

Rarotonga Water Supply Improvement Schedule

WSP Improvement Schedule Table Key

Improvement List or break down of activities that need to be done as identified by the corrective action

Responsible Agency responsible for undertaking the improvement

Rarotonga Water Safety Plan Improvement Schedule:

Source and Catchment Improvement Schedule

Risk	Cause	Priority	Control Measure in place	Corrective Action	Improvement	Responsible
No water	Land issues	Very high	Written agreement on supply assurance	Consultation process initiated, strengthen partnerships with landowners	1. Strengthen partnerships with landowners	DWW, NES
No water	Streams drying out during drought	Very High	Monitoring of rainfall and stream flows (trending). When flow <50% then initiate SOP .	Investigate feasibility of groundwater abstraction. Public advisory to conserve water. Investigate increased storage	2. Investigate feasibility of groundwater abstraction. 3. Public advisory to conserve water. 4. Investigate increased storage 5. Written Standard Operating procedure when stream flows <50% of normal.	DWW DWW, NES, Agriculture DWW DWW, MoH
Poor water quality (blocks off stream filters)	High sediments load from heavy rain	Very High	Some sedimentation tanks, cleaning of off stream filters (SOP)	Increased storage and shut off intake	4. Investigate increased storage, to allow for shut off of intake. 6. Written Standard Operating Procedure for cleaning of off stream filters. Investigate use of air compressor and modification of filtration system	DWW DWW
Poor water quality	High sediment load from heavy rain	Very High	Takuvaine has catchment management plan (catchment zoning)	Catchment inspections. Increased storage and shut off intake	7. Conduct catchment inspections 4. Investigate increased storage, to allow for shut off of intake.	DWW, NES DWW
Chemical	Chemicals used in catchment	High	Takuvaine has catchment management plan (catchment zoning), unknown chemical use	Catchment Inspections. Advice to landowners on chemical use in catchments above intakes.	7. Conduct catchment inspections 8. Advice to landowners on chemical use in catchments above intakes.	DWW, NES, Agriculture DWW, NES, MoA

contaminat ion of water			in other catchments			
Risk	Cause	Priority	Control Measure in place	Corrective Action	Improvement	Responsible
Blocked intakes	Sediment and gravel blocks intakes	Very High	Inspection and cleaning of intakes after heavy rain (SOP)	Intake modification investigations. Increased storage investigation	10. Intake modification investigations 4. Investigate increased storage, to allow for shut off of intake 11. Written Standard Operating procedure for inspection and cleaning of intakes	DWW DWW DWW
Poor water quality or damage to structures	Human activities in catchments	Very High	Water Works ordinance, catchment management plan enforced (Takuvaine only)	Enforcement of Water Works Ordinance. Investigate new legislation (IWRM Act?) Advice to tourist operators. Signage improved. Better understanding of risks. Replication of Takuvaine Catchment Management Plan	12. Enforcement of Water Works Ordinance. Investigate new legislation (IWRM Act) 13. Advice to tourist operators 14. Signage improved 14a. Investigation of Catchment Management Plan	DWW, NES DWW, NES, TA DWW, NES DWW, NES
Damage to infrastructure, pipe breakage, intake damage	Effects of cyclone, hurricane and extreme weather events.	Very High	Contingency plans and SOP's in place. (Some pipes made of metal where cross stream so when knocked off they can easily be put back on). Emergency Plan	Assessment and review of mitigation / contingency plan and liaison with Emergency office and cabinet	15. Written contingency plans and Standard Operating procedures for repair of broken infrastructure. Liaison with Emergency office	DWW, EO
Unable to access intakes after extreme weather event	Effects of cyclone, hurricane and extreme weather events.	Very High	Clear tracks to intakes asap after extreme weather event. (SOP for access track clearing)	Improve access to intakes where possible.	16. Improve access to intakes where possible 17. Written Standard Operating procedure for access track clearing.	DWW DWW

Treatment, Storage and Distribution Improvement Schedule

Risk	Cause	Priority	Control Measure in place	Corrective Action	Improvement	Responsible
Poor water quality in distribution zone	Increased turbidity and runoff after heavy rain	Very high	Sedimentation tanks in place for Tukevaine & Papua. Hospital, tourist resorts and licensed premises have own treatment	Investigation into continuous turbidity meters at each intake. Investigation into additional settling tanks at each intake which may allow for shutting off intakes (Tukevaine & Papua have them). Promote rainwater harvesting use to public. Regular system for inspection / audit of treatment facilities for hospital, Tourist resorts and Licensed premises.	18. Investigation into continuous turbidity meters at each intake. 4. Investigate increased storage, to allow for shut off of intake. 19. Promote rainwater harvesting use to public 20. Develop regular system for inspection / audit of treatment facilities for hospital, Tourist resorts and Licensed premises.	DWW DWW DWW, MoH, NES MoH
Poor water quality in distribution zone	Increased due to low flow	High	As above	As above	As above	
Poor water quality in distribution zone	Microbiological contaminants not removed as no treatment	Very High	Arkal filter reduces microbes (1 intake) sedimentation tanks reduces microbes (2 intakes)	Investigate filtering options to reduce coliforms. Investigate sedimentation tanks for all intakes. Investigate other treatment options if filtration not sufficient.	21. Investigate filtering options to reduce coliforms. 4. Investigate increased storage, to allow for shut off of intake 22. Investigate other treatment options if filtration not sufficient, such as disinfection.	DWW DWW DWW
Poor water quality in distribution zone	Failure of treatment due to high turbidity water from storage tanks	Very High	Sectorising the network (configuration into an area and flush). SOP for flushing.	Investigate primary and secondary tanks with control mechanisms. Supplement source from the network. Water Demand Management	23. Investigate primary and secondary tanks with control mechanisms. 24. Consider supplementing source from the network 25. Written Standard Operating Procedure for flushing of distribution zone.	DWW DWW DWW

Treatment, Storage and Distribution Improvement Schedule

Risk	Cause	Priority	Control Measure in place	Corrective Action	Improvement	Responsible
Pathogens in water supply	Contaminated water, lack of effective treatment	Very High	Periodic tests for E-coli. Collaboration with Ministry of Health (disease stats) possibly a MOU	Contingency plan. Consider testing water supply for pathogens if supply implicated.	26. Written contingency plan for detection of pathogens in water supply. 27. Consider testing water supply for pathogens if supply implicated	DWW, MoH DWW, MoH
Suspended particles not removed from water	Not sufficient time in tanks, lack of tanks, insufficient particle removal.	Very High	Some tanks and Arkal filter present but may not be sufficient to remove suspended particles.	Investigate filtering options to reduce suspended particles. Investigate sedimentation tanks for all intakes, can they remove suspended particles	28. Investigate filtering options to reduce suspended particles. 4. Investigate increased storage, to allow for shut off of intake (can they remove suspended particles?)	DWW, MoH DWW
Poor water quality	Secondary contamination of the network	Very High	Non-return valves in domestic and agriculture connections. Domestic completed in upgraded areas.	Remedy Plan for network. Backflow prevention (high risk areas) identified eg. Resorts, manufactures, industry. Health care.	29. Develop Remedy Plan for network. 30. Identify high risk backflow areas and encourage backflow devices where appropriate.	DWW DWW. MoH
Poor water quality	Secondary contamination after repair works on the mains	Very High	(Ensure all efforts were made to control secondary contamination). SOP	Quality control on repairs (create checklist and inspection guidelines) Training refresher courses on standard procedures	31. Create checklist and inspection guidelines for repair work on mains. (SOP) 32. Look into training refresher courses on standard procedures.	DWW, MoH DWW
Low pressure / flow	High demand, weak network	Very High	Water meters, pressure loggers, Water Demand Management Plan	Water Demand Management Plan and completion of network upgrade	33. Instigate Water Demand Management Plan 33a. Complete network upgrade 33b. Leak detection surveys	DWW
Disruption to flow	Damage to pipeline network from earthworks, uncontrolled	Very High	Database mapping of network. Inform DWW of intended civil works at least 24 hours	Application forms, public awareness on uncontrolled activities	34. Create application forms for civil works near water main and make available. 35. Public awareness on activities which may effect water mains	DWW DWW

	civil works		in advance		
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Treatment, Storage and Distribution Improvement Schedule

Risk	Cause	Priority	Control Measure in place	Corrective Action	Improvement	Responsible
Disruption to flow	Damage to pipeline network from natural hazards	Very High	Emergency Plan	Emergency Plan recorded	36. Ensure Emergency plan developed for natural hazards and link into Ministry of Works disaster plan.	DWW, MoW
Pump failure	Lack of maintenance, power supply, age	Medium	Regular checks of pumps when manually switched on/off	Pump maintenance and inspection programme. Spare pumps and parts. Service agreement	37. Create inspection and maintenance programme. (SOP) 37a. Purchase spare parts and backup pump with service agreement.	DWW, MoW DWW, MoW

Other Improvement Schedule

Risk	Cause	Priority	Control Measure in place	Corrective Action	Improvement	Responsible
Contamination of samples	Sampling procedure	High	Two staff can undertake sampling	Training of additional sampling staff. SOP's for sample taking. Additional sampling equipment.	38. Train additional staff on sampling technique. 39. SOP for sampling. 40. Get additional sampling equipment.	DWW -NZDWA DWW -NZDWA DWW
Samples not taken	Not enough staff	High	Two staff can undertake sampling	Training of additional sampling staff. SOP's for sample taking. Additional sampling equipment.	38. Train additional staff on sampling technique.	DWW
Samples not Analysed	Not enough trained staff and inadequate laboratory facilities	High	One staff member can do analysis. DWW has small area set aside for sample analysis, although not a proper lab.	Additional Staff trained on sample analysis. SOP's for sample analysis New Laboratory space	41. Train additional staff on sample analysis. 42. SOP's for sample analysis. 43. Investigate and get new lab.	DWW DWW DWW/MoW

Work not done	Staff motivation, training and supervision	Very High	Foreman supervises work	Job sheets for activities. DWW database	44. Create job sheets for DWW operations staff activities. 45. DWW database	DWW DWW
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WSP Improvement Summary Table Key

Improvement List or break down of activities that need to be done as identified by the corrective action

Improvement Schedule Category Identifies whether improvement is:

capital expenditure (**C**),
an investigation (**I**),
operational procedure (**O**),
additional monitoring (**M**),
Action (**A**),
training (**T**).

Responsible Agency responsible for undertaking the improvement

Timeframe When activity or improvement is to be done by

Source and Catchment Improvement Summary

Improvement	Category	Responsible	Timeframe
1. Strengthen partnerships with landowners	A + I	DWW, NES	
2. Investigate feasibility of groundwater abstraction. 3. Public advisory to conserve water. 4. Investigate increased storage 5. Written Standard Operating procedure when stream flows <50% of normal.	I A I A + O	DWW DWW, NES, Agriculture DWW DWW, MoH	
4. Investigate increased storage, to allow for shut off of intake. 6. Written Standard Operating Procedure for cleaning of off stream filter, Arkal 6a. Investigate use of air compressors and modification of filters	I A + O I	DWW DWW DWW	
7. Conduct catchment inspections	A	DWW, NES	
7. Conduct catchment inspections 8. Advice to landowners on chemical use in catchments above intakes.	A I	DWW, NES DWW, NES, Agriculture	
10. Intake modification investigations 4. Investigate increased storage, to allow for shut off of intake 11. Written Standard Operating procedure for inspection and cleaning of intakes	I I A + O	DWW DWW DWW	
12. Enforcement of Water Works Ordinance. Investigate new legislation (IWRM Act) 13. Advice to tourist operators 14. Signage improved 14a. Investigate replication of Takuvaine Catchment Management Plan and development of Catchment Zoning	A A A + C A	DWW, NES DWW, NES, Tourism Authority DWW, NES DWW, NES	
15. Written Emergency plans and Standard Operating procedures for repair of broken infrastructure.	A + O	DWW, EO	
16. Improve access to intakes where possible	A	DWW	

17. Written Standard Operating procedure for access track clearing.	A + O		
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Treatment, Storage and Distribution Improvement Summary

Improvement	Category	Responsible	Timeframe
18. Investigation into continuous turbidity meters at each intake. 4. Investigate increased storage, to allow for shut off of intake. 19. Promote rainwater harvesting use by public 20. Develop regular system for inspection / audit of treatment facilities for hospital, Tourist resorts and Licensed premises.	I I A A + M + O	DWW DWW DWW, MoH, NES MoH	
21. Investigate filtering options to reduce coliforms. 4. Investigate increased storage, to allow for shut off of intake 22. Investigate other treatment options if filtration not sufficient, such as disinfection.	I I I	DWW, MoH DWW DWW, MoH	
23. Investigate primary and secondary tanks with control mechanisms. 24. Consider supplementing source from the network 25. Written Standard Operating Procedure for flushing of distribution zone.	I A + O A + O	DWW DWW DWW	
26. Written contingency plan for detection of pathogens in water supply. 27. Consider testing water supply for pathogens if supply implicated	A + O M	DWW, MoH DWW, MoH	
28. Investigate filtering options to reduce suspended particles. 4. Investigate increased storage, to allow for shut off of intake	I I	DWW, MoH DWW	
29. Develop Remedy Plan for network. 30. Identify high risk backflow areas and encourage backflow devices where appropriate.	A + O A + I	DWW DWW, MoH	
31. Create checklist and inspection guidelines for repair work on mains. 32. Look into training refresher courses on standard procedures.	A + O T	DWW, MoH DWW	
33. Instigate Water Demand Management Plan 33a. Complete network upgrade 33b. Leak detection surveys	A C + A A + O + C	DWW DWW DWW	
34. Create application forms for civil works near water main and make available. 35. Public awareness on activities which may effect water mains	A A	DWW DWW	
36. Ensure Emergency plan developed for natural hazards and link into Ministry of Works disaster plan.	A + O	DWW, MoW	

37. Create inspection and maintenance programme. (SOP) 37a. Purchase spare parts and backup pump with service agreement.	A + O C + A	DWW, MoW	
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Other Improvement

Improvement	Category	Responsible	Timeframe
38. Train additional staff on sampling technique. 39. SOP for sampling. 40. Get additional sampling equipment.	T O C	DWW -NZDWA DWW -NZDWA DWW	Done
38. Train additional staff on sampling technique.	T	DWW -NZDWA	Done
41. Train additional staff on sample analysis. 42. SOP's for sample analysis. 43. Investigate and get new lab.	T O I + A + C	DWW DWW DWW/MoW	
44. Create job sheets for DWW operations staff activities. 45. DWW database	A + M + T A	DWW DWW	