National Study on Water Point Functionality and Water Quality in Afghanistan

By M. Hassan Saffi, Hydro geologist
Ahmad Jawid Hydro geologist

August, 2014

Paikob-e-Naswar, Wazirabad, PO Box 208, Kabul, Afghanistan
Phone: (+93)(020) 220 17 50 Mobile (+93)(0)70 28 82 32
E-mail: dacaar@dacaar.org Website: www.dacaar.org

List of Abbreviations:

DWPs	Drinking Water Points
WASH	
ECHO	
NTU	Nephelometric Turbidity Unit
NDWQS	National Drinking Water Quality Standard
Mg/l	Milligram per litre
WP	Water point
WPs	Water points
WS	Water Sample
QC	Quality Control
QA	Quality Assurance
DW	Dug Well
TW	Tube Well
SP	Stand Post
WHO	World Health Organization
WSG	Water and Sanitation Group
RMO	Regional Management office
Al	Aluminium
As	Arsenic
Ba	Barium
Ca	Calcium
Cl	Chloride
Cr	Chromium
Cu	Copper
DACAAR	Danish Committee for Aid to Afghan Refugees
E.Coli	Escherichia Coli
EHC	Environmental Health Criteria
F	Fluoride
Fe	Iron
Hb	Haemoglobin
Hg	Mercury
I	Iodine
MethHb	Met haemoglobin
MoPH	Ministry of Public Health
MRRD	Ministry of Rural Rehabilitation Development
NGVS	No Guideline Value Set
NH4	Ammonia
Ni	Nickel
NO3	Nitrate
NO2	Nitrite
Pb	Lead
PCRWR	Pakistan Council of Research in Water Resources
pH	Power of Hydrogen Ion Concentration
K	Potassium
SO4	Sulphate
Na	Sodium

TCU	True Color Unit
TDS	Total Dissolved Solids
TTC	Thermo Tolerant Coli form
UNICEF	United Nations Children Fund
Zn	Zinc
Mg	Magnesium
Mn	Manganese
$CaCO_3$	Alkalinity
HCO_3	Bicarbonate
CO_3	Carbonate
OH	Hydroxide
PO_4	Phosphate
Br	Bromine
SIO_2	Silica
H_2S	Hydrogen Sulphate
BO_2	Boron

List of National Drinking Water Quality Standards (NDWQS)

Physical and Chemical Parameters			
Parameter Properties	Standard Values For Afghanistan	WHO guidelines 2011	National Standard of most Asian countries
Color	15 TUC	NGVS	5 NTU
Test	Non Objectionable / Acceptable	Non Objectionable / Acceptable	Non Objectionable / Acceptable
Odor	Non Objectionable / Acceptable	Non Objectionable / Acceptable	Non Objectionable / Acceptable
Turbidity	5 NTU	NGVS	5 NTU
Total Hardness as CaCO3	500 mg/L	NGVS	500 mg/L
TDS	1000 mg/L	NGVS	1000 mg/L
pH	6.5 – 8.5	NGVS	6.5 -8.5
Aluminum	0.2	NGVS	0.2
Antimony	0.02	0.02	0.02
Barium	0.7	0.7	0.7
Boron	2.4	2.4	2.4
Cadmium	0.003	0.003	0.003
Chloride	250	NGVS	250
Chromium	0.05	0.05	0.05
Copper	2	2	2
Iron	0.3	NGVS	0.3
Sodium	200	NGVS	200
Sulphate	250	NGVS	250
Magnesium	30	NGVS	30
Calcium	75	NGVS	75
Toxic Inorganic	Mg/Liter	Mg/Liter	Mg/Liter
Cyanide	0.05	NGVS	0.05
Arsenic	0.05	0.01	0.01-0.05
Fluoride	1.5	1.5	1.5
Lead	0.01	0.01	0.01
Manganese	0.3	NGVS	0.3
Nickel	0.07	0.07	0.07
Nitrate	50	50	50
Nitrite	3	30	3
Nitrate as Nitrogen	11	11	11
Selenium	0.04	0.04	0.04
Zinc	3.0	NGVS	3.0

TABLE OF CONTENT

Table

1 Introduction/Background

The Humanitarian sector has through the CHAP managed a process of reporting and decision making on where needs should be targeted. The WASH Cluster has managed through making use of a number of existing surveys of the WASH sector and other surveys (AMICS, the Morbidity study and NRVA 07/08) to have data sets and extracted those provinces that are the worse off. No data were available on water point functionality and no water quality were taken into account, therefore the study will support the WASH cluster in the selection of needy provinces for humanitarian interventions

2 Objective

2.1 Overall objective

Overall objective of this study to provide a detailed pictures of Drinking Water Points (DWPs) Functionality and Water Quality (quantitative and quantitative functionality of DWPs) and impact of water quality concern parameters on human health in the rural areas of Afghanistan.

2.2 Specific Objective

The specific objectives of the proposed national study are:

- Collect a representative sample data(quantitative) on DWPs functionality
- Collect water samples from drinking water points for physical and chemical analysis
- Perform water samples physical and chemical analysis
- Manage, evaluate. maps and report the data
- Identify challenges facing WASH sector

3 Rational of the study

Groundwater is the major source and it is also playing a crucial role in drinking water supply in Afghanistan. It does not, however, have a large potential for development as it is a finite and hidden resource and it is needed to address its qualitative and quantitative status for efficient and affective using, development and protection. The rationale of this study is:

- Highlights DWPs quantitative (working conditions) and qualitative problems to support WASH decision makers and policy makers for improvement of policies strategic plan and regulation for efficient and effective implementation of sustainable water supply project

- Provide detail picture of drinking water points quantitative functionality and impact of water quality concern parameters in DWPs and the links between water use and health outcome

4 Material and methodology

4.1 Study area

The study area include 31 provinces (Badakhshan, Badghis, Baghlan, Balkh, Bamyan, Farah, Faryab, Ghazni, Ghor, Hilmand, Kandaha Hirat, Jawzjan, Kabul, Kapisa, khost, Kunar, Kunduz, Laghman, Maydan Wardak, Logar, Nangarhar, Nimroz, Nuristan, Paktya, Panjsher, Parwan, Samangan, Sari Pul, Takhar and Uruzgan) of Afghanistan. The study area was mapped using using arc GIS 10.2 and it is presented in Annex 1

4.2 Field investigation

The field investigation carried out on 30,182 DWPs (DW, TW, SP and spring) from November, 2013 to June 2014 in 31 provinces of Afghanistan. The DWPs location were geo- referenced using geographical position system(GPS). The location of DWPs of study area was mapped using arc GIS 10.2 and it is shown in the Annex 2 and the collected WPs functionality data is given in the Table 1. 11.5% (3491 water samples) of the WPs functionality data (30,182 WPs) were sampled and the water samples were transferred into the plastic container either to the DACCAR Main office (Kabul) or DACAAR Regional offices (Herat, Faryab, Nangrahar and Takhar) for performing physical and chemical analysis.

The sampled water points location was mapped using arc GIS 10.2 and it is presented in the Annex 3.

4.3 Water samples Analysis

The water samples were analyzed for 35 physical-chemical parameters using pH conductivity meter, turbidity meter, digital Arsenator, photometer 600 and photometer 8000 devices. The analyzed physical-chemical parameters were checked and revised according to the QC and QA and recorded to database. The location of sampled WPs and analyzed physical-chemical parameters is given in the Table 2

5. Planned activities

Planned activities included:

- Collect 21,000 DWPs functionality data
- Collect 3,200 water sample (10% of total WPs):

5.1 DWPs functionality activities

The main activities of WPs functionality are:

- Identify location for data collection
- Document field data and record in the standard formats
- Check the recorded field data on the map

- Record data in database after checking and revising
- Manage, analyze, graphic interpretation, visualize, map and report the data
- Address concern, challenges and policy relevant option
- Sharing information and knowledge with Donor and WASH sector

5.2 WPs sampling activities

The main activities of WPs sampling(qualitative functionality) activities are:

- Identify the location of sampling
- Collect water samples from DWPs according the DACAAR water quality analysis Lab procedure and guideline
- Measuring and document physical parameters on site
- Transfer water samples to the DACAAR Main office or DACAAR Regional Management Offices (RMOs)
- Analyze water samples according the DACAAR Lab water quality analysis guideline and procedure
- Document and record analyzed parameters to the standard format
- Check the location of water samples
- Check and control analyzed water quality parameters in regard QC and QA
- Record water quality data in the databas
- Manage, analyze, interpretation , map and report the data
- Address concern, challenges and policy relevant option
- Sharing information and knowledge with Donner WASH sector

6 Achieved activities

Achieved activities included:

- Collect 30,182 DWPs functionality data:
- Collected 3,491 water sample (11.5% of 30182 DWPs)

6.1 WPs functionality activities

The main achievement of WPs functionality activities are:

- Identified the location of DWPs for data collection
- Documented field data and recorded in the standard formats
- Checked the recorded field data on the map
- Recorded data the in database after checking and revising

- Managed, analyzed, graphic interpreted, visualized, map and provided the report the collected data.
- Addressed concern, challenges and policy relevant option
- Shared information and knowledge with Donor and WASH sector

6.2 WPs sampling activities

The main activities of DWPs sampling(qualitative functionality) activities are:

- Identified the location of sampling
- Collected water samples from WPs according the DACAAR water quality analysis Lab procedure and guideline
- Measuring and document physical parameters on site
- Transferred water samples to the DACAAR Main office or RMOs
- Analyzed water samples according the DACAAR Lab water quality analysis guideline and procedure
- Documented and recorded analyzed parameters to the standard format
- Checked the location of water samples on the map
- Checked and controlled analyzed water quality parameters regarding QC and QA
- Recorded water quality data in the database
- Managed, analyzed, interpreted , mapped and provide the report from the data
- Addressed concern, challenges and policy relevant option
- Shared information and knowledge with Donner and WASH sector

7. Water Point functionality and water quality data interpretation and Results

The WPs functionality data interpretation includes:

- Quantitative functionality (working conditions)
- Qualitative functionality (impact on human health)

7.1 Quantitative functionality

30,I82 DWPs quantitative functionality (working condition) data (Table 1) were managed, analyzed and interoperated. The results indicate that 35% of WPs are non-functional (5 % dried up, 3 % collapsed, 4 % working with bucket, % 2 plugged/abandoned, 1% closed and 20 % having multiple problem). The number of investigated DWPs according to the provinces summarized and in it is shown in the Figure 1 and the DWPs functionality status is presented in the figure 2. The monitored DWPs location mapped using Arc GIS 10.2 (geographical position system) and it is shown in Annexe 2.

.

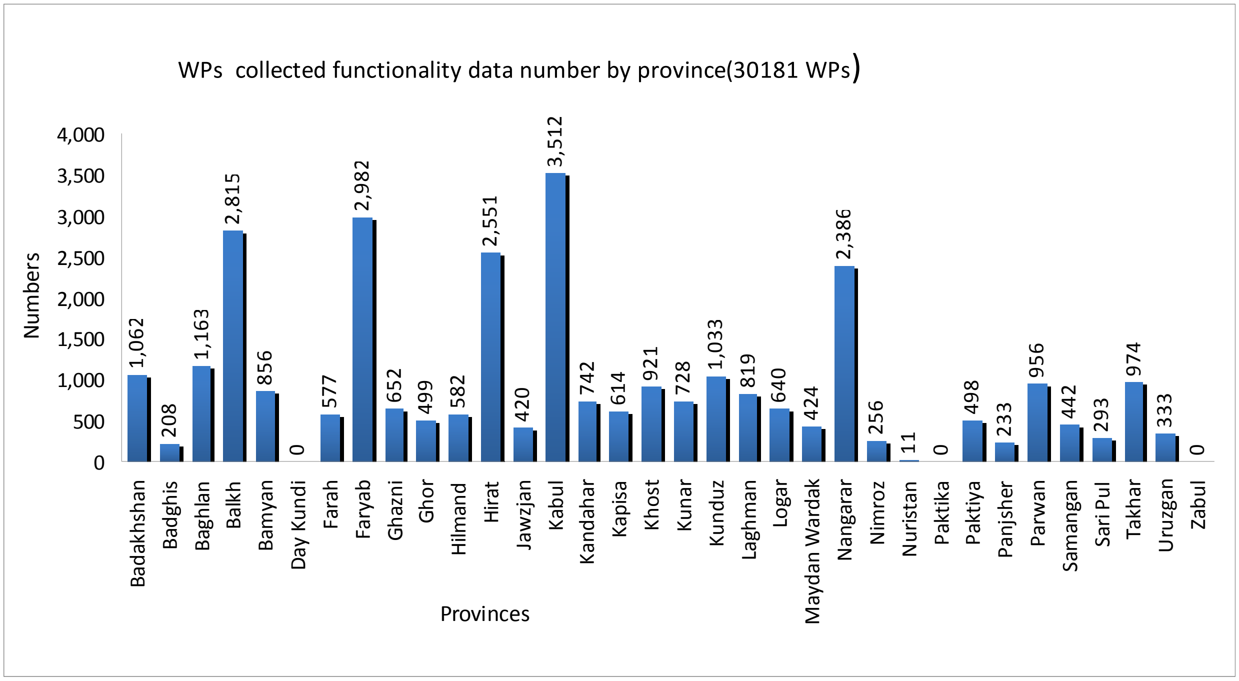


Figure 1 DWPs collected functionality data number by province

The location quantitative functionality (working condition) of DWPs are presented in the Table 2.

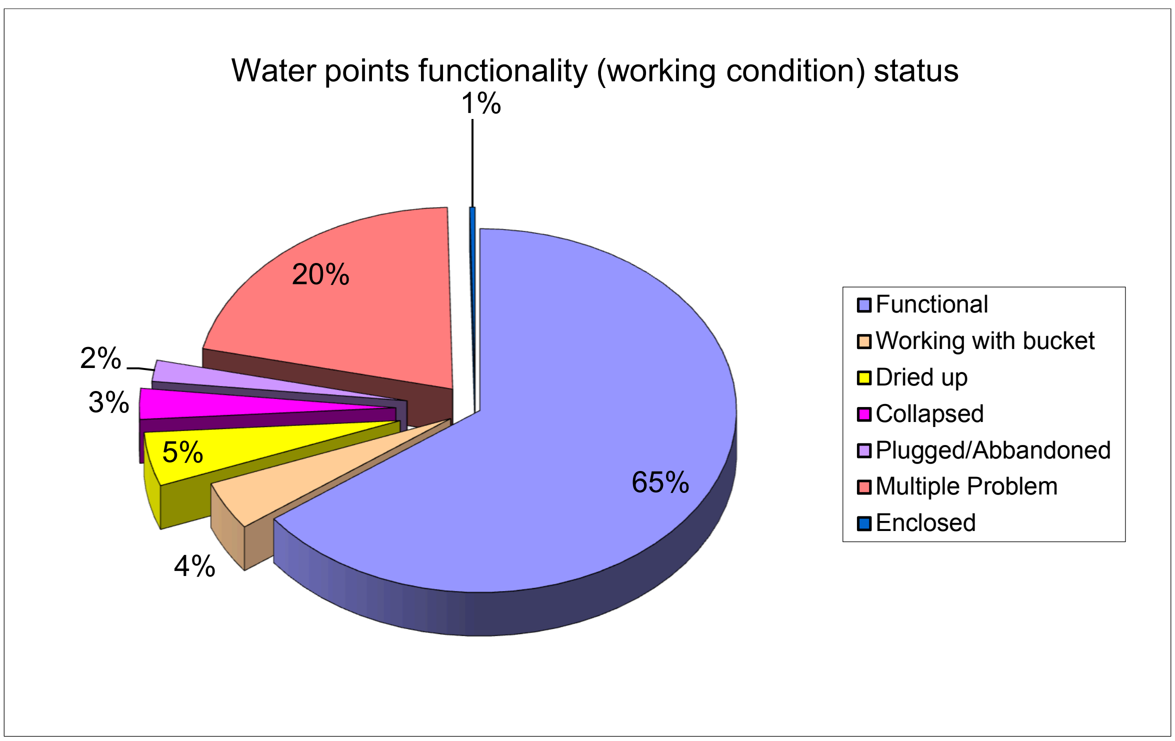


Figure 2 DWPs functionality (working Condition) status

7.2 Qualitative functionality

3,491 water samples from DWPs (11.5 % of 30182 DWPs) were sampled from 31 provinces of Afghanistan and the number of water sample from DWPs is summarized in the figure 3. The Sampled DWPs location was mapped using Arc GIS 10.2 and it is shown in Annexe 3.

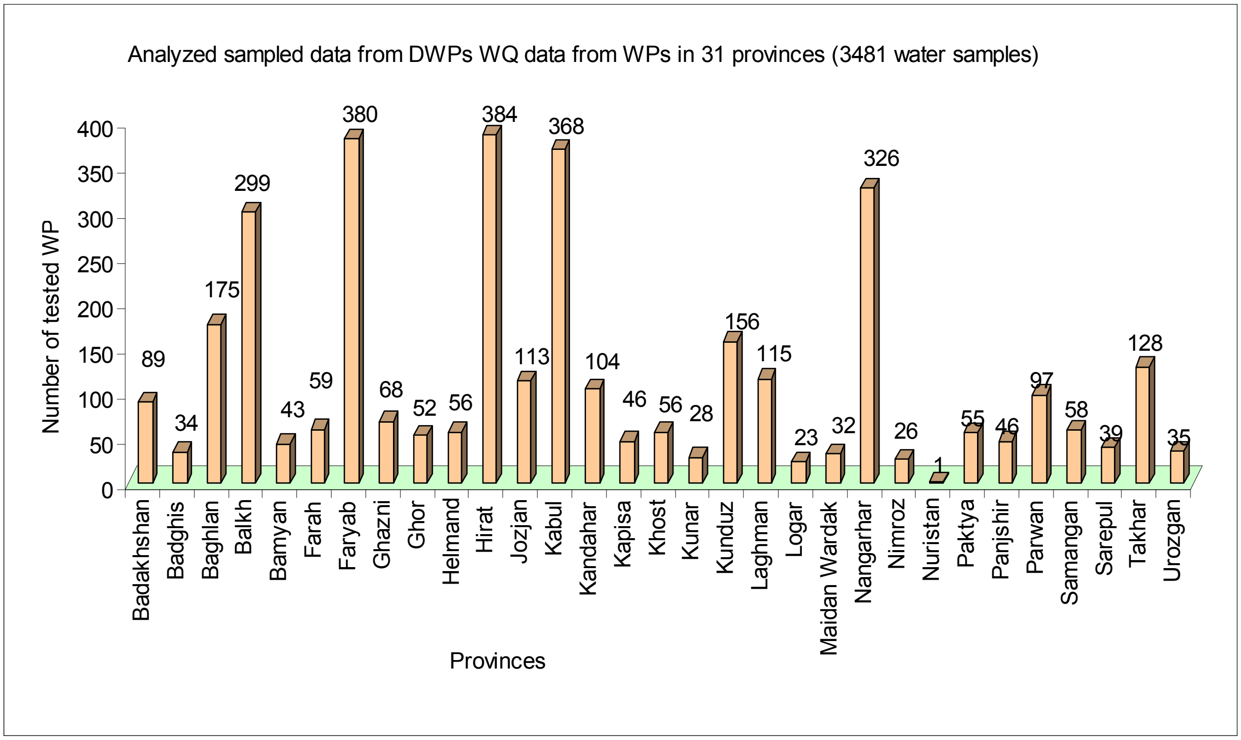


Figure 3 Number of sampled DWPs by province

The water samples from DWPs were analyzed for determining of 35 physical -chemical parameters and the results indicated the following water quality concern parameters which exceeded the NDWQS and potentially affect the health of people:

7.2.1 Electrical conductivity (EC)

The concentration of EC in water samples collected in the study area range from 320 µS/cm (WP_ Code 186) to 26100 µS/cm (WP_ Code 3032) (table 2) and the median value is 2242 µS/cm. The spatial distribution level of EC concentration was mapped using arc GIS 10.2 and it is shown in annexe 4

The analysis result revealed that 8% of tested water samples from Balkh, Nimroz, Jawzjan, Takhar, Samangan, Sari Pul, Faryab, Herat, Ghor, Kandahar, Badghis, Bamyan, Hilmand and Kunduz provinces

drinking water points exceeded the limit of 3000 µS/cm recommended by NDWQS, however, 31 % of analyzed water samples exceeded the limit 1500 µS/cm recommended by WHO. Because of the acute shortage of safe drinking water in Afghanistan, the EC of drinking water up to 3000 µS/cm is tolerance for human consumption.

The percentage of EC distribution levels is shown in the Figure 5.

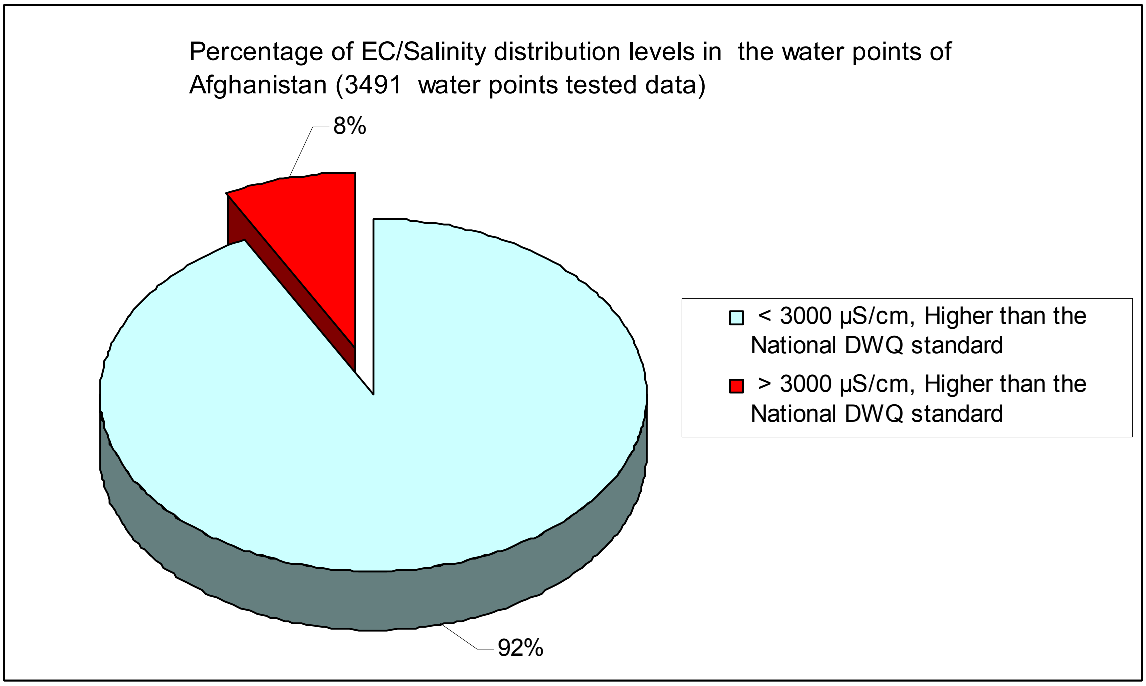


Figure 4 Percentage of EC distribution level

7.2.2 Turbidity

The Turbidity value of analyzed water samples ranged from 0 NTU (WP_ Code 2226) to 291 NTU mg/l (WP_ Code 111) (Table 2). The Turbidity value in the water points of Afghanistan is shown in Annex 5. The NDWQS for turbidity is recommended 5 NTU.

The water quality analysis result revealed that 22% of tested water samples from Kabul, Baghlan, Paktya, Nangarhar, Laghman, Kapisa, Uruzgan, Kunar, Parwan, Logar, Ghazi, Farah, Badakhshan Balkh, Nimroz, Jawzjan, Takhar, Samangan, Sari Pul, Faryab, Herat, Ghor, Kandahar, Badghis, Bamyan, Hilmand and Kunduz provinces drinking water points exceeded the NDWQS of 5 NTU (the turbidity of water ranged from 5.02 NTU to 291 NTU).

The exceeded Turbidity values in the water points indicates poor well drilling and and design consideration of DWPs. The percentage of Turbidity value is shown in the Figure 6

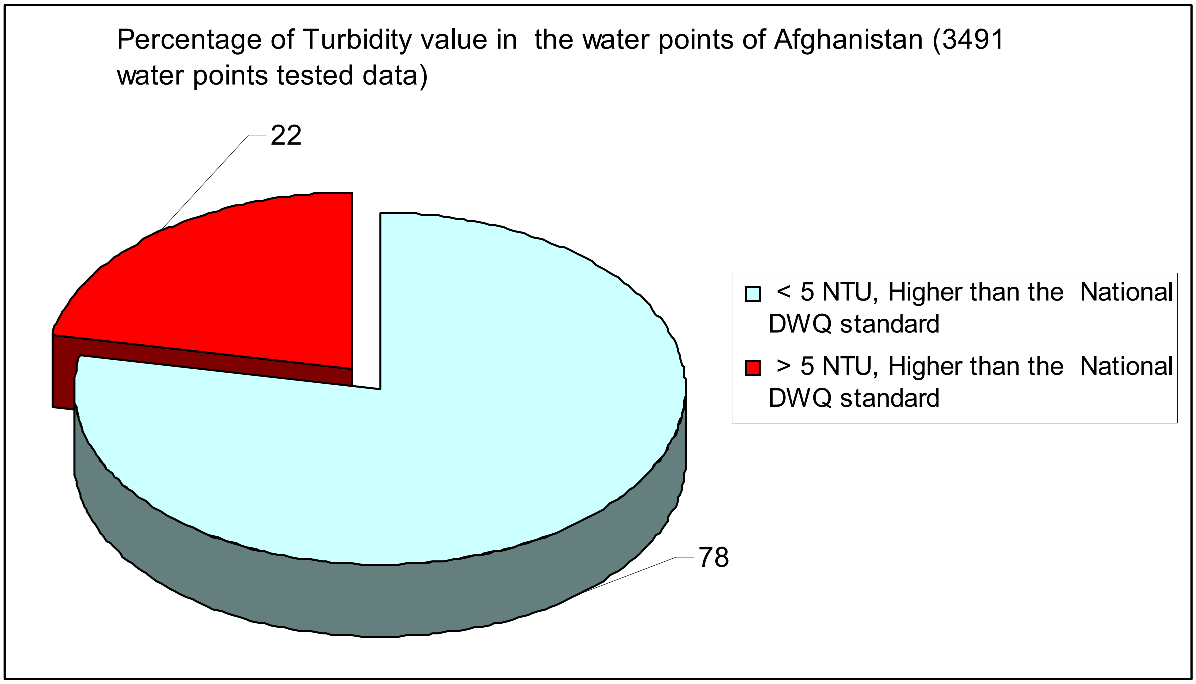


Figure 5 Percentage of Turbidity

7.2.3 Sulphate

The sulphate concentration value of water points varied from 10 mg/l (WP_ Code 3101) to 2720 mg/l (WP_ Code 1741) (Table 2). The sulphate spatial distribution level in the water points was mapped using arc GIS 10.2 and it is presented in the annexes 6. ***The NDWQS for sulphate concentration in the drinking water is recommended 250 mg/l.***

17% of analyzed water samples from Kabul, Baghlan, Parwan, Farah, Balkh, Nimroz, Jawzjan, Takhar, Sari Pul, Faryab, Herat, Ghor, Kandahar, Badghis, Bamyan, Hilmand and Kunduz provinces DWPs exceeded the NDWQS of 250 mg/L(the Sulphate concentration of water ranged from 251 mg/L to 2160 mg/L). The percentage of sulphate distribution levels is shown in the Figure 7.

Using of high sulphate content drinking water (above the NDWQS) causes severe diarrhea and loss of body fluid of users and can be dangerous for children , however given bitter taste to the water and the water as toxic for health

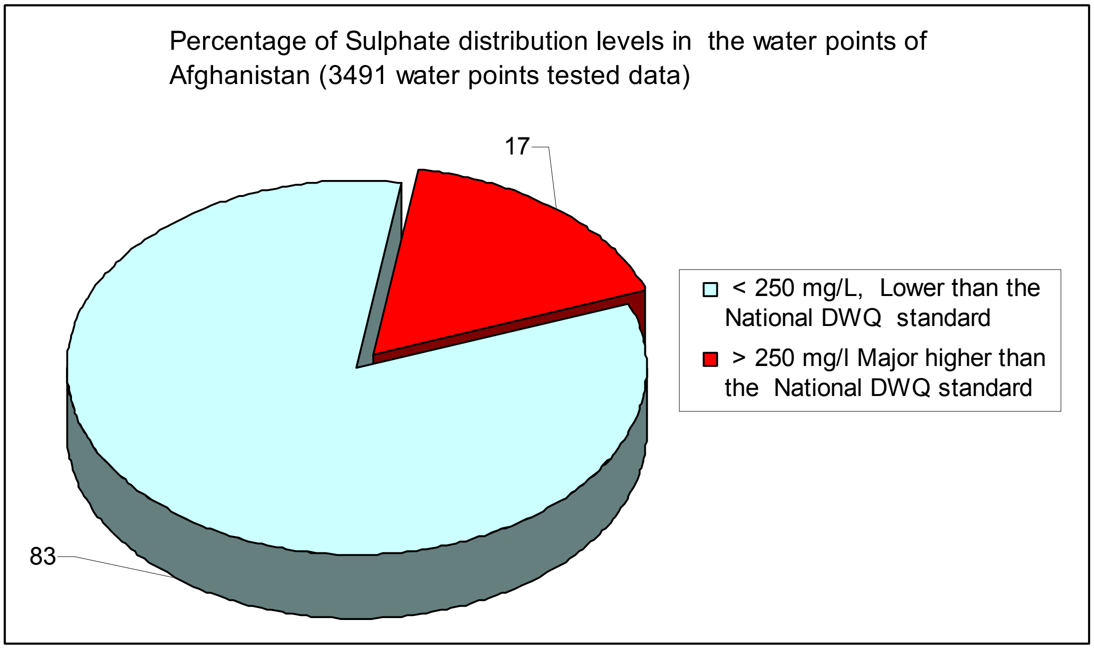


Figure 6 Percentage of sulphate special distribution levels in DWPs

7.2.4 Fluoride

The analyzed fluoride concentration value of water points varied from 0.01 mg/l (WP_ Code 2573) to 13.8 mg/l (WP_ Code 1638). ***The NDWQS for Fluoride concentration of drinking water is recommended 1.5 mg/l.*** The spatial distribution level of fluoride concentration mapped using arc GIS 10.2 and it is shown in annexe 7

19% of analyzed water samples from Uruzgan, Farah, Balkh, Nimroz, Jawzjan, Takhar, Samangan, Sari Pul, Faryab, Herat, Ghor, Kandahar, Badghis, Hilmand and Kunduz provinces DWPs exceeded the NDWQS of 1.5 mg/L (the Fluoride concentration of water ranged from 1.51 mg/L to 13.8 mg/L). The percentage of fluoride distribution levels is shown in the Fig. 7.

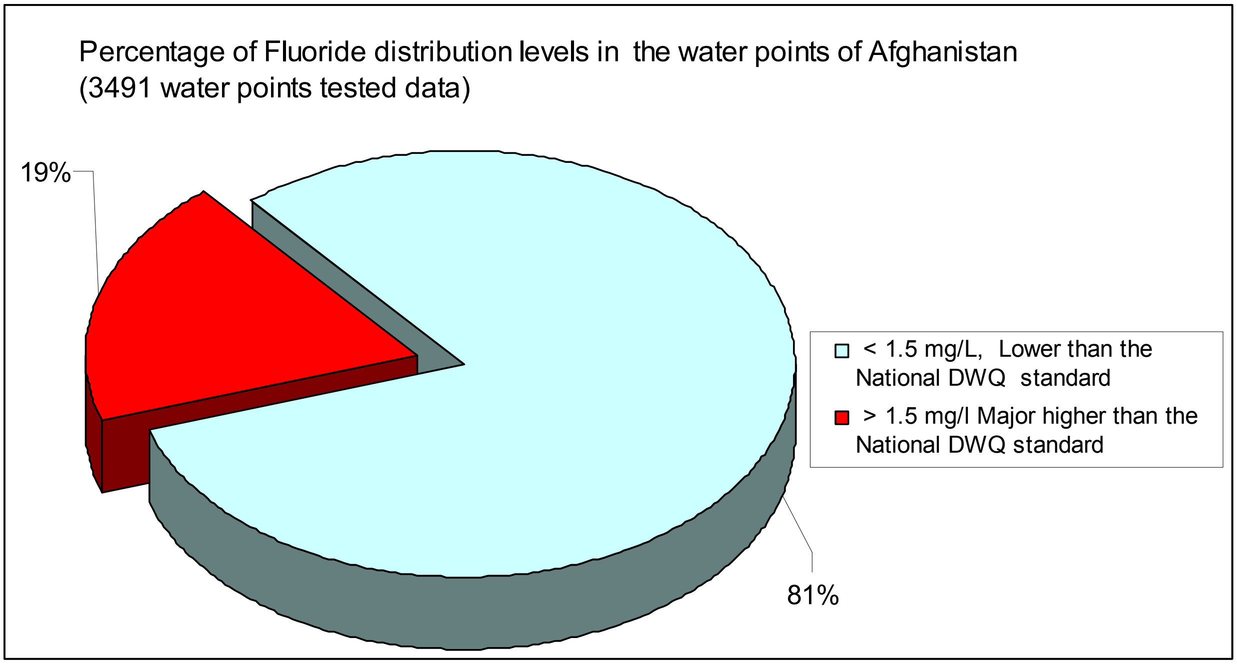


Figure 7 Percentage of Fluoride special distribution levels

Using of high Fluoride content drinking water (more than 1.5 mg/L) causes skeletal, crippling and dental fluorosis.

7.2.5 Nitrate

The Nitrate concentration of analyzed water samples ranged from 0.01 mg/l (WP_ Code 2414) to 234.8 mg/l (WP_ Code 288)(Table 2). The nitrate spatial distribution levels is presented in the annex 8. ***The NDWQS for nitrate concentration of drinking water is recommended 50 mg/l.***

19% of analyzed water samples from Kabul, Baghlan, Paktya, Nangarhar, Laghman, Kapisa, Uruzgan, Kunar, Parwan, Logar, Ghazi, Farah, Badakhshan Balkh, Nimroz, Jawzjan, Takhar, Samangan, Sari Pul, Faryab, Herat, Ghor, Kandahar, Badghis, Bamyan, Hilmand, Khost, Maydan Wardak, Panjsher and Kunduz provinces DWPs are exceeded the NDWQS of 50 mg/l (the Nitrate concentration of water ranged from 51.02 mg/L to 234.8 mg/L). The percentage of nitrate distribution levels is shown in the Figure 8.

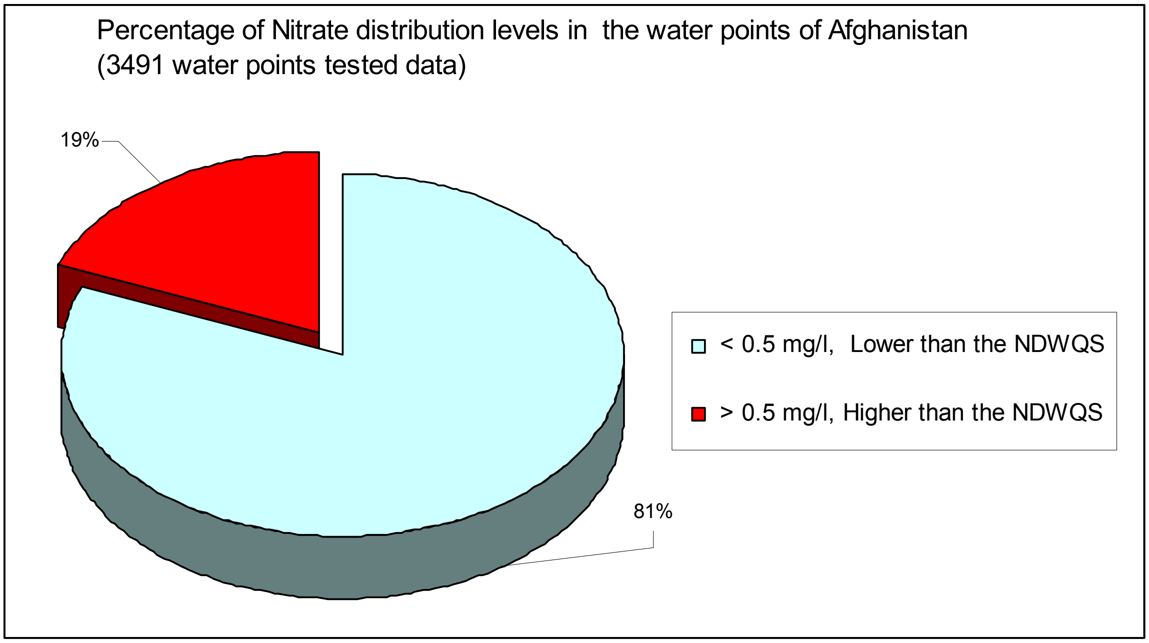


Figure 8 Percentage of Nitrate special distribution levels in DWPs

Nitrate can cause health problems for infants, especially those six months of age and younger. Nitrate interferes with their blood's ability to transport oxygen. This causes an oxygen deficiency, which results in a dangerous condition called methemoglobinemia, or "blue baby syndrome". The most common indication of nitrate toxin is bluish skin colouring, especially around the eyes and mouth. Infants six months of age and younger and pregnant and nursing women should avoid consumption of water high in nitrate. Toxic effects occur when bacteria in the infant's stomach convert nitrate to more toxic nitrate. Some scientific studies suggest a linkage between high nitrate level in drinking water with birth defects and certain types of cancer.

According to the US Environmental Protection Agency (EPA) long-term exposure to water with high nitrate levels can cause diuresis (excessive discharge of urine), increased starchy deposits, and haemorrhaging (flow of blood) of the spleen. People with heart or lung disease, reduced gastric acidity, may be more vulnerable to the toxic effects of nitrate than others.

7.2.6 Sodium

The Sodium concentration value of analyzed water samples ranged from 12 mg/l (WP_ Code 3245) to 1750 mg/l (WP_ Code1750) (Table 1). The Sodium spatial distribution levels is shown in the annex 9. ***The NDWQS for Sodium concentration of drinking water is recommended 200 mg/l.***

28% of analyzed water samples from Farah, Balkh, Nimroz, Jawzjan, Takhar, Samangan, Sari Pul, Faryab, Herat, Ghor, Kandahar, Badghis, Hilmand, and Kunduz provinces DWPs indicated that the Sodium concentrations exceeded the NDWQS of 200 mg/L (the high content of Sodium drinking water ranged from 201 mg/L to 1700 mg/L). The percentage of Sodium distribution levels is shown in the Figure 9.

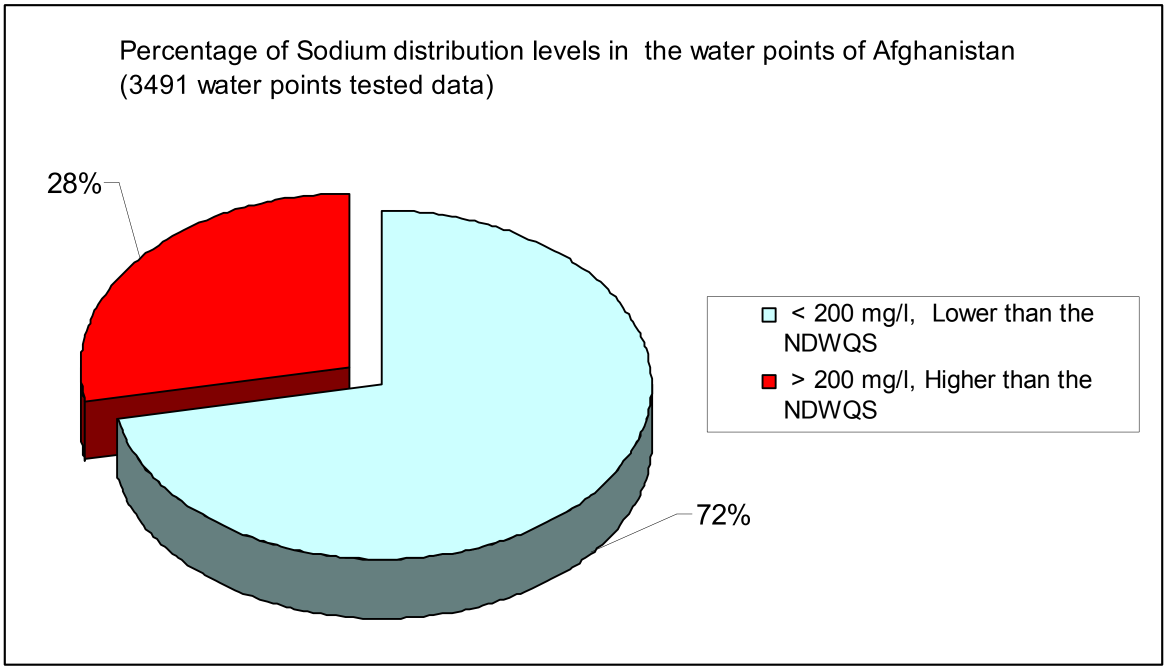


Figure 8 Percentage of Sodium special distribution levels in DWPs

A high content of sodium in drinking water injurious to health (increases blood pressure).

7.2.7 Chloride

The Chloride concentration value of analyzed water samples ranged from 5 mg/L(WP_ Code 129) to 2500 mg/L (WP_ Code 3226)(Table 1). The chloride spatial distribution levels is presented presented in annex 10. ***The NDWQS for chloride concentration of drinking water is recommended 250 mg/l.***

17% of analyzed water samples from Farah, Balkh, Nimroz, Jawzjan, Takhar, Samangan, Sari Pul, Faryab, Herat, Ghor, Kandahar, Badghis, Hilmand, and Kunduz provinces drinking water points indicated that the Chloride concentrations are exceeded the NDWQS of 250 mg/l (the chloride concentration of water ranged from 255 mg/L to 2500 mg/L). The percentage of Chloride distribution levels is shown in the Figure 10

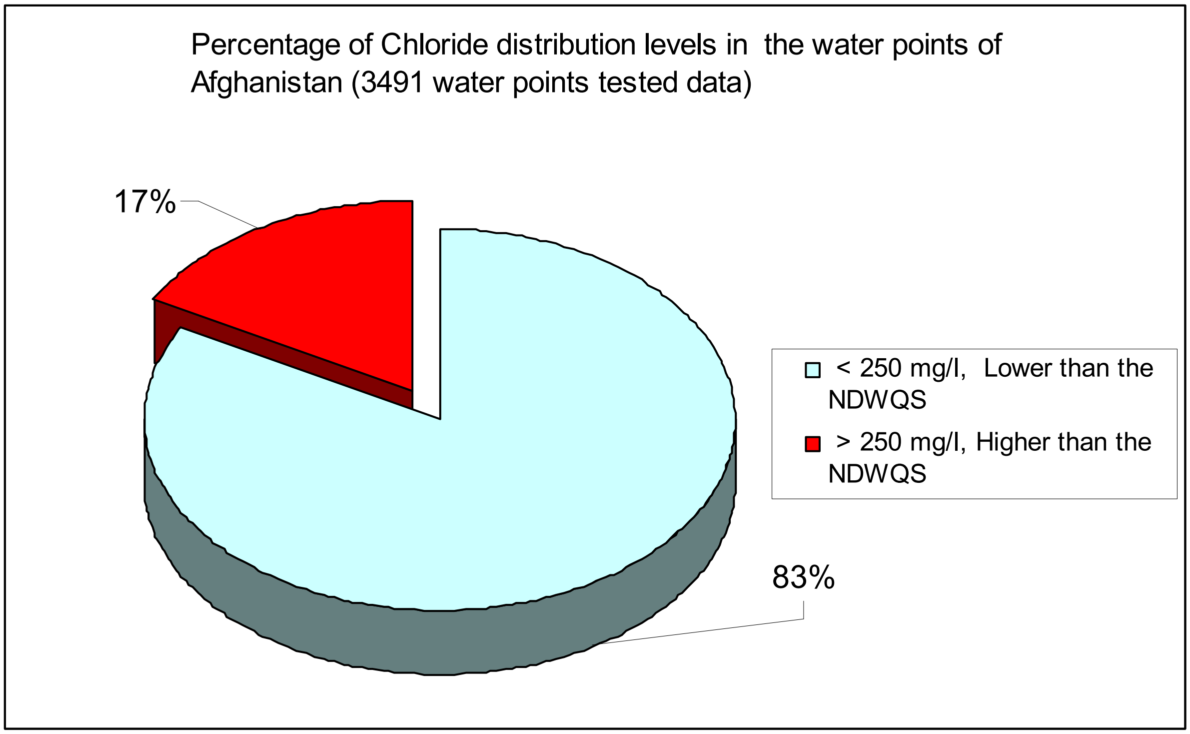


Figure 10 Percentage of Chloride special distribution levels

Water with high chloride concentration give saline taste and it can cause considerable damage to the body's fluid balance. One of the negative effects of highly saline water is also the corrosion of metal and destroys concrete elements.

7.2.8 Calcium

The Calcium concentration value of analyzed water samples from DWPs ranged from 11 mg/l (WP_ Code 2212) to 1120 mg/l (WP_ Code 1745)(Table 2). The Calcium spatial distribution levels of water points mapped using arc GIS 10.2 and it is shown in annex 11. ***The NDWQS for Calcium concentration in drinking water is recommended 70 mg/l.***

43% of analyzed water samples from Kabul, Baghlan, Paktya, Uruzgan, Kunar, Parwan, Logar, Ghazi, Farah, Badakhshan Balkh, Nimroz, Jawzjan, Takhar, Samangan, Sari Pul, Faryab, Herat, Ghor, Kandahar, Badghis, Bamyan, Hilmand and Kunduz provinces drinking water points indicated that the Calcium concentration are exceeded the NDWQS of 70 mg/l (the Calcium concentration of water ranged from 74 mg/L to 1120 mg/L). The percentage of Calcium distribution levels is shown in the Figure 11.

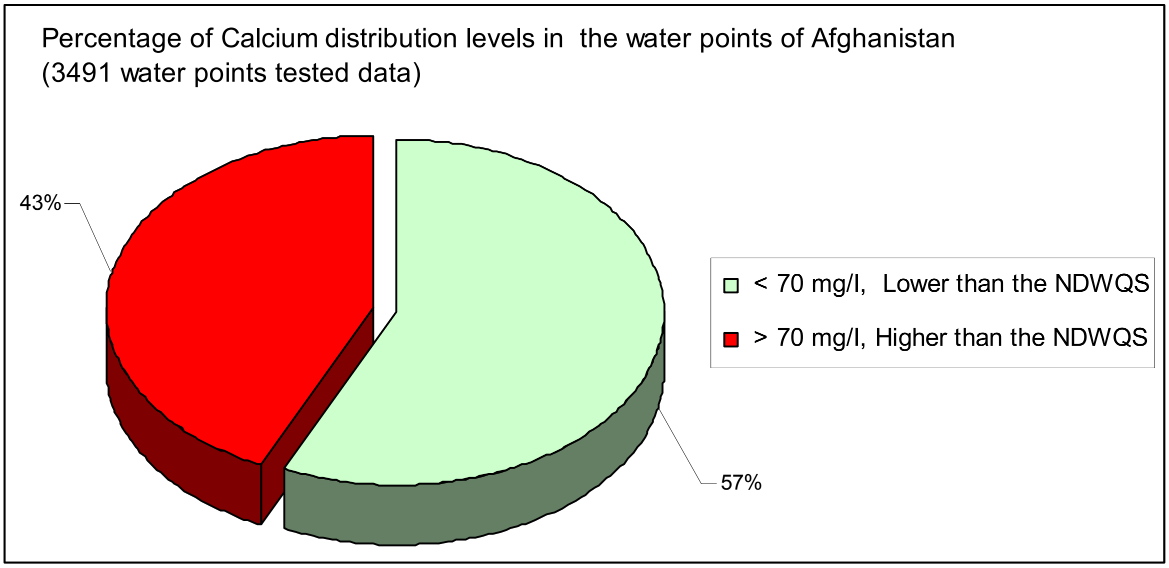


Figure 11 Percentage of Calcium special distribution levels

7.2.9 Magnesium

The Magnesium concentration value of analyzed water samples ranged from 8 mg/l (WP_ Code 133) to 860 mg/l (WP_ Code 1747) (Table 2). The Magnesium spatial distribution levels of water points mapped using arc GIS 10.2 and it is shown in annex 12. ***The NDWQS for Magnesium concentration in drinking water is recommended 30 mg/l.***

71% of analyzed water samples from Kabul, Baghlan, Paktya, Uruzgan, Kunar, Parwan, Logar, Ghazi, Farah, Badakhshan Balkh, Nimroz, Jawzjan, Takhar, Samangan, Sari Pul, Faryab, Herat, Ghor, Kandahar, Badghis, Bamyan, Hilmand and Kunduz provinces DWPs indicated that Magnesium concentration are exceeded the NDWQS of 30 mg/l (the Magnesium concentration of water ranged from 31 mg/L to 860 mg/L). The percentage of Magnesium distribution levels is shown in the Figure 12.

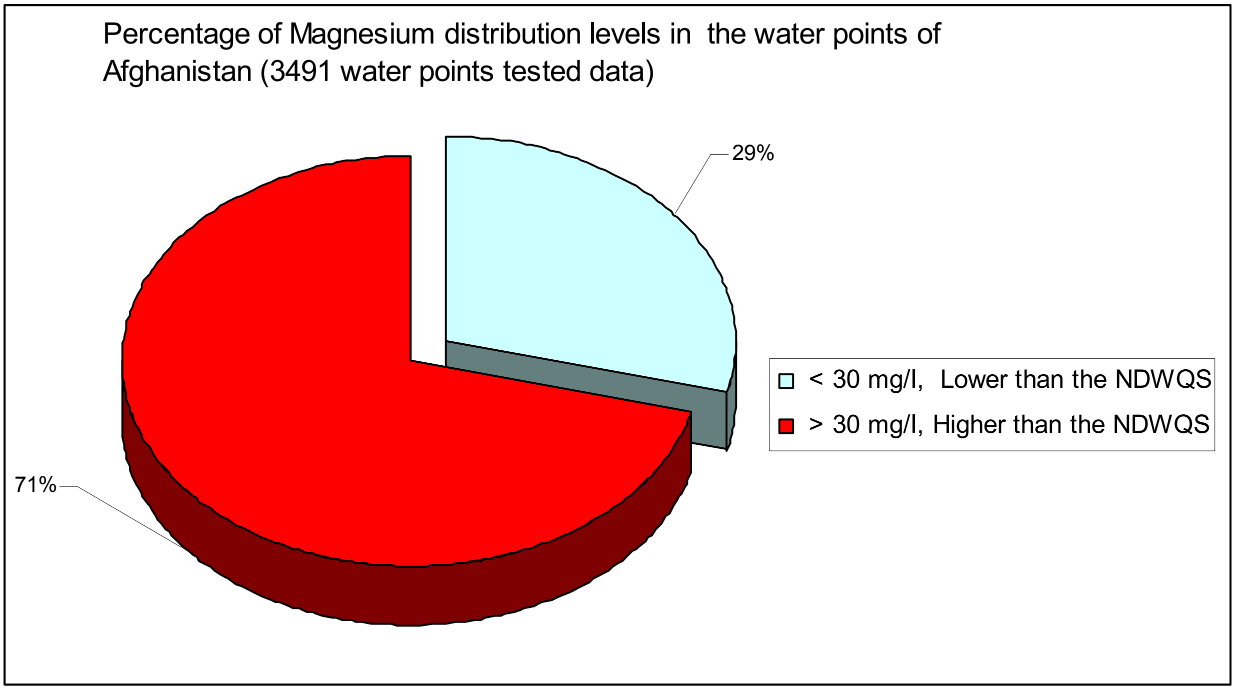


Figure 9 Percentage of Magnesium special distribution levels in DWPs

Using of high Magnesium content drinking water (more than 400 mg/L) causes severe diarrhea among the users and given bitter taste to the water.

7.2.10 Chromium

The Chromium concentration value of analyzed water samples ranged from 0 mg/l to 0.21 mg/l (WP_ Code 2619) (Table 2). The Chromium spatial distribution levels of water points mapped using arc GIS 10.2 and it is shown in annex 13 . ***The NDWQS for Chromium in drinking water is recommended 0.05 mg/l.***

4% of analyzed water samples from Kabul, Baghlan, Paktya, Parwan, Logar, Ghazi, Badakhshan Balkh, Nimroz, Jawzjan, Takhar, Samangan, Sari Pul, Faryab, Herat, Ghor, Kandahar, Badghis, Bamyan, Hilmand and Kunduz provinces drinking water points indicated that Chromium concentration are exceeded the NDWQS of 0.05 mg/l (the Chromium concentration of water ranged from 0.06 mg/L to 0.21 mg/L). The percentage of Chromium distribution levels is shown in the Fig.13.

Chromium is toxic and pose potential health risk to people.

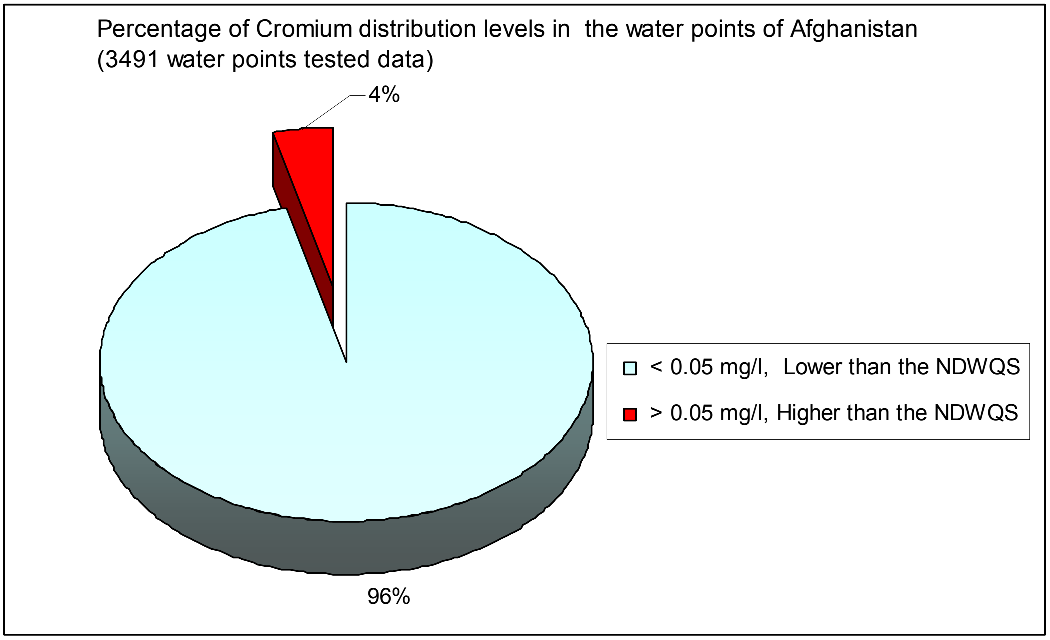


Figure 10 Percentage of Chromium special distribution levels

7.2.11 Arsenic

The Arsenic concentration value of analyzed water samples ranged from 0 mg/l to 0.25 mg/l (WP_ Code 1088) (Table 2). ***The NDWQS for Arsenic in drinking water is recommended 0.05 mg/l.***

The Arsenic spatial distribution levels of water points mapped using arc GIS 10.2 and it is shown in annex 14

Arsenic concentration in the WP_ Code 3017, 23, 1074, 1134, 1120, 690, 1089, 1091, 1092, 1093 and 1088 are higher than NDWQS of 0.05 mg/l

The analyzed water samples from Logar, Ghazi, Badakhshan, Panjsher and Herat provinces drinking water points exceeded the NDWQS of 0.05 mg/L.

8 Outcome

8.1. WPs quantitative functionality:

- 65 % of WPs () were functional
- 35 % of WPs were non functional;
    - 5 % of WPs were dried up
    - 3 % of WPs were collapsed
    - 4 % of WPs were without hand pump (working with boucket)
    - 5 % of WPs were dried up
    - 2 % plugged/abandoned

- 20 % had multiple problem
- 1% closed

8.2 WPs quantitative functionality

The following water quality concern parameters are above the NDWQS and potentially affect the health of people:

- 8 % of water samples exceeded the DWQS of 3000 µS/cm and 31% of water samples exceeded the WHO limit of 1500 µS/cm
- The water quality analysis result revealed that 22% of tested water samples from DWPs indicated that the Turbidity exceeded the NDWQS of 5 NTU. The exceeded Turbidity values in the water points indicates the poor drilling and construction of drinking water points without technical and hydrogeological consideration.
- 17% of analyzed water samples from drinking water points indicated that the sulphate concentrations are exceeded the NDWQS of 250 mg/l. Using of high sulphate content drinking water (above the NDWQS) causes severe diarrhea and loss of body fluid of users and can be dangerous for children, however given bitter taste to the water and the water as toxic for health
- 19% of analyzed water samples from drinking water points indicated that the fluoride concentrations are exceeded the NDWQS of 1.5 mg/l. Using of high Fluoride content drinking water (more than 1.5 mg/L) causes skeletal fluorosis and dental fluorosis.
- 19% of analyzed water samples from water points indicated that the Nitrate concentration are exceeded the NDWQS of 50 mg/l.
- 28% of analyzed water samples from drinking water points indicated that the Sodium concentrations are exceeded the NDWQS of 200 mg/l. A high content of sodium in drinking water injurious to health (increases blood pressure).
- 17% of analyzed water samples from drinking water points indicated that the Chloride concentrations are exceeded the NDWQS of 250 mg/l. Water with high chloride concentration (above NDWQS) give saline taste and it can cause considerable damage to the body's fluid balance. One of the negative effects of highly saline water is also the corrosion of metal and destroys concrete elements.
- 43% of analyzed water samples from drinking water points indicated that the Calcium concentration are exceeded the NDWQS of 70 mg/l.
- 71% of analyzed water samples from drinking water points indicated that Magnesium concentration are exceeded the NDWQS of 30 mg/l. Using of high Magnesium content drinking water (more than 400 mg/L) causes severe diarrhea among the users and given bitter taste to the water.
- 4% of analyzed water samples from drinking water points indicated that Chromium concentration are exceeded the NDWQS of 30 mg/l. Chromium is toxic and pose potential health risk to people.

The percentage of elevated analyzed water quality concern parameter summarized in the Fig.

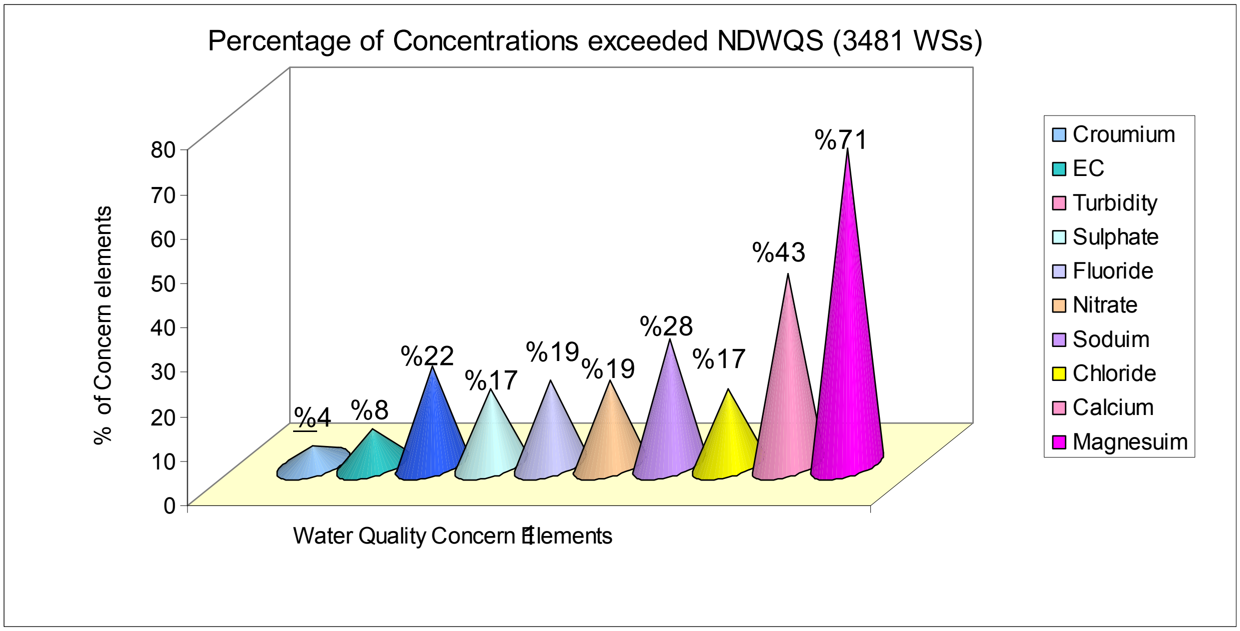


Figure 11 Percentages of water quality concern parameters exceeded NDWQS

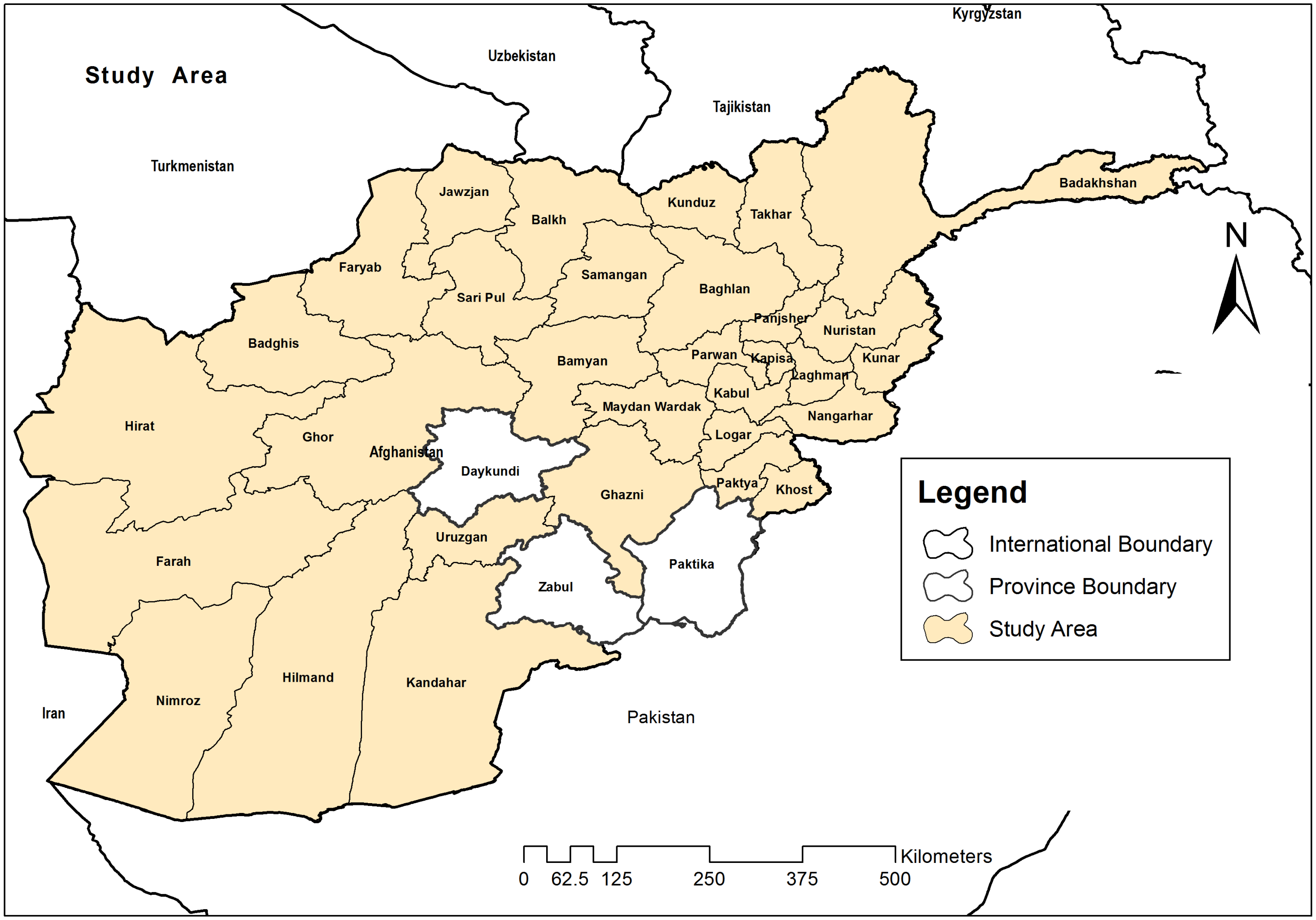
9 Challenges

- Deep water table aquifer, hard strata and saline /brackish and fresh aquifer and poor technical and hydrogeological capacity.
- Poor inspection, operation and maintenance of WASH project.
- Cross contamination in wells due to poor well site selection and construction without qualitative and technical-hydrogeological consideration.
- Lack of coordination among various water supply stakeholders in regard practical knowledge, sharing experiences, lessons learning, dissemination and exchange information.
- Limited technical options for water using, development, conservation and storage.
- Poor groundwater data collection, database and data information system for effective and efficient water resources planning and management.
- Low coverage of WASH
- No clear strategic plan for immediate and future water resources protection.
- Lack of hydrogeological research for finding alternative water resources where the water scarce scare and saline.
- Poor formulation of effective water policies, strategies and enforcement of water legislation
- Climate change, variability of precipitation, insufficient groundwater storage and very high degree of population growth and increasing trend for water demand
- High density of well per unit area without regard to spacing norms and priority
- Limited technical option for water using, development, storage and protection
- Improvement of policies, strategies, legislation and action for sustainable construction and improvement of WP)
- Continues lowering water table (depilation natural aquifers) and deteriorating water quality

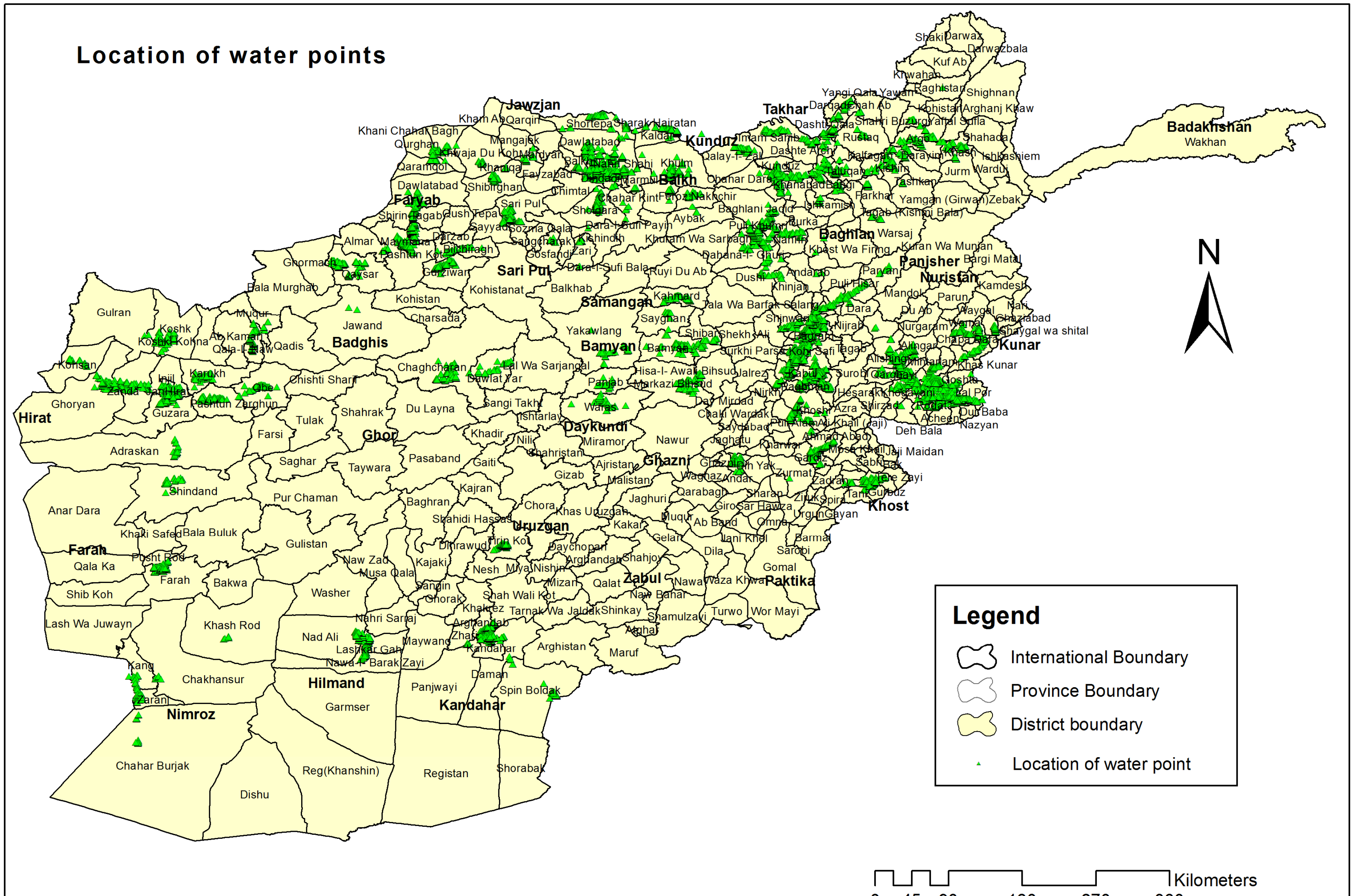
10 Recommendation

- Constructed and improved high density of well per unit area without regard to spacing norms, priority and sustainability. ***It is needed to construct and improve the water points in regard spacing , priority and technical-hydro-geological consideration.***
- The water quality interpretation results indicated that the considerably of constructed and improved drinking water points are unsafe and potentially affect the health of people. Construction and installation of these kind of drinking water poets is waste the the time and money. ***Therefore it is needed to improve and construct the drinking water points according to the NDWQS***.
- Considerably drinking water points indicated high turbidity and they produce muddy and muddy- silt water. The exceeded Turbidity values points points out the poor drilling and construction of drinking water points. **Therefore it is needed to enhance the technical capacity of WASH sector to construct standard drinking water points in regard technical-hydrogeological consideration.**
- ***Improve inspection, operation and maintenance of WASH project***
- ***Enhance coordination among various WASH stakeholders in regard practical knowledge, sharing experiences, lessons learning, dissemination and exchange information.***
- Considerably WPs dried up due to declining water table. ***Therefore it is needed to extend the groundwater monitoring system.***
- ***Encourage action research for finding alternative water resources where the water scarce and saline.***
- ***Enhancer groundwater data collection, database and data information system for efficient and effective planning and implementation of WASH project.***
- ***Encourage research for finding alternative water sources(rain water harvesting, artificial groundwater recharge)***
- ***Improvement policies, strategies, legislation and action for sustainable using, development, storage and protection of groundwater***.

Annex 1 Study Area

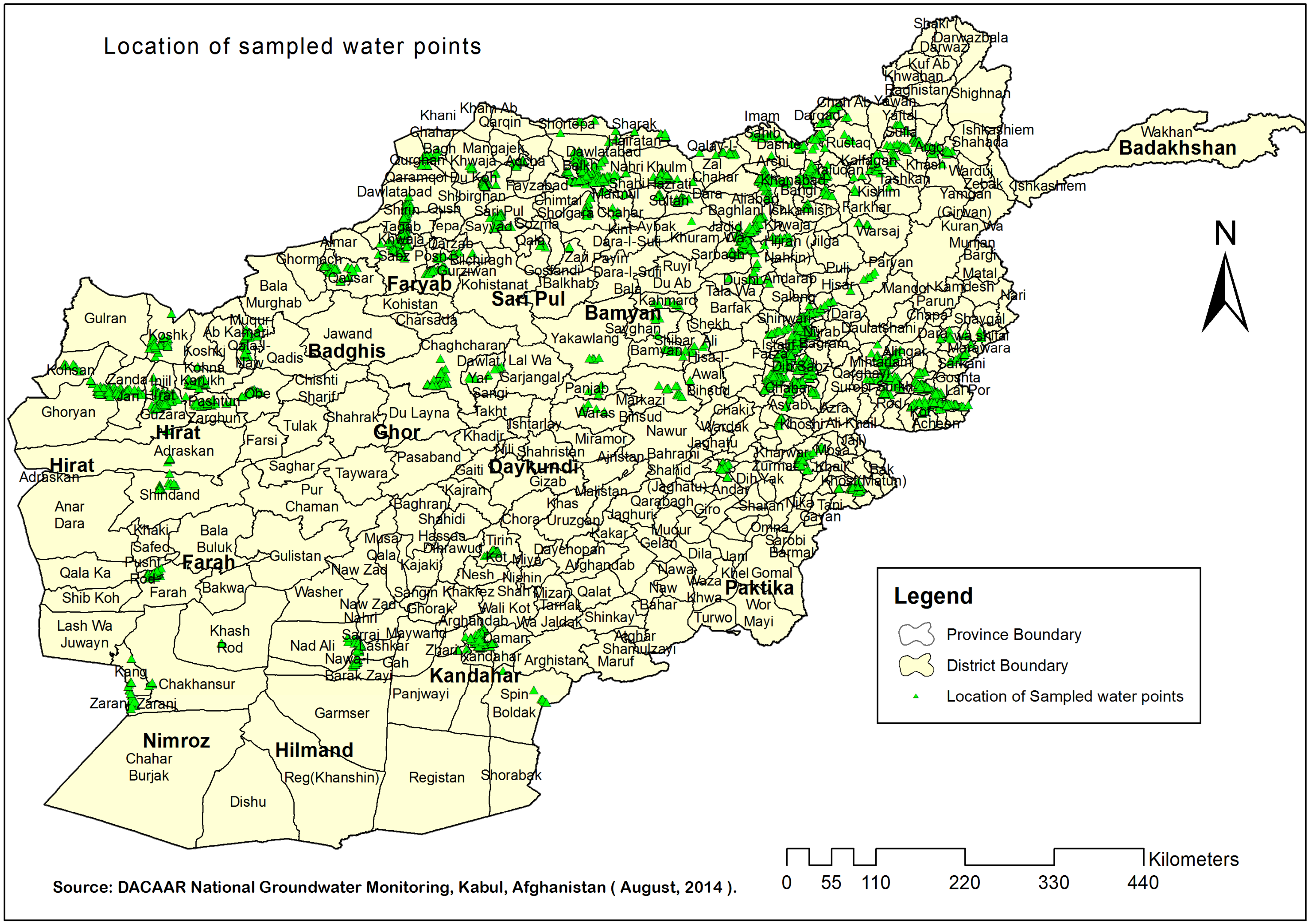


Annex 2 Location of water points (30,182 WPs)

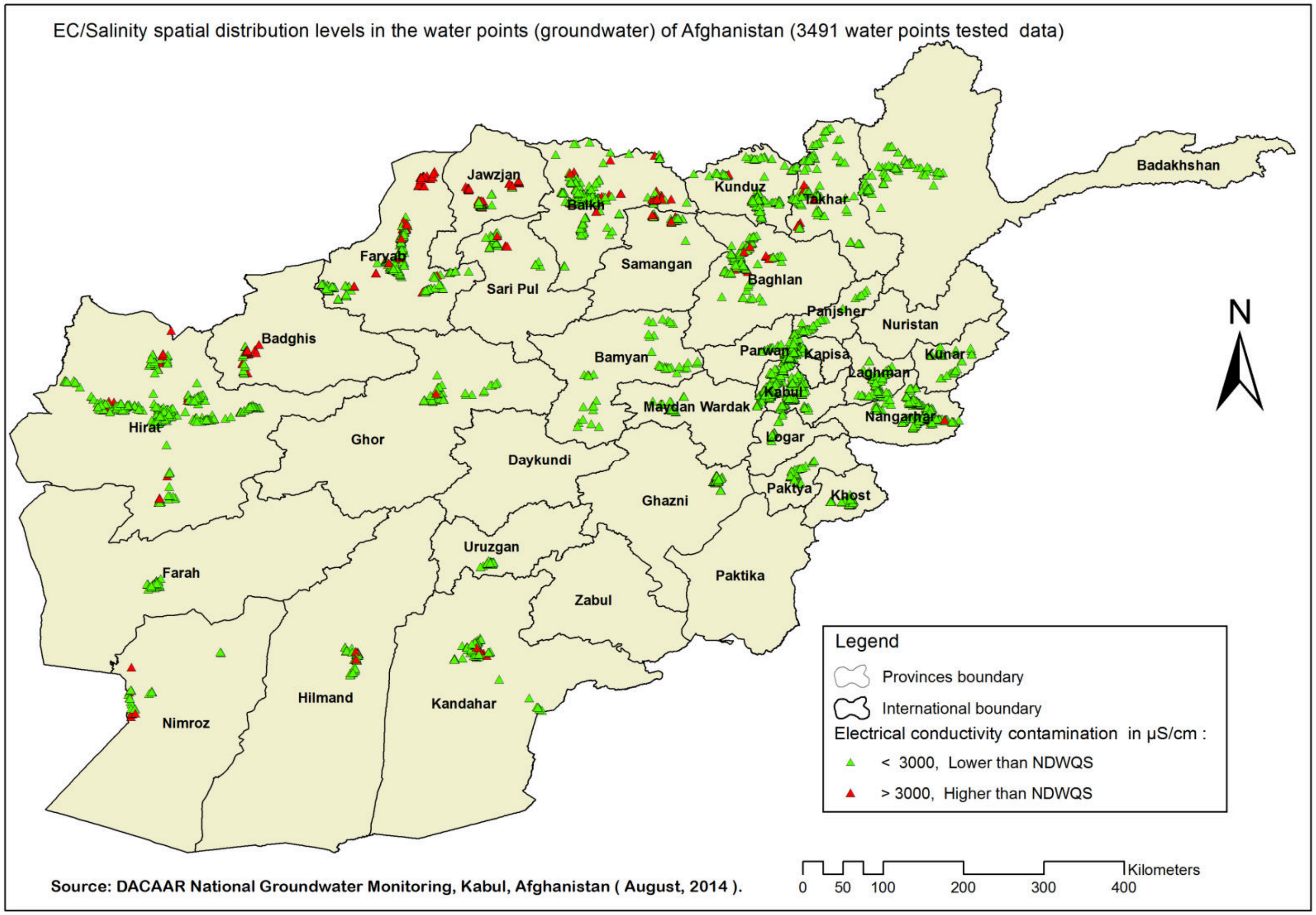


Source: DACAAR National Groundwater Monitoring, Kabul, Afghanistan (August, 2014).

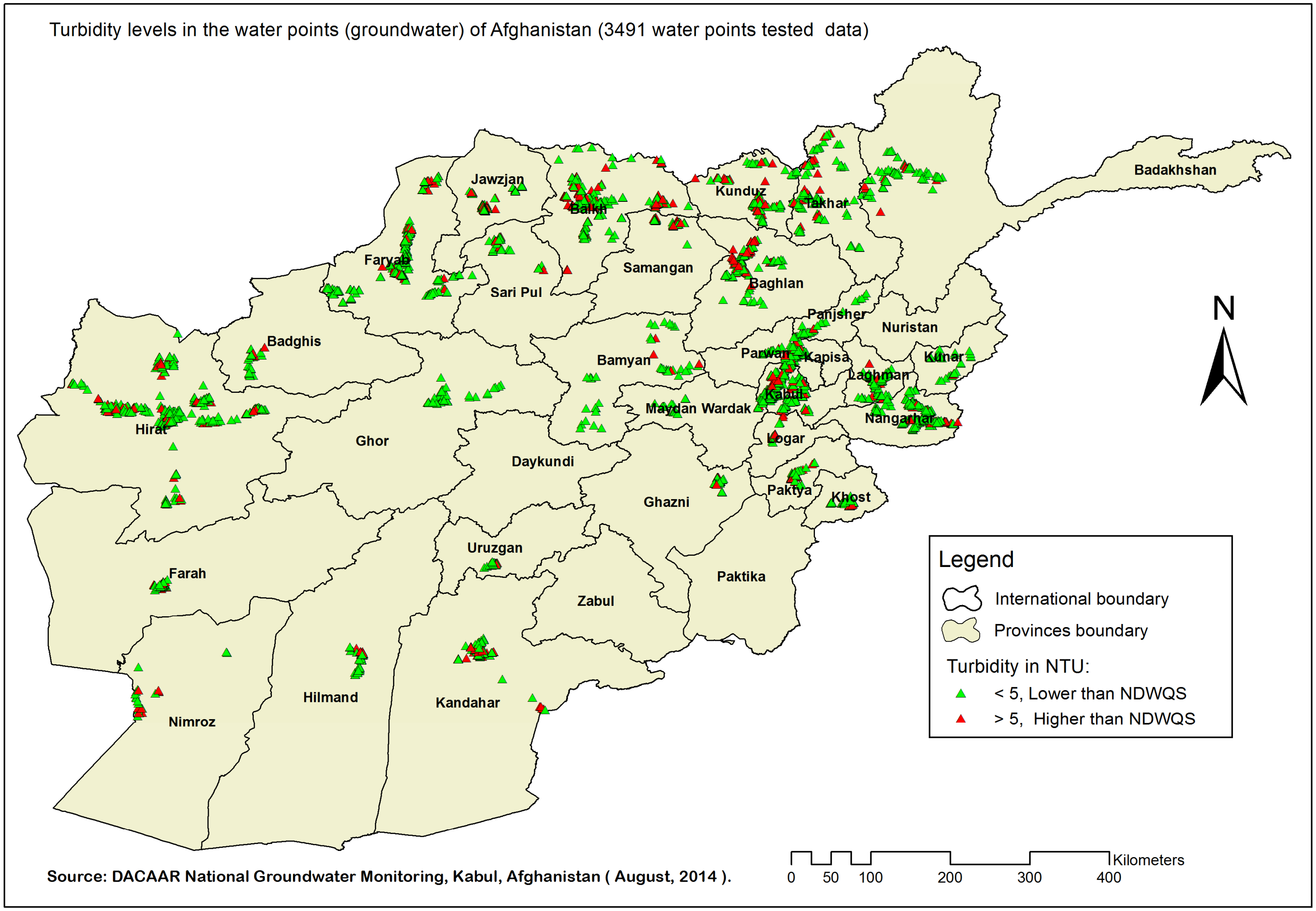
Annex 3 Sampled water points location (3481 water samples)



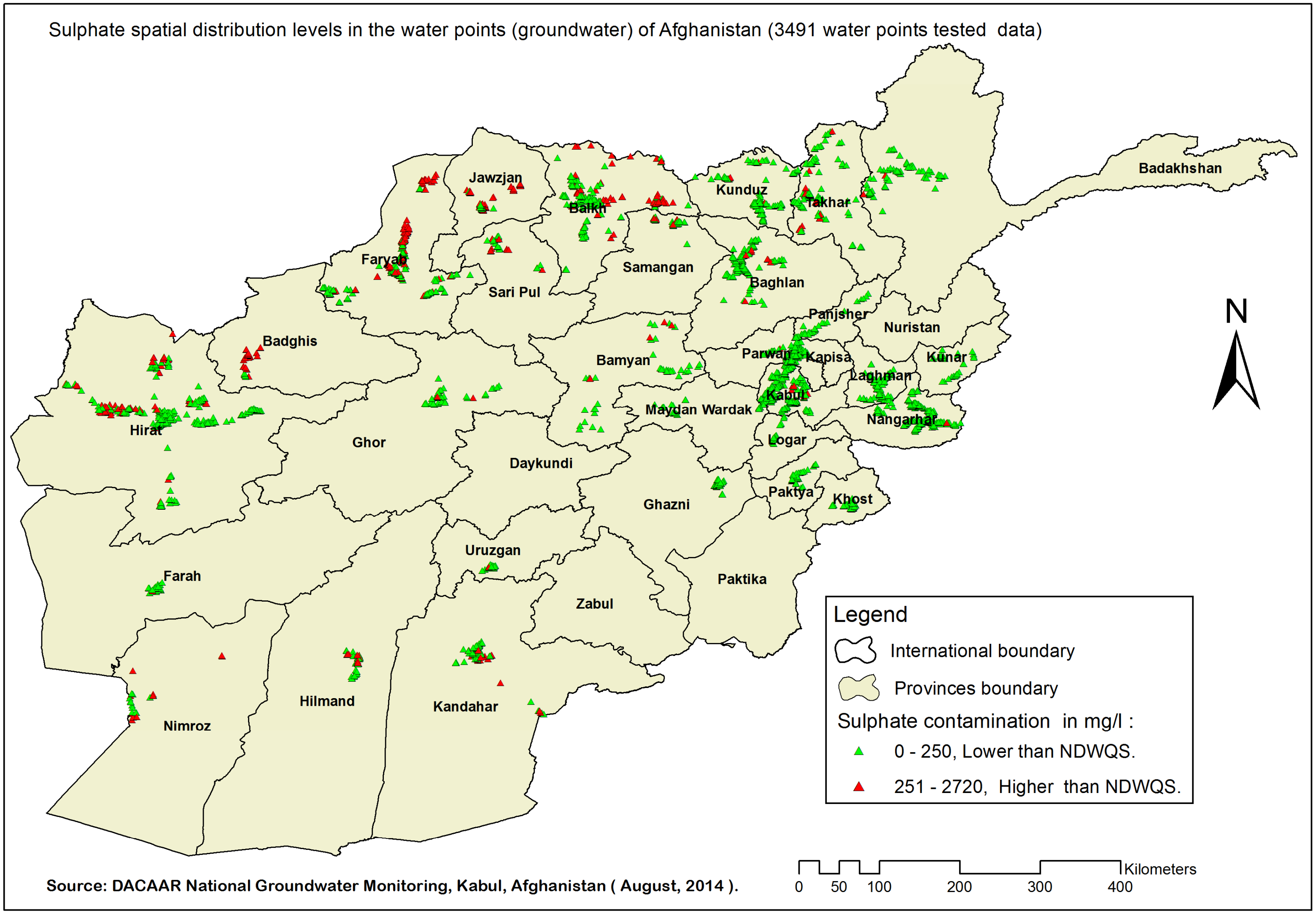
Annex 4 EC/Salinity spatial distribution level in the water points.



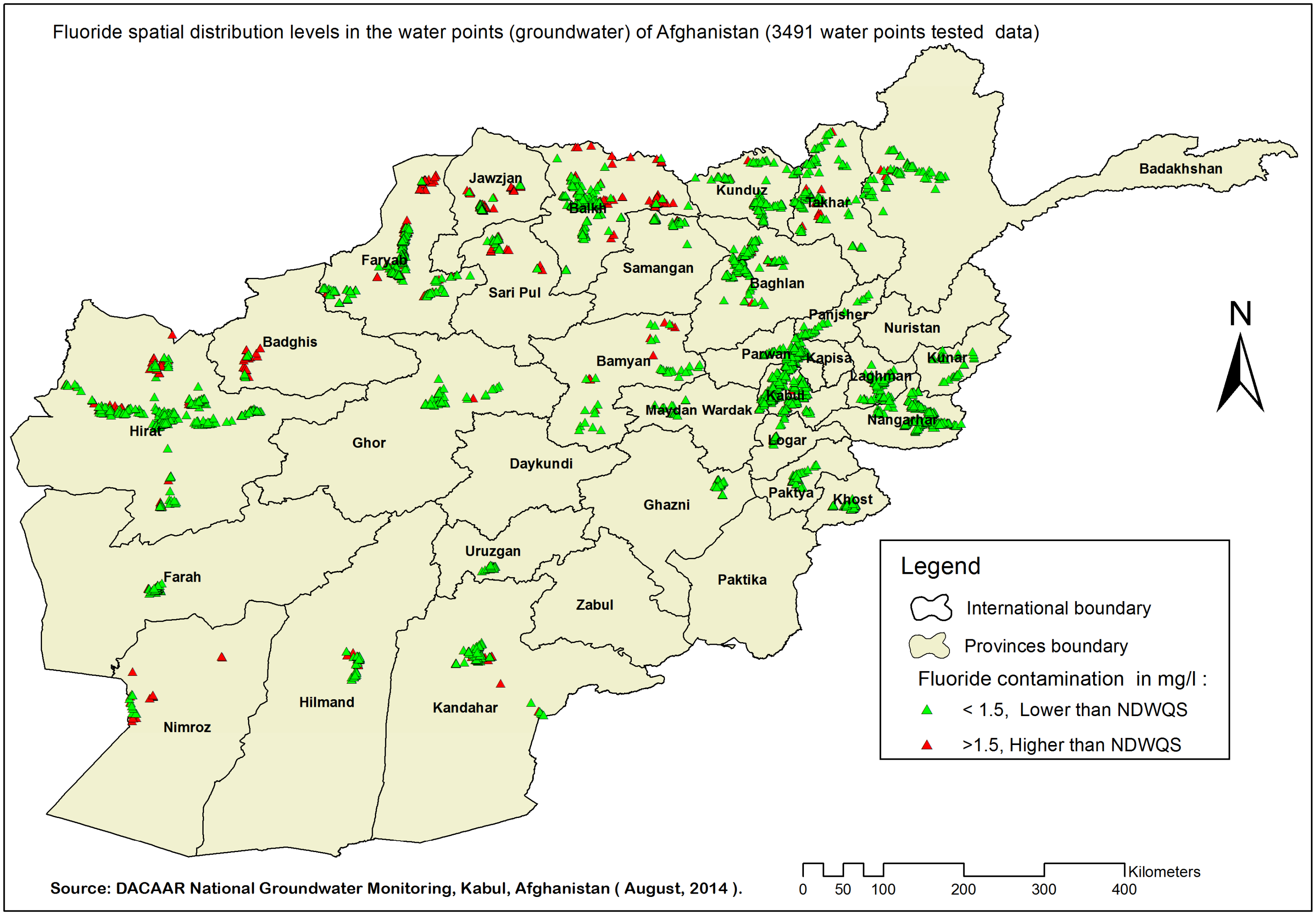
Annex 5 Turbidity values level in the water points



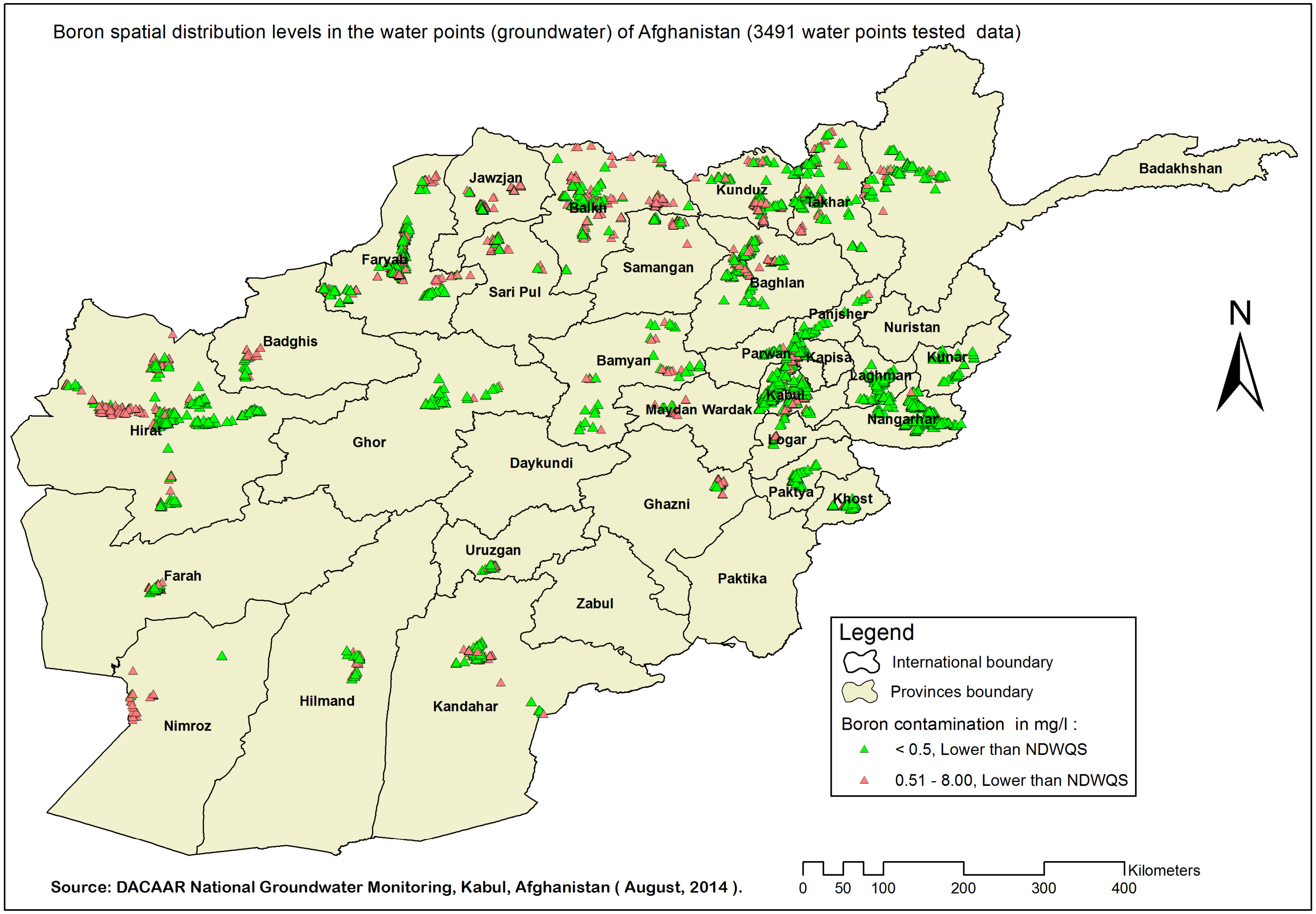
Annex 6 sulphate spatial distribution level in the water points



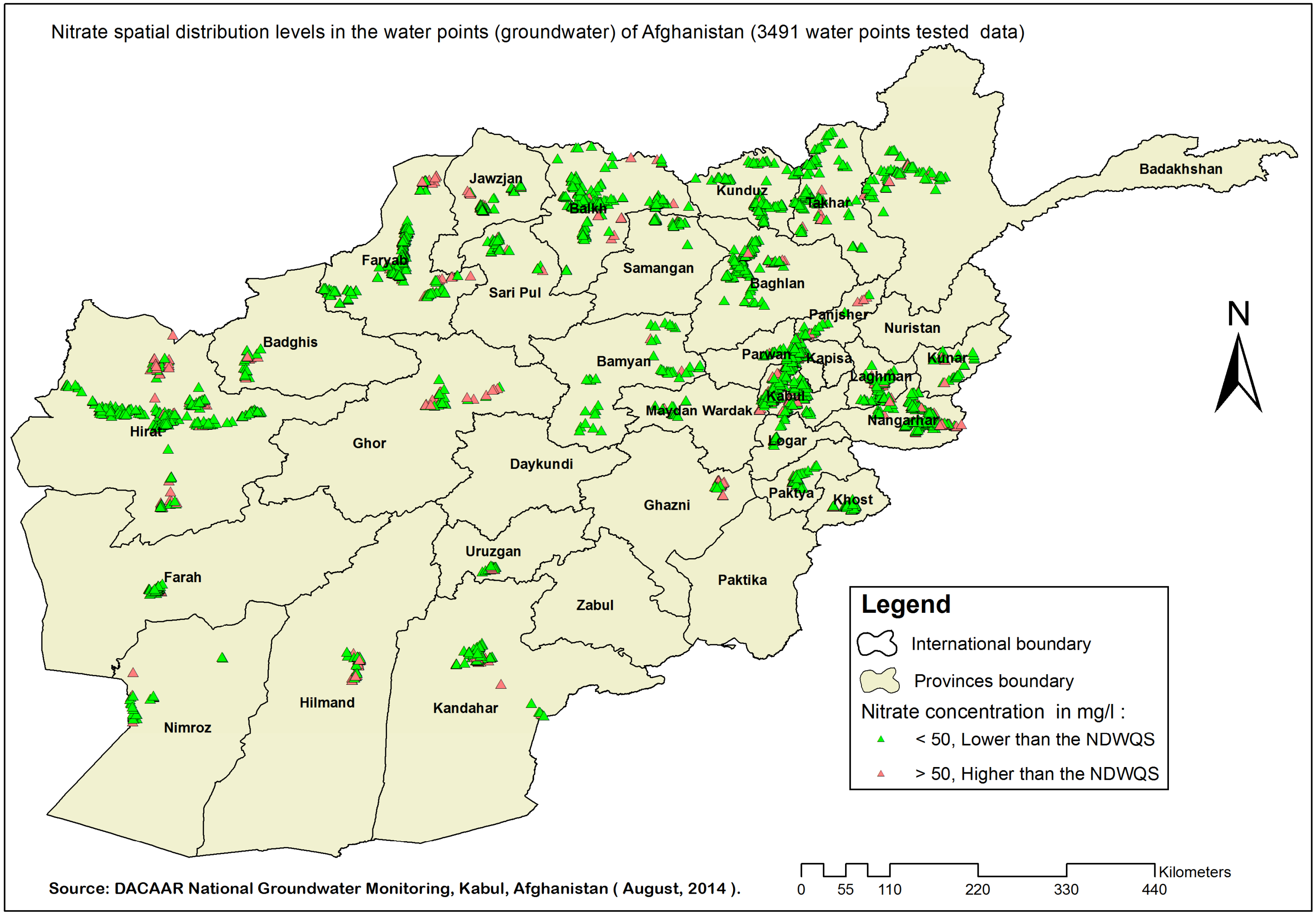
Annex 7 Fluoride spatial distribution level in the water points



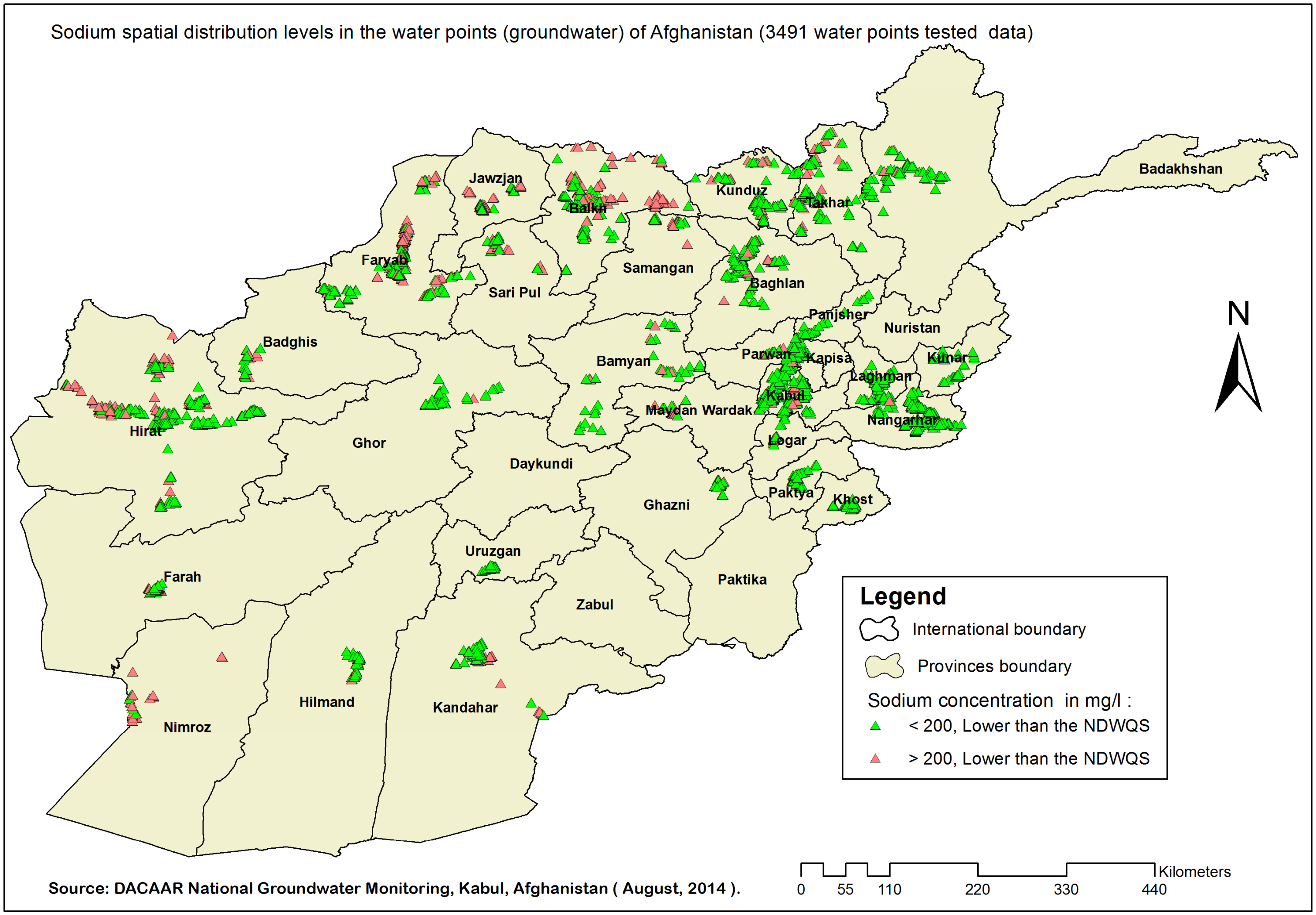
Annex 8 Boron spatial distribution levels in the water points



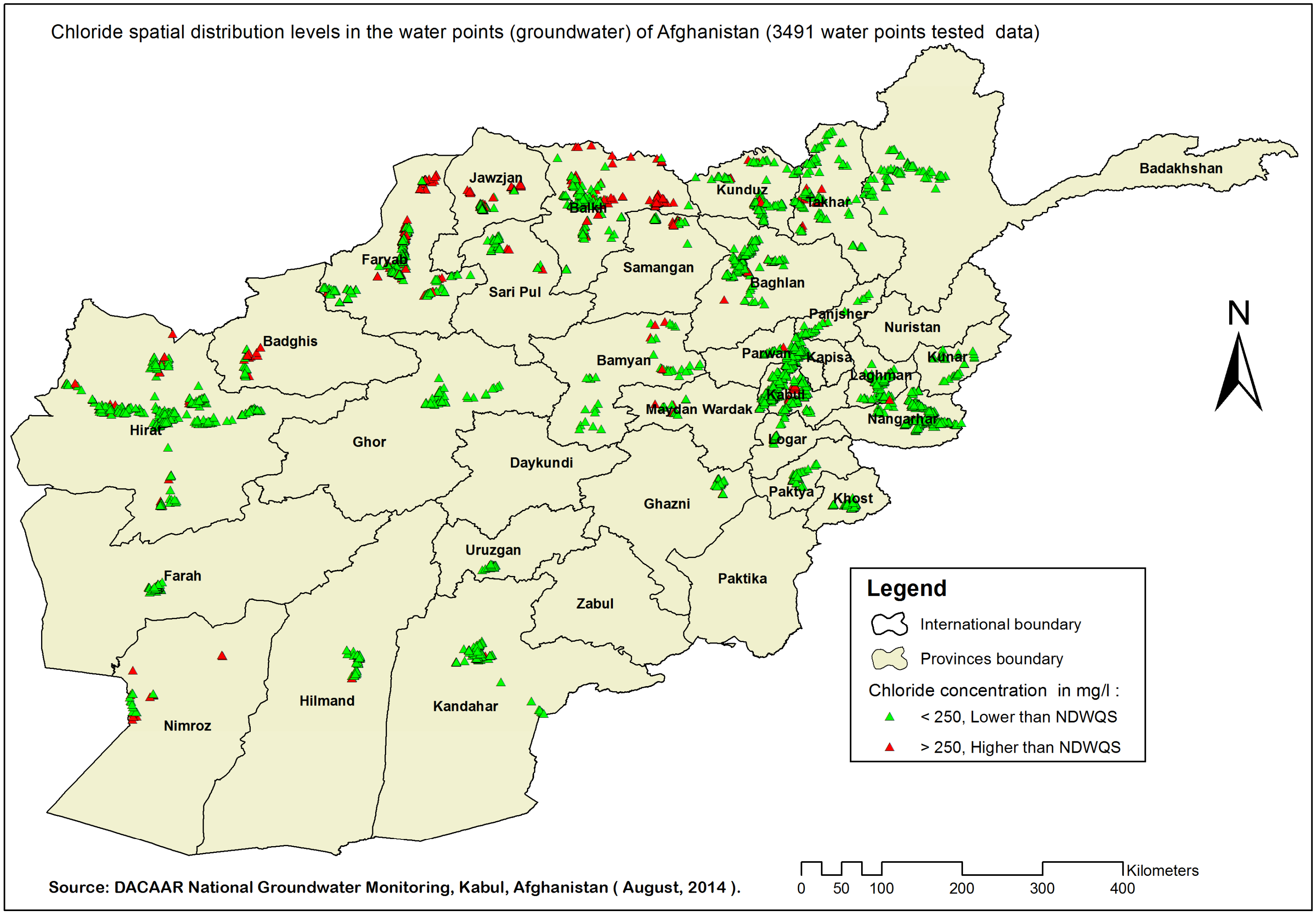
Annex 8 Nitrate spatial distribution level in the water points



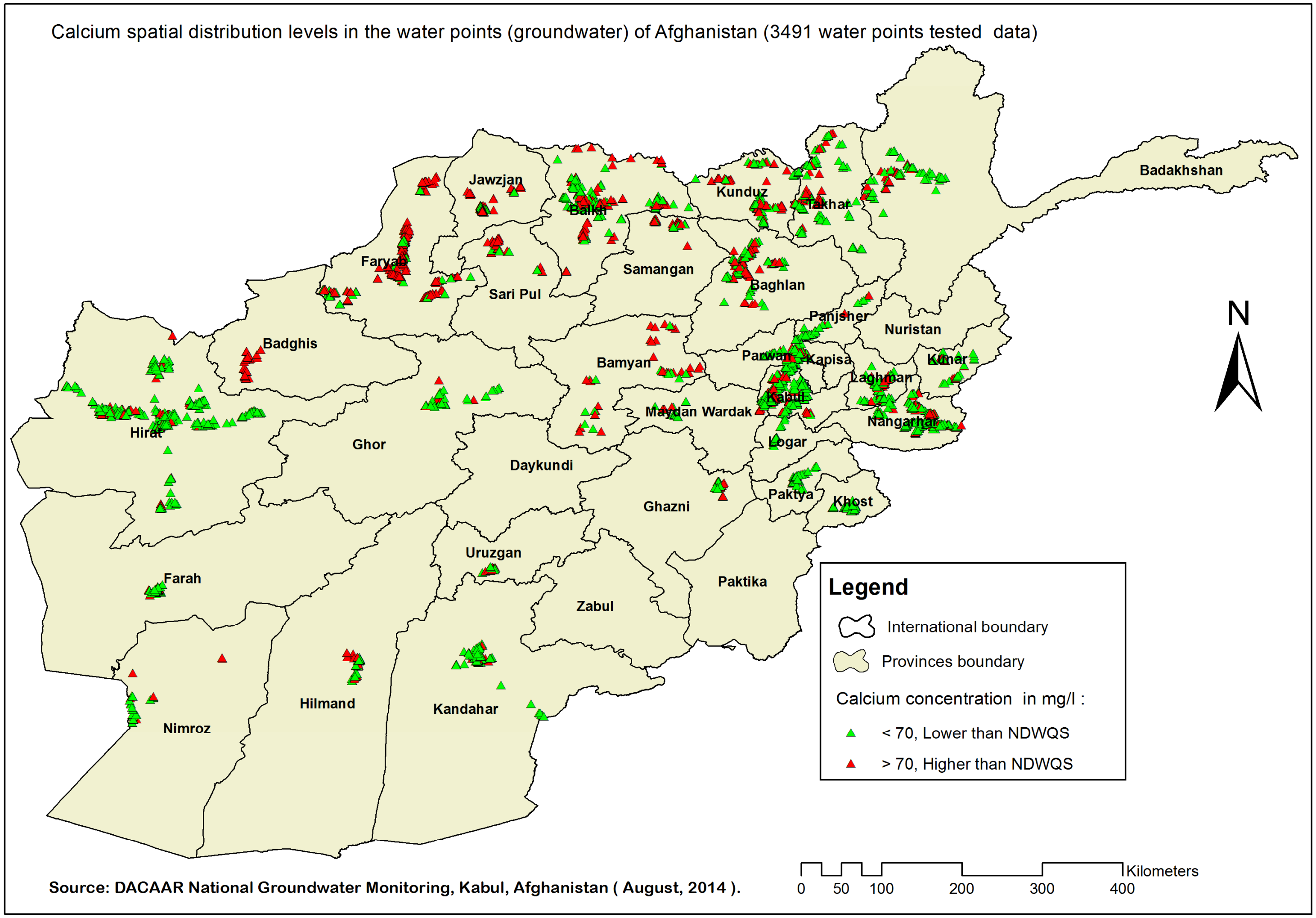
Annex 9 Sodium spatial distribution level in the water point



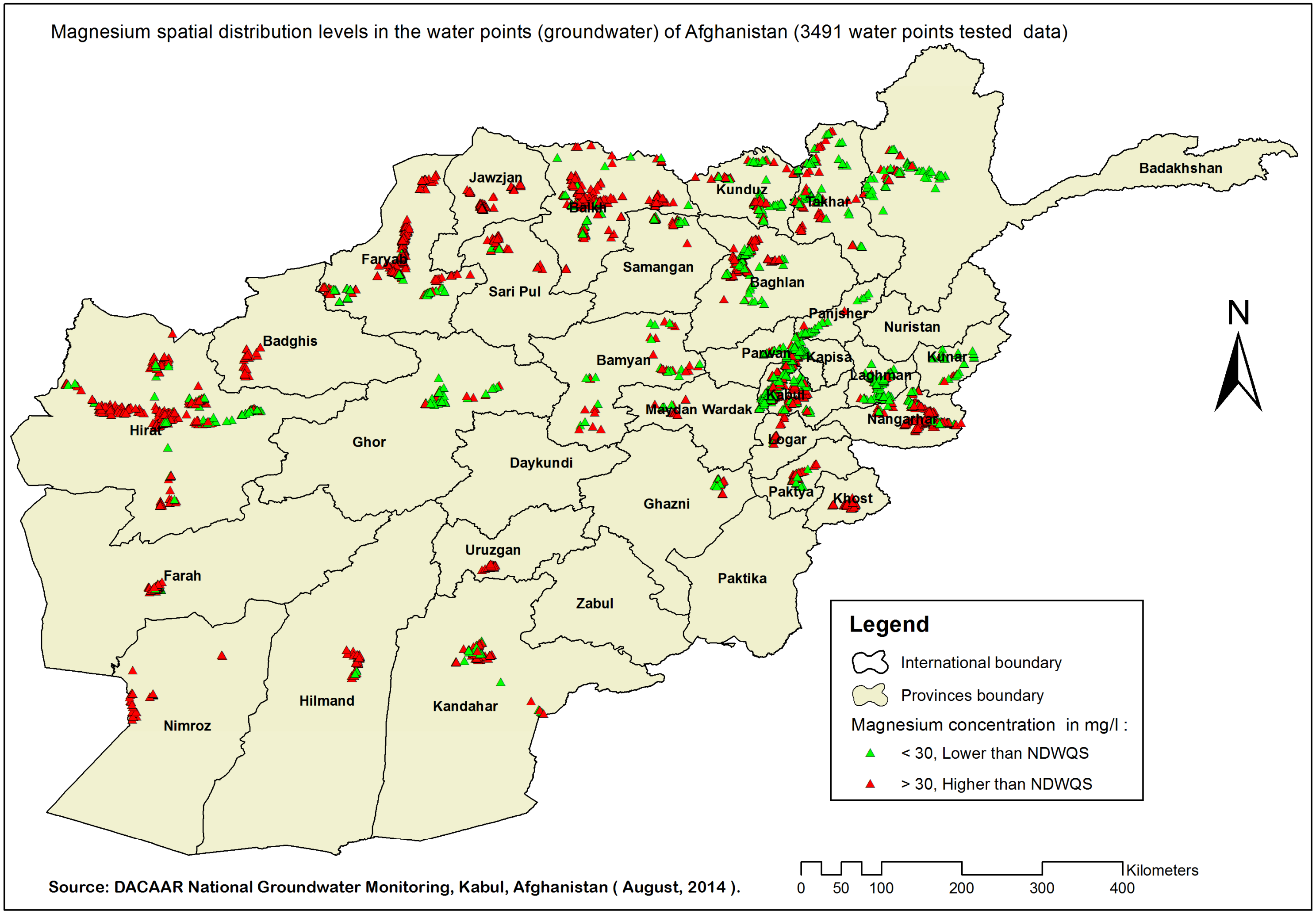
Annex 10 Chloride spatial distribution level in the water point



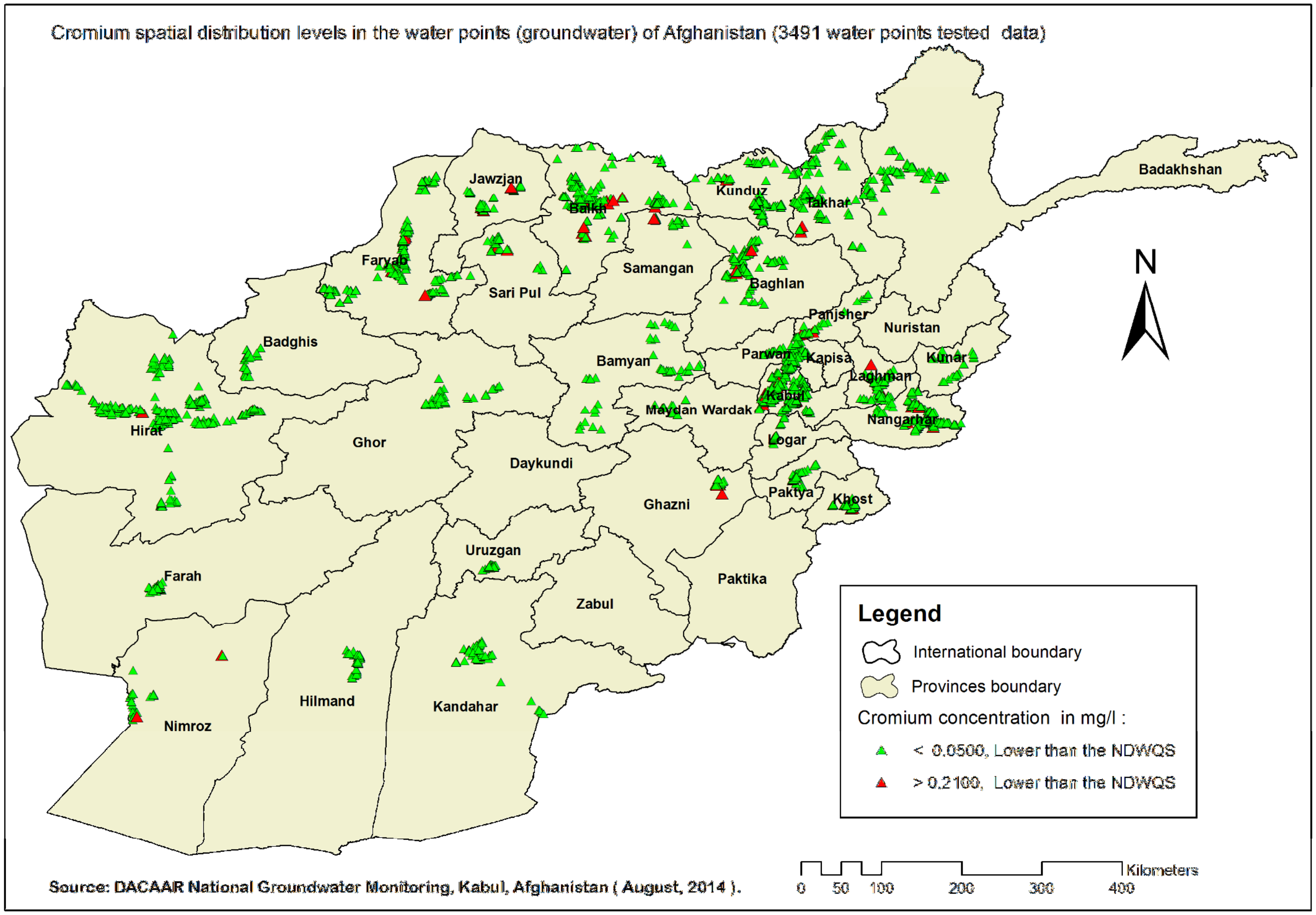
Annex 11 Calcium spatial distribution level in the water point



Annex 12 Magnesium spatial distribution level in the water points



Annex 13 Chromium spatial distribution level in the water points



Annex 14 Arsenic distribution levels in the water points