Figure 1: Location map of Najran City within the Kingdom of Saudi Arabia

3. Methodology

Water samples were collected in one liter ethylene plastic bottles, after bottle was washed with soap and then with distilled water and then dried, were then washed each bottle with water well, or treated water plant to be studied. Figures 1 and 2 show some water samples taken from a groundwater well and a treated water station in Najran City. Then the physical parameters were measured in the field (pH, EC, T, TDS) and then take the remainder of the sample to the laboratory to measure the chemical parameters (Na, K, Ca, Mg, Fe, Total hardness, total alkalinity, CL, F, SO4, NO_2 and NO_3).

Figure 1: Groundwater sample taken from a borehole at Najran City

4. Physical Parameters

PH, Electrical conductivity (EC), Total dissolved Solids (TDS), Turbidity and Dissolved oxygen. The above parameters were measured, on-site immediately after the collection of samples. Measurements of pH in the field were conducted by using an instrument model HANNA HI 8424 pH meter. Turbidity has been measured in the field using a turbidity meter (Lovibond-Turbi Check SN10l21759).The total dissolved solids (TDS) has been measured in the field using the instrument Electrical Conductivity TDS meter (SPER SCIENTIFIC, 850038 Pure Water Meter).A dissolved oxygen meter has been used for the measurement of dissolved oxygen in the water samples in the field.

Figure 2: Treated water sample taken from Al Athayba treated water station

5. Results and Discussion

The physical parameters studied and analyzed in the area surveyed and comprise the following: Hydrogen ion concentration (pH), Dissolved oxygen (DO), total dissolved solids (TDS), electrical conductivity (EC) and Turbidity.

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Tables 1 and 2 shows the results of physical parameters for water samples collected from water stations and bore holes respectively.

Table 1: Results of physical properties of treated water collected from treated water stations

No.	*Locality*	*pH*	*DO (mg/l)*	*TDS (mg/l)*	*EC (µS)*	*Turbidity (NTU)*
1	Al Hadan	8.4	0.03	76	151.9	2.33
2	Al Athayba	7.1	0.1	147	293	0.32
3	Al Uraisa	7.2	0.03	1.2	2.4mS	0.30
4	Al Mishaliya	7.5	0.04	86.5	173.5	0.77

Table 2: Results of physical properties of groundwater collected from boreholes

No.	*Locality*	*PH*	*DO (mg/l)*	*TDS (mg/l)*	*EC(µS)*	*Turbidity (NTU)*
5	Al Hadan	7.4	0.70	183	366	0.46
6	Uraisa Farm	7.6	0.05	41.5	83	0.55
7	Al Shurfa	7.2	0.05	719	1438	0.48
8	Al Hayra	7.4	0.06	909	1817	0.38

6. Chemical Analysis

The chemical analyses had been carried out at the chemical Laboratory of Water Administration at Najran City. They used the classical chemical methods for the investigation of different chemical parameters.

7. Chemical Parameters

The chemical parameters studied and analyzed in the treated water samples and those samples collected from bore holes (Groundwater), comprise the following: The major cations i.e.; Ca (Calcium), Mg (Magnesium), and the major anions which include Nitrite (NO_2), Nitrate (NO_3), Chlorides (CL), Sulfates (SO_4), and fluorides (F), this beside the total hardness, total alkalinity, ammonia (NH_3), iron (Fe) as trace element.

Tables 3 and 4 shows the results of chemical analysis for treated water samples and groundwater samples collected from the study area. As can be seen from tables 3 and 4, chemical analysis for groundwater (samples collected from bore holes), and treated water samples collected from treated water stations, showed that ammonia (NH_3), fluoride (F), and iron (Fe) are not detected in the water samples. It was clear that according to the results of chemical analysis carried out in the study area, groundwater samples showed the water samples are very hard, while water collected from treated water stations are hard.

Also according to the results of chemical analysis done for the treated water samples, nitrates (NO_3) were recorded high at Al Mishaliya (Table 3) while for groundwater samples chemical analysis showed high nitrates amounts at Al Hayra(Table 4).

Table 3: Results of chemical analysis of treated water

No.	*Locality*	*NH_3*	*NO_2*	*NO_3*	*Cl*	*SO_4*	*T.H.*	*Ca Hard.*	*Mg Hard.*	*Fe*	*F*	*T.Alk.*
1	Al Hadan	0.0	0.0	2.3	2.5	10.0	150	120	80	0.12	0.0	100
2	Al athayba	0.0	0.2	12.3	35	38.6	140	110	30	0.0	0.0	90
3	Al Uraisa	0.0	0.0	5.6	25	4.3	120	100	20	0.0	0.0	50
4	Al Mishaliya	0.0	0.51	56.2	50	22.9	150	120	30	0.0	0.0	90

*All units in mg/l

Table 4: Results of chemical analysis of groundwater collected from boreholes

No.	*Locality*	*NH_3*	*NO_2*	*NO_3*	*Cl*	*SO_4*	*T.H.*	*Ca Hard.*	*Mg Hard.*	*Fe*	*F*	*T.Alk.*
5	Al Hadan	0.0	0.0	32.6	35	32.8	200	160	40	0.0	0.0	95
6	Uraisa Farm	0.0	51	29.6	400	205.0	1500	1200	300	0.0	0.0	120
7	Al Shurfa	0.0	0.04	23.2	200	155.7	500	400	100	0.0	0.0	100
8	Al Hayra	0.0	0.2	69.9	300	140.4	1000	800	200	0.0	0.0	90

*All units in mg/l

8. Conclusion and Recommendation

From the work done during the period of this study carried out for the investigation of groundwater (collected from bore holes), and treated water (collected from treated water stations), quality in Najran town the following can be concluded:

- The groundwater and surface water quality in the studied area is fit for drinking and other domestic uses as compared with the international drinking water standards.

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- It can be concluded that the treated water samples are fit for different uses except at Al Mishaliya which shows high nitrates content.
- Groundwater samples are very hard and high content of nitrates were recorded at Al Hayra.

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