



Pacific IW Ridge to Reef and American Samoa EPA

Pacific IW R2R Regional Knowledge Exchange:
Improved Domestic Pig Waste Management

Workshop Summary Report



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October 7th – 11th 2019

Pago Pago, American Samoa



*Empowered lives.
Resilient nations*



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Participants

GEF IW Project Managers and Partners

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Gunter Koepka	Falekaupule Representative	Tuvalu
Taarai Abere	Environment Inspector, Environment and Conservation Division	Kiribati
Nelson Ngaiorae	Ministry of Health	Cook Islands
Edwin Apera	Head of Policy and Projects, Dept of Agriculture	Cook Islands

AS-EPA Workshop Facilitators

Name	Title
Christianera Tuitele	Manager, Water Division
Antonina Te'o	Piggeries Chief, Water Division
Aioletuna Sunia	Water Quality Chief, Water Division
Tumau Lokeni	Manager, Environmental Awareness and Education Division
Neil Pilcher	Manager, Administration and Finance



Figure 1: Pacific IW R2R Knowledge Exchange (IW:LEARN and AS-EPA)

“If we can leverage our experiences, success factors, and challenges on piggery management over the last decade in the Territory to help other islands build their own capacity, then we are imparting the true meaning of public service in the region.”

- Fa’amao Asalele Jr, Director AS-EPA

Pacific IW R2R Regional Knowledge Exchange:

Improved Domestic Pig Waste Management

Background

Pigs play an integral role in the culture and traditions of the majority of the Pacific Islands. Typically pigs are gifted and/or consumed during a variety of celebratory and traditional events, such as weddings, births, funerals, inaugurations, church and social events, making pig production a necessity and often a sign of prosperity or rank.

Pig operations are usually small, at the household or community scale and are spread across the landscape. Most of these are not commercial operations, have limited family income to maintain or expand, and are often bounded by the sea or streams. As island populations have grown, so too has pig production increased and disposing of the resulting animal waste has become problematic.

In many places waste is washed out of the pen to the receiving environment, and in some countries pigs are free to wander or tied to trees or posts defecating as and where they please. This large volume of untreated urine and feces contaminates drinking water supplies with pig-related diseases such as leptospirosis and has the potential to negatively impact near shore coral reefs and their ecosystems due to the high nutrient content of pig waste. Many countries now report elevated occurrences of algal blooms, fish die off, and declining coral health as a result.

Historically many pig pens are improvised, open sided structures with concrete slab or packed earth floors. The majority of these use either piped or buckets of water to wash down the pens, with wastewater going to “septic tanks” or directly into the receiving water system, whether that is a stream or coast. The septic tank systems generally have open bottoms, making them more cesspit than septic system, and although farmers have installed them to handle waste streams they are inadequate to treat the waste before it reaches the water table or surface waters.

The Pacific Community (SPC) is executing the Pacific Regional International Waters Ridge to Reef Project (IW R2R) sponsored by the Global Environment Facility and implemented by the United Nations Development Programme. The IW R2R Project has helped identify the Dry Litter Technology (DLT) system as an alternative means of managing pig waste at the source, a system that also produces a soil conditioning compost that in many of the low-lying atoll countries will additionally benefit food security.

Of the 14 countries participating in IW R2R Project, five countries (Tuvalu, Kiribati, Nauru, FSM and Cook Islands) have identified improved pig waste management as a necessary means to reduce pathogen and nutrient loads from entering natural water systems. These countries have previously identified that environmental problems associated with excess nutrient loads associated with improper disposal of animal waste are of significant national concern and are trialling the DLT system in response.

Initiating a new form of animal husbandry is a behavioural change and regulatory control initiative that needs dedicated effort on multiple fronts. The American Samoa Environment Protection Agency (AS-EPA) has worked for over 13 years to develop, build and strengthen their Piggery Compliance Program (PCP), which began as a response to leptospirosis deaths, and has shown sustained benefits in the reduction of nutrient and pathogen loads to natural water systems.

The PCP is the compliance, enforcement and education mechanism for Environmental Health regulations that control animal farming and land use. It is a phased program and works alongside local farmers to develop Land Use Plans that identify type and site of piggeries. In addition to inspection and enforcement, technical assistance for design and construction of piggeries is offered with improved sustainable piggery designs that address the problems with nutrient management, and are affordable and manageable for the local farmers.

To date they have supported construction of over 150 DLT piggeries that are still in operation. All of this work is supported through federal funding mechanisms, an Interagency Piggery Management Group that meets monthly to discuss problem piggeries and general challenges and successes, and a comprehensive outreach program that educates farmers on use and benefits of the alternative piggery systems.

This Knowledge Exchange event has brought national representatives from Tuvalu, Kiribati, FSM and the Cook Islands to American Samoa for a one week program, from the 7th – 11th of October 2019. The program consists of learning workshops, site visits and roundtable Q&A sessions.

The purpose of this exchange is to expose participants to a long-term, operational and coordinated program that is addressing pig waste management in a Pacific Island context. It has given participants an opportunity to see governance arrangements in action, understand how compliance mechanisms can work, how to build community buy-in, and experience world class water quality monitoring and the key role that plays in communicating effectiveness of a program and ensuring public health safety.

Besides the exchange of knowledge and experiences, the workshop also aimed to increase awareness of the benefits of Ridge to Reef approaches, outline recommendations on how to most effectively provide solutions to Ridge to Reef issues, and establish a network of practitioners.

It is a particularly timely opportunity for those IW R2R projects that are just reaching the community consultation and design stage, as it highlights the involvement of farmers in the technology and site selection as well as for those projects that already have operational systems and are building the buy-in for interagency coordination and community up-take.

Session Summary

Day One:

Overview of R2R IW Projects and the AS-EPA Piggery Compliance Program

Presenter: Christianera Tuitele (AS-EPA)

Each of the participating country staff presented on their National IW Project generally and on the issues that domestic pig waste is causing to environmental and public health and on the improvement works they are pursuing specifically. Christianera Tuitele presented on the history and initiation of the PCP, highlighting the cases of leptospirosis that occurred and led to several deaths. This human health risk is what sparked the national reform in pig waste management practices. Ms Tuitele presented on the practices at that time and the improved dry-litter system that was introduced as a result.

Key Discussion Notes:

The commonalities that appeared from the presentations revealed how pigs hold a similar cultural place in the different countries. They are an integral contribution to most traditional and celebratory occasions and are often a signifier of family or community prosperity. This laid the common understanding of the valued place pigs have in the region and thus the importance and sensitivities around changing how families or farmers care for them and manage their waste.

These presentations also highlighted the commonalities of challenges that current pig waste management is causing to environmental and public health. Most pigs in the participating countries are housed either in concrete based piggeries that are washed down daily. The wastewater from this daily wash down has no treatment and usually discharges directly to nearby ponds, streams or the coast impacting on drinking water sources and/or coastal water health.

Education and Outreach

Presenter: Tumau Lokeni (AS-EPA)

Ms Tumau Lokeni presented on the extensive outreach program that was implemented as a response to the leptospirosis and the high levels of pathogens being found in adjacent streams. The program began long before any piggeries were converted and initially consisted of an island wide effort to visit every household and explain the situation and the potential ways to remediate.

Key Discussion Notes:

Participants shared their approaches to outreach which had so far been limited to the households or farmers trialling the DLT system, and discussion with government or NGO agencies. Questions were asked regarding what are popular methods of awareness raising. Ms Lokeni explained the 3D model of a DLT system that they use to show how the system can work to new farmers, as well as several brochures outlining the public health issues associated with improper management of waste and also the environmental impacts. She highlighted the frequent radio spots the EPA holds on both the English language and Samoan language stations. On these spots members of the public can call and ask questions and the EPA representative provide advice and information.

Regulations and Water Quality Standards

Presenter: Sofai Falelua (AS-EPA)

Mr Sofai Falelua presented on the regulations that govern the Piggery Compliance Program. The law is in the American Samoa Code Annotated – Title 25 (Environmental Health), Chapter 16 (Domestic Animals) and has five subsets:

- ASCA 25.1601 – Confinement of domestic animals. (all animals must be confined or properly secured)
- ASCA 25.1602 – Distance between animal confinement and human habitation. (must be 50 feet)
- ASCA 25.1603 – Animals not permitted between highway and sea
- ASCA 25.1604 – Distance between animal confinement and bodies of fresh or salt water (must be 50 feet)
- ASCA 25.1605 – Confinement areas of animals must be kept sanitary

This is the law used to issue citations to owners who do not meet these conditions and when building new animal housing structures. The regulations were identified after consultation with experts at the beginning of the PCP.

Every household that wishes to build a piggery must submit a Land Use Permit Application. A piggery is considered a major project and requires a permit and site inspection. These are reviewed and approved by the Project Notification Review System (PNRS) Board.

Key Discussion Notes:

Many of the participating countries do not have regulations for domestic animals and households or farmers can keep pigs however they please. It was recognised that without regulations and the law within in which to operate is impossible to convince people to make changes to the way they keep their animals. Participants noted that small pilot project can be useful to demonstrate alternative methods but on their own are not enough to make lasting change, that this requires strong regulations.

Day Two:

Water Quality Monitoring

Presenters: Jewel Tuiasosopo and Aioletuna Sunia (AS-EPA)

The water quality standards followed by the AS-EPA have been derived from US-EPA standards. The standards and their monitoring fall under the Clean Water Act (CWA) and are designed to protect public health and the bio-physical integrity of natural waters. The CWA requires that the AS-EPA monitor and report on the status of the natural waters and to submit a list of impaired water bodies – that is water bodies not meeting the water quality standards. To achieve this the AS-EPA has 5 data collection programs and a team of specialists to collect and analyse water samples in their US-EPA certified laboratory. The 5 programs are:

- Beach Monitoring Program
- Stream Monitoring Program
- NPDES Receiving Water Reports
- ASPA/AS-EPA Groundwater Monitoring Program

- Ridge to Reef Project

Ms Sunia highlighted the baseline assessment work that was done to identify all the piggeries on American Samoa and what type of system they were using. This was correlated in GIS with the watershed and streams that are listed as impaired, and then updated with data from 2016 showing the piggeries that have been closed or converted to the DLT system. As a result of the PCP work, 4 watersheds were removed from the impaired waters (303.D) list in 2010.

Composting Processes

Presenter: David Engelstad (AS-EPA)

A critical but often overlooked step in the DLT system process is the generation of good quality compost. Mr David Engelstad presented on the process and stages of composting and some of the best management practices particularly for tropical climates. Mr Engelstad highlighted that compost piles can be simple and kept in a small space fenced with chicken wire or can be built into the design of the full piggery as they are in AS-EPA. Other questions discussed were the use of simple agricultural thermometers to measure temperatures in the compost pile, and the importance of keeping the pile dry and away from rain or seaspray. It was noted that using good quality organic carbon material as the dry litter is important. In most instances a woodchipper is needed to chip fallen trees and other spent wood on a property, however other options exist such as banana or breadfruit tree leaves, and coconut husks that have been broken up. The key is to have the pieces of organic matter small enough that there is a high surface area for absorbing the animal waste, and that they are sufficiently dried to start with.

Dry Litter Technology Designs and Construction

Presenter: Jessica Ludgate (NRCS)

This was a thorough session that covered the engineering design of the DLT system, composting and compost use, development of household Comprehensive Nutrient Management Plans (CNMP) and best practice for DLT. Ms Jessica Ludgate of the American Samoa Office of the USDA Natural Resources Conservation Service (NRCS) presented on the design and construction process for the DLT system as it is used by the AS-EPA. Ms Ludgate noted that this design was tested and improved over several iterations and received funding and research support from the USEPA, NRCS and University of Hawaii, and is only one of several design options that could be used. Key points on the design include (see annex for full design specs):

- The 6% slope for the flooring of the pen – this allows the natural rooting movement of the pigs to move the spent dry litter towards the collection alley, but not so steep that small piglets might fall towards the alley.
- Full roof coverage – though new designs may include transparent roofing to allow daylight into the pens – that is cyclone ready.
- Collection alley at the rear of the pens – spent dry litter collects here and is transferred to compost bins every 2 weeks.
- Pens are 6x10' and usually 6 pen stalls

Ms Ludgate espoused the importance of adhering to design specifications that have been tested to ensure they can withstand high winds and storm events, as well as the rigours of daily animal activity.

The presentation mentioned research work conducted by Mr Glen Fukumoto of the University of Hawaii in which they observed the growth rates of mustard cabbage with different applications of DLT compost. The research showed that greater use of DLT compost produced higher yields and Ms Ludgate noted that the DLT system is both an engineering and agronomics system.

A livestock nutrient management system is designed to collect, transfer, store, treat and finally utilize nutrients generated from animal wastes, from the point of production to beneficial integration into a cropping system. The system is planned and designed to manage the nutrients and pathogens, normally associated with a livestock operation, in a manner that would protect the natural resources (water, soil, air) in the surrounding environment. This CNMP is developed in partnership between the NRCS and the householder and details the operations of the DLT system, handling of manure and compost, nutrient management, and soil quality and application. Ms Ludgate noted that these take a lot of time to develop and are often only necessary for farmers that have sizeable crops or gardens in which to efficiently utilise the manure fertiliser.

As the DLT systems are funded by the AS-EPA there is a detailed process which farmers and AS-EPA go through before, during and after construction. There is a pre-construction meeting and approval process, site inspection and checks, and final construction inspection to ensure that the completed piggery meets the AS-EPA standards.

Key Discussion Notes:

There was a lot of discussion in the group around the requirements for construction and how the design can be amended for different climate and island type. In particular for atoll countries that have limited access to materials, can substitutions be made? Ms Ludgate explained that it is important to keep some things the same, for example the heavy duty bolting, double welding and galvanised square tubing – this is to ensure that large boars cannot push through the structure – and any design aspects there to cyclone proof the structure. However if a country needs to adapt certain aspects then trying several different designs and observing how they withstand the climate and animal conditions is the best option. Questions were asked about the necessity and use of the CNMP and is it always followed through by the farmers. Ms Ludgate noted that it does take a lot of time to develop a CNMP and it's best to identify the farmers who are serious about the management of their crops and work with them.

Piggery Waste Management

Presenter: American Samoa Community College, Land Grant

A short presentation was provided by the American Samoa Community College (ASCC), Land Grant team that highlighted the demonstration site that is operational at the campus. The demonstration has trialled portable dry litter piggeries, fixed dry-litter system and wash-down to septic systems. The program provides a research site for students and training for farmers and sells piglets to the public. The presenters highlighted the importance of keeping the conditions of any animal housing sanitary for the well-being of the animals, and providing clean water and nutritious food or supplements, particularly to breeding sows.

Impact of Nutrient Loading on the Reef

Presenter: Kitiona Fa'asalafa (Coral Reef Advisory Group)

The impacts on human health of improperly managed animal waste was the motivation for initiating the PCP but it is also well known that the impacts of excessive nutrient loading from animal waste is detrimental to coastal ecosystem. Ms Kitiona Fa'asalafa from the Coral Reef Advisory Group (CRAG) presented to the group on the impacts of nutrient loading on the coral reef ecosystem. Excessive nutrient inputs can reduce the fertilisation success of gametes from scleractinian coral reefs, reduce calcification or growth rates, and can increase macroalgae densities which reduces light and coral recruitment. As coral species begin to suffer, opportunistic species such as the Crown of Thorns can begin to encroach and fish species can begin to decline as food sources disperse. Ms Fa'asalafa noted that it is important for the general public to understand these linkages and recognise that they have the responsibility to manage their piggeries properly, and by doing so are protecting the reef and their food sources.

Day Three

Site Visit 1: American Samoa Community College, Lands Grant – Demonstration Piggery

An existing piggery at the American Samoa Community College Land Grant was renovated in 2008 to demonstrate a variety of environmentally friendly pig waste management techniques. The project was co-funded by the Coral Reef Advisory Group and AS-EPA. Four types of piggery waste management systems were initially featured: Dry litter, Portable, Ihaka Washdown, and Septic System Washdown. At the time of the site visit only the dry litter system was operational.

The demonstration site has 6 operational DLT pens all with one sow and her piglets. The compost that is generated is used on the College farms and they have a commercial wood chipper to supply the dry litter. It was noted during the visit that the supply of dry litter is often the limiting factor in sustained use of a domestic DLT piggery, which is sometimes attributable to the lack of wood material but more often due to the limited access to wood chippers on island. Much of the discussion focussed on the construction of the pen and the materials used. It was here that the welding, galvanised steel poles and heavy duty hinges etc. was appreciated.

Site Visit 2: Eddie S'ua Ah-Siu – Private Pig Farmer

Mr Ah-Siu has a 10 pen DLT piggery on his private property and has extensive fruit trees and root crops that his family uses the compost on. Two of the pens were converted into one that houses all the size 2 piglets. Mr Ah-Siu, now retired and in his sixties, had worked for the EPA in Florida for much of his career and is dedicated to the protection of the environment. Participants had the opportunity to ask Mr Ah-Siu about his experience installing and then using the DLT system, as well as share with each other the unique situations they have in their countries. Key discussions were held around the time and commitment required for tending the piggery. Mr Ah-Siu mentioned on several occasions that a farmer must be prepared for the responsibility of raising pigs, that to do it properly does take effort but it is worth it to know that you have healthy pigs, can fertilise your own gardens and are doing no damage to the water. Participants shared that having a community champion such as Mr Ah-Siu could be critical to encouraging farmers and householders to change to the DLT system.

Day Four

Administration of the PCP

Presenters: Neil Pilcher and Antonina Te’o (AS-EPA)

Key to the smooth operations of the PCP and the EPA in general is the administration and documentation. Mr Neil Pilcher and Ms Antonina Te’o presented to the group on the process flow of the PCP from community consultations and individuals applying for a land use permit, through the enforcement and follow up, noting that under federal law the AS-EPA has the Right of Entry to enter private property if there is reason to believe a violation has been made. Some of the documentation includes:

- Non-point source Pollution Complaint Form
- Field Inspection checklists
- PCP Field Reports
- Letter of Warning
- AS-EPA Citation
- Land Use Permit Application

The PCP Today

Presenter: Christianera Tuitele (AS-EPA)

Ms Tuitele presented to the group on the status of the PCP today. Some stats from the presentation on the success of the PCP include:

- ✓ Total nitrogen load reduction of 205,887pounds from 2007-2018
- ✓ Total phosphorous load reduction of 74,482pounds from 2007-2018
- ✓ 160 DLT piggery installations
- ✓ 63 non-compliant piggeries closed in 2018
- ✓ Weekly follow ups
- ✓ Continued community outreach and education
- ✓ Increased stream monitoring – weekly

Some of the challenges that the PCP and DLT for domestic use faces is sourcing a consistent supply of dry litter and wood-chippers. At the moment this is the main reason cited for why farmers are not using the DLT system, as many are found to have reverted back to using a wash-down approach and have simply smashed a hole in the wall of the collection alley to allow the waste to flow out. More research needs to be done as to how much dry litter supply is needed to support the DLT systems already constructed, and to suitable fast growing, native trees that could be grown on plantations to supply. One example is the moringa tree that can be harvested both for wood and as a food source for the pigs. The deep litter method is also being explored as another option to complement existing DLT systems.

Challenges and ways forward

Throughout the week participants had been asked to write their questions on sticky note and all were collated on to the “Parking Lot” to be answered at the end of the sessions. The last formal session of the week was to identify some of the major challenges posed through these questions and to brainstorm ways forward. These are summarised as follows:

1. *Changing public mindset and behaviour*
 - a. Develop a comprehensive awareness campaign that highlights the public health concern and environmental impact of traditional wash down piggeries and emphasises improved animal health of using the DLT system
 - b. Focus on early adopter of the technology and highlight their positive experiences with it
 - c. Hold an annual competition for the best kept DLT piggery and/or the biggest vegetables grown with compost/manure.
2. *Finding reliable funding for construction and program maintenance*
 - a. Use the proceeds from selling compost and vegetables for the maintenance of domestic piggery
 - b. Experiment with non-traditional sources of funding such as crowd-funding, by developing engaging video content and telling the right story.
 - c. Use the successful implementation of pilot sites as leverage to propose new donor funded projects.
3. *General lack of enforcement and regulations or regulating agency*
 - a. Through reliable scientific evidence of the problems caused by pig waste, lobby government for the establishment of a regulating agency and regulations. Make the case from public health and environmental protection view.
 - b. Revise existing regulations to ensure they specifically address domestic piggeries and waste
 - c. Have strong regulations that are enforceable and a dedicated team of people from enforcement officers, regulating agency, and court system to enforce fines.
 - d. Establish a strong regulatory agency or division with existing structures, with clear responsibilities and roles.
 - e. Don't expect enforcement officers to fine their own family, have a system where officers can trade places if the offender is a relative.
4. *Small islands have limited land*
 - a. Investigate the potential for small community pig pens instead of individual household
 - b. If there is a clear threat to public health and environmental protection and a piggery will violate regulations, then there can be NO piggery.
 - c. Limit the number of pigs a family can own
 - d. Families can lease land from those that have, to raise pigs, as long as all regulatory conditions are still met.
5. *Sourcing a reliable supply of wood chips*
 - a. Especially for the portable DLT system, farmers can use the leaf litter that is found around the property as long as it is properly dried and cut into smaller pieces
 - b. Use shredded cardboard and link with a domestic and office recycling program
 - c. Grow and harvest specific trees (moringa) especially for the DLT systems on a communal plantation
 - d. Have a co-operative that farmers pay into for maintenance of wood chippers and plantations

Lessons learned and recommendations

The PCP is example of a detailed and thoughtful program that covers all aspects of animal husbandry, piggery design and construction, compost management and use, water quality and outreach. It demonstrates the importance of partnerships in consistent design and delivery. The phased and integrated approach along with dedicated partners in delivery has made this an ongoing success with much that can be adapted for other Pacific Island countries. Critical to its success has been the financial and human resource support it receives from the US EPA and NRCS. It is this support that has allowed the program to build over one hundred high quality piggeries and to provide regulatory enforcement and environmental monitoring, two of the key aspects of the wider program.

Some of the key implementation successes of the PCP that were shared and could be adapted in other countries include:

- Recognition of the importance of pigs in the American Samoan culture and bringing the community with the PCP to develop and test piggeries in order to find the best solutions.
- Various research on the best construction designs of the DLT system for American Samoa weather conditions, efficacy of compost use, behaviour change of the early adopters and general populations. This research has helped to place the PCP as a locally appropriate enterprise.
- Extensive community outreach and education period that focused on household visits and providing different opportunities for people to ask questions. This program was operational for 2 years before the first household DLT piggeries were even built
- Additionally the outreach and education program has been updated and modified over the years as understanding amongst the population changed and new challenges arose.
- Use of 3D models and site visits to educate farmers on the use and benefits of the system
- Well-founded partnerships with national and federal agencies to support the program in various phases, including the backing of the legislature.
- Environmental Health regulations based on scientific evidence of animal waste contamination and a strong regulatory agency to enforce them.
- Functional administrative processes that allow for ease of tracking farmers through the PCP as well as for permitting and enforcement (complaints, citations etc.)
- Dedicated and knowledgeable staff at the AS-EPA
- Certified water quality laboratory and data collection team that monitors stream and coastal sites weekly and provides advisories when WQ exceeds standards for public health. This process has built trust in the EPA and gives the PCP the recognition it needs to stay relevant.

Recommendations

- ✓ Start community consultation and education programs early and target as many audience groups as possible to ensure full coverage understanding of the negative impacts of piggeries, and buy-in to the benefits of the alternative management systems.
- ✓ Engage farmers and households during design phase to allow for a locally grown option to emerge that generates more buy-in and is also financially and socially responsive
- ✓ Ensure designs are cyclone ready if using iron roofing and timber.
- ✓ Invest in water quality monitoring in at-risk areas to provide the scientific basis for lobbying change as well as providing public health advisories
- ✓ Build strong partnerships with agencies and projects that focus on food security, nutrition and home gardening – providing the link between compost, soil health and food production.

Sustainability

This workshop was the first time that SPC GEM Division has engaged with the American Samoa EPA and was an important step in a longer-term effort to explore and implement domestic pig waste management interventions in the Pacific Region.

Through the IW R2R Project, countries that are initiating the DLT system and behaviour change are provided ongoing technical and managerial advice to support the transition. The Project tracks and documents this progress through National IW Project reporting requirements and Lessons Learned documentation.

Participants were required to prepare a Lessons Learned document on the workshop and highlight how they best see what they had learned fitting in to or informing their national efforts to initiate pig waste management interventions. These are attached here in Annex 2.

Several short videos were made from the workshop experience itself and also through the Tuvalu IW R2R Project that highlights the construction process and community engagement approach. These videos are available for all practitioners to use for education and outreach.

Finally, a network of practitioners was established through the workshop amongst the participants and with the PCP staff at the AS-EPA that has opened up the opportunity for ongoing discussions as countries transition to stronger regulations and management options. The discussion, outputs and lessons learned from this workshop, as well as the experiences exchanged by the practitioners will be shared with other partners and global initiatives, like the IW:LEARN platform and other GEF R2R project managers.

Annexes

Annex 1: Schedule/Programme of Activities

Day/Date	Time	Activity	Responsible Person/s	Attendees
Day 1 Monday 07 Oct	am	Welcome and introduction session with the American Samoa EPA	RPCU and AS-EPA	All
		Session One: Overview of the GEF Regional R2R Programme and National IW Projects History & Initiation of the Piggery Program	AS-EPA and IW R2R	All
	pm	Session Two: Regulations and Best management practices (DLT) Q&A Documentation & Process Tour of the Green Building	AS-EPA	All
Day 2 Tuesday 08 Oct	am	Session Three: Composting 101 The Pre-Construction Workshop Session Four: Piggery Waste Management Public Health Issues	AS-EPA	All
	pm	Roundtable meeting with the Interagency Piggery Management Group		
Day 3 Wednesday 09 Oct	am-pm	Field trip: Dry Litter Piggeries Wash Down Piggeries Demonstration Site (Participants video blogs)	AS-EPA IW-R2R and RPCU	All
	am	Session Five: Administration of the PCP	AS-EPA	All
Day 4 Thursday 10 Oct	pm	Video interviews with participants and AS-EPA staff	RPCU and AS-EPA	All
	am	Roundtable: Discussion on construction designs and options – what is being used where, how effective, cultural barriers etc. Q&A with AS-EPA staff	AS-EPA IW-R2R and AS EPA	All
Day 5 Friday 11 Oct	pm	Official Closing	AS-EPA	All

Annex 2: Participant Lessons Learned (drafts)

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1. TITLE –

Twinning Exchange (American Samoa) – Piggery Waste Management

2. PROJECT TITLE –

International Waters R2R Project in Kosrae, FSM

3. PROJECT DESCRIPTION –

IW R2R Projects are designed to guide the integration of water, land, forest and coastal management required sustainable futures for island community. The expected outcomes from the FSM Project are 1) Demonstration of Innovative approaches to Integrated Ridge to Reef Catchment Management in Kosrae, FSM, 2) Tofol Area Freshwater Resources Management Plan established, and 3) Kosrae State and local capacity for Integrated Ridge to Reef catchment management built to enable best practice in coastal waters, land and public health protection.

4. BACKGROUND TO THE LESSONS LEARNED –

Piggeries are major contributors to nutrient release to water bodies throughout the island state of Kosrae. Pig farmers are not compliant to the existing piggery regulations, and at the same time, enforcement of said regulations are poor. To address this issue, the project's first component is "Demonstration of innovative approaches to Integrated Ridge to Reef Catchment Management" with one of the outcomes focusing on Environmental and public health safeguarding via reductions in nutrient and pathogen contamination of surface and ground water. The FSM R2R Programme (both IW & STAR Projects) will be constructing and converting existing wash-down piggeries along the coast of Mutunnenea Channel in Lelu into Dry-Litter Piggeries. This is to ensure that farmers do not continue to practice the wash-down method releasing more effluent into the channel or any other bodies of water.

There is an existing regulation in place – Regulation 41-97 of the Kosrae State Code: which specifies the type of pen structures to be used throughout the island state. "It must be constructed with a concrete floor and equipped with proper drainage pit constructed of concrete or other material approved in advanced by the Environmental Health and Sanitary Division". However; with poor enforcement and compliance to the regulation, many pig farmers have just been operating their respective pig farms using the wash down method, without actually having a septic tank for the pens. Without a septic tank, the washed down manure and feed are then effluent to the surrounding land and bodies of water. Thus being a major contributor to pollution. These poorly managed piggeries can also become nuisance to the community – releasing odor, and being an eye sore to the community.

The FSM IW-R2R Project in Kosrae, in collaboration with the FSM R2R STAR Project (STAR), the Kosrae Conservation and Safety Organization (KCSO), the Kosrae Island Resources Management Authority (KIRMA), the Lelu Town Government and the community members of Lelu Municipality is addressing this issue through a joint-effort to reduce the nutrient load released to improve the water quality of Mutunnenea Channel. The way to do this as agreed upon is to convert regular existing piggeries along the

banks of the Mutunnenea Channel. The site was predetermined, but the project will serve as a demonstration, a pilot site, as well as baseline for future endeavors with such issue.

The project will convert these existing regular wash-down piggeries into piggeries that will be operated using the Dry-Litter system, eliminating the effluent to both land and water, eliminating the strong odor from pig pens, and will also produce fertilizers that farmers will then be able to use or sell to other farmers.

5. LEARNING EXPERIENCE

5.1 Summarize your learnings from the exchange.

- Which institutions, legal and regulatory frameworks, rights, ownership, informal agreements have management mandates for pig waste management (PWM)?
- *The American Samoa Code Annotated Title 25 Chapter 16 (ASCA 25.16) mandates the American Samoa EPA the authority to manage and regulate domestic animals which includes pig farming. AS-EPA has a piggery compliance program wherein the agency oversees everything that has to do with piggeries, compliance, and management. This ensures that the agency does what it is mandated to do.*
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- Are those management mandates in conflict with each other and are they supportive of achieving the desired PWM outcomes?
- *ASCA 25.16 really supports AS-EPA when it comes to enforcement of their Piggery Compliance Program. ASCA 25.16 clearly states each requirement of owning a pig, therefore supports enforcement. This law specifies and covers confinement of domestic animals, distance between animal confinement and human habitation, distance between animal confinement and bodies of water, sanitary confinement areas and so on.*
- *One of the most supportive document to PCP Enforcement is also part of the mandate. This document is the Land Use Permit. For every construction on new or existing piggery, a Land Use Permit is required. Other wise if cited, AS-EPA will shut down the construction and the farmers will have no chance with their case in court.*
- Are there other actors, e.g., private sector or non-governmental organizations, that may influence the PWM?
- *The history behind the start of the Piggery Compliance Program has been the main push to this program since the very first day. The story of the construction worker that contracted Leptospirosis after working at Matu'u Bridge in 2002 – also know as the first Lepto case in American Samoa. Before PCP, all piggery waste was just discharged into streams. There were illegal piggeries, non-compliant to regulations. In 2002, both sides of the Matu'u bridge had pig pens that were illegal and non-compliant. The stream water was found to be heavily contaminated with animal waste.*
- *Because of the first lepto case, piggeries became focused on, people were becoming aware of how harmful illegal piggeries could be.*
- *Later on in 2005, AS-EPA was granted shared authority for citation alongside Public Health whereas before, Public Health had the SOLE authority. But in 2006, AS-EPA ended up getting SOLE authority for citation.*
- *The court almost always rules in favor of the AS-EPA PCP.*
- *Public Health supports the PCP – with their work. : sanitation of domestic animal confinement -*
 - What is the relative power and impact of government, the private sector and civil society in affecting the condition of the PWM system?
- *continuous discharge of waste into the streams,*
- *documented diseases, illnesses, deaths due to pig-related issues*
- *Increasing Human Population – more people – more constructions of piggeries*
- *Culture: Piggeries are people's Treasures. People are rejecting the government's involvement in this matter*

- Are the practices being used by the targeted stakeholders in line with the institutional mandates or is there a failure in enforcement?
 - *Enforcement of the PCP has been good since its start. It's been hard but enforcers are really working hard to do their job. Since there are a couple of enforcement officers, they work together when an issue arises. For instance, if the farmer that they must cite is someone one of them knows, that officer that knows the farmer will stay in the car while the other officers go out to give out citations. This is an effort to reduce the likelihood of this becoming a personal issue outside work.*
 - Are there mechanisms for stakeholders (identify the stakeholders) to be involved in decision making, are there procedures in place for resolving conflicts that may arise between stakeholders and are they being effectively applied?
 - *There's a procedure and very clear guideline to the work that enforcement officers work by. With this, once a citation is issued, any conflicts that arise will have to be addressed by the court – should any farmers want that. Otherwise, farmers will have to comply to consequences as cited.*
 - What kind of outreach strategy and tools have worked in American Samoa?
 - *To fit American Samoa, the Education and Awareness program have employed an outreach strategy that is similar to their traditional houses – Mata'i. This strategy meant that they had to first go through layers of authority first. In the village setting – the team has to go through the high chief first, then the chief council, and finally be able to meet with the families and villagers. Likewise, in school setting, similar to what the project's been doing in Kosrae, in order to do outreach at schools, they'd go through the director of education, the school principal, and the teachers. AS also notes that having a Mayor present when entering a village is quiet vital.*
 - How has the AS maintained a sustainable model of operation and compliance?
 - *Keeping enforcement strong while showcasing success and failures via outreach and education. Good outreach and education program really ensures that the people of AS are aware of the efforts, and how these efforts are beneficial to all in the long run. Other than that, the very strict and well thought out and planned out supporting roles of other stakeholders, documents required really support the PCP and leaves no loopholes.*
- 5.2 What was your most significant learning?
- *It was interesting to see how strong and structured the whole program is. From documents required even before construction stage, to the involvement of the stakeholders to ensuring piggeries comply and are legal, and even on to the precise monitoring of the piggery construction.*
 - *Also, it was most significant to see how all these stakeholders come together to formalize, structure, and make all these guidelines to ensure that construction, compliance and enforcement will be backed up, using what is already set. This is something a bit harder to do in Kosrae at the moment as we see hesitation from some of our key stakeholders because the roles and responsibilities aren't clearly stated.*
 - *"BE A SOLUTION TO PIGGERY POLLUTION"*

6. REPLICATION –

- 6.1 Identify what learnings you can replicate in your project/country?
- *Enforcement of regulations – to be firm and not let personal relations get in the way*
 - *Regulations – to be well written to avoid loopholes*
 - *Coordination – amongst all stakeholders; including government agencies and even the Court.*
 - *Mandate – to be clearly stated – specifying roles and responsibilities of each agency*
 - *Education and Awareness Program – utilizing all medium, educating people about DLP and its benefits*
 - *BE A SOLUTION TO PIGGERY SOLUTION – to instill this in the mentality of our people*
- 6.2 Highlight specific factors or conditions needed for effective replication. What support will you need from the Experts/PCU to ensure effective replication?
- *Strong and firm enforcement of regulations already in place.*
 - *Work on updating regulations/laws that are loosely written to be specific and firm*
 - *Sell-out the concept of DLP – "be a solution to piggery pollution"*

- *The kind of support the PM needs most from Experts/PCU would be more around the technical and scientific area. Knowing HOW to measure reduction in pathogens released, monitoring change from DLP, measuring improvement in water quality.*

7. LEARNING EXCHANGE IMPROVEMENT – *What more would you like to learn? How could the design of the learning exchange be improved for future application?*

- *It would have been nice to actually go out with enforcement officers to issue citations. It would have also been nice if there were more time to show us how to calculate/estimate how much nutrient is reduced by pigs removed.*

1. **TITLE** – *Twinning Exchange (American Samoa) – Piggery Waste Management*
2. **PROJECT TITLE** – *IW Regional Ridge to Reef Project. Country - Tuvalu.*
3. **PROJECT DESCRIPTION** - *Testing the Integration of Water, Land, Forest and Coastal Management to Preserve Ecosystem Services, Store Carbon, Improve Climate Resilience and Sustain Livelihoods in Pacific Island Countries. The Time is three years 2016 to 2019.*
4. **BACKGROUND TO THE LESSONS LEARNED** - *The initial problem was identified as municipal waste water which has impacted the islands natural environment. The probable causes identified are from unmanaged waste water from farming and domestic use. Focusing on animal waste, piggeries on Funafuti are the main causes in which the using of the wash down systems with no proper management of waste water. From the new introduced system the Dry Litter Piggery, it is envisioned that the strengths that it holds may be a solution to the ongoing problem. While there has been an engagement with the local communities in understanding the concept, the Local Council has developed a new proposed municipal pig pen to adopt new technologies that are environmental friendly. Political support has been sought with the expected materialization of the undertaking to be in the very near future.*
5. **LEARNING EXPERIENCE**

5.1 Summarize your learnings from the exchange.

- Which institutions, legal and regulatory frameworks, rights, ownership, informal agreements have management mandates for pig waste management (PWM)?
 - The American Samoa Environment Agency. Other than the Health Department, they are the regulators and managers of the key regulatory frameworks, respectively as to;
 - **Air** – The Clean Air Act (CAA)
 - **Land & Sea** - Resource Conservation and Recovery Act (RCRA), Federal Fungicide, Insecticide and Rodenticide Act (FFIRA), and the Beach Act.
 - **Water** - . The Clean Water Act (CWA), Safe Drinking Water Act (SDWA).
- Are those management mandates in conflict with each other and are they supportive of achieving the desired PWM outcomes?
 - After sitting through each stakeholder's testimonial presentation, it seemed there is an overlapping and uncertainty between the ASEPA and the AS Health Department (ASHD). The ASHD once mentioned they have the full authority to shut down a system once they see it unhealthy and unsafe to human health (on the sport), however the ASEPA one mention they do also in respect to the regulations etc. Looking from an external perspective it may seem in conflict but commonsense wise it all boils down to humanities safe livelihood. So I won't see it in conflict but in collaboration, '*one person cannot see all, but two people will make it easier*'. And yes they all contribute to achieving the desired PWM outcomes.
- Are there other actors, e.g., private sector or non-governmental organizations that may influence the PWM?
 - As mentioned above, the AS-EPA and the AS Health department seem to be the only actors in PWM.
- What is the relative power and impact of government, the private sector and civil society in affecting the condition of the PWM system?
 - There is not impact from government and other relative sectors in affecting the condition of the PWM systems.
- Are the practices being used by the targeted stakeholders in line with the institutional mandates or is there a failure in enforcement?

- Out of the 160+ targeted stakeholders only a small number are in line with the institutional mandates, however most of them fall victim of limited resources (like dry materials) to sustain the system therefore they turn to what is available which is water flushing. It's a huge challenge for the enforcer of the mandate (ASEPA) to monitor or maintain the practice.
- Are there mechanisms for stakeholders (identify the stakeholders) to be involved in decision making, are there procedures in place for resolving conflicts that may arise between stakeholders and are they being effectively applied?
 - Yes, there are mechanism in place by the ASEPA to resolve conflicts and they are working just well according to presentation from the ASEPA management team. However the final say is from the Justice Office.
- What kind of outreach strategy and tools have worked in American Samoa?
 - The following outreaches tools below;
 - Advocate over the local radio
 - Reach out to each villages with stickers and posters etc
 - Reach out the congregation in churches
 - Reach out to youths in sports and activities.
 - And the strategies was through environment and health perspective. Sharing the causes and the improvement data's that was monitored over the years (more than 15ys is a long time, a lot of change may/did occur).
- How has the AS maintained a sustainable model of operation and compliance?
 - This all come to the commitment of the staffs and most of all methods and strategies they practiced throughout the years.

5.2 What was your most significant learning?

- I personally admire the pathway they the EPA journeyed throughout the beginning up until today, in particularly the lessons learned and the methods to improve/overcome those challenges.

6. REPLICATION –

6.1 Identify what learnings you can *replicate* in your project/country?

- The integrating of the wash down (similarly to the bio gas) and the dry litter concepts, we in Tuvalu are gearing up to establish these two technologies with the same goal to protecting the environment resources etc.

6.2 Highlight specific factors or conditions needed for effective replication. What support will you need from the Experts/PCU to ensure effective replication?

- First of all is the Government of Tuvalu's support, if their will can be turned to our best interest this idea/initiative will be successful.
- Secondly is the technical expertise technically and scientifically and most of all the administrative personnel to run this project smoothly from the starting stages all throughout tot the final stage.

7. LEARNING EXCHANGE IMPROVEMENT – What more would you like to learn? How could the design of the learning exchange be improved for future application?

- It is vital to having participants from Tuvalu be involved in all the implementing stages of the project mainly in the design and installation.

1. TITLE – Twinning Exchange (American Samoa) – Piggery Waste Management**2. PROJECT TITLE – *Piggery Waste Management in Kiribati*****3. PROJECT DESCRIPTION**

The project objectives is testing the integration of Water, Land, Forest & Coastal Management to preserve Ecosystem Services, store carbon, improve climate Resilience and Sustain Livelihoods.

The following are the expected outcomes of the project:

Component 1: *Voluntary piggery waste management*

Component 2: *Piggery best management practices (Rapid Coastal Assessment)*

Component 3: 1. *Access to information on dry litter pig pens is enhanced*

2. *Communications, media, knowledge management*

3. *Diagnostic & state of coast report*

4. *National R2R Strategic Action Plan*

4. BACKGROUND TO THE LESSONS LEARNED

Currently in Kiribati, there are couple of problems associated with piggery management which greatly have an impact both on the environment and human health. Listed below are emerging issues experienced:

1. Pig waste polluting coastal land and contamination to groundwater
2. Pigpen with concrete floor require lot of water for cleaning
3. Discomforting odor during dry seasons to concrete base pig pens
4. Discomforting odor during rainy seasons to pig pens on bare ground
5. People raising pigs near homes poses threat to spread of diseases to human
6. Pig escaped from owners cause environmental damage to gardens, plants and attack other pigs
7. Pig leashed near the coast contribute to coastal vulnerability to coastal erosion

Ministry of Environment, Lands and Agricultural Development through Environment Inspectors responded to complaint related to discomfort from pigsty odor and sanitary as part of their core responsibility. Therefore, it is expected from implementing the Dry Litter Technology once the Ridge to Reef project commenced the issues encountered above would be minimized or resolved.

5. LEARNING EXPERIENCE**5.1 Summarize your learnings from the exchange.**

- Which institutions, legal and regulatory frameworks, rights, ownership, informal agreements have management mandates for pig waste management (PWM)?
Land Use Permit (LUP) is a legal requirement in American Samoa for those who wants to run piggery farm. The LUP is reviewed by an established committee known as Project Notification Review System (PNRS) which comprises of 11 representative from different agencies.
- Are those management mandates in conflict with each other and are they supportive of achieving the desired PWM outcomes?
The is only one approved documentation known as LUP that incorporate or consider all areas of concern in related to piggery farming.

- Are there other actors, e.g., private sector or non-governmental organizations that may influence the PWM?
Land grants is one of the non-government organization that influence PWM through a Dry Litter Program. As learned during a site visit to this farm, there are other PWM programs including portable pen and wash down system implemented by the organization but came to halt for some issues which needs to be fixed in order for the programs to be sustainable and environment friendly in the long run.
- What is the relative power and impact of government, the private sector and civil society in affecting the condition of the PWM system?
PNRS comprises of different agencies with different roles in the review process.
 1. American Samoa Environmental Protection Agency – based on impacts on land, air, and water quality. Projects involving hazardous materials, chemicals, and pesticides must be approved by ASEPA
 2. Department of Health reviews projects for the impacts on public health, these include new facilities such as restaurants or food distribution centers, and pollution from sources that will impact the public.
- Are the practices being used by the targeted stakeholders in line with the institutional mandates or is there a failure in enforcement?
From the environment perspective the targeted stakeholders' role are well scrutinized however socially those who has the authority to approve for land use should consider approaching or consulting neighboring land-owners to avoid piggery farm being shut down when new residents arrive.
- Are there mechanisms for stakeholders (identify the stakeholders) to be involved in decision making, are there procedures in place for resolving conflicts that may arise between stakeholders and are they being effectively applied?
There are appointed stakeholder to sit in the LUP reviewing committee but I am not aware of any conflicts or procedures to fix conflicts among the stakeholders.
- What kind of outreach strategy and tools have worked in American Samoa?
A house to house consultation all over the island
- How has the AS maintained a sustainable model of operation and compliance?
This has been successfully maintained through enforcement and court cases

5.2 What was your most significant learning?

From the knowledge exchange between participants and AS.EPA highlighted below are some of the important lessons on PWM.

1. To persuade people to change to a proper PWM an awareness approach from public health effect has to be undertaken.
2. Spend time preparing awareness materials and messages for the awareness not go in vain.
3. In order for the PWM to be well on the island it would need piggery compliance officers who focused only on the piggery farming operation
4. It took commitment, passion and team work for the program to be sustainably successful

6. REPLICATION

6.1 Identify what learnings you can *replicate* in your project/country?

A few of the practice that can be replicated in Kiribati involves

- awareness approach
- enforcement procedure
- usage of cardboard as alternative to wood chip
- developing MOU similar to LUP MOU to soon to be establish DLT piggery farmers

6.2 Highlight specific factors or conditions needed for effective replication. What support will you need from the Experts/PCU to ensure effective replication?

- DLT structure design that fits Kiribati context
- Research on carbon rich leaves/tree in Kiribati to be used instead of wood chip
- Water quality monitoring equipment and skill

7. LEARNING EXCHANGE IMPROVEMENT – The arrangement of the learning exchange is well organized. However, knowing from the presentation and exchange of discussion that enforcement is lacking or missing in most countries I recommend if a chance to join Enforcement officers is arranged. This would be a better chance to observe how the approach undertaken to set as a leading example to participants.