



An assessment of impact of the tannery effluents on Tuul river water quality and approach in choosing suitable waste water treatment technology for tanning industry

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CONTENT



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STUDY AREA



MONGOLIA

- Population :2.9 million
- Population density :2 (people /sq. km)
- Area :1.56 million sq km
- GDP per capita :US 3,627(World Bank)
- Surface water :0.24%
- Life style: Nomadic civilization up to now in the classic form



ULAN BATOR

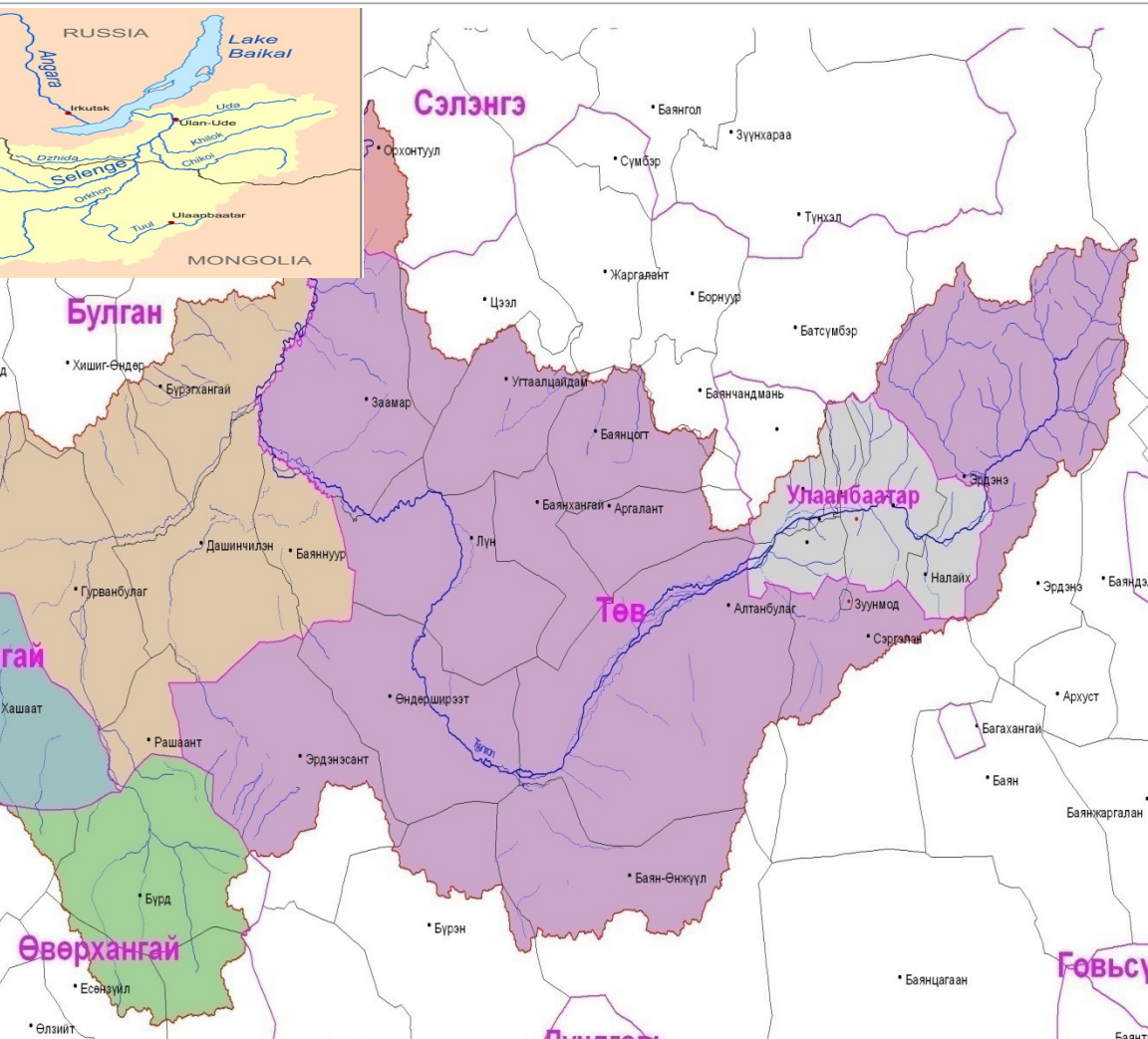
- Population: :1,372,000
- Population density: :272 (people /sq. km)
- Area: :4704,4 sq km
- Ulanbator is the coldest capital city (-36-40°C)
- In 1778, settled permanently at present location, the junction of the **Tuul** and Selbe rivers.



STUDY AREA: Tuul River Basin

Туул голын сав газар - Засаг захиргаа

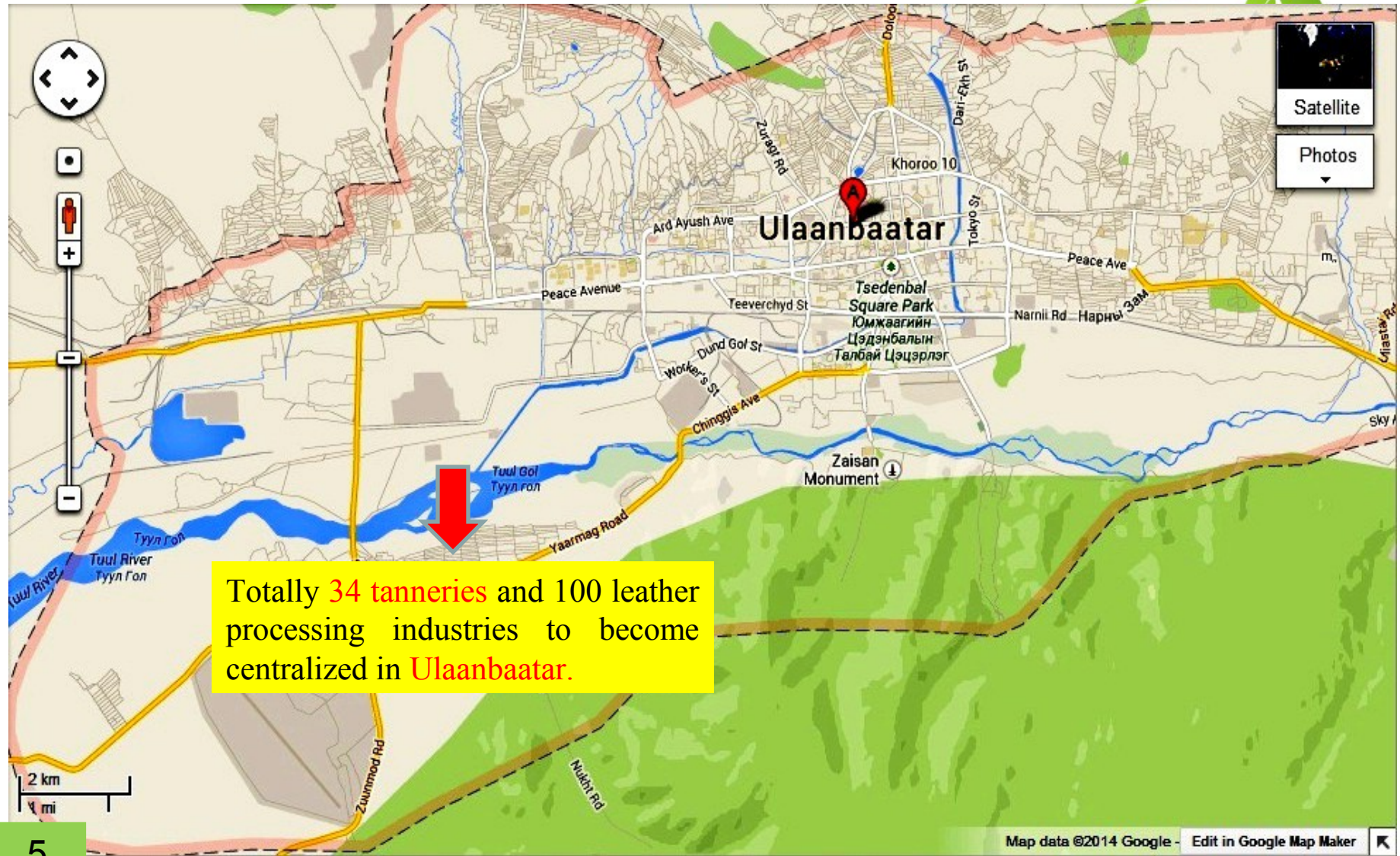
Масштаб 1: 650 000



Situation	Tuul river basin area is 49,840 km ² includes 7 districts of Ulaanbaatar city. It is 704 km long and originating in Khentii Mountains, this body of water runs through the southern part of the Ulanbaatar city. It is a tributary of the Orkhon and Selenge river which flows into Lake Baikal.
Total population in the basin	Basin covers the highest populated part of Mongolia and occupies 3.19 % of the total area of Mongolia.
Water usage, mln m ³ /year	Drinking water (UlaanBaatar's citizens basic drinking water source, 10% of people in Ulaanbaatar depend on surface water as their primary source of water , World Bank 2008), livestock, agriculture, mining, manufacturing and power plant (4000 small and mid scale industries, 40 mining, 16000 enterprises, 3 thermal power plants)
Water Poverty Index parameters: Water scarcity index: 0.025; Safe drinking water accessibility: 0.379; Vulnerability index for TRB 0.441; Water pollution: 0.420; Ecosystem deterioration: 0.829 <i>Source: UNEP report "Freshwater under threat Northeast Asia"</i>	

Source: Tuul river basin authority, 2014

STUDY AREA: Tanneries location



OVERVIEW OF THE TANNING INDUSTRY

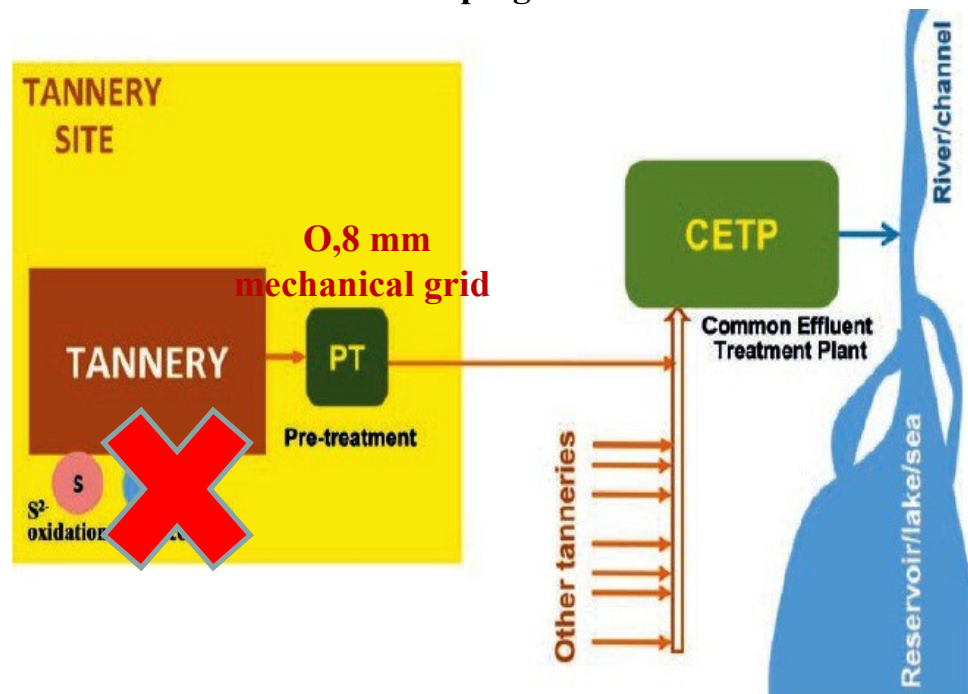


- **Tanning industry** is 3rd biggest industrial sector in Mongolia.
- **Capacity:** Mongolia has a large number of leather tanneries that process some **30 000** skins per day, for a total output of about 8 million units per year.

The findings during visit to tanneries:

- Activity is not regular, maximum number of leathers manufactured in autumn season;
- Not much considers about waste management and safety;
- Lack of the facilities, expertise and skills to mitigate the adverse impacts of chemicals on health and the environment;
- Most tanneries lack of the capacity effectively treat and safely dispose-off their effluents;

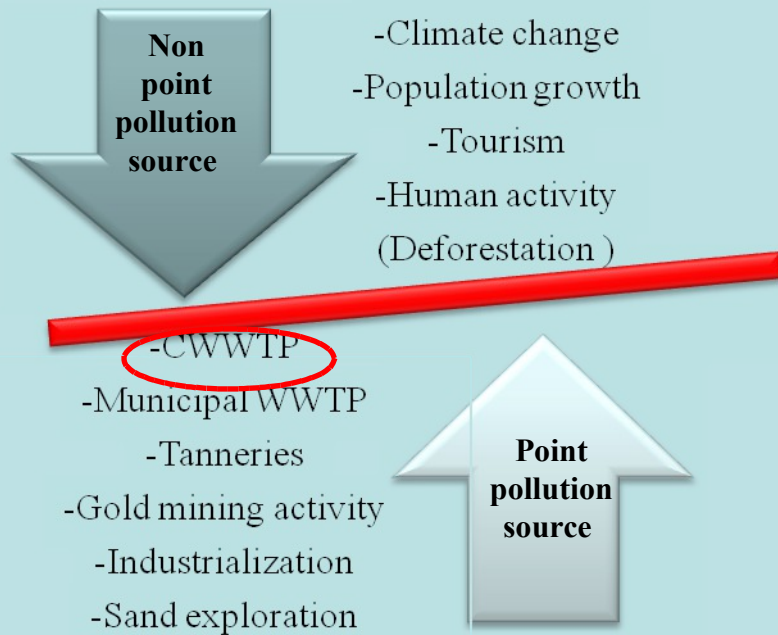
Schematic chart of typical effluent treatment in developing countries



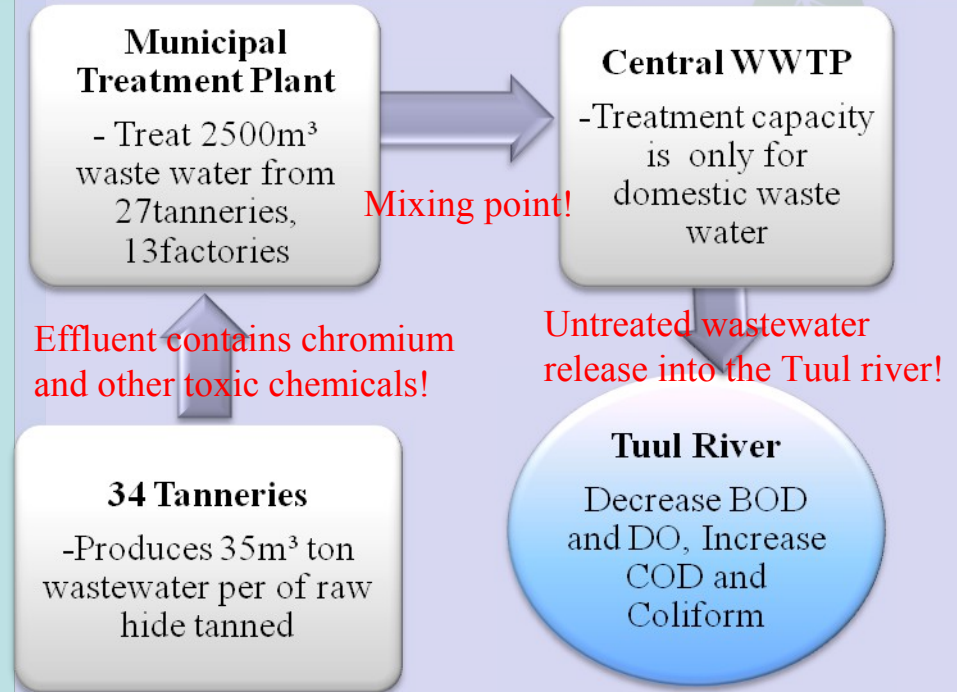
Source: Introduction to treatment of tannery effluent, UNIDO 2011

FACING PROBLEM STATEMENT

Tuul river's pollution sources:



Environmental Impacts of Tanneries:



- **Tanning leather** is biggest pollution source of Tuul river which chromium and other toxic chemicals are widely used.
- **100,000 m3 of domestic** sewage and **70,000 m3 of industry** sewage is discharged to Tuul river everyday.
- Tuul River believed to be **most polluted river** in Mongolia.



RESEARCH GOAL AND OBJECTIVES



Reduce the environmental impacts of the leather tanning industry to the Tuul river water quality by introducing suitable waste water treatment technology

Objective 1.

Evaluate Tuul river water quality by guideline “Surface water quality classification” and determination of the pollution level ;

Objective 2.

Assessment on impact of the tanneries waste water to Tuul river water quality;

Objective 3.

Introduce suitable waste water treatment technology for leather tanneries

METHODOLOGY



SAMPLING

- *Methodology for sampling industrial waste water, tannery effluent and surface water :*
- MNS ISO 5667-10:2001
- MNS ISO 5667-6:2001, MNS ISO 5667-2:2001
- MNS ISO 4867:99;
- **Sampling from:**
 - Tuul river 44 samples
 - Tanneries 26 samples
 - Municipal TP 12 samples
 - CWWTP 12 samples
- **Time frame:** 2012-2013
- **Frequency :** 2 times in a year (March, October)



TEST

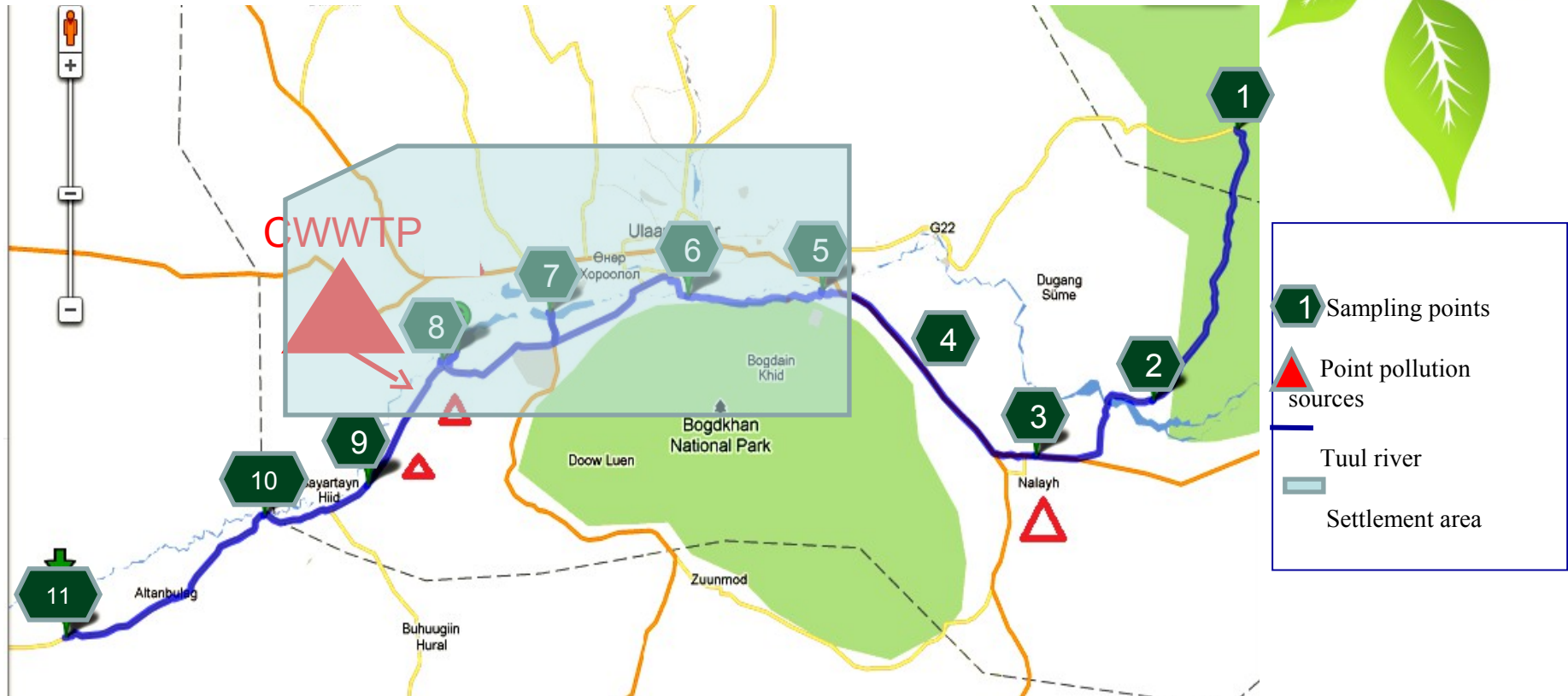
- *Mongolian National and International Standard for surface and waster water quality:*
- On site analysis
- Laboratory analysis
- MNS 4496:97, MNS ISO 4421:99 , MNS ISO 5815:2001, MNS ISO 6060:2001
- Central Laboratory, Metropolitan Inspection Agency
- **The parameters:** BOD, DO, SS, COD, ammonium, Sulfide, pH, Cr, Pb, Cd, Fe, Zn



EVALUATION

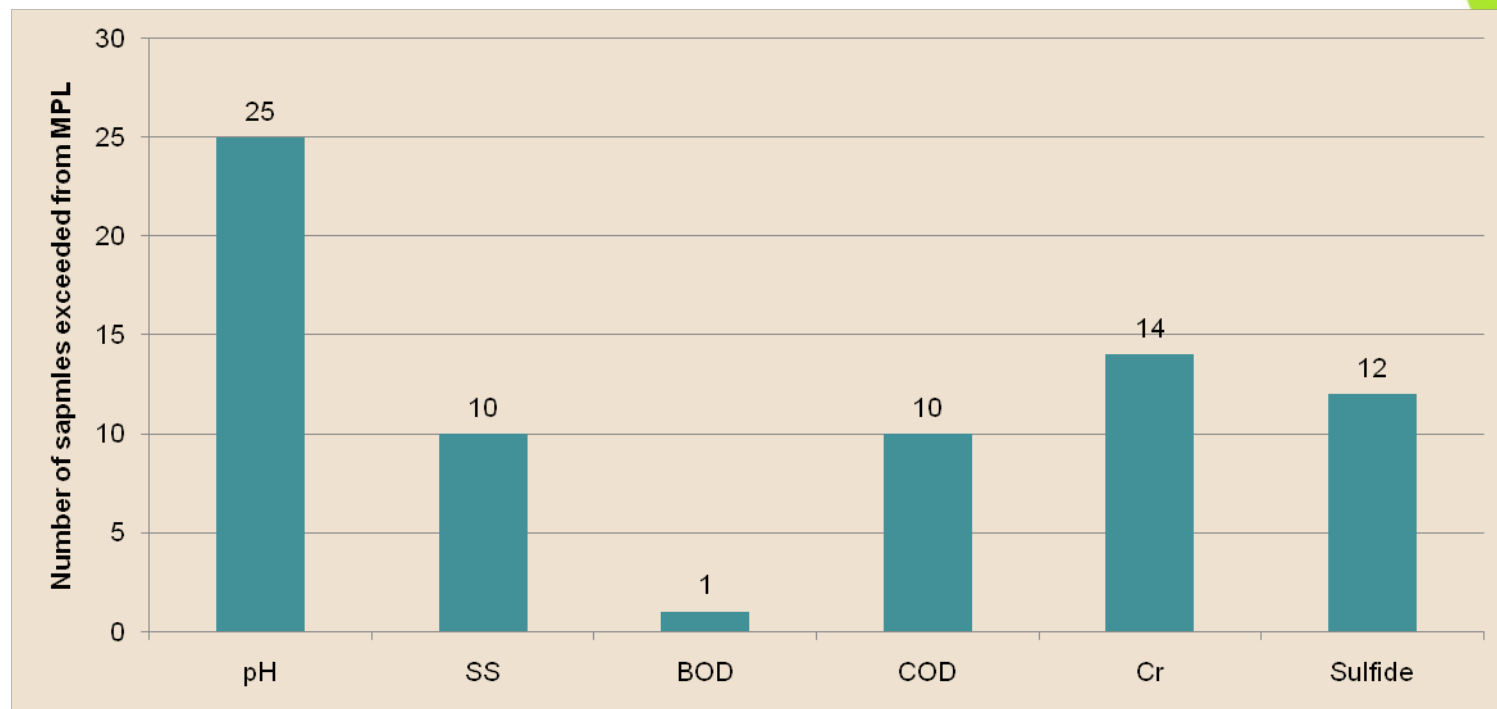
- *Assessment methodology:*
- Surface water quality standard 143-352 “ Standard of determination of the surface water quality” confirmed by Ministry of Health and Ministry of Nature and Environment.

SAMPLING POINTS



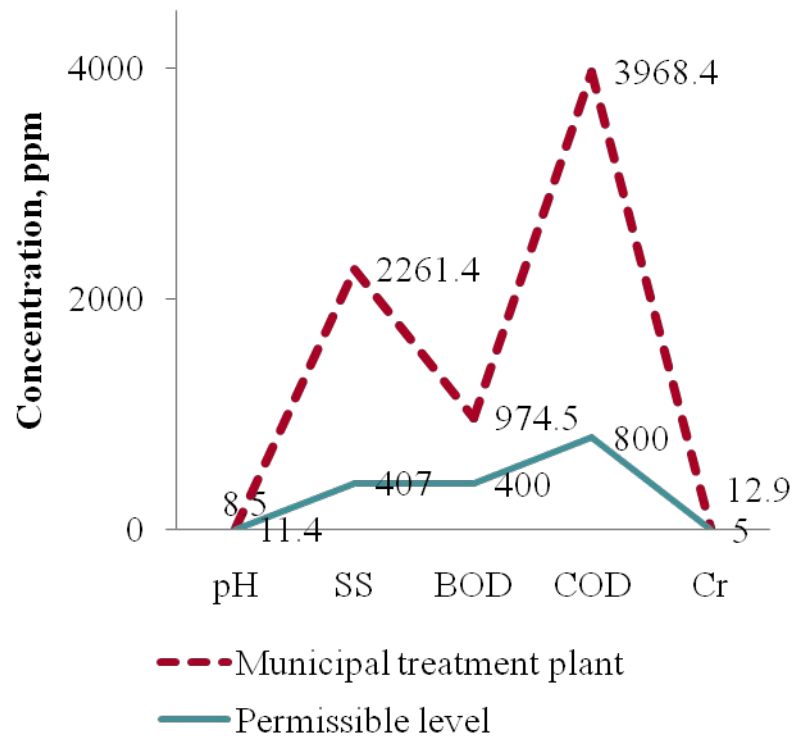
- The upstream part contains data from the sampling point number 1 (Terelj) until the 8th (Songolon) sampling point, which is located in upper reach of junction of the Tuul River and the CWWTP discharge.
- The down-stream part covers from sampling point number 9 (Songino) until the last sampling point number 11 (Altanbulag).

RESULT: Tannery effluent



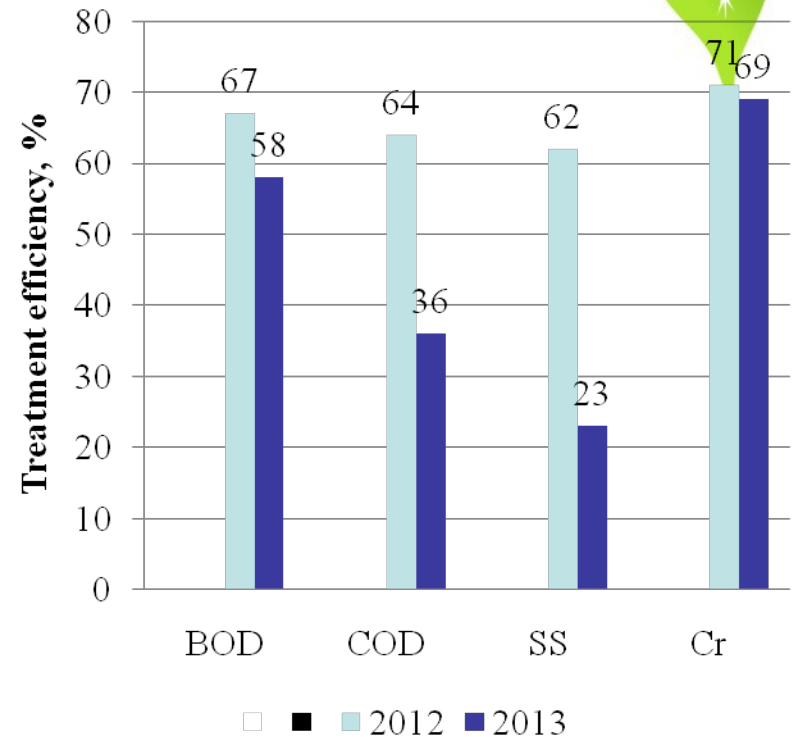
The results studied 52 samples of waste water of tanneries that the 35 samples (67 %) are the highest values above the permitted level (The requirements of waste water of leather factories “Water quality. Technical requirement for tannery effluent to municipal treatment plant. MNS 5582:2006”)

RESULT: Treatment Plant efficiency



Municipal TP:

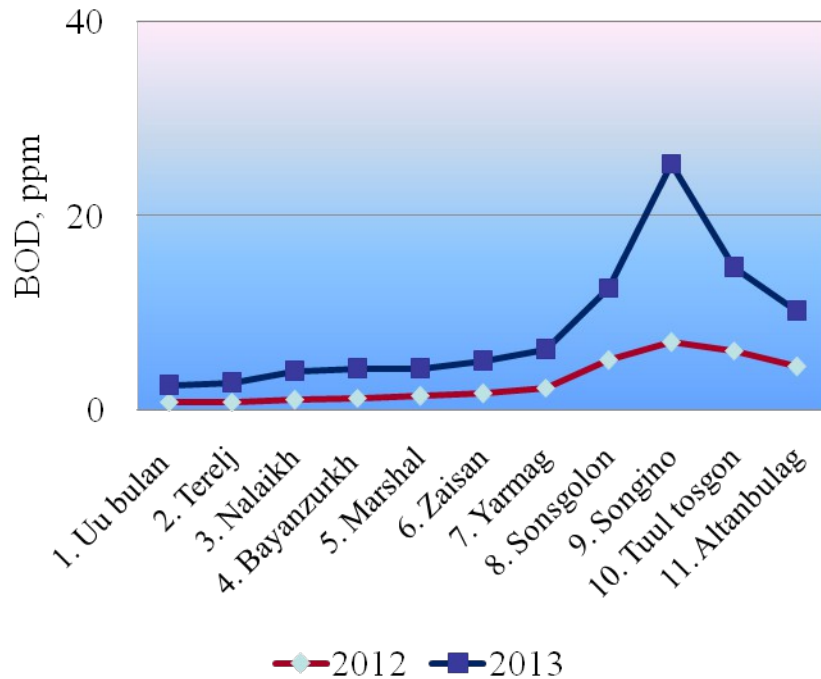
The results shows that the amount of COD is 4 times, BOD is 2 times, weighing component is 10 times, pH is two times higher than MPL according to regulation “Requirement of the highest level of waste water of factories to Central treatment plant”.



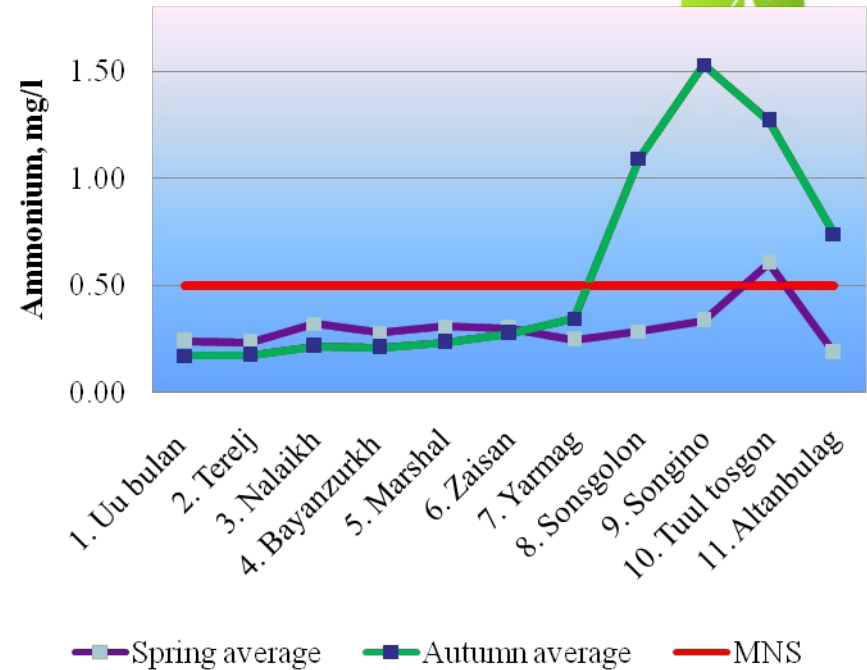
CWWTP:

After the evaluated the force of purification of CWWTP for BOD, COD, SS and Cr, the average efficiency were calculated as 66.8 % on 2012 but 49.8% on 2013 which was decreased by 17 %.

RESULT: Tuul river water quality (BOD, NH3)



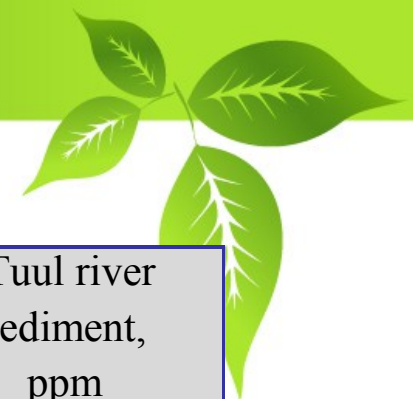
• From 1st until 7th sampling point Tuul river is not polluted, but from the Songolon bridge water pollution is increasing and that pollution is getting maximum level at the 9th (Songino) point.



• Mongolian National Standard (MNS 4586:1998) NH₃ < 0.5 ppm

• Autumn average concentration higher than (2 times) spring season.

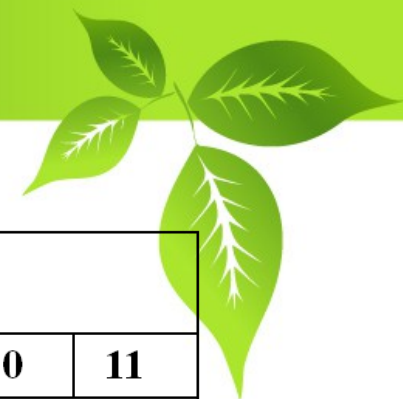
RESULT: Heavy metal content



Heavy metals	Tannery effluent, ppm	Waste water treatment plant, ppm	Tuul river water, ppm	Tuul river sediment, ppm
Zn	nd	nd	0.352±0.030	40.7±0.06
Pb	46.56	25.20	<0.002	36.5±0.26
Fe	169.24	619.00	0.074±0.008	6.40±0.10
Cd	0.74	0.84	<0.0003	0.43±0.02
Cr	9707.64	2632.00	<0.0025	39.4±0.32

- Tuul river water not contaminated by toxic heavy metals but river sediment contains Cr and Cd which indicates originating from the tanneries waste water.
- It can be expected that changes from reducing to oxidizing conditions which involve transformations of sulfides that from tannery waste water and shift to more acid conditions were increased the mobility of Cd and Cr.

RESULT: Pollution level of Tuul river



		Sampling points										
		1	2	3	4	5	6	7	8	9	10	11
		Upstream							Downstream			
2012	Spring	2	2	2	2	2	3	3	3	4	3	2
	Autumn	2	2	2	2	2	2	3	3	4	3	3
2013	Spring	2	2	2	2	2	2	3	3	4	4	4
	Autumn	2	2	2	2	3	3	3	4	5	4	4
	Average	2					3			5	4	3

Mongolian classification on surface water quality No142-a-352 (Ministry of Nature and Environment and Ministry of Health)

<u>Level</u>	<u>Properties</u>
1	Very pure
2	Pure
3	Small contaminated
4	Contaminated
5	Highly contaminated

CONCLUSION



- ❑ Tuul River is not strongly polluted until the Ulaanbaatar and the pollution appears when the river entering the city. Levels of pollution in the downstream section (points 9-11) of the river are strongly dependant effluent treatment levels from the CWWTP. Pollution of the river reduces along the downstream, but not completely purified even 50 km downstream of the city.
- ❑ In 2012, when 15 factories were operating near Tuul river, data result shows Tuul river had 2nd level of pollution in average. However, in 2013, when number of tanneries had been increased up to 23, average pollution is also increased to the 3rd level.
- ❑ Water quality of Tuul river becomes poor in autumns, which overlaps with intensive operating period of leather factories. From the other hand, efficiency of the CWWTP had been decreased 66.8% in 2012 to 49.8% in 2013 by 17%.

FUTURE WORK



- ❑ Correlation analyze between parameters
- ❑ Tuul river's pollution map
- ❑ Choose suitable waste water treatment technology (low cost, environmental friendly, easy acceptable etc)
- ❑ Introduce choosing suitable treatment technologies to tanneries;
- ❑ Evaluate cost effectiveness and environmental benefit of choosing suitable technology



**THANK YOU FOR YOUR
ATTENTION!**