	Drain from Govt. Industrial Estate, Piparia Silvassa, DNH	7.46	18	63	350	
5.		D-05	Drain from Piparia Industrial Estate, Piparia Silvassa, DNH	7.47	<1	<5	140	
6	Gujarat (Vapi)	D-06	Drain from Lawachha village flowing adjacent to Rameshwari temple, Lawachha.	7.46	< 1	<5	350	
7		D-07	Drain from Dadra at Dungra village, Vapi, Gujarat.	7.58	11	45	34	
8		D-08	Drain from Borigaon Village opp. Dungra village, Gujarat.	7.9	<1	<5	240	
9		D-09	Pipe discharge at Vapi weir, Vapi, Gujarat.	6.96	10	42	350	
10		D-10	Drain from Nani Sulpad, Khanki Phalia, Vapi, Gujarat	7.28	18	48	280	
11		D-12	Drain from Nahuli Village flowing adjacent to industry Neestech Pvt. Ltd, Vapi,	7.39	<1	<5	49	
12		D-13	Drain from Vapi Industrial Area, Vapi, Gujarat.	7.41	6	23	110	
13	Daman	D-14	Drain from Shree Ganesh Industrial Estate and Daman Industrial Estate, Daman.	7.47	<1	<5	430	
14		D-15	Drain from Kabra Industrial Estate, 50 m u/s of Zari Cause Way, Daman.	6.86	190	622	1600	High Concentration wastewater drain
15		D-16	Drain from Kachigam Village, Daman.	7.38	5	22	350	Low Concentration wastewater Drains

16	D-17	Drain from Nalia Pardi village Daman, Tribute Jharia Ashram School, Daman.	-	-	-	-	Seasonal drain
17	D-18	Pipe discharge from Khemani Distillery, Daman.	-	-	-	-	Removed
18	D-19	Drain from Makat Falia Village, Daman.	-	-	-	-	Seasonal drain
19	D-20	Drain from Varkhund village, Daman (Somnath Industrial Estate, Bhenslore Industrial Estate, Ringanwada Industrial Estate).	7.12	14	62	170	Medium Strength wastewater drain
20	D-21	Drain from Nani Daman Near bus stand, Daman.	7.13	58	199	79	
21	D-22	Drain from Moti Daman near Rajiv Gandhi bridge, Daman.	6.87	22	80	170	

**Table 6: All the Twenty-three drains have been categorized into low, medium & high strength wastewater based on their characteristics:**

<b>Drain Discharge</b>	<b>Strength of Effluent/Wastewater</b>
D-01 to D-10, D-12, D-13, D-14 & D-16	Low strength wastewater
D-20, D-21 & D-22	Medium strength wastewater
D-17 & D-19	Seasonal Drains
D-18	Removed
D-11A, D-11B and D-15	High strength wastewater

## 6 Prioritization of Polluted Stretch based on Present River Water

### Quality:

To assess the water quality of river and impact of various drains on River Damanganga, samples were collected on monthly bases.

Under the **National Water Quality Program (NWMP)**, water quality of River Damanganga was assessed at 09 different locations from Madhuban Dam to its confluence with the Arabian sea at Moti Daman Jetty. Based upon the assessed river water quality it had been identified that the polluted stretch of Damanganga River begins after Vapi Weir, Vapi, Gujarat till the river confluence with the Arabian sea at Moti Daman Jetty, Daman.

Based upon the assessed water quality of Damanganga River during the period of 2017 to 2018, river stretch after Vapi Weir, Vapi, Gujarat had been categorized as **Priority - III** (length - 9.06 km ) polluted stretch till discharge of distillery (Daman) in Damanganga River and afterwards as **Priority – II** (length - 4.25 km) polluted stretch. Priority wise categorization of polluted stretch of Damanganga River had been described through Table No. 7, 8, 9 & 10 and Figure no. 07, based upon the assessed water quality from the period of 2017 to 2018.

Damanganga River receives 07 drains after Vapi Weir (Gujarat) till discharge point of Distillery (at Daman) which cause the deterioration of the river water quality to Priority - III polluted stretch (however, discharge line of the distillery was completely removed and achieved ZLD) i.e. D-11A (Treated effluent discharge from CETP, Vapi, Gujarat), D-11B (Treated effluent discharge from ETP of GHCL, Vapi, Gujarat), D-12 (Drain from Nahuli village flowing adjacent to industry Neestech Pvt. Ltd, Vapi), D-13 (Drain from Vapi Industrial Area, Vapi, Gujarat), D-14 (Drain from Shree Ganesh Industrial Estate and Daman Industrial Estate, Daman), D-15 (Drain from Kabra Industrial Estate, 50 m u/s of Zari Cause Way, Daman) & D-16 (Drain from Kachigam village, Daman).

Further in downstream, Damanganga River receives another 03 domestic wastewater drains after discharge point of Distillery (at Daman) till Moti-Daman Jetty (Daman) which causes further deterioration of the river water quality to Priority - II polluted stretch i.e. D-20 (Drain from Varkund village, Daman), D-21 (Drain from Nani Daman Near bus stand, Daman) and D-22 (Drain from Moti Daman near Rajiv Gandhi bridge, Daman).

<b>Table 7: Priority wise categorization of polluted stretch of Damanganga River based upon the water quality during the year 2017</b>														
<b>Sampling Location</b>	<b>Parameter</b>	<b>1/17</b>	<b>2/17</b>	<b>3/17</b>	<b>4/17</b>	<b>5/17</b>	<b>6/17</b>	<b>7/17</b>	<b>8/17</b>	<b>9/17</b>	<b>10/17</b>	<b>11/17</b>	<b>12/17</b>	<b>Priority</b>
<b>Madhuban Dam (DNH)</b>	<b>COD</b>	10	5	5	5	20	5	5	5	5	12	5	5	Does not fall under polluted stretch criteria
	<b>BOD</b>	1	1	1	1	5	1	1	1	1	3	1	1	
	<b>DO</b>	6	6.7	6.4	6.6	6.3	6.4	6.95	6.8	6.4	5.6	7.7	5.5	
	<b>FC</b>	23	17	150	17	17	12	130	10	7.8	10	17	350	
<b>Naroli Bridge (DNH)</b>	<b>COD</b>	5	5	5	5	10	5	5	5	5	5	5	5	Does not fall under polluted stretch criteria
	<b>BOD</b>	1	1	1	1	1	1	1	1	1	1	1	1	
	<b>DO</b>	5.8	6.6	5.6	5.8	7.25	6	6.2	6.4	5.9	5.6	8	5.6	
	<b>FC</b>	170	94	240	100	1600	210	17	1600	17	1.8	94	76	
<b>Lawacha Temple (Gujarat)</b>	<b>COD</b>	18	5	5	16	10	8	5	5	5	14	28	5.4	Does not fall under polluted stretch criteria
	<b>BOD</b>	4	1	1	3	1	1	1	1	1	3	5	8	
	<b>DO</b>	5.2	6.9	6.4	5.8	5.7	6.2	6.4	6.5	5.8	5.8	6	1	
	<b>FC</b>	170	49	540	50	1600	540	49	49	14	170	140	240	
<b>Surat Beverages (DNH)</b>	<b>COD</b>	5	5	5	5	10	5	5	5	5	5	9	5	Does not fall under polluted stretch criteria
	<b>BOD</b>	1	1	1	1	1	1	1	1	1	1	1	1	
	<b>DO</b>	5.8	6.6	6.2	5.8	4.5	5.6	5.9	5.75	6.2	5.6	5.6	6.1	
	<b>FC</b>	110	430	240	430	920	32	50	130	12	120	350	920	
<b>Vapi Weir (Gujarat)</b>	<b>COD</b>	14	5	5	16	20	14	5	5	10	24	19	6	Does not fall under polluted stretch criteria
	<b>BOD</b>	4	1	1	4	6	3	1	1	2	8	1	1	
	<b>DO</b>	6.2	6.8	6.2	6.4	6.7	6.6	7.2	7.1	6.8	6.4	4.6	5.5	
	<b>FC</b>	540	46	350	540	920	40	120	50	31	63	79	240	

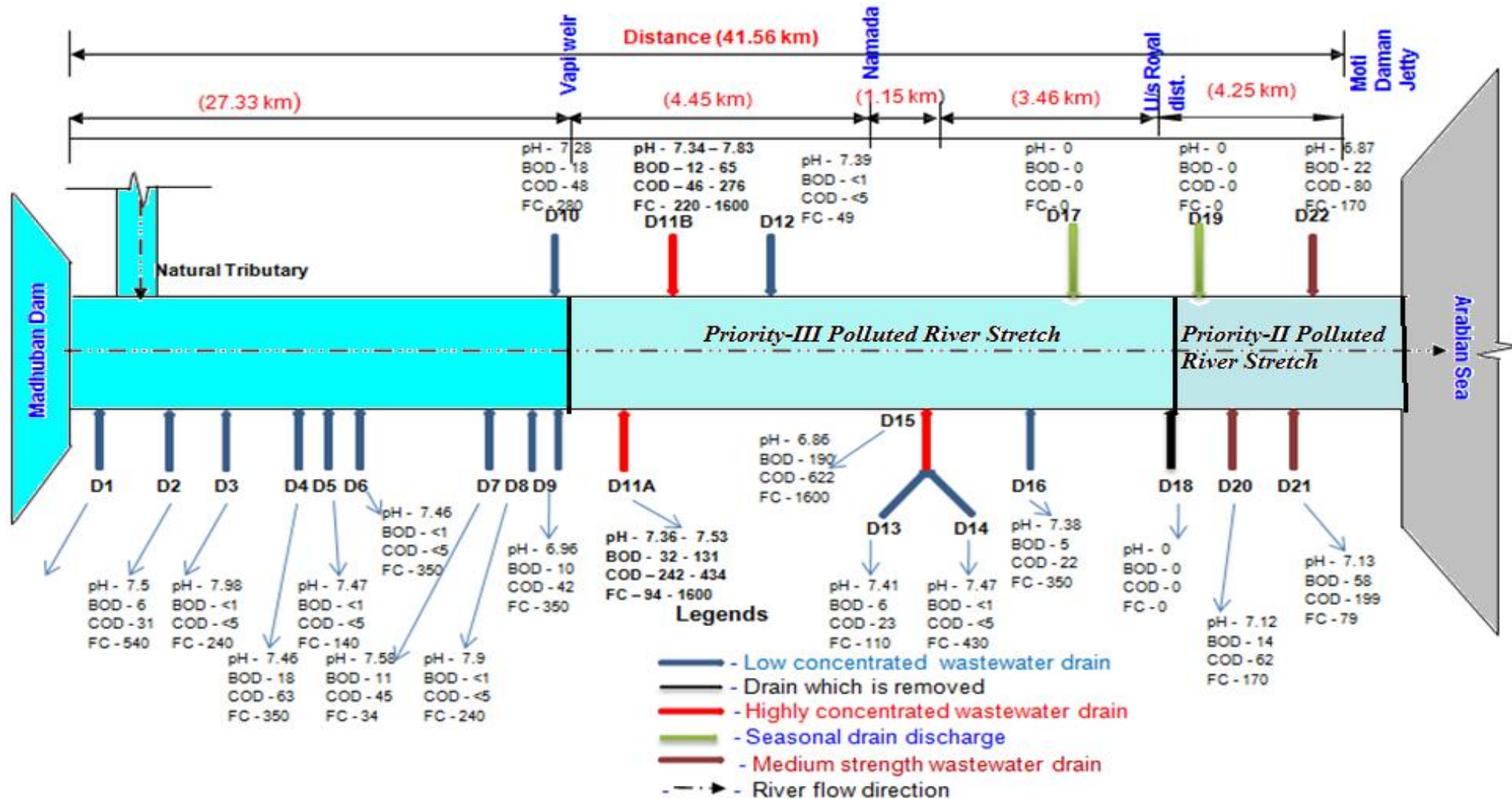


<b>Table 8: Priority wise categorization of polluted stretch of Damanganga River based upon the water quality during the year 2018</b>														
<b>Sampling Location</b>	<b>Parameter</b>	<b>1/18</b>	<b>2/18</b>	<b>3/18</b>	<b>4/18</b>	<b>5/18</b>	<b>6/18</b>	<b>7/18</b>	<b>8/18</b>	<b>9/18</b>	<b>10/18</b>	<b>11/18</b>	<b>12/18</b>	<b>Priority</b>
<b>Madhuban Dam (DNH)</b>	<b>COD</b>	5	5	5	9	5	5	5	5	8	5	10	<2	Does not fall under polluted stretch criteria
	<b>BOD</b>	1	2	1	2	1	1	1	1	3	1	2	<1	
	<b>DO</b>	6.1	5.8	5.2	6.3	4.5	6.4	5.9	4.9	5.6	5.8	5.1	6.7	
	<b>FC</b>	94	84	33	130	170	26	33	70	79	33	79	2	
<b>Naroli Bridge (DNH)</b>	<b>COD</b>	5	5	10	5	5	5	5	5	10	5	14	8.1	Does not fall under polluted stretch criteria
	<b>BOD</b>	1	1	3	1	1	1	1	1	1	1	3	1.3	
	<b>DO</b>	7	6.2	5.4	6	5.1	6.1	6.2	5.6	5.6	6.4	5.7	6	
	<b>FC</b>	120	46	49	140	140	170	46	49	920	1600	110	27	
<b>Lawacha Temple (Gujarat)</b>	<b>COD</b>	18	12	9	5	5	5	5	5	5	10	12	7	Does not fall under polluted stretch criteria
	<b>BOD</b>	6	5	2	1	1	1	1	1	1	3	4	1.2	
	<b>DO</b>	6.1	6.2	4.8	5.9	5.2	6.4	6.2	5.7	5.9	5.4	6.1	6.7	
	<b>FC</b>	120	33	79	350	280	70	34	64	41	26	280	40	
<b>Surat Beverages (DNH)</b>	<b>COD</b>	5	10	8	12	5	18	5	11	5	5	5	8	Does not fall under polluted stretch criteria
	<b>BOD</b>	1	3	2	5	1	4	1	4	1	1	1	1.1	
	<b>DO</b>	5.2	6.3	5.4	5.8	7	5.5	6.5	5.1	5.8	5.4	6	6.3	
	<b>FC</b>	220	120	94	79	220	140	70	84	170	350	34	60	
<b>Vapi Weir (Gujarat)</b>	<b>COD</b>	8	7	5	18	5	6	5	10	16	20	21	<2	Does not fall under polluted stretch criteria
	<b>BOD</b>	2	2	1	4	1	2	1	3	5	6	3	<1	
	<b>DO</b>	6	5.8	5.4	5.9	5.7	6.1	5.5	6.2	5.6	5.9	4.9	6.5	
	<b>FC</b>	180	70	170	540	220	58	64	34	920	170	140	50	

Table 9: Priority wise categorization of polluted stretch of Damanganga River based upon the water quality during the year 2017														
Sampling Location	Parameter	1/17	2/17	3/17	4/17	5/17	6/17	7/17	8/17	9/17	10/17	11/17	12/17	Priority
Namdha Village (Gujarat)	COD	48	27	31	24	13	15	5	15	5	36	97	80	Priority - III
	BOD	12	10	10	8	1	4	1	1	1	10	25	19	
	DO	4.4	6.8	6.2	7.2	8.6	6.6	5.55	5.7	6.2	5.9	3.2	5.6	
	FC	48	23	130	250	240	21	23	33	33	22	120	540	
At Zari Causeway (Daman)	COD	98	59	65	62	53	44	9	45	18	72	232	53	Priority - III
	BOD	24	17	18	18	13	12	1	8	5	28	60	12	
	DO	5.8	4.8	4.2	5.2	4.2	5.6	6.6	6.4	5.8	6.2	4.9	6	
	FC	94	79	1600	720	920	920	49	440	210	13	130	240	
At D/s discharge of Distillery (Daman)	COD	18	16	28	-	53	44	-	64	58	28	102	26	Priority - III
	BOD	5	1	10	-	15	12	-	17	20	8	33	5	
	DO	5.2	5.9	6.2	-	5.35	5.8	-	5.95	5.8	5.6	5.1	3.6	
	FC	280	170	240	-	540	130	-	240	220	34	170	240	
Moti Daman Jetty (Daman)	COD	32	16	20	46	80	56	24	28	36	42	206	160	Priority - II
	BOD	10	4	1	12	22	16	8	4	10	15	58	46	
	DO	5.2	5.8	5.9	5.2	5.4	6.2	6.8	6.75	5.4	5.4	4.4	5.6	
	FC	26	17	170	440	510	240	540	240	17	12	920	240	

<b>Table 10: Priority wise categorization of polluted stretch of Damanganga River based upon the water quality during the year 2018</b>														
<b>Location</b>	<b>Parameter</b>	<b>1/18</b>	<b>2/18</b>	<b>3/18</b>	<b>4/18</b>	<b>5/18</b>	<b>6/18</b>	<b>7/18</b>	<b>8/18</b>	<b>9/18</b>	<b>10/18</b>	<b>11/18</b>	<b>12/18</b>	<b>Priority</b>
<b>Namdha Village (Gujarat)</b>	<b>COD</b>	64	48	53	10	20	5	28	5	28	46	70	28	<b>Priority - III</b>
	<b>BOD</b>	<b>14</b>	<b>12</b>	<b>15</b>	1	1	1	6	1	<b>8</b>	<b>19</b>	<b>24</b>	2.7	
	<b>DO</b>	4.9	5.6	6	6.6	5.8	6.4	5.6	5.95	5.6	6.1	5.5	4.5	
	<b>FC</b>	350	140	<b>920</b>	240	70	220	46	120	79	<b>920</b>	220	1600	
<b>At Zari Causeway (Daman)</b>	<b>COD</b>	42	68	74	80	70	16	12	11	28	50	38	32	<b>Priority - III</b>
	<b>BOD</b>	<b>18</b>	<b>20</b>	<b>28</b>	<b>19.1</b>	<b>18.5</b>	4	3	2	<b>9</b>	<b>14</b>	<b>8</b>	2.9	
	<b>DO</b>	5.2	6	5.2	5.9	6.6	6.4	6.6	6.1	6.4	5.8	6.1	3.5	
	<b>FC</b>	94	70	49	70	350	84	46	170	26	170	90	1600	
<b>At D/s discharge of Distillery (Daman)</b>	<b>COD</b>	31	44	-	25	29	8	-	-	44	-	-	19	<b>Priority - III</b>
	<b>BOD</b>	<b>10</b>	<b>14</b>	-	<b>6</b>	<b>8</b>	3	-	-	<b>12</b>	-	-	1.6	
	<b>DO</b>	4.4	5.6	-	5.9	6.8	6.6	-	-	6.2	-	-	5.9	
	<b>FC</b>	220	70	-	33	350	130	-	-	240	-	-	26	
<b>Moti Daman Jetty (Daman)</b>	<b>COD</b>	120	156	378	76	13	22.6	66	202	53	80	62	21	<b>Priority - II</b>
	<b>BOD</b>	<b>34</b>	<b>48</b>	<b>108</b>	<b>20</b>	2.01	6	<b>14</b>	<b>64</b>	<b>10</b>	<b>22</b>	<b>18</b>	1.8	
	<b>DO</b>	6.1	5.2	6.4	5.9	7.2	6.2	5.8	5.7	5.4	6.1	5.8	6.1	
	<b>FC</b>	280	220	140	70	10	46	49	220	130	94	41	50	

Fig. 7: Priority wise categorization of polluted stretch of Damanganga River



This is the most important source of information that is being considered while prioritising the areas where action has to be taken first for rejuvenation of the polluted stretch of Damanganga River.

**Table 11: Drains contributing in Priority-III and Priority – II polluted stretch of Damanganga River**

Sr. No	District/ Town	Location Code	Location detail	Wastewater Flow in MLD	Drains in Polluted stretch
1	Gujarat (Vapi)	D-11A	Treated effluent discharge from CETP, Vapi, Gujarat	55 – 60	<b>Priority – III</b>
2		D-11B	Treated effluent discharge from ETP of GHCL, Vapi, Gujarat	2.5	
3		D-12	Drain from Nahuli Village flowing adjacent to industry Neestech Pvt. Ltd, Vapi,	1.12	
4		D-13	Drain from Vapi Industrial Area, Vapi, Gujarat	19	
5	D-14	Drain from Shree Ganesh Industrial Estate and Daman Industrial Estate, Daman			
6	D-15	Drain from Kabra Industrial Estate, 50 m u/s of Zari Cause Way, Daman			
7	Daman	D-16	Drain from Kachigam village, Daman	Seasonal	
8		D-17	Drain from Nalia Pardi village Daman, Tribute Jharia Ashram School, Daman		
		D-18	Pipe discharge from Khemani Distillery, Daman.	Removed	
9		D-19	Drain from Makat Falia Village, Daman	Seasonal	
10		D-20	Drain from Varkhund village, Daman (Somnath Industrial Estate, Bhenslore Industrial Estate, Ringanwada Industrial Estate)	2.43	
11		D-21	Drain from Nani Daman Near bus stand, Daman.		
12		D-22	Drain from Moti Daman near Rajiv Gandhi bridge, Daman.		

## 7 Plan of Action:

### a. Strategies for pollution abatement in River Damanganga:

The aim is to restore the natural flow of River Damanganga by multiple interventions. Thus, ecological river restoration will be the foremost aspect of Damanganga River management. Restoration of any degraded river can be done by reconstructing the structure and function of the pre-disturbance of the ecosystem. It is also to note that river restoration will only be sustainable if it is undertaken within a process-driven and strategic framework with inputs from a wide range of specialists. Such an approach needs to be reviewed constantly.

For practical purposes, past and current human intervention should be taken into account to achieve a more natural sustainable river habitat/rich status. Any planning and design should interface between the urban area and the course of the river to ensure that it can be protected and restored as a natural resource.

We propose five criteria for measuring the success with which the entire plan of action, with special emphasis on an ecological perspective, is delivered. First, the design of an ecological river restoration project is based on a specified guiding image of a more dynamic, healthy river that could exist at the site. Secondly, the river's ecological condition must be **measurably** improved. Thirdly, the river system must be more self-sustaining and resilient to external perturbations so that only minimal follow-up maintenance is needed. Fourthly, during the action phase, no lasting harm should be inflicted on the ecosystem. Fifthly, both pre- and post-assessment must be completed and data made publicly available.

The CPCB has carried out water quality assessment activities, on long term basis, has provided information on the segment of rivers that are not meeting water quality criteria and have been identified as polluted. Monitoring locations not meeting the water quality criteria have been identified as polluted and sources of the pollution are identified for intervention to contain the discharges.

As per direction from CPCB, river water is considered to be fit for bathing when it meets the criteria of having Bio-chemical Oxygen Demand (BOD) - 3.0 mg/l or less, Dissolved Oxygen (DO) – 5 mg/l or more, and Faecal coliform bacteria – 500 MPN/100 ml or less. In this action plan, the ultimate aim will be to reach to this level of BOD in all stretches of river with careful interventions within a span of two years.



Fig. 8: (Source: **Standards for ecologically successful river restoration, British Ecological Society**)

Keeping the above in mind, the strategies for developing management plan for Damanganga River are:

- Implementing specific measures for the progressive reduction of discharge and solid waste disposal into the river and the cessation or phasing-out of discharges and solid waste disposal into the river.
- Preventing further deterioration, protecting and enhancing the status of aquatic ecosystems by improving water quality of the river.
- Promoting the concept of “sustainable water” based on long-term protection of available water resources.
- Integration of urban growth with existing natural systems in order to create a sustainable and holistic development of the adjoining areas.

**b. Strategies for Priority – III Polluted River Stretch :**

- As shown in Fig. 7, Priority – III stretch (length 9.06 km) covers 07 drains i.e. D-11A, D-11B, D-12, D-13, D-14, D-15 & D-16 from which 04 drains (D-11A, D-11B, D-12, D-13) fall in Vapi, Gujarat state and 03 drains (D-14, D-15, D-16) fall in Daman district.
- Action plan and strategy for the 04 drains from Gujarat will be worked out by GPCB and Gujarat Government.
- Remaining 03 drains in Daman District will be monitored on monthly basis.
- Wastewater generating industries from these industrial areas have already installed effluent treatment plant.
- Major industrial areas i.e. Kabra Industrial area, Shree Ganesh Industrial Area, Premier Industrial Estate, will be monitored on monthly basis.

**Table 12: Action Plan for rejuvenation of the Priority – III polluted stretch of Damanganga River**

Sr. No	District/ Town	Location Code	Location detail	Action Plan	Financial Closure Budget	Targeted Time Period	Implementing Agency
1	Daman	D-14	Drain from Shree Ganesh Industrial Estate and Daman Industrial Estate, Daman.	Sewage networking project is under process. STP of capacity 54 MLD (approx) will be planned.	To be planned	June, 2020	District Panchayat, Daman
2		D-15	Drain from Kabra Industrial Estate, 50 m u/s of Zari Cause Way, Daman.				
3		D-16	Drain from Kachigam village, Daman.				
4		D-17	Drain from Nalia Pardi village Daman, Tribute Jharia Ashram School, Daman.	Seasonal	-	-	-

\*\*The Drains D-11A, D-11B, D-12, D-13 are fall in Gujarat State. Action plan for the same will be prepared by Gujarat State.



**c. Strategies for Priority – II Polluted River Stretch :**

- As shown in Fig. 7, Priority – II stretch (length 4.25 km) covers 03 drains i.e. D-20, D-21, D-22.
- For the drains, D-21 and D-22, sewage treatment plant of capacity 4.21 MLD had been installed and operational at Moti Daman.
- To cover the gap in sewage treatment, another sewage treatment plant of capacity 16 MLD is proposed at Nani Daman area, which will cover the entire Nani Daman area and nearby rural area.
- The drain, D-20 carries domestic wastewater as well as industrial wastewater from the Somnath, Ringanwada, and Dabhel area.
- The industries located in these areas are not allowed to discharge treated or un-treated wastewater outside their industrial premises and strictly directed to utilise generated wastewater within the premises only. Regular checks and inspections are carried out to ensure the same. These will be intensified further.
- **Inventorization** will be taken on priority basis in these areas to make sure that there is no discharge of treated or untreated wastewater to nearby drainage line.

**Table 13: Action Plan for rejuvenation of the Priority – II polluted stretch of Damanganga River**

Sr. No	District / Town	Location Code	Location detail	Action Plan	Financial Closure Budget	Targeted Time Period	Implementing Agency
1	Daman	D-18	Pipe discharge from Khemani Distillery, Daman.	Removed	-	-	-
2		D-19	Drain from Makat Falia Village, Daman.	Seasonal	-	-	-
3		D-20	Drain from Varkhund village, Daman (Somnath Industrial Estate, Bhenslore Industrial Estate, Ringanwada Industrial Estate)	Sewage networking project is under process. STP of capacity 54 MLD (approx) will be planned.	To be planned	June, 2020	District Panchayat, Daman
4		D-21	Drain from Nani Daman Near bus stand, Daman.	Proposed STP of 16 MLD capacity. Sewage networking project in Nani	For now, total budget allotted for STP and	Sewage networking project is scheduled to	Daman Municipal Council

				Daman area is undergoing.	Sewage Networking project is around 30 Crore.	be completed by 31/12/2020 and construction of STP will be completed 31/12/2020.	
5		D-22	Drain from Moti Daman near Rajiv Gandhi bridge, Daman.	The STP of 4.21 MLD capacity has already been constructed at Moti Daman and it will take care all the sewerage being generated in the nearby areas of Nani Daman and Moti Daman.			Daman Municipal Council

## 8 Implementation:

### a. Interception of sewage and industrial effluent discharges:

For abatement of pollution in the River Damanganga, inflow of untreated wastewater into the river is proposed to be intercepted. Under any circumstances the raw wastewater (both domestic and industrial) will not be allowed to get discharged into the river.

To accomplish this, the drains having the worst water quality parameters are identified and accordingly a priority list has been made so as to target them first. (Refer to Table 5) It is seen that drain D15 (Drain from Kabra Industrial Estate, 50 m u/s of Zari Cause Way, Daman) is having the worst quality parameters and hence, industries and establishment all along this drain will be of primary focus. The Action Plan as specified earlier will be strictly adhered to monitored and properly documented so as to ensure maximum compliance.

### b. Establishment of sewage network including rehabilitation of old sewerage system:

The status of sewerage system can also lead to pollution when the river watershed areas have inadequate or not properly maintained or no sewerage system. Therefore, the existing sewerage system facilities have to be improved to reduce the risk of sewage seepage into the river, especially during rainy season. Provision

should be made to capture entire sewage generated within the watershed areas. For effective interception of wastewater and to bring untreated sewage / effluent to the treatment plant, it is imperative that a **comprehensive sewerage network plan** including augmentation of existing sewerage systems be delineated so that all discharges in the catchment area be tapped and conveyed to the proposed wastewater treatment facilities. Taking advantage of the natural slope the wastewater conveyance system should preferably be based on gravity flow, whenever possible. Detailed status of sewage networking system connected with wastewater treatment plants are given under point c below.

**c. Establishment of new wastewater treatment plants including upgradation of existing facilities:**

The gap between wastewater generation and its proper management has to be reduced by establishing new wastewater treatment plants and adopting appropriate treatment technology in the proposed treatment plants. This will facilitate the removal of organics, inorganics, solids, nutrients, pathogens and other toxic pollutants including heavy metals from the wastewater/effluent. Treated water can either be used for horticulture or in industrial process or for any other purposes to achieve the clean water goal.

The Daman Municipal Council, Daman has proposed Sewerage Networking and Sewerage Treatment Plant for Moti Daman & Nani Daman. The households of Moti Daman are 4500 and the quantity of sewerage generated is around 1.5 MLD. To process all the sewerages (liquid waste), all the households in Moti Daman have been joined to a Sewerage Networking System and the length of the sewerage networking is 18 KM for the Moti Daman, Daman Municipal Council area. The work of Sewerage Networking in Moti Daman has already been completed. Apart from this, a Sewerage Treatment Plant of 4.21 MLD capacity has been constructed for processing of liquid waste and is operational.

The households of Nani Daman are 15500 and the quantity of sewerage generated around 06 MLD. On similar lines, to process all the sewerages (liquid waste) in this area as well, a **Sewerage Networking System based on vacuum system** is being started in Nani Daman area as a pilot project in two wards, which are adjacent to

Damanganga River. Ward no. 3 & 15 have been taken in first phase of the project and the Sewerage Networking length is 8 KM and the sewer line has connected to STP Moti Daman. Rest of the Nani Daman Municipal area will also be covered subsequently and the sewerage system for Nani Daman area is scheduled to be completed by March 2020. Liquid waste processing system a stake of all sewerage which is controlling pollution of Damanganga River.

**d. Management of Industrial Effluent:**

Industrial pollution can be controlled through proper planning of industrial areas based on environmental impact assessment. The large scale industries should treat their effluent within the industrial premises aiming at zero liquid discharge. The small and medium scale industrial units shall provide individual effluent treatment facility.

However, tapping and monitoring of these units is a challenge that will be taken up as a part of this Action Plan. Inventorisation and management of waste generated in these units will be taken up on priority basis to make sure that they are connected to the sewerage network system. In addition to this, stricter penalties for violations will be charged and especially those industries lying in the worst polluted zone will be held accountable in case of any irregularity found at their end.

**e. Treatment and tapping of discharges:**

It was observed that the domestic sewage, agricultural & storm water runoffs and partially treated or untreated industrial effluent were directly discharged into the river through different open drain discharges. These drain discharges imperil the river water. Details of various drain out-falls in River Damanganga are mentioned in Table 4.

This is the most challenging activity as it requires a multi-pronged approach involving active participation of communities, industries as well as administrative stakeholders. Awareness programmes are already going on in densely populated *chawls* and residential areas for reducing dumping of waste in drains. Open drains in these areas which are susceptible to any kind of solid waste have now been covered and are discharged only into notified nalas or septic tanks. Similarly, NGOs are teaming

up with PCC to raise awareness about plastic and e-waste and its collection. These efforts will help reduce non-biodegradable and toxic wastes in the river.

With respect to storm water, there are no specific guidelines or manual provided by CPCB. But, for the optimization of the performance of wastewater treatment plants it is required to construct a separate line for the storm water run-off and domestic/ municipal wastewater line, which meets to its treatment system without access load. It will help to eliminate sewer over flow which in turn helps to prevent pollution specifically in a heavy rain and flood plain zones. Much work is needed to be done in this regard but this has to be parallel with the development of STPs. This direction was well taken by implementing agencies and necessary storm water drains have been proposed in annual budgets. However, complete coverage will take another 2 years.

Collaboration meeting of implementing agencies namely, District Panchayat and Daman Municipal Council with the Pollution Control Committee will also help to achieve this objective. On similar lines, co-ordination meetings between implementing agencies in Gujarat, Dadra & Nagar Haveli and Daman & Diu with regional committee of PCC will also help.

**f. Ban on deleterious anthropogenic activities and disposal of municipal waste or solid waste dumping into the river or on the bank:**

- Washing of clothes, utensils, vehicles and bathing by the nearby communities in the River Damanganga, these activities have to be stopped immediately because it contributes inorganic, organics, detergents and biological contaminants to the river water. Presence of detergent causes significant foaming at turbulence site which may hamper the oxygen diffusion rate and also affect various aquatic biological processes.
- Disposal of garbage, semi-solid and solid wastes into river leads to significant depletion of dissolved oxygen and affects biotic community in the river. Therefore, disposal of such waste into river and its tributaries including drain discharges should be restricted. This waste must be scientifically treated and disposed off to secured landfill.

- Awareness drives have been carried out extensively in densely populated areas along the river. It has also covered proper disposal of garbage and sewage. It is being monitored proactively with the help of citizens initiatives.

<b>TIME-BASED ACTIVITY CHART FOR DAMANGANGA RIVER ACTION PLAN</b>	
<b>Activity</b>	<b>Status</b>
Mapping of every municipal sewer and every natural drain meeting to the River Damanganga.	Accomplished. Drains have been prioritised based on extent of deterioration of water quality indicators. Accordingly nearby industries are being carefully monitored and violations of directions is heavily penalised.
Strengthening of inspection and monitoring of wastewater generating industrial units.	Inventorisation has already been started and will take 2 months to be completed. A standard format of data collection is being circulated so that useful information is sought on a regular basis. Monitoring is to be strengthened by surprise checks and frequency of visits to areas where worst parameters are found is being increased.
Industries will not be allowed to discharge treated effluent as well as domestic wastewater outside their own premises.	Clear directions have been issued and good compliance is found. However, zero discharge will take almost one year as many small-unit clusters are present which need sewerage networking.
Industries should achieve zero liquid discharge system or reuse/re-utilize the treated wastewater within the premises.	Major industries are following these norms. But needs to be implemented in stricter sense with measurable criteria for most polluting industries.
Construction of adequate and efficient sewage treatment	In process. Will be able to treat majority of the waste within 2 years.

plant for the domestic wastewater generated from the cities.	
Properly channelizing all the wastewater generated from residential settlements to its treatment facility.	Sewage system in being laid down. Will take one year to be fully integrated.
Stopping dumping of solid waste nearby river bank and drainage line.	Awareness Programmes and community mobilisation is being carried out. The intensity will have to be increased. The District Panchayat and Daman Municipal Council are the nodal agencies for carrying out these activities on a regular basis.

## Action plan of Municipal Solid Waste Management

Sr. No.	Activity	Status	
		Daman	Dadra & Nagar Haveli
1.	Notify buffer zone for the solid waste processing and disposal facilities of more than five tons per day in consultation with the PCC.	31 <sup>th</sup> October, 2019	31 <sup>st</sup> May, 2019
2.	Clearing existing dumps/landfills sites.	30 <sup>th</sup> December, 2019	31 <sup>st</sup> December, 2020
3.	Door to Door Collection.	100% implemented	31 <sup>st</sup> March,2019
4.	Source Segregation.	30 <sup>st</sup> June, 2019	31 <sup>st</sup> March,2019
5.	Processing of waste.	100% processing will be achieved till July, 2019	100% processing will be achieved till March 2019
6.	Computerization of waste collection process.	GPS already installed in vehicles, Vehicles are compartmentalized	31 <sup>st</sup> May, 2019
7.	Develop Scientific Landfill Site.	30 <sup>th</sup> October, 2019	31 <sup>st</sup> December, 2020
8.	Penalty provisions.	Implemented	Implemented

**--The End--**