USAID
FROM THE AMERICAN PEOPLE

USAID Mekong Adaptation and Resilience to Climate Change (USAID Mekong ARCC)

Water Supply Assessment in Kok Klang Village, Thailand

USAID Mekong Adaptation and Resilience to Climate Change (USAID Mekong ARCC)

Water Supply Assessment in Kok Klang Village, Thailand

Program Title:	USAID Mekong Adaptation and Resilience to Climate Change (USAID Mekong ARCC)
Sponsoring USAID Office:	USAID/Asia Regional Environment Office
Prime Contract Number:	AID-486-C-11-00004
Contractor:	Development Alternatives Inc. (DAI)
Subcontractor:	Bryse Gaboury and Claire Benveniste, Advancing Engineer Consultants
Submission Date:	February 20, 2015

This publication has been made possible by the support of the American People through the United States Agency for International Development (USAID). It was prepared for USAID Mekong ARCC by AEC (Advancing Engineering Consultants). The contents of this document are the sole responsibility of AEC and DAI and do not necessarily reflect the views of USAID or the United States Government.

FOREWORD

In December of 2014, water engineers from Advanced Engineering Consultants, an engineering and construction consulting firm based in Phnom Penh, conducted feasibility assessments in USAID Mekong ARCC target villages in Khammouan, Lao PDR and Sakon Nakhon, Thailand. The purpose of the assessment in Khammouan was to identify small scale infrastructure investments that would increase village water supply. The recommendations in this report served as input into efforts of project implementing partner, International Union for Conservation of Nature (IUCN), Lao PDR, to develop practical and beneficial village-based solutions in support of the communities' current and future water needs. In Sakon Nakhon, IUCN, Thailand utilized results generated by this report to support the ability of villagers in the Kok Klang community to clarify with local level government their village water needs and potential means that these could be addressed through local level planning and financing.

TABLE OF CONTENT

1. INTRODUCTION 1
2. EXECUTIVE SUMMARY 1
3. DESCRIPTION OF THE WATER SYSTEM 3
3.1 Northern sector 5
3.1.1 Used storage tanks in the South of the Northern sector 6
3.1.2 Abandoned storage tank in the South of the Northern sector 6
3.1.3 Northern abandoned storage tank 7
3.2 Central sector 7
3.2.1 Storage tanks / School water supply 8
3.2.2 Storage tanks 10
3.2.3 Main supply pipe 11
3.3 Southern sector 12
3.3.1 Protected well 13
3.3.2 Storage tanks 15
3.3.3 Mi Sung pond 16
4. EQUIPMENT AVAILABLE IN THE AREA 17
5. RECOMMENDATIONS 18
5.1 Water committee 18
5.2 Mi Sung expansion 19
5.3 Other recommendations 20

LIST OF FIGURES

Figure 1: Water distribution sectors in Kok Klang 4
Figure 2: Northern distribution sector 5
Figure 3: Storage tanks of the Northern sector 6
Figure 4: Too high storage tank in the South of the Northern sector 6
Figure 5: Abandoned concrete storage tank, in the North of the village 7
Figure 6: Central distribution sector 8
Figure 7: Elevated storage tanks located next to the school 9
Figure 8: Low and elevated storage tanks of the school 9
Figure 9: Sophisticated water supply system for the schools use 10
Figure 10: Storage tanks in the Central distribution sector 10
Figure 11: One of the highest Eastern springs 11
Figure 12: Water collection system 11
Figure 13: Leaking junction between two pipes 11
Figure 14: Connection to the main pipe 11
Figure 15: Head of the main pipe 11
Figure 16: Main pipe junction 11
Figure 17: Main supply line of the Central sector 12
Figure 18: Low point of the Central supply line 12
Figure 19: Southern distribution sector 13
Figure 20: Submersible pump in the protected well 13
Figure 21: Hose connected to the submersible pump, providing groundwater from the protected well. 14
Figure 22: Pump out of service 15
Figure 23: Highest storage tank next to the well 15
Figure 24: Storage tanks next to the well 15
Figure 25: Lowest storage tanks next to the well 15
Figure 26: Storage tanks in the Southern supply sector 16
Figure 27: Mi Sung pond 16
Figure 28: Water storage tanks 17
Figure 29: Submersible pumps 17
Figure 30: PVC pipes 17
Figure 31: Mi Sung pond ongoing enlargement 19
Figure 32: Southern distribution sector 20

1. INTRODUCTION

The overall goal of this water assessment is to provide recommendations for an improved water management in Kok Klang village, located in North-East Thailand, Sakon Nakhon Province. This assessment mostly consisted of a 2 days field visit, carried out on December 12 and 13, 2014 by two water engineers. The specific objectives of this visit are listed below:

- Understand the topography of the area and the main water issues encountered,
- Give an opinion on the existing plans of the community to improve water management,
- Suggest additional solutions to improve water supply and management.

The first day, AE team, together with IUCN Thailand, met with the local authorities (Obotor) and visited the main infrastructures of the water supply system in the village. On the second day, AE and IUCN teams split into two groups, in order to:

- Further assess the topography and the water system within the village, and interview the villagers,
- Join a group of villagers along the Eastern supply pipe to look for leaks, potentially causing an abnormally low level of water noticed in one of the storage tanks.

The next sections describe the existing water supply system and the water equipment available in Sakon Nakhon. Recommendations are detailed in the last section.

2. EXECUTIVE SUMMARY

Kok Klang is a small town of 445 households in a rural area. It is not a poor rural village where people are unsure what to do. Kok Klang is an active and engaged community. From community leaders and water committee members to individuals in the community, everyone spoken to knew very well the technical issues of water supply and sanitation.

It is evident through the various types of technology and age of infrastructure in the town that there has been much initiative on the part of individual households, the community as a whole and the government to find solutions for water. Today households depend on various sources of water to meet their needs throughout the year. Gravity piped water systems from mountain springs are the preferred sources. Community leaders and the water committee actively manage the systems to distribute water to all the households and use limited community budgets for repairing leaks, replacing pipes, and making it work as best it can.

Technically, the current shortages are likely a result of the existing community water system being extended beyond its capacity. The piped network seems to have been originally fed by gravity from the springs to mostly ground level storage tanks. Households collected water from those tanks. Today most, if not all, households still have water carts and collect their own water when needed. However, over time, most households have extended the pipe network directly to their houses. With household

connections, water use increased, resulting in insufficient pressure to fill the storage tanks and an inequitable distribution of water in the community.

People are willing to support and work to find solutions to current water shortages. The Water Committee is wants to lead this effort. Leaders and the Water Committee have good ideas and know what they want to do. They are completely capable of finding sustainable solutions without any direct initiative from outside donors.

The best role for USAID Mekong ARCC is to keep encouraging the community to keep taking the next steps to a fully functional, sustainable water system equitably meeting the needs of all households. USAID Mekong ARCC could consider ways to help the community and water committee envision what potential there is by facilitating a vision and goals process. USAID Mekong ARCC should stay involved to offer new ideas when needed.

Following are three specific areas to focus attention:

1. Establish and Enforce Rules: The Water Committee and the community already know what rules are needed. There is a lack of ability or influence to enforce the rules. There should be established mechanisms for connecting new households, disconnecting unapproved connections, and preventing individual households form pumping water directly from the system.

2. Payment System: Households do not pay for water. Households interviewed indicated a strong willingness to pay for readily available water from the mountain springs, especially during the dry season. Most households pay for power and trash collection, which is another positive indication of advanced organization and willingness to pay for services. The Water Committee wants to start collecting fees, though are hesitant to start before the system is fully functional.

3. System-wide Improvements: The Water Committee already thinks the system would function better if they provided interconnections between the three sectors. This is a good idea that will likely improve the availability of water across all sectors. Connecting the three sectors is completely within the water committee's current capacity.

Another idea that the Water Committee should consider is to completely replace the system at one time. For years they have been piecing the system together. Given the household demand and the close proximity of the houses, it is likely technically feasible and financially viable to replace the entire system at one time and have households start paying for water service. The Water Committee could finance the design and construction of the system without depending on outside assistance. They would collect an initial connection fee or down payment from individual households and then pay the remaining debt by collecting fees based on household consumption. Depending on local regulations, a small public-private partnership with a local company could bring additional investment in the water system.

3. DESCRIPTION OF THE WATER SYSTEM

Kok Klang village comprises 1,143 inhabitants and 445 households. The main water resources of this village are mountain springs, groundwater, rainwater, and bottled water. Some water shortages have been reported primarily during the dry season. All households interviewed reported that everyone has plenty of water from the community system (mountain spring source with piped network to houses) during the rainy season, at which time there can be too much pressure and even flooding.

The existing water system is divided into 3 independent distribution sectors (North, Central and South), supplied by three different mountain springs.

Through the years there has been much initiative from individual households, the community as a whole and the government to find solutions for water. This is evident from the various types of technology and age of infrastructure in the town. There are hand pumps for shallow wells and deep boreholes with submersible pumps and centrifugal pumps. There are various types and sizes of storage tanks and elevated towers. Storage tanks are mostly abandoned. The pipe network is pieced together with improper joints and fittings; however, the community keeps repairing leaks and making it work. The community system continues to be the preferred system among households interviewed. Along most streets in the town distribution pipes line both sides of the road. The village leader regularly uses the annual fund to pay for repairs or replacement of the water supply with a larger diameter pipe.

It seems that as the community grows, they keep finding ways to meet their water needs. This may help explain why the three independent water sectors developed. When the water was not enough, presumably that's when people from other sectors would find another spring, or collections of springs, to use.

This is a very positive indication that people are willing to support and work to find solutions to current water shortages.

The current shortages are likely a result of the existing community water system being extended beyond its capacity. The piped network seems to have been originally fed by gravity from the springs to mostly ground level storage tanks. Households collected water from those tanks. Today most, if not all, households still have water carts and collect their own water when needed. However, over time, most households have extended the pipe network directly to their houses. With household connections, water use increased, resulting in insufficient pressure to fill the storage tanks and an inequitable distribution of water in the community.

Today different management mechanisms are used in the sectors to distribute water when there are shortages. Valves are available to control which area receives water. Then they rotate which day areas have water. Another approach is to fill the tanks and require everyone to collect from the storage tanks, and not use the household connections. In one area, where there is a deep well, where nearby households pay to have water pumped to their house.

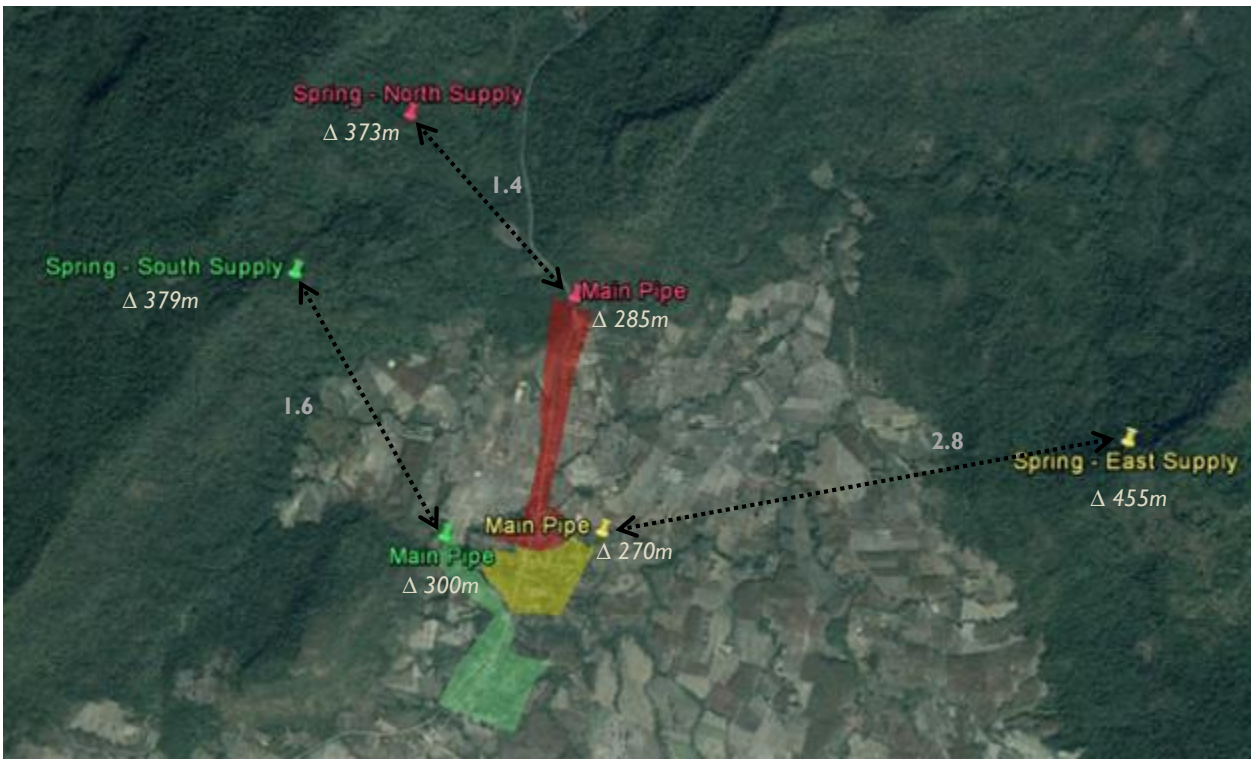
Most of the village is part of a same watershed, except the southern community which belongs to another watershed within which the water flows towards the South.

Many families cultivate rubber and cassava around the village. The chemicals used are drained downstream through the two main rivers that flow in Kok Klang. Obotor authorities therefore work with this community to limit chemical pollution.

There was an effort by the Department of Water Resources recently to provide a new water system, which used good quality pipe and proper installation. It used a ground water source with pump and elevated water tank, with piped connections through the village. However, the system was never fully functional and eventually abandoned. It is unclear as to what the probable technical, social, or political causes were for it not to work.

Most households have power and trash collection, which is another positive indication of advanced organization and willingness to pay for services.

Figure 1: Water distribution sectors in Kok Klang



Based on the flow measurements described in the Water Management Summary Report written by IUCN Thailand in September 2014, the total volume of water which can be provided by the three main spring sources is about 266,400 L/day. According to this report, the flow rate of the springs observed during the dry season is approximately 50% lower than the flow during the wet season, which is 133,200 L/day. It is likely that at least 30-50% of the minimum natural spring discharge during the dry season would need to be released down the stream to maintain the aquatic and riparian ecosystems, especially during the dry season.

Considering that all households in Kok Klang village would have pipe connections, we can assume that the daily individual consumption could be at least 100 L/day/inhabitant[1]. The total water demand would then be 114,300 L/day.

Additional water sources for the village water supply system will probably be required during the dry season. Regular (weekly or at least fortnightly) measurements of the spring discharge rates should be made from now through June 2015 to give at least a 1-year baseline of data. The amount of water that can be safely drawn off for the village water supply system can then be determined.

For further details on the recommendations related to a single water supply system for the whole village (not divided into three sectors), see section 5.3.

3.1 Northern sector

This sector is mostly supplied by a mountain spring located 1.4 km North of the village. The main supply pipe of this sector was installed two years ago.

Figure 2: Northern distribution sector

[1] Domestic Water Quantity, Service Level and Health – Guy Howard, Jamie Bartram - World Health Organization - 2003

3.1.1 Used storage tanks in the South of the Northern sector

These two storage tanks are filled with Northern spring water. They are full all year round.

Figure 3: Storage tanks of the Northern sector

3.1.2 Abandoned storage tank in the South of the Northern sector

This storage tank is not being used due to insufficient pressure from the spring.

Figure 4: Too high storage tank in the South of the Northern sector

3.1.3 Northern abandoned storage tank

This concrete tank located North of village has been abandoned because of a low point located between the tank and the village, where the pipe was subject to clogging. This tank now leaks and is out of service.

Figure 5: Abandoned concrete storage tank, in the North of the village

3.2 Central sector

This distribution sector is supplied by several springs located in the mountains approximately 3km East of the village. It was reported that during the dry season, water supply is ensured only 3 days per week in this sector.

Figure 6: Central distribution sector

3.2.1 Storage tanks / School water supply

Four elevated plastic tanks are located next to the school of the village (same as the one mentioned in section 2). They used to be filled with the central spring water without pumping. The water was then distributed to the neighbouring households.

A new village representative decided to disconnect the spring from the tank. As a result, the water is directly distributed to the households. The pressure is lower than before and water shortages in the dry season were reported, which was not the case when these elevated tanks were being used.

Figure 7: Elevated storage tanks located next to the school

The school of the village, located next to the above mentioned elevated tanks, is supplied by another spring than the one used for the households. The water is stored in a low and an elevated storage tanks, shown on Figure 8.

Figure 8: Low and elevated storage tanks of the school

The school also has a very sophisticated, deep well with pump and filter, and an elevated tower for the schools use only. There is a program for students to be able buy water for their families, and the students receive a small percentage of the fee. This well was installed this year, and the program only recently began. The spring system will soon be abandoned.

Figure 9: Sophisticated water supply system for the schools use

3.2.2 Storage tanks

These storage concrete tanks are filled with the Eastern mountain springs. The village chief tries to keep the tanks full all year round. They are only used during the dry season. During the rainy season, they remain full as a precaution.

Figure 10: Storage tanks in the Central distribution sector

During our visit, the water level in these tanks was unusually low. The villagers therefore decided to check the watertight integrity of the main supply pipe. It turned out that the condition of the pipe was not the reason of the lack of the water shortage, which was due to a problem at the inlet of one of the main pipes, which was not collecting water as usual. The villagers fixed this problem on the day of the visit.

3.2.3 Main supply pipe

This line collects about 15 springs spread over the mountains. Some of the springs get dry during the dry season, but others have water all year round. Each spring is collected by a PVC pipe, which is connected to the main PVC pipe. The main pipe has a diameter of 3 inches (7.62 cm).

Figure 11: One of the highest Eastern springs

Figure 12: Water collection system

Figure 13: Leaking junction between two pipes

Figure 14: Connection to the main pipe

Figure 15: Head of the main pipe

Figure 16: Main pipe junction

The blue dots on Figure 17 show a rough outline of this main pipe.

Figure 17: Main supply line of the Central sector

It is worth noticing the low point located between the springs and the village (258 m), where the pressure is significant.

Figure 18: Low point of the Central supply line

The 3 inches main supply line was funded by the Government in 2013 to replace a 2 inches pipe, which used to crack regularly due to the high pressure. This new bigger pipe resists the water pressure; no crack has been reported so far and it does not get clogged either. The only issue are the forest fires in the dry season which burn the pipe. The villagers need to carry out repairs every year. Some of them volunteer to clean the surroundings of the pipe from the dry leaves twice per year, to limit the risk of fire.

It was reported that the team who repairs the water leaks/system is always the same: one representative of Obotor authority, the headman of the village, and his assistant. For minor repairs, villagers of the sector volunteer to pay (about 70% of the villagers usually give money).

3.3 Southern sector

This sector is supplied in water with both mountain spring and groundwater from a protected well.

Figure 19: Southern distribution sector

3.3.1 Protected well

This protected well, located in the centre of the Southern sector, is 60 m deep. A submersible pump provides a flow of 20 L/h in the dry season.

Figure 20: Submersible pump in the protected well

Yet this pump is not powerful enough to pump the groundwater in the elevated storage tanks located next to the well. As a result, the pump is currently connected to a hose.

Figure 21: Hose connected to the submersible pump, providing groundwater from the protected well

Another pump out of service is located next to the well. It was supposed to pump the water from the lower tanks to the highest one.

Figure 22: Pump out of service

Figure 23: Highest storage tank next to the well

Figure 24: Storage tanks next to the well

Figure 25: Lowest storage tanks next to the well

The villagers plan to purchase a more powerful pump to store the groundwater in the highest tank to provide more pressure to the community.

3.3.2 Storage tanks

One of these 3 concrete tanks is usually partially filled with water from the mountain spring. The 2 other tanks are not used, as the households are directly connected to the pipe.

Figure 26: Storage tanks in the Southern supply sector

3.3.3 Mi Sung pond

The Mi Sung pond is located in the West of the village. Some inhabitants currently use this pond for irrigation purposes. During the time of the visit, several trucks pumped water from the pond for a construction site.

Figure 27: Mi Sung pond

The local authorities have started to enlarge this pond. They also plan to install an elevated storage tank next to the pond to provide more water to the community during the dry season.

Our recommendations related to this plan are detailed in section 5.2.

4. EQUIPMENT AVAILABLE IN THE AREA

Diversified water equipment is available in Sakon Nakhon:

- 1000L storage tanks: 4000 to 10,000 TBH (UV protection)
- Water meters: 345 TBH
- Water pipes: smallest is 4m, 0.5 inch, 13.5 bar → 40 to 50 TBH
- Pumps
- Drip irrigation systems

Figure 28: Water storage tanks

Figure 29: Submersible pumps

Figure 30: PVC pipes

5. RECOMMENDATIONS

5.1 Water committee

Overall, the community is quite pro-active and already quite organized for minor repairs.

The villagers currently do not pay for water during the wet season, as there is enough water supplied. However, they can pay during the dry season. For minor repairs, a majority of villagers from the sector concerned by the damage usually volunteer to pay (about 70% of the villagers usually agree to give money). Some inhabitants also volunteer to work for the water system, but there is nothing neither official nor organized at this point.

The villagers are planning to settle a water committee and install water meters in order to improve the water management within their community. Though it will not be an easy task as Kok Klang inhabitants migrated only 10 years ago from diverse areas and are not a united community, it is strongly recommended to support the establishment of such a committee.

Specific recommendations related to this water committee are listed below:

- It was reported that some villagers had installed pumps to get more water from the water network. Such equipment at the household level should be prohibited as these households divert all the water, which leads to water shortages for other households.
- We therefore approve the installation of lockers on some taps to control the flow direction, which was noticed during the field visit, and encourage the installation of further lockers.
- New households should be able to get a connection, which is not the case, based on the interview of a household recently settled.
- The headman of the village plans to fix the system before installing water meters and make villagers pay, as he expects the villagers to be willing to pay for water meters only if they are provided with sufficient water all year round. We would recommend developing the committee either by starting khoum by khoum (making one khoum operational then charge connected villagers and then expanding the committee) or by repairing the whole system at once with a contractor, and collect the fees from the villagers to reimburse the cost of the works.

From a broader perspective, the responsibilities of the water committee will also include:

- Ensure an equitable sharing of the water resources among all the users;
- Control waste into water sources;
- Operate the system (valves, pumps, etc.);
- Prevent contamination of the environment;
- Supervise and advise on use and maintenance of taps, hand pumps, etc.;
- Clean and maintain the water supply system;
- Collect water fees and keep accounting;
- Organize meeting and discussion to solve problems/conflicts related to water use;
- Distribute work responsibilities among men and women;
- Make small repairs;

- Liaise with the sub-district authorities to report major issues encountered, which would require specific funding;
- Monitor and promote sanitation and hygiene.

5.2 Mi Sung expansion

With a funding from the Province, the sub-district administration (Obotor) has started to enlarge the Mi Sung pond to collect more water. This enlargement will likely not have a significant impact on the community water supply. On average they plan to dig 5 meters deep. The water level upon visual inspection appeared to be 2-3 meters below ground level. There is a risk that they will dig a lot without gaining much volume.

Figure 31: Mi Sung pond ongoing enlargement

The sub-district administration also plans to build an elevated storage tank to supply all 3 sectors of Kok Klang. However, the elevation at the location of the future tank is 290 m, whereas the storage tanks of the Southern sector (described in section 3.3.2) are located at an altitude of 300 m. As the standard model for an elevated tank is 12 m high, there will not be enough pressure to connect the tank directly to the households. A solution could be to connect the Mi Sung water to the existing concrete tanks located in the South of the sector, and distribute this water to the households. Yet a water committee representative mentioned that they do not want to mix the pond water and spring water. From household interviews, people actually have a good understanding of which water sources are better than other between mountain spring, ground water, and pond water.

We would therefore recommend using one of the abandoned tanks and having another pipe system with one or two taps distributing to each sector. The existing connections with the 2 other tanks should be closed so that this pipe network is kept completely independent from the existing network. This system would only be used as a back-up to the spring sources.

Figure 32: Southern distribution sector

The Obotor authorities provided the construction plans for the water tower (see Annex 3). There is another tower (abandoned) of similar design. The structural design was not reviewed in detail by AE. It is likely though that this is a standard design in the province that has been used for years, so it is likely structurally sufficient. Soils should be checked and well compacted by the Obotor to confirm the foundation is adequate.

5.3 Other recommendations

- Given that many households already have household connections, consideration should be given to design a new system specifically for household connections to be supplied from the three springs and potential additional sources, through a pipe network. Independent sectors would likely not be necessary. It would be a fresh start for the community, water committee and the government. There seems to be plenty of willingness to pay at the household level.

- A less expensive alternative is to provide pipe interconnections between the three independent sectors. This could significantly improve equitable distribution and resiliency. Each sector would not depend on a single water spring source and would be less vulnerable. Control valves could be installed between each sector to still separate flow to each sector when needed. A detailed topographic survey as well as proper estimation of the spring water flows (with several

measurements throughout the year to assess the seasonal variations) would help optimizing the design of such a resilient system.

- Consider connecting the Eastern mountain water directly to the elevated tanks located next to the school, as it used to be, before distribution to the households. Storage prevents from temporary shortages due to peaks of consumption, and provides better pressure. Allowing households to connect to the main supply from the mountain before the elevated tank decreases the available pressure for the rest of the community.

- The low point of the main Eastern pipe which supply the Central sector should be regularly cleaned to prevent any clogging. From a broader perspective, a valve should be added at each low point of the system in order to clean the pipes.

- The villagers have also submitted a request to the princess to build a large reservoir (15 m high dyke) next to the national park in the longer term, for irrigation purposes in the South West of the village. This reservoir would lead to the flooding of a whole area. It was reported that a smaller option is being studied. As no further information related to this project has been shared, it is not possible to give any recommendation at this point.

ANNEXES

Annex 1 – List of documents received....23
Annex 2 – Photos of the field trip....24
Annex 3 – Construction plans for the water tower....25

Annex 1 – List of documents received

Documents related to Kok Klang, Thailand:

- Kok Klang village, Sakon Nakhon – Water Management Summary – IUCN Thailand
- Kok Klang Village, Sakon Nakhon – Adaptation Plan Phase I (v.3) – IUCN Thailand

General documents available from USAID Mekong ARCC website:

- Lao PDR Climate Change Vulnerability Profile – USAID Mekong ARCC
- USAID Mekong ARCC Climate Change Impact and Adaptation Study – Summary – November 2013 – USAID Mekong ARCC
- USAID Mekong ARCC Climate Change Impact and Adaptation Study – Main Report – November 2013 – USAID Mekong ARCC
- Protected Areas – April 2014 – USAID Mekong ARCC

Other general documents:

- Results of Climate Study Lower Mekong Basin / Review of Impacts by Province - USAID Mekong ARCC
- Ecosystem-based Adaptation in Mountainous Areas of Khammouane Province – January 2014 – USAID Mekong ARCC
- So what? Expected Project Impact & Outcomes – Kick-Off Meeting for Implementing Partners – January 2014 – USAID Mekong ARCC
- USAID Mekong ARCC Monitoring & Evaluation System – Kick-Off Meeting for Implementing Partners – January 2014 – USAID Mekong ARCC
- Example Tools for Project Implementation Flow – Kick-Off Meeting for Implementing Partners – January 2014 – USAID Mekong ARCC
- Initial Environmental Examination – August 6, 2014 – USAID

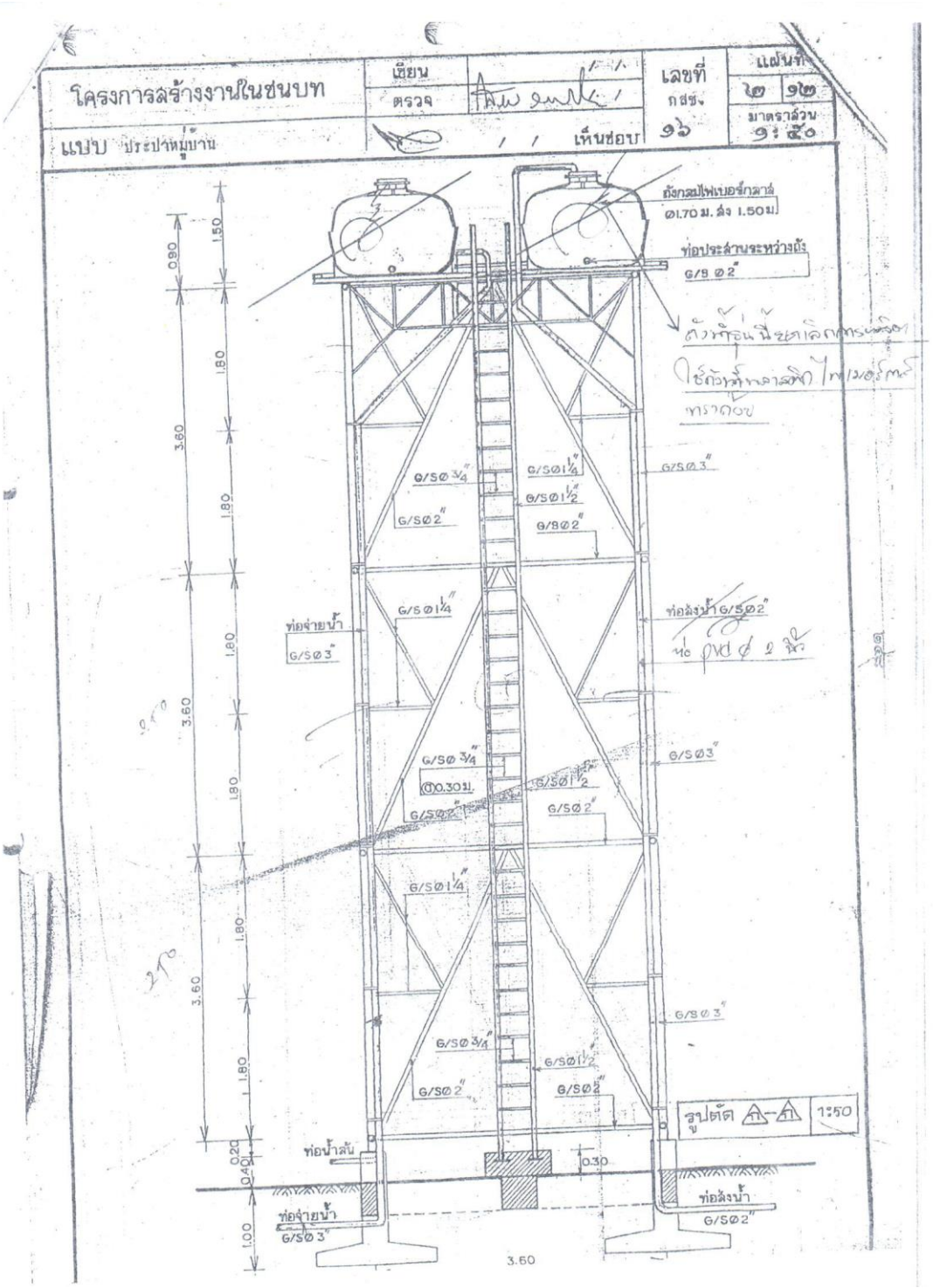
Annex 2 – Photos of the field trip

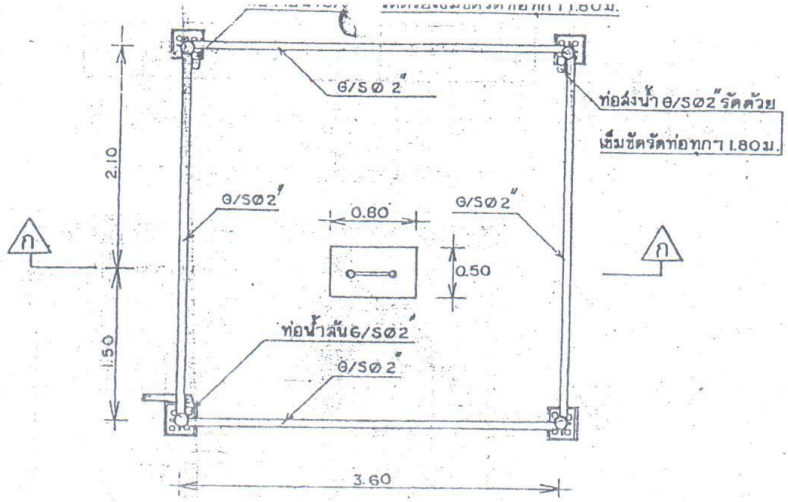
The photos of the field trip are available at the following link:

https://www.flickr.com/photos/mekongarcc/sets/72157651537685935/

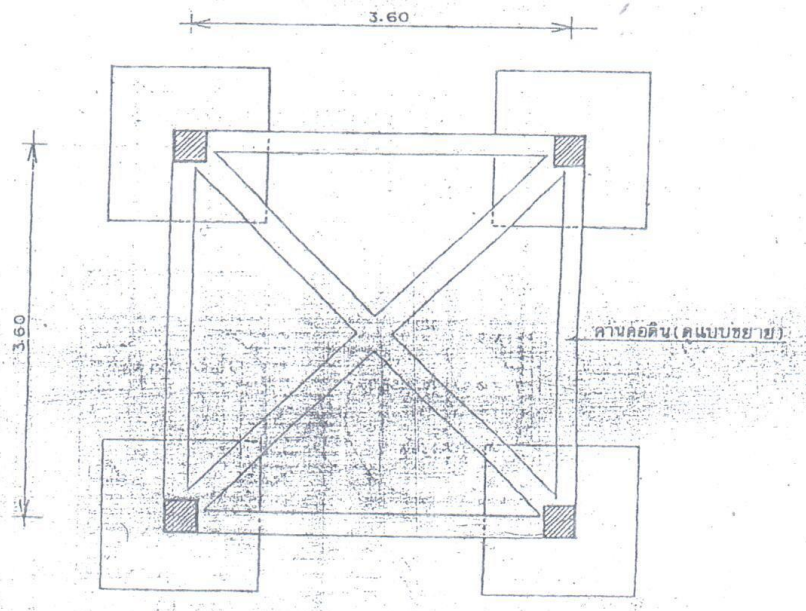
Annex 3 – Construction plans for the water tower

These plans refer to the water tower to be built next to the Mi Sung pond. They have been provided by the Obotor authorities during the field visit.





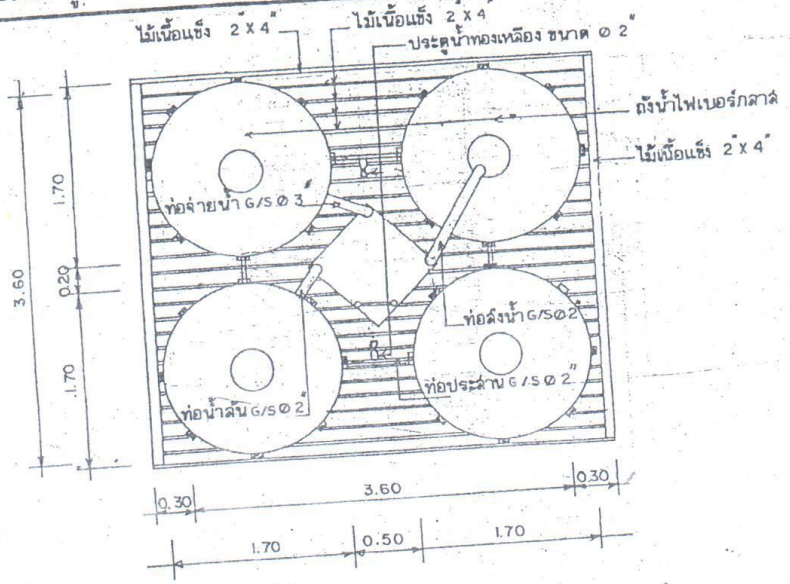
แปลนชั้นที่ 1	1 : 50



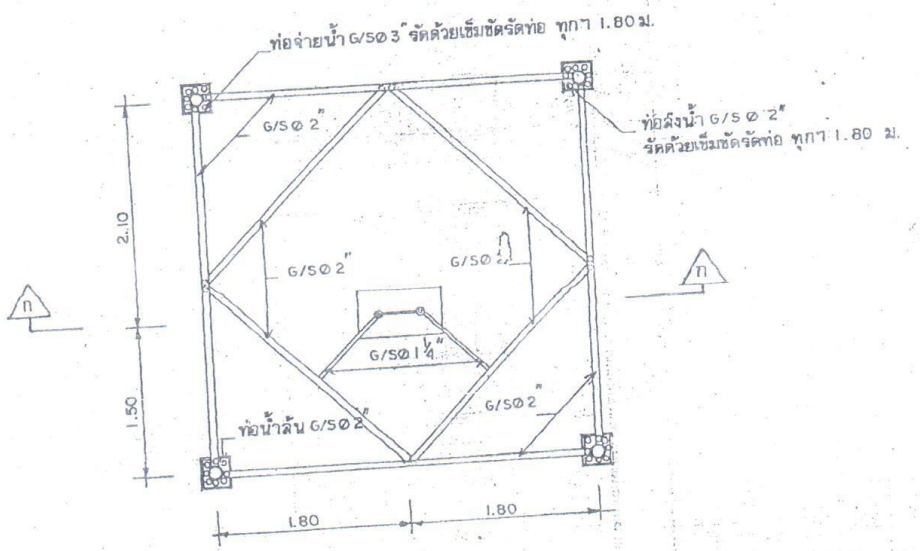
แปลนฐานราก คานคอดิน	1 : 50

โครงการสร้างงานในชนบท	เขียน	/ /	เลขที่ กสช. ๑๖	แผ่นที่ ๓ ๑๒
แบบ ประปาหมู่บ้าน	ตรวจ	/ /		มาตราส่วน ๑ : ๕๐
		/ / เห็นชอบ		

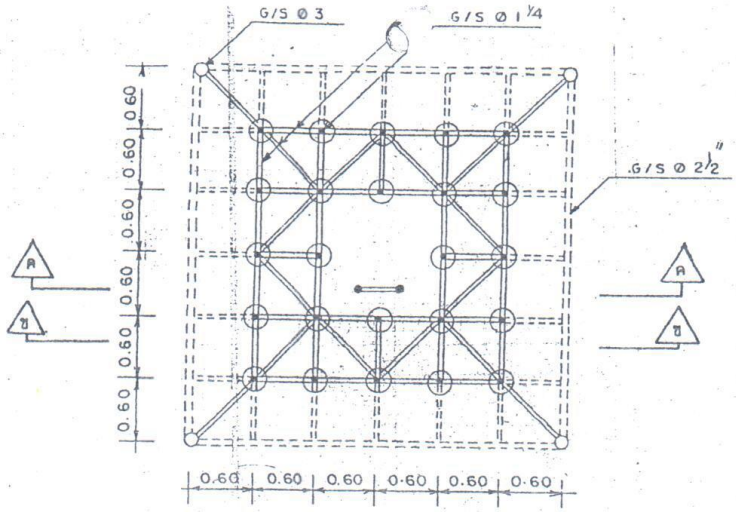
โครงการสร้างงานในชนบท	เขียน	/ /	เลขที่	แผ่นที่
	ตรวจ	/ /	กสช.	๔ ๑๒
แบบ ประปาหมู่บ้าน		/ / เห็นชอบ	๑๖	มาตราส่วน ๑ : ๕๐



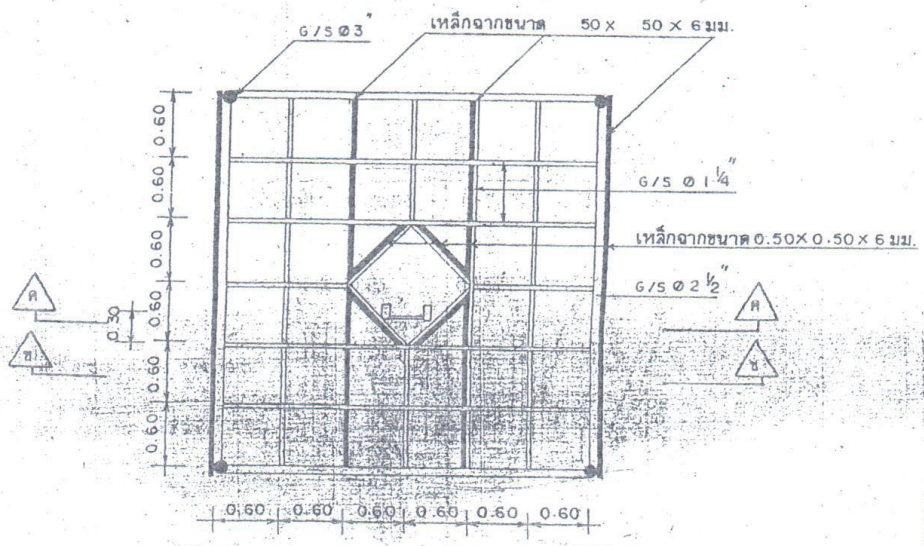
แปลนพื้นชั้นที่ 4 รับถังน้ำ	1 : 50



แปลนชั้นที่ 2 , 3	1 : 50



แปลนโครงเหล็กรับถังน้ำในระดับ (B)	1 : 50



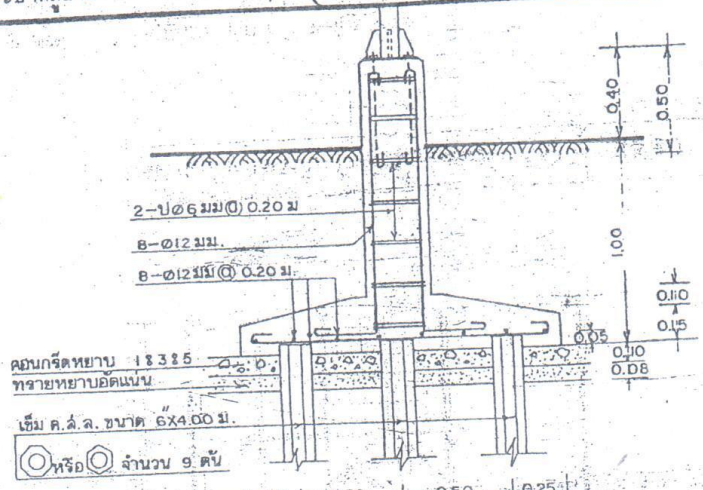
แปลนโครงเหล็กรับถังน้ำในระดับ (A)	1 : 50

คัดลอกจากแบบเลขที่ 5292 กองประปาภูมิภาค กรมโยธาธิการ

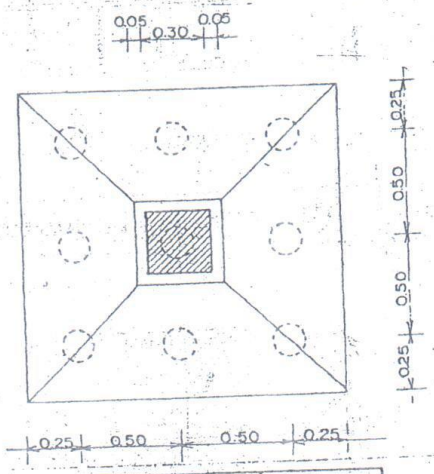
โครงการสร้างงานในชนบท	เขียน		เลขที่ กสช. ๑๖	แผ่นที่ ๕ / ๑๗
	ตรวจ			
แบบ ประปาหมู่บ้าน		/ / เห็นชอบ		มาตราส่วน ๑ : ๕๐

๑๖๑

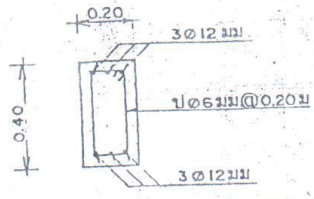
โครงการสร้างงานในชนบท	เขียน	/ /	เลขที่	แผ่นที่
	ตรวจ	/ /	กสช.	๖ ๑๒
แบบ ประปาหมู่บ้าน		/ / เห็นชอบ	๑๖	มาตราส่วน ๑:๒๕



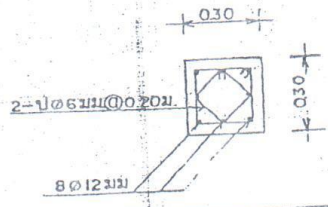
รูปตัดฐานราก | 1 : 25



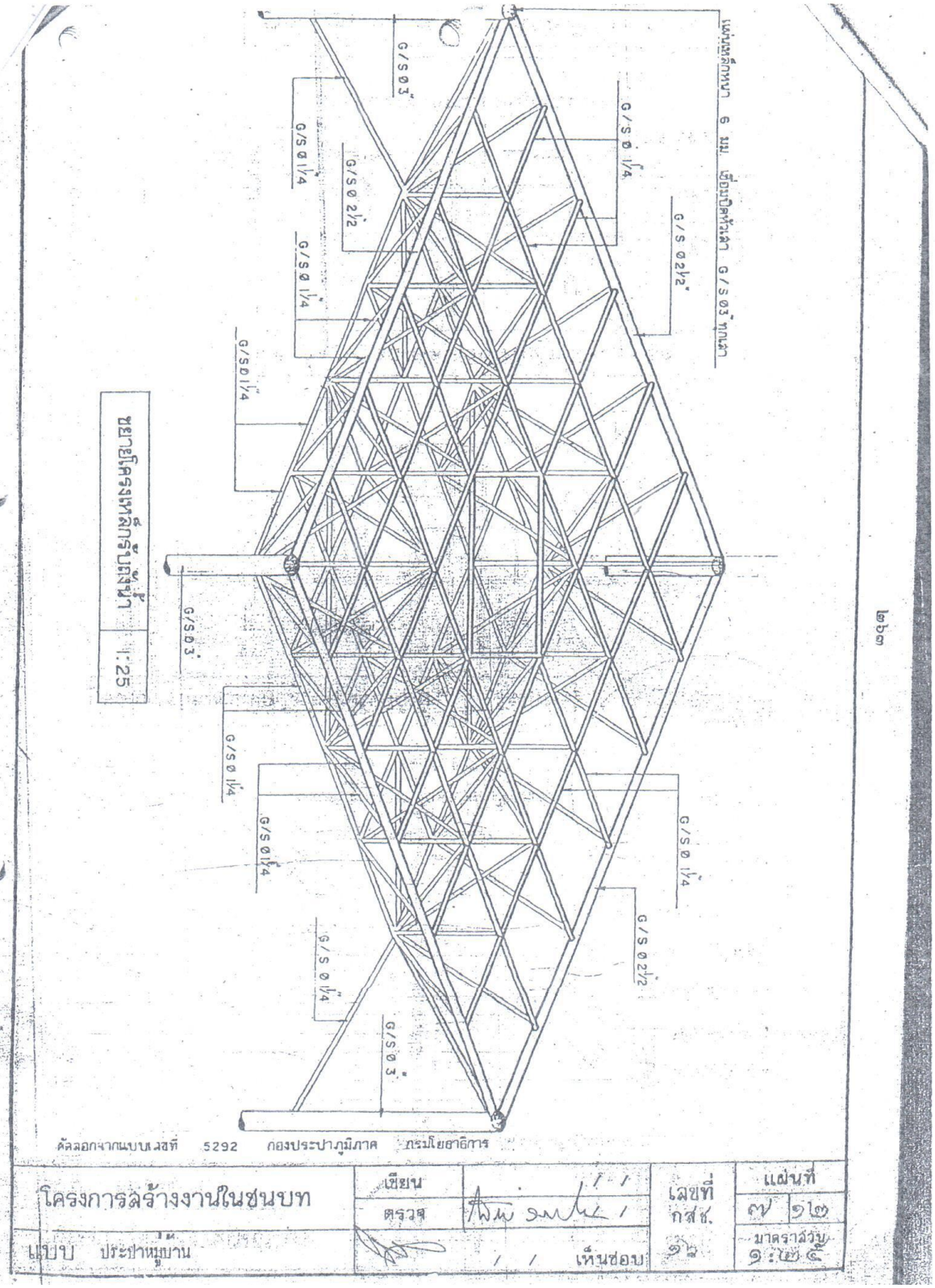
ขยายแปลนฐานราก | 1 : 25



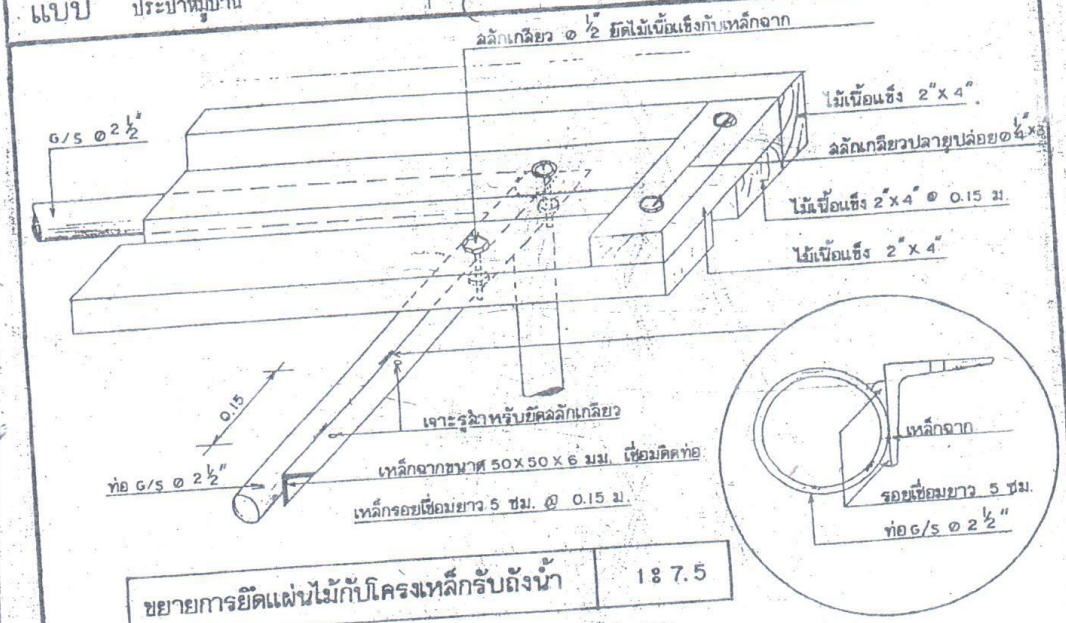
คานคอดิน | 1 : 20



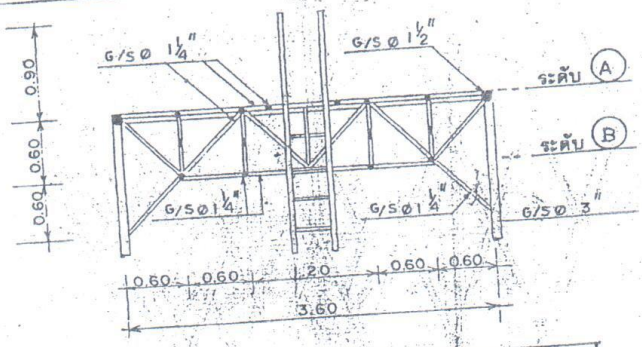
เสา ค.ส.ล. | 1 : 20


แผ่นเหล็กหนา 6 มม. เชื่อมปิดหัวเสา G/S ø3" ทุกเสา
G/S ø3"
G/S ø1¼"
G/S ø2½"
ขยายโครงเหล็กรับถังน้ำ
1:25
ดัดลอกจากแบบเลขที่ 5292 กองประปาภูมิภาค กรมโยธาธิการ
โครงการสร้างงานในชนบท
แบบ ประปาหมู่บ้าน
เขียน
ตรวจ
เห็นชอบ
เลขที่ กสช. ๑๖
แผ่นที่ ๗ ๑๒
มาตราส่วน ๑:๒๕

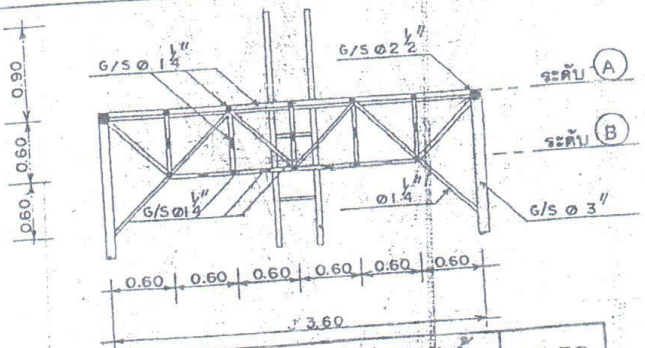
โครงการสร้างงานในชนบท	เขียน		เลขที่ กศช. ๑๖	แผ่นที่ ๘ ๑๒
	ตรวจ			มาตราส่วน ๑:๕๐
แบบ ประปาหมู่บ้าน		เห็นชอบ		



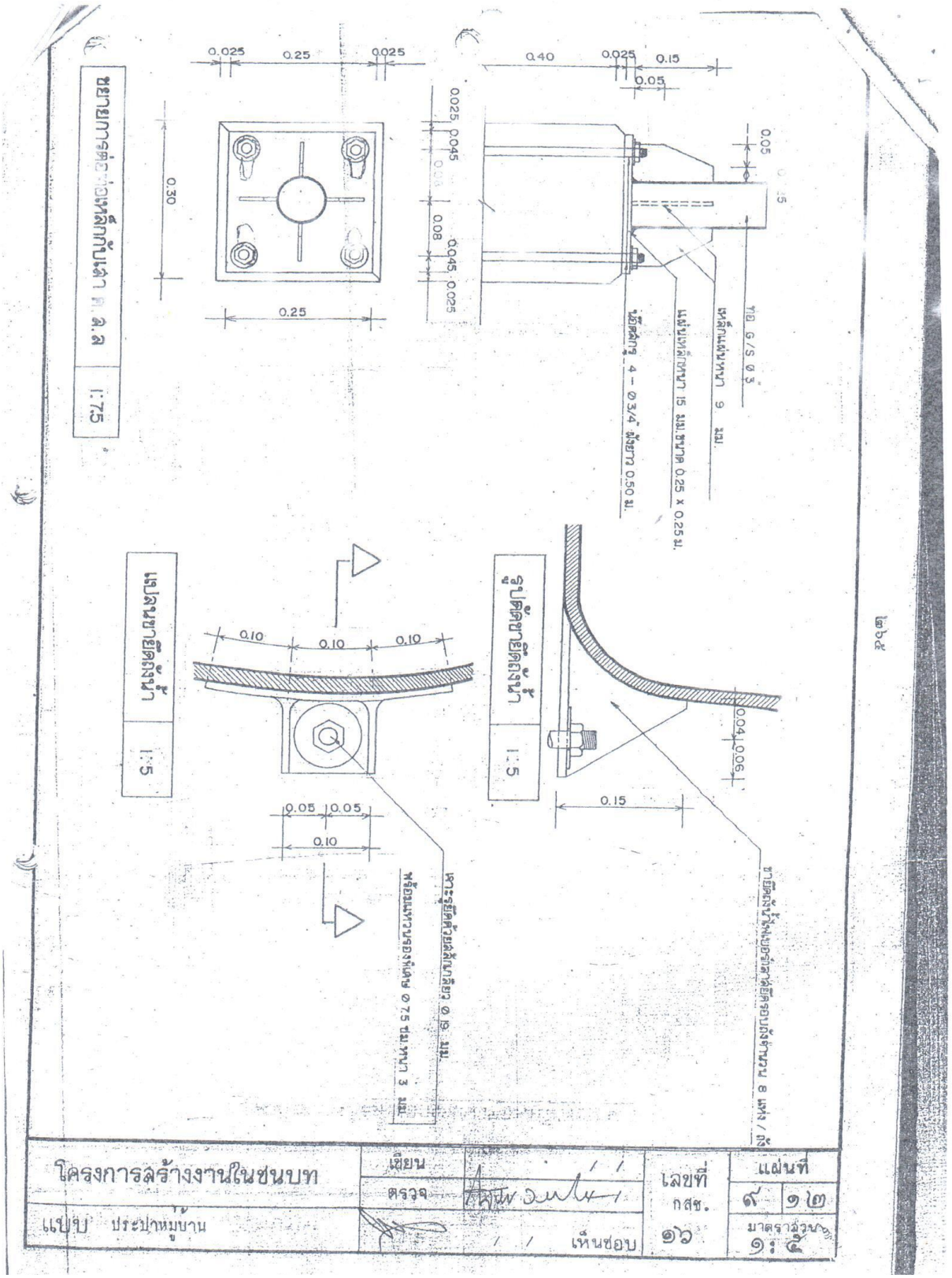
ขยายการยึดแผ่นไม้กับโครงเหล็กรับถังน้ำ | 1:7.5



รูปตัด A A ขยายโครงเหล็กรับถังน้ำ | 1:50



รูปตัด ข ข ขยายโครงเหล็กรับถังน้ำ | 1:50

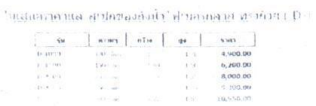

ขยายการต่อท่อเหล็กกับเสา ค.ส.ล
1:7.5
0.025
0.25
0.025
0.30
0.25
0.40
0.025
0.15
0.05
0.05
0.025
0.045
0.08
0.045
0.025
ท่อ G/S ø 3"
เหล็กแผ่นหนา 9 มม.
แผ่นเหล็กหนา 15 มม.ขนาด 0.25 x 0.25 ม.
น็อตสกรู 4 - ø 3/4" ฝังยาว 0.50 ม.
แปลนขายึดถังน้ำ
1:5
0.10
0.10
0.10
0.05
0.05
0.10
เราะรู้ยึดด้วยสลักเกลียว ø 19 มม.
พร้อมแหวนรองพิเศษ ø 7.5 ซม.หนา 3 มม.
รูปตัดขายึดถังน้ำ
1:5
0.04
0.06
0.15
ขายึดถังน้ำเพื่อรักสาลียึดรอบถังจำนวน 8 แห่ง / ถัง
โครงการสร้างงานในชนบท
แบบ ประปาหมู่บ้าน
เขียน
ตรวจ
เห็นชอบ
เลขที่
กสช.
๑๖
แผ่นที่
๙
๑๒
มาตราส่วน
๑:๕

รายละเอียดการก่อสร้าง

1. คอนกรีต ใช้ส่วนผสมคอนกรีต ส่วนผสม 1/2/4 หรือ ตามมาตรฐานของกรมโยธาธิการ
2. เหล็กเส้น ใช้เหล็กเส้นกลม ขนาด 6 มม. และ 12 มม.
3. ฐานราก ในกรณีที่พื้นดินเป็นดินอ่อน รับน้ำหนักบรรทุกปลอดภัยได้น้อยกว่า 6 ตัน/ม.^{2} ให้ใช้เสาเข็มไม้หรือเสาเข็มคอนกรีต สำเร็จรูป ⊙ หรือ ⊙ กลวงขนาด 6"+4.00 ม. ฐานละ 9 ต้น ในกรณีที่เป็นพื้นดินแข็งรับน้ำหนักบรรทุกปลอดภัยได้เกิน 6 ตัน/ม.^{2} ไม่ต้องใช้เสาเข็ม
4. ท่อเหล็ก ที่เป็นโครงสร้างใช้ท่อเหล็กอาบสังกะสีชนิดหนาปานกลาง ประกอบโครงสร้างด้วยการเชื่อม
5. การทาสี โครงสร้างที่เป็นเหล็กให้ทาสีกันสนิม 2 ชั้น และทาทับด้วยสีน้ำมัน สำหรับโครงสร้างไม้ให้ทาสีกันปลวกยี่ห้อโซลิกนั่มตลอดทั่วผิว

แบบ	ปลัดกระทรวงมหาดไทย	เขียน	/ /	เลขที่	๑๑
โครงการสร้างงานในชนบท		ตรวจ	/ /		
			/ /	เห็นชอบ	

1 / 5



ZOOM IN ZOOM OUT START STOP