THE PHILIPPINE SUSTAINABLE SANITATION KNOWLEDGE SERIES

Guidebook on Water Supply Protection Program

Department of Health

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For inquiries or comments, please contact the email address listed for the National Center for Disease Prevention and Control listed under this page: http://www.doh.gov.ph/contact_us.html.

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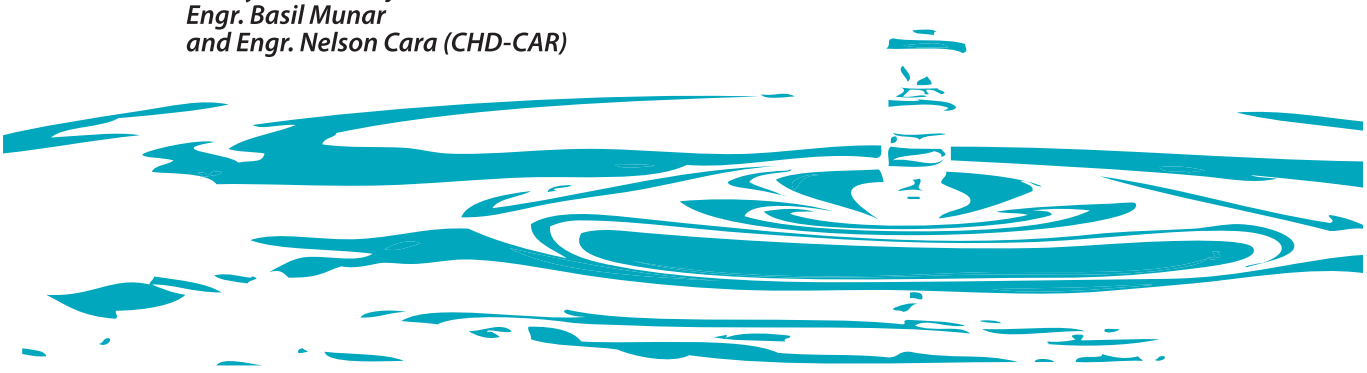

FOREWORD

According to 2008 UN data, 2.6 billion people still do not have access to or have inadequate sanitation facilities.

Every 20 seconds, a child dies as a result of poor sanitation. That's 1.5 million preventable deaths each year. In the Philippines, 23% of Filipinos or roughly 19 million still do not have access to sanitary toilets.

These realities necessitate tangible and concerted efforts that are owned by the people through the local government units (LGUs). The United Nations has already declared access to water and sanitation as a human right in its July 28, 2010 General Assembly. With the synergistic efforts of both the public and private sectors, the Philippines is also making significant gains in raising awareness and accelerating progress towards the Millennium Development Goal (MDG) on sanitation: to reduce by half the proportion of people without access to basic sanitation by 2015.

Through this Guidebook, we also emphasize that the National Government needs the support of its partners in order to achieve this goal. We need greater collaboration with our partners in the local government units. Likewise, we need to intensify our partnership with the private sector.

Attaining sustainable sanitation is a significant challenge. However, we believe that we have committed partners in the LGUs. Sustainable sanitation will happen because the LGUs are recognizing their roles and equipping themselves with the appropriate knowledge, tools, and skills.

This Guidebook is just one in a series of knowledge resource materials that we are developing towards one of our shared aspirations: ensuring health and wellness for all Filipinos through clean, safe, and life-giving water and sanitation facilities. This specific Guidebook is for local government units, nongovernment organizations, and others involved in the operation, management, or provision of drinking water supply. It is hoped that with this Guidebook, these organizations may be assisted in developing a Water Safety Plan (WSP) for organized community or barangay managed water supply systems. These are water systems outside the operation of Water Districts (WDs) and serving cluster of households defined by a purok, group of puroks or as large a group as barangays.

The World Health Organization has issued the 3rd edition of the Guideline for Drinking Water Quality recommending that Water Safety Plans be introduced in all water supply programs as a key component of water safety management. The municipality of Bauko in Mt. Province, one of the Sustainable Sanitation in East Asia (SuSEA) pilot sites utilized this approach in the development of its Water Supply Protection Program. While following the guidance provided by Water Safety Plan Manual by Davison, et al., 2006, actual field conditions dictated the experience of the WSP team members in the development of WSPs for the respective water systems in the three (3) priority barangays of Bauko. The SuSEA program is sharing this experience through this Guidebook.

The development and implementation of WSPs, however, cannot be successful with minimal intervention on the sanitation problems of the concerned communities or barangays. For every water supply and sanitation project, both the safety of a community's water supply and other sanitation issues must be given equal importance. This Guidebook is for the LGUs and the Filipino people. Use it well and then share it with other LGUs who may also find it useful in their pursuit of sustainable sanitation.

Enrique T. Ona, MD, FPCS, FACS
Secretary of Health

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ACRONYMS AND ABBREVIATIONS

Brgy	Barangay
BHW	Barangay Health Worker
CHD	Center for Health and Development
DOH	Department of Health
EO	Executive Order
EOHO	Environment and Occupational Health Office
GDWQ	Guideline for Drinking Water Quality
GI	Galvanized Iron
HH	Households
IEC	Information, Education and Communication
IRA	Internal Revenue Allotment
LDWQMC	Local Drinking Water Quality Monitoring Committee
LGU	Local Government Unit
MEO	Municipal Engineering Office
MLGU	Municipal Local Government Unit
MPDC	Municipal Planning and Development Coordinator
NGO	Non-government Organization
PD	Presidential Decree
PE	Polyethylene
PHO	Provincial Health Office
PHP	Philippine Peso
PNSDW	Philippine National Standard for Drinking Water
POW	Program Of Works
PVC	Polyvinyl Chloride
RHU	Rural Health Unit
RSI	Rural Sanitary Inspector
SuSEA	Sustainable Sanitation In East Asia
TAMS	Technical Assistance Management Services
WD	Water District
WHO	World Health Organization
WSP	Water Safety Plan
WSPP	Water Supply Protection Program

The SuSEA Program

The Sustainable Sanitation in East Asia Program-Philippine Component (SuSEA) supported by the Water and Sanitation Program (WSP) of the World Bank and the Swedish International Development Cooperation Agency (SIDA), and implemented through the leadership of the Departments of Health (DOH) and Environment and Natural Resources (DENR), is geared towards increasing access by poor Filipinos, primarily low-income households, to sustainable sanitation services by addressing key demand and supply constraints. Aside from this, the program hopes to learn from local implementation of sanitation programs as basis for national policy and operational guidance.

SuSEA Philippines commenced in July 23, 2007 as a learning program to support the Government of the Philippines (GoP) update its approaches and interventions in sanitation and needs that were not present or not addressed in traditional sanitation programs that focused on two extremes: 1) toilet-bowl distribution and hygiene education and 2) centralized sewerage systems. The most important of these emerging needs are:

- Complementing interventions related to the reduction of risks of sanitation- and poverty-related diseases such as soil transmitted helminthiasis and acute gastroenteritis

- Linking sanitation interventions with environmental objectives, such as the improvement of water quality and water resources

- Sanitation in rapidly urbanizing towns and cities, including the occurrence of disease episodes that aggravate impacts of poor sanitation (such as flooding) on the economy and quality of life of city populations

- Reaching pockets of communities that comprise the remaining 20% of those without access to basic sanitation, particularly in the rural areas (among whom include indigenous peoples/cultural minorities) and urban slum communities.

SuSEA-Philippineswas designed using four different models as the platform for developing specific interventions (according to themes below). The learning gained and the tools developed from these models served to assist other local governments units (LGUs), as well as informing national sanitation policy and programs for GoP-led expansion and scaling up. The four models are:

Model 1 Disease Prevention and Control – Sanitation interventions for the eradication/ reduction of disease
Model 2 Water Quality Management – Sanitation interventions for the improvement of water quality within a water quality management area
Model 3 Liveable Cities - Sanitation interventions for the improvement of quality of life in cities and low-income urban poor communities
Model 4 Sustainable Rural Livelihoods - Sanitation interventions to support sustained livelihoods in rural areas

Six sites participated in the main program sub-component of SuSEA. These are: Bauko Municipality in the Mt. Province, Dagupan City in Pangasinan Province, Guiuan Municipality in Eastern Samar Province,

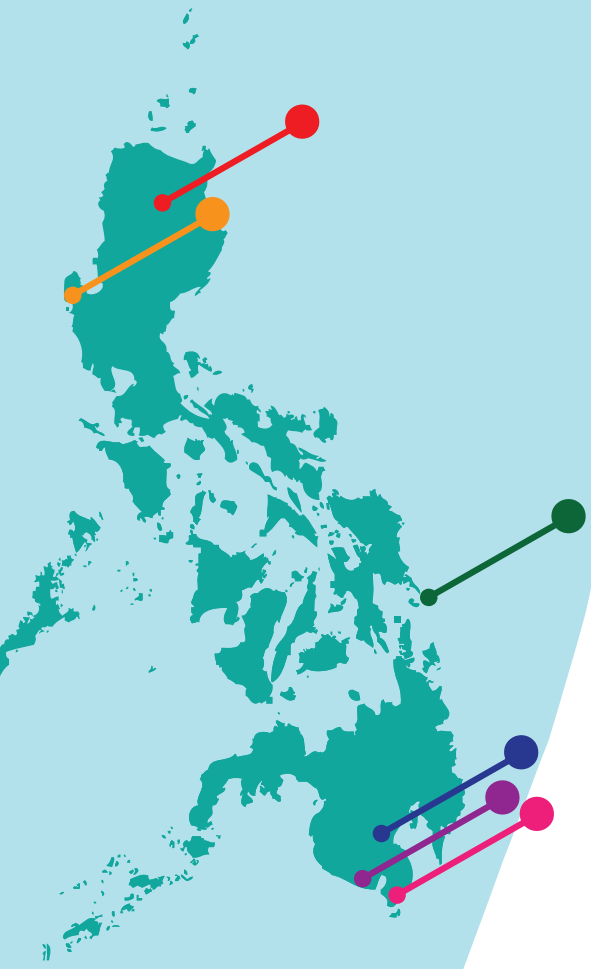
General Santos City and Polomolok Municipality in South Cotabato, and Alabel Municipality in Sarangani. The desired outcome in each of the project sites varied according to the model and agreements by the Program Steering Committee and the local government.

While outcomes varied per site, each of the projects were additionally intended to provide the LGUs with a fount of information on developing and running their own sanitation programs based on the on-field experiences of the SuSEA team and their partners.

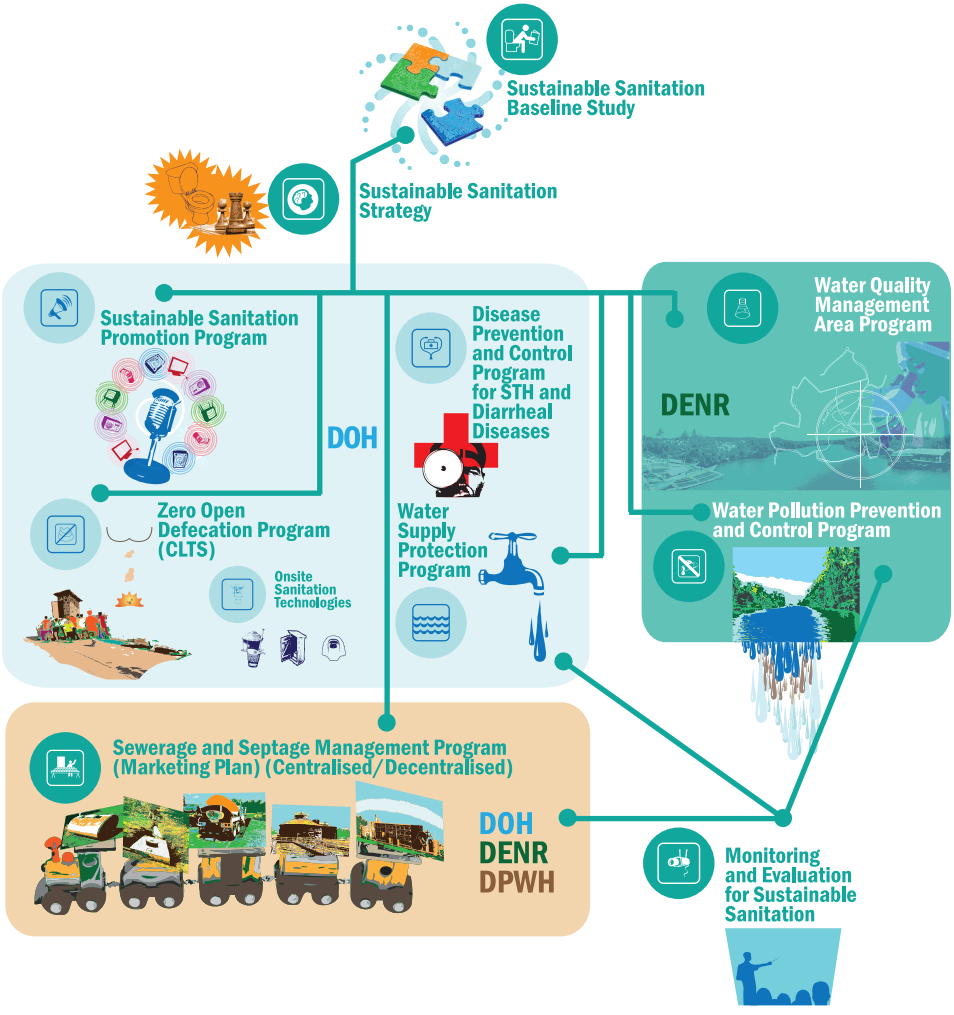
This information has been packaged for your use in a Sustainable Sanitation Knowledge Series, to which this guidebook/report belongs. The reader is encouraged to familiarize himself/herself with all the guidebooks/reports in this series beginning with the Guidebook for Conducting a Baseline Study and followed by the Guidebook for Developing a Local Sustainable Sanitation Strategy.

What guidebooks/reports you choose to utilize next will be determined by your community's particular needs and your LGU's proposed sanitation programs.

On the succeeding page, you will find an illustration of the various sustainable sanitation programs (SSPs) under the National Sustainable Sanitation Plan (NSSP). For each of these SSPs, SuSEA has also developed materials under the Philippine Sustainable Sanitation Knowledge Series, intended to guide local government units in implementing the various sanitation programs and initiatives in their own area. The information gathered in the Knowledge Series is, in turn, based on specific SuSEA projects and activities in each of the six project sites.



Sustainable Sanitation Programs



I. WHY THIS GUIDEBOOK?

This Guidebook describes the process in developing Water Safety Plans (WSPs) for community or barangay-managed water supply systems, which typically serve a barangay or one to several puroks depending on the population size. WSPs provide for an organized and structured system to minimize the chance of failure through oversight or lapse of management and for contingency plans to respond to system failures or unforeseen events.

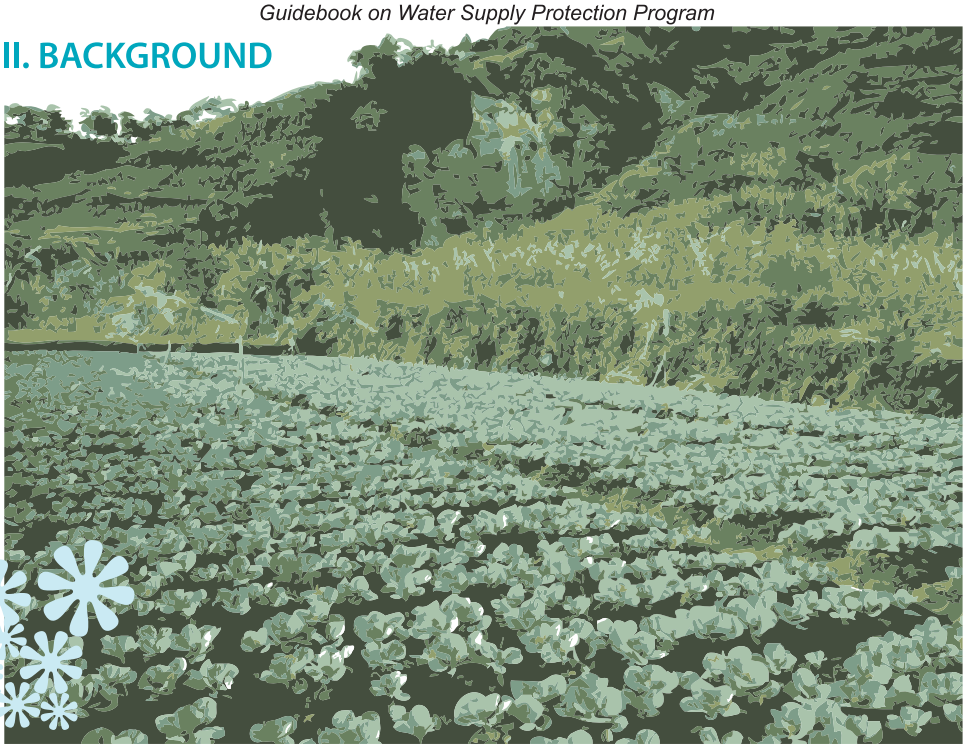
The need to develop this Guidebook came about due to the fact that most WSPs developed in the Philippines are for water utilities like water districts (WDs). Two of the first water utilities to develop their own WSPs were Maynilad Water Systems Inc. and Manila Water Company, Inc. For these two companies, developing WSPs was a necessity because they cater to the water needs of millions of people in Metro Manila. Outside Metro Manila, most WSPs that have been developed were intended for WDs. Compared to WD-managed water systems, however, the development of WSPs for small, community-managed or barangay-managed water system is different.

WDs have trained and professional staff with sufficient background and experiences on the proper management, operation, and maintenance on the different component parts of water systems. For these people, it is not difficult to understand the processes and different steps involved in the development of a WSP. WDs have a range of equipments and devices to monitor the microbial, chemical, and physical properties of water flowing along the pipes when it undergoes a series of treatment processes prior to distribution to households.

Conditions are different for rural areas, however, where water supply is intended for just a hundred of houses. Most of the time, they are managed by formal or informal neighborhood associations or barangay councils through caretakers or plumbers whose main task is to flush out the debris from the water storage tank once in a while and do simple pipe repair. Oftentimes, among these neighborhood associations or barangay councils, there is hardly a person knowledgeable on the proper operation and maintenance of water systems. Involvement of users by way of providing regular water tariff is minimal, in some cases, nonexistent.

While there is a need to involve users, specifically, plumbers and caretakers, in the development of a WSP, it may not be easy for these users to prepare the documents for the WSP due to the complexity of some of its aspects. This Guidebook simplifies the different steps involved in the preparation of a WSP by presenting selected parts of the WSP of the Municipality of Bauko developed through the SuSEA program as an example.

II. BACKGROUND



The municipality of Bauko in Mt. Province is one of the pilot areas under the Sustainable Sanitation (SuSEA) in East Asia Philippine Program. The main concern in this municipality is the contamination of drinking water sources primarily caused by vegetable farms. This is in addition to the usual source of environmental pollutants such as stagnant water and human and animal feces as a result of open defecation practice, untreated waste water flowing along canals coming from households and backyard piggeries, and uncollected solid wastes (garbage), among others.

Through SuSEA, it was recognized that there was a need to develop a Water Supply Protection Program (WSPP) that would protect drinking water supply in the different barangays of Bauko. In the development of a WSPP for Bauko, Water Safety Plans (WSPs) were piloted in three of Bauko's priority barangays (Annex D). WSPs provide for an organized andstructured system to minimize the chance of failure through oversight or lapse of management and for contingency plans to respond to system failures or unforeseen events. WSPs use comprehensive risk assessment and risk management techniques that encompass all steps in water safety from catchment to consumer (WHO, 2004). This systematic approach was presented in the 3rd Edition of the World Health Organization (WHO) Guidelines for Drinking Water Quality (GDWQ). This Guidebook is adapted from the "Water Safety Plan Manual" by Annette Davison for the World Health Organization. Direct lines lifted from the "Water Safety Plan Manual" are enclosed in blue-colored boxes all throughout this text. The discussion of different steps, examples, and insights from the development of pilot WSPs for the three (3) water supply systems in Bauko, Mt. Province are also presented in this Guidebook.

A template of estimated costs for the preparation of a Water Safety Plan based on the Bauko experience is located in Annex A.

III. THE WATER SAFETY FRAMEWORK

A. The WHO Framework

The World Health Organization's water safety framework comprises five key elements that are required to deliver safe drinking water.

Table 1. WHO Safety Framework for Drinking-Water Supply

Component	*Requirements*
1: Setting Health-based Targets 	Targets are based on an evaluation of health concerns and need to be set at a tolerable level for the community (e.g. are risk-based and can be coordinated with national guidelines, standards or WHO guidelines).
2: System Assessment 	An assessment is conducted to characterize the water supply system, assess risks and determine whether the drinking-water supply (from source through treatment to the point of consumption) as a whole can deliver water that meets the health-based targets).
3: Operational Monitoring 	Monitoring of the control measures in the drinking-water supply that are of particular importance in securing drinking-water safety. Monitoring at multiple points within the system, rather than relying on end-product monitoring, provides the supplier with assurance that an unsafe product does not end up with the consumer.
4: Management Plans 	Management plans are set up and encompass: • Documentation of the system assessment • Monitoring plans including normal and incident operations, upgrades, improvements and communication
5: Surveillance 	A system of independent surveillance verifies that the above components are operating properly and effectively.

B. Health-based targets

Safety requirement is identified using the four types of health-based targets:

- *Health outcome, refers to the reduction in detected disease incidence or prevalence;*
- *Water quality, refers to guidelines applied to water quality;*
- *Performance, refers to generic performance target for removal of group of microbes; and,*
- *Specified technology, refers to specifying specific processes to adequately address constituents with health effects.*

The objectives of developing a WSP are expressed as health-based targets. In Bauko, specific health-based targets were identified by the WSP team members and the Rural Health Unit (RHU). These groups agreed on the following:

- Health outcome - Reducing the cases of watery diarrhea from 517 cases per year (2006 data) to less than 200 cases per year;
- Water quality - Complying with the water quality standards as specified in Philippine National Standards for Drinking Water (PNSDW);
- Performance - Removing microbial contaminants e.g. E. coli, from the drinking water supply; and,
- Specified technology - Recommending actions, processes and technologies that will render drinking water supplies potable for all domestic consumption.

C. Water Safety Plan

The 3rd Edition of the World Health Organization Guidelines for Drinking Water Quality recommended the systematic approach of Water Safety Plan (WSP) in securing drinking-water safety. It uses a comprehensive risk assessment and risk management approach that encompasses all steps in water safety from catchment to consumer (WHO, 2004). Under a WSP, water quality analysis is mainly used for periodic verification of water safety. The development of a WSP plan involves:

- *Preventing contamination of water sources;*
- *Treating to reduce or remove contamination in order that water safety targets are met, and:*
- *Preventing re-contamination during storage, distribution and handling of water. (Godfrey & Howard, 2005)*

III. THE WATER SAFETY FRAMEWORK

The steps involved in the development of a WSP are illustrated in Figure 1.

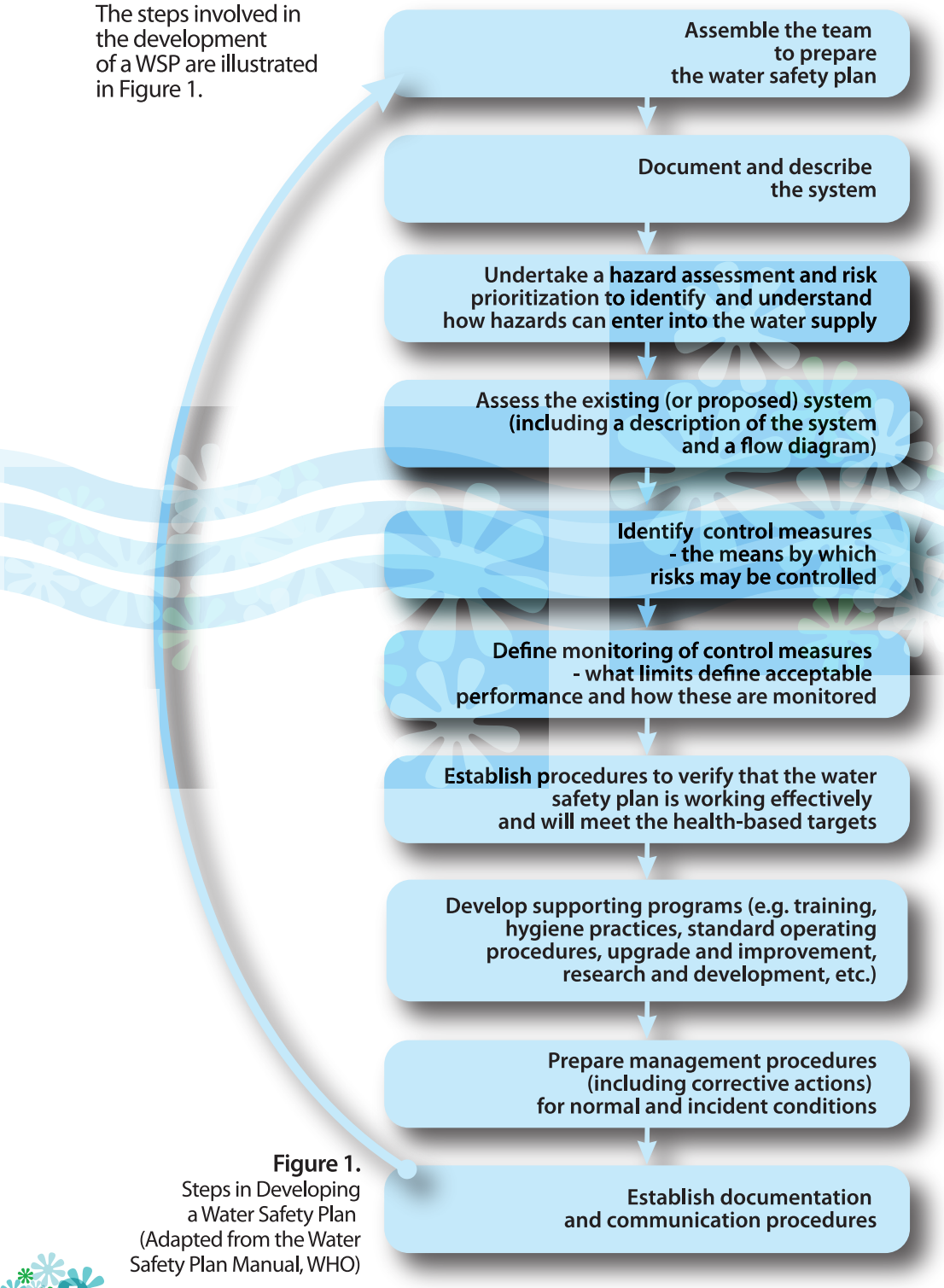


Figure 1.
Steps in Developing a Water Safety Plan (Adapted from the Water Safety Plan Manual, WHO)

D. Surveillance

To check if the WSP is working according to plan, an independent body will be needed. Chapter 2, Section 3.5 of the Sanitation Code (PD 856) states that the local health authority shall establish a water surveillance program through the creation of a Local Drinking Water Quality Monitoring Committee (LDWQMC).

This LDWQMC, officially organized by the LGU, will be responsible for the surveillance of the WSP. The following are the roles of the LDWQMC:

1. To oversee the operations of the water systems and the quality of water produced and distributed by the water provider, and

2. To monitor the implementation of the implementing rules and regulations of the Code of Sanitation.

The functions of the LDWQMC are:
1. Collects and analyses water samples regularly;

2. Evaluates laboratory results as to their compliance to standards;

3. Conducts regular or immediate sanitary survey during the existence of a potential cause of contamination;

4. Institutes remedial measures to correct the deficiency of the water system;

5. Informs the public of the latest quality of the drinking water in the locality.

6. Initiates regular or immediate sanitary survey for contaminated water supply sources.

7. Reviews and approves the location of water sampling points.

8. Issues pronouncements on the quality of drinking water in the locality and release corresponding advisories if necessary.

9. Conducts the water quality audit.

According to PD 856, the LDWQMC should be composed of the following personnel: the Municipal Mayor as the Chair; the Municipal Health Officer as Vice Chair; a DOH representative; the Municipal Engineer; the Chairman of Committee on Health and Sanitation; the Municipal Agriculture Officer; the Municipal Planning and Development Officer; the Provincial Sanitary Engineer; the Head of the Private Water Supply Provider Association; a representative of the water laboratory; and, a representative of a Non-government Organization.

In the event that an LDWQMC cannot be created, there is a need to organize an independent group or utilize existing related monitoring groups, if any, to monitor the WSP.

III. STEPS IN DEVELOPING A WSP

An important early decision that a water supply organization must make is how to structure its WSP(s) to ensure that all systems are most efficiently encompassed. Where a water supply organization is responsible for managing a single system, a WSP will be developed for that system. However, a complication arises where a water supply organization is responsible for managing many water supply systems. According to WHO, there are three ways for a water supply organization to structure WSP(s) for multiple systems:

- *A single WSP can be developed for all systems;*
- *Several WSPs can be created with each WSP covering one system or a group of related systems; or*
- *A combination of the above, whereby a single high-level WSP overarches a series of subordinate system-specific WSPs.*

In practice, where a water supply organization is responsible for multiple systems, a WSP for one distinct system is often developed as a 'pilot' before moving on to encompass other systems. Once the pilot WSP has become well enough developed, other systems are encompassed through an extension of the WSP program.

A. Preparing for the WSP

a. Selection of Pilot Water Systems

Since the development of a WSP is system specific, you should consider the type of water source or technology in your area and adapt your WSP accordingly. Depending on your situation, any of one of the following types of WSP should be drafted:

- WSP for a piped water system from a spring source
- WSP for a piped water system from a surface water source
- WSP for hand pumped wells
- WSP for motorized well

In Bauko, a typical barangay has more or less five (5) water sources. Each water source comprises a distribution system and a service area making it a water system in itself. Being a mountainous area, the municipality is blessed with numerous water sources such as springs, streams, brooks and waterfalls.

For Bauko's WSPP, the biggest water sources that serve the most number of households were chosen as the pilot. One WSP team developed a WSP for a piped water system from a spring source in one barangay while the other team opted to develop a WSP for a piped water from a surface water source.

b. Training-Orientation of WSP Teams of Pilot Water Systems

WSP development starts with orientation training for the members of the water supply organization that is formally or informally managing the water system. Members may include

barangay captains, selected barangay councilors, barangay health workers (BHWs), caretakers, and plumbers from the pilot barangays.

Local nongovernment organizations (NGOs) and other civic organizations can also be encouraged to be part of the team while the involvement of LGU staff residing in pilot barangay is also recommended. The experience in Bauko showed, in particular, that LGU staff members were capable of leading the WSP teams during discussions, analysis and preparation of WSP documents. Being residents of the pilot barangays, these LGU staff members were additionally motivated to develop and successfully implement the WSPs because of their own personal stake in the results (i.e. their respective families obtained their drinking water supplies from the systems). They also functioned as a "link" for needed resources and support from the municipal LGU and other support groups.

It is also recommended that as early as this stage, the LDWQMC be organized and the members are oriented on their roles and responsibilities (see Section III-D of Presidential Decree No. 856: Code on Sanitation). The Center for Health Development (CHDs) or the Department of Health-Environment and Occupational Health Office (DOH-EOHO) can provide assistance in the organization of the LDWQMC. The modules in these activities are as follows:

- Orientation-Workshop on Water Safety Planning

Module 1 – Water Borne Diseases Outbreak

Module 2 – Philippine National Standards for Drinking Water

Module 3 – Overview, Framework, Foundation and System Assessment for WSP

Module 4 – Assembling a Team, Describing the System, constructing a Flow Diagram

Module 5 – Overview of Hazard Identification and Risk Analysis; Identification of Hazard and Risk Analysis

Module 6 – Operational Monitoring

Module 7 – V erification and Audit

Module 8 – Supporting Programs and Management Plans

Module 9 – Documentation and Records

• Orientation-Workshop on LDWQMC

Module 1 – DOH Policies on Drinking Water

Module 2 – Philippine National Standard for Drinking Water

Module 3 – Introduction to Local Drinking Water Quality Monitoring Committee

Module 4 – Drinking Water Supplies Surveillance

Module 5 – Water and Health

Module 6 – Water Operation, Maintenance and Disinfection

Module 7 – Water Sampling Procedures

Module 8 – Water Sampling and Analysis

Module 9 – Recording, Reporting and Communication

c. Pre-training of Water Organization Staff

It is recommended that a representative or a small group from the water organization or municipality attend the WSP orientation prior to the actual preparation of WSP for the target area or water systems.

This would help provide them with an overview on the process and the different steps involved in the development of a WSP. They can also assist in the preparatory activities. Two of the rural sanitary inspectors (RSIs) in the Bauko RHU attended the WSP orientation-workshop in Laoag given for the Ilocos Norte Water District. These RSIs were then able to help the teams in the preparation of the WSP documents.

You can also seek help in the pre-training of your staff or the development of your WSP by inquiring from Water Districts in the nearby municipalities who might have already prepared WSPs or attended the relevant training.

B. Organizing the WSP Team

The WSP team will be a working party or taskforce that is collectively responsible for developing, implementing and maintaining the WSP as a core part of their day-to-day roles. However, in actual situation, most members of the team will not be 100% committed to WSP duties but will also continue with their normal duties. Team members need to collectively possess the skills required to identify hazards as well as to understand how these hazards may be controlled. Ideally, the following checklist points are considered to ensure that an appropriate team mix is achieved:

- *Technical expertise and operational system-specific experience required to develop the WSP;*
- *Capacity and availability to undertake the WSP development, implementation and maintenance;*
- *Organizational authority to report through to the relevant controlling authorities, such as the Executive of an organization, or leaders of a community;*
- *Understanding of the organizational and people management systems and processes that turn plans into actions and that communicate the results of monitoring and reporting;*
- *Understanding of the health based targets to be met;*
- *General appreciation of the water quality needs of the end users;*
- *Understanding of the practical aspects of implementing WSPs in the appropriate operational context;*
- *Appreciation of the regulatory and policy environment of the organization, and,*
- *Familiarity with training and awareness programs.*

Members of WSP teams can be the barangay councilmen, BHWs, caretakers, and plumbers. These are the same persons already involved one way or another in the operation and maintenance of the water system. Staff members from the Municipal Planning and Development Office (MPDO), the Municipal Engineering Office (MEO), the RHUs and other LGU staff who can help in the preparation of WSP are also recommended to be part of the team. As mentioned earlier, this strategy of including the LGU staff in the development of the WSP helped significantly in the preparations of the required documents for each step in the Bauko experience. These LGU staff members were the ones who led the respective team members and facilitated the discussion during workshops and small group discussions.

The basic information to obtain from the WSP team members are: name, affiliation, role in the WSP and contact information. Table 2 provides an example of the specific WSP team composition in Bauko.

Table 2. Water Safety Plan Team of Barangay Banao, Bauko, Mt. Province

Name	Org/Dept/Address	Job Title	Role	Contact Details
Julie A. Taganas	LGU-Bauko	MPDC Staff	Team Leader	
Emilia P. Alcido	LGU-Bauko	MEO Staff	Secretariat	
Francis Delim	LGU-RHU	SI	Technical Staff	
Marina Ayeo	Barangay Banao	BHW	Health and Sanitation	
Rosano Lacwasan	Barangay Banao	Plumber	Maintenance Crew	
Alfonso Pelis	Barangay Banao	BHW	Maintenance Crew	
Elena Guinabang	Barangay Banao	BHW	Health and Sanitation	
Antonio Wacangan	Barangay Banao	Councilman	Maintenance Crew	

Experience has shown that WSP development and implementation takes many months and requires significant resources. Even a third party can document a WSP relatively readily. However, implementation of a WSP within an organization requires genuine and strong commitment at all levels within that organization. At least one person within the water supply organization needs to be dedicated to coordinating the WSP development and implementation process in a full time capacity.

C. Documenting the Pilot Water System

The first task of the WSP team is to document and describe the pilot water system. During the actual survey, community leaders, barangay councilmen, BHWs and selected community members can also be involved in assisting the WSP team. The purpose of this is for them to begin their involvement in the development and eventually, implementation of the WSP for their own water system. This will also give them the chance to understand and personally observe the actual conditions of the different parts of their water systems.

The WSP team leads the survey on the different component parts of the water system: the watershed, the spring source, the transmission pipeline, the storage tank(s) or reservoir, the tap stand/community faucets and selected houses.

During the survey, defects and problems on the different parts of the systems must be noted. The possible points where contamination may enter into the system must be pointed out to the group. Sources of contamination from the environment especially in the watershed area must be discussed with the team and the community.

This may include pit latrines, unlined septic tanks, animals defecating within the watershed, farms or gardens using pesticides and other chemicals, among others.

The WSP team needs to also observe methods of fetching water from the community tap stands/communal faucets, to the home, and storage and handling methods of drinking water by family members.

All observations must be recorded, as these records will form part of the documentation of the system. Records may consist of written notes or pictures and videos which may then be used during the discussions to support the observations.

Other information that can be gathered is as follows:

a. Groups or persons managing the water system

b. Uses of the water system

c. Education or training, if any, provided to the community regarding proper operation and maintenance of water supply facilities.

d. Vulnerable groups within the user population who have specific water quality requirements

e. Date system was constructed (this is to establish age of the facilities)

f. Methods of water treatment at home or barangay water tank

g. Water tariff, if any

h. Person(s) in charge of repair and maintenance

i. Prevalent water related diseases in the community

j. Common type(s) of sanitation facilities used by households (note type of septic tank construction).

k. Any other useful information.

A sample documentation done by the WSP Team in Bauko is available in Annex B.

D. Assessing the Pilot Water System

Process observations with the group during the visit of the water system, making sure to note all comments and observations. To better understand the water system, a flow diagram would be needed.

Objectives of constructing a flow diagram are:

- *To conceptually understand the water supply process; and,*
- *To identify the linkages, water flow direction and responsibilities in the water supply process.*

This step captures the elements in detail to enable the accurate assessment of links and identification of control measures.

A spot map showing the water sources, the transmission pipelines that supply the reservoir, and the distribution pipelines going to the different puroks can also aid in the analysis. Flow diagram symbols that can be used are listed in Table 3. A sample flow diagram of the Tanap water system is shown in Figure 2.

Table 3. Process flow diagram symbols

Flow Diagram Symbol	Definition of Symbol
	**Operation:** ***Indicates when there is an operation or group of operations that result in intentional change in the water.***
	**Inspection:** ***Represents an inspection or decision. Eg. water supply is examined or is verified.***
	**Storage:** ***Where water is stored.***
	**Transport:** ***Occurs when the water is moved from one place to another.***
	**Combined activity:** ***Indicates activities performed either concurrently or by the same operator at the same location. Any combination of symbols may be used. Example shown indicates a combined operation and inspection.***

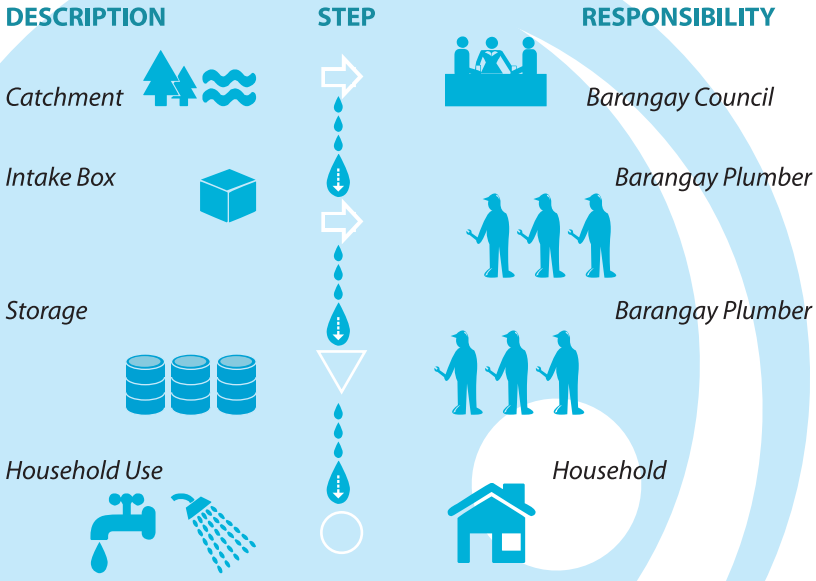


Figure 2. *Flow Diagram of Tanap Water System, Guinzadan Sur, Bauko*

A sample assessment based on the documentation of a water system is in Annex C.

E. Undertaking a Hazard Assessment and Risk Prioritization

The objectives of this step are:

- *To consider each step of the flow diagram;*
- *To identify all potential biological, physical and chemical hazards that are associated with the drinking water supply;*
- *To identify the hazardous events that can result in hazards gaining entry to the water supply;*
- *To identify the control measures currently in place; and*
- *To determine the risk potential of each hazardous event at each process flow step.*

a. Identifying Potential Hazards

In reference to the flow diagram, the team needs to assess what could go wrong in each step. Identify the hazards and hazardous events that may happen. This is the part where all potential biological, physical and chemical hazards are analyzed and associated with the different parts of the systems. The risk potential is determined for each hazardous event at each process flow step. Risks are rated following the Risk Factor Matrix in Table 4.

Table 4. Risk Matrix

Likelihood or frequency	Severity or Consequence				
	Insignificant No impact / not detectable Rating: 1	Minor Compliance Impact Rating: 2	Moderate Aesthetic Impact Rating: 3	Major Regulatory Impact Rating: 4	Catastrophic Public Health Impact Rating: 5
Almost Certain Once a day Rating: 5	5	10	15	20	25
Likely Once a week Rating: 4	4	8	12	16	20
Moderate Once a month Rating: 3	3	6	9	12	15
Unlikely Once a year Rating: 2	2	4	6	6	10
Rare Once every 5 years Rating: 1	1	2	3	4	5

b. Identifying Control Measures

Control measures are activities and processes applied to prevent hazard occurrence. These are the so-called "barriers to contamination" that allow the team to assess the water systems and determine if the risks are high, and consequently, need further action to reduce the risk at tolerable level.

Control measures may take the form of:

- *Preventing contaminants (hazards) gaining access to the water;*
- *Removing hazards from the water;*
- *Inactivating pathogens in the water; and*
- *Maintaining the quality of the water during distribution*

Control measures should be recorded against each of the identified hazards and hazardous events.

Table 5 shows the hazards, control measures, and risk prioritization by process step that was prepared for the Tanap Water Source in Barangay Guinzadan Sur, Bauko. The points assigned under columns for severity and likelihood were discussed among WSP team members and the barangay people.

The ratings on certain hazardous events to happen were the group's decision. They reflect the group's opinion on the severity and the likelihood that a given hazardous event may happen. Multiplying the scores under the factors of severity and likelihood will yield the risk factor score of the respective hazardous event.

Table 5. *Hazards, control measures, and risk prioritization by process step*

Process Step	Hazardous Event	Hazard	Control Measure	Severity	Likelihood	Risk
Catchment	Soil erosion due to landslide/ typhoon	Physical	Plant trees for slope protection	3	2	5
Catchment	Entry of chemical residue from vegetable farms	Chemical	Perimeter fencing, pass ordinance prohibiting vegetable farming near the water source	5	5	25
Catchment	Defecation of stray animals, pathogens will contaminate surface water source	Biological	Perimeter fencing, construct spring intake box	4	5	20
Storage tank	Entry of insects, debris through damaged parts	Biological	Repair damaged parts, chlorinate stored water	4	2	6
Storage tank	Entry of flood water during typhoon	Biological	Install backflow control to prevent entry of flood waters, repair damaged parts	4	2	8
Storage tanks	Entry of insects and rain falling in the surface of the tank through cracks	Physical	Repair damaged parts	3	5	15
Distribution Pipes	Microbes enter through leak and broken pipes	Biological	Repair/replacement of rusted/leaking pipes	4	5	20
Distribution Pipes	Broken and buried pipes due to landslides	Physical	Clean affected areas, repair damaged pipes	3	2	6
Storage	Buried reservoir due to landslide and soil erosion	Physical	Clean affected areas, repair broken structures	3	2	6
Distribution pipes	Contamination coming from piggery wastes	Biological	Elevate pipes to higher level	4	5	20

Ranking of severity (to be agreed by team members): 5-chemical, 4-biological, and 3-physical

For additional reference, the NGO Forum for Water Supply utilized a set of survey questionnaires in the assessment of risks on the different types of drinking water supplies in Bangladesh (APSU, 2006). Though this is used in the surveillance part of their program, this can also be adapted with some modification as a guide for this step.

F. Additional Control Measures

In cases where the system needs to be upgraded in order to achieve the target water quality objectives and reduce the risk to an acceptable level, action plans need to be prepared. These plans can be divided into short-, medium-, and long-term action plans. Short-term action plans are those that can be done immediately without much additional financial resource. The implementation of these plans can range from three to six months. Medium-term actions plans will need a brief preparation period, minimum financial resources and can be implemented within eight months to one year. Long-term action plans, on the other hand, are those that will need a long preparation period and substantial resources to accomplish. Action plans should also include an estimate of costs, which will provide an idea of the budget to be prepared or allocated by the water association or the LGU.

Table 6 shows the short-term action plans that were developed for Tanap Water System in Barangay Guinzadan Sur, Bauko.

Table 6. *Short Term Action Plan (1 month to 6 months)*

Issues	Actions Required	Resources Needed	Responsible Persons/Groups
Unsafe water at the households (HH)	• Conduct community meeting on drinking water treatment - Inform HH on result of water analysis and effect on health - Educate HH on different water treatment and disinfection methods - Educate HH on proper handling and storage of drinking water	Meeting funds (food, office supplies) Php1,000-5,000/meeting	RHU (RSI), BHW, WSP Teams, HH
Distribution pipes submerged under wastewater along drainage canals	• Elevate pipes to higher levels • Repair leaks and replace rubber ties with standard couplings • Contain wastes from pigpens by constructing septic tanks/biogas digesters	Construction materials (wires, ropes, pegs, couplings), labor by HH Php 500-1,000/HH for GI couplings and other GI pipe fittings Php 5,000-15,000/ septic tank, biogas digester	Brgy. Officials, Caretakers, plumbers, HH
Unprotected water Sources	• Construct diversion ditch • Construct protective fence • Construct water tight septic tanks for HH near or above water sources	Construction materials, labor by HH Php 10,000-15,000/fence Php 5,000-15,000/septic tank,	Brgy. officials, plumbers, HH
Diversion of flow by farmers to irrigate vegetable farms	• Initiate dialogue with farmers on prioritization of water use • Pass ordinance prohibiting such act	Meeting funds (minimal amount for food during dialogue)	Brgy. officials, WSP Teams
Spring intake box has no standard appurtenances	• Construct additional appurt nances for the spring intake box	Construction materials, labor by HH Php 1,000-3,000	Brgy. officials, plumbers, HH

G. Operational Monitoring

Operational monitoring is the act of conducting a planned sequence of observations or measurements, to assess whether the control measures applied at a point in the system are achieving their objectives. -Effective monitoring relies on establishing:

- What will be monitored;
- How it will be monitored;
- Where it will be monitored;
- When it will be monitored;
- Who will do the monitoring.

Corrective actions, along with monitoring, form the control loop to ensure that unsafe drinking-water is not consumed. Corrective actions should be specific and pre-determined where possible to enable their rapid enaction. By ensuring that a contingency is available in the event of an operational limit being exceeded, safety of supply can be maintained.

Table 7 shows the operational monitoring of the Tanap Water System in Barangay Guinzadan Sur in Bauko.

Table 7. *Operational Monitoring and Corrective Actions*

Control Measure	Operational limit
All distribution pipes are installed away from any source of contamination	With proper types of pipe fittings and protection , away from sources of contamination
Regular monitoring of pipelines	No sign of leaks and deterioration
Water quality monitoring residual chlorine	Chlorination device continuously providing chlorine solution
Ground reservoir should be free from debris, mud and other contaminants	Clean reservoir
Completely sealed spring intake box with proper appurtenances	Sealed at all times, appurtenances working properly
Spring intake box should be free from debris, mud and other contaminants	Clean spring intake box
Immediate area of the water source should be secured from stray animals and be free from any habitation and human activities	Uninhabited catchment, appropriate vegetative cover

Where to Monitor	How to Monitor	Frequency of monitoring	Who will Monitor	Corrective Actions
Distribution pipelines	Visual inspection	Weekly	Plumber, caretaker	Repair or replacement of deteriorated pipes
Distribution pipelines and main pipelines	Visual inspection	Daily for distribution pipes, monthly for main pipelines	Plumber, caretaker	Repair or replacement of deteriorated pipes
Reservoir	Visual check on the chlorination device Sampling	Twice a day Monthly	Plumber, caretaker Rural Sanitary Inspector/ Lab technician	Adjust chlorine dosage
Reservoir	Visual check	Weekly	Plumber, caretaker	Flushing, re-disinfection Repair defective parts
Spring intake box	Visual inspection	Quarterly	Brgy. Officials, plumbers	Flushing, re-disinfection
	Visual check	Quarterly	Plumber, caretaker	
Immediate vicinity of the spring intake box	Visual inspection	Semi-annually	Brgy. Officials, plumbers	Provide fencing, assign security patrols, strict enforcement of ordinance

H. Verifying and Auditing

The objectives of this step are:

- *To build a body of evidence that water produced by the water supply system is compliant with the water quality objectives; and*
- *To confirm that the WSP is being implemented in practice as it was designed to be, and*
- *To confirm that the critical limits and other important values are appropriate for controlling the identified risks so that the system is capable of producing water fit for intended users*

Verification involves water quality monitoring to prove that the WSP is working in practice to provide water that meets the health-based targets. Auditing involves checking that the activities identified in the WSP are being carried out in practice and that records are kept where required.

To effectively carry this out, an independent body needs to confirm that the WSP is being implemented according to plan. This is the role of LDWQMC and its members (see Section III-D of Presidential Decree No. 856: Code on Sanitation). A sample verification and audit for the water system is in Table 8.

Table 8. *Verification and Audit*

Activity	Location of Activity	Type of Activity	Frequency of Activity	Which Organization will undertake the activity	Records
Water Quality Monitoring: Microbial	Household taps Communal taps	Water Quality Testing	Monthly	RHU-RSI	Laboratory Reports
Water Quality Monitoring: physical	Reservoir at Sitio Lamangan Spring Intake Box at Tanap Source	Water Quality Testing	Monthly	RHU-RSI	Laboratory Reports
Reservoir cleaning	Reservoir at Sitio Lamangan	Internal Audit	Monthly	MEO	Monthly Reports
Leak detection	Distribution and Main Pipelines	Internal Audit	Monthly	MEO	Monthly Reports
Pipe repair	Along distribution pipes and main pipeline	Internal Audit	Quarterly	MEO	Quarterly Reports
Intake box cleaning	Spring Intake Box at Tanap Source	External Audit	Semi Annually	LDWQMC	Semi annual Reports

I. Updating/ Establishing Supporting Programs

Supporting programs are activities that indirectly support water safety and are essential for operation and control measures. They are essential to the water organization. Assess existing programs and identify gaps that need to be addressed. Update existing programs as necessary and develop new ones.

Programs may cover a range of activities such as installation of water treatment device (e.g. chlorinator); training caretakers on the preparation of chlorine solution, proper preventive maintenance, hygiene and sanitation, IEC campaign to household members on the proper handling and storage of water, proper construction of spring intake box, and competency of operators, among others.

J. Implementing Management Procedures

Elements of an incident/emergency response plan are:

- *Accountabilities and contact details for key personnel*
- *Clear definitions of trigger levels for incidents including a scale of alert levels e.g. when an incident is elevated to a boil water alert;*
- *Clear description of the actions required in response to alerts;*
- *Location and identity of the standard operating procedures and required equipment, including backup equipment;*
- *Relevant logistical and technical information;*
- *Checklists and quick reference guides.*

Given the usual immediacy of emergencies, it is essential that the organization's staff is trained in the response procedures and that the training is up to date, including emergency scenario training with other agencies where appropriate.

Review of the emergency situation and response should also be carried out by the organization to ensure that if possible, the situation does not recur or whether the response could have been handled better.

Questions to be asked in a review include:

- *What was the cause of the problem?;*
- *How was the problem first identified or recognized?;*
- *What were the most essential actions required?;*
- *What water contamination problems arose and how were they addressed?;*
- *What were the immediate and longer-term consequences?; and*
- *How well did the emergency response plan function?*

K. Documenting Information

Documentation of all aspects of drinking-water quality management is essential. Documents should describe activities that are undertaken and procedures that are performed. They should also include detailed information on:

- *Assessment of the drinking-water system (including flow diagrams and potential hazards and the outcome of validation);*
- *Control measures and operational monitoring and verification plan;*
- *Routine operation and management procedures;*
- *Incident and emergency response plans; and*
- *Supporting measures, including:*
  - *Training programs*
  - *Research and development*
  - *Procedures for evaluating results and reporting*
  - *Performance evaluations, audits, and reviews*
  - *Communication protocols*
  - *Community consultation.*

Documentation and records need to be retained to provide retrospective proof of compliance and to support due diligence requirements. In summary, document information pertinent to important aspects of water quality management should be covered and the following actions should also be conducted:

- *Develop a document control system to ensure current versions are in use;*
- *Establish a records management system and provide support in keeping records of activities; and*
- *Periodically review documentation and revise as necessary.*

Examples of desired and useful records are adapted from Stevens et al., 2004 as provided in the Manual by Davison et al., 2006 (Table 9).

Table 9. *Examples of WSP Records*

REQUIREMENT	COMPONENT
Must contain	• Overarching WSP document • WSP team information • Description of the supply system, intended use and water quality requirements • Process flow diagrams including identifying control measures • Operational monitoring procedures for control measures • Hazard identification • Contingency plans
Should contain	• Agreements for suppliers that are being relied upon to provide goods or services that influence water quality • Detailed specifications for chemicals and materials used in the water supply system • Job descriptions for those holding principal accountabilities for operating the water supply system • Corrective action plans for deviations detected from the operational monitoring • Record-keeping requirements • Verification and validation data for control measures and for the system as a whole • Procedures for verification and revision of the WSP • Overarching water quality incident management plan
May contain	• Operational manuals such as for line hygiene, preventative maintenance, and equipment calibration • Job descriptions and accountabilities for all staff • Training program and records for all staff • Findings and corrective actions from previous audits (including verification procedures) • Consumer complaint policy and procedure

References:

Arsenic Policy Support Unit (APSU). 2006. Water Safety Plans in Bangladesh: Experiences from Pilot Projects.

Davison, A, Deere, D, Stevens, M, Howard, G and Bartram, J. 2006. Water Safety Plan Manual. World Health Organization.

Godfrey, S. & Howard, G. 2005. Water Safety Plans Book 1: Planning Water Safety Management for Urban Piped Water Sources in Developing Countries. Water, Engineering and Development Centre, Loughborough University, United Kingdom.

Maynilad Water. 2007. Water Safety Plan: Managing drinking water quality from catchment to consumer.

Rural Water Supply Design Manual, Vol. 1, National Water Resources Board, 1980.

World Health Organization, 2004. Guidelines for Drinking Water-Quality. 3rd Edition. World Health Organization, Geneva, Switzerland.

ANNEXES

ANNEX A: Direct Cost of WSP Preparation per barangay or water system (in Philippine pesos)

Activities	No. of pax*	Cost of meals/day**	No. of days	Total Cost	Supplies & handouts (per person)	Documentation	Total Cost
Step 1: Organization and WSP Team Orientation	20	250.00	2	10,000.00	100.00	1,500.00	15,000.00
Step 2 to 3: Documentation of Systems***	30	250.00	1	7,500.00	100.00	1,500.00	12,000.00
Step 4 : Assessment of Findings	10	250.00	1	2,500.00	100.00	1,500.00	5,000.00
Step 5 to 6: Identifying Control Measures	10	250.00	1	2,500.00	100.00	1,500.00	5,000.00
Step 7 to 8: Establishing Verification Procedures	10	250.00	1	2,500.00	100.00	1,500.00	5,000.00
Step 9: Preparation of Management Procedure	10	250.00	1	2,500.00	100.00	1,500.00	5,000.00
Step 10: Establishing Documentation	10	250.00	1	2,500.00	500.00	1,500.00	9,000.00
LDWQMC Orientation and Organization	20	250.00	2	10,000.00	100.00	1,500.00	15,000.00
					Total Cost		71,000.00

** May vary depending on the actual number of WSP Team members*

*** Training venue is within the barangay or municipality, thus, lodging and transportation cost of participants are not included*

****Ocular visit to the different parts of the systems with other community members*

Note: Actual number of meetings and workshops can be reduced by joining two or more steps

Annex B: Description of Pilot Water System in Brgy. Guinzadan Sur, Bauko, Mt. Province

A water source supplies the need in a given purok or group of houses depending on the water source's flow rate and proximity to the service area. The barangay council supports the management of this water system by way of providing support to the caretakers who are tasked to regularly drain the reservoir and do minor repairs on the pipelines. In Guinzadan Sur, there are three water sources.

Among these sources, the biggest is the Tanap water source. Being the biggest and serving more families compared to others, this source will be developed as a pilot WSP for barangay Guinzadan Sur. Once developed, the WSP will be extended for other systems in Guinzadan Sur. The WSP Team will take the lead in the preparation of the WSP of other systems.

Description of the pilot water system: The main water source in Barangay Guinzadan Sur is Tanap springs with a measured flow of about 8.3 liters per second. The source is classified as spring water. It is located at Barangay Nanggawa. It has two concrete spring intake boxes that are structurally in good condition. However, it has no drain pipe, valves to control the flow, and overflow pipe for the release of excess water accumulating inside the box.

There is no protective fence installed around the immediate vicinity of the water source. The location of this water source can be reached by foot in about an hour from the center of the barangay. The source is surrounded by vegetable gardens such as carrots, cabbage, sweet peas, beans, potatoes, cucumber, petchay, eggplant, chayote, pepper, tomato and camote.

The land area used for the planting of these crops is about 15 to 20 hectares. There are portions where the spring sources are about 5 to 10 meters below the vegetable gardens. The distance of the springs from the vegetable gardens is about 15 to 20 meters.

The spring intake box at Tanap water source lacks the standard appurtenances.

Transmission line: The length of the transmission line is about 4 kilometers of 2-inch diameter galvanized iron (GI) pipes, about 50% of whose total length is already deteriorating. Most of the pipe's portion was submerged under the ground due to frequent landslides and road widening. About 25% of the total length passes along vegetable gardens and rice land, and 5% passes along drainage systems and a network of canals within the barangay.

The Rural Sanitary Inspector estimated that about 20% of the total length of the pipelines has been damaged by typhoons and other calamities that have hit the barangay in the past. Repairs were done by communities and barangay officials in replacing damaged pipelines.

Due to lack of funds, however, polyvinyl chloride (PVC) pipes and recycled rubber ties were used instead of the standard couplings to connect the GI pipes in stopping the leaks.

Storage Facilities: A ground concrete water tank that measures 2.3 meters x 3.2 meters x 6.5 meters is located in Sitio Lamangan. It is being fed by water coming from Tanap Spring. According to the residents, water is always at low level

and the tank is seldom filled to even half of its capacity. The reason for this is the diversion of water flow by the farmers to irrigate their vegetable farms.

This reservoir was constructed in the 1980s funded by the local government and presently serves Sitio Lower Lamagan, Sitio Tabacan, East Tabacan, Lower Tongtongbawi, Guinzadan Central, the Barangay Hall, Barangay Health Center, and Elementary School. .

This reservoir is regularly drained once a month by the assigned plumbers and caretakers in Guinzadan Sur and Guinzadan Central. According to plumbers, debris coming out of the drain pipes includes mud, sand, gravel, leaves and worms.

Household Water Storage and Treatment: Water is fetched from flexible rubber hoses (level 2) using 20 liter plastic containers or plastic gallons. These containers also serve as water storage in the households. After fetching, the end of the flexible hose is hung on a piece of wooden pole or on the side of a wall, a practice which makes the water prone to contamination. The water treatment method used in majority of households is boiling. Only one household claimed to use hyposol for water treatment.

Distribution Area: There are leaks along distribution lines due to the rusty conditions of the GI pipes. Most pipe connections do not use the standard pipe coupling but are connected only with rubber ties. During summer, the volume of water decreases to more than half.

Uses of Water: Water is primarily used for drinking, cooking, bathing, laundry and washing utensils in households. It is also used to supply water for school children at the elementary schools, barangay health centers, barangay halls, and variety stores. Where a household owns a backyard piggery, water is also used for cleaning pigpens. Water is also used for irrigating vegetable farms. When water pipes pass a property with vegetable gardens, water flow is diverted by farmers without permission from the barangay council. This is the reason why water stored in water tanks in Sitio Lamangan is always at low level. There are even

Water supplied by Tanap spring is conveyed through these 2-inch diameter GI pipes.

instances when Lower Tongtongbawi has no water at all and households fetch water direct from the nearby spring.

Management of Water Systems: The barangay council directly managing the water system assigns caretaker or plumbers to regularly drain the reservoir in each water system. Frequency of cleaning is at least once a month or 'as the need arises'.

Caretakers receive a quarterly honorarium of Php 2,000.00 from the barangay's internal revenue allotment (IRA). Where there are system problems that result to reduce or lower water flow, a bayanihan group from among the residents is organized to check and solve the problem.

There is no regular collection of water tariff from the households. If there is a need to buy pipes, fittings or materials for concreting, the funds will be provided by the barangay while labor is obtained through bayanihan by the residents. When the funds needed cannot be provided by the barangay, assistance from the municipal LGU is requested.

In case a household wishes to connect to the system, the house owner will be the one to provide for the pipe or rubber hose needed to convey water from the location of the mainline up to the point where water can be fetched. The cost of pipes can also be shared between neighbors depending on their agreement.

Annex C: Assessment of Tanap Water System, Brgy. Guinzadan Sur, Bauko, Mt. Province

From the result of the assessment, it can be concluded that the water system is not properly maintained due perhaps to the lack of organized groups in charge of the management of the different structures. Plumbers and caretakers are the ones individually doing the tasks of regularly cleaning the reservoir and periodic repair of leaking pipes while the Rural Sanitary Inspectors are chlorinating the system after heavy rains, if chlorine granules are available at the RHU. Similarly, bacteriological tests are being done by the RHU as part of their mandate, again if chemicals are available and the sole laboratory equipment at the RHU intended for the water analysis is in good working condition. Major repairs beyond the capacity of the plumbers and caretakers are done with the help of community members themselves through bayanihan system.

This usually happens after every major calamity such as typhoons and earthquakes. Funds used for the procurement of the repair materials like cement, pipes, fittings and other needed materials come from barangay IRA. Pipe connections are haphazardly installed due to a lack of planning and technical support from the LGU.

There is no fund solely allocated for the maintenance of the water system. Households do not have a share in providing funds for the water systems by way of water tariff or maintenance fee. Below is the detailed assessment of the system.

a. The Tanap water source is surrounded by vegetable farms that use commercial fertilizers and chemical pesticides. The possibility is high that residue from farms may contaminate the water source which are located just below the vegetable farms.

b. The spring box lacks the necessary appurtenances such as drain pipes, control valves, overflow pipe, and protective fence.

c. A large portion of the 2-inch diameter GI main pipeline is already corroding.

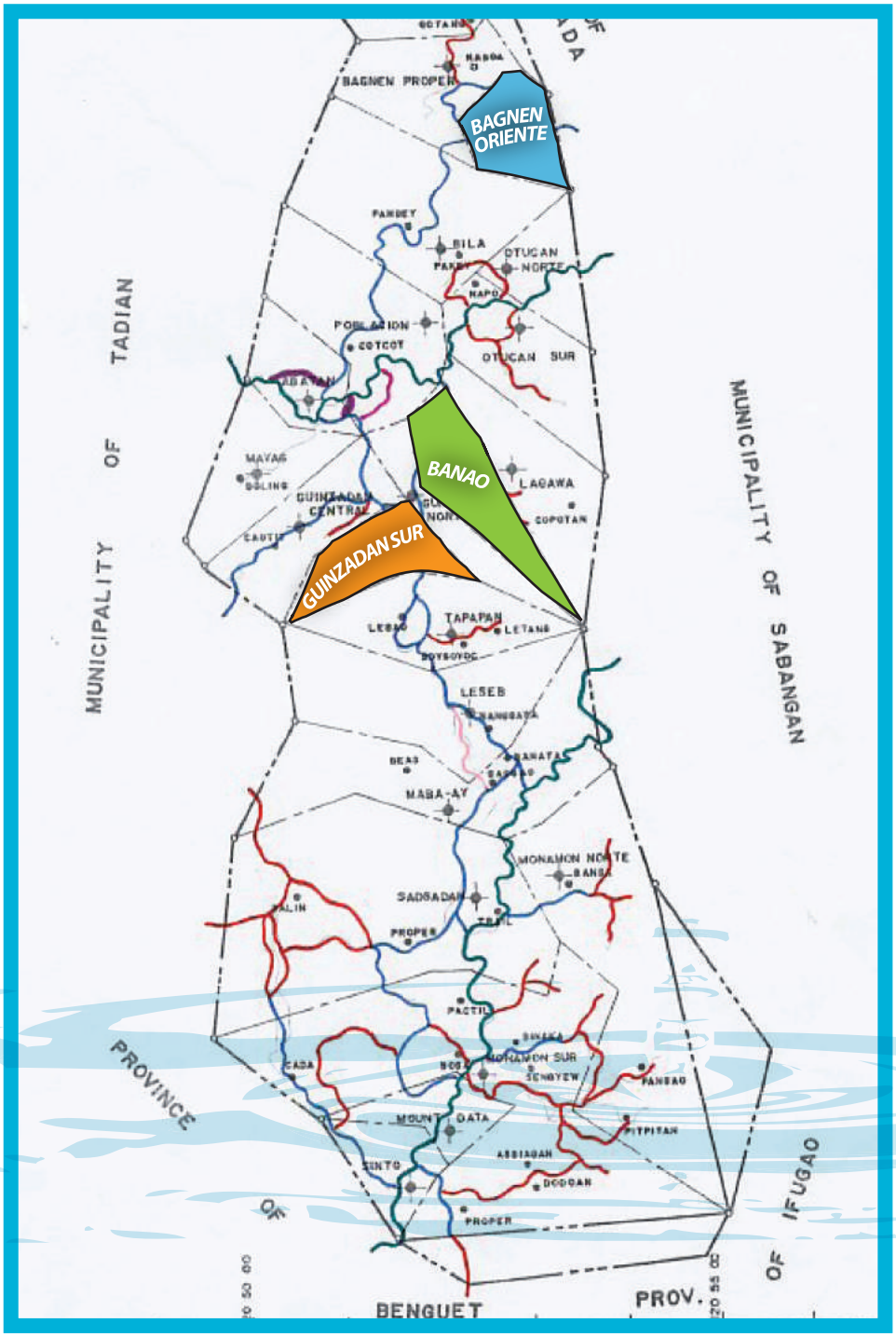
d. Leaks are prevented through the use of rubber ties, which are a temporary and inappropriate solution.

e. Portions of the main pipeline pass through vegetable gardens and drainage canals along the main road. These areas are a potential source of contamination.

f. Water flow from main pipelines is diverted to irrigate vegetable farms. This affects the quantity of water that is supposed to be used by households for regular household chores. This has resulted in more time spent in fetching water due to low flow.

Annex D

Map of Bauko, showing Barangays Banao, Bagnen Oriente, and Guinzadan Sur, pilot sites of the WSPs.



Definition of Terms

Term	Definition
Control (noun) (for instance control of water safety)	*The state wherein correct procedures are being followed and criteria are being met.* *To take all necessary actions to ensure and maintain compliance with criteria established in the WSP.*
Control (verb) (for instance control of a hazard)	*Any action and activity that can be used to prevent or eliminate a water safety hazard or reduce it to an acceptable level.*
Control Measure	*Any action to be taken when the results of monitoring at the control point indicate a loss of control.*
Corrective Action	*A step at which control can be applied to prevent or eliminate a water safety hazard or reduce it to an acceptable level. Some plans contain key control points at which control might be essential to prevent or eliminate a water safety hazard.*
Control Point	*A criterion which separates acceptability from unacceptability.* *Failure to meet a critical limit.*
Critical Limit	*A systematic representation of the sequence of steps or operations used in the production or manufacture of a particular water item.*
Deviation	*The process of collecting and evaluating information on hazards and conditions leading to their presence to decide which are significant for water safety and therefore should be addressed in the WSP.*
Flow diagram	*A biological, chemical or physical agent in, or condition of, water with the potential to cause an adverse health effect. Another word for hazard includes "contaminant".*
Hazard Analysis	*A process whereby a hazard/contaminant is introduced into a water supply.* *The act of conducting a planned sequence of observations or measurements of control parameters to assess whether a control point is under control.*
Hazard	*The likelihood of identified hazards causing harm in exposed populations in a specified timeframe, including the magnitude of that harm and/or the consequences.*
Hazardous Event	*The score assigned to a hazard based on the hazard analysis process.*

Monitor	*The act of conducting a planned sequence of observations or measurements of control parameters to assess whether a control point is under control.*
Risk	*The likelihood of identified hazards causing harm in exposed populations in a specified timeframe, including the magnitude of that harm and/or the consequences.*
Risk Score	*The score assigned to a hazard based on the hazard analysis process.*
Spring	*Spring are outcrops of groundwater and often appear as small water holes or wet spots at the foot of hills or along riverbanks. The presence of green vegetation in dry areas usually indicates the existence of springs.*
Surface Water	*Surface water supplies include water from rivers, streams, lakes, ponds, seas and oceans. It usually contains organic and inorganic minerals and needs expensive water treatment.*
Step	*A point, procedure, operation or stage in the water supply chain including raw materials, from primary production to final exposure.*
Supporting programs/supporting requirements	*The foundation activities required to ensure safe water including training, raw material specifications and general good water management practices. These programs can be just as important as control points in controlling water quality risks but where application tends to cover long timeframes and/or broader organizational or geographic areas. Includes general organizational supporting programs as well as specific programs targeted to particular risks.*
Validation	*Obtaining evidence that the elements of the WSP are effective.*
Verification	*The application of methods, procedures, tests and other evaluations, in addition to monitoring to determine compliance with the WSP.*