# CONTAMINATION ASSESSMENT NEAR PUBLIC DUG WELLS ALONG SHWE-TA-CHAUNG CREEK

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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 Creek 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. 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. Also four soil samples near each dug well and related creek were determined with Rigaku EDXRF spectrometer in two times to estimate the elemental pollution in the soil. Contamination factor, modified degree of contamination and pollution load index for soil contamination was calculated. The objective of this research is to determine the environmental pollution on the two public dug wells located adjacent to the Shwe-Ta-Chaung Creek in Tanpawaddy Quarter Mandalay, Myanmar. The water supply wells are impacted by contamination associated with waste water. Yarma Dug Well region adjacent to the rubbish filter site is more polluted than Cow Lake Dug Well region.

**Keywords:** Yarma Dug Well, Cow Lake Dug Well,Shwe-Ta-Chaung Creek, contamination

## Introduction

Water is one of the most vital natural resources for all life on Earth. Water use is the amount of water used by a household or a country, or the amount used for a given task or for the production of a given quantity of some product or crop, or the amount allocated for a particular purpose. The main ways a home has 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 Creek was tested in two times for chemical contamination in Public Health laboratory, Mandalay, Myanmar. Four soil samples near the two dug wells and relevant the creek were determined in two times for elemental contamination by Rigaku EDXRF technique in University Research Centre, Taunggyi University. The main focus of this research is to investigate environmental pollution near two dug wells located adjacent to the Shwe-Ta-Chaung Creek 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). Sewage, garbage and liquid waste of households, agricultural lands and factories are discharged into lakes and rivers. Early types of water pollution were usually due to contamination from human and animal waste, which caused major outbreaks of diseases like cholera. The toxic

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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 Creek may be contaminating the dug wells degrading the water quality. Thus, this research is to determine the impact of the creek on contamination near two public dug wells by the analysis of four water samples and eight soil samples collected at two sites next to the creek in October 2017 and in March 2018.

## Materials and Methods

### Description of Research Area

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

### Sample Location (Sampling Site) and Collection

Yarma Dug Well lies at approximately 21º 55' 45" north latitude and 96 º 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 Creek. 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$^{th}$ October 2017. The depth to water from the top of the well casing is 20.5 feet on 5$^{th}$ March 2018. The photograph of Yarma Dug Well beside the Shwe-Ta-Chaung Creek is shown in Figure (1). The width of the creek near Yarma Dug Well is about 25 feet and it lies approximately at 21º 55' 46" north latitude and 96 º 4' 3" east longitudes. Raw sewage from downtown Mandalay flows into the creek. In this area, the creek is not lined by concrete. Waste water is in direct contact with the ground in the creek. Yarma Dug Well region is located adjacent to the rubbish filter site along the creek. The photograph of trash located near the Yarma Dug Well in the bank of the Shwe-Ta-Chaung Creekis also shown in Figure (2).

Cow Lake Dug Well lies at approximately 21º 56' 19" north latitude and 96 º 4' 21" east longitudes. The well was constructed over 100 years ago. Typically, the well-base is about 45 feet away from the creek. 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$^{th}$ October 2017. The depth to water from the top of the well casing is 14 feet on 5$^{th}$ March 2018. The photograph of Cow Lake Dug Well beside the Shwe-Ta-Chaung Creek is shown in Figure (3).The width of the creek near Cow Lake Dug Well is about 20 feet and it lies approximately at 21º 56'18" north latitude and 96º 4' 21" east longitude. Raw sewage from downtown Mandalay flows into the creek. In this area, the creek is lined by concrete. Waste water is not in direct contact with the ground in the creek. The photograph of trash located near Cow Lake Dug Well in the bank of the Shwe-Ta-Chaung Creek is also shown in Figure (4).The photograph of location map of two research sites in Tanpawaddy 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 12th October 2017. Also four soil samples were collected. The soil sample near Yarma Dug Well was named as $S_1W$. The soil sample beside the creek in Yarma Quarter was named as $S_1C$. The soil sample near Cow Lake Dug Well is represented as $S_2W$. The soil sample beside the creek in Cow Lake Quarter is represented as $S_2C$. These soil samples from four research sites were each collected with two inches in diameter PVC pipe which is one feet long. The small trashes in these samples were cleaned and dried under the room temperature. And then it is needed to grind the soil powdered samples and to get very fine powders. The soil powder samples were passed through 325 mesh sieve of the samples. After getting very fine powder, the sample was weighted nearly 5g. Sample preparation is an important role in XRF measurement. Similarly the two water samples and four soil samples were also collected second time in 5th March 2018.

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

The water quality parameters (Appearance, Colour, Turbity, pH value, Total Solids, Total Hardness, Total Alkalinity, Ca, Mg, Cl, $SO_4$ 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.

**Experimental Procedure for Rigaku X-ray Spectrometer**

The EDXRF machine (Rigaku) at the University Research Centre, Taunggyi University is used for determination of elemental concentration in the sample of interest in eight soil samples. The photograph of Energy dispersive X-ray fluorescence spectrometer (Rigaku) in University Research Centre, Taunggyi University is shown in Figure (6).

**Contamination Factor (CF) and Modified Degree of Contamination ($mC_d$)**

The level of metal contamination was expressed by the contamination status of sediment in the current research. CF and $mC_d$ were calculated according to the equation described as

$$CF = \frac{MC}{BC}$$

$$mC_d = \frac{1}{N}\sum_{i=1}^{N} CF$$

Four contamination categories are documented on the basis of the contamination factor. CF<1 low contamination; $1 \le CF < 3$ moderate contamination; $3 \le CF < 6$ considerable contamination: CF > 6 very high contamination, while the degree of contamination ($C_d$) was defined as the sum of all contamination factor. The following terms is adopted to illustrate the degree of contamination $C_d$< 6: low degree of contamination; $6 \le C_d < 12$ : moderate degree of contamination; $12 \le C_d < 24$ : considerable degree of contamination; $C_d$> 24: very high degree of contamination indication serious anthropogenic pollution.

**Pollution Load Index (PLI)**

Pollution Load Index (PLI) was used to evaluate the extent of pollution by heavy metals in the environment.

$$PLI = (CF_1 \times CF_2 \times CF_3 \times ..... \times CF_n)^{1/n}$$

where n is the number of metals and CF is the contamination factor. Five contamination categories are reported on the basis of the pollution load index. A PLI<1 denote perfection, PLI=1 present that only baseline levels of pollutants are present, PLI>1 would indicate deterioration of site quality, PLI≥1 indicates an immediate intervention to ameliorate pollution, 0.5≤PLI<1 suggests that more detailed study is needed to monitor the site.

**Figure 1** Yarma Dug Well beside the Shwe-Ta-Chaung Creek

**Figure 2** Trash located near the Yarma Dug Well on the bank of the Shwe-Ta-Chaung Creek

**Figure 3** Cow Lake Dug Well beside the Shwe-Ta-Chaung Creek

**Figure 4** Trash located near Cow Lake Dug Well on the bank of Shwe-Ta-Chaung Creek

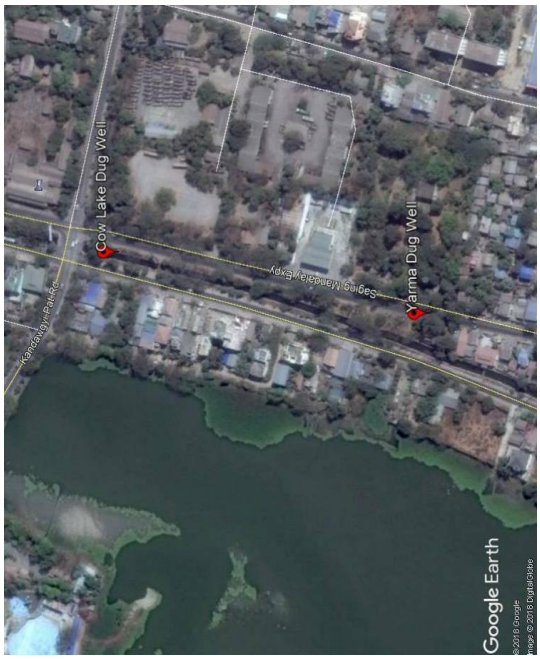


**Figure 5** Location Map of two dug wells in Tanpawaddy Township, Mandalay City, Myanmar


**Figure 6** Experimental Set-up for Energy dispersive x-ray fluorescence spectrometer (Rigaku) in University Research Centre, Taunggyi University

## Results and Discussions

In the research work, the water quality parameters of Yarma Dug Well and Cow Lake Dug Well were tested in two times at Public Health Laboratory. Chemical Analysis of the water in Yarma Dug Well in first time (October 2017) and second time (March 2018) is listed in Table (1).Chemical Analysis of the water in Cow Lake Dug Well in first time (October 2017) and second time (March 2018) is also shown in Table (2).

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 $SO_4$) of Yarma Dug Well are under the level in both times at the Yarma Dug Well. Total Hardness, Calcium Ca and Sulphate $SO_4$ are nearly to the level in the Cow Lake Dug Well. Total solids and total alkalinity are greater than the level in both times at Cow Lake Dug Well. Other parameters (Colour, pH value, Magnesium Mg and Chloride C1 of Cow Lake Dug Well are under the level in both times. Therefore, the remarks of water chemical analysis reports are chemically unpotable.

Yarma Dug Well base is nearer to the creek 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 the creek 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. Environment around Yarma Dug Well adjacent to the rubbish filter site along the creek is more polluted than Cow Lake Dug Well region because the distance between Yarma Dug Well is close to the creek than Cow Lake Dug Well.

The elemental concentration of elements of four soil samples in the first time and second time is listed in Table (3).These elements are magnesium (Mg), aluminum (Al), silicon (Si), phosphorus (P), sulfur (S), chlorine (Cl), potassium (K), calcium (Ca), titanium (Ti), manganese (Mn), iron (Fe), copper (Cu), zinc (Zn), lead (Pb) and chromium (Cr).The contamination Factor

(CF) for soil pollution near two dug wells in first time and second time is calculated in Table (4). These metals are magnesium (Mg), aluminum (Al), potassium (K), manganese (Mn), iron (Fe), copper (Cu), zinc (Zn), chromium (Cr) and lead (Pb). Modified degree of contamination ($mC_d$) for soil pollution near two dug wells in first time is calculated in Table (5) and second time is in Table (6).Pollution Load Index (PLI) for soil pollution near two dug wells in first time is listed in Table (7) and second time is in Table (8).Comparison of modified degree of contamination ($mC_d$)for soil pollution near Yarma Dug Well and Cow Lake Dug Well in first time is shown in Figure (7) and second time is in Figure (11).Comparison of modified degree of contamination ($mC_d$)for soil pollution in the bank of Shwe-Ta-Chaung Creek near Yarma Dug Well and Cow Lake Dug Well in first time is shown in Figure (8) and second time is in Figure (12).Comparison of pollution load index (PLI)for soil pollution near Yarma Dug Well and Cow Lake Dug Well in first time is represented in Figure (9) and second time is in Figure (13). Comparison of pollution load index (PLI)f or soil pollution in the bank of Shwe-Ta-Chaung Creek near Yarma Dug Well and Cow Lake Dug Well in first time is also shown in Figure (10) and second time is in Figure (14).

The calculated results of modified degree of contamination ($mC_d$) for soil near Yarma Dug Well are very high degree of contamination and soil in the bank of the creek near Yarma Dug Well are moderate degree of contamination in the first time. Both modified degree of contamination ($mC_d$) for soil near Yarma Dug Well and soil in the bank of the creek near Yarma Dug Well are moderate degree of contamination in the second time.

The modified degree of contamination ($mC_d$) results for soil near Cow Lake Dug Well is very low degree of contamination and the soil in the bank of the creek near Cow Lake Dug Well are moderate degree of contamination in the first time. Both modified degree of contamination ($mC_d$) for soil near Cow Lake Dug Well and soil in the bank of the creek near Cow Lake Dug Well are very low degree of contamination in the second time.

Pollution load index (PLI) for soil near Yarma Dug Well is strongly polluted and for soil in the bank of the creek near Yarma Dug Well is moderately polluted in the first time. Both pollution load indices (PLI) for soil near Cow Lake Dug Well and soil in the bank of the creek near Cow Lake Dug Well are moderately polluted in the first time. Both pollution Load indices (PLI) for soil near the two dug wells and soil in the bank of the creek near the two dug wells are moderately polluted in the second time. The pollution load index (PLI) for soil near Yarma Dug Well would indicate deterioration of site quality. The pollution load index (PLI) for soil near Cow Lake Dug Well presents that only baseline level of pollutants. The pollution load index (PLI) for soil in the bank of the creek near Yarma Dug Well and Cow Lake Dug Well would indicate deterioration of site quality.

According to the results, soil around Yarma Dug Well adjacent to the rubbish filter site along the creek is more polluted than Cow Lake Dug Well region because the distance between Yarma Dug Well is close to the creek than Cow Lake Dug Well. There is more pollution at Yarma Dug Well because there are many trash and garbage near in it.

**Table 1 Chemical Analysis of the water in Yarma Dug Well in first time (October 2017) and second time (March 2018)**

| No. | Parameter | First Result | Second Result | Maximum Permissible Level [WHO] | Unit |
|---|---|---|---|---|---|
| 1 | Appearance | Clear | Slightly Turbid | - | - |
| 2 | Colour (Platinum, Cobolot Scale) | 5 | 7 | 50 | Units |
| 3 | Turbidity (Silcoda Scale Unit) | - | - | 25 | NTU |
| 4 | PH value | 7.3 | 7.1 | 6.5 to 9.2 | - |
| 5 | Total Solids | 1482 | 1571 | 1500 | mg/l |
| 6 | Total Hardness (as $CaCO_3$) | 290 | 310 | 500 | mg/l |
| 7 | Total Alkalinity (as $CaCO_3$) | 1040 | 1105 | 950 | mg/l |
| 8 | Calcium as Ca | 80 | 112 | 200 | mg/l |
| 9 | Magnesium as Mg | 22 | 7 | 150 | mg/l |
| 10 | Chloride as Cl | 120 | 140 | 600 | mg/l |
| 11 | Sulphate as $SO_4$ | 157 | 147 | 400 | mg/l |
| 12 | Total Iron as Fe | Nil | Nil | 1 | mg/l |

**Table 2 Chemical Analysis of the water in Cow Lake Dug Well in first time (October 2017) and second time (March 2018)**

| No. | Parameter | First Result | Second Result | Maximum Permissible Level [WHO] | Unit |
|---|---|---|---|---|---|
| 1 | Appearance | Clear | Clear | - | - |
| 2 | Colour (Platinum, Cobolot Scale) | 5 | 6 | 50 | Units |
| 3 | Turbidity (Silcoda Scale Unit) | - | - | 25 | NTU |
| 4 | PH value | 6.9 | 7.3 | 6.5 to 9.2 | - |
| 5 | Total Solids | 2100 | 1808 | 1500 | mg/l |
| 6 | Total Hardness (as $CaCO_3$) | 400 | 230 | 500 | mg/l |
| 7 | Total Alkalinity (as $CaCO_3$) | 1430 | 1495 | 950 | mg/l |
| 8 | Calcium as Ca | 128 | 84 | 200 | mg/l |
| 9 | Magnesium as Mg | 19 | 5 | 150 | mg/l |
| 10 | Chloride as Cl | 160 | 120 | 600 | mg/l |
| 11 | Sulphate as $SO_4$ | 314 | 49 | 400 | mg/l |
| 12 | Total Iron as Fe | Nil | Nil | 1 | mg/l |

**Table 3 Concentration of elements of four soil samples in the first time and second time**

| Sr. No | Elements | Concentration (mg/ kg) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | YarmaDug Well | | | | Cow Lake Dug Well | | | |
| | | First time | | Second time | | First time | | Second time | |
| | | $S_1$ W | $S_1$C | $S_1$ W | $S_1$C | $S_2$ W | $S_2$ C | $S_2$ W | $S_2$ C |
| 1 | Mg | 9910 | 10800 | 8140 | 8790 | 7630 | 10800 | 9590 | 11000 |
| 2 | Al | 40800 | 43200 | 41000 | 48000 | 34800 | 39400 | 44000 | 51800 |
| 3 | Si | 169000 | 165000 | 166000 | 169000 | 136000 | 147000 | 171000 | 170000 |
| 4 | P | 2080 | 1860 | 2060 | 2050 | 1370 | 1330 | 2020 | 1060 |
| 5 | S | 819 | 2410 | 949 | 1140 | 777 | 1270 | 989 | 469 |
| 6 | Cl | 435 | 151 | 383 | 313 | 179 | 105 | 176 | 127 |
| 7 | K | 16700 | 16400 | 16800 | 17700 | 13900 | 15700 | 16400 | 18400 |
| 8 | Ca | 54100 | 52600 | 50300 | 40200 | 34600 | 56400 | 50700 | 38500 |
| 9 | Ti | 2460 | 2910 | 1990 | 2530 | 1710 | 2640 | 2440 | 2680 |
| 10 | Cr | 74 | 88 | 60 | 75 | 41 | 70 | 44 | 80 |
| 11 | Mn | 943 | 536 | 656 | 695 | 639 | 744 | 795 | 790 |
| 12 | Fe | 19100 | 29100 | 16300 | 22800 | 18800 | 24800 | 22000 | 24000 |
| 13 | Cu | 3080 | 502 | 502 | 748 | 90 | 497 | 145 | 77 |
| 14 | Zn | 17700 | 779 | 2010 | 792 | 197 | 591 | 330 | 154 |
| 15 | Pb | 314 | 217 | 177 | 164 | 113 | 139 | 175 | 91 |

**Table 4 Contamination Factor (CF) for soil pollution near two dug wells in the first time and second time**

| Sr. No | Symbol | Contamination Factor (CF) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Yarma Dug Well | | | | Cow Lake Dug Well | | | |
| | | First time | | Second time | | First time | | Second time | |
| | | $S_1$W | $S_1$C | $S_1$W | $S_1$C | $S_2$W | $S_2$C | $S_2$W | $S_2$C |
| 1 | Mg | 1.299 | 1.416 | 1.006 | 1.087 | 1.000 | 1.416 | 1.185 | 1.359 |
| 2 | Al | 1.172 | 1.241 | 1.030 | 1.206 | 1.000 | 1.132 | 1.106 | 1.302 |
| 3 | K | 1.201 | 1.180 | 1.159 | 1.220 | 1.000 | 1.707 | 1.131 | 1.269 |
| 4 | Cr | 1.805 | 2.146 | 1.364 | 1.705 | 1.000 | 1.707 | 1.000 | 1.818 |
| 5 | Mn | 2.235 | 1.270 | 1.075 | 1.139 | 1.514 | 1.763 | 1.303 | 1.295 |
| 6 | Fe | 1.137 | 1.732 | 1.000 | 1.399 | 1.119 | 1.476 | 1.349 | 1.472 |
| 7 | Cu | 34.222 | 5.578 | 6.519 | 9.714 | 1.000 | 5.522 | 1.883 | 1.000 |
| 8 | Zn | 89.848 | 3.954 | 13.052 | 5.143 | 1.000 | 3.000 | 2.143 | 1.000 |
| 9 | Pb | 2.935 | 2.028 | 1.945 | 1.802 | 1.056 | 1.299 | 1.923 | 1.000 |

**Table 5 Modified Degree of Contamination ($mC_d$) for soil pollution near two dug wells in first time**

| Sample location | $S_1W$ | $S_1C$ | $S_2W$ | $S_2C$ |
|---|---|---|---|---|
| $mC_d$ | 15.095 | 2.283 | 1.077 | 2.049 |

**Table 6 Modified Degree of Contamination ($mC_d$) for soil pollution near two dug wells in second time**

| Sample location | $S_1W$ | $S_1C$ | $S_2W$ | $S_2C$ |
|---|---|---|---|---|
| $mC_d$ | 3.128 | 2.713 | 1.447 | 1.279 |

**Table 7 Pollution Load Index (PLI) for soil pollution near two dug wells in first time**

| Sample location | $S_1W$ | $S_1C$ | $S_2W$ | $S_2C$ |
|---|---|---|---|---|
| PLI | 3.484 | 1.966 | 1.067 | 1.773 |

**Table 8 Pollution Load Index (PLI) for soil pollution near two dug wells in second time**

| Sample location | $S_1W$ | $S_1C$ | $S_2W$ | $S_2C$ |
|---|---|---|---|---|
| PLI | 1.879 | 1.941 | 1.397 | 1.256 |

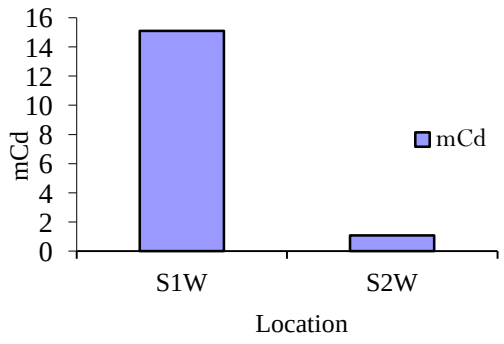


**Figure 7** Comparison of modified degree of contamination ($mC_d$) for soil pollution near Yarma Dug Well and Cow Lake Dug Well in first time

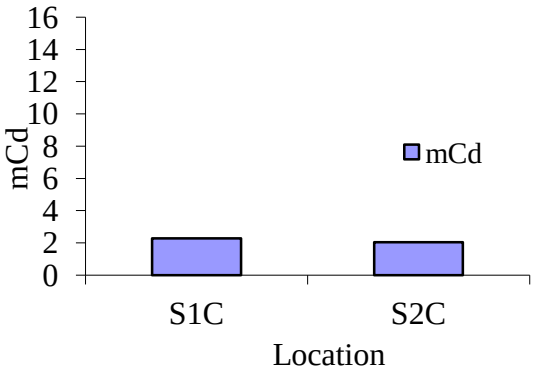


**Figure 8** Comparison of modified degree of contamination ($mC_d$)for soil pollution in the bank of Shwe-Ta-Chaung Creek near Yarma Dug Well and Cow Lake Dug Well in first time

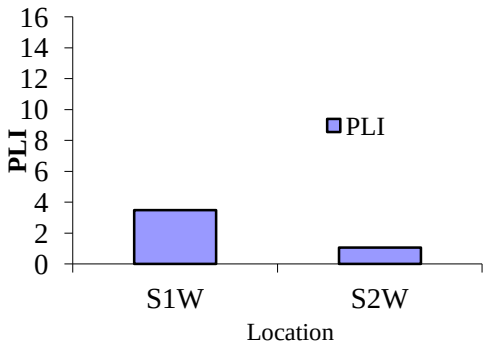


**Figure 9** Comparison of pollution load index (PLI) for soil pollution near Yarma Dug Well and Cow Lake Dug Well in first time

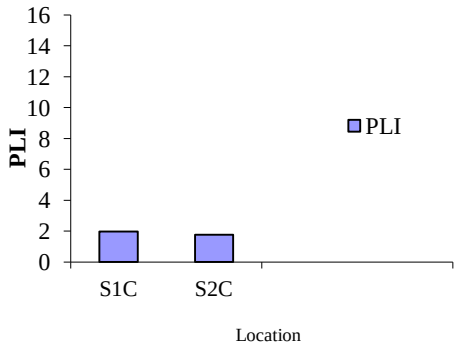


**Figure 10** Comparison of pollution load index (PLI) for soil pollution in the bank of Shwe-Ta-Chaung Creek near Yarma Dug Well and Cow Lake Dug Well in in first time

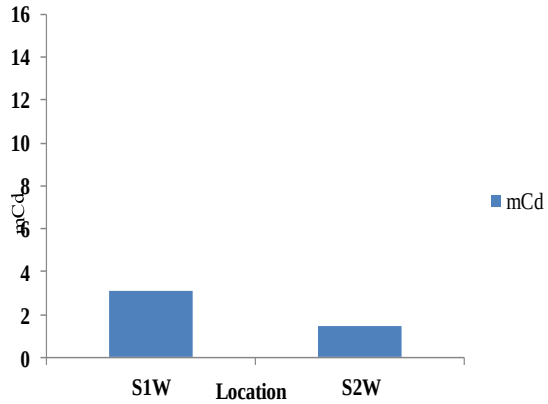


**Figure 11** Comparison of modified degree of contamination ($mC_d$) for soil pollution near Yarma Dug Well and Cow Lake Dug Well in second time

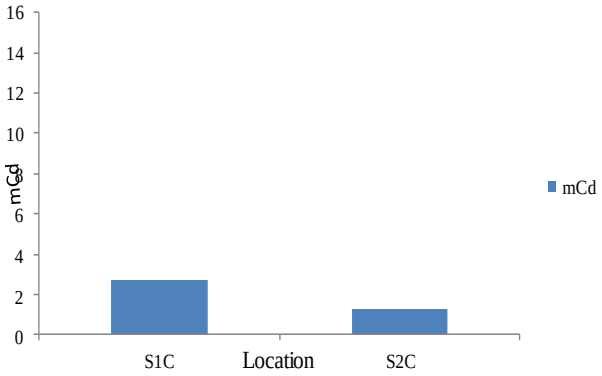


**Figure 12** Comparison of modified degree of contamination ($mC_d$) for soil pollution in the bank of Shwe-Ta-Chaung Creek near Yarma Dug Well and Cow Lake Dug Well in second time


**Figure 13** Comparison of pollution load index (PLI) for soil pollution near Yarma Dug Well and Cow Lake Dug Well in second time

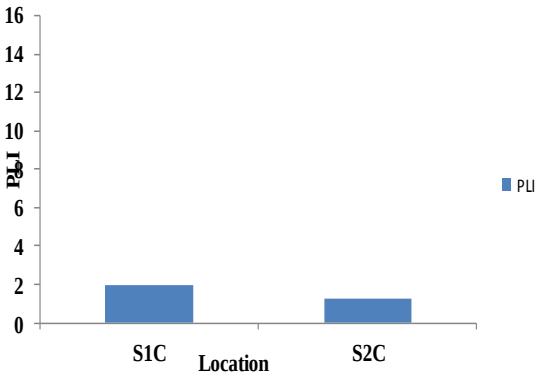


**Figure 14** Comparison of pollution load index (PLI)for soil pollution in the bank of Shwe-Ta-Chaung Creek near Yarma Dug Well and Cow Lake Dug Well in second time

## Conclusion

Water treatment will be needed to describe those processes used to make water more acceptable for a desired end-use. These can be used to get drinking water and for 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. Although the creek near Yarma Dug Well is not lined by concrete and the creek near Cow Lake Dug Well is lined by concrete. It is indicated that the water supply wells are impacted by contamination associated with waste water.

The waste water creek should be reconstructed with appropriate protection. The creek is too shallow so that it is flooded during the rainy season and the waste water reached to the base of the well. The creek should be constructed with concrete. So the garbage should not be dumped near the well base. Soil around Yarma Dug Well adjacent to the rubbish filter site along Shwe-Ta-Chaung Creek is more polluted than Cow Lake Dug Well region. The pollution around Yarma Dug Well is due to garbage landfills. 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 wastewater creek for any purpose.

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