



## River surface water quality of the River Garaso: A land use changed in the upper Ziarat Basin, Golestan province, Iran

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### ABSTRACT

The water quality of the River Ghara so are described in terms of point and diffuse sources of pollution, for this rural area of the upper Ziarat Basin that have had extensive villa building. So, the aim of this research was to investigate the role of urbanization and land use change on water quality in seven stations consisting of Siahab, Angirabad, Shastkalateh, Yasaqi, Naharkhoran, Abgir and Poleordogah. In this paper, principal component analysis and hierarchical cluster analysis methods have been used in order to investigate the water quality of the Gharaso River and to assess magnitude of anthropogenic and natural effects on the quality of river surface water. Therefore, we considered some parameters including electrical conductivity, total dissolved solids, bicarbonate, chloride, total and temporary hardness, calcium, potassium, sodium, sodium adsorption ratio, sulfate, pH and magnesium as physicochemical variables. The results indicated that water quality in Siahab and Naharkhoran stations was in the poorest quality among other stations because of anthropogenic effects. The best water quality was in Shast Kalateh station because there were no changes in the land uses. The Gharaso River joins the Caspian Sea creating sediment problems and an increasing threat to human and marine health. If these changes continue, there will be a serious threat to the entire ecosystem's health.

**Key words:** Cluster Analysis, Principal Component Analysis, Quality Water, Urbanization



	Rotated Component Matrix		
	1	2	3
TDS	<b>.935</b>	.328	.075
EC	<b>.935</b>	.335	.072
pH	.049	.262	-.627
Hco	.230	<b>.836</b>	.032
Cl	<b>.919</b>	.267	.052
So	.925	.037	.093
Ca	.590	.515	-.016
Mg	.885	.187	.092
Na	<b>.926</b>	.257	.069
K	.289	<b>.762</b>	-.057
SAR	.859	.396	.076
PNa	.509	.583	.455
ToHard	.601	.324	<b>.628</b>
TemHard	.072	.584	<b>.742</b>

	Component Matrix		
	1	2	3
TDS	<b>.976</b>	-.186	-.011
EC	<b>.979</b>	-.184	-.005
pH	.047	-.251	<b>.632</b>
Hco	.592	.434	.462
Cl	<b>.930</b>	-.232	-.029
So	.836	-.353	-.206
Ca	.747	.035	.235
Mg	.871	-.241	-.105
Na	<b>.935</b>	-.230	-.050
K	.592	.305	.473
SAR	<b>.942</b>	-.108	.044
PNa	.796	.410	-.065
ToHard	.788	.313	-.376
TemHard	.472	<b>.794</b>	-.207

