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Water Safety Plans

12 March 2021

TA6551-REG: Strengthening WASH practices and hygiene behavioral change in the Pacific

Introduction and Agenda

- **Fundamentals**
  - Introduction to WSP
  - Overview of Objectives of WSP
- **Mechanics**
  - How to Create WSP
  - Example on risk profiling your system
- **Sustainable Improvement**
  - Short term Gains
  - Long term Improvement
- **Reliance and Response**

Clara Laydon

Hunter H2O

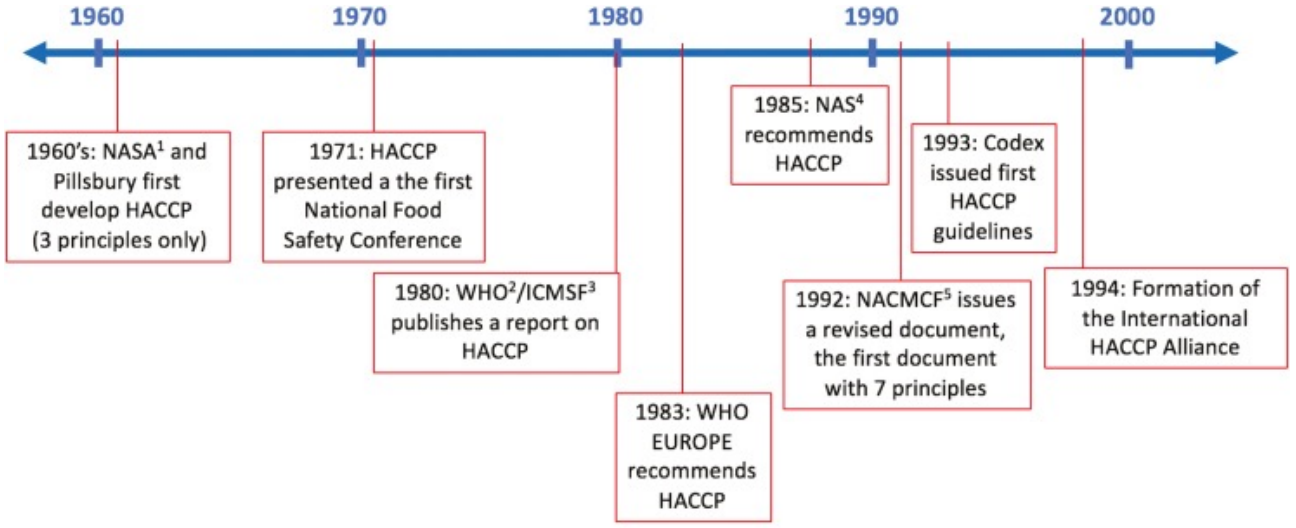
Principal Process Engineer

What are the key outcomes of a WSP

- Poll Question

WSP - Introductions

- Based on Food Safety & Hazard and Critical Control Point (HACCP)
- HACCP approach was created in 1960s by NASA and Pillsbury to ensure pathogen free food for space



[1] National Aeronautics and Space Administration
[2] World Health Organization
[3] International Commission on Microbiological Specifications for Foods
[4] National Academy of Sciences
[5] National Advisory Committee on Microbiological Criteria for Foods

History, development, and current status of food safety systems worldwide, Margaret D Weinroth, Aeriel D Belk, and Keith E Belk

What are the Principles of Water Safety Plans

Water Safety Plans Managing drinking-water quality from catchment to consumer, WHO, (summarized extract)

The objectives of a water safety plan are to ensure safe drinking-water:

- to prevent contamination of source waters
- to treat the water to reduce or remove contamination
- to prevent re-contamination during storage, distribution and handling of drinking-water.

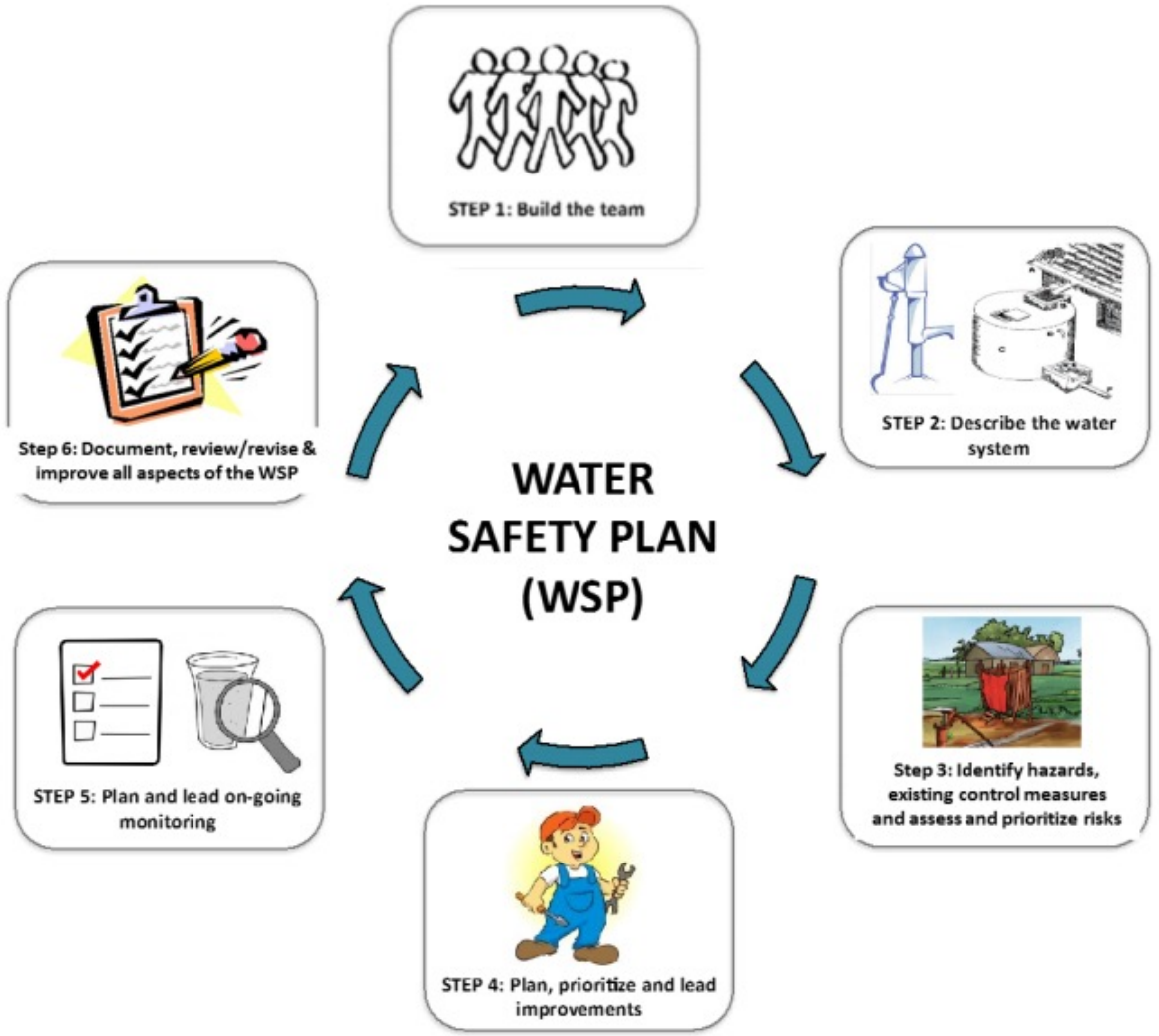
What are the objectives of creating WSP

Creating a WSP gains a wholistic understanding of the water supply system from source to tap and that the risks are understood.

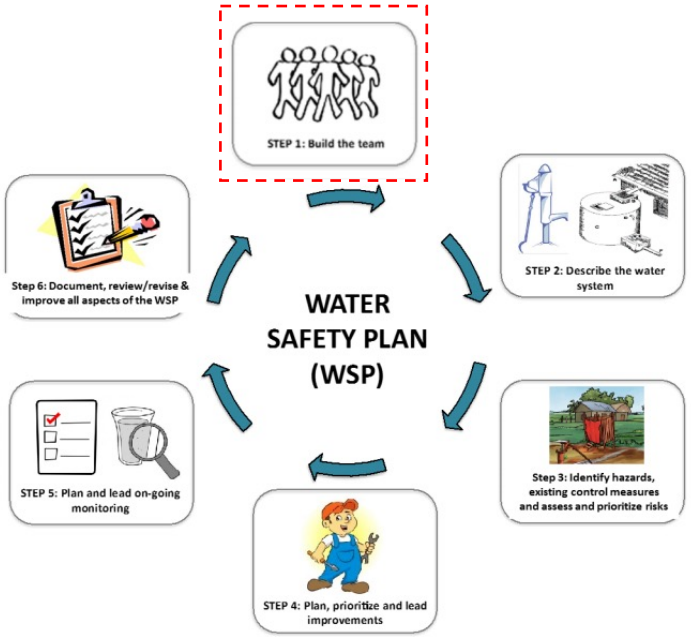
Risks can then be managed, and the system can be monitored to prevent water system events. If things do go wrong, there are plans in place to respond.

Over time ongoing improvements can be made to further strengthen systems.

The Mech


STEP 1: Build the team
STEP 2: Describe the water system
Step 3: Identify hazards, existing control measures and assess and prioritize risks
STEP 4: Plan, prioritize and lead improvements
STEP 5: Plan and lead on-going monitoring
Step 6: Document, review/revise & improve all aspects of the WSP
WATER SAFETY PLAN (WSP)

STEP 1 – Get your TEAM

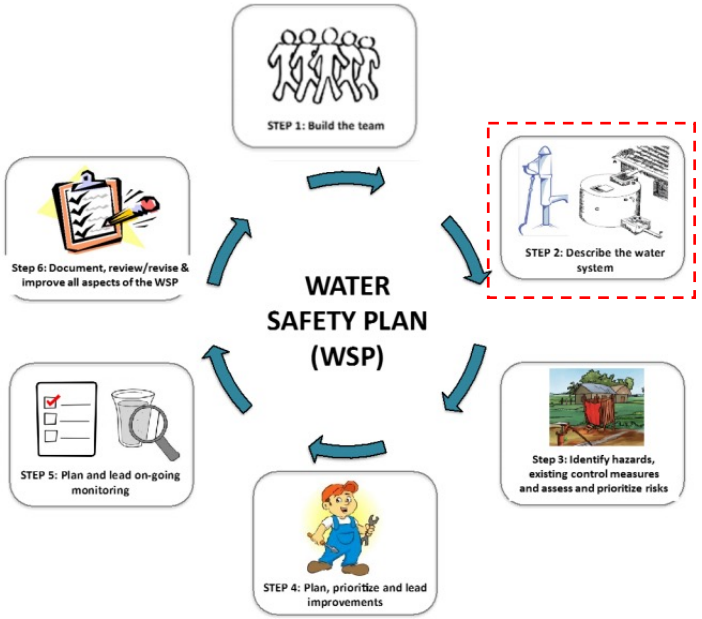


When recording, team leaders include the contribution and the experience.

e.g.
Clarissa Laulala, Program Manager, 3 years in IWSA.

The process can be a great training opportunity for trainees.

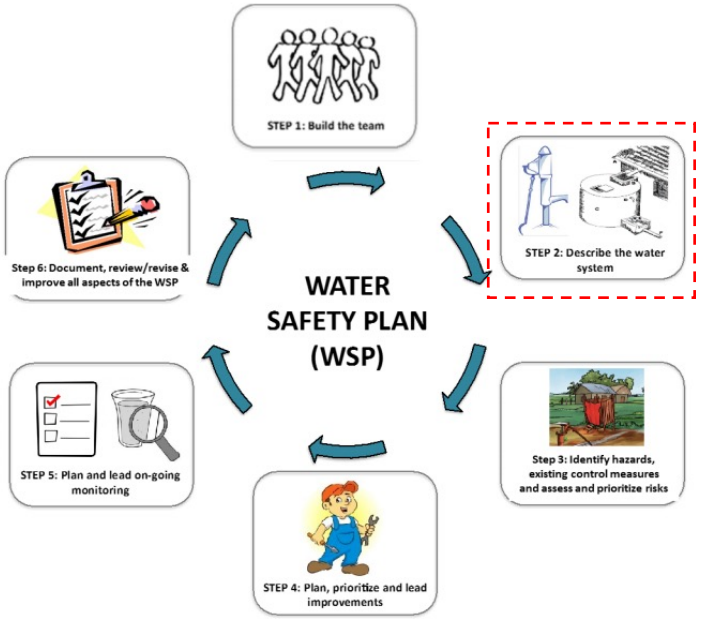
STEP 2 - System Analysis (1/5)



Set up some standard questions to ask the field operator, create a checklist of information to collect. Include field photos and even video!

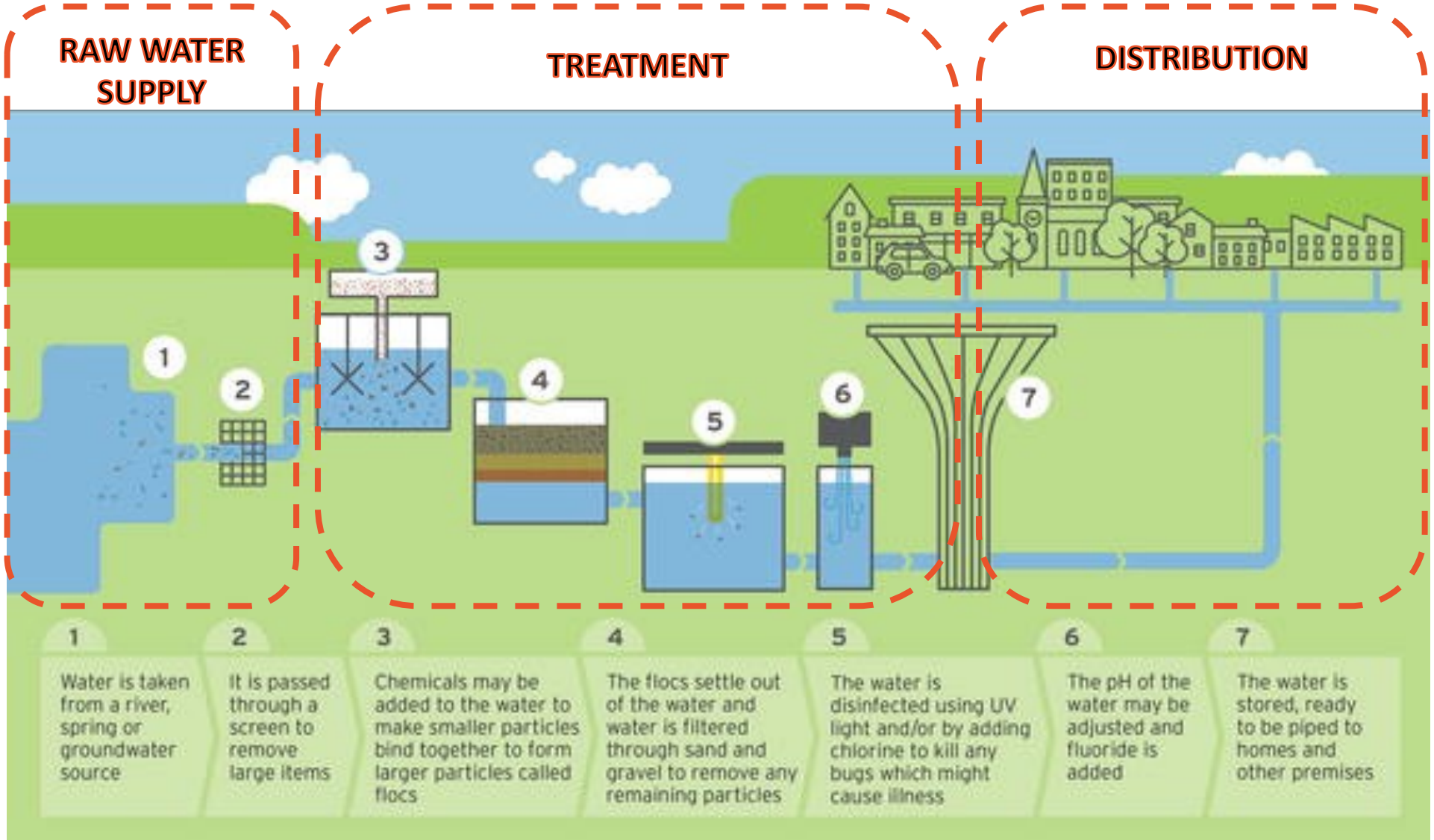
I often take a videos of operators giving important explanations, so I can relisten when creating WSP.

STEP 2 - System Analysis (2/5)



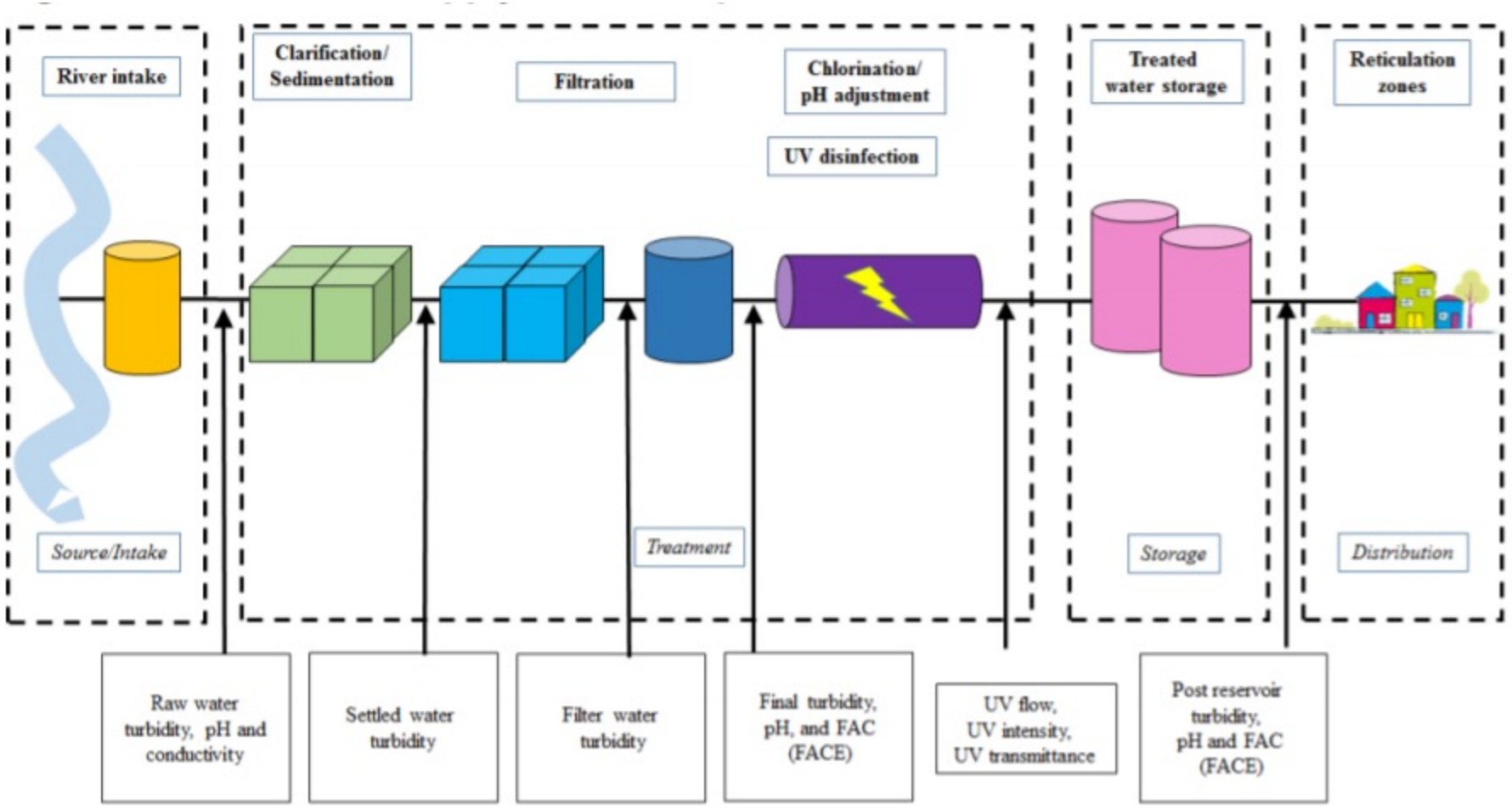
- Documenting each key stage of the water supply system.
  - ***Where it is?***
  - ***What it is?***
  - ***How it is?***
- It is important WSP reflect <u>how it actually is, not how it 'should' be</u>

STEP 2 - System Analysis (3/5)



Drinking Water Treatment

STEP 2 - System Analysis (4/5)



Handbook for Preparing a Water Safety Plan

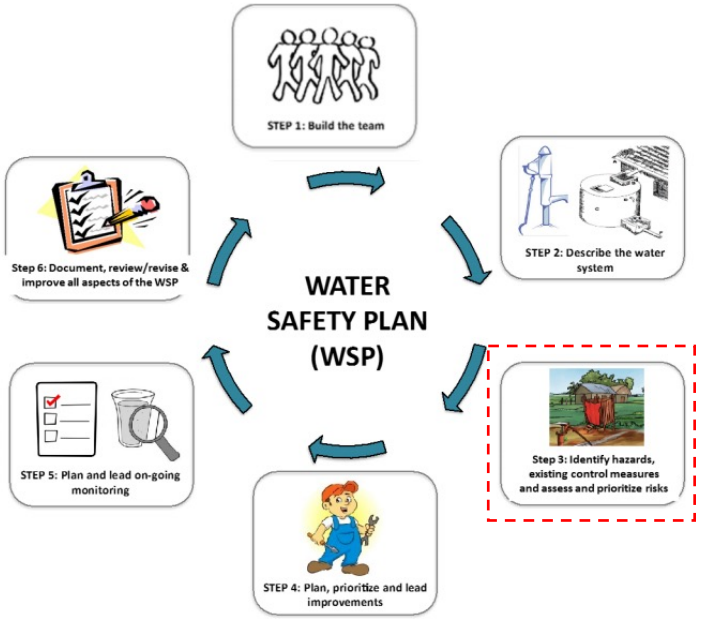
STEP 2 - System Analysis (5/5)

- Reco

Describe the general conditions of the catchment *(e.g. forested, agricultural),* **the source(s) of water** *(e.g. dug well, borehole, river),* **the water users/uses, and the number of people served. Include current/predicted climate considerations** (e.g. rain fall, flooding zones, water quality impacts, drought, alternative water supplies etc.)	**Describe if any treatment** (e.g. sedimentation, clarification, filtration, chlorination, UV) **of the source water occurs before consumer distribution/ collection.**	**Describe any centralized water storage, and how people collect and transport the water** *(e.g. piped to house, piped to tap stand, handpump & carry by hand, water carter, kiosk etc.).* **Consider how the current/predicted climate considerations may influence these practices.**	**Make a list of the different ways people treat** *(e.g. boiling, filtration, chlorine tablets)* **and store** *(e.g. in a household tank, jerry can, open bucket etc.)* **drinking-water at the household level** *(if practiced).* **Consider how the current/predicted climate considerations may influence these practices.**
Catchment: • Human settlements with limited sanitation facilities • Etc. *Source:* • Surface water (river); dug well • Etc. *Climate considerations:* • Current impacts include more severe rain fall events • Future impacts include shortening of the dry season and increased annual rain fall • Etc.	Chlorination (1% solution prepared from bleaching powder). Etc.	Concrete storage tank • 200 kL • Built 1975 • Closed tank • Cracked walls. Collection by consumers at tap stands (three tap stands in the town). Consumers collect water in open buckets to bring back to households. With predicted increase in annual rainfall, consumer likely to switch to rain water harvesting to save water tariffs. Etc.	No household treatment. Household water stored in large open ceramic pots (no lid generally), on ground level and dedicated to water storage. Use of dipping tool varies (e.g. cup, hand, ladle). During floods, consumers cannot access tap stands, so will likely rely on flood water or rainwater harvesting (if it is in place). Etc.

Rural Water Safety Plan Template

STEP 3 – Risk Assessment (1/8)



E. Coli

HAZARD GROUP – Microbicidal Pathogens

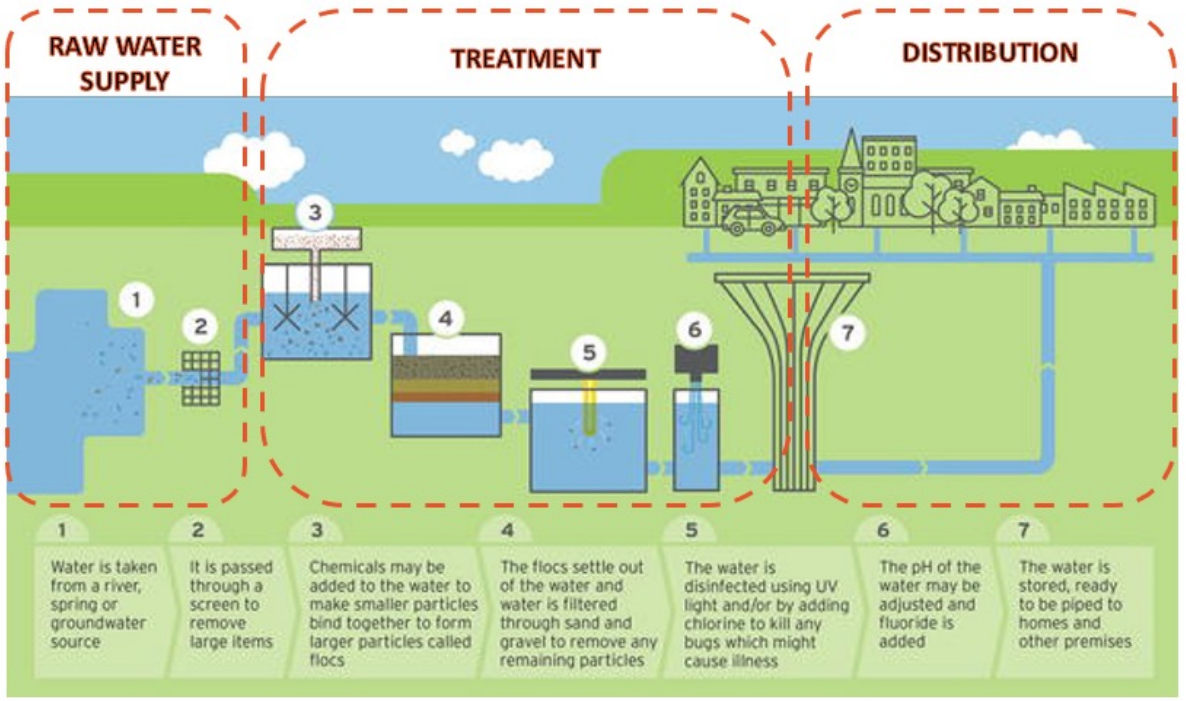
HAZARD – Microbiological Pathogens
HAZARDOUS EVENT – Rain event causes source water to have higher raw water microbiological contamination

HAZARD – Microbiological Pathogens
HAZARDOUS EVENT – chlorination fails, and disinfection is compromised

STEP 3 – Risk Assessment (2/8)

- At each **key step** of the process, ‘brainstorm’ the HAZARDS and HAZARDOUS Events

Brainstorm the Hazards in Excel and then you can sort them via the Hazard Type.



STEP 3 – Risk Assessment (3/8)

- Using the brainstorm of hazards and hazardous event determine the consequence and likelihood of each event

Risk Factor Matrix:		Insignificant Or No impact Rating: 1	Minor Compliance Impact Rating: 2	Moderate Aesthetic Impact Rating: 3	Major Regulatory Impact Rating: 4	Catastrophic Public Health Impact Rating: 5
Likelihood or frequen cy	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	8	10
	Rare Once every 5 years Rating: 1	1	2	3	4	5

STEP 3 – Risk Assessment (4/8)

Raw and Revised Risk

- RAW risk refers to the risk that is present before any controls

  Controls need to be specific and can then turned into Control Points with Limits

- The risk is then revaluated considering the controls, and the aim is to reduce the risks down

STEP 3 – Risk Assessment (5/8)

Critical Control Points

- Good approach is th ight

Critical Value – if exceeded than the immediate action due to high risk to public safety

Adjustment Value – if exceeded than operational action must be taken to correct or to plan

Target Value – operating within normal or acceptable range

STEP 3 – Risk Assessment (6/8)

Coastal Utility Critical Control Points

1.1 WTP Filtration System CCP

What is being measured?	Turbidity
Where/how is it measured?	Online monitoring of combined filtered water at clear wate pumps / daily sample from each filter outlet
What is the control point?	Filters
What are the hazards?	Pathogens, turbidity

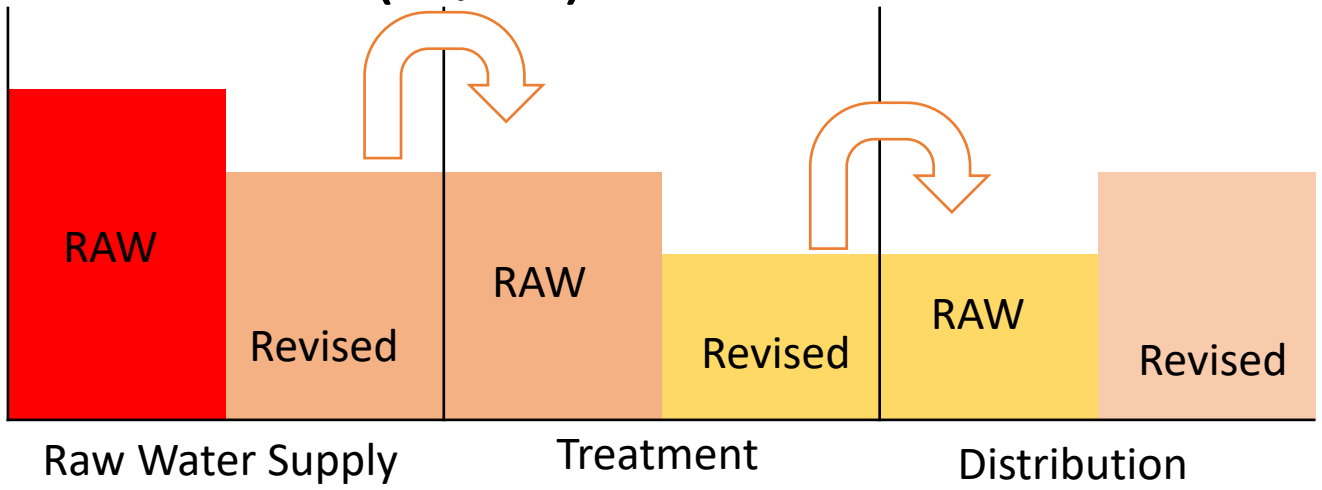
Target < 0.2 NTU	Adjustment Limit > 0.2 NTU	Critical Limit > 0.5 NTU
• Daily plant walk around and visual inspection • Daily plant water sampling and testing • Check filter backwash schedule • Drop test coagulant and polymer pumps weekly or whenever dosage changes • Monthly cleaning and calibration of pH and turbidity meters	• Check filter run time and headloss • Backwash filters • Check operation of dosing pumps and flocculators • Drop test coagulant and polymer pumps • Sample and re-test raw water • Jar test and adjust dosage if necessary • Review previous water quality results including chlorine residual, colour, pH and turbidity • Contact Supervisor or Manager if no change • Monitor plant performance	• Contact Supervisor and Manager • Shut down WTP • Review reservoir levels to determine how long town can be supplied from existing storage • Repeat adjustment and operational procedures as appropriate • If situation cannot be resolved Manager to: o Contact DPI Water o Contact local PHU • Consider all information needed for restart o Emergency procurement o Flushing of high turbidity water from clarifier / filters o consider boil water alert

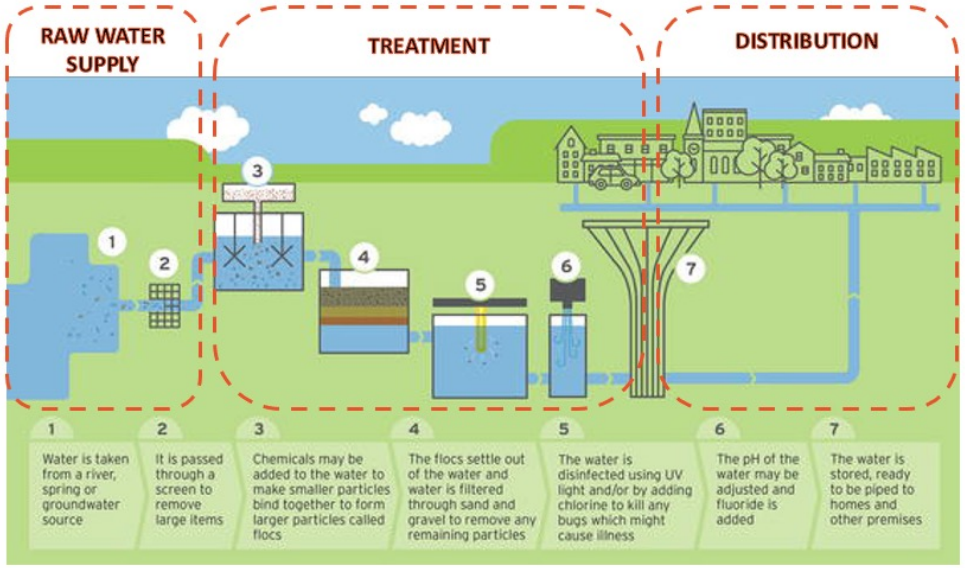
Implementing Drinking Water Risk Management in NSW

STEP 3 – Risk Assessment (7/8)

The Profiling Approach

- To undertake a risk profile review the risk at each major process step. Raw AND Revised.
- The Revised risk of that step is then the RAW risk for the next process treatment step (Barrier).



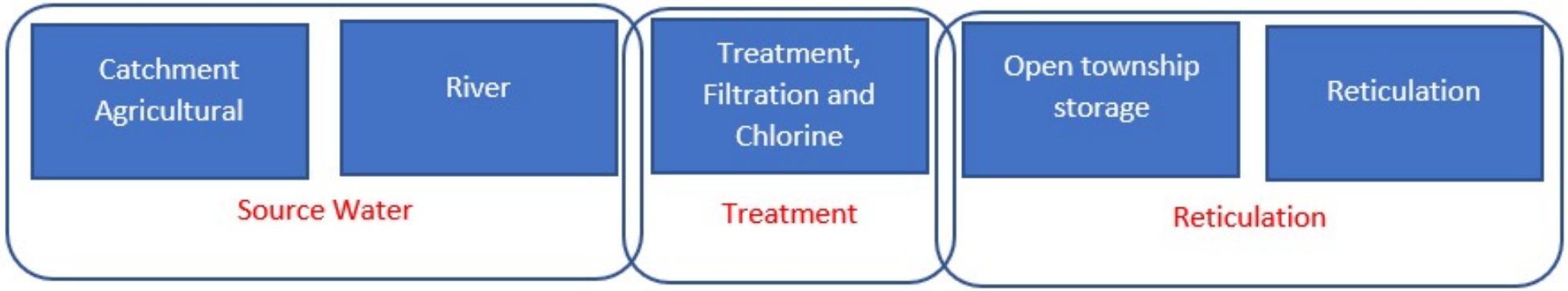


STEP 3 – Risk Assessment (8/8)

Risk Profile – Walk through example

- A surface water system which has farming animals in the catchment. Treatment is filtration and chlorination. Reticulation has open storages which haven't been inspected in some time.

SY



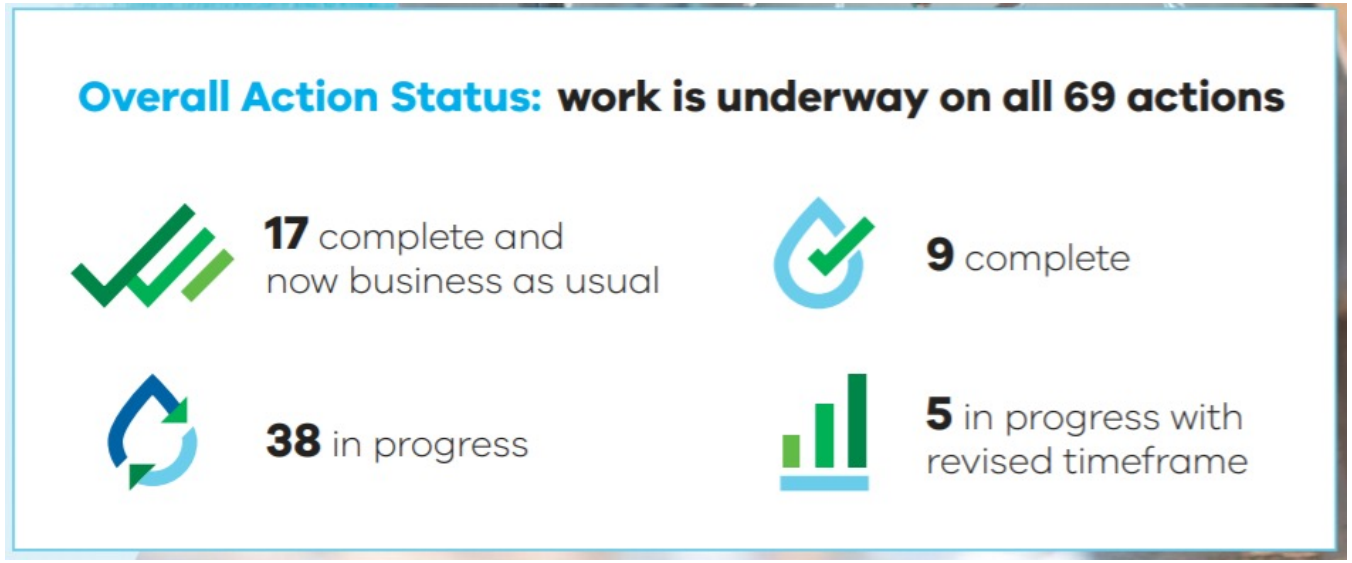
STEPS 4 & 5- Improvements & Monitoring (1/2)

- Create an improvement plan with has allocated responsibilities and deadlines (which are realistic)…
- Establish a monitoring program, such as water quality testing or inspections checklists.

Recommend using Excel

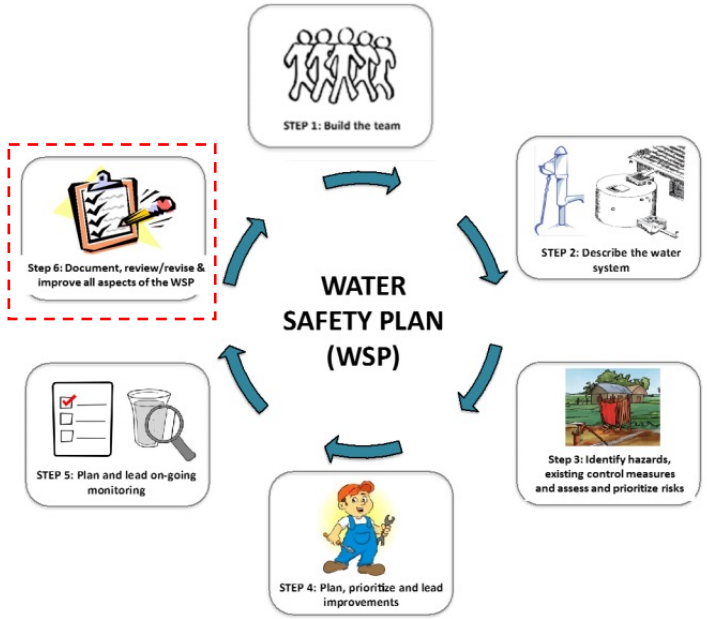
STEPS 4 & 5- Improvements & Monitoring (2/2)

Identifier No.	Water Supply System	System Component	Action Description	Owner	Type of Improvement	Action Source	Risk Event / Hazard	Uncontrolled Risk Rating	Controlled Risk Rating	Date Added to Improvement	Due Date	Days until Due Date	Days since Due Date	Status	Status Comment	Completion/ Approval Date	Evidence of Action Completion	Completed on time
150	City	Reticulation	After installing new chlorine dosing units and experience of its operation is gained, undertake monitoring and reporting on chlorine residual in the network to help assess and improve the control of network residual.	Water Network Operations	Development	Risk Assessment	Recontamination Micro Pathogens	20	10	15-Jul-19	31-Oct-20	Overdue	129	Progress Made	A WSP review and update was undertaken with Health Dept was held on 4 Oct 2020, within the meeting operational experiences awas discussed. A follow up workshop is be organised (tentatively for March 2021) with Dept Health to review final report and new procedures and CCP levels			n



Action Status Report: Water for Victoria

STEP 6 – Review WSP



- Improvement plans need to be checked frequently to ensure there is progress and ONGOING ENGAGEMENT.

- Experience TIP – Establish Quarterly Committee Meetings.

Short term goals

Knowledge Gathering and Sharing	Sitting down and gathering information – knowledge sharing and learning
Centralising Information	Centralising information that may be in many other documents – bringing it together

The implementation hurdle

The biggest issue is that after those initial gains, if there isn’t ongoing implementation, the plans can be out of date, aren’t followed and then ‘sit on the shelf’.

Long Term Gains – Behavioral Change (1/3)

- The WSP shouldn't just reflect how the water supply system operates, it needs to be **imbedded and become art** operations
  - Create summary WSP for operational purposes
  - procedures and CCP sheets that can go up on location walls
  - Using Excel to collect WQ data and be able to review short term and longer term trends

Long Term Gains – Behavioral Change (2/3)

Raw Water				Clarified Water		Filtered water	Treated Water	
Critical Control Points				**CCP 1**	**CCP 1**		**CCP 2**	**CCP 3**
Target (less than)				0.5			2	0.2
Target (greater than)								
Adjustment (less than)					7		1.5	
Adjustment (greater than)				0.8	8		2.5	0.3
Critical (less than)					6.5		1	
Critical (greater than)				1	8.5		5	1.0

Date	Turbidity RW	Colour RW	pH RW	Turbidity CW	pH CW	Turbidity FW	Free Chlorine FW2	Turbidity FW
01/02/2015	10.00	100.00	7.00	0.80	7.50	2.80	2.39	0.10
02/02/2015	8.00	100.00	6.80	0.70	7.20	1.60	3.10	0.10
03/02/2015	12.00	100.00	6.90	0.80	7.40	1.40	2.49	0.20
04/02/2015	12.00	100.00	7.00	0.90	7.00	1.90	1.40	0.25
05/02/2015	11.00	100.00	7.00	1.10	6.60	2.30	1.30	0.10
06/02/2015	11.00	100.00	7.00	1.50	5.50	1.30	0.90	0.10
07/02/2015	11.00	100.00	7.10	0.40	7.20	1.90	0.70	0.05
08/02/2015	10.00	70.00	7.00	0.60	7.30	2.00	1.60	0.15
09/02/2015	10.00	70.00	7.70	0.40	7.40	1.40	2.40	0.15
10/02/2015	10.00	70.00	8.10	0.40	8.00	2.00	2.26	0.18
11/02/2015	14.00	70.00	7.20	0.40	7.20	1.30	2.04	0.20
12/02/2015	21.00	70.00	7.10	0.40	7.40	1.90	2.60	0.23
13/02/2015	16.00	80.00	7.30	0.30	7.90	2.10	3.00	0.25
14/02/2015	10.00	70.00	7.00	0.60	7.30	2.00	2.00	0.28
15/02/2015	10.00	70.00	7.00	0.40	7.40	1.40	2.40	0.30
16/02/2015	5.00	70.00	7.60	0.40	8.00	2.00	2.26	0.33

Implementing Drinking Water Risk Management in NSW
Monitoring Template

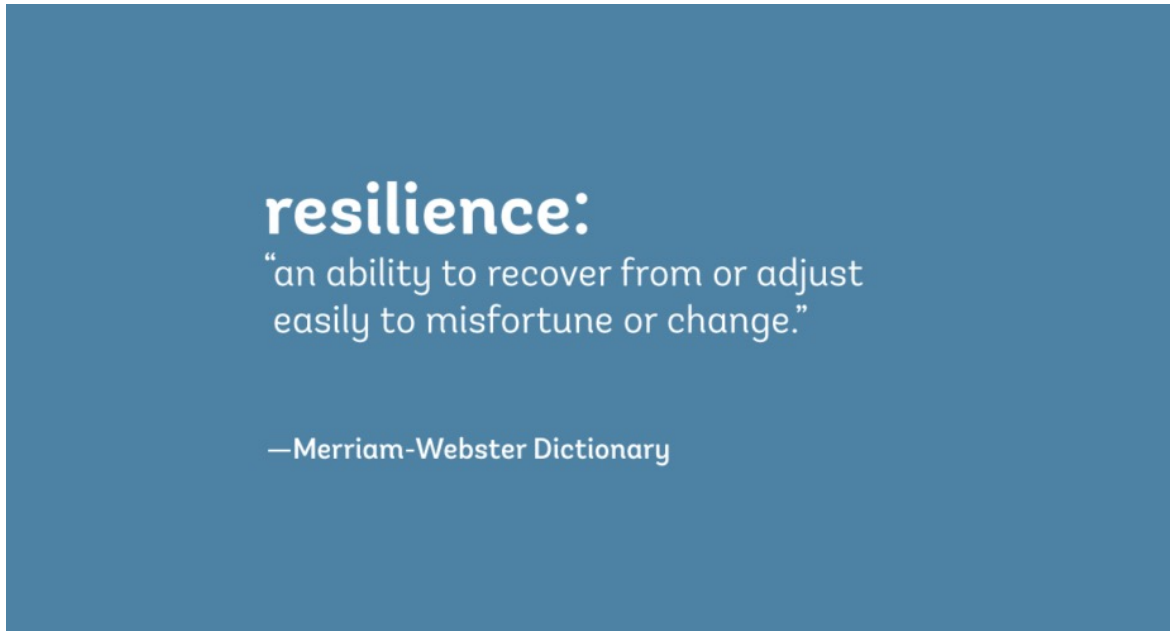
Long Term Gains – Behavioral Change

Also establish committees that have different focus.

WSP awareness, interaction and accountability needs to at different layers to enable behavioral change.

WSP – Pandemics and Resilience

- WSP also include incident response plans for when things go wrong.
- The WSP should also contain enough information on the water supply system, to help inform those that are working through the response



WSP – Pandemics and Resilience: COVID-19

- Example, with COVID-19 many city & town populations returned to precincts, which creates a significant change to demand on those preceding supplies.
- In addition, population migration can also create additional settlements and pollution sources in catchments, which can escalate quality risks.

Water Safety Plans

Thank you – Happy to Assist

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