DECLARATION

It is important to declare that where and what I have done in my internship program. I have done my internship program in central Gondar zone water irrigation and energy development department hosting company in order to have practical knowledge and skill. So, my declaration describes about what I have done during my staying of an internship program in CGZWIEDD.

Student name: AMANUEL BERHE

Signature …… Date of approve…….

Approval of the supervisor

I approved the student that has worked in our organization for four months and he has done all the tasks that has been given by the company's supervisor.

Name of supervisor: MOGES

Signature …….

Date of approve……..

ACKNOWLEDGEMENT

First of all I would like to thank my GOD who is the beginning and the end of my work for his support throughout my life. then after before starting my report I would like to say thanks to my families for their help and also thank to Central Gondar zone water Irrigation and energy Development department that makes me enjoy this chance and helps me to fulfill my task. Especially my University makes this great luck to develop my theoretical knowledge in practical work. This is the special time in my life to me what my working life looks like.

Finally; I would like to thank all who support me either directly or indirectly during my internship time.

EXECUTIVE SUMMARY

The goal of this project is giving an immediate solution of the severe quandary of water supply and sanitation system of Kuma rural town. A study and design of the system have been carried out and presented in this report. The report includes the result of the study and design of the water supply system in five chapters with its detail descriptions. In the introduction part it is tried to see the necessity of safe water for life and the essentiality of designing water supply scheme.

According to the socio-economic data, the base population that the project integrates is 2,439 accordingly the total projected population at the end of the design period is calculated to be 3,110.

Demand projections were also made throughout the design periods. The major modes and levels of services considered are public fountains (PF) and Yard connection (YC) .The maximum day demand, Total day demand and peak hour demand at the end of the design period is estimated to be 1.7l/s, 1.34l/s and 2.7l/s respectively. The water source for this project is Deep well located Easting 313378, Northing 1354987 and elevation 1795.and $50m^3$ Ground service reservoir location Easting 313918.2, Northing 1356276.481 and elevation 1837.425 Total dynamic head 134.4m,well depth 120m, pump position 99 m, Dynamic water level 57m and well discharge 22 l/s from this 2.5l/s will be pumped by using submersible pump .the system of the project is well up to reservoirs by using submersible pump with 9..2kw and also 25kva generator. After reach the service reservoirs the water pump by gravity system to the community.

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ABBREVIATION

CSA …….. Central Statistical Authority

L/s ……..... Liters per Second

L/c/d……Liter Per Capita per day

M3/d ……. Cubic meters per day

Amsl …….. Above mean sea level

BH…… Boreholes

DN…… Nominal Diameter

PN ……. Nominal Pressure

ID……inner diameter

ETB…….. Ethiopia birr

CHAPTER ONE

1. Introduction

1.1 General

In order to ensure the availability of sufficient quantities of good quality water, it becomes imperative in a modern society, to plan and build suitable water supply schemes, which will provide potable water to the various sections of the community in accordance with their demands and requirements. Since there is no modern constructed schemes of existing water supply system that is able to satisfy water demand of the community and also considering the above stated facts, N/Gondar Water Resources Development Department has studied and designed of the Small town water supply system namely Kuma Small town. This report presents the results of the study and design on water supply, sanitation and hygiene of the above mentioned town carried out in accordance with the scope of works with the following two main objectives:-

- To conduct feasibility study on the water supply system in order to improve living conditions of the population in the study area by enhancing the level of water supply services in terms of quantity, quality and its accessibility.
- To formulate a plan for diffusion of sanitary facilities in order to improve environmental sanitation this will be able to prevent the contamination of sources and to secure safe water supply.

The aim of the report is to collect, review and analyse data on the new water supply system, to prepare a preliminary design, discuss options, water supply system of the Small town to the year 2018 and to propose implementation for the water demand up to the year 2033

1.2. Brief History of the Hosting Company/CGZWIEDD

One of the governmental developmental organizations established to improve the living standards of peoples of the region with respect to food self-sufficiency, water shade management, and water supply and sanitation projects by use of water and land resources

is Central Gondar zone water Irrigation and energy development department which was established in the government of dreg around 1980.

The Amhara National Regional State water resources development bureau (ANRS BoWRD) is one of the leading public enterprise which supervises zone and woredas water supply, irrigation, urban drainage design and supervision service etc. and Central Gondar Water irrigation and energy development department is one of the departments which included in Amhara national regional state water resource and development bureau. From 1994-1999E.C it was under Agricultural and Rural Development Department as water desk. Then, from 1999-2002E.C it

Becomes Central Gondar Water Resource and Development Department branch office still now.

- This branch office has established with the following core process,
- Planning, monitoring and evaluation unit/process
- Water resource management core process
- Water supply and sanitation core process
- Irrigation and drainage study and design core process
- Mining Resource &Development Core Process
- Energy Resource& Technology Promotion process

Currently (CGZWIEDD) water supply is supervised by city council of Bahir dar, the Amhara national regional state government and the federal government is understood not to hold any direct ownership. It is somewhat unclear as to how this is organized. The office water service is organized as an autonomous public organization under the administration of the town. The office has responsibility for the production, transmission, distribution and sale of potable and sufficient water to the town.

1.3. Objective of the study

The main objectives are:

- to bring about an increased and sustainable supply of clean water for the rural areas through the use of indigenous renewable energy resources (solar & wind) as an alternative to fossil fuel driven pumps at lower financial, economic, environmental and social costs.
- to bring about sense of empowerment to the rural communities on technology selection, operation and maintenance of systems installed in their areas;
- to accelerate the employment of solar and wind energy systems as an environmentally friendly energy resources on the everyday life of the rural people.
- to adopt appropriate policies that facilitates the widespread use of solar and wind technologies for water pumping and for other rural applications such as for lighting and other home appliances on sustainable basis.
- to stimulate private sector involvement in the procurement, installation, O&M and funding of systems.

1.3.1. Project Objectives

Design the water supply system using deep well source to meet the water demand of Kuma small town from the year 2018 to the year 2033 and improving the health status by recommending sanitation facilities.

The general objective of the project is to provide safe, adequate and sustainable water supply to KUMA Rural kebele Towns by using deep well as a source which is located waste of the village which can be delivered to the project area by pressure.

The implementation of this project is expected to improve the standard living of the people residents in the project area thereby the provision of adequate and safe water supply for at the next 15 years. The report covers,

- General Background
- The Existing Water Supply System
- Population and Water Demand

- Water Resource
- Descriptions of Proposed Scheme

1.3.2 Mission

To render construction of rural pipe system timely and with reasonable cost.

1.3.3 Vision

To see all rural towns and communities are satisfied by using clean water to eliminate water born diseases and eradicating poverty by using irrigation in the next 40 years.

1.3.4 Goal

Improve the current critical water shortage & at the same time ensure the future water demand and decreasing poverty.

1.5.5 Value

The cores values that govern north Gondar water irrigation and energy development Department are: -

Professionalism, sound ethics, integrity, fast track to occurs innovation, quality first and detest Corruption to excel customers demand and expectations.

1.3.6 Slogan

Every drop of water has a value.

1.4 The main products and service of the company

This is the department that stands to avoid poverty and hunger, to address water coverage and water quality of the zone 100%, to insure food security, to create job opportunities for non-employers and to bring sustainable development by performing the following activities.

From water supply and sanitation core process of view ,

- Identifies and selects potential water source areas in Central Gondar Zone.
- Study and design work of the water distribution system.
- Operation and maintenance work of non-functional water institutes.

- Water quality and risk assessment works.
- From water resource management process point of views
- It collects data of different water institutes, metrological data, measure Seasonal and perennial discharges of surface water source /river/.
- From irrigation and drainage study and design core process points of view; it performs study and design works of small scale irrigation schemes to cultivate command areas twice and more per year.
- It identifies and delineates potential areas of different type of mines.
- It prevents over use of different mines and it also creates job opportunities for non-employers.
- It also performs promotion supply and distribution works of different technologies associated with energies like solar energy and biogas technology.
- To cultivate climate change.

Generally, the department is a part of water resource and development bureau executes law and rules of the federal/ministry of water supply and energy and water resource development bureaus. It also gives long-term and short-term trainings for expects in all division of the department by collaborating with water resource and development.

1.5The main Customers of the company

- Zone population
- Local, Non-Governmental Organization (NGO) and governmental organization
- Contractors
- Local artesian
- Woreda town water supply and sewerage services
- Different woredas and kebeles which occurs in Central Gondar Zone as a whole

1.6 Core value of the company

- Customer oriented
- Team work (motivation, dedication etc.)
- Honesty

- Equitable service
- Transparent
- Reliable service
- Accountability

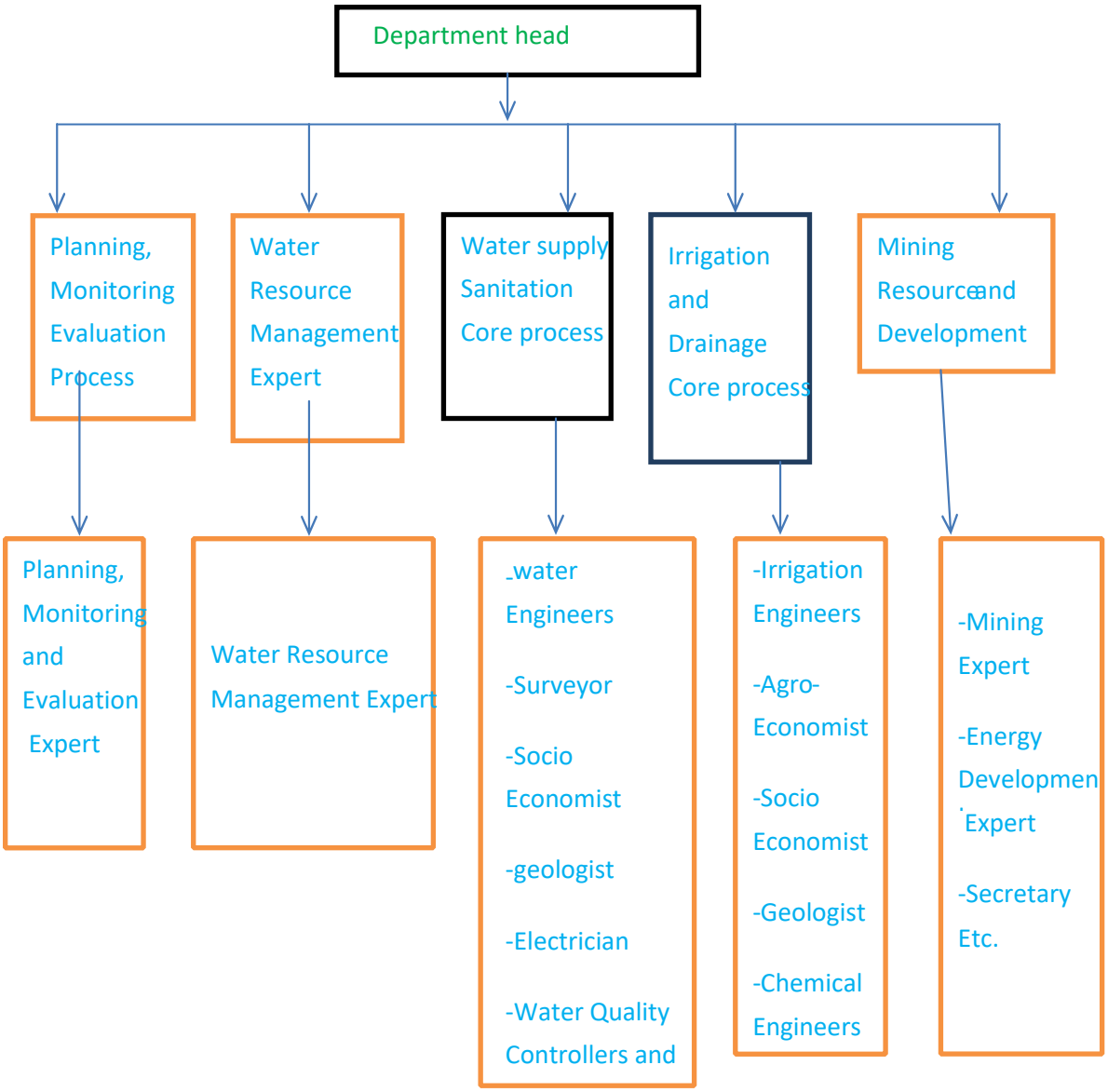
1.7 The main products of the company

- supply drinking water in quality &quantity
- operating and maintenance
- To make water supply service potable, permanent, reliable by increasing the capacity of the correlated demand progressive demand
- Water supply constriction
- Irrigation construction

1.8 End users /Customers

- People who are living in kuma
- City municipal
- Governmental organizations and institutes
- Non-governmental organizations and institutes
- Private sectors and Individual

1.9 The overall Organization and work flow in the company s



1 Figure 1work flow of the campany

CHAPTER TWO

2. OVERALL INTERNSHIP EXPERIENCE

2.1 How I get in to the company

The company in which I have done my internship program for four months' duration is that Central Gondar Zone Water Irrigation and Energy Development Department.in order to get this company I have done different process as follows;

The University Industry linkage (UIL) office announced the students to search the company that could host our internship program. By the time, we finished the second semester of third year; I have started searching Hosting Company. Having the application letter to get the possible host company (enterprise)

Finally, I had wasted much of my time in searching another company, which can host me but, I did not get, finally thanks to the university industry linkage head who asked for cooperation to different organizations which are governmental and nongovernmental to accept me for my internship program and the CGZWIEDD is the only willing company to host me.

After this we go to the company and asked the manager to start our internship program, but the company manager says it has two different project types water supply and Irrigation so on which type you are need to work. I select the water supply project and start my internship program on 15/07/2011 E.C

2.2 The section I have been working in the company

In general, the company that I have stayed for four months has an existing water supply system. so, I have seen on the site that existing structures like source/deep well, generator house, public fountain(bono) …etc. but on other hand I have been working and discussing in the office in such activities like ;

Forecasting population using different methods

Design of distribution system by using software

Selection of source criteria

Pipe materials and their selection …etc.

2.3 General work flow in the site

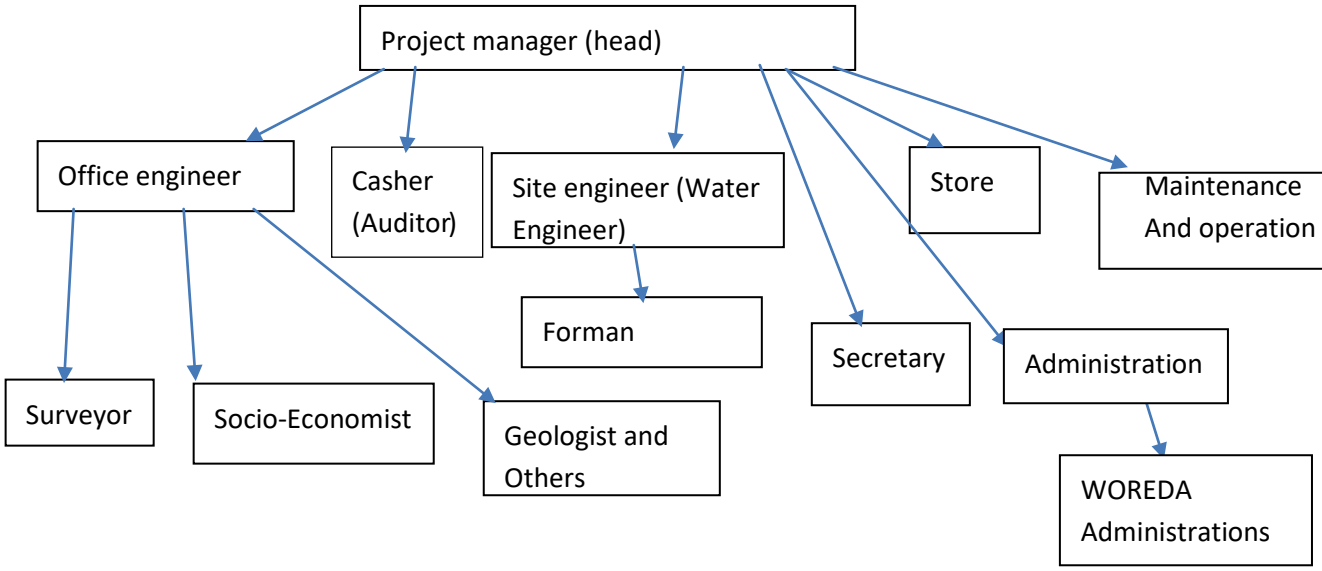


Figure 2 work flow of in the site

The work flow in (CGZWIEDD) is multi directional that means they participate in different category. Major Works Executed by each Category

2.4.1 Project manager:

The project manager manages the whole projects through the project site organization

He Controls the overall activities being undertaken in the site. He organizes different components of the site and assigns different professionals such as Engineers, Forman and others to the components. Project manager controls and allocates different resources to the various sections of the site. Among these he deciding on how much workers should be included under each Engineer or under each Forman, deciding on monthly budget and distribution of budget, deciding on the distribution of construction materials through different components. He organizes and prepares meetings with different stake holders in the site. By doing so one can evaluate the performances of the site, discuss on problems and create ideas on how to solve those problems, talk about the future plans and schedules.

2.4.2. Site engineer:

Site engineer in construction has a responsibility to make sure that the work is implemented based on the design and based on specifications used by the company. He communicates with the office engineers and construction engineer if the design has to be modified and orders the Forman to make it implemented. He visits the site on day to day basis for the purpose of making sure that the work is flowing as planned.

2.4.3. Office Engineer:

Collect data on the site from data collector or surveyor and compile these data and make report to the Project manager and make detail drawings to be easy for construction and installations and provides them to the concerned section.

2.4.4. Foreman:

Acts as an agent's right hand man for the execution of the work in the field, his duty being to keep the work moving ahead daily as the agent has planned it. The foreman has much authority on site and since long experience of construction any junior engineer could learn lot.

2.4.5. Administrator:

Administer the workers (employees), takes care of the employment of new workers and checks the working performance and punctuality of the workers with the time keeper.

2.4.6. Finance:

Takes care of monthly salary (fee) of the employees, finance the purchasing of requested materials.

2.4.7. Store keepers:

Controls the amount and type of material of the construction Entering and leaving from the store by preparing some forms.

2.4.8. Data collectors:

Collect the daily data about the work being done. Like: the type, the executed amount, the different materials and equipment's used to execute the work, and also the different trade labors participated on the specific work.

2.5 Work tasks that I have been execute

Work piece/tasks that I have been executed during my internship period where divided in to two sections office work and site work

2.5.1 Office work

Pre study of manual how the water supply can design

Population forecasting & demand estimation

Connecting pipe using WATER CAD soft ware

How to organize and change the raw data for design

Demand analysis by using WATERCAD Software

2.5.2 Site work

On the site work I have seen different components of water supply system and understand how each component should be operating to yield the required amount of water for customers, those founds on that specific area.

2.6 procedures and methods when I performed my tasks

To perform my tasks effectively and efficiently, I have used the following procedures and methodologies.

- By preparing time plan and scheduling for each office and site work
- By asking the site engineer for any un clear ideas
- Read different documents which helps to my tasks
- Doing any exercise which given by the supervisor
- At the end he corrects me that I made errors during my design

2.7 Challenges that I faced during my internship period and measures taken

During my internship period the following are the main obstacles that I faced and their measures.

During site visiting, the company does not have sufficient transport but the sites are far from the hosting company.

To solve this problem, I use my own money for transport and walk along distance.

The company do not have sufficient computer to practice about how to design water supply project using different software.

to solve this problem, I brought laptop from my friend

At the start of my internship period there is a lack of responsibility in office engineers and project manager in giving guidance and assistance in related with site works.

To overcome the problems in office I take many conversations with the project manager and office engineer to solve the problems and finally we arive an agreement. After that they start giving guidance, advice and showing all things related with the project.

Simple works take more time

To overcome this problem we tell for the project manager as a comment to improve for the next.

There is no equipment facility, instead there are many works to be done in equipment's but man power did instead of equipment's

this problem must be improved by buying of equipment's

Due to the presence of assembly for our site engineers there is shortage of time to visit the site.

To solve this problem, we have use break days (Saturday).

CHAPTER THREE

3. RESEARCH METHODOLOGIES

3.1 Project title: Design of kuma water supply Project

3.2 Short summary of the project

3.2.1 Location

The town Kuma is located in North Gondar Administrative Zone in Amhara National Regional State, the study area is located about 65 km from the capital of the Zone Gondar town and also 15 km from the woreda town Kolla diba .It is situated in Dega climate area .The road from Gondar to the study area is Asphalt road,. When compared to the town & population size, the water supply and sanitation system is not adequate. Hence to assure its progress a potable, reliable and adequate water supply system, sanitation and hygiene must be established and should be constructed.

3. 2.2 Topography and Climate

The study area occupies flat area in the Southern part and mountainous terrain in the Northern and Eastern parts. Kuma Small Rural town is situated in kola climatic group. Rainfall of the locality and air temperature in general characterizes climate of the area. However, additional factors like sunshine hours, humidity, wind speed, etc. has impacts on the two climatic parameters. Temperature is varying in every season to season. The mean monthly temperature of the area is 300c. The rainy season usually appears from May to September and has the mean annual rainfall of the town is 700-1200 mm. The town is found an average altitude of 1795m above mean sea level.

3.3 Socio-Economic Characteristics

3.3.1 Economic Activities

The investigation of socio-economy as it has conducted a sample survey, the main and the largest occupation of the head of the households in the Small town is Farming and the private business is the second while the rest are Government & public Employee, daily labourer, and unemployed etc.

Table 1main occupations of family heads

No	Main Occupation	Percentage share
1	Private clinic	3
3	Farming	45
4	Government Employee	10
5	Daily Laborer	36
6	Small traders	6
Total		100

3.3.2 Income

To roughly see the level of the community's cash earnings the socio economic survey has made an inquiry about the household's monthly cash income. The result of the sample survey is presented in table.2

Table 2Households Monthly Income Categories (source: Keble administration at year 2017)

No	Monthly Cash Income range	Percent Household
1	Less than 1000 Birr	24.17
2	1001- 2000 Birr	40.36
3	2001- 3000 Birr	10.78
4	3001- 4000 Birr	17.39
5	Above 4000 Birr	7.3
Total		100

3.4. Power and Communication

Kuma has no electric power supply, school, police center, ACSI, Agricultural development and sub Municipal found in the small town the community are communicated only Mobil. The study area is accessible from Gondar town to the study area has an average altitude of 1795m.

3.4.1. Education

In Kuma there is one Primary school now. So the school is served in the present water source. The number of students and the no teachers are presented in the school are listed in table3-3 below.

Table 3Number of students and teachers (at year 2017)

Item No.	Sex	No. of Students	No. of teachers or staffs
1	Male	75	5
2	Female	86	7
Total		161	12

3.4.2 Health and Hygiene Condition

Health infrastructures are the most crucial element for the development of an area. The number of health institutions as reported by the health office head, there is only one government health centre. This health centre provides medical services for the Kuma town and the surrounding town pastoralists/farmers. The ten most prevalent disease in the area as reported by the health centre head is Eye diseases, Jardia, few areas malaria, Common cold, skin diseases, pneumonia, ,parasitic diseases, Acute fabric illness, Urinary infection, Ear problem

Table 4Percentage coverage of the top ten diseases as reported by the Health Centre

Item No	Type of Diseases	Kuma	
		No. of people	Percent
1	Eye disease	204	6
2	Jardia	408	12
3	Infection of the skin	510	15
4	Malaria	1496	4
5	Ear diseases	204	44
6	Infection of the skin	136	6
7	Amoeba	102	3
8	Unitary infection	170	3
9	Ascaris	68	5
10	Gastrit	102	2
Total		3,400	100

3.5. Problem statement and justification

On this project some problems are faced

Firstly, there is the problems of getting reliable information (data).

The problem of putting the structure, it has some problems as computing with the drawing

The problem of rain

The problem of getting a sustainable power supply source

3.6. Objective of the project

3.6.1. Main objectives of the project

- To provide potable water supply for the existing resident of one village. i.e. kuma
- To improve the living standard of the community there by increasing the awareness towards the community using safe water
- To improve the health and hygienic standard of the community
- And to distribute the water for each house used for;
  - ✓ Drinking
  - ✓ Washing
  - ✓ Livestock
  - ✓ Fire protection
  - ✓ Parking etc…

3.7 Methodologies

3.7.1 Procedures that followed to Design kuma Water Supply Project

3.7.2 Population projection

In order to predict the future population, as correctly as possible it is necessary to know the factors affecting population distribution, size and growth rate of a certain area. The major factors that accounts for changes in population are births, death and migration. All these factors are influenced by social & economic factors and conditions prevailing in the various communities among which the important ones are: -

Family planning practice

Education and awareness

Development & advancement of medical facilities

Industrialization & commercialization of the area

Factors like war and natural disaster

In addition to the above factors some of the elements often taken into consideration in population prediction are economic activities in and around the study area, availability of potential natural resources including land for development, topographic suitability, the status of the area in the region i.e. its political & economic importance, relative position of the area with respect to main roads, availability & reliable infrastructure facilities along with proper management policies.

The above varying factors make the task of predicting future population very difficult. As it is very difficult & time consuming to evaluate all these economic & social factors, it is more common to rely upon mathematical formula based up on previous population records.

During preparation of a water supply system one must recognize that the various water supply system units are adequate to serve the present as well as the future population. Therefore, accuracy in population projection is one of the important parameter, which greatly influences system unit capacity. Knowing the base population of the area along with some indications on future growth trend would enable to design a reliable and sustainable water supply system. Adopting erroneous and non-reliable base population figure and formulating nonrealistic growth rate assumption would lead to either overdesigned scheme which has an impact on capital investment cost or under designed scheme which does not serve the purpose it is planned.

3.7.3 Base Population

Even though, the central statistics Authority (CSA) is recognized in Ethiopia to determine the official population figures and growth rates that should be taken for any development activity throughout the country, Keble Administrators also count population periodically. The data obtained from Kebele Administrators of the project area is tabulated below. In this project the kebele administrator data is taken because of the number of immigrants to village becomes increasing years to years as it is a new village.

Table 5Population data obtained from Keble administrators (2017 G.C)

Source	Year	places	No. Population		
			Male	Female	Total
Keble administrator	2017	Kuma	1,865	1,129	2,994

3.7.4 Design period

Generally the design period of water supply system is determined by considering the following facts:-

Funds available for the construction of the project

Useful Life span of materials that are used in the water supply system

Rate of interest on the loans taken to complete the project

Operation & maintenance cost

Anticipated expansion of the population

Kuma Keble is rural villages and based on the above-mentioned facts, 15 years design period is adopted (2018 – 2033).

3.8 Population forecasting

After the design period has been fixed, the population of the study area in various periods has to be determined. The World Bank Cost Effective Design Guide line has established growth rates for different regions of the country both rural and urban.

From this the rural growth rate of Amhara region is selected for this project area which is 2.1% is recommending

METHODS

The following are the common methods by which the projection of population is done

1. Arithmetic increase method

It is a simple method of population for casting and it gives lower results. This method is used based on the assumption that the population is increasing at a constant rate.

Basically this method is most reliable for cities which have reached their maximum development (for large & old cities which have stabilized).

2. Incremental increase method

In this method the population in each successive future decade is first worked out by the arithmetical increase method and to these values the incremental average per decade is added. Since the method combines both arithmetic as well as geometric increase method, it improves the few results that are obtained by arithmetic increase method. Hence it is more accurate and correct

3. Decrease rate method

In this method the average decrease in the percentage is worked out and is substrates from the lowest percentage increase is calculated. After this is so obtained is subtracted from the latest percentage increase for each successive periods. This method is applicable only in the case where the rate of growth of population shows a down ward trend.

4. Geometric increase method

For such developing Villages, population geometric progress method is the commonly used formula to forecast the population at the end of n years.

$Pn=Po\ (1+r)\ n$

Where: Pn=population at the target year

Po=present population

r=annual growth rate in % n=design period in year

Table 6Projected populations for kuma rural town

Year	2015	2030
Growth rate (%)	2.1	2.1
Total population	1315	1797

Therefore, the projected population at the end of the design year (2030) is 1,797

3.8 .1 per capital water demand assessment

In the design of any water supply project it is necessary to estimate the amount of water that is required to satisfy and serve up to the end of the design period. This involves determining the number of people who will be served and their per capita water consumption, together with an analysis of the factors that may operate to affect consumption. The major factors that affect amount of water usage are:

- Location and climatic condition
- Standard of living
- Pressure in the distribution system
- Cost and quality of water
- Installation of water meter
- Time taken to fetch water from the service center
- Efficiency of the water service administration etc.

From this the major types of water consumptions considered for kuma kebele rural piped system design purposes are discussed below.

3.8.2. Domestic Water demand

Domestic water demand includes water for drinking, food preparation, washing/bathing, cleaning, watering lawn and other various domestic purposes.

Domestic water consumption varies according to mode of service, climatic condition and Socio-economic factors. Tropics Consulting Engineers, 2003 and World Bank, 2006 recommend domestic water demand for the year 2003 to be 16l/c/d and 25 l/c/d for the year 2033.

The water requires for drinking, cooking, bathing, gardening, sanitation, purpose, it depends on the living standard of the consumer. The domestic water demand ranges from 20 l/pc/day for developing countries like Ethiopia to 350 l/pc/day for developed. In the case of kuma small village the water usage is estimating the domestic water demand: by considering Domestic water demand for the given categories of consumer, to satisfy people demand well and to design system components economically. Because of shortage of clear consumptive data 20 lit per capital per day demand was taken for designing this water schemes.

Dwd=projected population X average adjusted per capital demand

Using the above formula, the present and projected year domestic water requirement of the Village was calculated to be 1,797*20l/ca/day =35940l/day or =35.94m3/day

3.8.3 Mode and Level of Services

Modes of services commonly prevalent in most Ethiopian towns are classified into five categories

Traditional Source users [TSU]

Public tap users [PTU]

Neighborhood tap users [NTU]

Yard tap users [YTU]

House tap users [HTU]

Because kuma is a small rural town we only considered public tap user based on socio economic data of the town.

3.8.4 Adjustment factors

Climatic adjustment factor

The town is situated is kola the mean annual rain fall is about 700-1200 mm. The mean monthly maximum air temperature ranges from 29 to 38 o C during the dry season and to

23 to 27 o C during the wet season. On the other hand, the mean monthly minimum air temperature reaches 21o C in the rainy season and only 22-23 o C in the dry season.

So, by considering this value for Kuma village, the annual rain fall is 700-1200 mm. Which is found above 901mm, the project area belongs to the climatic group C.? Thus, an adjustment factor of 0.9 is considered.

Table 7Climatic grouping and factors

GROUP	Mean annual precipitation	Factor
A	<600mm	1.1
B	601-900mm	1
C	>900mm	0.9

Source WSSA, 1982

Socio economic adjustment factor kuma rural village can be considered as an area having a very high potential for development but lower living standard at present and based on this it is categorized in group D with a Socio economic adjustment factor of 0.9.

Table 8Adjustment of socio economic factors

Group	Description	Factor
A	Towns enjoying high living standards and with very high potential for development	1.1
B	Towns having a very high potential for development but lower living standard at present	1.05
C	Towns under normal Ethiopian condition	1.0
D	Advanced rural towns	0.9

Source WSSA, 1982

3.8.5 Projected domestic water demand

The demand calculation based on the previous steps is summarized in table below.

The following table presents summary of the results on population projection, percentage of population served by different mode of services, Water demand determination and its growth in the expected service year of the new system and the calculated adjusted average domestic demand in litter per second

Table 9Summary of Adjusted Domestic Demand

Demand category	Year				
		2018	2023	2028	2033
Domestic daily demand	m3/day	62.94	73.42	85.46	99.24
	l/s	0.73	0.85	0.99	1.15
Climatic adjusted factor		0.90	0.90	0.90	0.90
Socio Economic Adjustment factor		1.00	1.00	1.00	1.00
Adjusted domestic demand	m3/day	56.65	66.08	76.91	89.32
	l/s	0.66	0.76	0.89	1.03

3.8.6 Public water demand (Pd)

Under this category includes water furnished to Institutional and commercial establishment such as offices, stores, airport etc. to determine the quantity of water require as there is no clear consumptive data for each public Institutional of the area, but by gathering rough information on the site we have consider the required water demand for design purpose as 10%Dwd for this project. Pwd= 10%Dwd

3.8.7 Animal water Demand

In the town and the surrounding area there are many livestock of which the exact number is not known. Livestock found in the town and the surrounding area includes cattle,

sheep, goats and horse. They require too much water for their drinking purposes. Consideration of animal water demand in the design will make the water supply system costy, hence the usual way of using rivers / ponds for livestock drinking purpose is assumed in this study

3.8.8 Fire demand

A quantity of water required for extinguishing fire should be easily available and always kept in storage reservoir. Since the village is small additional reserve water for the fire demand is not necessary. By stopping the supply to the consumer it is better to satisfy the fire demand

3.8.9 Unaccounted water or Water Loss (UL)

All water leakages in the system and unauthorized connections are categorized under unaccounted for water. This includes:

- Leakage and Overflow from service reservoir,
- Leakage from mains and service pipe connections
- Defective pipe joint, cracked pipes,
- Loose valve and fittings.
- Under registration of supply meter and premises of consumer to get unmetered supply
- Wastage from public tap.

Loss will be minimal at the beginning of the design period and will increase gradually with time in the expected service life of the new system unless intermediate leakage detection & subsequent remedial work is carried out. It is logical to presume an increase in water loss with time in designing water supply system. Due to a new establishment of water supply system for the village sufficient data concerning the loss could not be assessed clearly here. Hence unaccounted water for this design purpose is considered in terms of a certain percentage of the above water demand considers (domestic &public water demand). In this design aspect 10% is assumed.

Uwl=10 %(Dwd Pd)

Where: - Uwl=unaccounted water loss

Dwd=domestic water demand

Pd = public demand

Therefore; the base year (2017) water losses is 2.34 m3/day and the projected year (2030) water losses estimated are 3.20 m3/ day

3.8.10 Total Average Daily demand

This demand is considered to be the sum of domestic demand, public, animal, firefighting demand and system water losses. In this case, livestock and fire Requirements are assumed to be null.

3.8.11 Variation of water use

The rate of water use varies from season to season, day to day and even hourly. Water requirement in dry seasons is more than wet seasons. The use of water is also more during weekends than working days. More water is also required at rush-hour when people come back from work than normal working hours. Therefore, to satisfy this variation of demand the average day demand is scaled up by certain factors to get the maximum day demand and peak hour demand. These scaled up water demand figures are used to size or determine the capacities of Pump stations, reservoir, rising main and distribution networks.

Maximum daily demand

The ratio of the maximum daily consumption to the average annual daily consumption is the max day factor and the factor varies from 1.2 to 1.3, (MoWRD, 2006). For this specific project, 1.3 is taken to be economical for design purpose. This demand is used to design source capacity, riser mains components and pump capacity

Peak hour demand

The peak hour demand is the highest demand of any one hour over the year. It represents diurnal variation in water demand resulting from behavior patterns of the local

population. Usually the peak hour demand is significantly influenced by the size, mode of service and social activity patterns of the town.

Both the maximum day demand and peak hour demand factors are determined by the number of population.

The population of the project village is about 1739 which are in the range of less than 20,000. Therefore, depending on the information the peak hour factor is taken as 2.

3.9 Service Reservoir

3.9.1 General

The number and size of service reservoirs are often determined based on number and sizes of the defined pressure zones, topographic suitability, and size of the area

Selected for reservoirs construction, and the volume of water which has to be stored for demand fluctuation purpose.

Service and balancing reservoirs are often determined using different methodologies. The most appropriate and economical approach is to carry out a 24-hour supply and demand simulation and then produce the corresponding design mass curve. But in order to be able to produce such types of curves and generate design curves it requires reliable historical data on hourly water demand variations of the town. In the absence of such type of information the best but simplified approach, which commonly practiced in many water supply studies, consider certain percentage of the maximum day demand. The stored volume is considered to be sufficient enough to serve the town at least for about 12 hours pump failure time and to balance the demand fluctuation during peak hours.

3.9.2. Service Reservoir Necessity

Water is stored for several purposes and the following functions are fulfilled by storage or service reservoirs.

- To equalize supply and demand over a long period of high supply.
- To furnish water for such emergencies as firefighting or accidental break down.

- It reduces the size of purification facilities and the number of wells required/water sources/.
- It reduces the necessary capacity of high rate pumping equipment's.
- It reduces the size of the transmission mains.
- It makes uniform pumping rate possible.
- It reduces friction head losses
- It provides uniform water pressure
- It reduces operating cost by operating pumps at the rate for maximum efficiency.

Water already pumped it to the elevated tank is more certain of availability that water at the lower level.

Reservoir capacity is determined on the following basis

Balancing storage: - is required to equalize between the fluctuations of demand rate with constant rate of pumping.

Break dawn storage: - This is the amount of storage down during the failure of power supply or break down of pumps. The period against which it is stored is difficult to ascertain and storing cannot be done for a long period, as that will make the reservoir capacity uneconomically large.



.Figure 3GROUND RESERVIOR

3.8.3 Design capacity and location

The capacity can be analytically determined by finding out maximum cumulative surplus during the stage when pumping rate is higher than water consumption rate and adding to this maximum cumulative deficit which occurs during the period when the pumping rate is lower than the demand rate of water.

The capacity also determined by drawing mass curve of water consumption rates and pumping or supply rates. Even though the capacity of the service reservoir is determined by the above two methods, mostly, the capacity/volume/ service reservoir is taken as one third or 30% to 50% of the maximum day demand at the end of design period for the small towns or villages(according to world bank design guideline). The average day demands of the Kuma small town are 150.7 m3/day Maximum daily demands. So based on one-third estimation is 50.23 m3. Take standard capacity of 50m3 Ground reservoirs UTM location of Easting 313918.203, Northing 1356276.481 and Elevation of 1837.425 above MSL.

3.10 Proposed scheme description

3.10.1. GENERAL

A design period of 15 years in one phase is considered for the design of the proposed scheme as it is rural piped water supply system. The proposed water supply structures

For these villages is Deep wall development, 50m3 Ground Reservoir, Distribution line, pump, electro mechanical works and public fountains. These proposed water supply structures should be constructed at selected sites and fenced properly the reservoir and public fountains.

3.10.2. WATER SOURCE

The adequacy of water *source* to meet the water requirement of the Town population till the end of the design period is an important factor to be considered in rendering sustainable water supply service. The borehole is located at Easting 313378, Northing 1354987, and Elevation 1795, well yield is 22 l/s from this 2.5l/s and the maximum day demand of the town at the end of the design period 2033 is estimated to be 1.7 l/s. This signifies that the source satisfies the community water supply demand throughout the design period.

3.10.3 Bore hole

The deep well is located 1.5km far from the project area Location and other necessary borehole data are shown below.

Table 10 bore hole detail

Source	Easting	Northing	Elevation		Depth of	Pump
Deep Well	313378	1354987	1795	22	120	99

3.10.4 RISING MAIN

The raising main is designed to convey economically the required maximum day demand and borehole capacity by considering 8 pumping hour. Water will be supplied from the bore holes to 50m^3 ground service reservoirs. The raising main will be Medium class HDEP pipe DN 54.5m OD 63mm with a total length of 1250.

3.11 Distribution system

The distribution network is designed in such a way that it safely and economically accommodates the Peak hour demand of the year 2033. The layout of the distribution network has been prepared based on the existing settlement pattern and topographic suitability. As per the design criteria, the following guidelines are maintained in the analysis of the distribution network.

During Peak hour flow velocity shall be between 0.3 and 2.2 m/s during minimum consumption water shall not be stagnant in the distribution network In the simulation of the network system, the demand at each node is calculated based on the information gathered regarding the future development trend of the town and the estimated population density. The hydraulic network diagram system for project area as shown on the layout drawing including minimum demand (night time) and peak hour demand (day time) conditions were carried out using the software called WATER CAD Software . Specific print outs of simulation results covering minimum and peak hour consumption periods are attached in annex A and schematic layouts showing the proposed pipe distribution network are presented in the drawing.

Therefore, providing pressure break tank at two locations is essential so that the pressure will be below 70 mH_2O as a result HDPE pipe with PE100 and PN 10 in the Hydraulic design

The Hazen Williams formula will be used for the hydraulic design of pipe lines. The roughness coefficient (Hazen Williams coefficient –HWC) used in this formula is dependent on a number of factors, including the type of pipes, corrosiveness of the water and the age of the installation. New Ferrous pipes, which are not subjected to corrosion, will remain relatively smooth with a HWC value in the range of 120mm. However the roughness is greatly affected by corrosion. Mains which will be subjected to a slight to moderate degree of corrosion are expected to have a HWC value approx. 100mm after some years of use. Therefore, the appropriate value of HWC will be adopted for the design of transmission mains. It is recommended that flow velocities in the transmission

mains remain in the ranges of 0.6 to 1.5m /s although in exceptional conditions it can raise up to 2m/s.

Pipe Material

The choice of pipe materials is dependent on the following criteria:

- Chemical nature of the soil
- Chemical nature of the water to be transported
- Comparative cost of alternatives
- Weather conditions of the area
- Formation of the pipe route
- The overburden pressure

HDEP pipe is recommended for transmission main lines and for all size of distribution lines for the proposed project. The inlet, outlet and washout pipe at service reservoirs is designed to be HDPE pipes. There are different types of pipes such as, Galvanized steel pipe (Gs), polyvinyl chloride (Pvc), poly ethylene (PE), High density poly ethylene (HDPE)…etc.

HDPE pipe is recommended for our proposed site. Due to the following characteristics:

- Cost effectiveness
- Abrasion resistance
- Corrosion and chemical resistance
- Long term durability
- Light in weight



Figure 4 HDPE pipes

3.11.1 Location of pipe lines and Pipe lying`

In determining the layout of the distribution system attention is given to the development of the rural town. Pipe lines should be laid at the edge of the road and farming lands instead of in the road itself. All distribution lines have on average a minimum of 90cm soil cover. Pipe lines are usually installed under the ground surface in a properly excavated trench. Trenches should be wide enough to allow good workmanship. Trench width should be 60cm. An extra width of trench on each side will also be required for ease in making the joints. Appropriate bedding material has to be provided between the rock and the pipe. Backfill material should be free from refuse or large stones. Backfill from the trench bottom to the Centre line of the pipe should be by hand with sand, shell, or other satisfactory material.

Table 11Summary of Pipe Diameter and Length

S/N	Diameter (mm)	Pipe type	Length (m)
1	OD 25	HDPE	198.120
2	OD 32	HDPE	570.281
3	OD 40	HDPE	429.463
4	OD 63	HDPE	20.726
5	OD 75	HDPE	4.267
Total			1,222.858

3.11.2 Public Fountains

Four public fountains are located in the selected areas of the rural town to ensure that each customer will be within 500 to 1000 meters walking distance. Each public fountain should serve about 300 households or 150 families. Each fountain will be fitted with water 4 taps and water meter and should be located within a secured compound.

Table 12Summary of Pipe Diameter and Length

Position of public fountains

Public fountains	Northing	Easting	Elevation
NWP-1	1356164.918	313772.223	1835.889
NWP-2	1356400.009	313762.921	1828.862
NWP-3	1356224.583	313557.112	1823.566
School NWP	1356345.059	313554.892	1820.726

3.12 Power supply

The main power supply to the borehole site is a diesel engine pump which has a pump power of 4kw.there is a submersible pump in the deep well at a depth of 160m which is used to suck water from the well to the collector tank.

CHAPTER FOUR

4. THE OVERAL BENEFITS GAINED FROM INTERNSHIP

4.1 BENEFITS GAINED IN TERMS OF UPGRADING THEORETICAL KNOWLEDGE

The internship program played a major role to me be strong enough in upgrading my theoretical knowledge through practice. It enables them in showing brightly the application of each theoretical knowledge in the real world.

Both theoretical and practical experiences go hand in hand, i.e. one can't stand by itself. Knowing the practical world has helped me to expand my range of knowledge.it helps to visualize while performing theoretical tasks.

During my four months' duration in kuma water supply project, I have upgrade the following theoretical knowledge:

How to forecast future population

Water demand analysis

How to design distribution system

It provides the ways of academic achievements

Selection of system components and their criteria

Pipeline materials and selection

4.2 In terms of improving practical skills

Understanding of the design of water supply project by computer software and other drawing is very difficult for someone who does not see the practical work. Before the internship program it was difficult for me to understand such designing and drawing. During this time, I understand and interpret such design efficiently. I got the following practical skills from the internship program

The ability to analyze and interpret complex data

I know how I can select pipe materials on market practically

How the desired site is selected

To create awareness on the wider impact of our work

Effective assessment and management of risk, resources and time.

4.3 In terms of improving industrial problem solving capability

This internship motivates me to be employee because it enables me to know more about my career, the real challenges, and ways of business establishment in my profession.

As I get from internship program I have developed the ability to design any water supply project concerning safety and economic activity. So in the future I can solve industrial problems by designing and constructing water supply project to fulfill industrial consumption of water.

4.4 What I gained in terms of team playing skill

Engineering work requires a team work in order to be done effectively with in its own time. While I was in internship program, I have worked with different persons having different knowledge, skill and attitudes. Therefore, in this way I have attempted to improve my team playing skills.

In my four months' duration, I have got the following a team playing skills while solving problems encountered in work areas that I gained.

Team playing skill makes me to build my confidence to accomplish my works

I have developed the habit of cooperation and working jointly to solve problems with engineers and others.

Strengthen my participatory skill, so that I played my own share in the process of solving problems.

I have developed the capacity to share ideas and the habit to work jointly with the project site workers to solve problems encountered in the work area to improve society satisfaction.

I have developed idea sharing with other university intern students about works which we have executed.

Develop great sense of tolerance.

How to solve engineering problems

Generally, I have improved my team work playing skill when I was working, going, sharing, and high commitment with other team work I have gained the ability to work together with other workers they increased my efficiency.

4.5 What I gained in terms of leadership skill

Leadership is the ability to influence a group toward the achievements of goals.

Good leadership have the following characteristics,

Being role model to workers

Motivate and encourage others

Knowing management system

Laying out action plan

Controlling and organizing things in the company.

During my internship program I under stood the following leadership skills from the leader:

Labor allocation: -every works cannot be done by one person.so the leader of the work should give responsibility for selected men and the main responsibility of the leader should be coordinating of these assigned persons.

When I see the work done by this man someone can conclude that the project will be fall in economical and mental crisis because every work is done by direct recommendation of one person. If this person is not available some one cannot do that work by taking the responsibility from these I understood that good leadership allocate the work of the

project for different responsibility workers of the project. The main work of this man is coordinating and monitoring the allocated persons.

Generally, a good leader allocates his work for other persons and he monitor and manage the efficiency of their work. When I say this it means he/she assign responsibility for different persons but the overall responsibility falls on leader, that means at any work he/she may participate especially when problem is happened.

He makes free discussion with workers: -The leader of any project should discuss with his or her workers about the work. This gives several advantages for leader from these the following are the main.

- The problem in work may raise during discussion
- Solution for the problem may suggests
- Source if the problem may be known during discussion
- Develop the habit how to decide for critical works.
- Develop how to lead a team and manage large projects.
- Develop my work ethics values like responsibility for the work.
- Develop transparency to workers of the company.

Generally, a good leader discuss with his workers in order to improve his drawback.

Respecting his workers: -A good leader should respect his/her workers.in other word any command should be done politely and it should have democratic base. That means work should be done by negotiation of the leader and the workers.

4.6 Benefit gained in terms of understanding about work ethics

Work ethics are very important medium for the peaceful coexistence of the society and the safety working environment in the project site.

Work ethics means the moral principle that should be observed and respected by the professionals in work area.

Any work can have its work ethics that means any work cannot do without its work ethics. Before I went to the internship program I am not understand about work ethics but when I was attending an internship program I understand work ethics such as:

- Develop motivation and good work habit
- Listening the idea of colleagues and trying to be as positive as possible
- Develop the habit of commitment and readiness to give concern customers interest certain positive and related attitudes towards important value such as civility, politeness, honesty etc. in work area and out work area.
- Develop common value out looks in work area, compromise tolerance and diversity among colleagues.

Develop the habit in provision of well standard service to the customers.

Create awareness about some of the common ethical principles which apply across different disciplines in work areas like; punctuality, impartiality, transparency, avoiding potential or apparent conflict of interest, honesty and accountability.

Respecting rule and regulation of the company

Develop friendship with the work partners

To develop my personal behaviors.

4.7 Benefit gained in terms of entrepreneurship skills

The word entrepreneurship can be defined as the process of creating new things and entrepreneur is the person who creates or invents something new. but the entrepreneur may not be necessarily creator or inventor.in general, entrepreneurship is important for both individuals and country levels.

During the internship program, I have tried to gained some entrepreneurial characteristics from those who are professional in the project work.

- Decision making capability
- Hard working habit

- Self confidence
- Motivated to solve any case which related to water supply projects

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1 Conclusion

This program is very important for me;

In giving clue (hint) about what real working environment looks like.

In deciding what will be my future stream (flow) of work

Learn practical considerations for water supply construction

Upgrade my theoretical knowledge and visualization

Learn about project evaluation and cost management

It uses me to upgrade my ability

And this project gives special ways to solve water shortage problem or balance and increase supply of kuma small rural town

The internship period is very effective because of I gained important and useful skill.

5.2 Recommendations

When students joined to their hosting company for internship program or field practice the company should encourage them and should give an attention up on the students in order to grasp all point what they need and to make them more effective, productive and competitive for the future.

The Company is not affording the students who are coming for the internship program

No payments for the students from the company

Students are traveled by their own cost to visit the site.so I recommended that the company should give a service and afford the students.

The company manager also aggressive to communicate especially to students but he should be sociable and should have good conduct.

Sometimes there happen also design problem as I have seen on the drawing some missing data, so they should be design correctly.

Sometimes there is disagreement between the workers and also the consultant and contractor side

There is no safety materials during construction (work). this may cause damage the workers, so there must be safety materials during construction.

On site recommendation: the people (workers) on the side of contractor are not taking a care for materials as well as for structure to be constructed; this must be given attention from project manager

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