



Rural Water Safety Plan (RWSP)

Workshop Facilitator's Guide

(Revision December 2013)



Rural Water Supply Programme

Royal Government of Bhutan
Ministry of Health
Department of Public Health
Public Health Engineering Division

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Acknowledgements

The revised facilitator's guide for the Rural Water Safety Plan Workshop has been prepared based on the Water Safety Planning for Small Community Water Supplies adapted to the Bhutanese context. The guide was developed with the field experiences of many people involved in the Rural Water Safety Planning process during the pilot phase from 2008 and with WHO guidance and assistance. The programme is led by Rural Water Supply Section under the Public Health Engineering Division (PHED), Department of Public Health, Ministry of Health with the financial support for scale-up from WHO–AusAID

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1 Introduction

Since the institution of the Rural Water Supply and Sanitation (RWSS) programme in 1974, the programme has constructed more than 4,055 drinking water supply schemes covering 94% of the rural population with 93.6% functionality based on Geog RWSS MIS 2012¹. The RWSS programme has also rehabilitated about 50 percent of total schemes in Bhutan. Despite the high water supply coverage and increased availability of health services throughout the country, the top 10 diseases reflected in the Annual Health Bulletin are all related to water, sanitation and hygiene, and they have not shown a marked decline over the past years. Further, National Rural Drinking Water Quality shows that only 16.8% of stream water and 28% of spring water is safe for drinking. The diseases related to water, sanitation and hygiene can be prevented if the right interventions are carried out at the right time.

The majority of RWSS schemes in Bhutan were built before the institutionalization of the Community Planning & Management Workshop (CPMW), and these older schemes were implemented with little participation from the user community side. As a result, their management systems are weak or non-existent. To counter the problem, various participatory, user-oriented programmes (e.g. CPMW, caretaker training and the Community Development for Health [CDH]) have been executed during the last decade to increase sustainability of RWSS facilities. To further supplement the existing programmes to increase the sustainability of RWSS facilities and to ensure the supply of safe drinking water to the rural communities, Water Safety Plans (WSPs) will be implemented for all rural water supply schemes. The general WSP approach was developed by the World Health Organization to assess and manage scheme-specific hazards and risks to drinking water safety, and the general WSP approach has been customized to suit the Bhutanese context by PHED staff and Dzongkhag health and engineering staff.

This manual will describe how rural communities can deliver and sustain safe drinking water by developing and implementing WSPs for their own communities.

¹ PHED coverage status December 2012

2 What is a WSP?

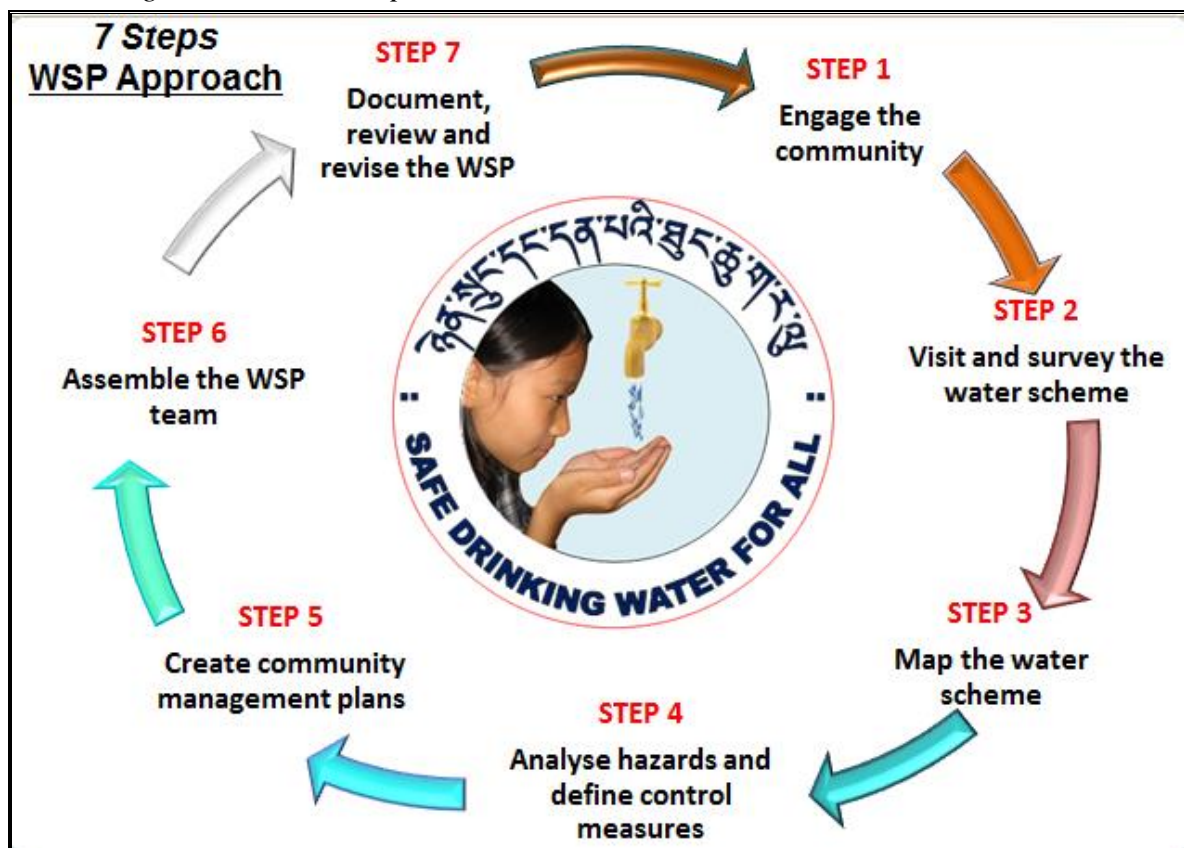
The WSP approach is the assessment, prioritization and continuous management of risks to water safety from catchment to consumer (World Health Organization 2012). It is an organized and systematic multiple-barrier approach to ensure the safety of a drinking water supply, focusing on the key hazards identified from the catchment to the point of use.

3 Primary objectives of a WSP

1. Minimize contamination at the water source;
2. Prevent contamination during storage, distribution and handling; and
3. Reduce or remove contamination through treatment processes.

4 The 7 steps of a WSP

The seven steps of a WSP are outlined in the figure below and detailed in Section 5:
Facilitating the WSP workshop.



5 Facilitating the WSP workshop

5.1 Workshop overview

DAY 1



Workshop introduction

- Overview of workshop theme
- Checking willingness to participate and adequate representation
- Introduction of facilitators/participants

Step 1: Engage the community

- “Bus Stop” icebreaker exercise*
- Group and plenary work on participation posters
- Group and plenary work on good vs. bad sanitation and management

Step 2: Visit and survey the water scheme

- Completing the system survey (hazard checklist) (Form 5)
- Review of proper O&M practices
- Collecting samples for water quality monitoring
- Measuring yield

** The placement of the various exercises is a suggestion only and the facilitator should feel free to lead the exercises as and when he or she sees fit.*

DAY 2

Recap of Day 1

Step 3: Map the water scheme

- Mapping the scheme (Form 2)

Step 4: Analyse hazards and define control measures

- Identifying hazards, assessing risks and defining control measures (Form 6)

Step 5: Develop community management plans

- “Badu Badu” energizer exercise*
- Defining caretaker roles and responsibilities for monitoring & maintenance (Form 7)
- Reviewing the water quality monitoring plan (Form 8)
- Developing the emergency response plan (Form 9)

Step 6: Assemble the WSP team

- Reviewing the general roles and responsibilities of the WSP team
- Forming the WSP team (Form 3)
- “Protecting Your Water Scheme” exercise*

Formal workshop closing (for all villagers)

- “Power Poster” exercise*
- Closing remarks

** The placement of the various exercises is a suggestion only and the facilitator should feel free to lead the exercises as and when he or she sees fit.*

DAY 3 (focused session with WSP team members only)



Recap of Days 1-2

Day 2 activity completion

- Following up on any activities not thoroughly completed on Day 2

Step 7: Document, review and revise the WSP

- Discussing all forms in the WSP template, one by one
- Transferring all information from chart paper to A4 paper
- Completing any remaining forms, e.g. the scheme information sheet (Form 1)
- Discussing records the WSP team should keep in the WSP file, e.g. water quality test results and WSP team meeting minutes
- Discussing future WSP review and revision

5.2 Workshop material requirements

Posters and Cards:

Participation posters (4 nos.)	4 sets
Bad management cards (green, 6 nos.)	1 set
Good management cards (red, 7 nos.)	1 set
Bad sanitation cards (yellow, 8 nos.)	1 set
Good sanitation cards (blue, 6 nos.)	1 set
Good/bad water practice cards* (18 nos.)	1 set
Power posters (blue, 6 nos.)	1 set

Banners and pre-printed charts (A1 size):

1. Example hand-drawn scheme map	1 no.
2. WSP team roles & responsibilities	1 no.
3. Example hazard analysis & control measures	1 no.
4. Partially complete caretaker roles and responsibilities chart	1 no.

Blank Forms (3 sets of complete WSP template):

1. Scheme information sheet (Form 1)	3 nos.
2. Scheme map (Form 2)	3 nos.
3. WSP team membership (Form 3)	3 nos.
4. WSP team meeting minutes (Form 4)	3 nos.
5. System survey (hazard checklist) (Form 5)	3 nos.
6. Hazard analysis & control measures (Form 6)	18 nos.
7. Caretaker roles and responsibilities (Form 7)	6 nos.
8. Water quality monitoring plan (Form 8)	3 nos.
9. Emergency response plan (Form 9)	3 nos.
10. Maintenance & improvement works log sheet (Form 10)	3 nos.
11. Training & education log sheet (Form 11)	3 nos.

WSP Binders/File:

WSP documentation binder/file	3 nos.
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Stationery and Supplies:

Chart paper	10 sheets
Marker pens	1 pkt.
Masking tape (¾ inch roll)	1 no.
Thumb pins	1 pkt.
Scissors	1 no.
Long ruler (40 cm)	1 no.

* Note that use of the good/bad water practice cards is not defined in the facilitator's notes, but the cards are included in the toolkit for use at the facilitator's discretion if time allows.

5.3 Workshop introduction

Key activities:

- Introduction of workshop theme and objectives
- Confirmation of willingness to participate and adequate representation
- Facilitator and participant self introductions

Required materials:

- None

Facilitator notes:

A brief introductory note has to be delivered regarding the importance of the Water Safety Plan (WSP), keeping in mind to minimize the lecture as far possible. The participants are to be informed that they will be familiar with the programme content at the end of the two-day workshop. The facilitator and participants should introduce themselves informally to the gathering.

5.4 Step 1: Engage the Community

Key activities:

- Bus stop icebreaker exercise
- Community participation poster activity
- Good vs bad management and sanitation card activity

Required materials:

- Participation posters (4 nos.) _____ 4 Sets
- Bad management cards (green, 6 nos.) _____ 1 Set
- Good management cards (red, 7 nos.) _____ 1 Set
- Bad sanitation cards (yellow, 8 nos.) _____ 1 Set
- Good sanitation cards (blue, 6 nos.) _____ 1 Set

Facilitator notes:

5.4.1 *Bus stop icebreaker exercise*

Bus stop is a very interactive game that creates much energy. It can also be used to create groups amongst the workshop participants.

Have all participants form a large circle while you explain the rules of the game from the centre. You own a bus company. You have many busses, some are small and can carry only 3

people (e.g. Maruti Van) and others are large and can carry many people. You are also very smart. When you take passengers on your bus, you want to make sure that all the seats are full so that you get full fares. However, you don't want to overload your bus by taking extra people because you would then get fined by the police.

When you drive up with one of your busses, you will get out and call out how many people you can take. The participants must then form groups of exactly that number of people. If there are more or less than that number, those people will not be able to ride on the bus (they will not be able to participate). It is very important that when groups are formed, people must physically grab hold of the other members of their group forming a tight, close group. Anyone that is not wanted in the group (because they would make the group too large) should be pushed away. If additional people are needed to make up the correct number, they can be pulled from wherever they may be free. (Demonstrate what you mean by grabbing a group of people and holding them close to you, arms over shoulders, around waists, etc.)

Once everyone understands the game, leave the circle and then pretend to drive into the centre of the group again, acting like a driver and make bus-like noises. Note that BHU staff should also participate as players in the game. Get out of your bus and shout “*my bus can take 6 (for example) people*”. Participants should immediately rush to form their groups. Then go to each group; if the number is correct and the group is tightly bound together, tell them that they can get on the bus. Others should be told that they will be left behind and beginning with the next round they will have to leave the game and sit down. Consider this a practice round. Now start the real game. Change the number of passengers that can ride on the bus each time you approach. Those groups that do not have the correct amount of passengers must sit down. The more physically rough the game is played, the more enjoyable people will find it. The number of players will get smaller as the game progresses until there are only a few left. You can end the game at this point.

5.4.2 Community participation poster activity

This activity uses visualization, group discussion and role-plays to discuss the various forms of community participation that have occurred in the past and that could be possible in the future. **Participation posters** are used that depict various forms of participation ranging from passive participation in which government directs all development planning and implementation, to a more interactive participation in which government assists in the development process by recognising and supporting self-development capacity within communities. Common understanding on the nature of past participation is reached and consensus on the need to adopt a more interactive type of participation is reached in which communities will take primary responsibility for development planning, implementation and management.

The intended meaning behind the participation posters is described below.

Poster #1: The Lecture

The poster shows a government official (perhaps from the BHU) lecturing to a community. The community members are not required to give feedback to the lecturer. The lecturer has his own agenda and has not asked the community about the issues that are of concern to them. As a result, people are not paying much attention (some are actually sleeping). The lecturer has perhaps come to inform the community about plans that have already been made, plans in which the community was probably not involved in making. The community cannot be said to be participating at all in the encounter.



Poster #2: Government directing

Here a Dzongkhag or BHU staff member is directing community members in a construction activity. As the Dzongkhag is clearly managing the implementation activities, it can be assumed that Dzongkhag has probably planned the activities as well. There is little thought required of the community members, they only do as they are told. While it could be said that they are participating, they do so only with their labour and not with their minds, much in the same way that a donkey participates by taking a rider where the rider wants to go. One of the things that separate humans from other animals is their ability to think for themselves. That ability is not being used here, in fact it may be forbidden.



Poster #3: Government assisting

Community members are discussing an idea (in this case it is about rural water). The idea comes from a poster brought by someone from government (BHU). However, the BHU staff member, after having introduced the idea, stands in the background while the community discusses the idea amongst themselves. In this way the community and the BHU jointly participate in decision-making (planning). This is a significant improvement over the previous poster in which the community was not expected to contribute to planning. This is the minimum level of participation we hope to achieve in the Community Development for Health workshops.



Poster #4: Community self-development

Here the fact that government is not present does not stop the community from prioritising their development needs and making plans to achieve them. Practical experience in these areas exists within the community and the role of government staff is to provide technical support if and when needed. The community takes prime responsibility for planning, managing the implementation of development plans, and operation and maintenance of their development infrastructure. This means significantly more than communities simply meeting and drawing up a shopping list of developments they want in their community and asking the Gup to see to it that they are provided. The poster implies that the developments discussed will actually be achieved through community participation in planning and management of implementation. While the capacity to do all of this does not currently reside within communities, it is this kind of participation that should be the goal for the future.



Introduction of theme

The facilitator introduces the theme of participation by relating it to the previously presented overview of the workshop theme. Specifically, the development and implementation of a WSP will not be possible without active community participation. Explain that a convenient way to initiate dialogue on participation is through a discussion centred on illustrations of various forms of community participation. This is best done in groups.

Group work

1. Discussing participation posters

Once groups have been formed, resource persons from amongst BHU staff should be assigned to facilitate group discussions. This can be difficult, but not impossible, if a single HA, BHW, or ANM is facilitating the workshop. Within each group, the group facilitator should display the first poster (*The Lecture*). Groups should be arranged so that all members can comfortably view the poster. Discussion within the group should be encouraged, without much input from the group facilitator. Remember that in this exercise, as with all exercises, participation of all group members is essential so that all people feel part of the process. If required, the group facilitator can motivate the group by asking questions such as: *what is happening in the picture?, who is this?, what is he doing?, who are these people?, what are they doing?* It is important to remember that before discussion on any poster is complete, an assessment about what the picture says about participation is required. *What kind of participation does this picture display?, is this kind of participation good or bad?, have you ever experienced this kind of participation?*

It is not unusual that what the group feels about a poster is very different from what the poster was meant to convey. If this is the case, the simple questions can be repeated by the group

facilitator to see where this view came from. It is very important that people arrive at realistic ideas about what each poster says about participation, it will have a much more lasting meaning than if they are told.

After a consensus is reached on what the 1st poster says about participation, display the 2nd and go through the same process. Repeat for the 3rd and last posters. As the group facilitator goes through the series of posters, it is helpful to compare the participation that one poster displays with the participation shown by the previous poster: *are the people in this poster participating in a better way than the people in the previous one?, is the Dzongkhag person encouraging participation more than in the previous poster?, which kind of participation is better, will lead to more sustainable development?*

2. Ordering posters: bad to good participation

When the discussion is completed, participants should be able to place the posters in an order going from worst participation to best. This is most easily done by having the participants select the worst first and then the best. The order of the middle two can then be quickly decided upon.

3. Past and future participation

The groups should decide on which of the posters typifies how participation in community development has occurred in the past. Similarly, they should identify the poster that illustrates how they hope to participate in the future.

Plenary

1. Group presentations

Each group should select a leader to make a brief presentation of the work done within their groups. Each group should tape or pin their posters in the order in which they have ranked them to the wall so that the plenary can view them (in this case there will be many sets of the participation posters displayed). The presentations should consist of the following:

- **Introduction of group members:** the group leader has the members of his or her group stand as the leader gives their names to the plenary
- **Preferred form of participation:** the group leader describes each poster and explains the ranking of the posters
- **Past participation:** the group leader explains which poster best illustrates what the group feels community participation has been like in the past
- **Future participation:** the group leader explains which poster best illustrates what the group feels the community should strive for in the future

2. General consensus on posters

During the group presentations, the facilitator should feel free to ask presenters to explain why they have chosen the forms of past and future participation the way they have. When all

groups have finished, the facilitator should build consensus amongst the participants on a common ranking of the participation posters. Once consensus is reached, the other sets of posters can be removed and one set that represents the group consensus will remain for the rest of the workshop. From past experiences, the plenary usually decides that the order of the participation posters is as was intended: the 1st being the worst progressing to the 4th being the best. The result may be different if the community's perception about what constitutes good participation differs from what most of the other communities that have participated in the workshop have described. In any case, the ordering should remain as the community decides. There will be ample opportunities for the community to change their opinions on what constitutes good participation during the course of the workshop.

Troubleshooting tips (if needed)

These tips can be used during group work or during the plenary session (or both).

1. Making clear that Poster #2 is not desirable

Poster #2 may be identified as a desirable model of community participation early in the workshop. In this case, start by clarifying who the people in the poster are. Hopefully, there will be consensus that they represent community members and someone from government. Ask if this represents the kind of participation that people want in their community. If the response is yes, forcefully direct someone in the group to stand up, walk away, come back, sit down, stand up, go over there, come back. After a bit of this, ask the person if he likes doing this? If he says yes, he likes it, start ordering him around again. How long would he support an activity in which he had no real say? Continue until no longer has an appreciation for this kind of participation. Ask the question: When a man rides a donkey, who decides where the donkey is going to go? The donkey only participates by doing what we tell it. The thing that makes people different from the other animals is that they can think, decide and plan. Now ask (referring to the man you had earlier ordered to stand up, sit down, etc.): Who is the man and who is the donkey? Then ask: In this poster, who is the man and who is the donkey? If people feel that the poster shows a good form of participation even though the people are discouraged from thinking for themselves, they imply that they prefer working like donkeys. Is that true?

Lastly, it should be stressed that no one from Dzongkhag is going to come and direct people in this way. If the community wants someone to do this (a lajab), they will need to find that person or group of people from amongst themselves. To emphasise this, the facilitator can quickly sketch a local person or committee and tape it over the picture of the Dzongkhag staff member in poster #2.

2. Choosing between Posters #3 and #4

People are often reluctant to diminish the influence that the government plays in their community's development. They may fear that their own capacity to direct development is lacking (*we are only poor, uneducated farmers*) or they may view the role of government as being naturally directive. Community development seems to have 2 faces for most villagers: 1) the developments that they would naturally undertake themselves without assistance (much of community agricultural practices, religious organisation, and local entrepreneurship), 2) and the mostly-infrastructural developments led by government (water supply, health, education). Ownership of government-led development processes is often lacking. This is one of the constraints that the RWSS programme faces and one that this workshop seeks to address. The aim should not be to say that government is no longer willing to assist in these types of development, but rather that it seeks to work in partnership with communities to achieve development goals. In this sense, the 3rd poster (*Dzongkhag Assisting*) is a realistic form of participation that communities should strive to attain. In fact, this is the kind of participation that this workshop encourages. Nevertheless, in the future it is hoped that communities participate more in setting the priorities for their development from the very start instead of actively supporting initiatives that have been introduced by government. One way of communicating this is through the following analogy:

While working in groups, the facilitator can ask one of the middle-aged persons if they have a son or daughter that is still under the age of 20. Ask them if they have contributed to their child's development by taking their hand and teaching them throughout their lives how to live good and productive lives. Do they still wish to have to hold their child's hand until they have reached the age of 30 or 40? Probably not. They would hope that their children grow to be able to make their own decisions and to be able to support themselves, their families and their communities. This idea is similar to the difference between the 3rd poster (*Government Assisting*) and the 4th (*Community Self-development*).

3. Explaining the full meaning of Poster #4

The 4th poster could be interpreted as the community simply having a meeting to decide to ask government for a school, a BHU or a water supply. In this case, how can a facilitator emphasize that the implications of the poster mean much more?

Explain that it is encouraging that the community participates so successfully. But ask: if you participate like the people in the 4th poster, where is your school, BHU or water supply? If you had a water supply that is no longer functioning, why did such a participating community let the scheme fall into disrepair and why has it taken so long to repair it? Good community participation doesn't mean knowing how to ask for things. It means directing a process that involves prioritizing an activity, planning for it and mobilizing the resources (government and community resources) to make it happen. It also means taking the lead in managing its implementation (construction) and organizing the community to maintain the activity long after construction is complete. Have you really participated in this way?

5.4.3 Water, sanitation & hygiene activity

This activity uses creative thinking and story telling to encourage groups to think about the links between water, sanitation and hygiene practices and the health of their families and communities. The **good and bad management card set** and the **good and bad sanitation card set** have each been designed to tell a story related to water, sanitation, hygiene and health, and the intended meaning behind the card sets is described below.

Bad management set

The card order shown here is intended to tell a story about how a poorly managed scheme (no source protection) eventually results in no water flowing from the taps. People are forced to get their water from a contaminated stream. Children begin to get skin and eye infections and others are sick in bed with stomach pains and diarrhoea. Ultimately the whole family is affected by diarrhoea. (It is not necessary for the groups to place the cards in the same order shown here, though the story told should point out a linkage between maintaining their water supply and the health of the individuals in the community.)



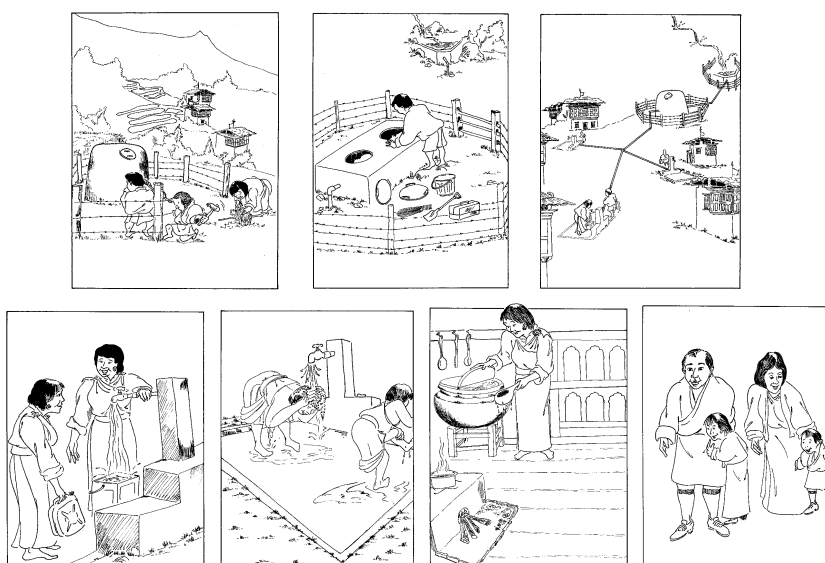
Bad sanitation set

This card set is intended to tell a story about a man who defecates in the open. Dogs and pigs eat the stool and the dog plays with a child. As the mother holds her child, she gets some of the man's (and maybe child's) faeces on her hands. This contaminates the food she prepares for the family's meal. The family eats the meal in an unclean environment and the father becomes ill. Eventually, the whole family is affected by diarrhoea. (It is not necessary that the story follow the order that is shown here. The main point is that without a sanitary means of disposing of faecal matter and by living in a dirty environment, the whole family will be at risk of becoming sick.)



Good management set

This card set illustrates some of the activities carried out in a well-maintained water supply scheme and also the effective use of the scheme. The benefits all contribute to the making of a healthy family. (It is very likely that the order presented by the groups will differ from that shown here, which is not important as long as the groups can relate a well-maintained/utilized water supply to good health.)



Good sanitation set

This card set illustrates some of the sanitation activities and hygiene behaviours that households engage in to promote the health of their families. (Card sets are not necessary for the groups to place the cards in the order shown below. Rather, the important point is to link good sanitation and hygiene practices with good health.)



Group work

1. Story telling

Split the participants into groups using your own method. Ideally, groups should be no larger than 8 people. Distribute the card sets to the groups (in random order) and give each group 15 to 20 minutes to discuss what the cards mean to them and to put them in order to tell a story. (There is little or no need for group facilitators to guide the discussion unless after some time there is still confusion about what the pictures are illustrating, in which case probing questions can be asked.)

An alternative procedure that works very well, particularly if the workshop is falling behind schedule, is to give out the card sets as homework for the first night. Experience shows that people take this exercise very seriously and will meet outside the workshop to come up with good stories. This effort, willingly given, builds commitment to acting on the message that the pictures tell.

Plenary

1. Group presentations and discussion

Ask the groups to place their cards on the wall and to tell their story to the plenary in whatever way they choose, either as a group or one person representing the group. Remind the group that by telling their story in the plenary, each group accepts personal responsibility for the message that their story contains.

The groups should present their stories in the following order:

- Bad management
- Bad sanitation
- Good management
- Good sanitation

After the groups have presented the bad management and bad sanitation sets, the facilitator should open a dialogue about the problems related to poor sanitation. It is not unusual to find communities that say that the reason that they become sick is that their water sources are not protected from contamination from animals. While this may be true, discussion along these lines can obscure the dialogue about how people themselves contaminate their own water, food and themselves.

The good management set should then be presented and displayed alongside the bad management set. Ask the participants to contrast the good and bad management stories and identify the story that best describes the way they intend to manage their scheme.

Finally, the good sanitation set should be presented and displayed alongside the bad sanitation set. As before, ask the participants to contrast the two stories and identify the story that best describes the way they intend to promote household sanitation and hygiene.

2. Activity wrap-up

To wrap up this exercise, emphasise this point clearly: about 1 out of every 10 of our babies dies before reaching the age of five. By far the most common cause of death is diarrhoea and dysentery. These deaths can be prevented, not by Health Workers but by people themselves. Look around your village, which of the babies here will die before the age of five and who could have saved them? Who is responsible for the health of the community?

5.5 Step 2: Visit and survey the water scheme

Key activities:

- Catchment to consumer survey, including:
 - Completing the system survey (hazard checklist) (Form 5)
 - Review of proper O&M practices
 - Collecting samples for water quality monitoring
 - Measuring yield

Required materials:

- System survey form (hazard checklist) (Form 5)
- Water sampling bottles (5 bottles for microbial testing)
- Container of known volume and stopwatch (for measuring source yield)
- Pipe wrench

Facilitator notes:

All participants should join the scheme survey walk, following the flow of water from the water catchment/source to the point of consumption in the user household. (The facilitator will need to visit some of the households to observe and discuss user storage and handling practices.) During this survey walk, participants should collectively complete the system survey form (to gain an understanding of hazards that threaten water safety along the complete water supply chain), review proper O&M practices for all key system components, collect water samples for testing, and measure yield at the source. During the survey walk, community participants will see for themselves the different components of the water supply system and gain an understanding of threats to the safety and functionality of the scheme. It is critical that the entire survey walk is conducted in a participatory manner so that the observations made during the survey (good or bad) are understood and accepted by all participants.

5.5.1 Technical references

Source Measurement

The source yield (Q) is simply the volume of the bucket (*in litres*) or tin divided by the time (*in seconds*) that it takes the complete source output to fill it.

$$Q \text{ (litres/sec)} = \frac{\text{Volume (litres)}}{\text{Time (seconds)}}$$

Method of measuring Source Yield

Source yield should be measured during dry season (March, April & May)

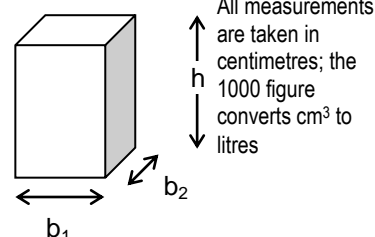
1. Bucket/Tin and stop watch method
2. Velocity method

1. Bucket/Tin and stop watch method

Volume of the container either bucket or oil tin should not be less than 10 litres.
Prefers oil tin for easy measurement of volume.

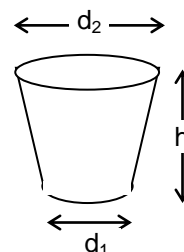
For a rectangular tin, the volume is simply

$$\text{Volume (litres)} = \frac{h \text{ (cm)} \times b_1 \text{ (cm)} \times b_2 \text{ (cm)}}{1000 \text{ cm}^3/\text{litre}}$$



For a bucket, the volume is given by:

$$\text{Volume (litres)} = \frac{\pi}{8} \times \frac{(d_1^2 + d_2^2) \times h}{1000}$$



2. Velocity method

This method is used for larger discharges (stream with minimum depth of 30cm) that are not practical to measure using either of the above methods.

$$Q = 850 \times V \times A$$

Where

$$Q = \text{Measure..flow(lps),}$$

$$V = \text{Velocity(m/sec)} = \frac{\text{distance(m)}}{t_1 - t_{2(\text{sec})}},$$

$$t = \text{Time(sec)}$$

$$A = \text{Area(m}^2\text{)} = \text{width(m)} \times h(\text{m}),$$

$$h = \text{height(m)} = \text{Average}(h_1 + h_2 + \dots)$$

Source sufficiency

Source is sufficient if Daily Supply is greater than Daily Demand.

Daily Supply = Measured yield X 80% safety factor X 24hrs in second

$$DS = Q \times 0.8 \times 24 \times 60 \times 60$$

Daily Demand = Present Population X Consumer rate X Population growth factor

$$DD = PP \times CR \times PGF$$

RWSS design specifications	
Community schemes	45 litres/person/day
Schools:	
Day scholars	10 litres/person/day
Boarders	65 litres/person/day
BHUs & dispensaries	500 litres/bed/day
Other offices	500 litres/day

Thumb rule for Reservoir sizing selection

- For up to 5 taps - 1.5 cum
- For up to 8 taps - 2.5 or 4.0 cum
- For up to 12 taps - 6.0 or 8.0 cum
- For up to 20 taps - 12 or 16.0 cum
- For up to 30 taps - 16.0 or 20.0 cum
- For up to 40 taps - 20.0 cum
- For up to 50 taps - 20.0 or 30.0 cum
- Greater than 50 taps - 30 cum plus additional FCR

FCR size may differ not only base on demand but also based on number of taps.

Thumb rule for pipe diameter sizing selection

- 0.1 - 0.2 lps --- 20mm HDP or ½” GI
- 0.2 – 0.3 lps --- 25mm HDP or 1” GI
- 0.3 – 0.6 lps --- 25-32 mm HDP or 1” GI
- 0.6 – 1.0 lps --- 40mm HDP or 1 ½” GI
- 1.0 – 1.8 lps --- 50mm HDP or 1 ½” GI
- 1.8 – 2.6 lps --- 63mm HDP or 2” GI
- 2.6 and above --- 90 mm HDP or 3” GI

Location of Break Pressure Tank (BPT)

BPT is placed after reservoir at every 60m vertical height and do not require if vertical height is between the last BPT and the last tap is within 100m head differences.

Location of Air Release Valve (ARV) and WashOut (WO)

ARV is placed between intake and reservoir at the top of U-profile where the difference is 10m and every 1000-1500m along the pipeline to release air block.

W/O is place at the low point along the pipe line to remove debries.

1. Completing the system survey

The system survey form (Form 5) has been designed to lead the community through an assessment of potential threats to water safety at each step in the water supply chain. (The system survey findings will help participants complete the hazard analysis form on Day 2 of the workshop.) Throughout the survey walk, the facilitator should review the survey questions and obtain participant consensus on every answer. Where possible, the facilitator should appoint one member of the community to record the group's answers on Form 5 in order to maximize community participation and ownership.

2. Reviewing proper O&M practices

During the survey walk, the facilitator should ask the water caretaker(s) to demonstrate and/or discuss proper O&M practices for all system components to raise awareness amongst all participants and to gauge and reinforce caretaker understanding.

3. Collecting samples for water quality testing

During the survey walk, samples for water quality testing should be collected in appropriate bottles by trained health workers at the source, FCR, BPT, tapstands and household storage containers. The facilitator should explain that the test results will be shared with the community and should be filed in the WSP binder/file.

4. Measuring yield

While at the source, the facilitator should demonstrate to participants how to measure the source yield, explaining the importance of this measurement and making clear that the community should repeat the measurement on their own every year. The result should be recorded on the system information sheet, or Form 1.

5.6 Step 3: Map the water scheme

Key activities:

- Mapping the scheme (Form 2)

Required materials:

- Example scheme map banner
- Stationary and supplies

Facilitator notes:

5.6.1 Mapping the scheme

The facilitator should show the group the **example scheme map banner** to demonstrate that the scheme map should capture the water source, FCRs, BPT, pipeline, tapstands and households in the community. The scheme map should also capture other information relevant to water safety, such as the location of sanitation facilities. The participants should first create the map on the ground, and the site selected for the scheme mapping should be an open surface where participants can draw with sticks and place stones, fruits, sweets or soaps to represent the water supply components and the houses on the map. Once the scheme map has been completed and agreed upon on the ground, the map should be transferred onto chart paper.



5.7 Step 4: Analyse hazards and define control measures

Key activities:

- Identifying hazards, assessing risks and defining control measures (Form 6)

Required materials:

- Stationary and supplies
- Completed system survey (hazard checklist) from Day 1 (Form 5)
- Example hazard analysis & control measures banner
- Chart for hazard analysis & control measures (Form 6)

Facilitator notes:

Before proceeding to the hazard analysis, the facilitator should ask participants to share the water supply system hazards or problems that they recall from the system survey (hazard checklist) (Form 5) from Day 1. After a discussion of the hazards that the participants recall from memory, the facilitator should ask the group to refer to findings documented on Form 5 and lead the group through a systematic process of hazard analysis and control measure identification. To do this, the facilitator should first guide the participants through the **example hazard analysis & control measures banner**. The facilitator should then ask a participant to draw the hazard analysis table on chart paper and ask participants to call out important hazards at each system component from catchment to consumer (in the order shown on Form 5). The hazards at the catchment/source should be documented first, and a risk assessment and improvement/action plan should be developed for each hazard by completing the various columns of the hazard analysis table. During this exercise, it is very important to shift ownership and responsibility to the community as far as possible. Once the hazards at the catchment/source have been analysed and appropriate improvements have been planned, the group should move on to the FCR, and so on through all the categories/components shown on Form 5.

After completing the table, it is very important to review the plan and make any changes necessary to achieve group agreement.

5.8 Step 5: Develop community management plans

Key activities:

- “Badu Badu” energizer exercise
- Defining caretaker roles and responsibilities for monitoring & maintenance (Form 7)
- Reviewing the water quality monitoring plan (Form 8)
- Developing the emergency response plan (Form 9)

Required materials:

- Stationary and supplies
- Pre-printed chart for caretaker roles and responsibilities (Form 7)
- Chart for water quality monitoring plan (Form 8)
- Chart for emergency response plan (Form 9)

Facilitator notes:

This portion of the workshop is one of the most important for making clear the important point that water safety planning is much more than a single workshop; rather, it is an approach to improved system management that the community must implement indefinitely. Working with the community to make plans for ongoing system monitoring and management helps to emphasize the long-term nature of the WSP and the ongoing commitment required. Because this step requires a lot of thought and effort, it may be helpful to begin with an energizer exercise.

5.8.1 *Badu badu exercise*

This popular energizer has the following message: actions speak louder than words! This game is very enjoyable for all players and can be played many times during the course of the workshop, particularly as a source of quick energy.

Have everyone stand in a circle facing you. The rules of the game are simple:

When you say **badu**, everyone should put their arms in the air.

When you say **badu-badu**, everyone should fold their arms on their chests.

When you say **badu-badu-badu**, everyone should put their hands on their knees.

Go through this slowly, with you moving your arms according to the above instructions with everyone following your lead. Remind everyone that it is very important that they should **listen to what you say**.

The trick to this game is that your actions do not have to follow your instructions. For example, if you say badu, you may either put your arms in the air, fold them on your chest or put them on your knees. But the participants are only correct if they put their arms in the air. The instructions were for them to listen to what you say (they were not instructed to do as you do).

Begin the game with a trial run. Begin by matching your actions with your words. At some point, make your action different from your words. You will find that most of the participants will follow your action instead of your words. Point out the people that have made the mistake. Warn them that when they make a mistake again, they will leave the game by sitting down. Once people catch on, it will become more and more difficult to force people into making mistakes. Play until there is only one participant left.

5.8.2 *Developing community management plans*

1. *Defining caretaker roles and responsibilities for monitoring & maintenance*

The facilitator should lead the community through the process of defining frequencies at which the system caretaker should carry out monitoring and maintenance activities at all major system components using the **partially complete caretaker roles and responsibilities chart**.

2. *Reviewing the water quality monitoring plan*

The facilitator should lead the community through a review of the plan for ongoing water quality monitoring using Form 8.

3. *Completing the emergency response plan*

The facilitator should explain the importance of thinking about how the community will respond to a water-related emergency (e.g. dead animal in the intake, waterborne disease outbreak, landslide, human activities posing an immediate threat, etc.) and making an emergency response plan to protect community health in such an event.

5.9 Step 6: Assemble the WSP team

Key activities:

- Reviewing the general roles and responsibilities of the WSP team
- Forming the WSP team (Form 3)
- “Protecting Your Water Scheme” exercise

Required materials:

- Stationary and supplies
- WSP team roles & responsibilities banner
- WSP team membership (Form 3)
- Sealed container filled with water

Facilitator notes:

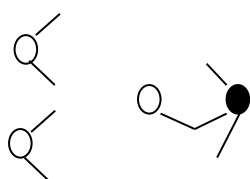
5.9.1 Forming the WSP team

The facilitator should review the **WSP team roles & responsibilities banner** with the participants and lead community discussion and decision-making on which individuals should assume the core responsibility of implementing, reviewing and revising the WSP. (It may be beneficial for the facilitator to leave the community alone for a while to discuss appropriate WSP team members amongst themselves.)

5.9.2 Protecting your water scheme exercise

This exercise is best done outside and requires a sealed container filled with water to symbolize the community's water supply scheme.

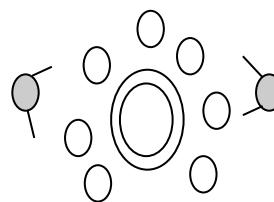
Hold up the container and explain that at least for today, the container is the community's water supply system. There are many things that can go wrong with a water supply, but usually problems are the result of people, not people from outside the community, but the people that use it everyday. Ask who is going to ensure that this supply remains functioning so that it benefits all people. If people respond that the caretaker(s) will take care of it, ask the caretaker(s) to come to the centre of the group. Put the "water supply" on the ground at their feet and tell them to take care of it.



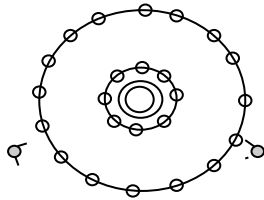
Casually walk up to the "water supply" and kick it over. Tell the caretaker(s) that they are not doing a very good job in protecting it. Tell them to try harder, only they are not allowed to pick the "water supply" up or hide it in their ghos; it should remain free on the ground so that all people can see it and use it. Do this a few times and ask the

people if they feel confident that the caretaker(s) will be able to protect the scheme.

It will be obvious that the caretaker(s) cannot by himself take care of the water supply. Ask who would normally have a responsibility to help him. People may respond that everyone will help him, in which case the facilitator should remind the group that "*when everyone is responsible, no one is responsible.*" Hopefully the WSP team or the village Tshogpa will be identified as the primary help to the water caretaker. Ask them to come in and help the water caretaker while you and other Dzongkhag staff continue to kick over the container. Remind everyone that an essential role of the WSP



team is to support the caretaker(s). Encourage the WSP team to use their bodies by joining arms over shoulders to protect the "water supply". Once they become skilled at stopping you from kicking the "water supply", another resource person can sneak in to help you. Be physical – jump over the committee members' backs, duck through their legs, etc. Do not let the rest of the community help at this time. You will still most probably be able to kick over the container.

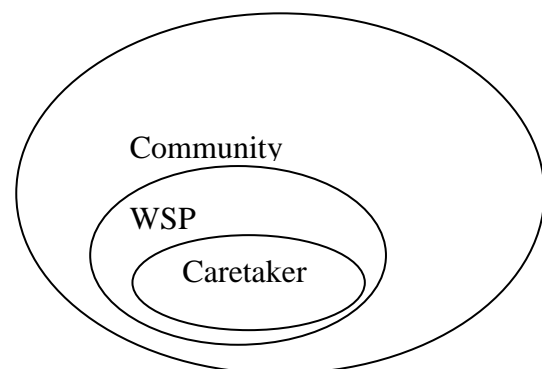


Explain to everyone that the WSP team alone will have a difficult task of protecting the community's water without the support of each and every person in the community. Have the rest of the participants form a large circle around the committee by joining hands. They should be the first ones that prevent

improper functioning of the scheme. Now start your attack (with additional help from colleagues) from the outside. Again, be physical. Offer some of the community members' money so that they release their grip and you can break through. Even if you manage to break through (some community members act irresponsibly toward the scheme), the WSP team is still there to make sure that it functions properly.

After playing this for a while, explain that the water supply is not only the responsibility of the caretakers or the WSP team. Yes, the WSP team can support the caretakers, but if the community as a whole does not support the committee, the scheme will fail. Water supply is everyone's responsibility. Whoever acts irresponsible weakens the whole system and makes the breakdown of the scheme possible.

You can reiterate the supportive relationship that will hopefully exist by sketching this on the ground. Emphasize that this is the kind of relationship that will make not only the water supply strong; it will strengthen all kinds of developments within the community.



5.10 Formal workshop closing (with all villagers)

Key activities:

- Power poster exercise
- Closing remarks

Required materials:

Power posters (blue, 6 posters)

Facilitator notes:

5.10.1 Power poster exercise

This can also be a good way to close the workshop. The exercise is very simple, participatory and creates enthusiasm to follow through on the commitments made during the workshop. The exercise makes use of the **power poster set**. Each poster represents a kind of power that an individual might possess. Individuals normally define themselves in terms of where their strengths lie. For example, a person might identify himself as being educated (more than others), having strong religious convictions or having strong attachments to his family and community. This person may get most of his power from his education or his religion. Another person is a skilled farmer and is able to get people work (mobilize people) and is wealthy. Overall, that person might identify that her greatest strength or power comes from her wealth. These various forms of power are illustrated below:



Religion

Wealth

Education

Skill

Authority

The exercise begins with the facilitator explaining the idea that we all are different and have different strengths. That is the strength of communities: they are made up of different kinds of people that, when put together, provide all the power and strength a community needs to develop.

Begin by showing one of the 5 posters shown above (do not show the poster of the people working together to move the rock). Ask what kind of power the picture represents. Stress

that the posters should not be interpreted literally, e.g. the poster of the monk should not represent that someone must be a monk to get strength from his or her religion. Ask if there is someone here that the group feels is very powerful in the power described by the picture. For example, once people identify the picture of the monk as referring to someone that gets his or her strength from religious belief and practice, ask the group if there is anyone present that fits that description more than other people. Give that person the picture and begin again with the next poster. Continue until all 5 posters are distributed. Note that Dzongkhag staff should also participate and can be identified as having these powers.

Have the 5 people holding posters move apart. Ask them to display their posters so that all can see them. The rest of the group should now consider themselves: of all the powers shown here, which one describes from where they get their greatest strength? Have them then go stand behind the person holding that poster. Go to each sub-group and ask the entire group if the sub-group's power is important to the community's development. Ask why? For example, when standing by the sub-group of people who feel that their power mostly comes from education, ask the whole group if they feel that educated people are important to the development of the community. Ask the sub-group to demonstrate how strong their power is by shouting at the count of three. Follow the same process until all sub-groups have been visited. Encourage all to shout their loudest.

Now tell everyone that there is one more kind of power that is stronger and more productive than any of the kinds of power that have just been visited. Does anyone know what that might be? Show the last poster of the people working together. Can any of the other powers by themselves ensure that the community can plan, implement and manage its water supply? Does it take all kinds of power within a community to ensure that the community's development proceeds well and meets everyone's needs?



The power of people working together in a group will always exceed what individuals can do. In fact, if the community does not work toward getting and maintaining their water supply as a group, the water supply will most likely fail in a relatively short time.

If you choose to close the workshop at this time, emphasize that by developing a plan of action for implementing and managing a water supply scheme, the community has demonstrated that it has a wide variety of skills and powers already at its disposal. Reiterate that Dzongkhag has full belief in the capacity of the community to take over responsibility for its own water supply. The community will take the lead from hence forward with Dzongkhag only assisting when needed. If the community can continue to work together as it has in the last three days, there is no doubt that they will succeed in their efforts not only to

have clean and safe water, but in whatever other developments they envision for their community.

5.10.2 Closing remarks

The facilitator should recap workshop objectives, activities and outputs and make closing remarks. The facilitator should also “hand over” the WSP to the WSP team and the wider community for ongoing implementation, review and revision of the WSP.

5.11 Step 7: Document, review and revise the WSP (With WSP team member only)

Key activities:

- Discussing all forms in the WSP template, one by one
- Transferring all information from chart paper to A4 paper
- Completing any remaining forms, e.g. the scheme information sheet (Form 1)
- Discussing records the WSP team should keep in the WSP file, e.g. water quality test results and WSP team meeting minutes
- Discussing future WSP review and revision

Required materials:

- All work previously documented on chart paper
- The complete WSP template (Forms 1 – 11)

Facilitator notes:

It will be most Over the course of the workshop, much work will have been documented on chart paper. It is now time to transfer all of this work onto the appropriate Forms within the WSP template and complete any forms not yet completed in order to compile the complete WSP document. The facilitator should show the participants how the binder/file is organized, reviewing each page (one by one) and explaining which pages belong in which sections (including pages that will be added to the WSP over time, like water quality monitoring results). The WSP team leader should have primary responsibility to protect and maintain the WSP document. During this portion of the workshop, the group should also discuss the additional copies of the community’s WSP document that will be maintained (e.g. at the Geog or Dzongkhag level). With the completed WSP document in hand, the facilitator should also remind the participants which forms should be reviewed and revised annually (as described in the WSP roles and responsibilities banner).

6 References

- CDH 2006, 'Community development for health, workshop facilitation guide', Public Health Engineering Division, Department of Public Health, Ministry of Health, Thimphu.
- CPMW 2007, 'Community planning and management workshop, facilitation guide', Public Health Engineering Division, Department of Public Health, Ministry of Health, Thimphu.
- Dasho Dorji S. et al. 2006, 'English-Dzongkha dictionary', Dzongkha development authority, Ministry of Education, Bhutan.
- Thomas D. Jordan Jr. 2006, 'A handbook of gravity flow water systems for small communities', Intermediate Technology Publication Ltd, Schumacher Centre for Technology and Development, Burton Hall, Burton on Dunsmore, Rugby, Warwickshire CV23 9QZ, UK.
- World Health Organization 2004, Guidelines for Drinking-Water Quality. Volume. 1:3rd edition.
- World Health Organization 2012, 'Water Safety Planning for small community water supplies'.

Water Safety Plan (WSP)



Village/Project Name:_____

Project No.:_____

System Description

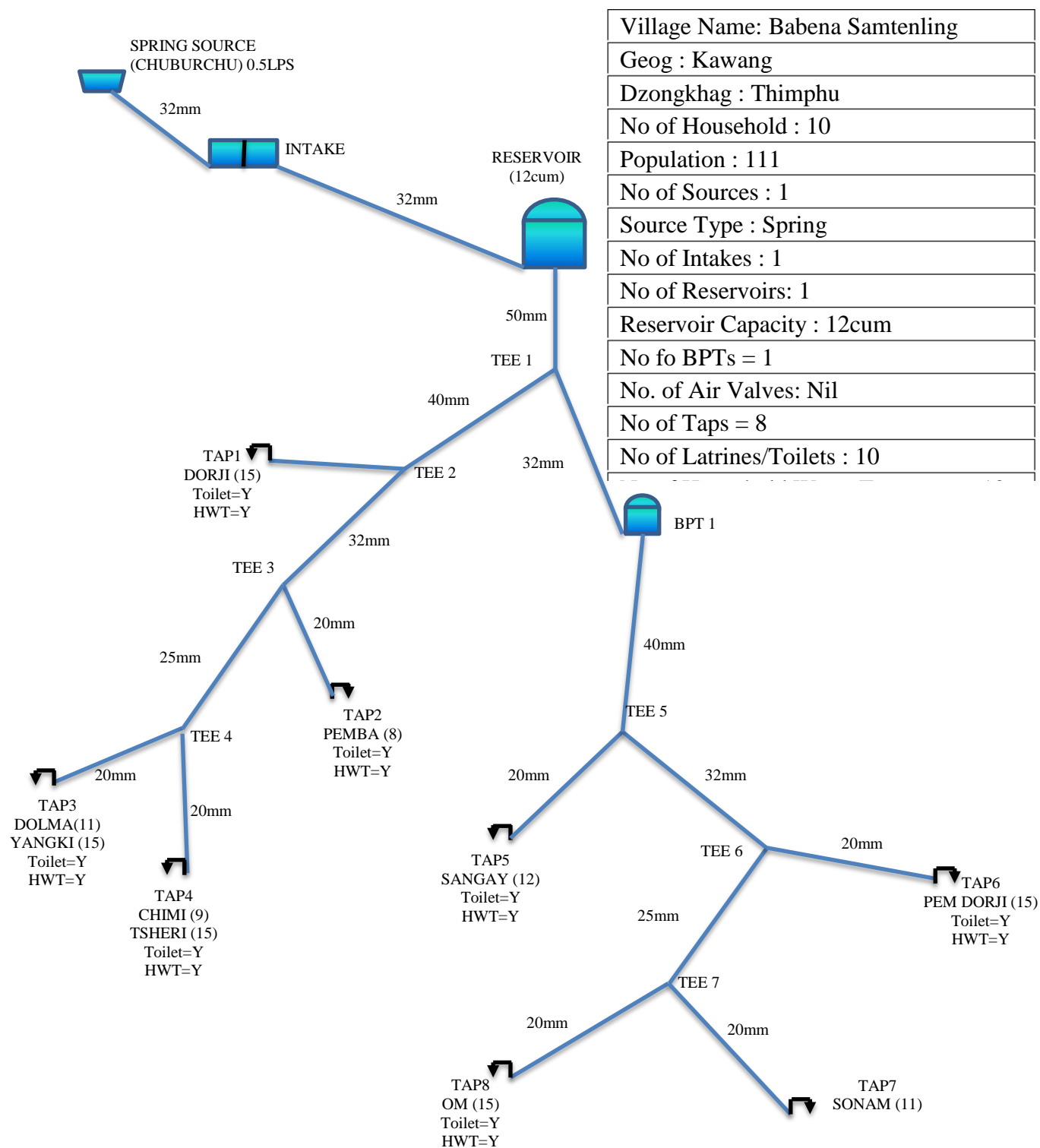
This section should contain:

- Completed scheme summary table ([FORM 1](#))
- Example scheme map
- Completed scheme map ([FORM 2](#))

Scheme information sheet (FORM 1)

General Information		Technical Information	
Project No		Source Type	
Project Name		Source Yield (lps)	
Dzongkhag		No. of Sources/Intakes	
Geog/Town		No. of FCR	
BHU/Hospital		Size of each FCR (m ³)	
Total Households		No. of BPT	
Total Population		No. of Taps	
		No. of Air valves	
		No. of Control Valves	
Survey by		No. of Washouts	
Survey Date		No. of Latrines/Toilets	
		No. of HWTS used	

Scheme map (EXAMPLE ONLY)



Scheme map (FORM 2)

Date: _____ Village/Project Name:_____

WSP Team

This section should contain:

- *WSP team roles and responsibilities*
- *Example WSP team membership table*
- *Completed WSP team membership table ([FORM 3](#))*

WSP team roles and responsibilities

WSP team must develop, carry out, review and revise the WSP. Responsibilities are described below.

WSP development and implementation:

- Walk the complete system (from catchment to consumer)
- Describe/map the system
- Complete the system survey (hazard checklist)
- Complete the hazard analysis and control measure report and carry out the improvement works according to the plan
- Define caretaker roles and responsibilities for monitoring and maintenance
- Implement the plan for ongoing water quality monitoring
- Develop an emergency response plan
- Meet quarterly or at least two times per year to verify that control measures are being implemented as planned and that the caretaker is carrying out roles and responsibilities
- Meet as needed in case of emergency situations involving the water supply
- Maintain the WSP file

Annual WSP review and revision:

Every year, the WSP team should:

- Repeat the complete system walk (from catchment to consumer)
- Review and update (if necessary) the system description/map
- Repeat the system survey (hazard checklist)
- Review and update the hazard analysis and control measure report
- Review and update (if necessary) caretaker roles and responsibilities for monitoring and maintenance
- Review water quality monitoring results
- Review and update (if necessary) the emergency response plan

WSP team membership (EXAMPLES ONLY)

Example 1 – Community water supply

No.	Name/job title	Role	Contact #
1	Mr. X / Tshogpa	Chairman	#####
2	Ms. Y / Women Representative	Member	#####
3	Representative	Member	#####
4	Water Caretaker	Member	#####
5	Village Health Worker	Member	#####
6	Health Assistant	Advisor	#####
7	RWSS Focal/Geog Engineer	Advisor	#####

Example 2 – School water supply

No.	Name/job title	Role	Contact #
1	Health Club Teacher	Member	#####
2	Health Club Student	Member	#####
3	School Water Caretaker	Member	#####
4	Health Assistant (BHU)	Advisor	#####
5	RWSS Focal/Geog Engineer	Advisor	#####

WSP team membership (FORM 3)

Date: _____ Village/Project Name: _____

No.	Name/job title	Role	Contact #
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Hazard Analysis & Control Measures

This section should contain:

- *Completed system survey form (hazard checklist)([FORM 4](#))*
- *Example hazard analysis & control measures form*
- *Completed hazard analysis & control measures form ([FORM 5](#))*

System hazard checklist survey form (FORM 4)

Date: _____ Village/Project Name: _____

No.	Questions	Yes	No	N/A	Notes
A. Scheme Component: <i>Catchment, source and intake area</i>					
1	Source free from upstream contamination (cattle, houses, latrines, etc.)?				
2	Source water quality appears to be clear and clean?				
3	Intake area clean?				
4	Fence around source intact, protecting the source?				
5	Sufficient vegetation around the source?				
6	Proper drainage above the source/intake?				
7	Strainer inside collection tank unclogged?				
8	Collection chamber clean and covered?				
9	The collection chamber free of cracks, holes, etc.?				
10	The valves and air vent in the valve box dry (not leaking) and is valve box intact?				

No.	Questions	Yes	No	N/A	Notes
B. Scheme Component: <i>FCRs (Ferro Cement Reservoirs)</i>					
10	FCR free of cracks?				
11	Inside of FCR clean?				
12	Area around FCR free of vegetation?				
13	FCR valves and air vent in the valve box dry (not leaking) and is valve box intact?				
14	Fence around FCR intact?				
C. Scheme Component: <i>BPTs (Break Pressure Tanks)</i>					
15	BPT free of cracks?				
16	Inside of BPT clean?				
17	Area around BPT free of vegetation?				
18	Float valves at the BPT inlet intact and functioning?				
19	BPT GI valve box intact and valve functioning?				
20	Fence around BPT intact?				

No.	Questions	Yes	No	N/A	Notes
D. Scheme Component: <u>Pipeline and valves</u>					
21	Pipes free from leakage?				
22	HDPE pipes properly buried (not exposed)?				
23	Proper support for GI pipes?				
24	Air release valves and washout valves not leaking and functioning?				
E. Scheme Component: <u>Tapstand</u>					
25	Platform area clean?				
26	Wastewater safely drained away?				
27	Structure free of cracks?				
28	Bibcock and regulating valve intact and not leaking?				
29	GI valve box and globe valve intact and not leaking (for school taps)?				

No.	Questions	Yes	No	N/A	Notes
Scheme Component: <i>User practices</i>					
30	Clean, closed and safe containers used to transport water from tapstand?				
31	Clean, closed and safe household storage containers?				
32	Clean and safe handling practices?				
33	Household Water Treatment System available?				
Scheme Component: <i>Management and functionality</i>					
34	Regular water supply at all tapstands?				
35	Active village water management?				
36	Caretaker(s) trained and doing their work regularly?				
37	Caretaker(s) being compensated?				
38	Caretaker(s) have sufficient tools?				
39	Water being used according to local agreements?				
40	O&M fund established?				
TOTAL		X	Y	Z	

Hazard score is use to check the functionality of scheme by adding all the Yes (X), No (Y) and NA (Z)

$$\text{Scheme functionality (\%)} = \frac{\Sigma X}{\Sigma(X+Y-Z)} * 100$$

Definitions on functionality		
Overall Score	Functionality scale	Description of functionality scale
76-100	High functionality	Water supply is functioning very well – and there is no immediate risk for scheme failure, deterioration or contaminated water.
51-75	Medium functionality	Water supply is functioning well – with some minor problems. There is no immediate risk for scheme failure, deterioration or contaminated water
26-50	Low functionality	Water supply is functioning – however need improvement. There is a risk for scheme failure or contaminated water and the scheme could be deteriorating fast.
0-25	Non functionality	Water supply is in reality not functioning. Numerous of problems have been detected and there is an obvious immediate risk for scheme failure or contaminated water and the scheme is without doubt deteriorating fast.

Hazard analysis & control measures (EXAMPLE ONLY)

Present Situation	Hazard	Risk level		Control Measure	Materials & Tools	When	Who	Verify
		High	Low					
Scheme Component: <u>Catchment, source and intake area</u>								
No strainer on intake pipe	Risk of blockage	X		Fix with HDPE strainer	63mm HDPE pipe =2m	30/09/12	Community	Geog and BHU
Fencing poles collapsed at source and reservoir	Animal entering and can cause damage & contaminate	X		Fencing properly	Wooden pole for source and reservoir	30/09/12	Community	Geog and BHU
Bushes growing around FCR	Roots may damage structure		X	Clear bushes	Sickle	30/05/13	Community	Geog and BHU
Scheme Component: <u>Pipeline and valves</u>								
Some HDPE pipe exposed in remote places in the jungle	Risk of pipe damage, water loss & contamination		X	Bury pipeline	Shovel, pick ax and spade from community	15/10/12	Community	Geog and BHU

Hazard analysis & control measures (FORM 5)

Date: _____ Village/Project Name: _____

Present Situation	Hazard	Risk level		Control Measure	Materials & Tools	When	Who	Verify
		High	Low					
Scheme Component:								

**Add extra sheets as necessary to complete the hazard analysis for the complete water scheme*

Monitoring, Maintenance & Management

This section should contain:

- *Completed caretaker roles and responsibilities for monitoring & maintenance ([FORM 6](#))*
- *Completed emergency response plan ([FORM 7](#))*
- *Completed water quality monitoring plan ([FORM 8](#))*
- *Water quality testing results (received from health officials)*
- *Maintenance & improvement works log sheet ([FORM 9](#))*

Caretaker roles & responsibilities for monitoring & maintenance (FORM 6)

Scheme Component	What to monitor and target condition?	How often?	
		Rainy season	Dry season
Catchment area	No upstream land use threatening water quality or quantity		
Intake	Structure intact; fence intact; strainer and collection chamber free of debris; intake area free of debris; valves not leaking and functioning; drainage above the source is free of blockage		
Valves (air release and washout)	Valves not leaking and functioning		
Reservoir (FCR)	Structure free of cracks; manhole cover closed; strainer intact and free of blockage; reservoir area clean and free of vegetation; valves not leaking and functioning; valve chamber intact; fence intact		
	Tank free of sediment (by cleaning according to caretaker manual)		
Break Pressure Tank (BPT)	Structure free of cracks; manhole cover closed; strainer intact and free of blockage; BPT area clean and free of vegetation; float valve functioning; gate valves not leaking and functioning; valve box intact; fence intact		
	Tank free of sediment (by cleaning according to caretaker manual)		
Pipeline	No exposed HDPE pipe; no leakage; proper support for GI pipes		
Tapstand	Structure intact and no leakage; equal tap flow; proper drainage; surrounding area clean		
	Tap closed when not in use and no leaking; proper drainage; surrounding area clean		

Emergency response plan (FORM 7)

Date: _____ Village/Project Name: _____

In the event of a water quality emergency (dead animal in the intake, waterborne disease outbreak, landslide, human activities posing an immediate threat, etc.), communication will be as follows:

[illegible]

Water quality monitoring plan (FORM 8)

Date: _____ Village/Project Name: _____

Sampling frequency:	Before and after WSP <u>AND</u> annually during household visits by Health Assistants
Parameter tested:	Microbial (faecal coliforms)
Target value:	0 cfu/100mL (faecal coliforms)
Sampler:	Health Assistants
Sampling locations*:	Source, Reservoir(s), taps storage containers

* Sampling at the source (in addition to reservoirs, taps and household storage containers) is preferred, but may not be feasible where the source is far from the village

Maintenance & improvement works log sheet (FORM 9)

Village/Project Name: _____

Date	Activity	Activity completed by	Cost	Funded by