

## Annex 1 - Setting up a Wormery

Even though there may be several composting worm suppliers in the country where you are implementing your project, getting worms in large enough quantities for tiger worm toilets may not be that easy. Setting up your own wormeries might be the easiest solution to meet the need. Here are the key things to consider for setting up wormeries:

### **Wormery construction**

Different types of materials can be used to set up a wormeries box, i.e. carton box, plastic drum, temporary box made of tarpaulin with bamboo frame, or masonry brick basin. It should be located in the shade to prevent overheating, protected from direct rain, have a cover to protect from birds, elevated from the ground, and with a drainage system to prevent water build up and flooding. The surface area is a critical factor, 1 square meter area is enough to grow 2 kg of baby worms.

### **Bedding material**

Use organic materials for the bedding area mixed with cow manure (as the source of food for the worms). Rice straws layer to be placed at the bottom to filter the liquid, mix cow manure and chopped banana trunk on top of it (banana trunk is good to maintain moisture). Use 10 to 20cm depth of bedding materials.

### **Feeding**

The food should be periodically topped up as the worms process it. Cow manure has been found to be an excellent food. Organic food waste is also suitable.

### **Watering**

To maintain the right moisture inside the wormeries, adding enough water twice a week may be needed. The amount of water needs to be carefully measured to ensure that all the bedding materials are soaked but not flooded. The drainage system below can be used to regulate the water.

### **Protection from rodents**

Beside the top cover (to protect birds preying on the worms), ants and other insects are the common rodent for the worms. Using ant-chalks or anti-insect painting is necessary to protect the wormeries being invaded by unwanted predators.

### **Harvesting the worms**

Successful wormeries can double the weight of worms within 6 weeks. Experience suggests that the India blue and Africa night crawler worms multiply faster than the Red worm. When it's time to harvest the worms a wormery of 2 m<sup>2</sup> will require at least 2 labourers for a 5-6 hours. It is labour intensive as it requires removing the compost & bedding materials batch by batch and finding and separating worms by size; mature large size and small baby size.

The mature large worms can be removed and used in the TWTs and the smaller baby worms and the compost & bedding materials are put back into the wormeries. Add some extra food and new bedding materials for the next growing cycle. It's important to make sure all the old food, compost and bedding materials are put back into the wormeries, as there may be a lot of worm eggs inside this mix.



Cow manure and chopped banana trunk ready to be mixed to set up a new wormery



Wormeries established in Rakhine, Myanmar, in plastic drums, under shade and above the ground

## Annex 2 WORM SUPPLIERS

Oxfam has sourced worms in Ethiopia, Liberia, Sierra Leone, Bangladesh, India and Myanmar. There are many suppliers in South Africa and Philippines.

Mostly they grow red worm, India blue or African night crawler for agricultural purposes.

In the country where you are planning to implement TWT you need to search on the internet for “suppliers of vermi-compost” or “vermi-compost producers”. These producers will most likely be able to sell you worms and help with questions about transportation and best conditions for local worms.

### WORM TRANSPORTATION

1. The worms will need ventilation, so we suggest you package them in breathable plastic weave or muslin bags. Jerry cans with holes on top to allow airflow have been used before. The holes need to be small so the worms cannot escape.
2. For every 1kg of worm, you need to have at least 1kg of bedding / vermicompost material.
3. The worms need to be kept moist so the bedding should be wet - packing with shredded damp cardboard or coconut fibre and moist soil is suitable. We do not recommend putting dry bedding on the top.
4. Place the worm bags in a box with a considerable amount of padding e.g. shredded paper (to absorb vibrations). Do not use polystyrene boxes as air cannot circulate (the worms need to breathe).
5. Send the package as soon as it is boxed up – we suggest you do this at the start of the week - to avoid them getting stuck in storage over a weekend.

### Lessons from Myanmar

**Bangkok to Yangon:** A batch of worms was imported via road transport, a 3 to 5-day journey. Roughly 50% of the worms died despite following the guidelines. It is thought that the excessive vibrations from the poor roads likely caused the worms to become over stressed and die.

**Yangon to Sittwe:** All worms were sent via air due to concerns that the 2-day road journey would cause too much vibration and stress for the worms.

Airlines in Myanmar were not always comfortable transporting worms and, in some cases, refused. The batch from Bangkok, where a large proportion of the worms had already died, caused the plane to smell bad leading to a serious complaint from the airline.

Other batches were hand-carried on the plane. It was found that batches that were transported in breathable containers had a 100% survival rate.

## Annex 3 - Worm Supply Planning (example from Sierra Leone)

### Notes

- This is a quick guidance for the facilitating team for the planning meeting with supplier to ensure that will be able to meet the demands of the worm supply to TWT toilets.
- Begin your meeting with the usual practice

### Objectives

1. To ensure that the supplier of worms will be able to meet the demands for worm supply for their specific areas.
2. Come up with the Worm Supply Plan, which will guide the supplier on the quantity of the worms required monthly by Oxfam.
3. Come up with strategy/sites to increase the worm production output.

### Steps

- a. Preliminaries (calling the meeting to start, prayer, etc.)
- b. Explain the **objectives** of the meeting and ask for any clarification
- c. Present to the group the scenario
  - TWT construction has been going on and we soon need to harvest worms to supply these worms to the toilets.
  - In February, each of the chiefdom will be ready to have 30 toilets to be supplied with worms.
  - Each toilet needs a minimum of 2 kilos of worms.
  - The toilet cannot be used until we have the system complete with worms in the bio-digester.
  - For 30 toilets, we need 60 kilos of worm.
  - Oxfam will buy the worm at SLL 40,000 per kilo. If they can produce 60 kilos, that is SLL 2,400,000.
  - Let them understand that each group will need to supply 100 toilets for Oxfam and there is a possibility that other community members will also buy worms from them. If they cannot supply enough worms to Oxfam, we will be forced to find other ways to buy worms from other sources. (At least, they will understand the situation).
- d. Ask the group what they think of the scenario. Can they come up with 60 kilos of worm in February? How? What strategy can they propose? Let the women brainstorm first so they will refine their ideas. You can give them 15 minutes to discuss first then ask them to present their ideas afterwards.
- e. You can use the flip chart paper to write key points then transfer these to the Worm Supply Plan form.
- f. Use the Worm Supply Plan as your guide to ask for the details of their strategy.
- g. Before ending the meeting, run through their plan and ask for any clarifications.
- h. Have a copy of the plan for our reference.
- i. Find out which support we can provide so they will be able to facilitate their plan, thus they can cope up with the requirements of the TWT project on worm production.

### Follow up

- Monitor the wormery daily.
- Support the women on the harvest schedule for the beds and sacks that are mature enough for harvesting.
- Revisit their Worm Supply Plan and ask updates on their progress.
- Spot any support that they require. Note that most of the challenges lie in their busy schedule and ability to a) provide good substrates and b) collect parent worms for propagation.

**Worm Supply Plan**

<b>Women's Group</b>	<b>Location</b>	<b>Date</b>
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**Objectives** To ensure a consistent supply of good quality earthworms for the Tiger Worm Toilets to estimated 100 units.

<b>What is your Strategy? (Activity)</b>	<b>How will you do it?</b>	<b>Support needed?</b>	<b>When do you start doing it?</b>

	<b>Monthly Target</b>											
	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Kilos of Worm												
No. of TWT												
<b>Validated by</b>											<b>Role</b>	<b>Signature</b>

## Annex 4 - Determining the required infiltration capacity of the pit

The table below provides a quick guide by using several general assumptions.

Flush volume	Flushes per day		
	2	3	4
1 litre	1.5 mm/hr	1.5 mm/hr	2.0 mm/hr
5 litres	3.5 mm/hr	5.0 mm/hr	6.0 mm/hr
10 litres	6.0 mm/hr	8.5 mm/hr	11.5 mm/hr

**Suggested minimum design infiltration rates:** table above assumes 1 litre for anal cleansing pppd, 1.5 litre urine pppd, adds a +25% safety factor, assumes 0.2m<sup>2</sup> pit surface area pp and is rounded up to the nearest 0.5mm/hr.

The actual specific required infiltration capacity of the pit can be determined using the method below.

The specific required infiltration capacity will depend on the type of latrine pan used. For example, a pour flush latrine that requires 7 litres to flush, which is used by 5 people who on average each flush twice per day will require a daily infiltration of 70 litres, plus 1.5 litres of urine per person (total 7.5 litres) plus any water used for anal cleansing that falls into the latrine pan, in this example 0.5 litres per person per day (total 2.5 litre). Therefore a total of 80 litres. As the number of users can some days be higher, for example due to visitors, it is advisable to add a safety factor of at least 25%. Therefore 80\*1.25 = 100 litres per day.

$$\text{Daily Water into the Pit (litres)} = \left( \left( \begin{array}{l} \text{Liters required to} \\ \text{flush the} \\ \text{toilet type} \end{array} \right) \times \begin{array}{l} \text{Expected} \\ \text{flushes per} \\ \text{person per} \\ \text{day} \end{array} + \begin{array}{l} \text{Liters of} \\ \text{water used} \\ \text{for anal} \\ \text{cleansing} \end{array} + \begin{array}{l} 1.5 \\ \text{liters} \\ \text{urine} \end{array} \right) \times \begin{array}{l} \text{Maximum} \\ \text{number of} \\ \text{expected} \\ \text{daily users} \end{array} \times \begin{array}{l} 1.25 \\ \text{Safety} \\ \text{factor} \end{array}$$

From community consultation and/or observation

$$\text{Required Minimum Infiltration Rate (mm/hr)} = \left( \frac{\text{Daily Water into the Pit (litres)}}{\text{Area of the proposed pit (m}^2\text{)}} \right) / 24$$

Soil type	Basic infiltration rate (mm/hour)
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sand	less than 30
sandy loam	20 - 30
loam	10 - 20
clay loam	5 - 10
clay	1 - 5

## FIELD INFILTRATION TEST

### Equipment required

Shovel/hoe

Hammer (2 kg)

Watch or clock

5 litre bucket

Timber (75 x 75 x 400)

Hessian (300 x 300) or jute cloth

At least 100 litres of water

**Important note:** If possible, you should try to conduct a site filtration test during the peak of the rainy season or at least get information from locals on the ground water level at peak of rainy season.

## Annex 5 - Infiltration Test: Example of results sheet

This is an example of what and how the results of the test should be recorded it can be adapted for your specific needs.

<b>Name:</b>	<b>Date 1:</b>	<b>Time 1:</b>			
	<b>Date 2:</b>	<b>Time 2:</b>			
<b>Site description:</b>					
Add a brief description of the general site and possible site coordinates.					
<b>Trail hole 1 details:</b> where dug, type of soil and coordinates etc.....					
<b>Trial hole 2 details:</b> where dug type of soil and coordinates etc.....					
<b>Was the water gone from the trail pits when visited the next day</b>		<b>Yes/No</b>			
If No, the site is not appropriate for this technology and another site should be chosen					
Trail hole #	Time started	Time ended	Time taken (sec)	Average (sec)	Vp (sec/mm)
1					
1					
1					
2					
2					
2					
2					



## Annex 6 - Guidance Note: Public Health Promotion

### Step 1: Understanding Current Behaviours

In the selection of locations for the TWTs, it is important to understand current behaviours to see if they align with the following criteria. In this context, TWT are to be constructed in communal areas (schools, markets, etc) so user behaviour might not be uniform. Therefore, an adequate cross-section of potential behaviours must be considered.

Criteria:	Important because....	Behaviours to consider: <i>(at the location where the latrine will be adapted)</i>	What it tells us...
Availability and use of water	2L of water per flush is required when flushing the TWT to ensure a proper moisture level for worms.	Where do communities get water for latrine use?	What kind of water is being used (treated, untreated, salty, PH levels etc) and if this potentially will affect the worms.
		How do individuals practice anal cleansing?	What is used for anal cleansing (i.e. paper, water, or other materials) and if behaviours need to be modified
Experience with flushing	The TWT is a flushing toilet.	How do community members flush the toilet?	If current flushing practices align with requirement of 2L of water and if additional awareness is needed on how to flush the TWT.
		Community perceptions and current practices towards flushing toilets.	Attitudes towards toilet flushing.
Items entering the system	There are restrictions on what can be flushed down the toilet.	In addition to faeces, what do community members put 'down' the toilet?	If other items are being put down the toilet (i.e. garbage, cigarettes, chemicals, nappies, menstrual materials, food waste, and plastic or glass bottles) and if additional awareness is required about how these items might damage the TWT.
Community opinions of worms	Communities may perceive worms in negative ways (i.e. lack of cleanliness)	Are worms used/accepted by the community for fishing bait or other uses?	If the worms in the toilets will be accepted or if community sensitization is needed to explain what they are for, what they do, etc.
Cleaning of latrines	Chemical cleaners should not be used on the toilet bowl as the run-off into the digester and kill the worms.	How are the existing latrines cleaned? What kinds of supplies are used?	If chemical cleaners are traditionally used, if a switch to water-only cleaning will result in communities perceiving toilets as 'unclean'
Insect and odour control	If insects (ants, flies, etc) are a problem in the area, there are specific	What practices are communities using to control insects?	If current control methods risk damaging TWTs and if fumigation, use of insecticide will be accepted by

	measures that can be taken to reduce their likelihood (fumigation, insecticide, etc)		communities.
		How do communities control odours from existing latrines?	If current coping mechanisms risk damaging TWTs and if use of 2L of water to maintain water seal and stop odours and flies requires some awareness-raising.
Use of gardens	Effluent may be collected in an external sump and used for gardening purposes.	Do communities have gardens? Do they accept (and understand) the idea of using effluent for gardening purposes?	If community members have gardens and if the disposal of collected effluent onto their gardens will be an accepted concept.

### Step 2: Involving the Community & Local Authority Figures

- ✓ Involving the Camp Management Committees (CMCs) as well as Religious Leaders, Women's and youth groups from the onset of all discussions regarding TWT will not only ensure sustainability but will teach new skills and broaden awareness about health and hygiene issues.
- ✓ Prior to the Inception Workshop, it's a good idea to meet with the CMC, Women's and youth groups, and the Religious Leaders to introduce the project. This is an important step to introducing the project and to request their support in its successful implementation. Be sure to allow a lot of time for questions and answers to make sure they digest the idea and express any fears or concerns they may have.
- ✓ Consider assigning the CMC a role in the Inception Workshop so they feel a part of the process and are in a position to meaningfully engage with users.
- ✓ Introduce the criteria for establishing the location of the TWTs – in schools, markets, shared family units and/or HH toilets feeding into a communal tank. Ask if the CMC has any addition criteria they would like to add and come to a final agreement.
- ✓ Request that the CMC facilitate subsequent meetings with community members so that the project can be introduced and – particularly in locations where the TWTs will be set up.
- ✓ Reach an agreement with the CMC on the community contribution to the project if this is at all possible given the lack of movement and restricted freedoms as well as limited livelihoods. In past TWT projects, this has included the following:

Potential Contribution	Why it's necessary	What it requires	Budget Implication? (TBD from the community or Oxfam)
Cleaning around the toilet (outside)	For hygienic reasons	Cleaning materials Dedicated latrine cleaners	Yes
Cleaning around the toilet (inside)	For hygienic reasons	Cleaning materials Dedicated latrine cleaners	Yes <sup>1</sup>
General Control Checks	For operation and maintenance	Trained technicians (from community)	Yes

<sup>1</sup> A suggestion here is: a starter hand over cleaning kit as the level of ownership needs to be empowered by the communities, and be less in-kind centric from NGOs

Technician teams to follow up on maintenance problems	For operation and maintenance	Trained technicians (from community)	Yes
Helpline to call in case of problems	For operation and maintenance	Dedicated phone (with credit) and person to be responsible for receiving calls	Yes
Collection and disposal of effluent	Effluent can either be discharged into the surrounding ground or collected in an external sump.	Households/communities may directly handle effluent. There might not be sufficient hygiene knowledge and attitudes to ensure safe practices.	Maybe
Household contribution towards materials needed for construction of TWT	Items such as: sand, coconut fibre, labour, and water are needed to construct toilets.	A commitment from community members to participate in the construction – either by providing materials or labour or both.	Maybe

### Step 3: Construction, Operation, & Maintenance of TWTs

- ✓ Prior to and during construction, holding community meetings with the latrine ‘catchment areas’ will help to share information about what’s happening, dispel rumors and myths, and provide a forum for questions and concerns.
- ✓ Develop a pictorial guide to be placed on the door of the TWT on how to use the toilet (to include the messages mentioned below).
- ✓ Also, during construction and during the first few weeks of usage, key messages (to be developed) can be shared with communities on the following:
  - Use of 2L of water for flushing
  - What can and cannot be flushed down the toilet
  - Role of the worms
  - Shared responsibility of using and maintaining communal latrines

The helpline and/or where to go when there are maintenance issues

### Step 4: Monitoring

- ✓ The following monitoring systems need to be established:
  - Every 3 months, the PHP team must hold focus group discussions (FGD) to solicit feedback from users (HIF requirement). To focus on: likes, dislikes, observations (including suggestions for improvement), and recommendations on how to improve it.
  - Regular weekly monitoring via direct observation of users as well as individual interviews
  - Establishing on-going user-centric complaints mechanisms to get real-time user feedback
- ✓ Given the personal nature of toilet use, FGD should be held in small homogeneous groups (men, women, and children).
- ✓ Latrines shall be equipped with door counters to monitor the usage of the latrines. This data shall be collated and triangulated with the observations made in the toilet (accumulation of faecal matter, and vermicompost).
- ✓ Communities shall need to be orientated that the monitoring by Oxfam staff shall also entail toilet observations of the magnitude of faecal matter, to vermicompost, and the worm population in the tiger toilet itself – having people regularly enter the latrines might cause rumors or suspicion which can be preventable.

# Annex 7 – TWT quick Users' Guidelines

<b>Tiger Worm Toilets Quick Users' Guidelines</b> Koinadugu District, Sierra Leone		 OXFAM
		
<p><b>Only use fresh water when flushing the toilet bowl.</b> Detergents, soap and salty water are harmful to the worms.</p>	<p><b>When cleaning the bowl, use only fresh water &amp; soft brush.</b> Never use soap, detergent or any cleansing agents as these will harm the worms.</p>	
		
<p><b>Never throw any objects into the bowl.</b> Used menstrual items should be disposed of separately. Any object aside from the human waste and water will affect the performance of the toilet.</p>	<p>If there are issues with your latrine that you cannot fix alone (smell, flies, toilet not flushing, etc.), contact the nearest TWT Technician in your area for support.</p>	
		
<p><b>Maintain the cleanliness in and around your toilet.</b> Comply with the required number of users to ensure that your toilet works properly.</p>	<p><b>Wash hands with soap &amp; clean water after latrine use.</b> Always provide clean water and soap near latrine for washing hands.</p>	

# Annex 8 – Worm Toilet Monitoring Form Examples



## OXFAM Worm Toilet Monitoring Form

### General Information

#	Information	Answer
1	Today's Date	
2	Latrine Number	

### Ask a household member

#	Question	Answer
3	What is number of people who were using the latrine yesterday?	
4	How long does the water last in the barrel inside the latrine?	
5	What are the good things about the toilet?	
6	What are the problems with the toilet?	

### Look inside the TWT superstructure

#	Observation	YES	NO	Add details
7	Is the latrine locked from the outside?			
8	Is their water in the barrel for flushing?			
9	Is the latrine clean?			
10	Does it smell bad inside the latrine?			
11	Are there flies in the latrine?			
12	Is there a handwashing station in the proper place?			Absent / Present / With Water / With Soap / Functional

### Look inside the tank. What best describes the situation?

#	Options	Tick
13	Working. Toilet is in use, worms are inside, vermicompost is visible	
	Not working – flooded. Toilet is in use, whole surface is covered with liquid	
	Not working – dry. Toilet is in use and is not flooded, but no worms	
	Out of use. Owner is away or not using the toilet.	
	Other. Specify:	

### Comments and Observations

14	
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# MONITORING FORM

Name of person collecting the data: \_\_\_\_\_

Date: \_\_\_\_\_

Site Name: \_\_\_\_\_

Tiger Worm Toilet (TWT) Number: \_\_\_\_\_

**Section 1: Questions to ask the person in charge of the TWT**

1 How many people (including children) use this toilet as their primary toilet ..... people

**Section 2: Structured observations in the superstructure TWT**

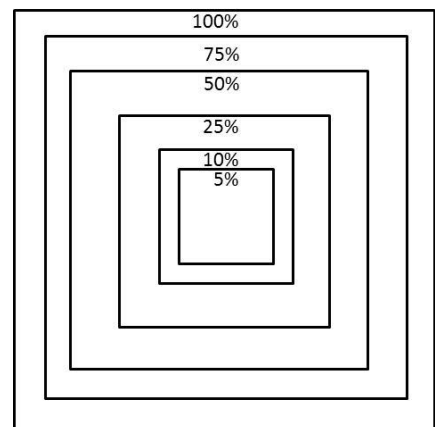
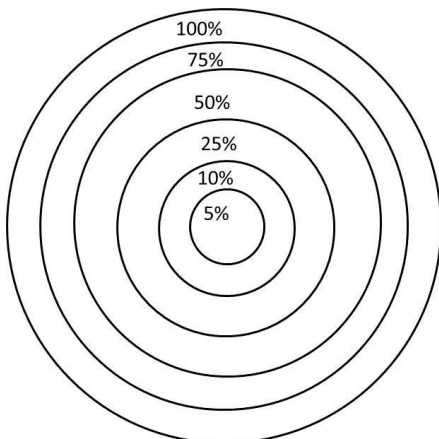
Is the superstructure clean?	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Does the superstructure smell?	Yes <input type="checkbox"/>	No <input type="checkbox"/>
If yes, what does it smell of?	Bleach <input type="checkbox"/> Urine <input type="checkbox"/> Poo <input type="checkbox"/> Other <input type="checkbox"/> <input type="checkbox"/> add details.....	
Are there lots of flies in the superstructure?	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Are there any cleaning products in the superstructure?	Yes <input type="checkbox"/>	No <input type="checkbox"/>

**Section 3: Structured observation of the TWT pit/tank – Open the manhole cover**

Does the tank smell?	Yes <input type="checkbox"/>	No <input type="checkbox"/>
If yes, what does it smell of?	Bleach <input type="checkbox"/> Urine <input type="checkbox"/> Poo <input type="checkbox"/> Other <input type="checkbox"/> add details.....	
Do any flies come out?	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Estimate the depth of the poo/liquid	..... Inches.	
Is it mainly poo or liquid?	Poo <input type="checkbox"/> Liquid <input type="checkbox"/> Half and half <input type="checkbox"/>	
How is the poo distributed?	Flat across the surface <input type="checkbox"/> Cone like <input type="checkbox"/>	

What percentage of the surface of the system is covered by the fresh poo?

Approx .....%



## Annex 9 – Wormery Monitoring Sheet

### Wormery Monitoring Sheet

TWT Project

Name of Wormery



NOTE: This is done daily for the first week then reduced to 3 times a week in the 2nd week then twice a week for the succeeding weeks. The group is expected to contact the team whenever there are urgent concerns or when they need assistance even not on the scheduled monitoring visit. The women are coached while monitoring is taking place. Concerns/issues must be addressed right away during the monitoring. It is expected that by 3<sup>rd</sup> week, the women's groups already mastered the use of this tool and the action points.

No.	Parameters/Area of Inquiry	Yes	No	Remarks	Action point done?
1	Is there enough moisture in the substrates? (You can check the substrates – between wet and moist)			If NO, then add water and agree on the amount of water and interval of watering the substrates.	
2	Do you see any formation of humus on top/edges of the substrates?			If NO, address the cause. Absence of humus may mean that worms do not have enough food or they escaped/died.	
3	Are there traces or evidences of escaping worms or dead worms?			If YES, then find the escape route and address. There might be direct sunlight or no enough food and moisture or there might be toxic substances in the food.	
4	Is there any unusual foul odour in any of the bed?			If YES, there might be rotting matter such as meat, fermented substance, fish waste, etc. Another possibility is poor ventilation.	
5	Are the beds directly hit by the sunlight?			If YES, they can use the plastic sheet to cover the side where sunlight is coming.	
6	Is the room temperature cool enough? (You do not sweat by just mere standing inside the wormery)			If NO, then ensure that there is enough ventilation/air flow. The Wormery is designed to get cooled by the air.	
7	Is there any indication that rodents/rats are feeding/boring into the substrates?			If YES, find out the entry point and address. There might be some substances (food wastes) eaten by the rats.	
8	Is there enough food in the bed? The worms feed daily, if organic matter is diminishing and replaced by the humus, food maybe scarce.			If NO, then add food. Note that the buckets should store reserve food for the worms. Ensure that there is always reserve food.	
9	Are there maggots on the substrates?			If YES, this might be due to the flies caused by the substance that attract flies. You can cover the	

				top of the bed with palm leaves. Maggots do not harm the worms but will attract predators.	
10	Are there ants on the substrates/bed or anywhere in the wormery?			If YES, address the cause and block the entry points. You can put ash along the access points/pathways (in between beds) but not inside the bed. Ash may harm the worm. Ants do not affect the worm due to the high moisture content.	
11	Is there any unusual thing in the wormery? Cracks, damages, leaks on the roof, etc.			If YES, address the cause.	

Name of Monitor
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Date of Monitoring
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