

Wastewater...1

- Urban wastewater includes wastewater from all urban sources such as industry, commerce and other domestic sources
- Growing urban population is producing increasing volumes of wastewater
- Wastewater treatment being costly, most of wastewater receives primary treatment and flows in natural water bodies

Wastewater..2

- In 1995, 29 countries totaling 436 million experienced water stress or scarcity
- By 2025, 48 countries, number of adversely affected people will exceed to 2.8 billion
- Increasing food requirements for growing urban population
- Emphasis on recycling wastewater on agenda of most water supply agencies

Wastewater : A Resource

- Provides reliable source to farmers for crop production
- Conserves nutrient, thereby reducing need for artificial fertilizer
- Is a low cost method for sanitary disposal for municipal wastewater

Wastewater : A Problem

- Increases exposure of farmers, consumers and neighboring communities to infectious diseases
- Can lead to groundwater contamination
- Long term use of wastewater can have negative impacts on soil resources (build up salts/heavy metals)
- Have negative impacts on socio ecological system

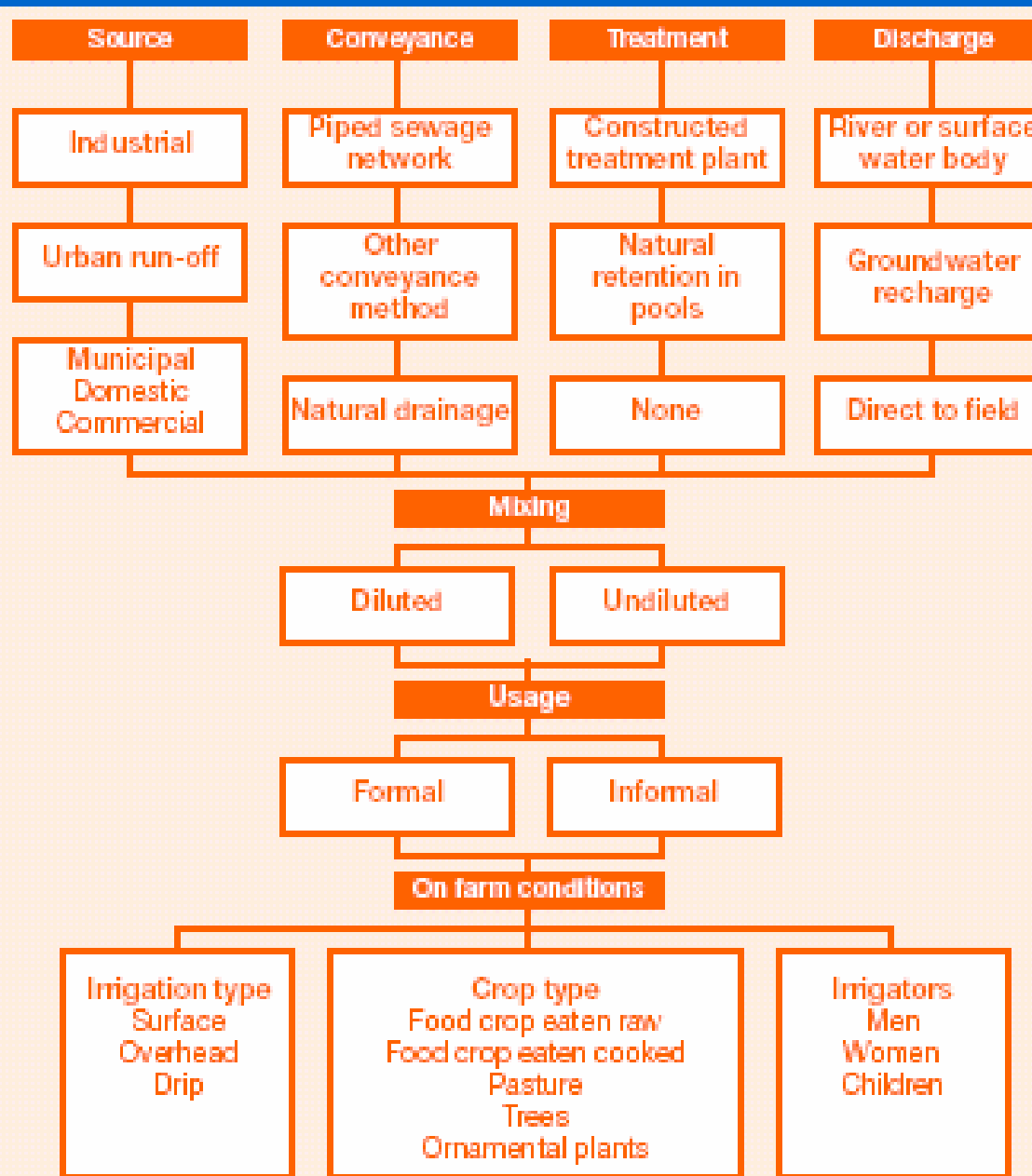


Figure 1 Typology of wastewater irrigation (see page 47 for definitions)



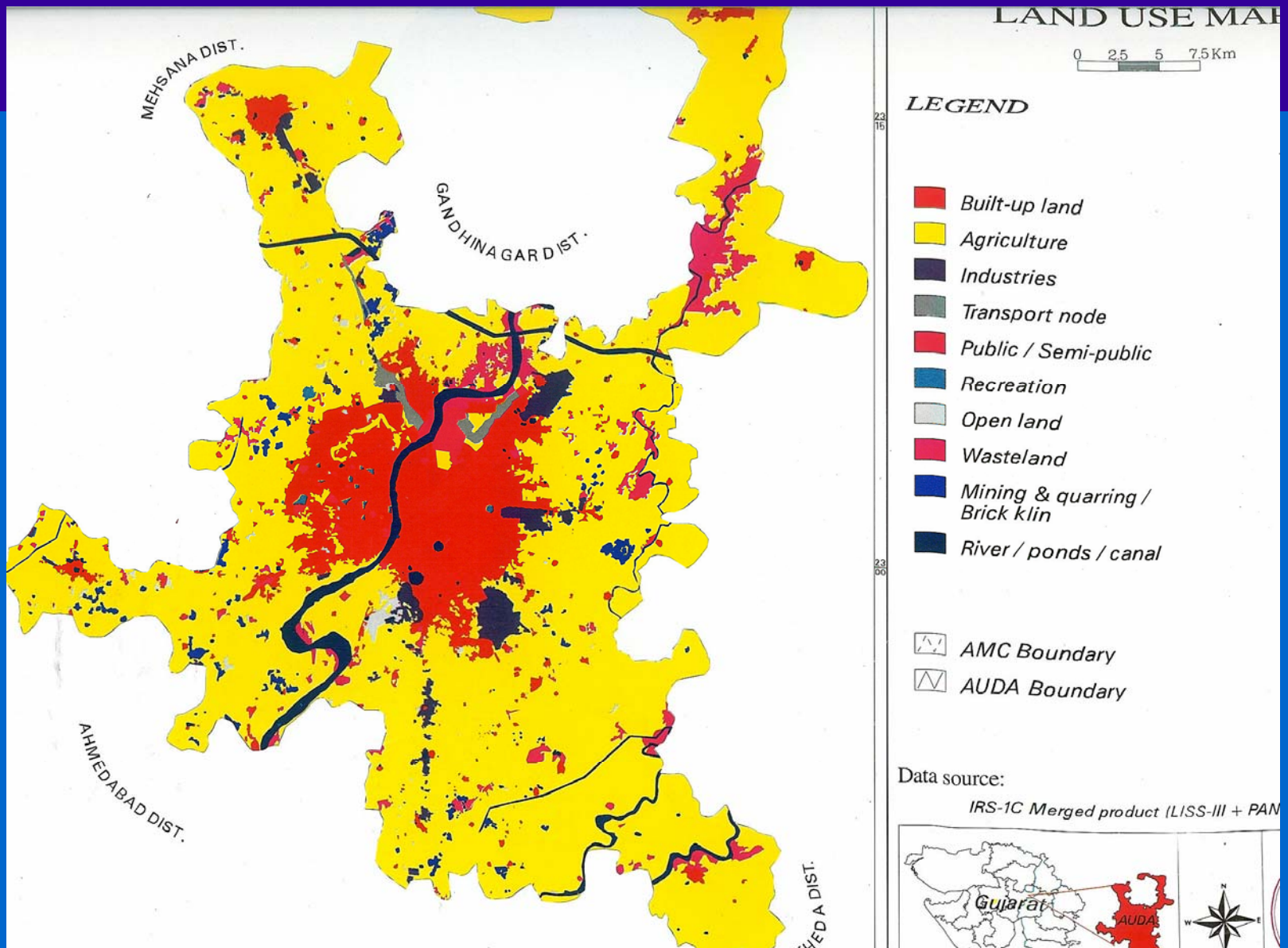
Literature Review



A Case of Ahmedabad

- Ahmedabad - seventh largest city in India registering a population of 4519278 persons (census 2001)
- The city limits have expanded from 5.7 kms in 1872 to 190.85 km in 1991
- Population growth - result of natural increase in population, net migration and merging of adjacent areas to the municipal limits

Ahmedabad : Land Use



Ahmedabad : Land Use

- Ahmedabad Urban Complex : shows predominant Agricultural land use
- Isolated patches of Special agriculture zone can be identified in AUC around Bhat, Sugad, Amiyapur in north, ISRO, Badrabad, Hebatpur in west Ahmedabad Urban Complex
- Area including AMC and surroundings up to Ring road is a dense urban mass with mixed land use

Ahmedabad - Water bodies

- Sabarmati river comprises of three sub basins - Dharoi, Watrak and Hathmati
- Ahmedabad located in southwestern part of Sabarmati basin occupying 27.31 % of the total basin area
- Sabarmati originates from Aravalli and passes through Ahmedabad city
- Besides Khari & Meshwo are other two small rivers passing through Ahmedabad

Ahmedabad - Water bodies..2

- Narmada canal passes through north of city, proceeding towards North Gujarat
- Two major water bodies Chandola Talav and Kankaria Talav exist in the southern part of the city
- Besides several small water bodies remain scattered across the cities in Thaltej, Shilaj, Charodi, Vastrapur and Vejalpur areas

Water Supply Status

Continuously decreasing per capita water supply

Table: Water Supply trends in Ahmedabad 1951 – 2001

S.No	Year	Population	Average daily supply (Million Gallons)	Gross Per Capita per day (Gallons per day)
1	1951	837163	20.24	25.68
2	1961	1149918		
3	1971	1585544	69.98	44.14
4	1981	2059725	96.08	46.64
5	1991	2876710	93.27	32.42
6	2001	3515361	104.83	29.82

Source: AMC Statistical Outline

Sanitation

- Investments in huge sewage treatment plants by AMC
- Sewage from AMC area is transported to Vasna & Pirana treatment plants
- Transportation through 20 drainage pumping stations
- Increasing energy costs for sewage transportation, pumping & treatment

Industries in the City

- Total 20 industrial estates in Sabarmati basin, out of which three lie within Ahmedabad district boundary
- Three major industrial areas : Odhav, Naroda & Vatva
- Vatva : 1750 industries
- Naroda : 850 industries
- Odhav : 765 industries

Wastewater Status...1

- Total of 556 mld of wastewater generated, out of which only 80% was collected in 1994-95
- 1997 : 740 mld generated, out of which only 630 mld collected
- Poor collection network
- Absence of organised sewerage collection network in AUDA area

Wastewater Status...2

- Overflowing of sewers in AUDA areas
- SIX CETP's operating in city that dump effluents in Sabarmati downstream of Vasna Barrage
- Wastewater discharged from CETP & STP used by farmers downstream for agricultural activities
- Urban wastewater source of livelihood to farmers & contributes to food security



Primary Survey Findings



Sampling

- 4 river water samples from Sabarmati
- one bore well sample from Vautha
- one soil and grain sample (Sahij & Gyaspur) were analysed by Consumer Education Research Centre, (CERC) Ahmedabad
- Focus group discussions with villagers (located on banks of Sabarmati)



Treated sewage from Vasna STP meets Sabarmati near Gyaspur



Industrial effluents being pumped in to fields near Sahij village



Polluted Sabarmati at Vatrak



Families practicing Agriculture on Sabarmati banks

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Vegetable cultivation from wastewater near Vautha



Fodder cultivation at Sahij from wastewater



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Parameters for Analysis

S.No.	Pesticides	Heavy Metals
01.	Aldrin	Copper
02.	Alpha – BHC	Lead
03.	Beta – BHC (Lindane)	Zinc
04.	Heptachlor	Cadmium
05.	Dieldrin	Chromium
06.	DDT	Arsenic
07.	Chlordane	
08.	Endosulphan	
09.	Dicofol	
10.	Organophosphorous	

Household Survey : In 9 affected villages (1790 households)

Village	Population	Households	Farmers	Landless Labourers	Other Occupations
Asamli	3500	700	187	0	0
Bakrol	3000	600	97	68	13
Chitrasar	1590	318	101	51	16
Fatehpura	1900	380	132	19	0
Gyaspur	5990	1198	112	158	19
Navapura	2200	440	65	120	0
Rinza	4000	800	200	16	1
Saroda	3500	700	63	133	23
Tarakpur	1200	240	103	2	0
Vautha	4800	960	119	68	26

Sample Characteristics

S.N.	Village	Total Households Surveyed	% Farmers	% Landless Labourers	% Other Occupations
1.	Asamli	187	100%	0%	0%
2.	Bakrol	178	54%	38%	8%
3.	Chitrasar	168	60%	30%	10%
4.	Fatehpura	151	87%	13%	0%
5.	Gyaspur	289	39%	55%	6%
6.	Navapura	185	35%	65%	0%
7.	Rinza	217	92%	7%	1%
8.	Saroda	219	29%	61%	10%
9.	Vautha	213	56%	32%	12%

Asamli

- Situated on east bank of Sabarmati
- Half village is dependent on Sabarmati river, other half on Mahi
- Yields in Sabarmati area have dropped as compared to the yield in Mahi area
- Significant decline in the orchards
- Farmers claim fruit bearing capacity of orchards has reduced

Asamli...2

- Germination rate of crops is low, hence extensive use of costly & hazardous pesticides
- Large number of livestock (8 affected by disorders
- 80% of households reported gastric disorders
- Other disorders include joint pain, cancer of throat as well as heart attack
- Trend of these diseases prominent in younger generation (under 40 yrs group)

Bakrol

- Discolored drinking water from borewell
- 27% households complain of gastric disorders
- Complains of skin irritation/boils and sores if working for long time in water
- 27% complained of skin disorders
- 45% of surveyed population complained of other disorders like muscle & joint pains
- Livestock disorders high : throat & skin infections, chakri rog, continuous fever

Chitrasar

- 28% households suffer from skin disorders : rashes, sores & discoloration of skin
- 10% reported digestion problems : constipation
- 27% complained of other disorders like joint pains etc.
- 35% of livestock are prone to health disorders common being foot rot, chakri, throat swelling
- Milk production has dropped steadily & has low fat content

Fatehpura

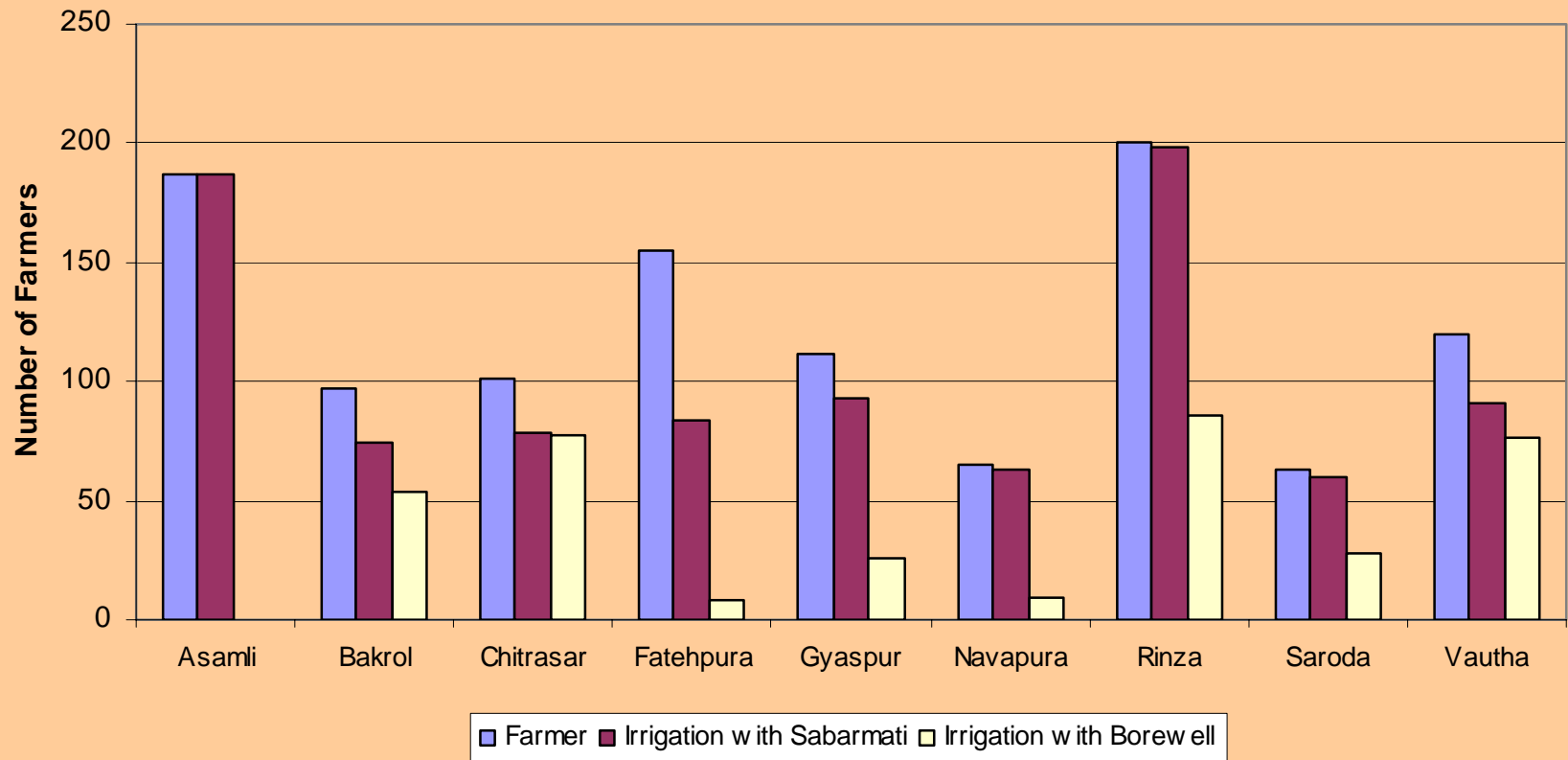
- 22% households reported gastric disorders, stomach pain and acidity
- 17% reported skin disorders
- Complains of cancer and heart diseases prevalent in younger group
- 90% of households reported some kind of health disorder

Findings...1

- Incomes in surveyed villages dependent on wastewater irrigation
- Almost 90% of crops grown in these villages are irrigated by Sabarmati
- Around 40% of farmers use borewell water, which also appears contaminated
- Of all surveyed villages, major cropping pattern is the same - Paddy & wheat

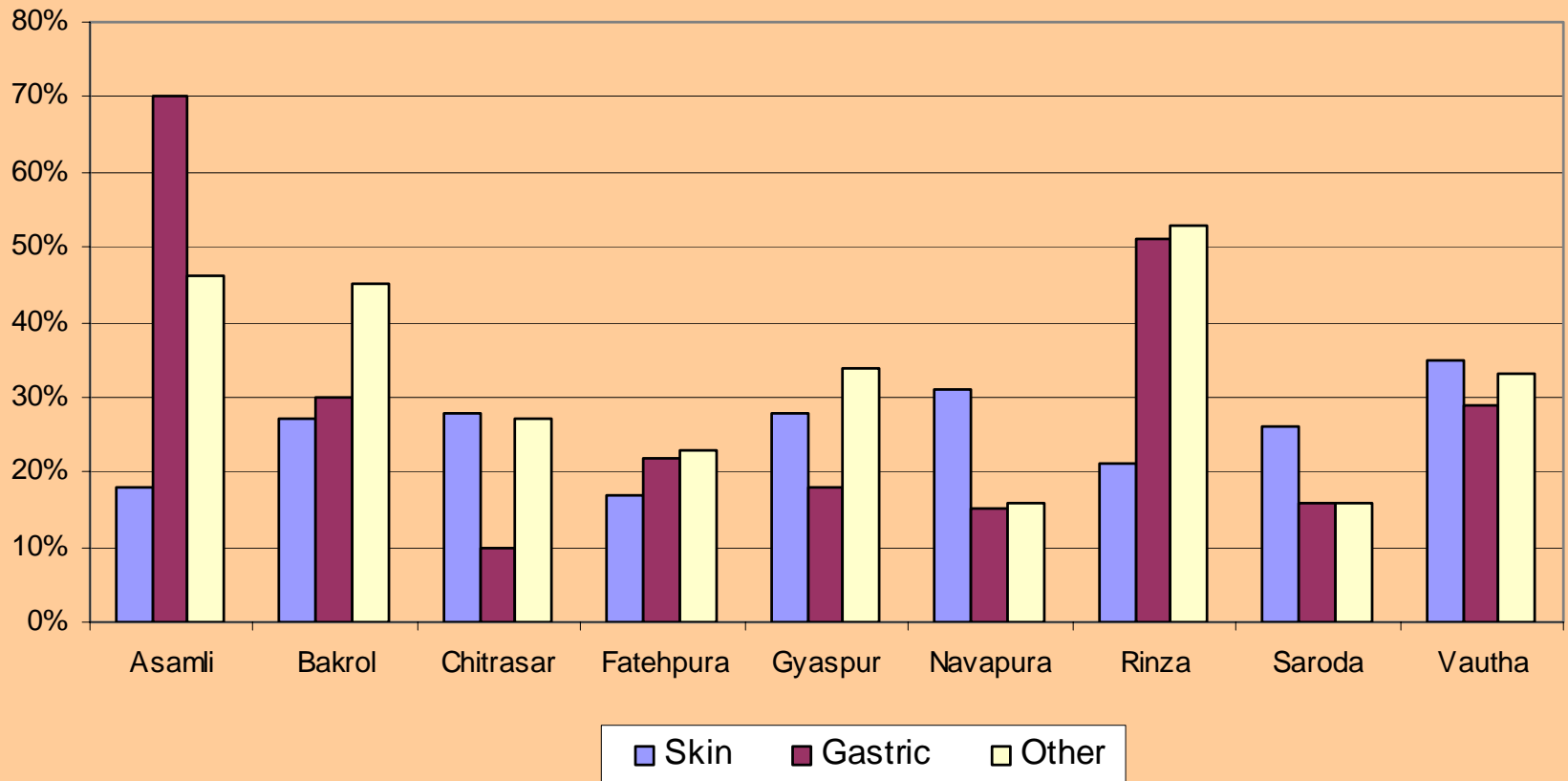
Findings...2

Irrigation Distribution



Findings...3

Health Disorders



Findings...4

Commonly reported Livestock Disorders

- “Chakri” – the animal feels giddy, walks around in circles and then falls to the ground
- “Afri” – frothing at the mouth
- “Gal Sutha” – swelling of the throat preventing the animal from being able to swallow
- “Kharva Movasa” – foot rot
- Aborting of calves half way through the gestation period
- Milk production has dropped drastically
- Fat content gone down

Findings...5

Village	Cadmium	Chromium	Copper	Lead	Zinc	Arsenic
Galiyana River water	0.02	0.46	0.16	0.00	0.07	0.00
Sahij River water	0.02	0.49	0.28	0.16	0.08	0.00
Gyaspur River water	0.007	0.92	1.57	0.17	0.65	0.00
Vautha Bore well water	0.01	0.61	0.22	0.40	0.56	0.00
Soil						
Sahij Soil	0.15	25.04	19.4	0.98	36.59	0.00
Grain						
Vautha Wheat	0.00	0.00	0.00	2.675	0.00	0.00

	Cadmium	Chromium	Copper	Lead	Zinc	Arsenic
Permissible Limits	0.01	0.05	1.5	0.10	15.00	0.00



THANK YOU

