

**REPORT ON LOWER KACHURA LAKE AND POSSIBLE POLLUTION
SOURCES**

Date	5 th - 7 th August 2018.	
Purpose	To investigate the potential sources (point and non-point) deteriorating the water quality of Lower Kachura Lake	
Team	Khadim Hussain Syed Waqar Hussain	Assistant Director R&D Field Monitoring Assistant

Reference to Chief Secretary Office letter no. CS-Coord-4(2)/2017 dated 13th July 2018; the worthy Chief Secretary Gilgit-Baltistan directed thorough investigation of the subject issue.

1. In-compliance, Gilgit Baltistan Environmental Protection Agency (GB-EPA) deputed technical team to investigate the instant issue. The team reached Skardu on 5th August 2018, and held a meeting with Commissioner Baltistan on 6th August for administrative assistance to get access into Shangrila and adjacent facilities. The Commissioner Baltistan deputed Magistrate Mr. Hussain Butt (Tehsildar) with three policemen to assist GB-EPA team to probe the potential sources (point and non-point) deteriorating the water quality of Lower Kachura Lake.

The detailed investigation included;

- Survey of the surrounding terrain
- Natural slope, flow of surface and underground runoff
- Distance between the lake and surrounding buildings
- Discharge of gray water (kitchen effluent), brown water (from toilets) and black water (from septic tanks and soak pits) from the buildings situated along the circumference of the lake
- Inspection of leakages from sewerage system
- Examination of eutrophication (excessive growth of algae) in lake
- Microbiological and physiochemical analysis of lake water and feeding channels

1. Terrain of the Area

Natural topography of the area is highly dominated by mountains and steep slopes towards the central depression (Shangrila Lake) acting as a centrifuge (natural catchment) of surrounding water bodies. Shangrila Lake is situated at an elevation of 7,358 ft, which is the lowest point of the surrounding area forming a unique cup shaped geographical feature.

2. Natural Slope and Flow of Surface and Underground Runoff

Natural water flows from the surface runoff and ground water discharge gets their natural path towards the lake, as it is lowest depression of the surrounding area. Hotels and rest houses throughout the circumference of the lake (sparing no free space) are situated at an elevation of 7,359 - 7,379 ft sloping towards the lake.

3. Distance between the Lake and Surrounding Buildings

The Lake is surrounded by Shangrila Resort covering about 70% of the lake's circumference, followed by FCNA Rest House, FWO Rest House, GB-PWD VIP Rest House, GB Scouts Rest House, Tibet Motel and under construction Rest House of Supreme Appellate Court GB.

Table 1: Location and distance of the buildings from lake

Sr.No	Location	Sub Location	Elevation (feet)	Coordinates	Building's distance from Lake (feet)
1	Shangrilla	Standard Rooms adjacent to Appellate Court Rest House	7,369	35°25'31.72"N 75°27'15.68"E	28
2	Shangrilla	Standard Rooms at South West	7,360	35°25'30.10"N 75°27'18.36"E	124
3	Shangrilla	VIP suite	7,363	35°25'41.78"N 75°27'16.60"E	126
4	FCNA	Behind the Rest Rooms	7,370	35°25'38.55"N 75°27'13.19"E	120
5	PWD	Behind the Rest Rooms	7,375	35°25'35.01"N 75°27'13.34"E	200
6	FWO	Behind the Rest Rooms	7,377	35°25'38.55"N 75°27'13.19"E	350
7	GB Scouts	Behind the Rest Rooms	7,371	35°25'38.55"N 75°27'13.19"E	100
8	Tibet Motel	Parking Area	7,380	35°25'31.27"N 75°27'13.37"E	400
9	S.A.C GB	Under construction Building	7,379	35°25'31.72"N 75°27'15.68"E	300

*S.A.C GB

Supreme Appellate Court Gilgit Baltistan

4. Discharge of Gray Water (Kitchen Effluent), Brown Water (From Toilets) and Black Water (From Septic Tanks and Soak Pits) From the Buildings Situated along the Circumference of the Lake:

a. Shangrila Resort

Most of the buildings of Shangrila Resort are situated very close to the lake and their elevation nearly equals to the lake water surface. Construction of soaking pits at this elevation leads to direct seepage of brown, gray and black water into the lake. During inspection overflow and seepage from Kitchen and latrines was observed. Empty mineral water bottles, juice packs and plastic bags were found along the circumference of lake occupied by Shangrila.

b. FCNA Rest House

FCNA Rest House is situated adjacent to the Shangrila VIP suite. Sewerage system of FCNA is quite better and managed as compared to the others. Effluents from kitchen and washrooms are collected in a centralized septic tank (at a distance of 150 ft from lake) from where it is drained periodically using bowsers and being disposed off at a safe distance from lake, on an open land owned by FCNA.

c. PWD VIP Rest House

PWD VIP Rest House is located between FCNA and FWO Rest House. Safety tank and soak pits of PWD are situated at a distance of 400 ft and about 30 ft of elevation from lake. Effluents (gray, black and brown water) from Kitchen and washroom get enough time and space to be filtered before entering into the lake.

d. GB Scouts Rest House

GB Scouts Rest House is situated next to PWD VIP Rest House. The sewerage system was not properly managed; septic tanks from rest rooms were over flowed and are seeped directly into lake. Effluents from Kitchen, washroom and open washing pad were directly discharged into water stream feeding the lake. Foul smell and discoloration of lake water at the inlet was observed.

e. Tibet Motel

Tibet Motel is located at a distance of 450 ft and elevated above 12m from the surface of lake. The safety tank and soak pits are constructed at a safe distance from the lake, very little or no impacts were observed.

5. Examination of Eutrophication (Excessive Growth of Algae) in Lake

Eutrophication is the process in which lakes receive nutrients (nitrates, phosphate and potassium) and sediment from the surroundings and become more fertile and shallow. Human practices such as agriculture runoff, discharge of gray, brown and black water from kitchens, septic tanks and soak pits contain very concentrated amounts of nutrients. These nutrients wash into lakes during heavy rains or through direct seepage. The additional nutrients cause algal blooms which deteriorate the water quality and make it unfit for the survival of aquatic life. During the investigation excess amount of algal growth was observed in the lake; depleting the level of dissolve oxygen (DO), in Lake Ecosystem. Following are the main causes of eutrophication in the lake;

- i. Discharge of gray, brown and black water from Shangrila Resort and GB Scouts Rest House.
- ii. Surface runoff of landscaping water and/or rainwater along with fertilizers used by Shangrila Resort in flower beds and trees situated along the edge of the lake.

6. Physiochemical Analysis of Lake Water and Feeding Channels Along With Concentration of Dissolve Oxygen

a. Dissolve Oxygen (DO), Turbidity and pH level

Dissolve Oxygen (DO) is the main constituent of Lake Ecosystem for survival of all aquatic living organisms. To the degree that pollution contributes oxygen-demanding organic matter (like sewage, lawn clippings, soils from stream bank and lakeshore erosion, and from agricultural runoff) or nutrients that stimulate growth of organic matter, pollution causes a decrease in average DO concentrations. Low DO may result in collapse of aquatic ecosystem. The mean level of DO measured was 9.0 mg/l and range from 8.2 mg/l to 10.2 mg/l at day time on different locations of the lake. The higher amount of DO is a result of excess algal growth in lake. During day time the level of DO increases as a result of photosynthesis by algae but at night time DO level decrease as algae starts aerobic respiration which leads to death of aquatic life due to less oxygen.

Turbidity level of both samples taken from Shangrila resort (Kitchen and VIP suites area) was high. Average pH level of the lake was 8.6 which shows altered pH due to ingestion of pollutants from surroundings.

Table 2: Levels of DO at different points of Shangrila Lake.

Sr. No	Location	pH range in fresh water lake (6.5-8.5)	Turbidity range in fresh water lake (>5NTU)	Level of DO range in fresh water lake (7-12mg/l)
1	Shangrila near Appellate Court Rest House	9.3	60 NTU	9.8
2	Shangrila near Kitchen	9.8	50 NTU	10.2
3	In front of FCNA Rest House	8.8	<5NTU	8.9
4	In front of PWD VIP Rest House	9.8	<5NTU	9.2
5	In front of FWO Rest House	8.6	<5NTU	9.1
6	In front of GB Scouts Rest House	6.8	<5 NTU	8.2
7	In front of Tibet Motel	6.8	<5NTU	8.8

*Trout fish species cannot tolerate pH >8 and Turbidity >5NTU

b. Biological Contamination

E. Coli is a gram negative non-spore forming bacilli (bacteria) which is found in warm blooded animal's feces and used as an indicator of water pollution for further investigation of other related organic pollutants. Water quality testing was carried out using **WAGTECH portable test kit**. Eight samples were collected adopting random sampling technique. Six samples were collected from lake and two samples from water channels feeding the lake. Out of eight samples six were found to be contaminated (samples taken from lake) while the rest of two (samples taken from channels) were uncontaminated. The results indicated that the water sources entering the lake are free of contamination which means the human activities around the lake i.e. discharge from kitchen and washrooms are the main sources of contamination.

Table 3: Sample location and biological contamination

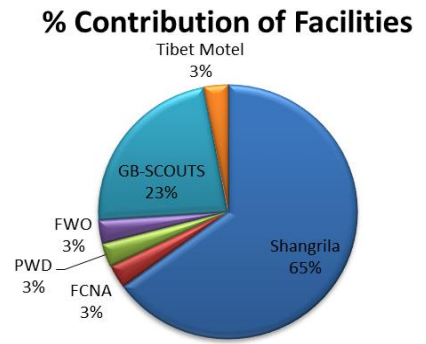
Sr. No	Sample Location	E. coli Count
1	Channel Inlet Shangrila	NIL
2	Shangrila in front of standard rooms near Appellate Court Rest House	TNT
3	Shangrila in front of Kitchen	TNT
4	Shangrila in front of VIP suite	TNT
5	In front of FCNA Rest House	TNT
6	In front of GB Scouts Rest House	TNT
7	Channel Inlet FCNA Rest House	NIL

*TNT Too Numerous To Count

7. Percentage Pollution Load of Facilities on Lake

Following figure is developed on the basis of below mention factors:

- Covered Area
- Number of buildings
- Distance and Elevation from Lake
- Discharge of gray, brown and black water from Kitchen, Toilets and landscaping
- Surface Runoff
- Tourist influx and solid waste management
- Terrain



PRESENT SITUATION: A SNAPSHOT



Figure 1: Shangrila; Flower beds and trees along the edge of Lake



Figure 2: Shangrila; Empty bottles, plastic bags and wrappers



Figure 3: Shangrila; Massive Algal bloom in front of VIP suite



Figure 4: Shangrila; seeping water containing oil and grease in front of VIP suite



Figure 5: FCNA; central septic tank



Figure 6: PWD; septic tank area



Figure 7: Sahngriila; kitchen drain directed towards Lake



Figure 8: Shangriila; Flowerbeds Fertilized, potential pollution source



Figure 9: GB-SCOUTS; kitchen and washroom effluent directly entering into water channel feeding the Lake



Figure 10: GB-SCOUTS; discoloration and eutrophication due to mixing of kitchen and washroom effluents



Figure 11: Lake sample (infront of Shangrila): E.Coli TNT



Figure 12: Shangrila: flowerbeds sloping towards Lake