Chapter - 9
Irrigation Planning and Command Area Development

9.0 General

The main objective of the Par-Tapi-Narmada Link project is to provide maximum irrigation facilities to Tribal areas enroute the link canal lying on its right side including drought prone Saurashtra region of Gujarat. The link project will cater the command areas of five projects namely Khuntali, Ugta, Sidhumber, Khata Amba, Zankhari, suggested by Government of Gujarat. Command in Tribal areas of Chhota Udepur and Panchmahal districts from Narmada Main canal on substitution basis, Tribal dominant districts of Dangs & Valsad of Gujarat State and Nasik district of Maharashtra State along with Drinking water of most of the villages in the vicinity and filling of most of Panchayat tanks will be served under Par-Tapi-Narmada link canal.

The Par-Tapi-Narmada link takes off from the Paikhed barrage. The initial part of the link consists of a 12.70 km long tunnel connecting Jheri to Nar river upstream of Paikhed dam. The canal part of the link starts from Paikhed barrage which is located 4.60 km downstream of the Paikhed dam. The FSL of the canal at Paikhed barrage is 142.800 m. The link canal on its way to Ukai reservoir on Tapi river is fed by the storages envisaged at Chasmandva, Chikkar, Dabdar and Kelwan reservoirs through feeder pipelines. The link canal after irrigating the command en-route, outfalls into the Ukai reservoir at FSL105.275 m and takes off from the Ukai reservoir with FSL 81.790 m and finally outfalls into the Miyagam branch canal at RD16.70 km of the Narmada main canal system. The FSL of the link canal at its tail end is 53.573 m.

9.1 Existing Irrigation Facilities in the Proposed Project Command Area

The Par-Tapi-Narmada link canal is aligned through Valsad, Navsari, Tapi, Surat, Bharuch, Narmada, and Chhota Udepur districts of South Gujarat. The Command Area identified en-route the link canal lies in Navsari, Tapi, Surat and Bharuch districts. The existing source of irrigation in the vicinity of the en-route Command Area of the link canal is mainly

Wells and Tube-wells. The details of existing, ongoing and proposed irrigation & multipurpose projects in the vicinity of en-route Command Area of the link canal are given in **Table-9.1:**

Table – 9.1

Irrigation Facilities from Existing, Ongoing and Proposed Projects

Sl. No.	District	Project	GCA(ha)	CCA(ha)
Existing Projects				
1.	Tapi	Kakrapar	347220	204080
2.	Tapi	Ukai	121410	66168
3.	Surat	Ver-I	2266	1376
4.	Surat	Ver-II	7248	5789
5.	Navsari	Jhuj	8950	6695
6.	Navsari	Kelia	6014	4794
7.	Narmada	Karjan	79785	56200
Ongoing Projects				
1.	Valsad	Chinchai LIS	10362	7000
2.	Tapi	Ukai LB High Level Canal	22775	13300

Source: *i) Major, Medium & Minor River Valley Projects of Gujarat, as published by Water Resources Department, Government of Gujarat-2002.*

ii) Narmada, Water Resources, Water supply & Kalpsar Department, Government of Gujarat

9.1.1 Proposed Irrigation Facilities in the Proposed Project Command Area

The area envisaged for irrigation under the Par-Tapi-Narmada link canal project is divided into six parts:

i) The command area proposed en-route the link canal and feeder pipelines by gravity.
ii) Command area of Projects proposed by Government of Gujarat by gravity.
iii) Command area in the Tribal area right side of link canal by lift.
iv) Command area in the vicinity of six proposed reservoirs through lift

v) Tribal area on right side of the Narmada Main canal by lift, on substitution basis.
vi) Command area of Miyagam branch canal of Narmada Main Canal (Target command) in Saurashtra region.

The total culturable command area under the link project is 232175 ha, of which 61190 ha lies enroute the link canal i.e., (i) 10100 ha is en-route command in the reach between Par and Tapi (ii) 49820 ha en-route command in the reach between Tapi and Narmada (iii) 630 ha en-route command under Dabdar feeder pipelines (iv) 640 ha en-route command under Kelwan feeder pipelines with 100% irrigation intensity.

The command area of projects suggested by Government of Gujarat on the left side of canal is about 45561 ha to be irrigated by gravity through link canal. Tribal area on right side of canal is 36200 ha will be irrigated by lift. About 12514 ha tribal area will also be irrigated directly by lift from proposed six reservoirs.Tribal area on right side of Narmada Main canal to the extent of 23750 ha in Chhota Udepur district and 10592 ha in Panchmahal district will also be irrigated through lift directly from Narmada Main canal on substitution basis. Finally, the linkproject will take over the area of 76710 ha under the command of existing Miyagam branch canal of Narmada canal system. Narmada Water so saved will be utilized to provide irrigation facilities in predominantly tribal areas of Chhota Udepur, Panchmahal district and in drought prone Saurashtra region of Gujarat State through Narmada Canal System. Thus the Par-Tapi-Narmada link project with present modified water planning shall provide irrigation facilities to 232175 ha CCA out of which 157291 ha in tribal areas of Gujarat and 74884 ha in other areas.

9.1.1.1 Command Area Proposed En-Route the Link Canal

The en-route command area of the link canal has been planned as (a) Directly from the link canal in Par-Tapi reach; (b) Feeder pipelinesoriginating from the proposed Dabdarand Kelwan dams to the link canal in Par-Tapi reach and (c) Directly from the link canal in Tapi-Narmada reach.

(a) Command area Directly from Link Canal in Par-Tapi reach on left side

The command area of about 10100 ha has been identified under this reach under Vansda taluka of Navsari district, Vyara taluka and Songadh taluka of Tapi districts are given in **Table -9.2:**

Table –9.2
Locations of Command Area Benefitted Under Par-Tapi Reach of Par-Tapi-Narmada Link Project

Outlet No/ branch canal	Topo sheet no.	Location of main canal RD in km.	En-route command area (ha)		FSL at head of Branch canal	En-route Irrigation Demand (MCM)	Dis-charge (cumec)	Taluka	District
			Gross	CCA					
1	46 H/6	76.45	250	233	126.597	1.50	0.12	Vansda	Navsari
2		81.20	70	69	125.593	0.43	0.04	Vansda	Navsari
3		82.35	3240	2448	125.090	15.32	1.27	Vansda	Navsari
4	46 H/5	99.00	222	222	121.140	1.38	0.12	Vansda	Navsari
5		103.85	314	312	120.123	1.98	0.16	Vansda	Navsari
6		108.49	208	201	119.036	1.25	0.1	Vyara	Tapi
7		111.82	174	167	118.471	1.05	0.08	Vyara	Tapi
8		112.45	122	118	118.242	0.74	0.06	Vyara	Tapi
9		115.05	4071	3796	117.487	23.65	1.97	Vyara	Tapi
10		118.36	163	163	116.783	1.02	0.08	Vyara	Tapi
11		122.02	38	36	115.756	0.26	0.02	Vyara	Tapi
12	46	125.33	37	34	115.15	0.26	0.02	Vyara	Tapi

Outlet No/ branch	Topo sheet no.	Location of main canal	En-route command area (ha)		FSL at head of Branch canal	En-route Irrigation	Discharge (cumec)	Taluka	District
			Gross	CCA					
	G/8				2				
13		133.09	64	47	113.818	0.29	0.02	Vyara	Tapi
14		137.61	185	165	113.095	1.04	0.08	Vyara	Tapi
15		143.53	100	98	111.830	0.62	0.05	Vyara	Tapi
16	46 G/12	159.86	438	421	109.138	2.62	0.22	Songadh	Tapi
17		161.94	146	139	108.663	0.86	0.07	Songadh	Tapi
18		165.94	493	428	107.863	2.66	0.22	Songadh	Tapi
19		169.42	218	205	107.043	1.28	0.11	Songadh	Tapi
20		171.99	288	253	106.551	1.55	0.13	Songadh	Tapi
21		174.27	134	133	106.012	0.82	0.07	Songadh	Tapi
22		177.12	473	412	105.347	2.56	0.22	Songadh	Tapi
		Total	**11448**	**10100**		**63.13**			

The command area is shown in plate No. 4.40 (1/5 to 3/5) Vol-VII of DPR.

(b) Command area through Feeder pipelines originating from the Proposed Dabdar and Kelwan Dams to the Link Canal in Par-Tapi Reach

The feeder pipeline from Dabdar dam on Khapri river to main canal of length 12.258 km will carry 262 MCM of water out of which 3.9 MCM of water will be utilized for irrigating 630 ha en-route command area of feeder before it join to main canal. The feeder pipeline from Kelwan dam on Purna river to main link canal of length 7.616km will divert 308MCMout of which 4.0MCMof water will be utilized for irrigating 640 ha command area before joining to the main link canal.

Though the feeder pipeline from Chasmandva dam on river Tan to main canal of length 2.859 km has also been proposed but no en-route command area has been proposed along the feeder. The proposed Chikkar and Dabdar Dams are also connected by 14.342 km pipelines but no en-route command area has been proposed. The total command area through feeder pipes shall be 1270 ha utilizing 7.9 MCM of water.

(c) Command area Directly from Link Canal in Tapi-Narmada Reach on Left side

Under Tapi-Narmada reach command area of about 49820 ha has been identified falling in Songadh taluka of Tapi District, Mandvi and Mangrol taluka of Surat District and Valia taluka of Bharuch District of Gujarat State. The details are given in **Table -9.3:**

Table –9.3
Locations of Branch Canal/Outlet and Command Area Benefitted Under Tapi-Narmada Reach of Par-Tapi-Narmada Link Project

Outlet No/ branch canal	Topo sheet no.	Location of main canal RD in km.	En-route command area (ha)		FSL at head of Branch canal	En-route Irrigation Demand (MCM)	Dis-charge (cumec)	Taluka	District
			Gross	CCA					
1	46 G/11	1.41	101	92	81.650	0.55	0.05	Songadh	Tapi
2		3.70	171	168	81.267	1.05	0.08	Songadh	Tapi
3		6.87	109	107	80.797	0.68	0.05	Songadh	Tapi
4		7.69	120	115	80.709	0.71	0.06	Songadh	Tapi
5		11.49	125	121	80.277	0.77	0.06	Songadh	Tapi
6	46 G/7	15.72	151	150	79.750	0.94	0.08	Songadh	Tapi

Outlet No/ branch	Topo sheet no.	Location of main canal	En-route command area (ha)		FSL at head of Branch canal	En-route Irrigation	Dis-charge (cumec)	Taluka	District
			Gross	CCA					
7		17.41	240	234	79.481	1.49	0.12	Songadh	Tapi
8		32.01	324	316	77.761	1.98	0.16	Mandvi	Surat
9		33.33	436	408	77.629	2.54	0.21	Mandvi	Surat
10		34.11	176	170	77.551	1.06	0.08	Mandvi	Surat
11		37.71	430	413	77.090	2.59	0.22	Mandvi	Surat
12		43.22	138	130	76.384	0.82	0.07	Mandvi	Surat
13	46 G/3	47.79	615	612	76.127	3.83	0.32	Mandvi	Surat
14		49.56	3570	3365	75.698	21.05	1.74	Mandvi	Surat
15		51.04	13347	11457	75.550	71.61	5.93	Mandvi	Surat
16		55.79	817	756	75.023	4.74	0.39	Mandvi	Surat
17		57.09	600	589	74.892	3.68	0.31	Mandvi	Surat
18	46 G/7	60.69	5003	4061	74.428	25.38	2.11	Mangrol	Surat
19		64.37	2636	2386	73.946	14.90	1.23	Mangrol	Surat
20		69.15	1493	1433	73.261	8.94	0.74	Mangrol	Surat
21	46 G/6	71.48	306	295	72.976	1.84	0.15	Valia	Bharuch
22		82.17	26437	22442	71.143	140.24	11.63	Valia	Bharuch
		Total	**57345**	**49820**		**311.39**			

The command area is shown in plate No. 4.40 (4/5 & 5/5) of Vol-VII of DPR.

9.1.1.2 Command Area of Projects suggested by Government of Gujarat.

The command area of about 45561 ha under five Projects as suggested by Government of Gujarat viz., namely Khuntali, Ugta, Sidhumber, Khata Amba and Zankhari irrigation projects which are in the vicinity of the project command area are planned to take over by the Par-Tapi-Narmada link canal. Details of these projects are given in **Table –9.4**.

Table –9.4

Sl. No	Name of Reservoir	River	Command area in		Culturable command area (ha)	Annual Irrigation (ha)
			Taluka	District		
1	Khuntali	Dholdo / Par river	Dharmpur	Valsad	3162	3162
2	Ugta	Par river	Dharampur	Valsad	4963	4963
3	Sidhumber	Man river	Dharampur Chikhli	Valsad Navsari	17441	17441
4	Khata Amba	Kaveri	Vansda	Navsari	2741	2741
5	Zankhari	Zankari river	Songadh& Vyara	Tapi	17254	17254
			Total		**45561**	**45561**

The salient features of the above projects are given at **Annexure No.9.26.**

The command area maps of these projects are at Plate No.3 to Plate no. 7 of Vol-VIII(c).

9.1.1.3 Command area falling in Tribal area on right side of canal by lift.

Maximum possible Tribal areas to an extent of 36200 ha at four different locations enroute on Right side of the Par-Tapi-Narmada link canal have been identified as requested by Government of Gujarat for providing irrigation in tribal areas. Since these areas are located at a higher level than the link canal, the water can be provided for irrigation by lift upto 70.0 m. These are described below:

(a) **Area No.1** is located in Par-Tapi reach between RD 113.25 to 115.00 km of link canal with average F.S.L. 117.70 m, in this area irrigation can be provided through lift upto 3 m from P-T-N link canal. About 900 ha area can be covered in this reach in Vyara tehsil of Tapi district.

(b) **Area No.2** is located in Par-Tapi reach between RD 141.440 to 153.400 km in between Jhankhari river and Mindhola river. Average F.S.L. of P-T-N link canal near this area is 111.0 m. Irrigation can be provided through lift upto 50 m to 70 m from P-T-N link canal. About 13100 ha area can be covered in this reach in Songadh tehsil of Tapi district.

(c) **Area No.3** is located in Tapi-Narmada reach between RD 32.00 to 72.00 km of link canal and average F.S.L. of this area is 70.0 m. Irrigation can be provided through lift of about 50 m from P-T-N link canal. About 6500 ha area can be covered in this reach in Mandvi and Mangrol tehsils of Surat district.

(d) **Area No.4** is located in Tapi-Narmada reach between RD 72.033 to 87.274 km in between Ghanta River and Amravati River and average F.S.L. of this area is 71.5 m. Irrigation can be provided through lift by about 50 m to 70 m from P-T-N link canal. About 15700 ha area can be covered in this reach in Valia tehsil of Bharuch district.

The abstract of proposed command area falling in tribal region is given in **Table – 9.5** below:

Table – 9.5

Additional irrigation in the tribal areas lying right side of Par-Tapi-Narmada Link Canal by lift

Sl. No.	Name of Command Area	CCA (ha)	Annual Irrigation at 100% intensity of irrigation (ha)	Taluka / District benefitted
1	Area-1	900	900	Vyara / Tapi
2	Area-2	13100	13100	Songadh / Tapi
3	Area-3	6500	6500	Mandvi and Mangrol / Surat
4	Area-4	15700	15700	Valia / Bharuch
	Total	**36200**	**36200**	

The command areas under Area-1 to Area-4 are shown in Plate No. 17 to 20 of Vol-VIII (C).

9.1.1.4 Command area in the vicinity of six proposed reservoirs by Lift.

About 12514 ha of command area in the vicinity of six proposed reservoirs which lies in Tribal dominant districts of Dang and Valsad of Gujarat and Nasik district of Maharashtra is proposed to bring under irrigation.Details are given in **Table-9.6**:

Table – 9.6

Command area in the vicinity of reservoir through lift up to 70meter.

Sl. No.	**Name of Dam**	**CCA (ha)**		**Annual Irrigation Total (ha)**	**Taluka/ District**
		Maharashtra	**Gujarat**		
1	Jheri	966	-	966	Peint / Nasik
2	Paikhed	3305	480	3785	Dharampur / Valsad
3	Chasmandva	-	2300	2300	Dharampur / Valsad
4	Chikkar	-	1260	1260	Ahwa / Dang
5	Dabdar	-	2595	2595	Ahwa / Dang
6	Kelwan	-	1608	1608	Ahwa / Dang
	Total	**4271**	**8243**	**12514**	

The command area in the vicinity of reservoirs is shown in Plate No.1 & 2 of Vol-VIII(c).

9.1.1.5 Command area of Tribal area on right side of Narmada Main canal by lift.

It is proposed to provide irrigation to 23750 ha predominantly in tribal areas of Jetpur pavi, Sankheda, Nasvadi, Kavant, Bodeli, Chhota Udepur taluks of Chhota Udepur district by lift directly from Narmada Main Canal on substitution basis.

It is also proposed to provide irrigation of 10592 ha predominantly in tribal area of Halol, Ghogamba and Kalol talukas of Panchmahal district by lift directly from Narmada Main Canal, on substitution basis. Thus, a total command area of 34342 ha can be brought under irrigation in the command area of Narmada Main canal through substitution. Details are given in **Table-9.7** below:

Table – 9.7

Tribal area right side of Narmada main canal by lift.				
Sl. No.	Name of Dam	CCA	Annual Irrigation	Taluka/District
1	Chhota Udepur	23750	23750	Jetpur pavi, Sankheda, Nasvadi, Kavant, Bodeli, Chhota Udepur
2	Panchmahal	10592	10592	Halol, Kalol, Ghoghamba
	Total	**34342**	**34342**	

The command area identified in Chhota Udepur and Panchmahal Districts is shown in Plate No. 21 & 22 of Vol-VIII(c)

9.1.1.6 Command area of Miyagam Branch canal of Narmada Canal System

The Par-Tapi-Narmada link canal will carry 1210 MCM of water out of which 374.52 MCM of water will be utilized for irrigating59920 ha en-route command area of link canal; 3.9 MCM of water will be utilized for irrigating 630 ha en-route command area of Dabdar feeder pipeline;4.0 MCM of water will be utilized irrigating 640 ha en-route command area of Kelwan feeder pipeline, 285 MCM for projects proposed by Government of Gujarat, 48 MCM for Tribal area in the vicinity of reservoirs, 138 MCM for enroute Tribal area on right side. Remaining water of 291 MCM will be utilized in the Command area of existing Miyagam Branch Canal to irrigate an area of **76710** ha CCA and the water so saved in Narmada Main Canal will be utilized to provide irrigation in the tribal areas of Chhota Udepur and Panchmahal Districts and drought prone Saurashtra regionby substitution. Out of 291 MCM, 90 MCM and 40 MCM respectively will be used in Tribal area on right side of Narmada Main Canal in Chhota Udepur and Panchmahal districts and 161 MCM in Saurastra region. Thus, 1144 MCM of water will be utilized for irrigating the 232175 ha by Par-Tapi-Narmada link canal.

In the irrigation planning of Par-Tapi-Narmada link project, it is proposed to take over the part Command Area of Miyagam Branch Canal of Narmada Canal System of Sardar Sarovar Project (SSP) under the Link Canal. The Narmada waters so saved in Sardar Sarovar Project would be utilized in Panchmahal and Chhota Udepur districts and in Saurashtra and Kutch regions of Gujarat by substitution through Narmada canal system to meet irrigation, domestic and other requirements.

Thus, a total command area of about 232175 ha will be brought under irrigation by the Par-Tapi-Narmada Link Project.

The canal runs through five basins lying in the districts of Valsad, Navsari, Dang, Surat, Tapi, Bharuch, and Narmada and Vadodara in Gujarat State. The details like existing, ongoing and proposed irrigation projects and the proposed command area under the link canal in the reach from Par to Tapi and Tapi to Narmada and beyond Narmada upto Miyagam branch canal of Narmada Main Canal are shown in Index map at Plate 1.1 in Volume-VII.Line diagram of Par-Tapi-Narmada canal system showing the location of dams, barrages and Feeder pipeline is at Fig-9.1.

9.2 Existing cropping pattern

9.2.1 Existing area under rain-fed cultivation

(A) En-route command

The existing cropping pattern of the area under rain-fed cultivation varies from District to District. The cropping pattern in the Districts which lie in the en-route command area is furnished in Table 9.8:

Table – 9.8
Existing Cropping Pattern in Rain-fed Area

Sl. No.	Crop	Districts			
		Navsari	Tapi	Surat	Bharuch
		(%)	(%)	(%)	(%)
1	Rice	40	23	9	1
2	Wheat	-	1	-	9
3	Jowar	1	25	16	11
4	Other Cereals	1	1	1	2
5	Gram	1	2	1	1
6	Tur	3	16	18	22
7	Other Pulses	10	3	5	3
8	Chilies	1	2	1	-
9	Vegetables	10	6	11	2
10	Cotton	-	1	-	39
11	Groundnut	-	12	6	1
12	Other Oilseeds	1	2	4	6
13	Sugarcane	-	-	5	-
14	Fodder	32	6	22	3
Total		**100**	**100**	**100**	**100**

Source: *"Irrigation in Gujarat 2011-12", Published by Directorate of Economics and Statistics, Government of Gujarat.*

(B) Command Area under Feeder pipeline

The major part of the Command Area proposed under Feeder pipelinelies in Ahwa taluka of Dangs district. Gross Irrigated Area in Dangs district is only about 3% of Gross Cropped Area. It indicates that 97% of

cultivation in district is rain dependent. The existing cropping pattern in the rain-fed areas of Ahwa taluka of Dangs district is given in Table-9.9:

Table-9.9
Existing Cropping Pattern in the Rain-fed Areas of Ahwa Taluka of Dangs district

Sl. No.	Crop	%age of Area
1	Rice	29
2	Jowar	7
3	Maize	4
4	Other Cereals	26
5	Gram	2
6	Tur	7
7	Other Pulses	7
8	Vegetables	1
9	Groundnut	9
10	Other Oilseeds	3
11	Fodder	5
	Total	**100**

Source: *Irrigation in Gujarat 2011-12, Published by Directorate of Economics and Statistics, Government of Gujarat.*

9.3 Soil Surveys

9.3.1 Soil Capability Classification

The taluka wise reports of the soil survey carried out by Gujarat Government in respect of the districts falling in the en-route command area have been collected from the Agriculture Department, Government of Gujarat. Reports on land irrigability and soil classification of Banni area of Kutch region and SSNNL phase I (Upto Mahi river), Soil classification report and soil maps for the talukas lying in reservoir submergence areas and link alignment have also been collected. Using this information the soil map of the en-route command area has been prepared and appended at Plate -4.45 in Volume -VII.

The characteristics of the soils present in the proposed Command Area are described below.

The en-route Command Area of the link canal lies in Navsari, Tapi, Surat and Bharuch districts of South Gujarat. The Command area of Feeder Canals lies in Navsari and Dangs districts of South Gujarat.The soils found in South Gujarat can be divided into 3 main types viz. i) Deep Black, Medium Black to Loamy Sand (Goradu) soils, ii) Deep Black with Alluvial, Laterite and Medium Black Soils and iii) Deep Black Clayey Soils. Deep Black Soils are clay-like in texture, poor in drainage, neutral to alkaline in reaction and most fertile soils. Medium Black soils are Silt loam to clay in texture, neutral to alkaline in reaction. Lateritic soils support good forests. Alluvial soils are very deep.

Deep Black Clayey soils are found in Plain & Coastal areas and Sandy loam soils with shallow depth are present in Hilly areas of Navsari district. Deep Black soils are present in Plain areas and Lateritic and eroded shallow and Clay loam moderately deep soils are present in Hilly areas of Tapi district. The predominant soils found in Surat district are Deep Black Clayey soils. “Goradu” soils are present in some areas of Kamarej, Mandavi, Mangrol talukas of Suratdistrict. Soils in Bharuch district are predominantly Deep Black soils followed by Loamy sand soils. Lateritic & Hilly soils are present in Dangs district.

The soils in Navsari, Surat and Bharuch districts are predominantly very deep. In Tapi district soil depth is dominantly shallow. In Dangs districtthe soil depth is mostly shallow.

Soils in South Gujarat are fine to medium textured (Clayey to Loamy Clay), except in Dangs district. In Dangs the soils are medium textured. Soil Drainage in South Gujarat in general can be classified as well to moderately drain. Whereas, the soils in Dangs district are well drained.Soil salinity belongs to slight to moderate and severe towards coastal area in Bharuch district. In Tapi and Dangs districts Soil salinity is moderate. Soil salinity in Surat and Navsari districts belongs to slight to strong salinity class. Soil Sodicity in South Gujarat in general belongs to slight Sodicity class except in Navsari where soil Sodicity varies from slight to moderate.

9.3.2 Land Irrigability Classification

Land irrigability class indicates limitations on the land use. Among Land Irrigability classes, Class 1 to Class 4 comes under Irrigable Land class, Land under Class 5 is temporarily non-irrigable (further investigations needed) and Class 6 is land not suitable for irrigation. The soils belong to Soil Irrigability Classes from A to D come under Irrigable Land class. The lands having slopes less than 10%and depth of water table more than 1.5 m come under Irrigable Land class. The soils of texture "Sandy loam to clay loam" come under Soil irrigability class "A". The soils of texture "Loamy sand and clay" come under Soil irrigability class "B". The soils of texture "Sand and clay" come under Soil irrigability classes "C&D".

As the soils in the Command Area are mainly Deep Black and Medium Black Clayey soils, slope of the land is less than 5% and Groundwater depth is more than 1.5 mthe area can be put under irrigation without any major constraints. However, in Tapi and Dangs districts where soil depth is shallow appropriate cropping pattern and water application methods need to be devised for irrigating the areas.

9.4 Agro-Climatic Conditions

9.4.1 Rainfall

i) Rainfall during Monsoon (Max, Min & Mean Rainfall)

The maximum, minimum and mean monsoon rainfall (June to Sept) observed at Raingauge stations situated in vicinity of proposed Command Area of the link canal viz Bopi, Vansda, Sara, Kalibel, Antapur, Dhanmodi and Vyara are given in Table-9.10:

Table-9.10

Monsoon Rainfall in the Vicinity of Proposed Command Area

Sl.No.	Raingauge Station	Monsoon Rainfall (mm)		
		Maximum	Minimum	Mean
1	Bopi	4098	897	2143
2	Vansda	3212	902	1870
3	Sara	2635	1088	1730
4	Kalibel	2641	450	1528
5	Antapur	4343	624	1715
6	Dhanmodi	2614	549	1260

7	Vyara	2873	603	1444

Source: Water Availability Study of Par-Tapi-Narmada link project-March,2012, HSO,CWC.

Maximum and minimum rainfall occurs in the months of July and June respectively during monsoon in the command. The mean monsoon rainfall at Baroda meteorological station (data of which is considered for estimating crop water requirement of en-route command area of link canal) is 760 mm. The mean non-monsoon rainfall at the station is 55 mm.

ii) Rainfall during Non-monsoon (Max. Min & Mean Rainfall)

The maximum, minimum and mean non-monsoon rainfall (Oct to May) observed at Bopi, Vansda, Sara, Kalibel, Antapur, Dhanmodi and Vyara Raingauge stations are given in Table-9.11:

Table-9.11

Non-monsoon Rainfall in the Vicinity of Proposed Command Area

Sl.No.	Raingauge station	Non-monsoon Rainfall (mm)		
		Maximum	Minimum	Mean
1	Bopi	323	0.0	44
2	Vansda	318	0.0	65
3	Sara	129	0.0	28
4	Kalibel	223	0.0	31
5	Antapur	127	0.0	18
6	Dhanmodi	257	0.0	34
7	Vyara	202	0.0	33

Source: Water Availability Study of Par-Tapi-Narmada Link Project,March, 2012, HSO, CWC.

9.4.2 Temperature, Relative Humidity, Wind Speed and Cloud Cover

Two meteorological observatories viz., Surat and Vadodara maintained by IMD located adjacent to the project area have been used to characterize the climatic condition of the project area. The normal temperature, relative humidity, wind speed and cloud cover observed at Surat IMD observatory (based on the data for the period from 1998 to 2007) and Vadodara IMD observatories (based on the data for the period from 1998 to 2007) are as follows.

Temperature

Monthly mean maximum and minimum temperatures recorded at Surat and Vadodara stations are 36.8 ^{0}C & 14.7 ^{0}C and 39.9 ^{0}C & 13.2 ^{0}C respectively.

Humidity

Monthly mean maximum and minimum relative humidity recorded at Surat and Vadodara stations are 90% & 53% and 94% & 44% respectively.

Wind Speed

Monthly mean maximum and minimum wind speed recorded at Surat and Vadodara stations are 6.4 km/h & 1.7 km/h and 13.3 km/h & 2.2 km/h respectively.

Cloud Cover:

Monthly mean maximum and minimum wind speed recorded at Surat and Vadodara stations are 6.2 oktas & 0.7 oktas and 6.4 oktas & 0.8 oktas respectively.

9.4.3 Frost Free Days

Generally this region does not experience any frost

9.5 Proposed Cropping Pattern

Irrigation Planning of Par-Tapi-Narmada link project has been carried out by the Irrigation Planning (South) Directorate of CWC. The working sheets /data/ computations are placed at Annexures- 9.1 to 9.23. Keeping in view the prevailing cropping pattern in the nearby areas the cropping pattern for En-route Command Area of the link canal and Feeder pipeline has been proposed. The proposed cropping in the en-route command of project has been approved by State Agricultural Department and is at Annexure-9.24.

(A) Proposed Cropping Pattern En-route and under State Government projects

Similar type of cropping pattern is proposed for the command areas enroute the link canal lying on left side as well as of the projects proposed by Government of Gujarat. The proposed cropping pattern and crop calendar for en-route command is given in **Table-9.12** below.

Table-9.12
Cropping Pattern Proposed for the En-route Command
CCA: 59920 ha

Sl. No.	Season/ Crop	%age of CCA	Area of Crop(ha)	Crop duration (days)	Starting Monthand Fortnight
Kharif					
1	Paddy	8	4794	153	Jun Ist
2	Jowar	8	4794	123	May IInd
3	Pulses	4	2397	107	May IInd
4	Groundnut	8	4794	169	May IInd
5	Oilseeds	8	4794	107	Jun Ist
6	Vegetables	4	2397	107	Jun Ist
7	L.S.Cotton	4	2397	199	Jul IInd
8	S.S.Cotton	8	4794	199	Jul IInd
Rabi					
9	Wheat	8	4794	135	Nov Ist
10	Jowar	4	2397	151	Oct Ist
11	Maize	4	2397	138	Oct Ist
12	Vegetables	4	2397	107	Nov Ist
13	Pulses	8	4794	151	Oct Ist
14	Oil seeds	4	2397	151	Oct Ist
15	Ground nut	4	2397	151	Oct Ist
Hot Weather					
16	Bajra	2	1197	151	Mar Ist
17	Vegetables	2	1197	137	Mar Ist
18	Soyabean	2	1197	151	Mar Ist
Perennial					
19	Sugarcane	4	2397	350	Oct IInd

Sl. No.	Season/ Crop	%age of CCA	Area of Crop(ha)	Crop duration (days)	Starting Monthand Fortnight
20	Fruits	2	1198	349	Jun Ist
	Total	**100**	**59920**		

(B) Command area under Feeder pipelines

The cropping pattern as adopted for en-route Command Area is also considered for the Command area proposed under Feeder pipeline.

(C) Target Command Area in Saurashtra Regionand under othercommand areas of the link canal

The proposed cropping pattern considering the pressurized irrigation system for the target command area in the Saurashtra region is given in **Table-9.13:**

Table-9.13
Cropping Pattern Adopted for the Target Command Area of Link Canal
Total CCA: 42368 ha

Sl. No.	Crop Season/ Name of the Crop	For Pressurized Irrigation	
		% age of CCA	Area of Crop (ha)
Kharif			
1	Late Paddy		
2	Early Paddy		
3	Maize/Bajra		
4	Oilseeds	10	4237
Rabi			
5	Wheat	55	23302
6	Jowar		
7	Pulses/Vegetables	20	8474
8	Potato	6	2542
Two Seasonal			
9	S.S. Cotton		
10	L.S. Cotton		
11	Tobacco		

Sl. No.	Crop Season/ Name of the Crop	For Pressurized Irrigation	
12	Lucene		
Hot Weather			
13	Bajra		
14	Fodder	6	2542
Perennial			
15	Sugarcane		
16	Fruits	3	1271
	Total	**100**	**42368**
	Grand Total		**42368**

9.5.1 Proposed Irrigation Facilities

9.5.1.1 En-route Command

The Par-Tapi-Narmada Link Canal off-takes from Paikhed barrage proposed on Nar River (a tributary of Par River) with a Full Supply Level of 142.800 m. The canal runs for a distance of about 177.736 km from Paikhed barrage and drops into existing Ukai reservoir on Tapi River at its left flank. Again the canal takes-off from the right flank of Ukai reservoir with an Off-take Level of 81.79 m and crosses the Narmada River downstream of Sardar Sarovar dam and out-falls into Miyagam branch canal (at RD 16.70 km) of Narmada Main canal after covering a total distance of about 191.307 km from its off-take point at Ukai reservoir. The Full Supply Level of the link canal at its tail end is 53.573 m.

Sample Command Area surveys were carried out in the Tapi-Narmada reach at three locations viz. i) Mandvi, ii) Wankal and iii) Valia to an extent of 1300 ha, 1750 ha and 1150 ha respectively, covering a total area of about 4200 ha. The topographical survey had been carried out at 50 m grid basis and the Command Area maps were prepared to a scale of 1: 15000 with contour interval of 1 to 2 m. The maps are appended as Plates 4.41 to 4.43 in Volume –VII. However, due to public hindrance no sample Command Area surveys could be carried out in the Par-Tapi reach.

En- route Gross Command Area of the link is 68793 ha which need to be surveyed for finalizing the Command Area en-route the link canal. Since field survey of such a large area was time consuming, it was decided to

demarcate en-route Command Area under the link canal with Remote Sensing techniques. The demarcation of Command Area was got done through Regional Remote Sensing Centre (Jodhpur), ISRO. IRS P6 LISS IV data has been used along with SRTM DEM data to get the ground information of the proposed Command Area. A total area of around 3851 km^2 is analyzed for identification of Command Area. For the analysis the entire area has been divided into two reaches viz. i) Par-Tapi reach and ii) Tapi-Narmada reach. It is proposed to adopt an irrigation intensity of 100% in the en-route Command. The details of Command Area in these reaches are furnished in Table-9.14:

Table-9.14
GCA, CCA and Annual Irrigation En-route

Sl. No.	Reach	GCA (ha)	CCA(ha)	Annual Irrigation(ha)
1	Par-Tapi	11448	10100	**10100**
2	Tapi-Narmada	57345	49820	**49820**
	Total	**68793**	**59920**	**59920**

9.5.1.2 Command Area Proposed under Feeder pipeline

The CCA and Annual Irrigation under Dabdar and Kelwan Feeder Canals adopting an Irrigation Intensity of 100% are given in Table-9.15:

Table-9.15
CCA and Annual Irrigation under Feeder pipeline

Sl. No.	Name of Feeder Canal	CCA(ha)	Annual Irrigation (ha)
1	Dabdar	630	**630**
2	Kelwan	640	**640**
	Total	**1270**	**1270**

9.5.1.3 Command Area of Narmada Main Canal (NMC) of SSP to be takenover by the Link Canal.

Par – Tapi – Narmada link project will take over 76710 ha CCA (annual irrigation 76710 ha with irrigation intensity as 100%) of existing

Miyagam branch canal of Narmada Canal System. The Narmada water so saved will be utilized to provide irrigation to 23750 ha CCA in Chhota Udepur district, 10592 ha CCA in Panchmahal distict and 42368 ha CCA with 100% irrigation intensity in Saurashtra region by Pressurized Irrigation.

The abstract of CCA and annual irrigation from the Par-Tapi-Narmada link and other demand are given in Table 9.16:

Table 9.16
Abstract of CCA and Area to be Irrigated Through Par-Tapi-Narmada Link Project

Irrigation / Drinking water benefits from Par-Tapi-Narmada Link

Sl. No.	Reach / Feedar	CCA (ha)			Annual Irrigation (ha)	Annual Utilisation in (MCM)
		In Tribal areas	Non-Tribal	Total		
1	Enroute command	51173	10017	61190	61190	382
2	Project proposed by Government of Gujarat on the left side of canal	40631	4930	45561	45561	285
3	Tribal area in enroute right side of canal	36200	0	36200	36200	138
4	Tribal area in vicinity of reservoirs	12514	0	12514	12514	48
5	Tribal areas on right side of Narmada main canal by lift					
	a.Chhota Udepur dist. b.Panchmahal dist.	14940 1833	8810 8759	23750 10592	23750 10592	90 40
	Sub-total	16773	17569	34342	34342	130
6	Supply of drinking water for all villages of Dang District and Villages of Kaprada	Provision of 76 MCM made for about 27.60 lakh population of these areas.				76

	& Dharmpur taluka of Valsad District.					
7	Filling all possible tanks in benefitted areas.					50
8	Target command in Saurashtra region	0	42368	42368	42368	161
	Total	**157291**	**74884**	**232175**	**232175**	**1270**
		Say 2.32 lakh hectares				
9	Environmental releases					**20**
10	Evaporation losses					**40**
	Grand Total					**1330**

9.5.2 Scope for Double & Multiple Cropping pattern and Change in Cropping Pattern

9.5.2.1 Soils

The details of soils present in the proposed Command Area are already described under para 9.3 above. As the soils in the Command Area are mainly Deep Black and Medium Black Clayey soils, there are no limitations for adopting double and multiple cropping patterns in the proposed Command Area as far as soils are concerned.

9.5.2.1.1 Agro-climatic Conditions

Based on soil characteristics, rainfall and temperature Gujarat is divided in to 8 Agro-climatic zones. The Command area of Par-Tapi-Narmada link canal falls in i) South Gujarat Heavy Rainfall Zone and ii) South Gujarat Zone. The climate in the region is Semi-arid to dry sub-humid. Therefore, the Agro-climatic conditions in the proposed Command Area are favorable for adopting double and multiple cropping patterns.

9.5.2.2 Water and Other Inputs like Fertilizers, Weedicides and Pesticides

Input survey carried out by Revenue Department, Government of Gujarat in 2006-07 indicated that in 86% of agricultural holdings having

irrigation facilities, Chemical Fertilizers were used and in about 80% of these holdings crops were treated with Pesticides. In un-irrigated holdings the use of Chemical Fertilizers & Pesticides was recorded as 62% and 65% respectively. It shows that usage of Fertilizers & Pesticides is very common among the farmers in the State.

9.5.2.3 Irrigated Crops in the Adjoining Area

The irrigated crops grown in the adjoining areas of command are mainly Paddy, Wheat, Sugarcane, Cotton, Fruits and Vegetables.

9.5.2.4 Attitude of Farmers towards Modern Irrigated Agricultural Practices

As the farmers in the Command Area will get assured irrigation through the link canal which improves their socio-economic status, most of the farmers may support modern irrigated agricultural practices.

9.6 Crop Water Requirement

(A) En-route Command Area

The annual crop water requirement for each crop under En-route Command Area has been computed by Irrigation Planning (South) Directorate, CWC adopting Modified Penman's method. Basic data is given at Annexure-9.7 and detailed computations are at Annexure 9.8 in Volume-II. The details are given below in Table-9.17:

Table –9.17

Crop Water Requirement for En-route Command Area

CCA: 59920 ha

Sl. No.	Crop Season/ Name of the Crop	% age of CCA	Area of Crop (ha)	Water Requirement (MCM)
Kharif				
1	Paddy	8	4794	39.664
2	Jowar	8	4794	9.928
3	Pulses	4	2397	5.936
4	Groundnut	8	4794	11.216
5	Oilseeds	8	4794	11.048

Sl. No.	Crop Season/ Name of the Crop	% age of CCA	Area of Crop (ha)	Water Requirement (MCM)
6	Vegetables	4	2397	0.176
7	L S Cotton	4	2397	11.192
8	SS Cotton	8	4794	21.728
Rabi				
9	Wheat	8	4794	38.576
10	Jowar	4	2397	15.928
11	Maize	4	2397	15.312
12	Vegetables	4	2397	18.064
13	Pulses	8	4794	36.328
14	Oilseed	4	2397	17.144
15	Groundnut	4	2397	18.520
Hot Weather				
16	Bajra	2	1197	8.608
17	Vegetables	2	1197	14.320
18	Soyabean	2	1197	8.608
Perennials				
19	Sugarcane	4	2397	43.456
20	Fruits	2	1198	22.368
	Total	**100**	**59920.00**	**374.52**

Say 375 MCM

(B) Crop Water Requirement of Feeder pipeline

The crop water requirement of the Command area under Dabdar and Kelwan Feeder Canals has been worked out considering the fortnightly crop water requirement computed for the En-route command area of the link canal. The crop-wise water requirement details are given in **Table-9.15 and 9.18:**

Table – 9.18
Crop Water Requirement of Command Area under Dabdar Feeder pipeline

CCA: 630 ha

Sl. No.	Crop Season/ Name of the Crop	% age of CCA	Area of Crop (ha)	Water Requirement (MCM)
Kharif				
1	Paddy	8	50	0.417

Sl. No.	Crop Season/ Name of the Crop	% age of CCA	Area of Crop (ha)	Water Requirement (MCM)
2	Jowar	8	50	0.104
3	Pulses	4	25	0.063
4	Groundnut	8	50	0.118
5	Oilseeds	8	50	0.117
6	Vegetables	4	25	0.070
7	L S Cotton	4	25	0.118
8	SS Cotton	8	50	0.228
Rabi				
9	Wheat	8	50	0.406
10	Jowar	4	25	0.167
11	Maize	4	25	0.161
12	Vegetables	4	25	0.190
13	Pulses	8	50	0.382
14	Oilseed	4	25	0.179
15	Groundnut	4	25	0.195
Hot Weather				
16	Bajra	2	13	0.090
17	Vegetables	2	20	0.151
18	Soyabean	2	12	0.090
Perennials				
19	Sugarcane	4	25	0.457
20	Fruits	2	10	0.234
	Total	**100**	**630**	**3.900**

Table – 9.19

Crop water Requirement of Command Area under Kelwan Feeder pipeline

CCA: 640 ha

Sl. No.	Crop Season/ Name of the Crop	% age of CCA	Area of Crop (ha)	Water Requirement (MCM)
Kharif				
1	Paddy	8	51	0.422
2	Jowar	8	51	0.106
3	Pulses	4	26	0.064
4	Groundnut	8	51	0.118
5	Oilseeds	8	51	0.118
6	Vegetables	4	26	0.070

Sl. No.	Crop Season/ Name of the Crop	% age of CCA	Area of Crop (ha)	Water Requirement (MCM)
7	L S Cotton	4	26	0.118
8	SS Cotton	8	50	0.234
Rabi				
9	Wheat	8	50	0.413
10	Jowar	4	26	0.170
11	Maize	4	26	0.163
12	Vegetables	4	26	0.192
13	Pulses	8	50	0.387
14	Oilseed	4	26	0.182
15	Groundnut	4	26	0.198
Hot Weather				
16	Bajra	2	13	0.093
17	Vegetables	2	13	0.154
18	Soyabean	2	13	0.093
Perennials				
19	Sugarcane	4	26	0.471
20	Fruits	2	13	0.240
	Total	**100**	**640**	**4.006**

9.6.1 Monthly Water Requirement for Irrigation

A total quantum of 1144 MCM of water is allocated to meet irrigation demand for about 232175 ha of command area under the Par-Tapi-Narmada link project. Details are given in the following paragraphs.

(A) En-route Command Area

Monthly water requirement for irrigation in en-route command area has been worked out by Irrigation Planning (South) Directorate, CWC is at Annexures- 9.3, 9.4, 9.5.1 and 9.5.2 in Volume-II. The month-wise break up of water requirement for en-route command area as computed isgiven in Table-9.20:

Table – 9.20
Month-wise Water Requirement for En-route Command Area
CCA = 59920 ha
Assumed Intensity of Irrigation = 100%

Annual Irrigation = 59920 ha

Sl. No.	Month	Water Requirement (MCM)
1.	June	30.38
2.	July	20.95
3.	August	18.65
4.	September	17.88
5.	October	18.21
6.	November	60.59
7.	December	47.29
8.	January	46.79
9.	February	48.32
10.	March	37.82
11.	April	14.24
12.	May	13.4
	Total	**374.52**

Fortnightly crop water requirement for the en-route command Area has been detailed in Irrigation Planning of Par-Tapi-Narmada link project prepared by Irrigation Planning (South), Directorate at Annexure-9.8 in Volume-II.The above crop water requirement has been computed considering field irrigation efficiency of 85% for Paddy and 65% for normal ID crops and a conveyance efficiency of 75% for all crops.

(B) Monthly Water Requirement of Feeder pipeline

The month-wise break up of water requirement of the Command area under Dabdar and Kelwan Feeder pipe line is given in Table-9.21:

Table – 9.21
Month-wise Water Requirement of Command Area under Dabdar Feeder pipeline

CCA = 630 ha

Assumed Intensity of Irrigation = 100%
Annual Irrigation = 630ha

Sl. No.	Month	Water Requirement (MCM)
1.	June	0.265
2.	July	0.252
3.	August	0.216
4.	September	0.251
5.	October	0.650
6.	November	0.498
7.	December	0.490
8.	January	0.528
9.	February	0.332
10.	March	0.163
11.	April	0.148
12.	May	0.107
	Total	**3.900**

Table – 9.22
Month-wise Water Requirement of Command Area under Kelwan Feeder pipeline

CCA = 640 ha
Assumed Intensity of Irrigation = 100%
Annual Irrigation = 640 ha

Sl. No.	Month	Water Requirement (MCM)
1.	June	0.280
2.	July	0.180
3.	August	0.140
4.	September	0.170
5.	October	0.780
6.	November	0.520
7.	December	0.530
8.	January	0.540
9.	February	0.367
10.	March	0.180
11.	April	0.176
12.	May	0.137
	Total	**4.000**

(C) Monthly Water Requirement of Command Area of Narmada Main Canal (NMC) of SSP to be taken over by the Link Canal

This command is already developed and water demands have been kept same as proposed in Sardar Sarovar Project. The monthly water requirements are given in Table-9.23:

Table – 9.23

Month-wise Water Requirement of Target Command Area in Saurashtra & Kutch by the Link Canal

Pressurised Irrigation :CCA-42368

Intensity of Irrigation - 100%

Annual Irrigation- 42368ha

Sl. No.	Month	Water Requirement (MCM	Total(MCM)
		For Pressurised Irrigation	
1.	June	7.38	7.38
2.	July	5.46	5.46
3.	August	7.65	7.65
4.	September	24.94	24.94
5.	October	23.26	23.26
6.	November	24.44	24.44
7.	December	15.85	15.85
8.	January	20.40	20.40
9.	February	16.33	16.33
10.	March	8.31	8.31
11.	April	3.48	3.48
12.	May	3.50	3.50
	Total	**161.00**	**161.00**

(D) Also, 285MCM for projects proposed by Government of Gujarat, 138 MCMfor Tribal areas lying enroute right side, 48 MCM for Tribal area in the vicinity of the reservoirs, 90MCM&40 MCM for Tribal areas on right side of the Narmada Main canal in Chhota Udepur & Panchmahal districts are planned in the irrigation planning of Par-Tapi-Narmada link project.

9.7 Water Planning

9.7.1 Surface Water

9.7.1.1 Total Irrigation Demand of the Link Project

The gross irrigation demand of the link project in vicinity of reservoirs, en-route of link canal / Pipe line, Projects proposed by Government of Gujarat,

Tribal area right side of link canal and for tribal areas of Chhota Udepur and Panchmahal districts and Saurashtra works out to be 1144 MCM.

9.7.1.2 Domestic & Industrial Use and Filling of tanks in the Periphery of Reservoirs

9.7.1.2.1 Supply of Drinking water for villages and filling of village and Panchayat tanks

A provision of 76 MCM has been made for supply of drinking water to 27.5 lakh populations for villages of Valsad, Navsari, Dang, Tapi, Surat, Bharuch, Narmada and Vadodara district of Gujarat and Nasik district in Maharashtra State.

In adition to above, provision of 50 MCM has been kept for filling of 2226 village and panchayat tanks located in Valsad, Navsari, Dang, Tapi, Surat, Bharuch, Narmada and Vadodara district of Gujarat and Nasik district in Maharashtra State.

9.7.1.4 Environmental Releases

The minimum environmental flow demand in the river is considered as 10% of the average annual lean season flows at the respective reservoirs/barrages during the period from October to May are given in Table 9.24:

Table 9.24

Demands for Environmental Flow

Sl. No.	Reservoir / Weir	Minimum Downstream Release for Environmental Needs (MCM)
1	Jheri reservoir	4.40
2	Paikhed reservoir	3.20
3	Paikhed barrage	0.00
4	Chasmandva reservoir	0.80
5	Chasmandva barrage	0.00
6	Chikkar reservoir	1.60
7	Dabdar reservoir	4.00
8	Kelwan reservoir	4.80
9	Ukai reservoir	0.00
	Total	**18.80**

Say 20 MCM

The monthly Environmental releases works out to 2.35 MCM from October to May month.

9.7.1.5 Evaporation losses

A provision of 40 MCM is kept to meet evaporation losses.

9.7.1.6 Total Water Demand of the Link Project

The total water demand of the link project include: i) Irrigation water demand of 1144 MCM, ii) Drinking water demand of 76 MCM iii) For filling of tanks 50 MCM (32 MCM in the vicinity of proposed reservoirs iv) Environmental demand of 20 MCM downstream of 6 reservoirs) and v) Evaporation losses from 6 reservoirs to an extent of 40 MCM.Thus, the total water demand of the Par-Tapi-Narmada link project is 1330MCM. The total monthly water demands of the link project are furnished in **Table-9.25:**

Table – 9.25
Total Monthly Water Demand of the Link Project

Sl. No.	Month	Irrigation	Provision for Drinking water	Filling of Tanks	Environmental Releases	Total Water Demand
1	2	3	4	5	6	7
1.	June	72.29	6.32	0.00	0.00	78.61
2.	July	53.15	6.32	0.00	0.00	59.47
3.	August	54.84	6.32	0.00	0.00	61.16
4.	September	109.36	6.32	0.00	0.00	115.68
5.	October	171.36	6.32	0.00	2.35	180.03

6.	November	153.89	6.32	8.31	2.35	170.87
7.	December	127.75	6.32	8.31	2.35	144.73
8.	January	146.38	6.32	8.31	2.35	163.36
9.	February	109.38	6.32	8.31	2.35	126.36
10.	March	60.38	6.32	8.31	2.35	77.36
11.	April	45.72	6.32	8.31	2.35	62.70
12.	May	39.50	6.32	0.00	2.35	48.17
	Total :	**1144.00**	**75.84**	**49.86**	**18.80**	**1288.50**
	Say	**1144.00**	**76.00**	**50.00**	**20.00**	**1290.00**
				Evaporation losses		**40.00**
	Grand Total					**1330.00**

9.7.1.7 Working Tables

Six reservoirs viz. i) Jheri, ii) Paikhed, iii) Chasmandva, iv) Chikkar, v) Dabdar and vi) Kelwan are proposed across the rivers Par, Nar, Tan, Ambica, Khapri and Purna respectivelyfor diversion of surplus waters in to Par-Tapi-Narmada link canal. Working table for 32 years from 1975-76 to 2006-07 have been prepared in an integrated manner, based on storage capacities of all these reservoirs to ascertain the success rate of the project in meeting the proposed water demands. The details of working tables/simulation studies are already discussed in Chapter-5: Hydrology & Water Assessment under Para -5.17 “Simulation studies”. The simulation studies show that the reservoirs are 100% successful in meeting Environmental, Domestic & Industrial demands at their peripheryand diversion demand of link canal between Auranga & Tapi Rivers. The reservoirs are 78% successful in meeting the Diversion demand of link canal beyond Tapi River.Working tables for 32 years from 1975-76 to 2006-07 are given in Annexure-9.9 and abstract of the working tables are given at Annexure -9.10 in Volume-II.

9.7.1.8 Designed Head Discharge of Canal Systems

The canal/tunnel capacities at the Off-take points of reservoirs and en-routeare worked out by Irrigation Planning (S) directorate of CWC and given at Annexure-9.10 in Volume-II. A provision of 10 % additional capacity has been provided towards rush irrigation and furnished in **Table: 9.26:**

Table – 9.26
Canal /Tunnel Capacity at off-take Points and En -route

Reservoir / Weir/Canal	Canal/Tunnel	Capacity (cumec)
Jheri Reservoir	Tunnel connecting Jheri and Paikhed reservoirs	12.80
Paikhed Weir	Par-Tapi-Narmada Link Canal at head	38.17
Link Canal	Link Canal between Paikhed weir and Chasmandva Feeder	38.17
Chasmandva Weir	Chasmandva Feeder Canal	8.50
Link Canal	Link Canal between Chasmandva Feeder and Dabdar Feeder	46.64
Chikkar Reservoir	Chikkar and Dabdar interconnecting canal	6.40
Dabdar Reservoir	Dabdar Feeder Canal	17.00
Link Canal	Link Canal between Dabdar Feeder and Kelwan Feeder	46.64
Kelwan Reservoir	Kelwan Feeder Canal	17.00
Link Canal	Link Canal between Kelwan Feeder and Ukai reservoir	63.69
Link Canal	Off-take from Ukai reservoir	46.64
	RD 51.043 Km to 69.150 Km	36.40
	RD 69.150 Km to 82.171 Km	31.89
	RD 82.171 Km to 191.310 Km	17.26

9.7.2 Ground Water

9.7.2.1 Ground Water Quality

The proposed Command Area of the link canal lies in Navsari, Dangs, Tapi, Surat and Bharuch districts of Gujarat.

Geologically the Navsari district comprises of Alluvium (Clay & Sand) & Trap. Basaltic out crops are seen in Vansda taluka in which the Command area lies. Ground water availability in alluvial formations is satisfactory. In Trap area, the availability of groundwater is less. The groundwater quality in the Command area is good.

Geologically the Dangs district is composed of Deccan trap Basalt. Basalt acts as poor aquifer. The water quality is very good.

Geologically the Tapi district is comprises of Deccan trap Basalt of Cretaceous-Eocene age, which is overlain by quaternary alluvium. The groundwater availability is poor in hard rock area but its quality is good.

Limestone & clay formation of Eocene ages and quaternary alluvium formation are seen in Surat district. The groundwater availability and quality is good in the proposed Command Area.

Geologically, Bharuch district is mainly divided in to 2 types of rocks. Alluvial formations are seen in western side. In the eastern side, where the Command area lies, Basaltic rocks are seen. Groundwater availability and quality is good in the proposed Command Area. Overall, the level of groundwater development in the proposed Command area of the link project can be categorized as "Safe".

9.7.2.2 Conjunctive Use / Ground Water Support

In order to make an economic and efficient use of available water resources, it is essential that a judicious mix of surface and ground water are resorted to for irrigation purposes. There is considerable scope to further intensify the irrigation in the command areas by making use of the ground water resources available. This may further facilitate in checking the hazards of water logging and soil salinity in the command.

In the present planning, no use of ground water is proposed in any of the command. However, the available ground water resource can be utilized in future for further intensification or augmentation of the irrigation facilities in various commands, particularly to meet the irrigation requirement during lean season.

9.8 Command Area Drainage

The command area en-route the link canal is drained by a network of rivers namely Par, Auranga, Ambica and Purna in addition to number of small streams and nallahs. The commands have quite good draining facilities. However, with the introduction of irrigation, as the command area develops, drainage problem may crop up in the course of time. Suitable provision is, therefore, made in the project estimate towards chalk and collecting drains in the command area.

9.9 Water Course / Field Channels

These are small channels to deliver water to each and every field in the command area of an outlet which is approximately 40 ha for a delivery system of one cusec. Water course generally off takes from a minor or distributaries. Capacity of a water course depends upon (a) Water allowance (b) running period of outlet and (c) Area to be irrigated.

Branch canals, major/minor distributaries, sub-minors & water courses /field channels etc., are planned and designed to facilitate in carrying water from their out lets upto the tail end, at very short time, preventing loss of seepage in agricultural land. The rate per hectare arrived on the basis of a representative sample area surveyed. Thus, the total cost of U-Distributaries, minors & sub-minors and V-Water courses/field channels in the whole command area of the link project has been arrived.

Three sample areas have been selected for command area surveys viz Wankal,Valiya and Mandavi. The grid survey of proposed command area under the Mandavi Branch canal which off-takes at RD 51.525 km of Tapi-Narmada portion of Par-Tapi-Narmada link has been carried out, covering an area of 1300 ha has been selected for cost estimation of command area development. The estimated cost/ha of CCA works out to Rs.38701/- (price level 2013-14), inclusive of U-Distributaries, Minors and Sub-minors and V-Water courses/field channels. The details are at Appendix Volume-VI.

9.10 Water Management

9.10.1 Review and Evaluation of Existing System of Operation and Distribution in the Command and/or in some Adjoining Projects, if any

Maximum gains in water use efficiency can only be made when these are combined with better management practices. Keeping this concept in view, the Government of Gujarat has decided to cover maximum possible command area under Participatory Irrigation Management to ensure that irrigation water is distributed efficiently and equitably in the command area and that it be used efficiently through Participatory Irrigation Management (PIM). Where irrigation Co-Operatives maintain the canal network and field channels, expand irrigated area and distribute and provide tail-enders their fair and just share of water. Rehabilitation of existing canal network through stakeholders' participation to make water available to tail-enders is given priority.

9.10.2 Proposals for Participatory Irrigation Management Including Formation of Water Users Association

The Government of Gujarat has taken up initiative to involve beneficiaries and stakeholders in irrigation management by enacting PIM Act in 2007. Under the provisions of this Act, Water Users' Association (WUA) is formed from amongst the beneficiary farmers in command area of an irrigation project. 90% of cost for community mobilization is borne by the Government. Rehabilitation of canals is completed by the Government before handing over to WUAs. The WUA contributes 10% of the rehabilitation cost. Preference is given to WUA to carry out rehabilitation by them. A canal can be handed over to WUA even prior to rehabilitation, if the WUA so demands. Advance payment of the order of 1/3rd of the estimated cost is given to WUA for starting the work.

Under the provisions of the Act, a WUA is authorized for;

- Collecting Government water charges
- Retention of 50% for O&M permitted, rest goes to the Government
- Deciding water rates higher than the Government charges
- Retaining entire additional amount
- Increasing women's participation in the WUA

Similar practice can be adopted in Par – Tapi – Narmada link project also.

9.10.3 Scope of Introduction of Modern Technology Like Sprinklers, Drip Irrigation etc.

A total command area of 232175 ha is envisaged under the Par-Tapi-Narmada link project with intensity of irrigation as 100%. Out of the above, 125424 ha area covered under Chhota Udepur & Panchmahal Districts (34342 ha) covered by lift from Narmada Main canal, target area under Saurashtra region (42368 ha), enroute area lying on right side of the link canal (36200 ha), area in the vicinity of the six proposed reservoirs (12514 ha) is planned to be irrigated by Drip & Sprinkler irrigation Systems.Government of Gujarat has also suggested to adopt pressure irrigation where lifting of water is involved.

9.10.4 Existing Practice of Department of Agriculture for Popularizing Micro Irrigation

Gujarat Green Revolution Company limited is an implementing agency for implementation of Micro Irrigation Scheme on behalf of Government of India and Government of Gujarat in Gujarat State through reputed authorized Micro Irrigation System suppliers, who supplies and installs the Micro Irrigation System and also provides agro services pertaining to Micro Irrigation System. It is aim to bring 2nd Green Revolution in the State by saving of water, electricity and enhancing agriculture productivity resulting in the farmers prosperity at large.

The Gujarat Agro Industries Corporation (GAIC) and Agricultural Produce Marketing Committee (APMC) adopts various programs and schemes for the Agriculture and Horticulture segment for investments and other processing subsidies in the Food Processing Sector. Agri implement service help is provided by the government for open pipelines and purchase of Tractor, etc. Bio gas subsidies are offered with loan application.

9.10.5 Facilities for Training the Operation and Maintenance Personnel at Different Levels of Management and Farmers-Adequacy of Existing Facilities and Proposals for Augmentation

Water Resources Department through Water & Land Management Institute (WALMI) initiated systematic and intensive training courses and

orientation programs for all stake holders at each level. Adequate training facilities are available to the farmers. Due to latest technology like Television and Mobile phones available in each house, farmers get to know the latest in the agricultural field and Government schemes, subsidies etc.Training to the farmers at their native villages may be imparted on various crops suitable in area specific agro climatic zone and also on Pressurrised irrigation practices.

9.10.6 Existing Extension Activity andProposals for its Improvement

The Agriculture & Co-operation Department, Government of Gujarat provides Training and extension services to educate the farmers about the use of improved and modern agriculture technology, and cultivation of high value crops. The department is organizing Krushi Mahotsavs (Lab to Land programme) with 'Krushi Raths' (vans) reaching to farmers with Researchers, Scientists and experts interacting and providing information and counseling on soil health, organic farming, technology and inputs, irrigation etc. Gujarat is the first State to issue Soil Health Cards to farmers which helps them in getting good yields. Agri-implements subsidies, Agriculture Support Schemes, Seeds Sahaya etc. are some of the schemes launched by the Agriculture & Co-operation Department, Government of Gujarat for the benefit of farmers.

9.11 Command Area

Location, Gross Command Area, Cultural Command Area, En-route irrigation demand etc are at Para 9.1.1 and descriptions of the Command Areas have already been given in previous paras.

9.11.1 Command Area Details

9.11.1.1 Location

The entire Command area proposed under Par-Tapi-Narmadalink project lies in Gujarat. En-route command area under the link canal is divided in to 2 parts viz. i) Command Area lying in Par-Tapi reach and ii) Command Area lying in Tapi-Narmada reach. The Gross Command Area (GCA) in Par-Tapi reach is 11448 ha and it lies in Vansdataluka of Navsari

district and Vyara&Songadhtalukas of Tapi district. The Gross Command Area in Tapi-Narmada reach is 57345 ha and it lies in Songadhtaluka of Tapidistrict, Mandvi&Mangroltalukas of Surat district and Valia, Ankaleswar&Zagadiatalukas of Bharuch district. Maps showing en-route command area are given as Plates 4.40 (total 5 sheets) in Volume - VII.Locations of command area have already been given at Table 9.2 and 9.3. Abstract of District / Taluka wise break-up of the en-route command area are given at Table-9.27:

Table- 9.27

Abstract of District/Talukawise Details of En-route Command Area

Sl.No.	District	Taluka	GCA (ha)	CCA (ha)
I	**Par-Tapi reach**			
a)	Navsari	Vansda	4096	3285
b)	Tapi	Vyara	5162	4825
		Songadh	2190	1990
Sub-total			**11448**	**10100**
II	**Tapi-Narmada reach**			
a)	Tapi	Songadh	1017	987
b)	Surat	Mandvi	9693	8978
		Mangrol	25179	21568
c)	Bharuch	Valia	8816	7557
		Ankaleswar	11800	10017
		Zagadia	840	713
	Sub-total		**57345**	**49820**
III	**Feeder Pipe lines**			
a)	Dabdar Feeder Pipe line			
	Dangs	Ahwa	714	630
b)	Kelwan FeederPipe line			
	Dangs	Ahwa	725	640
Sub-total			**1439**	**1270**
Grand-total			**70232**	**61190**

9.11.1.2 Classification of Land (Forest, Grass Land, Cultivable Land, Cultivable Waste, Barren Land)

The classification of land in en-route command area is furnished in Table-9.28:

Table: 9.28

Reach-wise Land Use Particulars in the En-route Command Area

Unit: ha

Land	Par-Tapi Reach	Tapi-Narmada Reach	Feeder pipe line		Total
			Dabdar	Kelwan	
Agriculture	10194	44620	233	236	54814
Forest	559	149	429	436	708
Land with scrub	143	2506	52	53	2649
Land without scrub	454	5494	0	0	5948
Mining	0	895	0	0	895
Water bodies	5	201	0	0	206
River	33	218	0	0	251
Towns	14	2305	0	0	2319
Villages	46	780	0	0	826
Industrial	0	177	0	0	177
Gross Command Area	**11448**	**57345**	**714**	**725**	**70232**

Source: *Technical Report: Demarcation of command area en-route PTN link-March, 2011, prepared by RRSC, Jodhpur.*

9.11.1.3 Size of Land Holding

The size of land holding and area in the Districts lying in the en-route command area as per Agriculture census 2005-06 is given in Table-9.29:

Table-9.29
Size of Land Holding in the En-route Command Area
Area: ha

Size Class	Navsari		Tapi		Surat		Bharuch	
	No	Area	No	Area	No	Area	No	Area
Marginal (Up to 0.99)	76938	24779	23732	10406	54050	25237	43096	21687
Small (1.00-1.99)	21215	30108	19052	27535	38139	55216	33660	48848
Semi medium (2.00-3.99)	14346	39827	14762	41462	31221	87803	30292	84930

Size Class	Navsari		Tapi		Surat		Bharuch	
	No	Area	No	Area	No	Area	No	Area
Medium (4.00-9.99)	6090	34511	7993	46061	15100	85334	21021	124891
Large (10&Above)	623	12932	882	16240	1121	17282	2935	43347
All Classes	**119212**	**142157**	**66421**	**141705**	**139631**	**270871**	**131004**	**323703**

Source: *Agriculture census–2005-06 (Part-I), Report on Operational Holdings, Revenue Department, Government of Gujarat, 2011.*

9.11.1.4 Climate of Command Area

The climate of en-route command is as given below:

a) **Rainfall:** The annual mean rainfall in the command is about 1700 mm, the mean monsoon rainfall is around 1670 mm and mean non-monsoon rainfall is about 36 mm. Maximum rainfall occurs in the month of July and the minimum rainfall occurs in June during monsoon.

b) **Temperature:** The climate of the Command Area is characterized by a hot summer except in the Monsoon season during June to Sept. The climate is moderately cold in winter. Maximum temperature recorded in the vicinity of the Command area was 48°C and minimum winter temperature recorded was5°C.

c) **Relative Humidity:** The maximum and minimum relative humidity in & around the command area are 89% and 32% respectively.

d) **Evaporation:** The monthly mean evaporation in the command area varies between 10 cm & 25 cm.

9.11.1.5 Irrigation

(a) Present Sources of Irrigation in Command

The present source of irrigation in proposed command area is mainly wells including Tube wells.

(b) Methods of Irrigation Followed

At present, the conventional method of applying water through minor irrigation channels, distributaries and water courses is being followed in these areas. However, sometimes electric/diesel pump sets are also used to lift water from the streams and wells.

(c)Status of Land Development for Irrigated Area
(i)Condition of Channels

The condition of existing irrigation channels in the command area is generally satisfactory except in some reaches where proper maintenance is required. Most of the channels are unlined, hence susceptible to loss of water through seepage.

(ii)Longitudinal Slope of Field

The slope in agricultural fields where irrigation channels are located, are adequate and irrigation water reaches almost every nook and corner of the fields.

(iii)Status of Field Channels

The status of field channels is satisfactory. However, proper drainage network need to be built after introduction of canal irrigation in the area.

9.11.1.6 Socio-economic Aspects

M/s WAPCOS, Gandhinagar has carried out Comprehensive Environmental Impact Assessment and Socio-economic studies of Par-Tapi-Narmada link project. The district wise socio-economic aspects are furnished in Table-9.30:

Table-9.30
District-wise Socio-economic Aspects

Sl.No.	Description	Navsari	Tapi	Surat	Bharuch
1.	Population density per km^2	592	257	1337	238
2.	Sex ratio (Female to 1000 male)	961	1007	787	925
3.	SC	2.67%	1.01%	2.60%	4.01%
4.	ST	48.11%	84.18 %	14.09 %	31.48%
5.	Landholdings	Maximum number of holdings belongs to marginal farmers owning less than 1 ha			
6.	Literacy rate	83.88%	68.26 %	85.53 %	81.51%
7.	Schools	750	805	1666	1026
8.	Medical and health facilities	58	37	103	59
9	Drinking water supply				
	Tap water	50%	26%	81%	76%
	Wells	10%	9%	2%	4%
	HandPump/Tubewell/Borewell	39%	64%	16%	18%
	Other sources	1%	1%	1%	2%

Source: *1. State, District and Talukawise Salient Features of Population statistics (2001 and 2011) Gujarat, Directorate of Economics & Statistics;*
2. Statistical Outline Gujarat State 2012, Directorate of Economics & Statistics;
3. Socio-Economic review 2013-2014, Gujarat State.

9.11.1.7 Infrastructure Facilities
(a)Roads and Railways

Details of roads and railways of the districts falling in the en-route command area are given in Table-9.31:

Table-9.31
Distribution of Roads and Railways in the en-route command area

District	Length of all	Length of	Total Length of

	Weather Roads (km)	Railway line(km)	Transport Network (km)
Navsari	2870	71	2941
Tapi	2242	82	2324
Surat	3803	242	4045
Bharuch	1309	168	1477

Source: *Brief industrial profiles of districts, prepared by MSME-Development Institute, Government of India, Ahmedabad.*

(b) Marketing Facilities

(i) Navsari District

Almost all the villages falling under the proposed command with in Vansda taluka are dependent on the marketing facilities available in Vansda, Navsariand Chikhli towns. These included about 8 co-operative marketing societies available in this taluka. There are 4 Main Agriculture Market Yards and 3 Sub-Market Yards in Navsari district.

(ii) Tapi District

The nearest marketing places for the people residing in Vyarataluka in the en-route command area of Vyara and Valod. The nearest marketing places for the people residing in Songadhtaluka in the en-route command is at Songadh. There are 5 Main Agriculture Market Yards and 12 Sub-Market Yards in Tapi district.

(iii) Surat District

Good marketing facilities are available for the people of the command areas in Mandvi and Mangroltalukas of Surat district. In addition, numerous fair price shops, within reasonable distances are available in all villages. There are 7 Main Agriculture Market Yards and 14 Sub-Market Yards in Surat district.

(iv) BharuchDistrict

In 3 talukas viz. Valia, Ankaleswar and Zagadiaof Bharuch district, good marketing facilities are available. There are 7 Main Agriculture Market Yards and 13 Sub-Market Yards in Bharuch district.

(c) Agro-industries

(i) Navsari District

Cotton Textile, Paper & Paper products, Oil products, Kachori Making/Food Products and Sugar mills are the major Agro-industries established in district. Floriculture projects are also coming up in the district.

(ii) Tapi District

Sugar, Textile and Paper mills are the major Agro based industries in the district. J K Paper Ltd is in Songadh taluka of the district.

(iii) Surat District

Sugar and Textile mills are the major Agro-industries in the district.

(iv) Bharuch District

Cotton mills, Oil mills, Poultry & Fish Feeds are the major agro based industries located in this district**.**

(d) Banks/Credit Societies etc.

(i) Navsari District

There are 137 Commercial banks, 25 Rural banks, 25 Co-operative banks and 21 PLDB branches are located in this district.

(ii) Tapi District

There are 40 Commercial banks, 3 Rural banks, 11Co-operative banks and 4 PLDB branches are located in this district.

(iii) Surat District

There are 200 Commercial banks, 9 Rural banks, 111Co-operative banks and one PLDB branch are located in this district.

(iv) Bharuch District

There are 129 Commercial banks, 23 Rural banks, 47 Co-operative banks and 8 PLDB branches are located in this district.

9.11.1.8 Topography and Soils

(i) Topography and Relief

Topography of the command area is undulating and of moderate slope. Basaltic out crops are seen in Vansda taluka of Navsari district in which the Command area lies. The Command Area in Tapi district is comprises of Deccan trap Basalt of Cretaceous-Eocene age, which is overlain by quaternary alluvium. Limestone & clay formation of Eocene ages and quaternary alluvium formation are seen in Command Area lying in Surat district. In the eastern side of Bharuch district, where the Command Area lies, Basaltic rocks are seen.

(ii) Land Slopes

Slopes of the lands in the command are generally moderate neither steep nor flat.

(iii) Soils

The details of soils present in the Command area are already given under Para 9.3 above. The soils in the command area can be broadly classified into 3 main categories viz. i) Deep Black, Medium Black to Loamy Sand (Goradu) soils, ii) Deep Black with Alluvial, Laterite and Medium Black Soils and iii) Deep Black Clayey Soils.

9.11.1.9 Ground Water and Drainage

Ground water assessment has been made for the en-route command area based on data collected from Central Ground water Board (CGWB). Details are furnished in Table -9.32:

Table -9.32
Assessment of Groundwater Availability in the Proposed En route Command Area

Sl. No.	District	Geographical Area (km^2)	Estimated Potential (MCM)	Present Draft (MCM)	%age Area of District in Proposed Command Area (km^2)	Estimated Potential in the Command (MCM)	Present Draft in the Command (MCM)	Balance Ground Water Potential (MCM)
Par-Tapi reach								
I	**Navsari**	2200.77	405.46	185.93	1.86	7.54	3.46	4.08
II	**Tapi**	3434.64	354.74	110.30	2.14	7.59	2.36	5.23
	Sub-total					**15.13**	**5.82**	**9.31**
Tapi-Narmada reach								
I	**Tapi**	3434.64	354.74	110.30	0.30	1.06	0.33	0.73
II	**Surat**	4326.97	856.33	365.12	8.06	69.02	29.43	39.59
III	**Bharuch**	5253.00	409.16	184.10	4.08	16.69	7.51	9.18
	Sub-total					**86.77**	**37.27**	**49.50**
	Grand-total					**101.90**	**43.09**	**58.81**

Though the soils in the Command Area are mainly clayey soils, as the slope of the land is less than 5% and Groundwater depth is more than 1.5 m no drainage problem is anticipated. With the network of a number of

tributaries of Kharera, Kelia, Kaveri, Ambica, Purna, Kim and Amravati Rivers, the command area has good drainage facilities.

Thedistrict wise total utilisable/extractable Ground Water Availability and net draft in the command area in pre & post project scenario are given in Annexure- 9.25.In the command area, the stage of groundwater development is less than 70% and hence falls under the "Safe Category"

9.11.1.10 Agriculture

The classification of lands and the present land use in en-route Command Area has already been discussed in this chapter under Para 9.11.1.2. Proposed land use will change due to increase in cultivated area and increase in developmental activities due to this project. The Cropping Intensity and Intensity of irrigated crops in the districts of en-route Command Area are given in Table-9.33:

Table-9.33
Cropping Intensity and Intensity of Irrigated Crops in En-route Command Area (Season and Crop Report 2007-08)

Sl. No.	District	Cropping Intensity (%)	Intensity of Irrigated Crops(%)
1	Navsari	118	117
2	Tapi	118	123
3	Surat	106	109
4	Bharuch	108	107

Source: *Irrigation in Gujarat, 2011-12, Directorate of Economics & Statistics*

The details of percentage of food crops to total cropped area and percentage of Irrigated food crops to total Irrigated area in the districts of en-route Command Area are given in Table-9.34:

Table-9.34
District-wise Percentage of Food Crops in En-route Command (Season and Crop Report 2007-08)

Sl. No	District	%age of Food Crops to Total Cropped	%age of Irrigated Food Crops to Total Irrigated

.		Area	Area
1	Navsari	83.87	97.90
2	Tapi	83.23	77.18
3	Surat	85.90	94.58
4	Bharuch	53.64	58.33

Source: *Irrigation in Gujarat, 2011-12, Directorate of Economics & Statistics*

The details of percentage of Non-food crops to total cropped area and percentage of Irrigated non-food crops to total Irrigated area in the districts of en-route Command Area are given in Table-9.35"

Table-9.35
District-wise Percentage of Non Food Crops in the En-route Command (Season and Crop Report 2007-08)

Sl. No.	District	%Age of Non-Food Crops to Total Cropped Area	%Age of Irrigated Non-Food Crops to Total Irrigated Area
1	Navsari	16	2
2	Tapi	17	23
3	Surat	14	5
4	Bharuch	46	42

Source: *Irrigation in Gujarat, 2011-12, Directorate of Economics & Statistics*

The yield of principal crops in the Districts of en-route Command Area is given in Table-9.36:

Table-9.36
Yield of Principal Crops in Districts of En-route Command Area (2004-05)

Sl. No.	Crop	Yield in kg/ha		
		Navsari	Surat*	Bharuch
1	Rice	2332	1731	1431
2	Jowar	1563	1486	763
3	Bajra	-	1024	1111
4	Wheat	3000	2488	1479
5	Maize	-	922	922
6	Gram	627	802	627
7	Groundnut	1571	1415	1533

Sl. No.	Crop	Yield in kg/ha		
		Navsari	Surat*	Bharuch
8	Rape seed & Mustard	-	-	1391

Source: *Statistical Abstract of Gujarat State, 2009 – Directorate of Economics & Statistics, Gandhinagar.* Include Tapi District area.*

9.11.1.11 Farmers' Attitude Towards Improved Agricultural Practices

The increase in Intensity of Irrigated crops in the area leads to increase in the agricultural production which in turn makes agriculture remunerative. Therefore, the farmers will have a positive attitude towards improved agricultural practices.

(a) Use of Improved Implements and Seeds

Sixty eight percent of Agricultural holdings in the Districts lying in en-route Command Area are Small & marginal (less than 2 ha). The Input Survey carried out by Revenue Department, Government of Gujarat in 2006-07 shows that among all groups of Holdings in which Tractors were used, 38% were used in Small & marginal holding for Agricultural purposes. Among all groups of Holdings in which Tractor drawn Seed Drill Cum Fertilizer Drills were used, 41% were used in Small & marginal holdings. Among all groups of Holdings in which Power Threshers were used, 42% were used in Small & marginal holdings. Among all groups of Holdings in which Sprinklers were used, 47% were used in Small & marginal holdings. Among all groups of Holdings in which Drip Irrigation Sets were used, 34% were used in Small & marginal holdings. Among all groups of Holdings in which Certified seeds were used, 63% were used in Small & marginal holdings. Among all groups of Holdings in which Notified seeds were used, 62% were used in Small & marginal holdings. Among all groups of Holdings in which Hybrid seeds were used, 53% were used in Small & marginal holdings. This shows that farmers in general are willing to use improved agricultural implements and seeds.

(b) Use of Fertilizers, Insecticides, Pesticides, etc.

Input survey carried out by Revenue Department, Government of Gujarat indicated that in 86% of agricultural holdings having irrigation facilities, Chemical Fertilizers were used and in about 80% of these holdings crops were treated with Pesticides. In un-irrigated holdings the use of Chemical Fertilizers & Pesticides was recorded as 62% and 65% respectively. It shows that usage of Fertilizers & Pesticides is very common among the farmers in the State. Farmers in the Command Area are also inclined to use Fertilizers, Insecticides, Pesticides, etc. in their farms.

9.11.1.12. Identification of Problems in En-route Command Area

(i) Physical Problems Including Hazards

(a) Land Slopes: The land is generally undulating; therefore, canal distribution system has to be aligned accordingly.

(b) Soil Depth: There may not be any problem on this account, as sufficient soil depth is available in the area for providing canal irrigation.

(c) Salinity/Alkalinity: Since the Par, Nar, Tan, Ambica, Kapri and Purna Rivers' water, which does not have Salinity/Alkalinity problem, will be used for irrigation no Salinity/Alkalinity problem is expected in the Command Area.

(d) Water Logging: No water-logging problem of serious nature has been reported from the area. But after introduction of irrigation, the Command Area shall be monitored for water logging as the soils in the Command Area are mainly clayey soils.

(e) Drainage: As area is undulating with moderate slopes no drainage problem is anticipated. However, keeping in view the soil type present in the Command suitable drainage network shall be provided.

9.11.1.13 Financial Problems

Kisan credit cards issued by State Government,Primary Agricultural Credit Societies, Regional Rural Bank Branches, Commercial Bank

Branches and Primary Land Development Banks will meet the credit needs of the farmers and hence no financial problems need to be faced by the farmers.

9.11.1.14 Proposed Cropping Pattern with Justification based on Land Irrigability Classification, Agro Climatic Conditions Developed Irrigated Cropping Pattern in Adjoining Project / Area etc.

Proposed cropping pattern of en-route command and target command has been developed based on the Land irrigability and capability classification along with agro climatic conditions of the region. The details of proposed cropping pattern for the command area have been covered in Irrigation Planning.

9.11.1.15 Land Development Work Proposals

As the area is already under rain-fed cultivation, no major land development works are required. However, a provision of Rs. 72547 lakh has been kept in the estimate for land development works wherever required. At the time of implementation of the project, detailed survey of each command will be done and based on the requirement, land development works will be taken up. This work will be done by State Irrigation Department or State Agriculture Department or Command Area Development Authority (to be decided by concerned State Governments). Estimate comprising land levelling charges are given in Annexure-13.4 in Appendix Volume-VI (A).

At present fairly good extension services exists in the command area and number of commercial banks and co-operative banks also have their branches there. Branches of land development banks are also located in some rural areas of the command. Moreover, the agricultural materials like seeds, fertilizers, insecticide, pesticides, etc. are provided to the farmers by the concerned government department at subsidized rates through different sale booths or fair price shops.

9.11.1.16 Ayacut Roads

Suitable provisions for CD structures will be made to avoid traffic disruption through ayacut roads.

9.11.1.17 Benefits

(i) Crop-wise Increase in Yield per ha and Total Estimated Output from the enroute Command

The irrigation under Par-Tapi-Narmada link project has been planned such a way that the diverted water will be utilized judiciously and optimally to bring more area under irrigation for benefitting as many farmers as possible. To achieve this objective an intensity of irrigation of 100% has been adopted for the entire command area of the link project.

The cropping pattern is proposed keeping in view the existing crop practices in the command area and the need for optimum utilization of water for obtaining better yields and returns. Pressurized Irrigation method has been adopted for the command area covered by lift irrigation. And also, cropping pattern with good mix of Food and Commercial crops has been adopted to maximize crop yields and returns in the post project scenario.

The crop-wise yields per ha under pre and post project scenarios in the command areas are furnished below.

The crop-wise yields from the enroute command in pre & post project scenarios are given in Table-9.37:

Table-9.37
Crop-wise Yield under Pre and Post Project Scenarios in En-route
CCA: 59920 ha

Sl. No.	Name of Crop	Pre Project Scenario			Post Project Scenario		
		Area (ha)	Yield per ha in qtls	Gross Yield in qtls	Area (ha)	Yield per ha in qtls	Gross Yield in qtls
A	**Kharif**						
1.	Paddy	5992	16.40	98269	4794	40.00	191760

Sl. No.	Name of Crop	Pre Project Scenario			Post Project Scenario		
		Area (ha)	Yield per ha in qtls	Gross Yield in qtls	Area (ha)	Yield per ha in qtls	Gross Yield in qtls
2.	Jowar	9587	13.33	127795	4794	20.00	95880
3.	Pulses	599	4.36	2612	2397	10.00	23970
4.	Groundnut	3595	11.00	39545	4794	20.00	95880
5.	Oilseeds	2397	12.23	29315	4794	12.93	61986
6.	Vegetables	7191	80.00	575280	2397	130.00	311610
7.	Fodder	13182	30.00	395460	0	0	0
8.	LS Cotton	0	0	0	2397	17.90	42906
9.	SS Cotton	0	0	0	4794	17.90	85813
	Sub-total	**42543**		**1268276**	**31161**		**909805**
B	**Rabi**						
10.	Wheat	599	17.43	10441	4794	32.00	153408
11.	Jowar	0	0	0	2397	20.00	47940
12.	Maize	0	0	0	2397	20.00	47940
13.	Vegetables	0	0	0	2397	130.00	311610
14.	Tur	10786	11.70	126196	0	0	0
15.	Pulses	2996	6.68	20013	4794	10.00	47940
16.	Oil seed	0	0	0	2397	12.90	30921
17.	Groundnut	0	0	0	2397	20.00	47940
	Sub-total	**14381**		**156650**	**21573**		**687699**
C	**Hot Weather**						
18.	Bajra	0	0	0	1197	20.00	23940
19.	Vegetables	0	0	0	1197	130.00	155610

Sl. No.	Name of Crop	Pre Project Scenario			Post Project Scenario		
		Area (ha)	Yield per ha in qtls	Gross Yield in qtls	Area (ha)	Yield per ha in qtls	Gross Yield in qtls
20	Soyabean	0	0	0	1197	12.93	15477
	Sub-total	0		**0**	**3591**		**195027**
D	**Perennial**						
21.	Sugarcane	2996	69.76	209001	2397	800.00	1917600
22.	Fruits	0	0	0	1198	20.00	23960
	Sub-total	**2996**		**209001**	**3595**		**1942560**
	Total	**59920**		**1633927**	**59920**		**3734091**

(ii) Estimated Value of Increased Production

The gross yield in pre and post project scenarios has been presented above in **Tables-9.39**.Based on the increased production; Value of increased production has been assessed in **Annexure: 13.10.5** in Volume–VI (B).

(iii) Likely Socio-economic Aspects

Due to increase in food grain production, the socio-economic condition of farmers will improve in general. Agricultural labourers will get employment in the nearby area. Situation of livestock will improve. Farmers will try to establish agro-based industries in the area.

9.11.2 Command Area Proposed Under Feeder Pipe lines

The Command Area proposed under Dabdar (630 ha) and Kelwan (640 ha) Feeder pipe lines is very small as the area is mostly covered by dense forests. Not much Command Area Development work need to be done in the areas as the areas are already under cultivation, but rain-fed. The major part of the Command Area proposed under Feeder pipe lineslie in Ahwa Taluka of The Dangs District and small patches lie in Navsari & Tapi Districts. The Agro-climatic and Socio-economic conditions in the

proposed Command area under Feeder pipe linesare more or less similar to the en route Command Area, so no separate details are given. The details of benefits from the Command are presented below.

9.11.2.1 Benefits

(i) Crop-wise Increase in Yield per ha and Total Estimated Output from the Command

The crop-wise yields under feeder pipe lines in pre & post project scenarios are given in Table-9.38:

Table-9.38
Crop-wise Yield under Pre and Post Project Scenarios
CCA: 1270 ha

Sl. No.	Name of Crop	Pre Project Scenario			Post Project Scenario		
		Area (ha)	Yield per ha in qtls	Gross Yield in qtls	Area (ha)	Yield per ha in qtls	Gross Yield in qtls
A	**Kharif**						
1.	Paddy	368	16.40	6035	102	40.00	4080
2.	Jowar	89	13.33	1186	102	20.00	2040
3.	Pulses	89	4.36	388	51	10.00	510
4.	Groundnut	114	11.00	1254	102	20.00	2040
5.	Oil seeds	38	12.23	465	102	12.93	1319
6.	Vegetables	13	80.00	1040	51	130.00	6630
7.	Other cereals	330	10.00	3300	0	0	0
8.	Fodder	64	30.00	1920	0	0	0
9.	L S Cotton	0	0	0	51	17.90	913
10.	SS Cotton	0	0	0	102	17.90	1826
	Sub-total	**1105**		**15588**	**663**		**19358**
B	**Rabi**						

Sl. No.	Name of Crop	Pre Project Scenario			Post Project Scenario		
		Area (ha)	Yield per ha in qtls	Gross Yield in qtls	Area (ha)	Yield per ha in qtls	Gross Yield in qtls
11.	Wheat	0	0	0	102	32.00	3264
12.	Gram	25	11.00	275	0	0	0
13.	Jowar	0	0.00	0	51	20.00	1020
14.	Maize	51	13.28	677	51	20.00	1020
15.	Vegetables	0	0	0	51	130.00	6630
16.	Tur	89	11.70	1041	0	0	0
17.	Pulses	0	0.00	0	102	10.00	1020
18.	Oil seeds	0	0.00	0	51	12.93	659
19.	Groundnut	0	0	0	51	20.00	1020
	Sub-total	**165**		**1993**	**459**		**14633**
C	**Hot Weather**						
20.	Bajra	0	0	0	24	20.00	480
21.	Vegetables	0	0	0	24	130.00	3120
22.	Soyabean	0	0	0	24	12.93	310
	Sub-total	0		**0**	**72**		**3910**
C	**Perennial**						
23.	Sugarcane	0	0	0	51	800.00	40800
24.	Fruits	0	0	0	25	20.00	500
	Sub-total	0		**0**	**76**		**41300**
	Total	**1270**		**17581**	**1270**		**79201**

(ii) Estimated Value of Increased Production

The gross yield in pre and post project scenarios has been furnished above in **Table-9.40**.Based on the increased production, value of increased production has been assessed in **Annexure: 13.10.5** in Volume –VI(B).

(iii) Likely Socio-economic Aspects

Due to increase in food grain production, the socio-economic condition of farmers will improve in general. Agricultural labourers will get employment in the nearby area. Situation of livestock will improve. Farmers will try to establish agro-based industries in the area.

9.11.3 Command Area of Projects Proposed by Government of Gujrat

The command area of about 45561 ha under five as proposed by Government of Gujarat viz.,projects namely Khuntali, Ugta, , Sidhumber, Khata Amba and Zankhari irrigation projects which are in the vicinity of the project command area are planned to take over by the Par-Tapi-Narmada link canal.The details of the benefits are given below.

9.11.3.1 Benefits

(i) Crop-wise Increase in Yield per ha and Total Estimated Output from the Command of projects proposed by Government of Gujrat.

The crop-wise yields from the command of projects proposed by Government of Gujrat. in pre & post project scenarios are given in Table-9.40:

Table-9.39
Crop-wise Yield under Pre and Post Project Scenarios in Command of projects proposed by Government of Gujrat.

CCA: 45561 ha

Sl. No.	Name of Crop	Pre Project Scenario			Post Project Scenario		
		Area (ha)	Yield per ha in qtls	Gross Yield in qtls	Area (ha)	Yield per ha in qtls	Gross Yield in qtls
A	**Kharif**						
1.	Paddy	4556	16.40	74718	3645	40.00	145800
2.	Jowar	7290	13.33	97176	3645	20.00	72900
3.	Pulses	455	4.36	1984	1823	10.00	18230

Sl. No.	Name of Crop	Pre Project Scenario			Post Project Scenario		
		Area (ha)	Yield per ha in qtls	Gross Yield in qtls	Area (ha)	Yield per ha in qtls	Gross Yield in qtls
4.	Groundnut	2734	11.00	30074	3645	20.00	72900
5.	Oilseeds	1823	12.23	22295	3645	12.93	47130
6.	Vegetables	5467	80.00	437360	1823	130.00	236990
7.	Fodder	10023	30.00	300690	0	0	0
8.	LS Cotton	0	0	0	1823	17.90	32632
9.	SS Cotton	0	0	0	3645	17.90	65246
	Sub-total	**32345**		**964297**	**23694**		**691828**
B	**Rabi**						
10.	Wheat	456	17.43	7948	3645	32.00	116640
11.	Jowar	0	0	0	1823	20.00	36460
12.	Maize	0	0	0	1823	20.00	36460
13.	Vegetables	0	0	0	1823	130.00	236990
14.	Tur	8201	11.70	95952	0	0	0
15.	Pulses	2278	6.68	15217	3645	10.00	36450
16.	Oil seed	0	0	0	1823	12.90	23517
17.	Groundnut	0	0	0	1823	20.00	36460
	Sub-total	**10935**		**119117**	**16405**		**522977**
C	**Hot Weather**						
18.	Bajra	0	0	0	910	20.00	18200
19.	Vegetables	0	0	0	910	130.00	118300
20	Soyabean	0	0	0	910	12.93	11766

Sl. No.	Name of Crop	Pre Project Scenario			Post Project Scenario		
		Area (ha)	Yield per ha in qtls	Gross Yield in qtls	Area (ha)	Yield per ha in qtls	Gross Yield in qtls
	Sub-total	0		**0**	**2730**		**148266**
D	**Perennial**						
21.	Sugarcane	2278	69.76	158913	1822	800.00	1457600
22.	Fruits	0	0	0	910	20.00	18200
	Sub-total	**2278**		**158913**	**2732**		**1475800**
	Total	**45561**		**1242327**	**45561**		**2838871**

(ii) Estimated Value of Increased Production

The gross yield in pre and post project scenarios has been presented above in **Table-9.41**. Based on the increased production, value of increased production has been assessed in **Annexure:13.10.5** in Volume –VI(B).

(iii) Likely Socio-economic Aspects

Due to increase in food grain production, the socio-economic condition of farmers will improve in general. Agricultural labourers will get employment in the nearby area. Situation of livestock will improve. Farmers will try to establish agro-based industries in the area.

9.11.4 Command of Tribal area enroute right side of canal, Tribal area in vicinity of reservoirs and Tribal area on right side of Narmada Main canal

Tribal areas to an extent of 36200 ha at four different locations enroute on Right side of the PTN link canal have been identified as requested by Government of Gujarat for providing irrigation in tribal areas. About 12514 ha of command area in the vicinity of six proposed reservoirs which lies in Tribal dominant districts is proposed to bring under irrigation. It is also proposed to provide irrigation to 34342 ha predominantly in tribal areas by lift, directly from Narmada Main Canal, on substitution basis. The details of the benefits are given below.

9.11.4.1 Benefits

(i) Crop-wise Increase in Yield per ha and Total Estimated Output from the Irrigated Area in Command of Tribal area enroute right side of canal, Tribal area in vicinity of reservoirs and Tribal area on right side of Narmada Main canal

The crop-wise yields in pre & post project scenarios in the Command of Tribal area enroute right side of canal, Tribal area in vicinity of reservoirs and Tribal area on right side of Narmada Main canal are given in Table-9.41:

Table-9.40

Crop-wise Yield under Pre and Post Project Scenarios in Command of Tribal area enroute right side of canal, Tribal area in vicinity of reservoirs and Tribal area on right side of Narmada Main canal

CCA: 83056 ha

Sl. No.	Name of Crop	Pre Project Scenario			Post Project Scenario		
		Area (ha)	Yield per ha in qtls	Gross Yield in qtls	Area (ha)	Yield per ha in qtls	Gross Yield in qtls
A	**Kharif**						
1	Late Paddy	831	16.40	13628	0	0	0
2	Early Paddy	0	0	0	0	0	0
3	Maize / Bajra	0	0	0	0	0	0
4	Oil seed	4983	12.23	60942	8306	12.93	107396.6
5	Groundnut	831	11.00	9141	0	0	0
6	Other Cereals	1661	10.00	16610	0	0	0
	Sub-total	**8306**		**100321**	**8306**		**107396.6**
B	**Rabi**						
7	Wheat	7475	17.43	130289	45681	32	1461792
8	Jowar	9136	13.33	121783	0	0	0
9	Pulses/ Vegetable	4153	6.68	27742	16611	10	166110
10	Potato	0	0	0	4983	230	1146090
11	Gram	831	11.00	9141	0	0	0
12	Tur	18272	11.70	213782	0	0	0
	Sub-total	**39867**		**502737**	**67275**		**2773992**
C	**Two seasonal**						
13	SS Cotton	0	0	0	0	0	0
14	LS Cotton	32392	5.17	167467	0	0	0

Sl. No.	Name of Crop	Pre Project Scenario			Post Project Scenario		
		Area (ha)	Yield per ha in qtls	Gross Yield in qtls	Area (ha)	Yield per ha in qtls	Gross Yield in qtls
15	Tobacco	0	0	0	0	0	0
16	Lucene	0	0	0	0	0	0
	Sub-total	**32392**		**167467**	**0**		**0**
D	**Hot Weather**						
17	Bajra	0	0	0	0	0	0
18	Fodder	2491	30.00	74730	4983	80	398640
	Sub-total	**2491**		**74730**	**4983**		**398640**
	Perennial						
19	Sugarcane	0	0	0	0	0	0
20	Fruits	0	0	0	2492	20	49840
	Sub-total	**0**		**0**	**2492**		**49840**
	Total	**83056**		**845255**	**83056**		**3329868.6**

(ii) Estimated Value of Increased Production

The gross yield in pre and post project scenarios has been presented above in **Table-9.42**. Based on the increased production, Value of increased production has been assessed in **Annexure: 13.10.5** in Volume –VI(B).

(iii) Likely Socio-economic Aspects

Due to increase in food grain production, the socio-economic condition of farmers will improve in general. Agricultural labourers will get employment in the nearby area. Situation of livestock will improve. Farmers will try to establish agro-based industries in the area.

9.11.5Command Area of Narmada Main Canal (NMC) of SSP to be taken over by the Link Canal – Additional Irrigation in SaurashtraRegion (Target Command) and Benefits

In irrigation planning, it is proposed to take overthe part Command Area of existing Miyagam Branch Canal of Narmada Canal System of SSP(CCA: 42368 ha and irrigation intensity 100%) by utilizing 161MCMof

waterthrough the Par-Tapi-Narmada Link Canal by substitution. Thus saved water of Narmada canal will be utilized in Saurashtra regionthrough substitution to provide irrigation to 42368 ha with irrigation intensity of 100%. The details of the benefits are given below.

9.11.5.1 Benefits

(i) Crop-wise Increase in Yield per ha and Total Estimated Output from the Irrigated Area in Saurashtra Region (Target Command)

The crop-wise yields in pre & post project scenarios in the Target Command are given in Table-9.42:

Table-9.41
Crop-wise Yield under Pre and Post Project Scenarios in Target Command
CCA: 42368 ha

Sl. No.	Name of Crop	Pre Project Scenario			Post Project Scenario		
		Area (ha)	Yield per ha in qtls	Gross Yield in qtls	Area (ha)	Yield per ha in qtls	Gross Yield in qtls
A	**Kharif**						
1	Late Paddy	424	16.40	6954	0	0	0
2	Early Paddy	0	0	0	0	0	0
3	Maize / Bajra	0	0	0	0	0	0
4	Oil seed	2542	12.23	31089	4237	12.93	54784
5	Groundnut	424	11.00	4664	0	0	0
6	Other Cereals	847	10.00	8470	0	0	0
	Sub-total	**4237**		**51177**	**4237**		**54784**
B	**Rabi**						
7	Wheat	3813	17.43	66461	23302	32	745664
8	Jowar	4661	13.33	62131	0	0	0
9	Pulses/ Vegetable	2118	6.68	14148	8474	10	84740
10	Potato	0	0	0	2542	230	584660
11	Gram	424	11.00	4664	0	0	0
12	Tur	9321	11.70	109056	0	0	0
	Sub-total	**20337**		**256460**	**34318**		**1415064**
C	**Two**						

Sl. No.	Name of Crop	Pre Project Scenario			Post Project Scenario		
		Area (ha)	Yield per ha in qtls	Gross Yield in qtls	Area (ha)	Yield per ha in qtls	Gross Yield in qtls
	seasonal						
13	SS Cotton	0	0	0	0	0	0
14	LS Cotton	16523	5.17	85424	0	0	0
15	Tobacco	0	0	0	0	0	0
16	Lucene	0	0	0	0	0	0
	Sub-total	**16523**		**85424**	**0**		**0**
D	**Hot Weather**						
17	Bajra	0	0	0	0	0	0
18	Fodder	1271	30.00	38130	2542	80	203360
	Sub-total	**1271**		**38130**	**2542**		**203360**
	Perennial						
19	Sugarcane	0	0	0	0	0	0
20	Fruits	0	0	0	1271	20	25420
	Sub-total	**0**		**0**	**1271**		**25420**
	Total	**42368**		**431191**	**42368**		**1698628**

(ii) Estimated Value of Increased Production

The gross yield in pre and post project scenarios has been presented above in **Tables-9.39 to 9.42**. Based on the increased production, Value of increased production has been assessed and details are furnished at **Annexure: 13.10.5** in Volume –VI(B).

From the above, it could be assessed that the gross yield of various crops per hectare in post project scenario in the enroute command and in the command area of 5 proposed projects of Government of Gujarat is 62 quintals/ha against 27 quintals/ha in the pre-project scenario. In case of command area under Feeders the gross yield of crops in post project scenario is 62 quintals/ha against 14 quintals/ha in the pre-project scenario. The gross crop yield in the Target command (Saurashtra region) is 40 quintals/ha against 10 quintals/ha in pre-project scenario. Hence, there will be significant increase in crop production with the proposed irrigation under the Link Project.

The net annual value of crop production under the Link Project is assessed as Rs. 111176.70 lakhs.

(iii) Likely Socio-economic Aspects

Due to increase in food grain production, the socio-economic condition of farmers will improve in general. Agricultural labourers will get employment in the nearby area. Situation of livestock will improve. Farmers will try to establish agro-based industries in the area.