WEPA
Water Environment
Partnership in Asia

Progress of Water Environment Governance in Nepal

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Singhadurbar, Kathmandu

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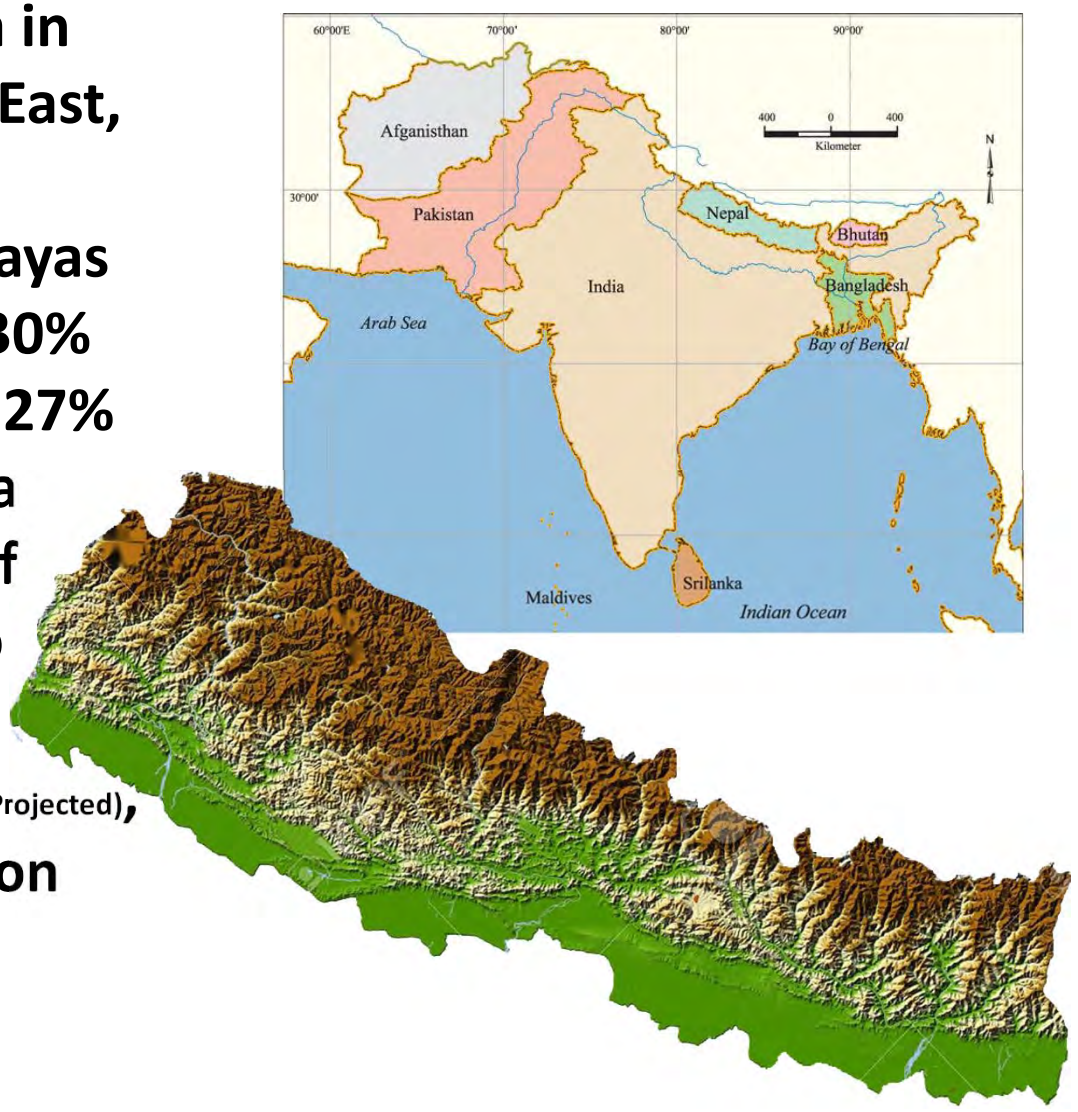
Nepal: Country Background

- Landlocked between China in the North and India in the East, West and South.
- Area: 1,47,181 km2, Himalayas and Mountains 43%, Hills 30% and ,Terai Plain(Flat Land) 27%
- Varied Topography within a short span (about193km)of width ranging from 64m to 8848m in altitude
- Population: 28.82 Million (Projected),
- GDP : Total= US$26.46 billion
  Per capita= US$ 1004



Nepal: Country Background

After promulgation of Constitution of Nepal 2015

- **Nepal has been restructured and renamed into Federal Democratic Republic of Nepal "सङ्घीय लोकतान्त्रिक गणतन्त्र नेपाल"**
  - **Federal Democratic Republic of Nepal**

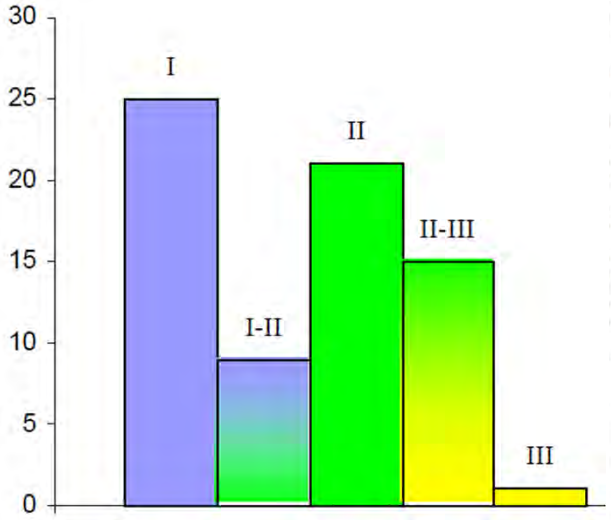
Seven Provinces
(Province No. 1, Province No. 2, Province No. 3, Gandaki Province (4), Province No. 5, Karnali Province (6) and Sudurpashchim Province (7))

Districts (77 District Coordination Committees)

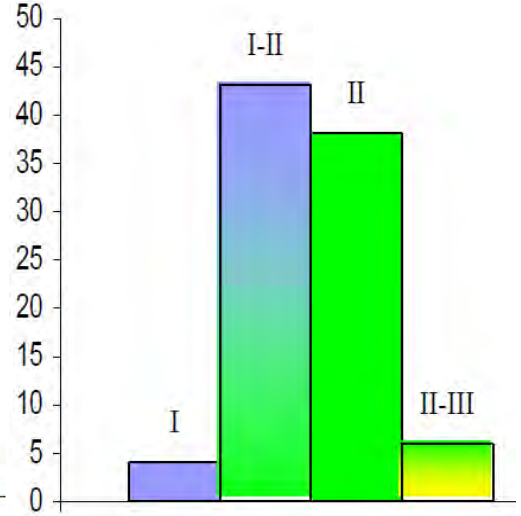
Local Units
(6 Metropolitan cities, 11 Submetropolitan cities, 276 Municipalities, 460 Rural municipalites and 6743 Wards)

Status of water quality in Nepal:

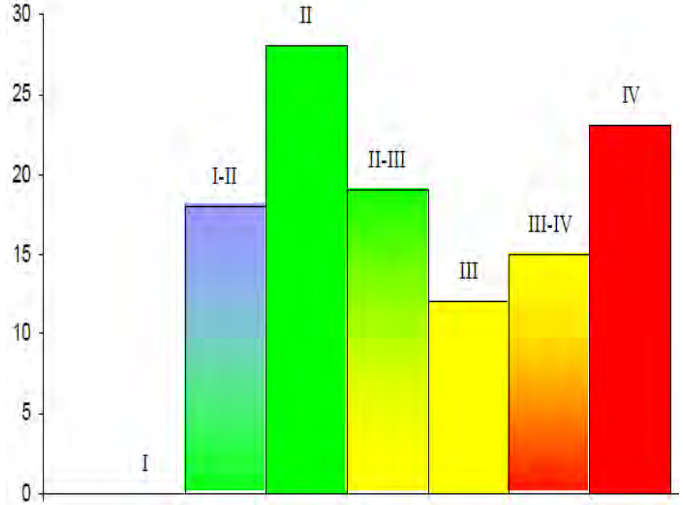
- Most of the water bodies laying in the major towns, cities, near to industrial zone and waste disposing sitesare polluted.
- Water quality of some of the major river systems of Nepal Koshi, Gandaki, Karnali and Mahakali followed by Bagmati, Tinau and Rapti are highlighted.



Koshi (71)



Gandaki (91)



Bagmati (115)

Quality level to due organic pollution:

I= None to slightly, I-II= Slightly, II= Moderately, II-III= Critically, III= Heavily, III-IV= Very heavily, IV= Extremely

Status of water quality in Nepal:

- **Some of the physico-chemical parameters along with the National Dringking Water Quality Standards (NDWQS) of some of the water bodies.**

Parameters	pH	DO	BOD	COD	TDS	EC	NH_3-N	NO_3-N	NO_2-N	TOC	TH	Mg	Fe	TC	E-coli
Desired Value *NDWQS	6.5-8.5*	>5	<30	<250	<1000*	<1500*	<1.5*	<50*	-	-	<500*	<100*	<0.3*	0*	0*
Unit	mg/l	mg/l	mg/l	mg/l	mg/l	µS/cm	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	MPN/ 100m	MPN/ 100m
Bagmati (Sundarijal – Khokana)	6.6 -7.4	14.8-1.2	9.6 – 90.5	24.8 - 192	380 - 810	460 - 970	10 - 70	0.1 – 0.3	0.1 – 0.1	6.8 - 30	140 - 90	21.1-10.6	0.5 – 3.9	500 - 900	40 - 50
Bishnumati (Budhanilkantha – Teku Dovan)	7 -7.5	12.5-0.9	15.4 – 167	36.7 - 178	120 - 920	187 - 1360	90 - 90	0.5 – 0.5	0.2 – 0.1	22.6 – 34.6	160 - 130	24.5-43.7	0.5 – 5.7	900 - 1600	110 – 170
Nakhu - Saibu	8 -8.1	2.1-7.1	40.5 – 5.4	78 – 15.9	120 - 920	650 - 300	90 - 30	0.5 – 0.2	0.13 – <0.1	12.1 – 3.6	100 - 120	12.3-24.7	4.2 – 2.8	1600 - 900	110 – 70
Hanumante (Sallaghari-Thimi)	8.5 -7.3	1.8-15.1	33.0 – 48.9	120 – 90.7	1530 - 1290	1800 - 1600	160 - 180	2.4 – 2.7	0.2 – 0.1	45.6 – 26.7	80 - 120	9.8-10.2	6.4 – 6.5	1600 - 1600	120 – 90
Manahara (Pepsikola - Balkumari)	7.4 – 7.6	7.0 – 3.9	14.5 –23.8	23.7 –40.5	620 – 980	870 – 1450	60 – 60	2.3 – 2.0	0.2 – 0.2	4.5 – 12.8	60 – 80	7.8 – 11.8	4.9 – 6.1	1600 – 500	140 – 40

Status of water quality in Nepal:

- **Some of the physico-chemical parameters along with the National Dringking Water Quality Standards (NDWQS) of some of the water bodies. Cont.**

Parameters	pH	DO	BOD	COD	TDS	EC	NH_3-N	NO_3-N	NO_2-N	TOC	TH	Mg	Fe	TC	E-coli
Desired Value *NDWQS	6.5-8.5*	>5	<30	<250	<1000*	<1500*	<1.5*	<50*	-	-	<500*	<100*	<0.3*	0*	0*
Unit	mg/l	mg/l	mg/l	mg/l	mg/l	µS/cm	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	MPN/ 100m	MPN/ 100m
Phewa lake(Halanchowk – Dam site)	7.5 – 7.6	7.9 – 8.0	2.5 – 2.1	5.7 – 5.7	50 – 50	50 – 60	1.6 – 1.6	0.11 – 0.16	0.07 – 0.07	5 – 4	120 – 120	6.7 – 11.1	0.1 – 0.1	900 – 900	70 – 70
Seti Pokhara (Mardi – Dobila)	7.4 -7.6	8.1-8.7	1.2 – 1.3	2.4 – 2.6	110 - 150	130 - 170	1.5 – 2.8	0.13 – 0.1	0.05 – 0.01	2.0 – 2.0	120 - 170	9.8-6.9	0.3 – 3.8	500 - 500	50 – 40
Narayani (Bridge – Devghat mixed)	7.3 -7.1	11.2-9.7	0.88 – 1.5	2.5 – 3.5	170 - 160	200 - 180	2.0 – 1.1	3.5 – 3.9	0.1 – 0.1	2.0 – 5.0	340 - 180	25.6-22.9	0.2 – 0.3	900 - 900	60 – 70
Sirsiya (Parwanipur – Ghadiharwa Pokhara)	6.5 -6.6	1.1-1.1	87.3 – 88.6	123.1 – 78	390 - 750	410 - 710	80.0 – 90.0	8.9 – 3.6	0.1 – 0.2	23.0 – 33.0	300 - 240	24.6-25.9	3.9 – 3.7	1600 - 900	170 – 110
Tinau (Jhumsa bridge – Radhakrishna Tole)	7.2 -7.5	10.4-9.5	1.6 – 1.5	2.6 – 3.9	200 - 220	220 - 220	0.9 – 1.0	0.5 – 0.5	0.02 – 0.01	4.0 – 4.0	200 - 200	14.5-9.8	0.1 – 0.1	900 - 500	70 – 30

Status of water quality in Nepal:

➢ Physical Status of Groundwater of Kathmandu Valley.

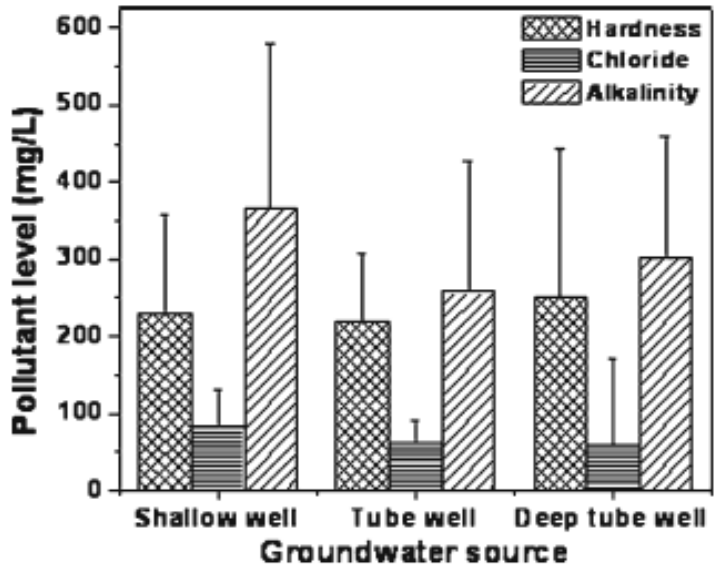
Ground Water Source	Temperature (^{0} C)	pH	Conductivity(μS/cm)	Turbidity (NTU)
Shallow Well	18.6	7.1	874.5	45.9
Tube Well	17.9	7.0	576.8	54.8
Deep Tube Well	20.3	7.0	704.2	33.2
WHO Guidelines	NA	6.5 – 8.5	500	5

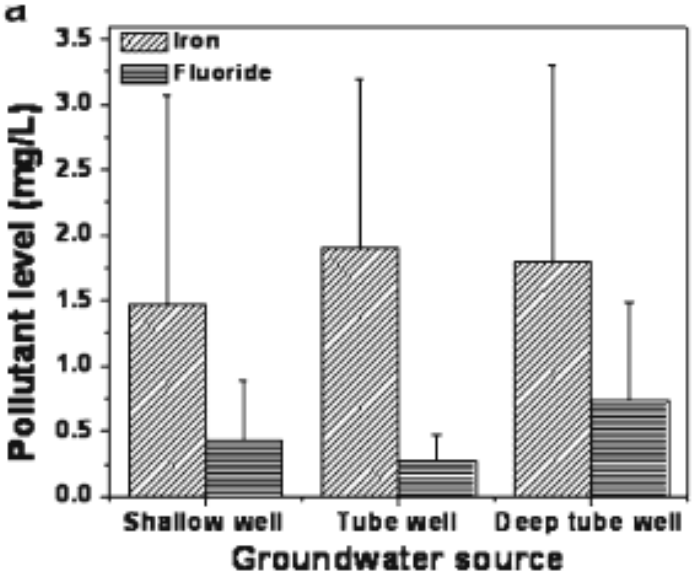
➢ Chemical Status of Groundwater of Kathmandu Valley.

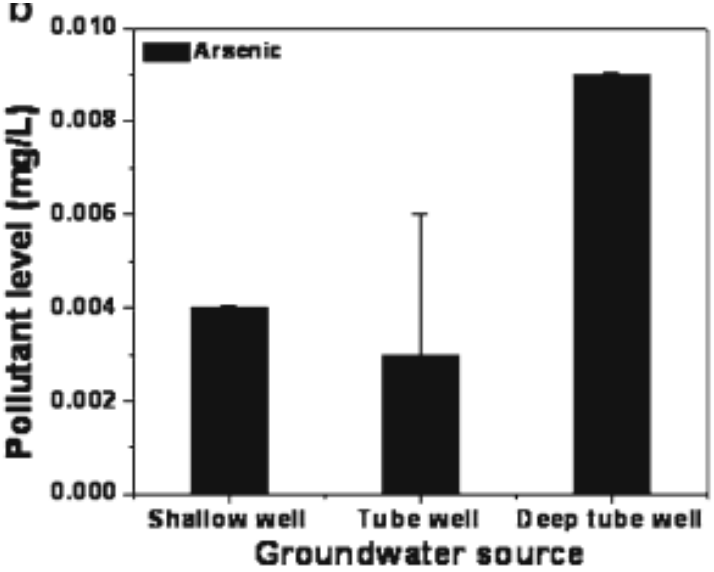
Ground Water Source	Hardness (mg/l)	Chloride (mg/l)	Alkalinity (mg/l)	Iron (mg/l)	Arsenic (mg/l)	Fluoride (mg/l)
Shallow Well	230.7	81.8	366.0	1.47	0.004	0.43
Tube Well	218.8	61.1	258.0	1.90	0.003	0.27
Deep Tube Well	251.2	59.0	302.7	1.80	0.009	0.74
WHO Guidelines	500	250	NA	0.3	0.01	1.5

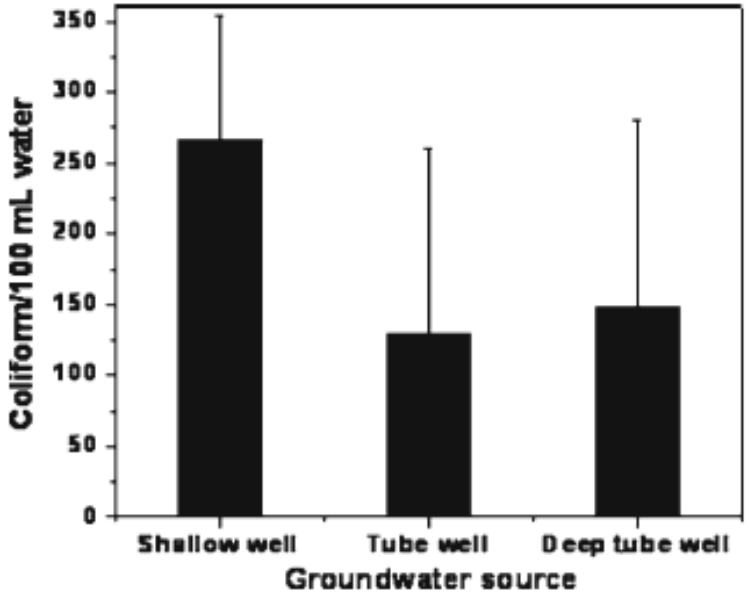
Status of water quality in Nepal:

- **Chemical Status of Groundwater of Kathmandu Valley.**









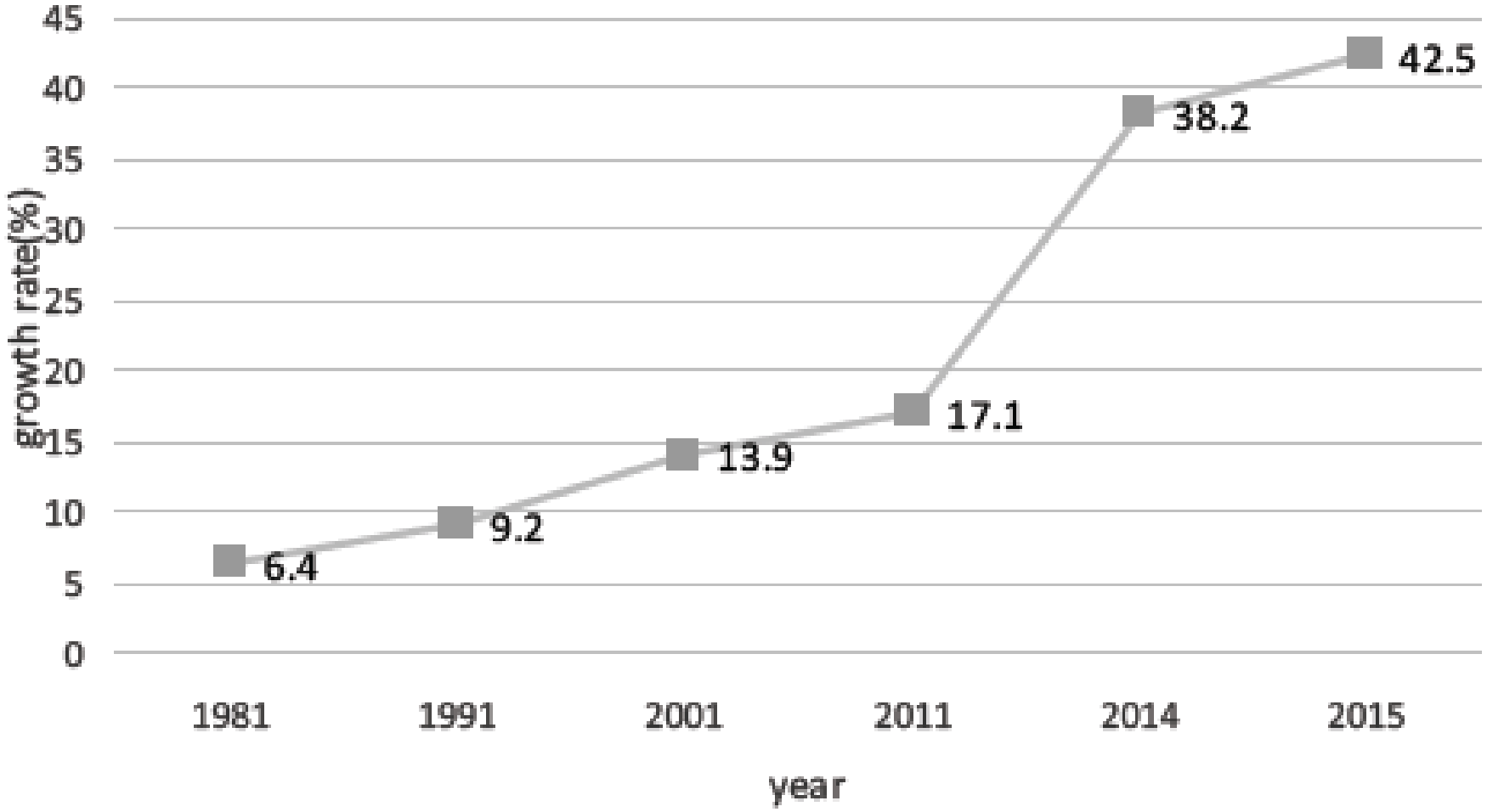
Domestic and Industrial Wastewater Management in Nepal

Water Resources and Uses in Nepal:

S.No.	Sources	Available amount
1	Annual Renewable Surface Water (billion m^3)	225
2	Annual Renewable Ground Water (billion m^3)	12
3	Per Capita Renewable Surface and Ground Water (000 m^3 / year)	9
4	Total Annual Withdrawal (billion m^3 / year)	24
5	Per Capita Annual Withdrawal (000 m^3 / year)	1
6	Sectorial withdrawal as % Total withdrawal	
	Domestic	3.43
	Industrial	0.41
	Agricultural	96.16

Domestic and Industrial Wastewater Management in Nepal

Urban Population Growth in Nepal:



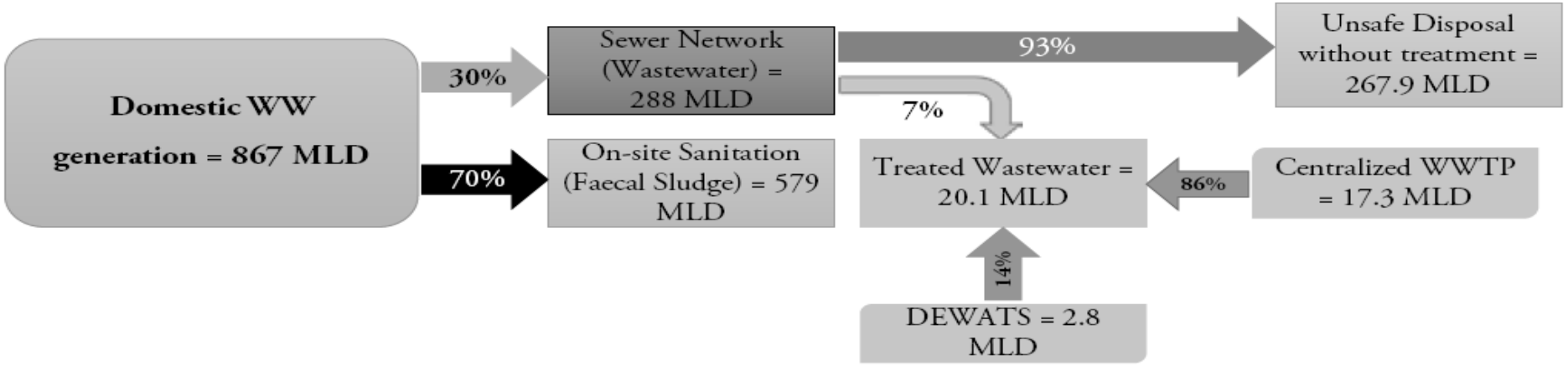
Domestic and Industrial Wastewater Management in Nepal

Waste Water Production in major urban areas of Nepal As of 2011:

S.No.	Urban Centers	Waste Water Production (MLD)			Collected for Treatment (million liter/day)
		Domestic	Industrial	Total	
1	Kathmanu	64.497	4.515	69.012	34.506
2	Patan	15.647	1.095	16.742	8.371
3	Bhaktapur	5.971	.418	6.389	3.195
4	Kirtipur	3.92	.274	4.194	2.097
5	Madhyapur Thimi	3.069	.215	3.284	1.642
4	Pokhara	NA	NA	13.42	NA
5	Biratnagar	NA	NA	12.15	NA
6	Birgunj	NA	NA	8.68	NA
7	Bharatpur	NA	NA	6.84	NA
8	Janakpur	NA	NA	5.41	NA
9	Dhangadhi	NA	NA	5.37	NA
10	Butwal	NA	NA	6.01	NA
	Total	93.104	6.517	157.501	49.811

Domestic and Industrial Wastewater Management in Nepal

Generalized Waste Water Management in Nepal As of 2016:



Some of the tested parameters among different sources of waste water:

Parameters	Source Type		
	Domestic	Industrial	Hospital
pH	7.04	6.67	7.1
TSS (mg/L)	356	429	195
DO (mg/L)	1	-	4
BOD (mg/L)	420	411	166
COD(mg/L)	640	766	329
Ammonia (mg/L)	118	17	48
Nitrate (mg/L)	6	-	4
TP (mg/L)	16	2	-
O&G (mg/L)	18	37	2

Domestic and Industrial Wastewater Management in Nepal

Existing Wastewater Treatment Plants in Kathmandu Valley and Other Urban Areas of Nepal

Location	Type/Stage	Capacity MLD	Present State	Service Details
Dhobighat, Patan (Kathmandu Valley)	1st Pond – Aerobic 2nd Pond – Anaerobic 3rd Pond – Facultative 4th Pond- Aerobic	15.4	Not working	HH Connections-53,900 Sewerage Lines-61,650 Combine channel- 44Km
Kodku, (Kathmandu Valley)	1st Pond – Aerobic 2nd Pond – Anaerobic 3rd Pond – Facultative 4th Pond- Aerobic	1.1	Partially working	HH Connections- 15,500 Sewerage Lines- 20,443 Combine channel- 11Km
Sallaghari, Bhaktapur (Kathmandu Valley)	Aerated lagoon	2.4	Not working	Details not available
Hanumanghat, Bhaktapur, (Kathmandu Valley)	Oxidation Ditch	0.4	Not working	
Guheswori, Kathmandu (Kathmandu Valley)	Oxidation Ditch	16.4	Partially Working	Sewers- 6 Km Population Served- 53,000 Urban area- 21 Ha
Hetauda Industrial Estate, Hetauda	Oxidation Pond	1.1	Working	Industrial Wastewater Treatment Plant
Dhulikhel Hospital	Reed Bed (Constructed Wetland)	< 0.10	Working	Without Primary Treatment Bed Size- 261 m^2 Population served- 330
Kathmandu Municipality	Reed Bed (Constructed Wetland)	< 0.40	Working	No Primary Treatment Bed Size- 362 m2 Population served- 330
Mulpi International School	Reed Bed (Constructed Wetland)	<0.25	Working	No Primary Treatment Bed Size- 376 m^2 Population Served- 850
SKM Hospital	Reed Bed (Constructed Wetland)	0.15	Working	Bed Size- 141 m^2 Population Served- 500
Kathmandu University	Reed Bed (Constructed Wetland)	< 0.035	Working	No Primary Treatment Bed Size- 587 m^2 Population Served- 1300
Middle Marshyangdi Hydropower Project	Reed Bed (Constructed Wetland)	< 0.026	Working	No Primary Treatment Bed Size- 298 m^2 Population Served- 870
Pokhara Municipality	Reed Bed (Constructed Wetland)	< 0.115	Working	No Primary Treatment Bed Size- 3,308 m^2 Population Served- 3830
Kapan Monastry (Kathmandu Valley)	Reed Bed (Constructed Wetland)	< 0.015	Working	No Primary Treatment Bed Size- 150 m^2 Population Served- 300
Tansen Municipality	Reed Bed (Constructed Wetland)	< 0.030	Working	No Primary Treatment Bed Size- 583 m^2 Population Served- 1000
Sunga Community Wastewater Treatment Plant (Kathmandu Valley)	Reed Bed (Constructed Wetland)	50 m^3/day	Working	Community Wastewater Treatment Plant Bed Size- 150 m^2 Population Served- 1200

Policy and Legal Framework for Water Environmental Governance

The Constitution of Nepal:

- **Constitution of Nepal(2015)**

  Part 3: Fundamental Rights and Duties

  Article 30: Right to clean environment

  Sub-article (1): Every citizen shall have the right to live in a clean and healthy environment.

  Sub-article (2): The victim shall have the right to obtain compensation, in accordance with law, for any injury caused from environmental pollution or degradation.

Policy and Legal Framework for Water Environmental Governance

Policy and Legislative Frameworks:

Name	Category	Year	Purpose
Water Tax Act	Act	1966	It provides modus operandi of recovering the amount of the water tax leviable pursuant to the prevailing law.
Water Resources Act	Act	1992	The umbrella Act governing water resource management and declares the order of priority of water use .
Water Resources Rules	Rule	1993	The umbrella Rules governing water resource management, Sets out the procedure to register a Water User Association and to obtain a license.
Drinking Water Service Charge Rules	Rule	1994	Details the procedures for Tap connection and hole change and ownership of Taps and its transfer.
National Solid Waste Management Policy	Policy	1996	Waste management by Local Bodies; mobilize wastes as resources and reduce wastes at sources.
Environment Protection Act	Act	1997	The umbrella Act governing over all environmental protection of the country.
Environment Protection Rules	Rule	1997	The umbrella Rule governing over all environmental protection of the country and further elaborates the Act.
Drinking Water Rules	Rules	1988	Regulates the use of drinking water; provides for the formation of Drinking Water User Associations and sets out the procedure for registration.
Local Self Governance Act	Act	1999	Sets out the powers, functions and duties of VDC, Municipality and DDC in relation to water and sanitation.

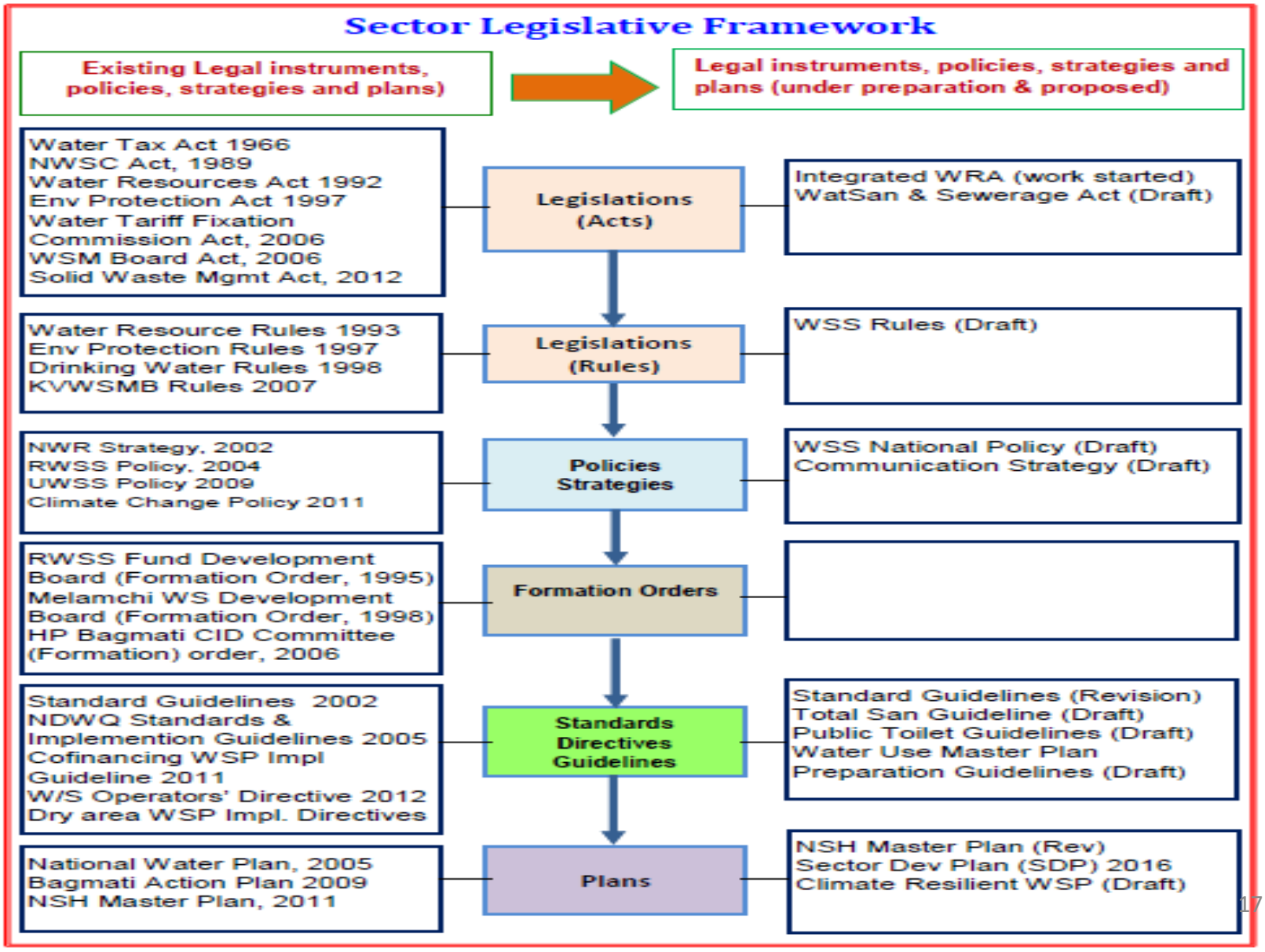
Policy and Legal Framework for Water Environmental Governance

Policy and Legislative Frameworks:

Name	Category	Year	Purpose
Local Self Governance Act	Act	1999	Sets out the powers, functions and duties of VDC, Municipality and DDC in relation to water and sanitation.
Water Resources Strategy	Strategy	2002	Sets out sectoral and cross cutting short, medium and long term strategies to optimize the sustainable benefits from the resource.
National Water Plan	Plan	2005	Plots short, medium and long term action plans for Water Resource Sector; More focused on Environmental Concerns; Introduces Integrated Water Resources Management (IWRM).
Drinking Water Quality Standards	Standards	2005	Sets standards for water quality; Service Providers responsible for monitoring; Local level offices.
Water Supply Management Board	Act	2006	The act puts emphasis on the participation of local bodies and WaSH institutions in water and sanitation services in the urban areas.
Sanitation and Hygiene Master Plan	Plan	2011	Recognizes the leadership and Coordination of local bodies; ODF status as entry point of Total Sanitation.
Integrated National Water Resources Policy (Draft)	Policy		The draft policy is aimed to cover all aspects of water resources development and management based on the Integrated Water Resources Management (IWRM) principle and newly restructured three tires of government.
Integrated National Water Resources Act	Act		The draft Act will be the new water resources act for the execution of new policy which covers all aspects of water

Policy and Legal Framework for Water Environmental Governance

Sectoral Legislative Framework in changed context:



Institutional Framework for Water Environmental Governance

Institutional Frameworks:

Name	Level	Working Area
Ministry of Energy, Water Resources and Irrigation	Central	Over all Energy, Hydropower, Irrigation and Water Resources development of the country.
Ministry of Water Supply	Central	Water supply, sanitation and hygeine development and management of the country.
Ministry of Urban Development	Central	Over all urban planning, development and Management for the development of municipalities in the country.
Ministry of Forest and Environment	Central	Forest resources and environmental development and management and enforcement environmental mandates.
Water and Energy Commission Secretariat	Central	Policy and planning regarding energy and water resources development and management covering all sectors. Advisory role on critical issues related to large water resources projects.
Department of Environment	Central	Responsible for the implementation and the compliance of Environmental Protection Act , and Rule (EPR), and pollution control standard as promulgated by the Government of Nepal.
Ministry of Physical Infrastructure Development	Provincial	Provincial level policy planning formulation and development of all sorts of physical infrastructures and their environmental management.
Department of Water Supply and Sewerage (DWSS)	Central	DWSS is dedicated to planning and implementation of both rural and urban WaSH projects.

Institutional Framework for Water Environmental Governance

Institutional Frameworks:

- **Except these institutions there are other institutions who take care about environmental issues in the country:**
  - Department of Forest (DOF)
  - Department of Soil Conservation and Watershed Management (DSCWM)
  - Department of Hydrology and Meteorology (DHM)
  - Department of National Parks and Wild Life Conservation (DNPWC)
  - Department of Environment (DOE)
  - Nepal Academy of Science and Technology (NAST)
  - Climate Change Council (CCC)
  - Environment Protection Council (EPC)
  - Department of Urban Development and Building Construction (DUDBC)

Future Plans, Projects and Targets

- Rehabilitation and expansion of sewerage network including property connections
- Rehabilitation and construction of interceptors along the streams
- Rehabilitation and construction of five wastewater treatment plants of 90.5 MLD capacity
- Energy generation of approximately 910 KW through sludge digestion and gasification

Kathmandu Metropolitan	Lalitpur Metropolitan	Bhaktapur Municipality	Kirtipur Municipality
• The cleaning of existing sewers • New sanitary sewer and storm water drain •New laying replacing brick sewer	•The cleaning of existing sewers • Rehabilitation of existing combined sewer • The separation by laying new sanitary sewer	• The cleaning of existing sewers • Rehabilitation of existing combined sewer • New storm water drain in Bhaktapur Industrial area	• Cleaning of existing sewers • Rehabilitation of existing combined sewer • The separation by laying new storm water drain

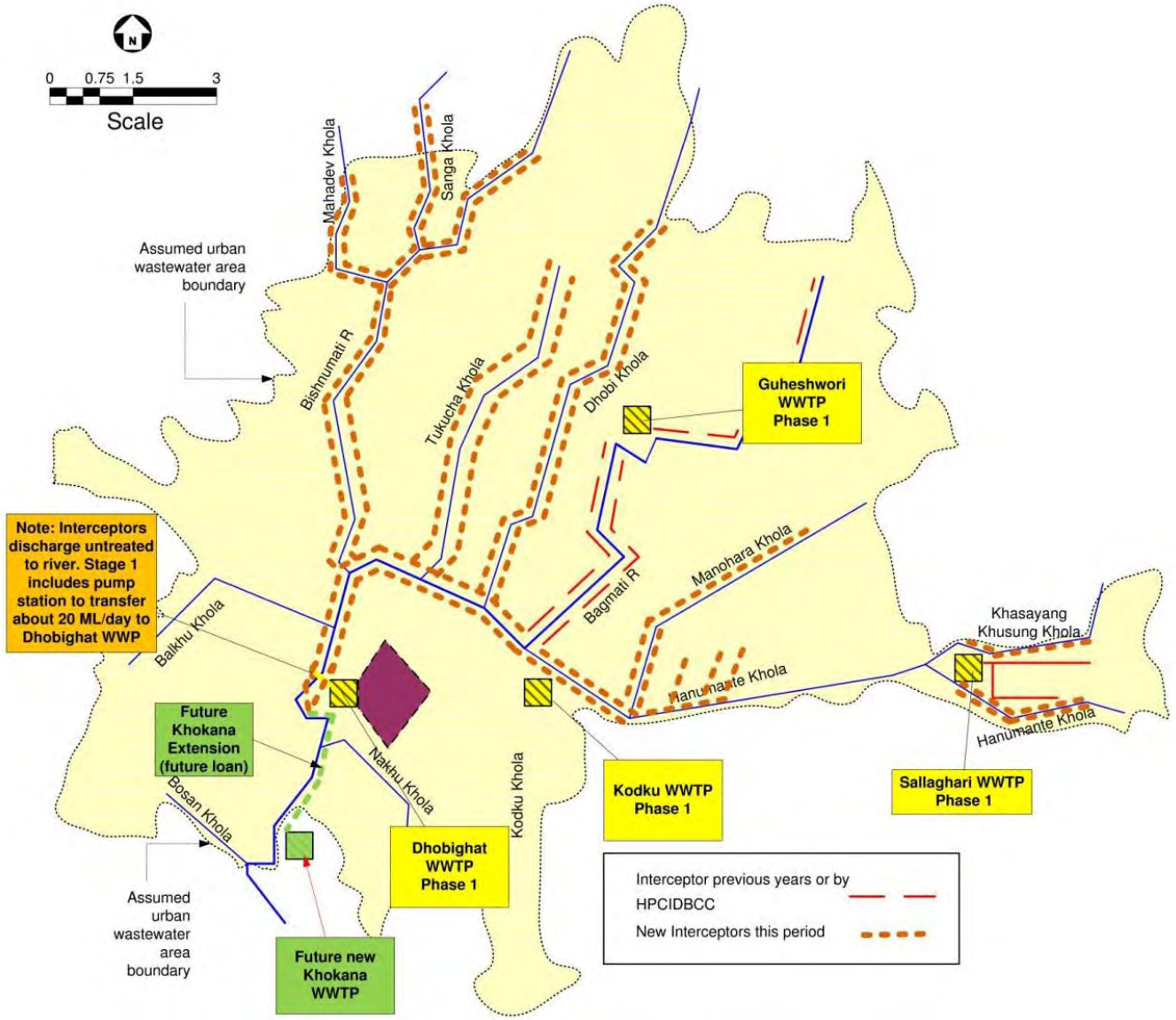
Future Plans, Projects and Targets

Wastewater Treatment Plan in Kathmandu Valley in 2020-2030

Wastewater Treatment Plants	Wastewater to be Treated (MLD)		WWTP Area Available (hectare)	Effluent Standards (BOD mg/l)	
	Year 2020	Year 2030		2020	2030
Guheswori	30.6	30.6	5.0	15.0	15.0
Gokarna	0.6	0.6	0.93	15.0	15.0
Sallaghari	13.1	13.1	3.4	50.0	30.0
Kodku	7.0	11.2	6.5	50.0	30.0
Dhobighat	39.2	81.6	30.0	50.0	50.0
Khokana	-	245.0	38.5	50.0	50.0
TOTAL	90.5	382.1	84.33	-	-

Future Plans, Projects and Targets

Ongoing Inceptors and Wastewater Treatment Plants in Kathmandu Valley



References:

- Department of Hydrology and Meteorology, Final Report: Water Quality Measurement and Hoarding Board Installation, 2073. Downloaded from internet.
- KUKL, Ministry of Urban Development, Government of Nepal. NEP: Kathmandu Valley Wastewater Management Project. Downloaded from internet.
- Pant, Bhoj Raj. Ground Water Quality in the Kathmandu Valley. Article in Environmental Monitoring and Assessment, July 2011. Downloaded from internet.
- Sector Efficiency Improvement Unit(SEIU), Ministry of Water Supply and Sanitation, Government of Nepal. Nepal Water Supply, Sanitation and Hygiene Sector Development Plan (2016-2030). Downloaded from internet.
- Sharma, Subodh et al., Water Quality in the Central Himalaya. Review Articles. Downloaded from internet.
- Shrestha, P. et al., Status of Wastewater generation and management in urban Nepal. Journal of Environment and Public Health. Downloaded from internet.
- Shukla Ashutosh, et al., Wastewater Production, Treatment and Use in Nepal. Downloaded from internet.
- Various other resources.

Thank You