

## Water Quality Assessment of Ground Water in Public Two Dug Wells Beside Shwe-Ta Chaung Canal

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### Abstract

Public dug wells are commonly used for drinking, bathing, cleaning and cooking purposes. Two water samples from two dug wells, named Yarma and Cow Lake, along Shwe-Ta-Chaung canal were examined at Public Health laboratory in two times to determine the contamination of surface associated with waste water. The first time is October 2017 and second time is March 2018. The objective of this research is to determine the water quality of two dug wells located adjacent to the Shwe-Ta-Chaung sewage canal in Mandalay, Myanmar. Four water chemical analysis reports for the two wells are chemically unpotable. The results are compared with the World Health Organization (WHO) standard values to identify the existence of contaminants above the acceptable levels. The results indicate that the water supply wells are impacted by contamination associated with waste water. Yarma Dug Well adjacent to the rubbish filter site is more polluted than Cow Lake Dug Well region.

### Introduction

Water is essential to sustain life, and a satisfactory supply must be available to all. Access to safe water is important as health and development issues at the national, regional and local level. Water is used at homes for consumption such as drinking, cooking, bathing and cleaning. The important way to access to water is either through a municipal water supply from a major city or through wells. Wells exist in two forms, dug wells and tube wells. These water supplies can be contaminated through different mechanisms. Water can be contaminated with either chemicals or microorganisms through improper installation of wells, or being in close proximity to sources of pollution such as sewage or lands fills. In this research, the water quality of two dug wells beside Shwe-Ta-Chaung canal was tested for chemical contamination in Public Health laboratory, Mandalay, Myanmar. The two dug wells are Yarma Dug well and Cow Lake Dug Well. They are located in Tanpawaddi, Chanmyatharsi Township, Mandalay District, Myanmar and situated beside Mandalay on Sagaing-Shwebo Road. The main focus of this research is to investigate the water quality of two dug wells located adjacent to the Shwe-Ta-Chaung sewage canal in Mandalay, Myanmar.

Chemical testing of water quality relies on the comparison of the results with WHO drinking water guidelines to identify contaminants. Most of these contaminants are only of concern with chronic exposure (long-term exposure). Some contaminants that occur in water are the matter of concern because of effects arising from acute exposure (short-term exposure). Other hazards may arise intermittently, often associated with seasonal conditions or fluctuations. The toxic elements effect on human health including organs, damage respiratory tract disorder, lung diseases, skin diseases and other illnesses.

It is suspected that the waste water from the Shwe-Ta-Chaung canal may be contaminating the dug wells degrading the water quality. Thus, this research is to determine the impact of the Shwe-Ta-Chaung canal on ground water by the analysis of water samples collected at two sites next to the Shwe-Ta-Chaung canal in October 2017 and the second time is in March 2018.

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## Materials and Methods

### Description of Research Area

Yarma Dug Well and Cow Lake Dug Well are located in the Tanpawaddi, Chanmyatharsi Township, Mandalay district, Myanmar and situated beside Mandalay-Sagaing-Shwebo Road.

### Sample Location (Sampling Site) and Collection

Yarma Dug Well lies at approximately 21° 55' 45" north latitude and 96 ° 4' 4" east longitudes. The well was constructed over 100 years ago. Typically, the well-base is about 30 feet away from Shwe-Ta-Chaung canal. A garbage area is about 75 feet away from the well-base. The diameter of the well is 6.5 feet and the thickness of the well is 1 foot, which is constructed with a brick lining. The height of the well base is 1.5 feet above the ground. The depth to water from the top of the well casing is 15.35 feet on 12<sup>th</sup> October 2017. The depth to water from the top of the well casing is 20.5 feet on 5<sup>th</sup> March 2018. The photograph of Yarma Dug Well beside the Shwe-Ta-Chaung canal is shown in Figure (1). The width of Shwe-Ta-Chaung canal near Yarma Dug Well is about 25 feet and it lies approximately at 21° 55' 46" north latitude and 96° 4' 3" east longitude. Raw sewage from downtown Mandalay flows into the canal. In this area, the canal is not lined by concrete. Waste water is in direct contact with the ground in the canal. Yarma Dug Well region is located adjacent to the rubbish filter site along Shwe-Ta-Chaung canal. The photograph of trash located near the Yarma Dug Well in the bank of the Shwe-Ta-Chaung canal is also shown in Figure (2).

Cow Lake Dug Well lies at approximately 21° 56' 19" north latitude and 96 ° 4' 21" east longitudes. The well was constructed over 100 years ago. Typically, the well-base is about 45 feet away from Shwe-Ta-Chaung canal. A garbage area is about 95 feet away from the well-base. The diameter of the well is 4 feet and the thickness of the well is 11 inches, which is constructed with a brick lining. The height of the well base is 9 inches above the ground. The depth to water from the top of the well casing is 21 feet on 12<sup>th</sup> October 2017. The depth to water from the top of the well casing is 14 feet on 5<sup>th</sup> March 2018. The photograph of Cow Lake Dug Well beside the Shwe-Ta-Chaung canal is shown in Figure (3). The width of Shwe-Ta-Chaung canal near Cow Lake Dug Well is about 20 feet and it lies approximately at 21° 56'18" north latitude and 96° 4' 21" east longitude. Raw sewage from downtown Mandalay flows into the canal. In this area, the canal is lined by concrete. Waste water is not in direct contact with the ground in the canal. The photograph of trash located near Cow Lake Dug Well in the bank of the Shwe-Ta-Chaung canal is also shown in Figure (4). The photograph of location map of two research sites in Tanpawaddi is represented in Figure (5).

In this research work, two water samples from Yarma Dug Well and Cow Lake Dug Well were collected first time in 12<sup>th</sup> October 2017. The two water samples were also collected in second time in 5<sup>th</sup> March 2018.

### Public Health Laboratory, Ministry of Health and Sports

The water quality parameters (Appearance, Colour, Turbidity, pH value, Total Solids, Total Hardness, Total Alkalinity, Ca, Mg, Cl, SO<sub>4</sub> and Fe) in four water samples of Yarma Dug Well and Cow Lake Dug Well were tested at Public Health Laboratory, Ministry of Health and Sports, Mandalay.



Figure (1) Yarma Dug Well beside the Shwe-Ta-Chaung canal



Figure (2) Trash located near the Yarma Dug Well on the bank of the Shwe-Ta-Chaung canal



Figure (3) Cow Lake Dug Well beside the Shwe-Ta-Chaung canal



Figure (4) Trash located near Cow Lake Dug Well on the bank of Shwe-Ta-Chaung canal

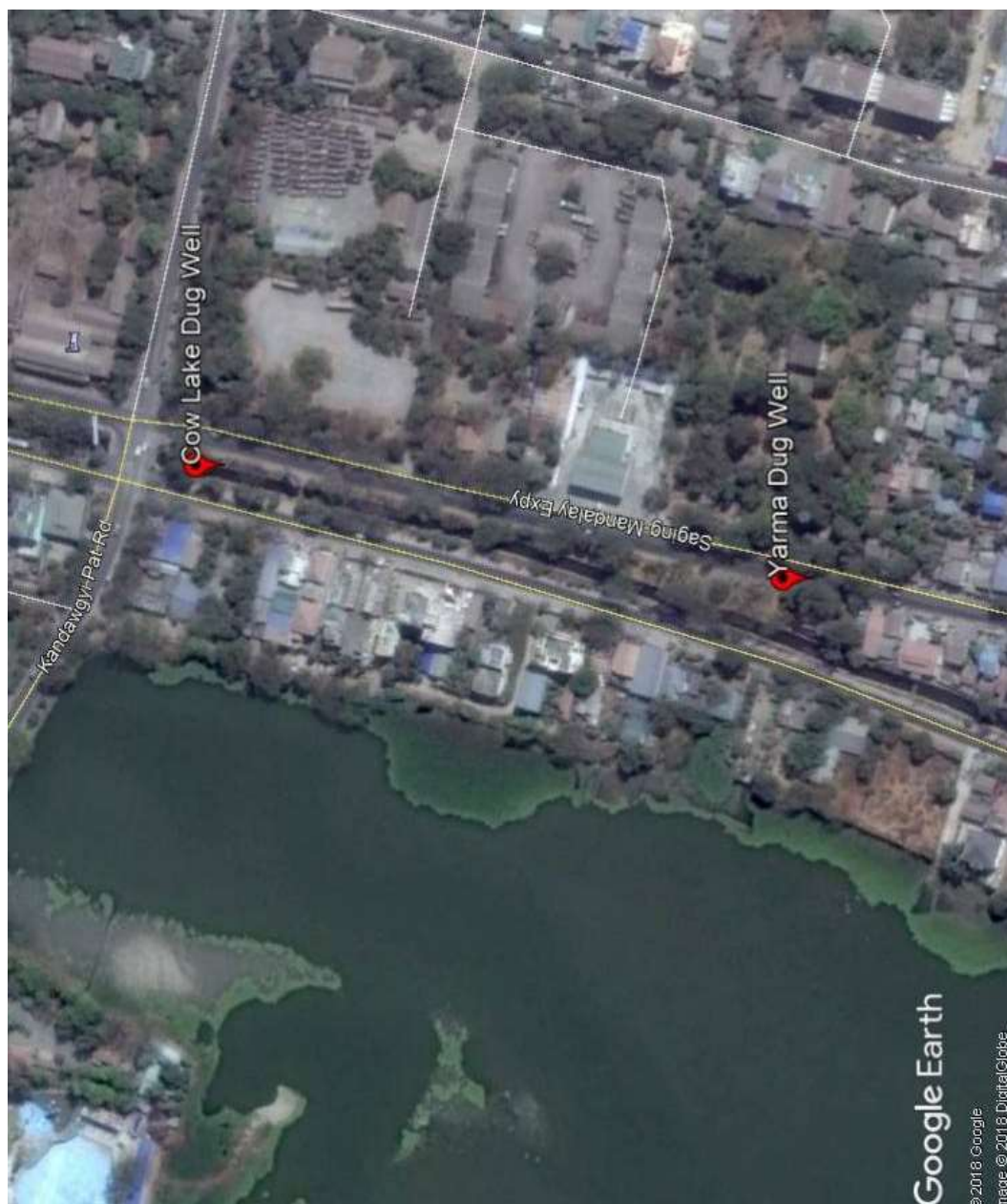


Figure (5) Location Map of two research sites in Tanpawaddi Township, Mandalay District, Myanmar

### Results and Discussions

In the research work, two water samples from Yarma Dug Well and Cow Lake Dug Well were collected in two times and analyzed in Public Health Laboratory, ministry of Health and Sports. The chemical analysis of the water in Yarma Dug Well in first time (October 2017) is listed in Table (1). The chemical analysis of the water in Cow Lake Dug Well in first time (October 2017) is also shown in Table (2). The chemical analysis of the water in Yarma Dug Well in second time (March 2018) is listed in Table (3). The chemical analysis of the water in Cow Lake Dug Well in second time (March 2018) is listed in Table (4).

The water quality parameters of Yarma Dug Well and Cow Lake Dug Well were tested in two times at Public Health laboratory. According to the results, total solids are nearly to the maximum permissible level of WHO in first time and greater than maximum permissible level in second time at the Yarma Dug Well. Total alkalinity is greater than maximum permissible level in both times at the Yarma Dug Well. Other parameters (Colour, pH value, total hardness, Calcium Ca, Magnesium Mg, Chloride Cl and Sulphate SO<sub>4</sub>) of Yarma Dug Well are under the maximum permissible level in both times at the Yarma Dug Well. Total Hardness, Calcium Ca and Sulphate SO<sub>4</sub> are nearly to the maximum permissible level in the Cow Lake Dug Well. Total solids and total alkalinity are very greater than maximum permissible level in both times at Cow Lake Dug Well. Other parameters (Colour, pH value, Magnesium Mg and Chloride Cl of Cow Lake Dug Well are under the maximum permissible level in both times. Therefore, the remarks of water chemical analysis reports are chemically unpotable.

Yarma Dug Well base is nearer to Shwe Ta Chaung canal than Cow Lake Dug Well base. The disposal area is nearer to the Yarma Dug Well base than the garbage area around Cow Lake Dug Well base. But the height of the Yarma Dug Well base is greater than the Cow Lake Dug Well base above the ground. The width of Shwe Ta Chaung canal near Yarma Dug Well is greater than near Cow Lake Dug Well.

The water from Yarma Dug Well and Cow Lake Dug Well are used only for taking baths, washing clothes and cleaning dishes. It is not used for drinking purpose now. Enviroment around Yarma Dug Well adjacent to the rubbish filter site along Shwe-Ta-Chaung canal is more polluted than Cow Lake Dug Well region because the distance between Yarma Dug Well is close to the canal than Cow Lake Dug Well.

Table (1) Chemical Analysis of the water in Yarma Dug Well in first time (October 2017)

No.	Parameter	Result	Maximum Permissible Level [WHO]	Unit
1	Appearance	Clear	-	-
2	Colour (Platinum, Cobolot Scale)	5	50	Units
3	Turbidity (Silcoda Scale Unit)	-	25	NTU
4	PH value	7.3	6.5 to 9.2	-
5	Total Solids	1482	1500	mg/l
6	Total Hardness (as CaCO <sub>3</sub> )	290	500	mg/l
7	Total Alkalinity (as CaCO <sub>3</sub> )	1040	950	mg/l
8	Calcium as Ca	80	200	mg/l
9	Magnesium as Mg	22	150	mg/l
10	Chloride as Cl	120	600	mg/l
11	Sulphate as SO <sub>4</sub>	157	400	mg/l
12	Total Iron as Fe	Nil	1	mg/l

Table (2) Chemical Analysis of the water in Cow Lake Dug Well in first time (October 2017)

No.	Parameter	Result	Maximum Permissible Level [WHO]	Unit
1	Appearance	Clear	-	-
2	Colour (Platinum, Cobolot Scale)	5	50	Units
3	Turbidity (Silcoda Scale Unit)	-	25	NTU
4	PH value	6.9	6.5 to 9.2	-
5	Total Solids	2100	1500	mg/l
6	Total Hardness (as CaCO <sub>3</sub> )	400	500	mg/l
7	Total Alkalinity (as CaCO <sub>3</sub> )	1430	950	mg/l
8	Calcium as Ca	128	200	mg/l
9	Magnesium as Mg	19	150	mg/l
10	Chloride as Cl	160	600	mg/l
11	Sulphate as SO <sub>4</sub>	314	400	mg/l
12	Total Iron as Fe	Nil	1	mg/l

Table (3) Chemical Analysis of the water in Yarma Dug Well in second time (March 2018)

No.	Parameter	Result	Maximum Permissible Level [WHO]	Unit
1	Appearance	Slightly Turbid	-	-
2	Colour (Platinum, Cobolot Scale)	7	50	Units
3	Turbidity (Silcoda Scale Unit)	-	25	NTU
4	PH value	7.1	6.5 to 9.2	-
5	Total Solids	1571	1500	mg/l
6	Total Hardness (as CaCO <sub>3</sub> )	310	500	mg/l
7	Total Alkalinity (as CaCO <sub>3</sub> )	1105	950	mg/l
8	Calcium as Ca	112	200	mg/l
9	Magnesium as Mg	7	150	mg/l
10	Chloride as Cl	140	600	mg/l
11	Sulphate as SO <sub>4</sub>	147	400	mg/l
12	Total Iron as Fe	Nil	1	mg/l

Table(4)Chemical Analysis of the water in Cow Lake Dug Well in second time (March 2018)

No.	Parameter	Result	Maximum Permissible Level [WHO]	Unit
1	Appearance	Clear	-	-
2	Colour (Platinum, Cobolot Scale)	6	50	Units
3	Turbidity (Silcoda Scale Unit)	-	25	NTU
4	PH value	7.3	6.5 to 9.2	-
5	Total Solids	1808	1500	mg/l
6	Total Hardness (as CaCO <sub>3</sub> )	230	500	mg/l
7	Total Alkalinity (as CaCO <sub>3</sub> )	1495	950	mg/l
8	Calcium as Ca	84	200	mg/l
9	Magnesium as Mg	5	150	mg/l
10	Chloride as Cl	120	600	mg/l
11	Sulphate as SO <sub>4</sub>	49	400	mg/l
12	Total Iron as Fe	Nil	1	mg/l

### Conclusion

Water treatment will be needed to describe those processes used to make water more acceptable for a desired end-use. These can use as drinking water, industrial processes, medical and many other uses. The goal of all water treatment process is to remove existing contaminants in water. Surface water usually needs to be filtered and disinfected, while ground water often needs to have hardness (Ca and Mg) removed before disinfection. Effective municipal wastewater treatment system to human health, ecosystem stability, and water quality will be needed. The results of water samples indicate that water supply wells should not be located near the disposal area. Moreover, garbage should not be dumped near the wells. According to the results, environment around Yarma Dug Well adjacent to the rubbish filter site along Shwe-Ta-Chaung canal is more polluted than Cow Lake Dug Well region. Because the canal near Yarma Dug Well is not lined by concrete. Waste water is in direct with the ground in the canal. The canal near Cow Lake Dug Well is lined by concrete. Waste water is not in direct with the ground in the canal.

The sewage canal should be reconstructed with appropriate protection. The canal should be constructed with concrete. The canal is too shallow so that it is flooded during the rainy season and the sewage reached to the base of the well. So the garbage should not be dumped near the well base. It is indicated that the water supply wells are impacted by contamination associated with waste water. Humans and animals should not use the wells located near the waste water canal for any purpose.

### Aknowledgements

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