Sialkot district is well recognized as the centre of export oriented industries of Pakistan.

Regrettably, water quality of surface water resources in Sialkot has deteriorated due to the influx of solid and domestic waste as well as industrial effluents.

The water table depth in Sialkot is normally between 30-50 feet which is polluted due to industrial and municipal wastewater leaching. In practice, a water level below 500 feet is considered safe for consumption, which indicates the gravity of the groundwater pollution problem.

In order to retain its industrial productivity and to meet the needs of Sialkot's growing population, stakeholders need to understand and address the water issues of the city through integrated water management strategies.

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SIALKOT ISSUE BRIEF

Our Water, Our Future

SITUATION ANALYSIS OF WATER RESOURCES OF SIALKOT

Sialkot district is well recognized as the centre of export oriented industries of Pakistan. It is popularly known as the manufacturing hub of surgical instruments, sports and leather goods. Sialkot is divided into four *tehsils*, including Sialkot, Pasrur, Daska and Sambrial[1]. One sector worth mentioning in terms of production is the leather industry, which contributes 5.4 per cent towards Pakistan's Gross Domestic Product (GDP)[2].

Demographic Profile[3]

DISTRICT / TEHSIL	REGION	POPULATION	NO OF HOUSEHOLDS
SIALKOT DISTRICT		**3,893,672**	**574,143**
	Rural	2,750,310	400,653
	Urban	1,143,362	173,490
SIALKOT TEHSIL		**1,794,658**	**269,546**
	Rural	1,114,681	164,854
	Urban	679,977	104,692

WWF-Pakistan, under its project titled International Labour and Environmental Standards Application in Pakistan's SMEs (ILES), conducted a study to assess the situation of freshwater in Sialkot. Pakistan's freshwater resources are under stress and its management requires better policy and implementation. The aim of this brief is to highlight the major water issues of Sialkot and recommend integrated initiatives that may be adopted to mitigate the water situation.

[1]Pakistan Bureau of Statistics
[2]Pakistan Tanners Association Annual Report, 2017-2018
[3]Pakistan Bureau of Statistics, Census 2017.

Where Do We Stand?

1. Surface water resources in Sialkot are comprised of *nullahs* (streams) Aik, Bhaid and Palkhu. River Chenab and River Tawi are also considered surface water resources, which flow about 20 km to the north of Sialkot city[4].
2. Water quality of these surface water resources has deteriorated due to the influx of solid and domestic waste as well as industrial effluents. This has influenced the biological, chemical and physical properties of these *nullahs* making them unfit to sustain any kind of living organisms. Sialkot generates approximately 32 million gallons per day (MGD) of wastewater that drains in *nullahs* Aik, Bhaid and Palkhu.
3. Sialkot experiences an average of 1,016 mm of rainfall[5] per year. Water streams flowing from the city are seasonal and also recharge the groundwater. However, these streams are highly polluted and contaminate the groundwater they recharge.
4. The water table depth in Sialkot is normally between 30-50 feet which is polluted due to industrial and municipal wastewater leaching. In practice, any water level below 500 feet is considered safe for consumption which indicates the gravity of the groundwater pollution problem.
5. Currently, 97 tube wells are present in the city of Sialkot, out of which 95 tube wells are functioning. An additional 15 tube wells are operating in the Cantonment area to meet the city's water demand. Water discharge from each tube well is generally 1.5 cusec (42.5 l/sec or 153m^3/hr) with water extraction per capita per day of about 79.8 gallons.
6. The depth of the tube well bore ranges between 350 to 600 feet. Town Municipal Authority (TMA) Sialkot is replacing 350 feet bore tube wells with ones that have a depth of 600 feet, after it was determined that the water table up to 500 feet is polluted with industrial and sewage water. Presently, 36 tube wells are reported to have been replaced[6].
7. The water supply to domestic consumers in urban settlements is managed by the Municipal Corporation through pumping of groundwater. There are a total of 39,274 domestic users and 2,269 commercial users in 24 urban union councils who get their water supply from 372 km long pipelines. These pipelines are reported to be 60 years old, damaged in various points and very rusty[7].
8. As of 2015, the water demand of Sialkot was estimated to be 42.43 MGD. Its distribution among different sectors is shown in Figure 1[8]. Figure 2 presents the sources of water and where it is discharged once it is used.

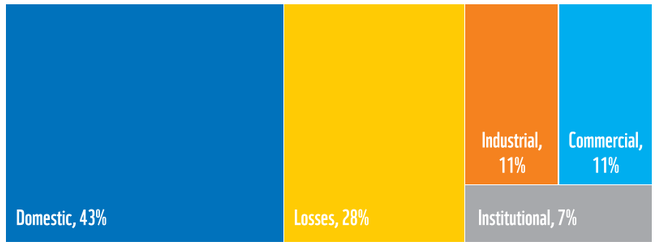

Fig. 1: Water Use in Sialkot

[4]Mahmood A, Malik RN, Syed JH, Li J, Zhang G. Dietary exposure and screening-level risk assessment of Polybrominated diphenyl ethers (PBDEs) and Dechloran plus (DP) in wheat, rice, soil and air along two tributaries of the River Chenab, Pakistan. Chemosphere. 2015; 118, 57–64.
[5]Pakistan Meteorological Department
[6]Cities Development Initiative for Asia, (CDIA, 2015). Annexe 11; Sialkot PFS water supply, wastewater and municipal drainage; ADB, REG. 8556. 2015.
[7]The Nation. Sialkot in grip of water-borne diseases. 29 January 2018.
[8]Cities Development Initiative for Asia, (CDIA, 2015). Annexe 11; Sialkot PFS water supply, wastewater and municipal drainage; ADB, REG. 8556. 2015.

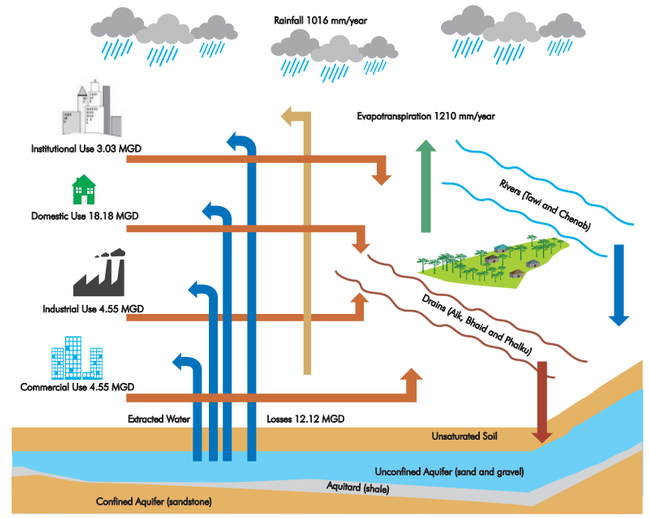

Fig. 2: Origin and Fate of Freshwater in Sialkot

9. There are at least 264 tanneries, 244 leather garment production units, 900 leather sports goods production units, 57 rice husking mills and 14 flour mills in Sialkot. These industries produce significant quantities of highly polluted wastewater[9].
10. The centre of the city can be considered a depression zone due to a dense population and practice of extensive groundwater pumping. A detailed investigation is required to identify other groundwater depression zones.
11. No wastewater treatment facility has been established within the city and untreated water and raw sewage are directly or indirectly discharged in to surface water bodies. The map in Figure 3 shows the *nullahs* through which wastewater is discharged in the River Chenab.

Fig. 3: Map of nullahs that drain into River Chenab

[9]Cities Development Initiative for Asia, (CDIA, 2015). Annexe 11; Sialkot PFS water supply, wastewater and municipal drainage; ADB, REG. 8556. 2015.

What Could Happen?

Multiple risks have been identified that are expected to aggravate the water situation in Sialkot. The following need to be addressed through relevant actions:

1. **Demographic and Socio-economic Risks**

   The population census of 2017 revealed a +1.90 per cent/year change in population density from 1998 to 2017. Due to the burgeoning population, water demand in the next 25 years will also increase significantly and will in turn put more pressure on the water table.

2. **Challenges to Water Quantity**

   Intense abstraction on a daily basis poses a serious risk to the water table in Sialkot. It is important to note that groundwater pumping at deeper levels will increase the risk of saline water intrusion from surrounding areas and will exacerbate water quality problems.

3. **Challenges to Water Quality**

   Several research studies have indicated the presence of biological contamination, toxic metals and persistent organic pollutants in the groundwater and surface water of Sialkot[10]. The presence of Coliform in water is due to mixing of municipal and sewage sludge in surface water bodies. Chromium, iron and nickel were detected in groundwater samples, at levels higher than the permissible limits set by water quality agencies and the World Health Organization[11].

   The Punjab Environmental Protection Agency (PEPA) has also expressed concern on the increasing pollution load in water bodies. For this reason, PEPA has intimated that farmers should not use wastewater for irrigation, but the practice is unchanged[12].

4. **Water Pollution Related Health Risks**

   There is no proper water treatment system in Sialkot. Industrial wastewater along with sewage water directly drains to surface water bodies of the city. This polluted water ultimately contaminates the groundwater. A study conducted by UNICEF found that 20 to 40 per cent of hospital beds in Pakistan are occupied by patients suffering from water-related diseases, such as typhoid, cholera, dysentery and hepatitis, which are responsible for one-third of all deaths. The increase in the number of reports of hepatitis cases in Sialkot can be associated with the poor water quality of the city[13].

5. **Lack of Water Management Infrastructure**

   Due to non-maintenance of the canal system, their delivery capacity is around 30 per cent less than designed capacity. Moreover, there is an absence of water reservoirs in the district that can act as recharge sources for groundwater.

6. **Risks from Local and Regional Climate Change Scenarios**

   Sialkot city has a humid sub-tropical climate. During every monsoon season *nullahs* Aik, Palkhu and Bhaid experience outburst flooding and are responsible for overflow in surrounding areas. If the predicted climate change scenarios are realized, Sialkot will experience more torrential rains increasing and intensifying the floods.

7. **Negligence and Unawareness of Consumers**

   A substantial amount of water is wasted at the household level as a consumer water metering system is not in place in Sialkot. Water is supplied at a constant rate and due to its almost free of cost availability, people do not make conscious water conservation efforts.

[10] Mahmood A, Malik RN, Syed JH, Li J, Zhang G. Dietary exposure and screening-level risk assessment of Polybrominated diphenyl ethers (PBDEs) and Dechloran plus (DP) in wheat, rice, soil and air along two tributaries of the River Chenab, Pakistan. Chemosphere. 2015; 118, 57–64.

[11] Ullah R, Malik RN, and Qadir A. Assessment of groundwater contamination in an industrial city, Sialkot, Pakistan. African Journal of Environmental Science and Technology Vol. 3 (12), pp. 429-446, December, 2009.

[12] The Nation. Sialkot in grip of water-borne diseases. 29 January 2018.

[13] World Bank. The World Bank, South Asia Environment and Social Unit, Pakistan Strategic Country Environmental Assessment, Water Supply and Sanitation: Protecting Sources and Safeguarding Supplies, The World Bank, 1818 H Street, N.W., Washington DC 20433, USA, pp. 52, 53,54 (2006).

What Needs to be Done?

WWF-Pakistan recommends the following actions be taken in order to improve the water situation in Sialkot and avoid future risks:

1. **Research and Analysis**
   - For development of targeted strategies, comprehensive data on groundwater levels and estimate recharge rates needs to be collected.

2. **Policies and Regulations**
   - Town Municipal Administration (TMA), Public Health Engineering Department (PHED) and the Environment Protection Agency (EPA) should enforce water quality standards and environmental laws to restrict industries from disposing off untreated waste in drains, canals or other water bodies.
   - Regulations are needed to address groundwater pumping without permits.
   - Installation of water meters will discourage consumers from wasting water.
   - For the domestic sector, relevant authorities should only approve those building designs that include a septic tank and rainwater harvesting system.
   - The City District Government should make efforts to contribute towards Sustainable Development Goal (SDG) 6, which focuses on access to safe water and treatment of at least 50 per cent of untreated wastewater produced.

3. **Water Conservation through Public Awareness**
   - It is important to educate all water consumers and stakeholders about the importance of groundwater management. Residents of the city should be sensitized about the issue to become responsible citizens and conserve water in their personal ambit as well.
   - Trainings and education series should be introduced for local communities about rainwater and run-off water harvesting for domestic and agricultural use and as a groundwater recharge option.

4. **Infrastructure Maintenance**
   - One of the key ways of solving the problem of water scarcity in Sialkot can be through infrastructure repair and maintenance of water channels such as Bambanwala River Bedian (BRB) Canal, Marala Ravi Link Canal and Upper Chenab Canal. The three natural streams in Sialkot i.e. Aik, Palkhu and Bhaid *nullahs* must also be maintained properly to prevent water losses.

5. **Use of Technologies**
   - Water efficient technology should be used in farming and agriculture practices.
   - Industries in Sialkot should be encouraged to translocate to the Sialkot Tannery Zone to improve environmental management.
   - In industries, reuse, recycling and the use of zero-liquid discharge systems should be promoted. The zero-liquid discharge system constantly treats water within a facility, which is then used and reused again and again without being discharged into the sewer or other external water systems.
   - Non-potable water (grey water) should be used for washing cars, irrigating landscape, industrial processing and flushing toilets. Water reuse or grey water can save a lot of freshwater for human consumption in times of water shortage and water stress. Such recycling technologies must be promoted in Sialkot.
   - Leather tanning is a major industrial activity in Sialkot. It produces considerable volumes of toxic wastewater with chromium being a major environmental and health concern. WWF-Pakistan piloted a bio-remediation experiment for chrome-specific treatment of tannery wastewater (Plate 1). The pilot showed promising results for selected plant species (water hyacinth and water reed). Therefore WWF-Pakistan recommends that this wastewater treatment method should be upscaled and replicated by tanneries to reduce the harmful health and environmental impacts of the tanning industry.

Plate 1: Bio-remediation pilot for chrome tanning wastewater

6. Aquifer Recharge

- Water recharge units i.e. rainwater reservoirs should be designed in open areas in depression zones.
- To increase recharge to groundwater, rainwater harvesting should be encouraged in all new schemes and in TMA jurisdiction areas. Special recharge zones need to be developed where rainwater can be collected and then used to recharge groundwater with different recharge technologies. A water recharge zone is proposed in an open depressed land area near Shadiwal village (Latitude 32° 35.458´N and Longitude 074°32.725´E) (Plate 2).
- Measures to inject excess surface water into the underground aquifers should be taken. This may include aspects such as construction of watersheds and wetlands and the practice of green infrastructure, which aims to reduce impervious surfaces.

Plate 2: Proposed site for rainwater harvesting and water recharge zone

7. Flood Management

- One possible location for a small water reservoir is an elevated depression site near the cricket ground of Kharota Sayadan village (Latitude 32° 32.258´N and Longitude 074° 32.432´E). If this site is utilized, flood water can be better managed during the monsoons, encouraging groundwater recharge simultaneously. This site is already serving as a natural water harvesting site. If a slight diversion in water flow of *nullah* Palkhu is created, water will flow into this depression zone (Plate 3).

Plate 3: Proposed site for small water reservoir

There is tangible evidence that the overall water situation in the country is deteriorating both, in terms of quality and quantity. Sialkot is no less than an economic hub and a significantly populated city. In order to retain its industrial productivity and to meet the needs of its growing population, Sialkot needs to understand and address its water issues through the aforementioned recommendations.