UNDERGROUND WATER TABLE POSITION OF KYAUKSE TOWNSHIP: THE CASE STUDY OF KYAUKSE PLAIN

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ABSTRACT

Kyaukse area lying in the eastern periphery of dry zone of Myanmar has to rely on the surface water resources from Zawgyi, Panlaung and Samon rivers for agriculture. For drinking water and partly for irrigation of garden lands, underground water is utilized. To utilize safe and sustainable underground water resources, it is important to know the underground water occurrence, water table position and its related present and future problems. In Kyaukse alluvial plain, coarse sand and gravelly horizons are found to be main aquifer of water table aquifer. Almost all the water samples quality show that total dissolved solids (TDS) and electric conductance (EC) are acceptable limit. The elevation of water table gradually lowers towards north- northwest direction, the highest being more than 350 feet (above sea level) at the vicinity of Shantaungu range and Kyaukse hill. The shallow water table is found at Shabin village tract in the northwest of the area lying at 230 feet. The water table position indicates the prevalence of its relationship with the regional surface morphology. Depths to water table gradually decrease from more than 30 feet up to 6 feet in the west southwest direction. Measurement of water table was performed at 30 villages during summer and at the end of rainy season. At Minsu and Kobin village tracts, in summer as well as at the end of rainy season water table lies at the depth of less than 10 feet. Based upon the peculiar nature of the underground water table, it is recommended that future rational planning for water resources utilization should be made for sustainable development of the area.

KEY WORDS

water table, aquifer, water quality

INTRODUCTION

Kyaukse Township is one of the most important townships in Mandalay Division in agricultural and industrial aspects. Some Indus-

trial complexes and most of the agricultural practices occupy this Kyaukse plain. Thus, it is the most important area in central Myanmar.

Kyaukse area is part of the dry area and annual precipitation is small compared to other parts of monsoon area, it has to depend on natural water resources which are water from the local streams and rivers and underground water for these needs. Thus, hand-dug wells and tube wells had been drilled in order to retrieve the ground water resources to solve the problem of water insufficiency encountered in this area for domestic uses.

Underground water resources which are more or less reliable source for safe water supply play an important role in the world. If it has to depend on underground water resources, nature of its occurrence, especially water table condition becomes important to be considered.

PREVIOUS STUDIES

Although physical characteristics of Kyaukse area had been studied by many researchers concerned, the study on the underground water resources had not been carried out from the geomorphologic point of view. Rural Water Supply Division of former Agricultural Mechanization Department, now Water Resources Utilization Department of Ministry of Agriculture and Irrigation had carried out drilling for underground water in this area. Also local population had performed water jet drilling of shallow wells. Although the drilling records are available, no lucid account on underground water had been mentioned.

M.M. Ivanitsin (1962, 1962 a) had described the hydro geologic account of Myanmar and dry zone of Myanmar which mentioned generalized nature of underground water occurrence in broad alluvial plain of Thazi-Kyaukse-Mandalay area. Detailed description of underground water of the present study area had not yet been made at present.

U. D Aung Ba (1965) had carried out the underground water resources study of Kyaukse and part of Meiktila area and mentioned the nature of occurrence of underground water in this area.

M.L Thein and San Thu (1984) of Applied Geology Department and L. Durey (1986), UNICEF consultant, described the regional nature of underground water of central Myanmar including dry zone. In their works, hydrogeology of Kyaukse-Mandalay plain was briefly mentioned.

In all the above mentioned works, particular nature of water table and its longterm impact on the surface physical condition had not been stated. In the present study, nature of water table in the present irrigated area and its related problems are determined for the future rational utilization of underground water.

The underground water have been supplemental to the surface water resources needed for the development of social and economic condition of the local population in the study area, and thus it is necessary to know the occurrence of underground water in this area. In this present study, the main purpose is to know the water table and its distribution throughout the area.

OBJECTIVES OF THE STUDY

The objectives of water table study at the alluvial plain of Kyaukse area are performed with the following purposes:

1. To determine the position of water table, and its flow direction and the depth to the water table throughout the study area.

2. To find out the area where the water table rests at shallow level.

3. To determine the nature of fluctuation of water table near the canals and its distributaries.

4. To identify the composition of underground water, its relation to the position of water table and its suitability for the specific purposes of utilization.

To fulfill the above objectives, the research programmer had been carried out by performing field trips, monitoring of water table and laboratory analysis of the collected water samples.

METHODS USED

In the present study, the following methods of study are performed:

1. Collection of previous study.

2. Field survey and taking sample measurement by using with the GPS, Tape, Plumb bob.

3. Analysis of data using the software's of GIS, AutoCad, Arc/View, Sulfer 7.

4. Interpretation

SCOPE OF WORK

The outline of the research is to enumerate the physical and chemical nature and distribution of water table in the study area and its influence on the physical nature of the area.

PHYSICAL BACKGROUND OF STUDY AREA

Location

Kyaukse Township is situated in the eastern part of the Dry zone of central Myanmar. It is lying between latitudes 21° 26′N and 22° 20′N and between longitudes 95° 57′ E and 96° 58′ E. The township has an area of 725.278 square miles. Topography of Kyaukse Township can be divided into Kyaukse plain and the Yeyaman range. The Kyaukse plain lies within the present study area. The location of the study area is delimited the western part of the Kyaukse township

lying between latitudes 21° 26′ N and 21° 50′ N and longitudes 95° 57′ E and 96° 20′ E. It has an area of about 90.8 square miles wide. So this area has been surveyed to study the settlement area with the objective for the future water resources development of the western part of the Kyaukse Township (Figure 1.1).

Topography and Drainage

The plain is very gently inclined downward from south to north, and east to west, so that general direction of its drainage is to the northwest. It is lying above 250 feet above sea level. Within this plain, the alluvial valley area is made up of sand clay and loam.

Myitnge River, Zawgyi River, and Samon River drain in this plain. A system of canal fed by the Zawgyi and Panlaung rivers lies between the Samon rivers in the west and the Shan hills in the east. These canals are Minye canal, Thindwe canal. Htongyi canal, Pyaungbya canal, Ngapyaung canal, Tamoke canal, Zidaw canal, etc. These may be rechargeable area or replenishment area for the underground water.

Climate

Study area is one of the dry zone areas in central Myanmar. According to Koppen's classification, it has a tropical steppe climate (BSh) in some years and tropical savanna climate (Aw) in some years in the low land. It receives a total average rainfall of 27.23 inches. The average maximum temperature is 95.62°F and the minimum temperature is 66.56 °F (Figure 1.2).

Vegetation

The vegetation of the area is controlled by climatic conditions, especially rainfall. Large trees like tamarind (*Tamarindus indicus*), kokko (*Pithicolodium Saman*) and mango (*Mangifera Indica*) are thrive well under existing conditions .The species vary depending upon the temperature, water supply, soil type and relief of the area.

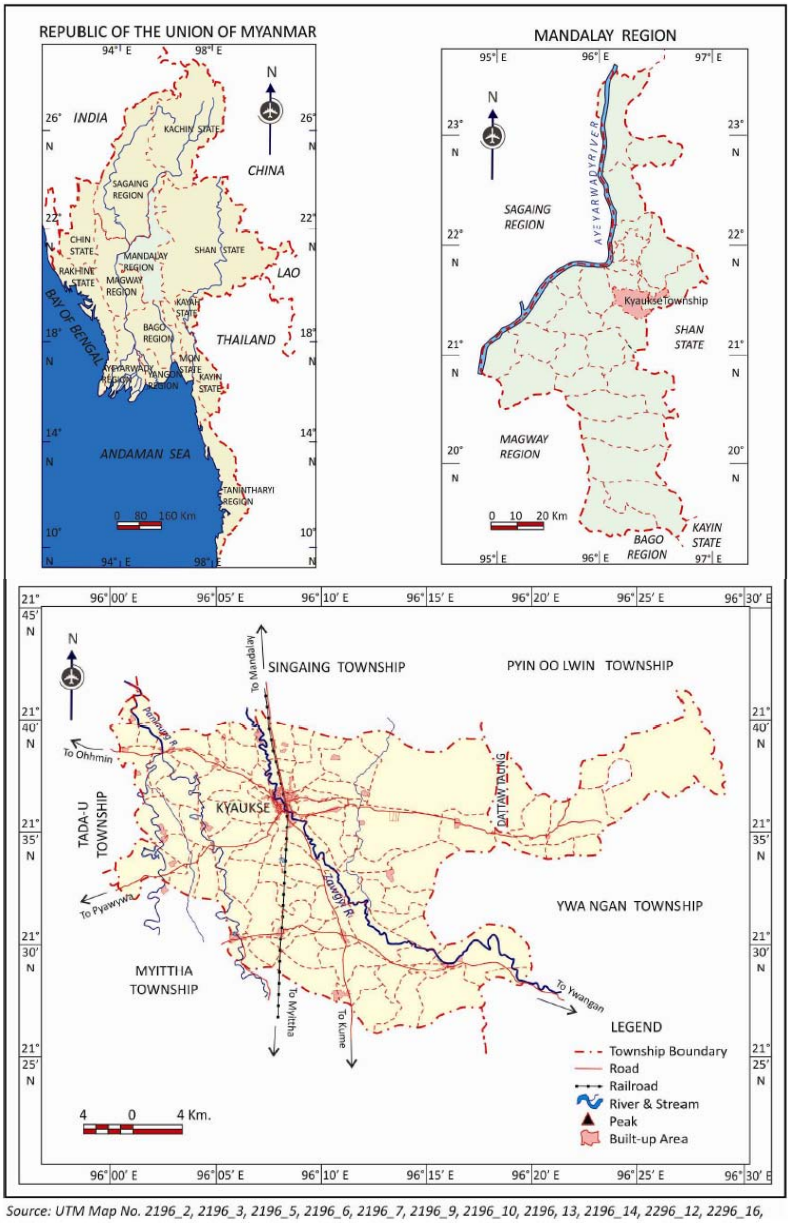
Soil

The soil cover of Kyaukse plain is complicated depending upon the geomorphologic condition of the township. The following are the main types of soils, which are found in Kyaukse Township such as Meadow Alluvial Soils, Brown Meadow Slightly Compact Soils, Alluvial Soils, Brown Compact Soils, Brown Compact Savanna Soils, Red Brown Forest Soils, and Cinnamon Soils.

Geological Setting

Kyaukse area can be divided into flat plain forming part of the long alluvial valley extending from north to south in which run the Samon and Panlaung rivers, and the lower water of the Myitnge. The alluvial valley is bounded on the west by nor th – south trending low flat ridge of upper tertiary beds which belong to the Irrawaddian rocks consisting of conglomerate, gritty sandstones and small bands of shale.

The texture is moderately fine. Metamorphic rocks are well foliated biotite gneiss forming the prominent pagoda hill at Kyaukse. Shwethalyaung hill is composed of gneiss and unclassified crystalline rocks dipping to north north-west.



Source: UTM Map No. 2196_2, 2196_3, 2196_5, 2196_6, 2196_7, 2196_9, 2196_10, 2196, 13, 2196_14, 2296_12, 2296_16,

Figure 1.1. Location Map of the Study Area.

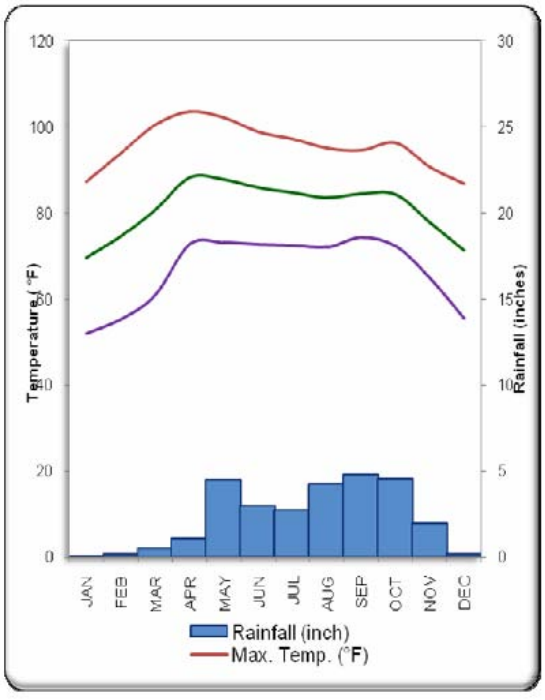


Figure 1.2. Climograph of Kyaukse (1981-2010).

Table 1. Data Climograph of Kyaukse (1981-2010).

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Avg./ Total
Max. Temp. (°F)	87.4	94	101	104	102	98.9	97.3	95	94.6	96.4	90.6	86.9	95.62
Mean. Temp. (°F)	69.7	74.7	80.95	88.4	87.6	85.7	84.9	83.6	84.5	84.3	77.7	71.3	81.09
Min. Temp. (°F)	52	55.4	60.9	72.8	73.2	72.7	72.4	72.1	74.5	72.2	64.8	55.6	66.56
Rainfall (inch)	0.01	0.15	0.46	1.05	4.44	2.89	2.69	4.21	4.74	4.51	1.93	0.15	27

Source: Meteorology and Hydrology Department, Kyaukse.

AQUIFER

An aquifer is generally a rock body, whether it may be consolidated or unconsolidated sediments, and as long as it can hold and store water and it can transmit water enough for utilization, it is termed as aquifer. Kyaukse Plain is underlain by consolidated rocks of sedimentary, metasedimentary and intrusive rocks as well as unconsolidated sediments; it

can be generalized as having two types of aquifers, viz, consolidated and unconsolidated aquifers.

Aquifer of Consolidated Rocks

The eastern part of the area is underlain by the sedimentary rocks of Prepaleozoic, Paleozoic and Mesozoic age. The area is transverse in east-west direction by the Shantaung U and Kyaukse hill, which are composed of metamorphic rocks of Paleozoic and Mesozoic age (Geology Map of Myanmar, 1977).

Aquifer of Unconsolidated Sediments

The central and western part of the area is underlain by the alluvial sediments. At the eastern periphery of the alluvial plain which is close to the Yeyaman range, a rather elevated morphology of the plain is found. In these places, the coarse sediments of alluvial fans are mixed with the sediments of alluvial plain. At the western boundary, this alluvial plain is underlain by Irrawaddian rocks (U. D. Aung Ba, 1965).

Subsurface Setting

Water bearing capacity of the rocks varies from one another depending upon the lithology of the rocks. In Kyaukse area, the alluvial sediments composing of sandy loam and coarse sands are found to possess good water storage capacity. Hence, many handdug wells and tube wells are sunk in this alluvial sediment for domestic and agricultural purposes. As these sediments are the products of fluvial processes, generally they have the nature of inconsistency in distribution. This is evident from the lithologic crosssections drawn across the area.

Subsurface cross-section (A) drawn from Kyauksaukkalay in the west and Mainban in the east which are lying in the south of the area shows that the clayey fraction is dominant in the east and gradually sandy ones increase towards west. A thick clay bed becomes wedged out towards the west having the thickness of about 150' in the east and it is found to be interlayer in the west mixing with sand layers of 10' - 20'. Waterbearing layer of gravels lies at the depth of more than 150'. (Fig 2.1) Subsurface cross-section (B) drawn at north of the area along Kyeebya in the west and Ebawgyi in the east shows that the water-bearing layer of gravels having the thickness of 10' - 30' lies at the shallow depth of 60' - 170'. It is overlain by the thick clay and shale layers. (Figure 2.2)

Based on the data of these two cross-sections it is evident that the aquifer in the north lies at the shallow depth, whereas the aquifer in the south is lying at the deeper level than the former. Furthermore, it suggests that the aquifer of gravelly sand and coarse sands are thick in the east and it becomes gradually interlayer with clay in the west.

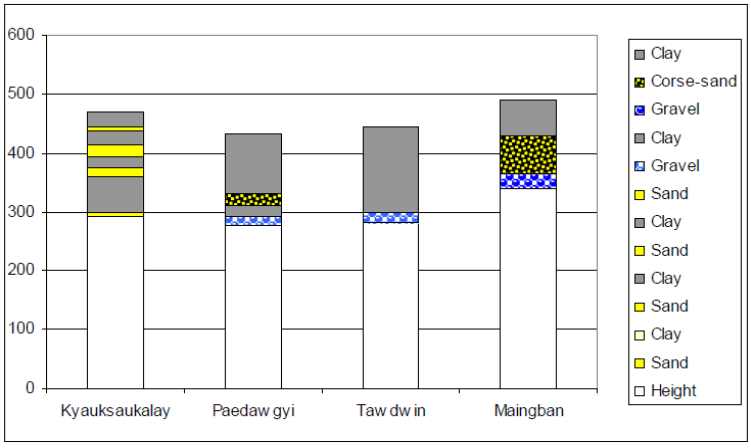


Figure 2.1. Cross-section (A) of the southern part of Kyaukse Plain from west to east.

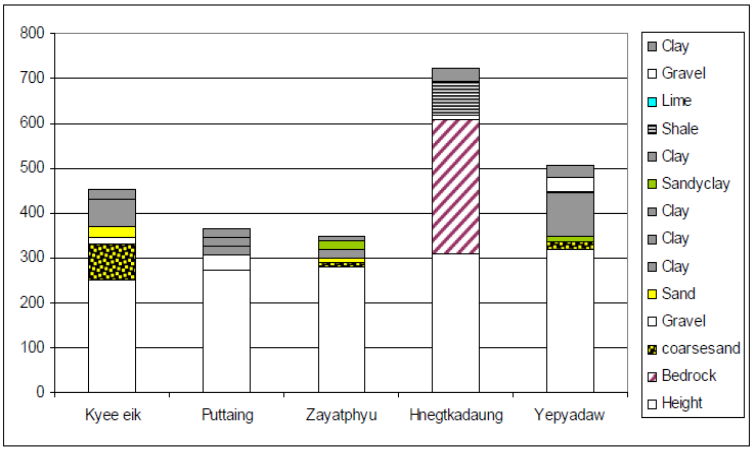


Figure 2.2. Cross-section (B) of the northern part of the Kyaukse Plain from west to east.

QUALITY OF UNDERGROUND WATER

To determine the suitability in utilization of underground water, it is necessary to know their potential as well as the chemical quality. Although there are 6 851 water wells in Kyaukse area, water samples were taken from only 64 villages which are situated in every part of our study area. Water samples were taken in September, 2005 and 64 water samples were sent to the laboratory of Water Sanitation Department of Mandalay City

Development Committee and analyzed for their TDS (Total Dissolved Solid) and EC (Electric Conductance) (table 2).Which has indicated distribution pattern of EC shows that more than 1000 micromhos/cm is found only at Thingdaung water well and the remaining ones have EC lower than that. Distribution pattern of TDS is noticed that a little higher content having more than 600 ppm and above is seen at Sulegone, Hnectkadaung and Thindaung villages and less than 500 ppm is occurred at the remaining villages. Water that contains less than 500 ppm of TDS is generally satisfactory for domestic and irrigated agriculture uses. (FG.Driscoll,1986) (Fig 3.1)

Also, 14 water samples were sent to the laboratory of Myanmar Agricultural Service (Land Use), Ministry of Agriculture and Irrigation, to analyse their chemical composition. It is found that majority of the underground water are of bicarbonate type, except in two areas such as Yanbetlo (chloride- bicarbonate type) and Shantaungu (bicarbonate-sulphate type). Thus, it is found that almost all of the underground water is of good quality water type.

The value of SAR (Sodium Absorption Ratio) of underground water falls within the range of 0.01 to 16.01. It shows that they are regarded as good quality water suitable for agricultural purposes. In almost all of the underground water, the presence of nitrate nitrogen compound is noted.

Table 2. Spatial value of TDS and EC in Study Area.

No	Village	TDS (ppm)	EC (micromhos/cm)	No	Village	TDS (ppm)	EC (micromhos /cm)
1	Yanbetlo	350	550	33	Kontha	290	310
2	Shantaungu	320	500	34	Thanmantalin	370	580
3	Pintale	281.6	440	35	Lezegon	435.2	290
4	Kobin	294.4	460	36	Legyi	236.8	370
5	Pyitawtha	307.2	480	37	Mazebin	262.4	410
6	Letpanzin	211.2	330	38	Htanaungpinhla	326.4	510
7	Kongyi	211.2	330	39	Shweda	409.6	640
8	Kade	243.2	180	40	Kyaungbankon	204.8	320
9	Bongwin	172.8	380	41	Kyakar	185.6	290
10	YemaU	204.8	270	42	Kyieik	358.4	560
11	Tawdwin	268.8	320	43	Tazo	243.2	380
12	Thanywa	116.4	420	44	Kyaukse	691.2	1080
13	Minzu	288	260	45	Paukpingwe	198.4	310
14	Kyeebya	217.6	450	46	Pegin	192	190
15	Tadale	595.2	340	47	Hnegtkhataung	806.4	1260
16	Ngetoe(east)	230.4	930	48	Sulegone	640	1000
17	Montboung	256	360	49	Thindaung	720	1152
18	Shweda	371.2	400	50	Kyetsin	140.8	220
19	Nyaung shwe	435.2	220	51	Theepin	305	1089
20	Shwein	179.2	580	52	Dan	430	671
21	Indaing	275.2	680	53	Balegwin	853.4	1333
22	Thagaya(west)	198.4	280	54	Taungnatha	1391.8	2173
23	KalaingKyaw	499.2	430	55	Ingon	935	2750
24	Shabin	595.2	310	56	Shwelay	197.1	307.8
25	Ywapale	249.6	780	57	Phyaukseikpin	1061.2	1657
26	Maingban	275.2	930	58	Zayaphyu	410.24	640
27	Phaungywa	140.8	390	59	Nyaungpinsauk	582.4	910
28	Patta	185.6	430	60	Singun	115.2	180
29	Thapyewin	204.8	220	61	Uyin	208.8	326.25
30	Paedawgyi	262.4	290	62	Taunglwe	160	250
31	Panan	198.4	320	63	Taungnaut	339.2	529.6
32	putting	371.2	410	64	Taungtaw	577.4	902.2

Source: Field survey

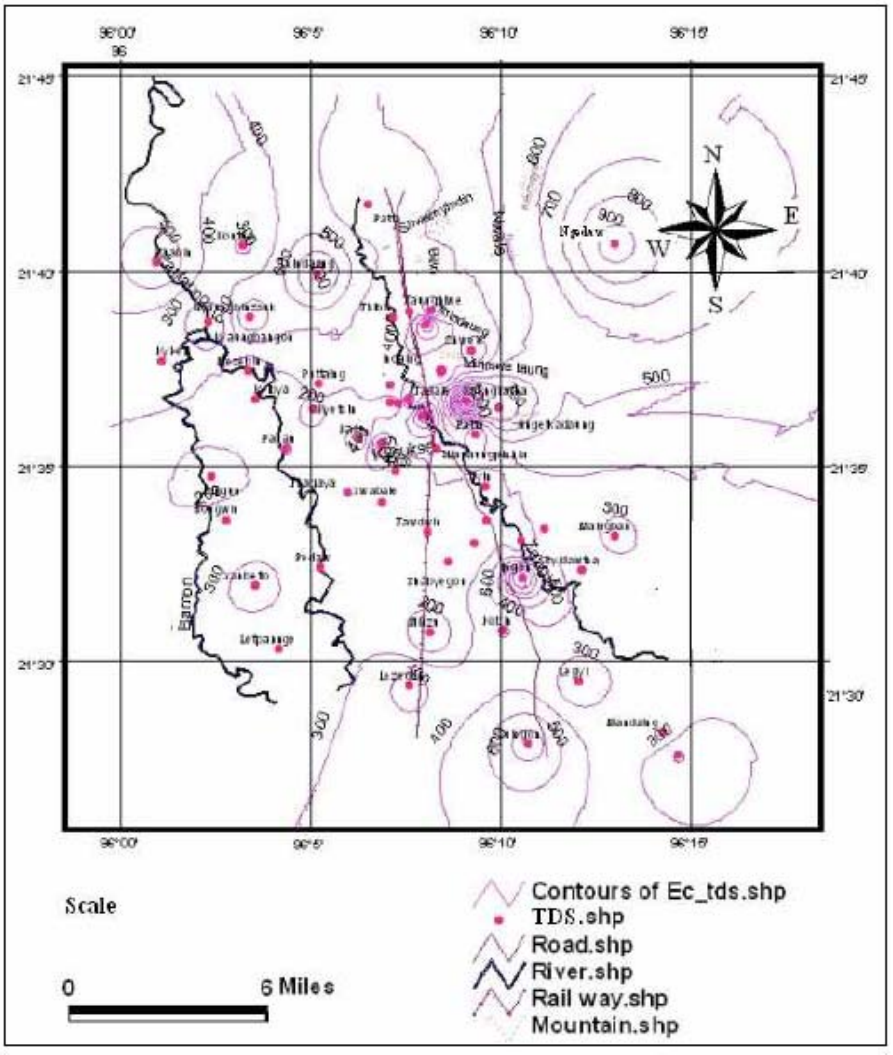


Figure 3.1. Map showing the distribution of TDS in the underground water of Study Area.

Source: Table 2

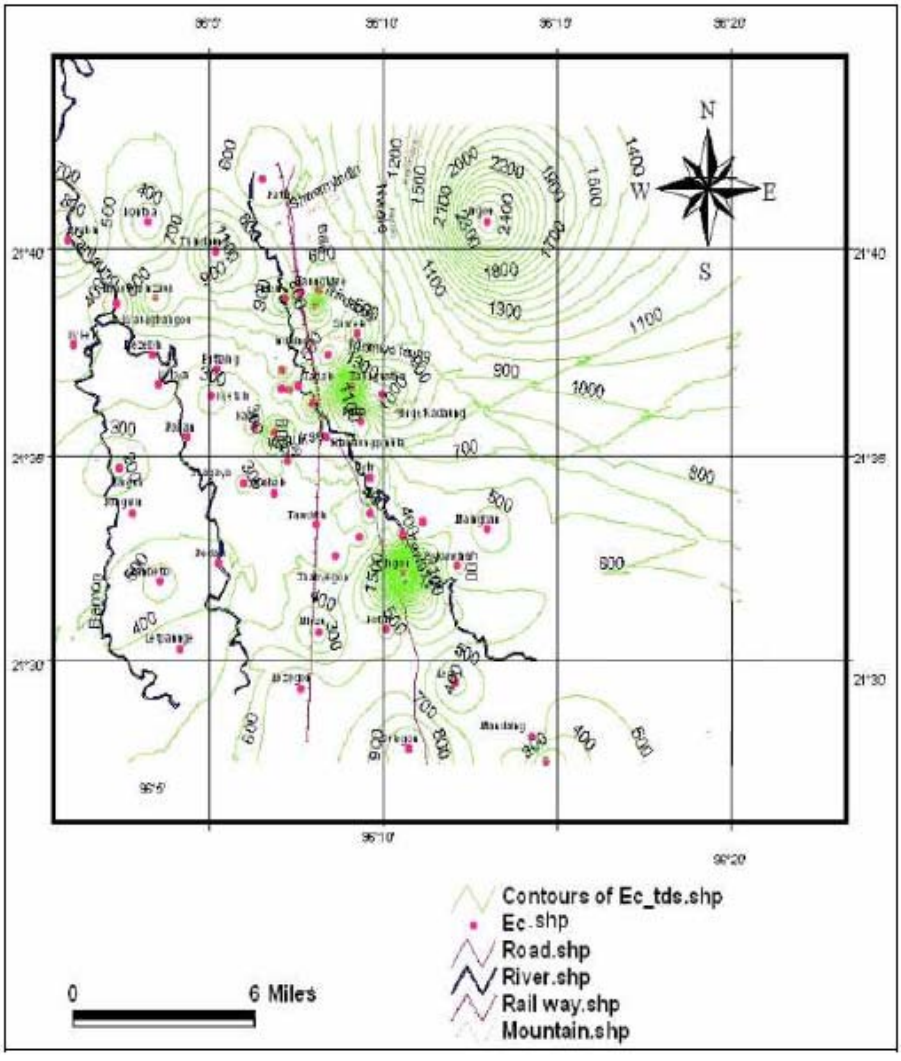


Figure 3.2. Map showing the distribution of EC in the underground water of Study Area.

Source: Table 2

UNDERGROUND WATER TABLE POSITION OF STUDY AREA

In Kyaukse area there are 6000 tube wells and 851 hand-dug wells (Kyaukse City Development Committee, 2012) . Among the tube wells, the records of only 96 wells are available and these data are used in compilation of water table contour map. Out of 851 hand-dug wells, only 36 wells are measured to know the

fluctuation of water table in some selected areas.

Water Table Contour

The nature of water table contours is shown in Figure 4.1. From this water table contour map, it is found that elevation of the water table gradually lowers towards the north-northwest direction. Some of the higher levels are found around the Shantaungu and Kyaukse hill area and it exceeds 350 feet. The shallow underground water table is found at the northwest of the area, i.e. Shabin village where water table rests at 230 feet. It is found that water table contours around Kyaukse hill and ShantaungU range are rather closely spaced than those found at the alluvial plain of western area. The fact is that in the latter area water table is sloping very gently in accordance with the surface morphology of alluvial plain satisfies the relationship of the general nature of water table position with the regional surface morphology. It is usually seen at the area where the water table aquifer of unconsolidated sediments underlies.

Underground Water Flow

In the south-central part of the area, i.e. at Paukpinkwe village, the underground water flows towards northeast and it is similar to the flow direction of Panlaung River. The gradient of the flow in the south is 1/158 and it gradually changes to 1/1372 (i.e. at Magyidaw village). Usually in water table aquifer the underground water flow is in accordance with the slope direction of the regional surface morphology (Davis, S N. And De Wiest, R.J.M., 1966).In Shantaungu south area, the grounder water initially flows towards south and it turns towards west, and then northwest direction (see Pyidawtha Ywadaw and Ywashe area). Also at Shantaungu village it flows towards west and then it turns northwesterly direction towards Shabin area. The gradient of water table at Shantaungu is found as 1/264 and then gradually lowers and becomes 1/ 1478. However it becomes 1/264, then again it reduces to 1/950 (Yanbonthit area).

At the east of Kyaukse hill, the initial gradient of the water table is 1/ 211 (Ngasu village) and it becomes 1/422 at the north of Minmwe hill. This unusual nature of gradient changes may be due to the heterogeneous nature of aquifer (Driscoll, F G, 1986) or shallow underlying of buried rock body..

At the north of Kyaukse area, the underground water flows due north. The gradient in the south is 1/105 and it gradually decreases to be 1/158 and then it becomes 1/316 - (Figure 4.2).

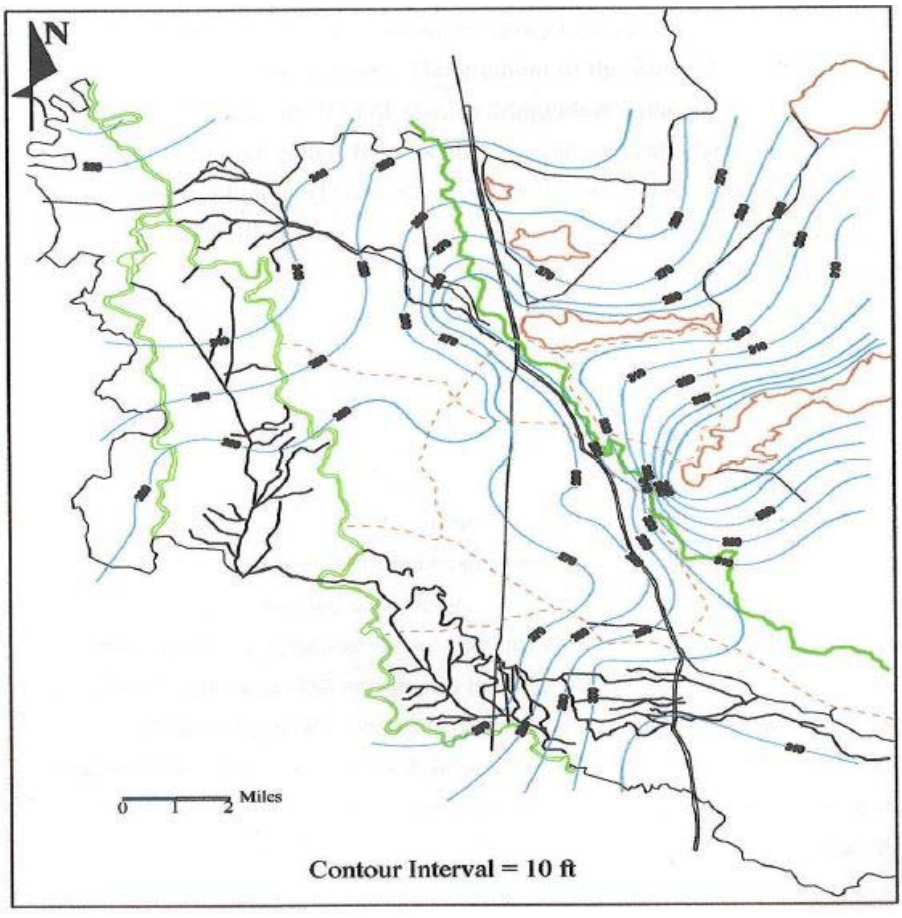


Figure 4.1. Map showing the water table Contour of Kyaukse Plain.

Source: Field survey

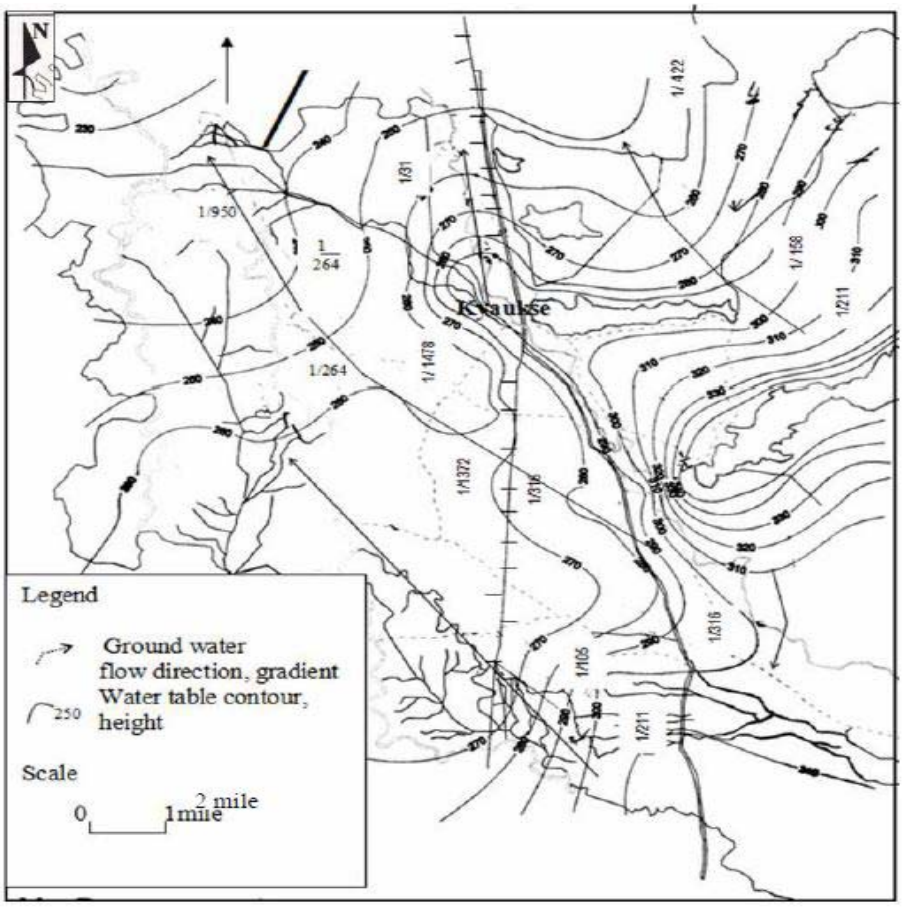


Figure 4.2. The hydraulic gradient and Ground water flows of Study Area.

Source: owned researcher

Depth to Water Table

Depth to water table map shows the spatial distribution of the depth of the water table below the land surface. The water level data measured from all wells observed for a certain date represent the upper surface of water table below land surface. (Figure 4.3)

The depth to water table is high in such areas as Yebawgyi and other villages lying at the east of the area having more than 30 feet depth water table in the wells of Thindaung, Panan and Kyieik is found to be lying at the depth of between 22 and 30 feet. This unusual nature of water table position lying at the greater depth at some localized area can be explained that Yebawgyi village is situated on the alluvial fan deposits stretching along the western part of Yeyaman range. The areas where the shallow water table lies are found at

Dandaing, Peleze, Tazoe , Minzu and Ingon villages and water table is found to rest at the depth of 6-10 feet. The depth to water table gradually decreases to 14 feet in south west direction towards Kalagyaung and to 10 feet in west southwest direction towards Thindaung north. It can be generalized that water tables lies within the depth of 6 -10 feet in Kyaukse plain.

In the study area, depth to water table can be divided into 7 zones with 5 feet intervals starting from the shallowest zone of 0-2 feet. These zones are 0-2 ft , 2-7 ft, 7-12 ft, 12- 17 ft, 17-22 ft, 22-27 ft and 27-32 zones (Fig .4.4) The shallowest zones of less than 2 feet are found at Dandaing, Minzu, Tazoe, Paedawgyi, Shantaungu, Kobin and Zale village tracts. The zone of 27-32 feet depth is found only at a narea covering Yebawgyi and Thabyewun village tracts.

Depth Zone

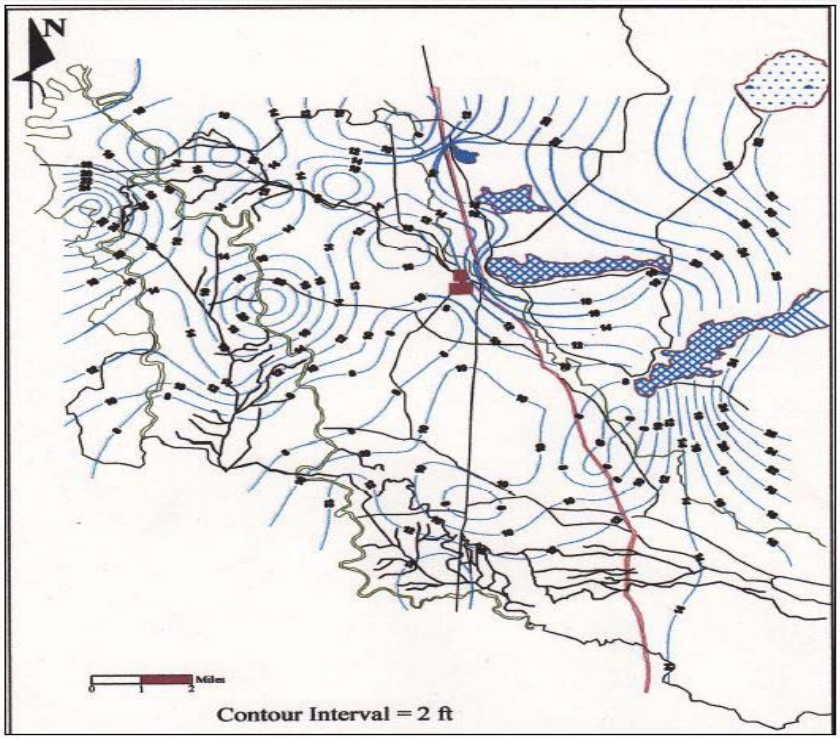


Figure 4.3. Map showing the Depth to Water Table contour.

Source: Kyaukse City Development Committee and Field Survey

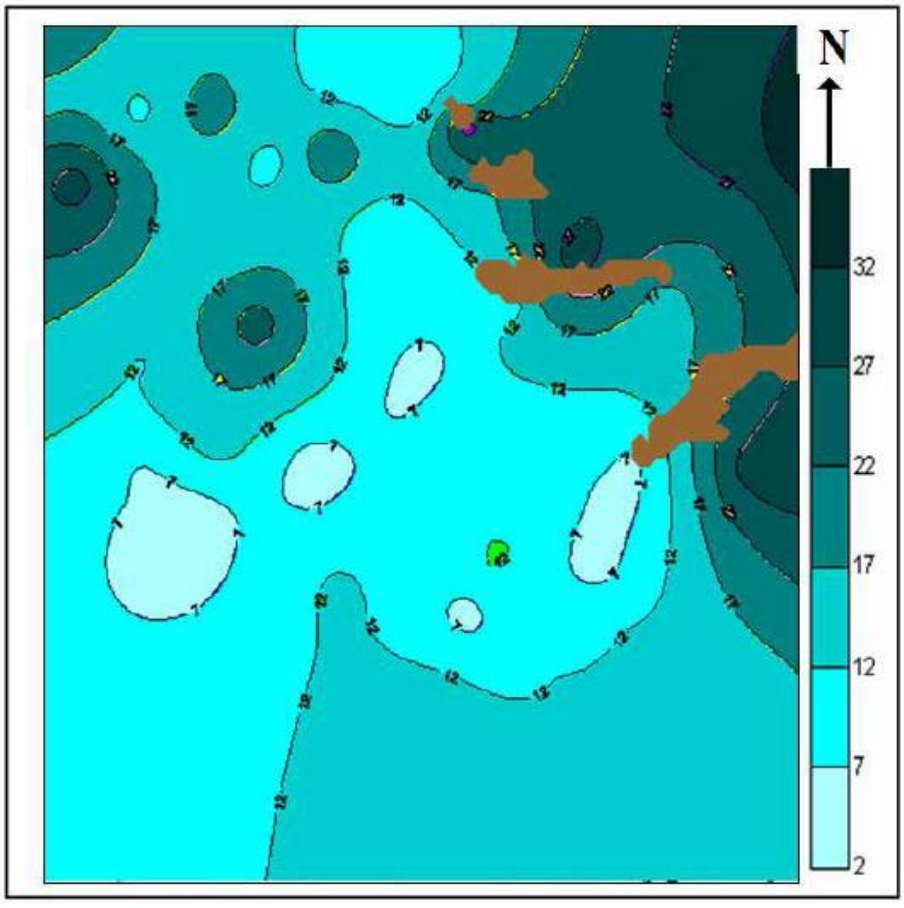


Figure 4.4. Map showing the Depth Zone of water table.

Source: Kyaukse City Development Committee and Field Survey

Fluctuation of Water Table

The fluctuation of water table aquifer in some places where the water table is lying shallow may affect the overlying soil and vegetation of that area. The nature of seasonal fluctuation of water level in tube wells of 30 villages which are situated in different parts of the study area had been investigated in September, 2005.

Observation at Villages

In order to know the fluctuation of water table in the whole area, measurement of water table was made at 30 villages during summer and end of rainy season (Table 3). These data are used for the compilation of the maps showing the lowest and highest water table position at summer and end of rainy season. Which appeared in (Figure-4.5) showing the general nature of

water table fluctuation of tube wells at some selected village tracts.

At the end of rainy season the places where the water table lies shallow i.e. 6-10 feet depth occupy the area of Panlaung valley. In summer, the water table lowers to the depth of 15 feet in that area. Thus the magnitude of fluctuation is 5-10 feet. In the northern and west northwestern area at the end of rainy season, it generally lies at the depth of 14 feet but in summer it lowers upto the depth of 24 feet. Thus the magnitude of fluctuation is about 10 feet. Thus the seasonal fluctuation of water table in these areas does not exceed 5 feet. In some cases where the water table lies at more depth i.e. 15 feet, it fluctuates up to the depth of 7feet and 2 feet at Ywapale and Kyibya respectively. It suggests the probability of more infiltration by surface water.

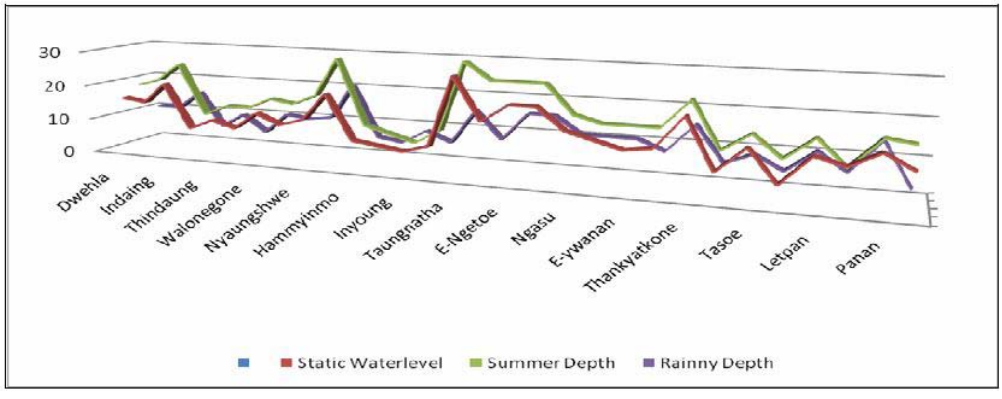


Figure 4.5. Seasonal ground water level changes in Study Area.

Source: Field survey

Table 3. Seasonal Groundwater Level Changes in Study Area.

Village	Static Water level(ft)	Summer (Depth to water level)(ft)	Rainy (Depth to water level)(ft)
Dwehla	15	18	10
Zayatphyu	14	20	10
Indaing	20	25	15
Taungnaut	7	10	5
Thindaung	10	13	9
Nyaung pinsauk	8	13	4
Walonegone	13	16	10
Puttaing	10	15	9
Nyaungshwe	12	18	10
Kyaungbangone	20	29	20
Hammyinmo	7	10	5
Kobin	6	8	4
Inyoung	5	6	8
Minsu	7	10	5
Taungnatha	27	30	15
Hnegtkhataung	15	25	7
E-Ngetoe	20	25	15
Yebawlay	20	25	15
Ngasu	14	17	10
Shanywagyi	12	15	10
E-ywanan	10	15	10
Ywapale	11	15	7
Thankyatkone	20	23	15
W-thagaya	6	10	5
Tasoe	13	15	8
Ywanan	4	9	4
Letpan	12	15	10
Mazepin	10	8	5
Panan	14	16	14
Kyibya	10	15	2

Source: Field survey

FINDING AND DISCUSSION

Based upon the mentioned facts, some following peculiarities regarding the occurrence of water table and its influence on the physical and environmental characteristics in Kyaukse area can be made.

Water Table Contour

The position of underlying water table in Kyaukse area is found to be sloping towards northwest in accordance with the regional surface morphology. In places around western foothills of Yeyaman range, Shantaungu range and Kyaukse and Minmwe hills, the water table rests at higher position than the regional level. Thus, these areas can be regarded as recharge area of aquifer by the seasonal surface run-off.

Underground Water Flow

The underground water flow is described and it can be generalized that more or less it follows the regional drainage pattern. This fact is supported by the changes in gradient of flow on the same path.

Depth to Water Table and Depth Zone

As mentioned, water table is generally found to be at the depth of 6-10 feet, except in a few localized areas having less or more than that. The deep lying nature of water table is totally influenced by the surface morphology. Thus, differing nature of depth to water table is present.

The shallow zone of water table lying less than 2 feet may be represented by the presence of ponds, lakes or swamps on the ground surface. If the water table lies at the depth of less than 2 feet, water logging problem will be encountered. In waterlogged soil, water rises to the root zone of the plants, retarding their growth.

In irrigated areas, if the water table is lying within the depth of 10 feet or 3 meters, it can be sometimes dangerous to the agricultural fertile lands Thus, in Kyaukse area, proper attention should be paid to this factor in planning for sustainable development of the land resources.

Water Table Fluctuation

Seasonal fluctuation is high in elevated area of alluvial plain. These areas are recharge areas of the aquifer through which rain and surface runoff infiltrate to the underground water. In the plain area having water table of less than 10 feet in summer, it fluctuates up to position of 5 feet below the surface at the end of rainy season. Based on the water table position at the end of rainy season in villages, it can be deduced as follows;

1. At the end of rainy season, the water table rises up to the depth of within 5 feet at Minsu and Kobin village tracts. It indicates that it has much potential of damaging soil fertility due to capillary rise and in some places there will be problem of water logging.

2. At the same time, the zone with the water table of less than 7.5 feet shows an oblong shape having the shallowest place at Minsu and Kobin and trending northwest-southeast direction. At the northern part of the area at the village tracts of Thindaung- a zone of similar nature has been noted. In this area if the capillarity rises up to its maximum limit, it will possibly be carrying salts upwards and harmful to surface condition.

3. If the water table lowers down with 5 feet from the highest position (i.e. Minsu and Kobin) the resultant zone forms as that of Panlaung and Samon alluvial plain. If the recharges by irrigation return water and surface drainage in surplus amount, the water table rise upwards and it will probably cause the damage to the fertility of soil.

4. Assuming that water table lowers 5 feet depth at summer, the zone having water table less than 5 feet at the end of rainy season will have the water table lying less than 10 feet depth . Thus, the village tracts of Minsu and Kobin have much tendency to deteriorate the soil fertility due to the fluctuation of water table for the whole year (Figure 5.1).

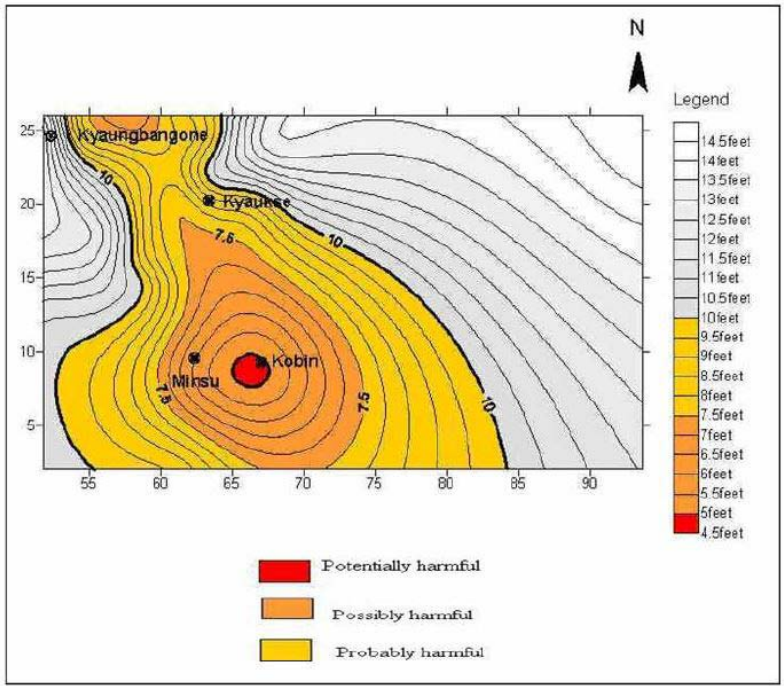


Figure 5.1 Water table position at the end of rainy season showing future expected deterioration of soil fertility.

Source: Field survey

CONCLUSION

Kyaukse area, lying in the eastern periphery of dry zone of Myanmar is insufficient in natural water resources. If the underground water can be used as an alternative source, it will solve the problem of water insufficiency in the area. To attain such objective, it is necessary to know the nature of underground water occurrence, water table condition and its related problems.

Physical characteristics of the area i.e. area lying in the Kyaukse plain proper which the present study is solely paid much attention to indicates that the water needs are very important for the development of the area.

The elevation of the water table gradually lowers towards the north-northwest direction.

The areas of closely spaced water table contour are regarded as recharge area of the aquifer.

This unusual nature of gradient changes may be due to the heterogeneous nature of aquifer or shallow underlying of buried rock body or presence of some topographically elevated areas in alluvial plain.

The areas where the shallow water table (6-10 feet) lies are found at Dandaing, Peleze, Tazoe, Minzu and Ingon villages. In this area of shallow water table position which is less than 10 feet, the occurrence of surface water body and swamps are found.

Hence, it has to summarize and generalize that water logging problem exists in topographically depressed area and locally in these areas of shallow underlying water table which may hinder the healthy growth of crops contamination by pesticides and pollutants from industrial sites can be expected in such area as Kyaukse plain where water table lies shallow.

Measurement of water table was performed at 30 villages during summer and at the end of rainy season. Thus, the range of fluctuation is about 10 feet. Thus, it has also to conclude that the above said physical deterioration will be encountered at places where water table lies within 10 feet depth.

Based upon the peculiar nature of the underground water table and other characteristics of the water table aquifer, it is recommended that future rational planning for water resources utilization should be made for sustainable development of the area.

ACKNOWLEDGEMENT

First and foremost, I am indebted to Dr Khin Maung Oo (Rector, Yadanabon University, Amarapura Township) who has supported to attend in this conference. My deep gratitude is extended to Dr Maung Maung Naing (Pro-Rector, Yadanabon

University) for his sincere cooperation. And also I would like to express my special gratitude to Dr Than Than Win, Professor, Head of Geography Department, Yadanabon University for her guides and permission. I am always deepest thank to Dr Maung Thin (Rtd., Rector, Dagon University and Yangon), for his teaching and guides.

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