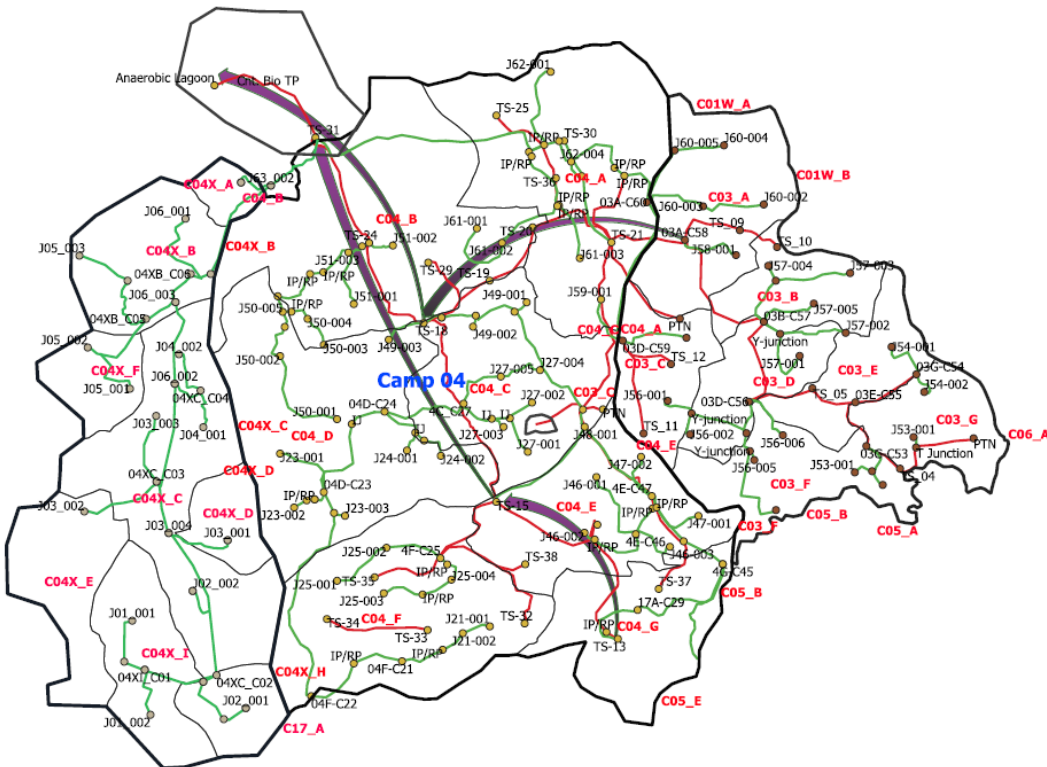


**Intermediate Fecal Sludge Transfer Network - I (As Built Map)**



IFSTN Vs Camp Block

**Legend**

- Camp 4 extension
  - FSTP
  - Camp 4 xAs Built Junctions
  - Camp 4 ext
  - Sewer Line As Built
  - Camp 4-
  - Camp 3-
- Camp 3 asbuilt
  - Camp 3 as built Junction
  - Sewer Line As built Camp 3
- Camp 4 As Built
  - Camp 3 block
  - Camp 4 x block
  - Camp4 block
  - GPS data base Camp 4
  - New construction C 4
  - Sewer Line Z C4 ( OV)
  - Bypass LLines Camp 4,Popular

Map Version - Initial  
Creation Date- 31st December,2021

Notes - Maps to be updated based on the field anomalies if any.  
Please follow the designed files / Maps for planned bypass line of the whole network including camp 5,17.

# INTERMEDIATE FECAL SLUDGE TRANSFER NETWORK

An Overview & Operation Maintenance Manual

**Historical context**

When Rohingya response had started back in 2017, sanitary environment of camps was very fragile. All the WASH agencies constructed emergency latrines of two or three 36-inch diameter ring to cope up with the rapidly growing demand of the latrines and reduce open defecation. Later, WASH Sector Unified designs had been adopted but from the beginning till date, the need of desludging latrine and safe disposal of the fecal sludges has been a burning issue. From the era of open desludging into pond or digging hole next to the pit to decentralized or centralized fecal sludge treatment facility, and transportation of sludges have its own impact on overall faecal sludge management. Transportation system needs to be adopted considering the demand of the camp, safety of workers, and sustainability aspects.

**Common Practice:** In the very beginning for all camps and till date in few camps causal Rohingya labour or volunteers transport the fecal sludge from latrine pit to nearest treatment plant. Using desludging pump or diaphragm pump workers empty the latrine pit and fill them into 60 or 80-liter blue barrel which is carried then in shoulder of two person with support of bamboo stick. The major challenges or drawback of this system are following –

1. It induces health risk to the desludging volunteers while carrying the sludges in shoulder. High possibility of splitting in undulation terrain.
2. Chances of splitting while filling the barrel as pump flow rate is much higher compared to the volume of barrel.
3. While the carrier team carry the sludges to FSTP, person who operates the desludging pump remains idle.
4. Physical labor or muscle strength is parameter.
5. During hot summer days it's quite difficult to perform the job
6. Takes a lot of time to carry up to FSM impacting daily desludging frequency and desludging cost.



Figure 1: Emptying latrine containment



Figure 2: Pumping into 60 or 80 L blue barrel



Figure 4: Manual loading at FSTP



Figure 3: Manually carry to nearest FSTP

Later on, WASH agencies started using vacutug (2/w3m3 capacity) or mini trucks assembled with plastic tanks for sludge transportation in long distance. But this mode of transportation can't met the carrying demand of a camp per day including inability to reach hilly terrain , inaccessible roads/ blocks , low suction lift and high operating cost etc.



Image: Vacutug operated in the camp

### Intermediate Fecal Sludge Transfer Network :

It's evident from the study that total solid percentage of fecal sludge from camp latrine is 1.46 meaning around 98.54 % liquid and 1.46 % solid. So fecal sludge character in camp is mostly liquid which can be easily pumped in medium and long distance with desludging pumps. To overcome the challenges of manual desludging process and transportation to centralized FSTP, in collaboration with UNHCR , OXFAM has introduced a sludge transfer network with series of holding tanks internally connected with pipes and continued up to destined FSTP. In a nutshell with this network we can pump directly from latrine pit to FSTP minimizing direct physical labor and contact with fecal sludge desludging time maximizing the amount of sludge transfer quantity.

### Process diagram ( Initial concept)

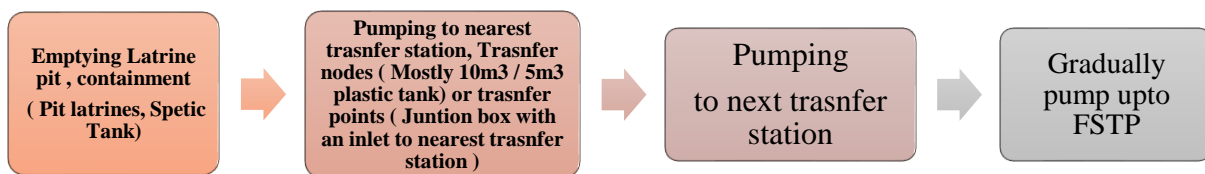




Figure 2: Desludging of latrines.



Figure 1: Pumping to nearest transfer station or Transfer Pit.



Figure 3: Transfer Pit/ Box / Transfer node



Figure 4: Pumped sludge received at FSTP intake.



Figure 5: Pumping to NEXT TRANSFER station.



Figure 6: Transfer Station

### Example - Desludging Team composition ( Camp 3,4 )

During 2020 ,2021 total desludging operation of camp 3 and camp 4 was being done by a group of skilled casual and supervisors. In total 29 persons was directly involved with this activity serving around 75,000 population . The total number of workforce is flexible as per need of desludging per month ,also on seasonal variations. This team works in two different composition.

**Desludging Team:** This team works in the front line of the operation. They are mobilized in the blocks where it's been reported of having filled up latrines. They work in 3 different team in different blocks or same block base on need, each team consist of 6 persons. Each team carries desludging pump, 100 to 120-meter flexible hose or canvas pipe with necessary connectors with them. Their main job is to pump the sludge directly from pit to nearest transfer station either directly or via transfer boxes.

**Transfer Team** – This team have in total 6 persons and divided in 3 group. Their work is to keep the network traffic free meaning pumping the sludges from one transfer station to another and reach up to FSTP. When desludging team works in a particular block this transfer team ensures that their destined transfer station is free and ready to take the sludges.



Figure 7: Desludging team and transfer team working approach

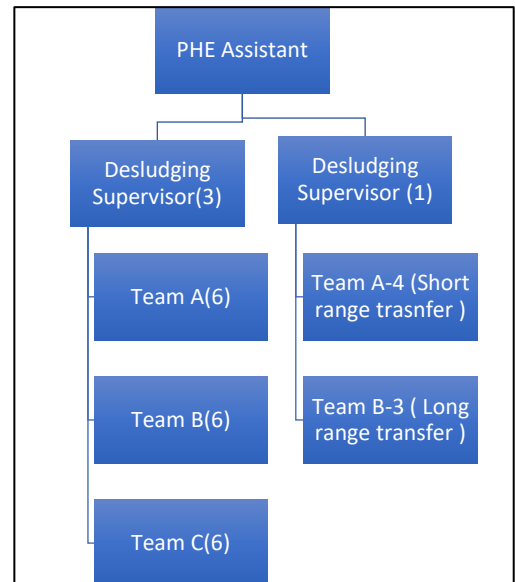


Figure 1: Desludging team and transfer team working approach

### Materials Used:

All the materials i.e. tank, pumps, pipes are locally available and can be readily installed in the field.

Item Name	Specification / Remarks	Capacity (L), Diameter(mm)
<b>Tank Base preparation</b>	Earth filled Geotextile bag with reinforced lining, plastic fencing.	
<b>PVC Transfer Tanks</b>	Can resist 70°C temperature -Double Layer -U. V stabilized in outer layer -Food Graded plastic in inner layer -Threaded & airtight lid	5000L and 10000L
<b>HDPE Pipes for network</b>	PN-10, PE-100	Dia -63mm,
<b>Desludging Pump</b>	Make-Robin Model Number: PT 305 Use: Water pump Engine: Robin EY20 Engine Type:4-stroke petrol, single-cylinder, air-cooled Engine Power:5.0 HP Inlet Size (inches)-2 Outlet size (inches)-3 Max Solid Size (mm)-30 Total Head (m)-22 Suction Lift (m)-8 Maximum Capacity (m3/hr.)-60	Used for latrine to tank transfer and tank to tank transfer
<b>Desludging pump</b>	Make: Robin Model Number: PST80 - Trash pump Use: Slurry, sludge & sewerage Engine: Robin EY20	Used for latrine to tank transfer and tank to tank transfer

	Engine Type:4-stroke petrol, single-cylinder air-cooled Engine Power:3.7kw (5.0HP) Inlet Size (inches):3 Outlet size (inches):2 Max Solid Size (mm):30 Total Head (m):22 Suction Lift (m):8 Maximum Capacity (m <sup>3</sup> /hr.):38	
<b>Desludging pump</b>	Heavy duty clay pump, Engine – 25HP, Suction X Delivery- 3”X3”, Total Head 30m	Stationary base pump for long distance tank transfer with higher flowrate.
<b>Fitting and accessories</b>	Necessary GI and HDPE compression fittings are needed to connect tank, pump, and pipes.	

The basic design parameters considered for IFSTN design -

- Designers should take into account strong seasonal variations; therefore, sludge generation is taken as 0.75 l/c/d (dry season) to 1.5 l/c/d (wet season).
- Sludge is planned as 1.8% solids (FoS 1.2 on head losses) with the network capable of functioning at 4%. (FoS 1.5 on head losses)
- Specific gravity of fecal sludge can be taken as 1.2.

(In coarse grained sub-soils, the filled up pits’ contents that are thick will be diluted with addition of water for ease of pumping)

# IFSTN Operation & Maintenance Guide

**PINCH POINT FOR SUCCESSFUL OPERATION**

- 1. UNDERSTAND AND VISUALIZE YOUR SEWER NETWORK CONNECTIONS/ JUNCTION LOCATION AND BYPASS ARRANGEMENTS.**
- 2. CLOSE COORDINATION BETWEEN DESLUDGING TEAM AND TRANSFER TEAM.**
- 3. DIFFERENCE BETWEEN QUANTITY DESLUDGED AND QUANTITY RECEIVED AT FSTP SITE SHOULD BE AS MINIMUM AS POSSIBLE.**
- 4. NO SECTION OF THE PUMPING LINE SHOULD REMAIN IDLE FOR LONG PERIOD.**



**Ensure PPE for sanitation workers**

Sanitation workers remain reluctant to use full phased PPE rather only wear green safety vest which is not safe enough for their health and family members. Knowing the fact of excessive heat proper PPE should be worn before starting off the work and they need to be trained and motivated once per two / three month.

Each sanitation workers should have dedicated two to three set of PPE for hygienic use everyday.

Team should wash their hands properly before taking lunch or food. At the end of a day, PPE should be washed and dried. On next day a fresh set of PPE to be ensured. All sanitation workers are encouraged not to go home without taking a shower at FSTP site. Shower facility is available at lime stabilization site.



Minimum safety PPE Items for sanitation workers engaged in IFSTN operation.

1. Face Mask
2. Safety Goggles
3. Hand Gloves
4. Full Body Apron
5. Safety Gumboot

### **Team Combination and Startup**

Supervisor of each desludging team collects information of the filled latrines and set a target block based on the priority in coordination with the EIC.

This information of filled up latrine comes from various way. In the year of 2021, most of the complain came via Community based volunteers. But in 2022, to change the process from reactive to proactive solution, PIT (PIT INTELLIGENT TRACKER) is launched and its expected that desludging team will be mobilized to specific sanitation zones utilizing different prediction features.



When desludging team moves towards certain block they fix the target of transfer stations which will be used in that particular day for sludge transfer. In the same time, The task of transfer team is to keep that transfer station empty while latrine desludging going on. This combination has following attributes -

- If that particular Transfer Tank is filled with sludge, Desludging team will remain idle for the day or they need to shift the target.
- Emptying that transfer station where desludging is happening means the forwards stations should be clear until FSTP inlet. In worst cases big collection tank can be used for immediate storage but sludge should not be stored inside the network to settle or produce sewer gas.
- The main time consumes to mobilize desludging team from one block to other. So, it's always better to plan for a particular block/ sub-block and keep the brunch free.

### **Sludge Collection from latrine Pit**

Desludging team should follow the below points -

- **Foot valve /strainer** should be used with the suction pipe of Robin Pump<sup>1</sup>. It will reduce the chances of clogging in the sewer lines.
- Empty pit upto bottom of the pit / septic tank. Most cases in pit latrine there is a bottom thick sludge which can't be pumped.
- Properly sealing the cover slab of septic tank or twin pit latrine after desludging.
- **Priming of Robin Pump-** As it's a centrifugal pump, it can't pump with air inside the suction pipe. Water from nearby source to be filled in the suction pipe before starting up.
- Plumbing and coupling/camlock of layflat and flexible pipe should be monitored closely for any leakage.
- Holding the outlet of the Robin pump at the top of the transfer tank while pumping to nearest transfer station. For transfer through transfer node camlock to be installed properly to avoid leakage. A ladder generally carried by team to climb up the tank.
- After completing the desludging of a particular latrine, pipe must be rolled back towards the latrine pit in hygienic manner ensuring no spillage around.



FIGURE 8: PRIMING OF ROBIN PUMP

### **Manual Stirring and Pumping**

In the whole system manual stirring is suggested in two location -

- Pumping out from septic tank with robin pump
- Pumping from transfer tank to transfer tank.

<sup>1</sup> Robin pump – Most common pump(5 HP) used at Rohingya camp. But it's a pump brand name, any similar /better centrifugal pump can be used.



This will help to maximize the latrine pit performance and avoid clogging at the system.



FIGURE 9: MANUAL STIRRING INSIDE PLASTIC TANK WHILE PUMPING TO NEXT TRANSFER STATION

### IFSTN Repairing needs

Mostly repairing may require in the following cases-

- Tank fittings loosen and leaking
- Gatevalve joint loosen /handle broken
- Robin pump broken (Casing( Aluminum plate ) damaged – due to solid particles/ foreign materials /Starter ( Rope torn ) , Engine plug , Impeller broken/Gasket / seal damage )
- 25 HP pump broken ( Water seal , Engine – Pump connecting belt , Impeller damaged ) etc .
- Layflat pipe/ flexible hose pipe leakage
- Leakage at the joint of layflat pipes / hose pipe ( Desludging team )
- Regular monitoring of plastic tanks in harsh conditions with faecal sludge is crucial. These tanks should be checked on a monthly basis for any signs of cracks or leakage. If any issues are detected, they should be promptly addressed, and the tanks should be replaced before reaching the end of their expected lifetime.

The repair team should always be prepared to respond promptly whenever needed. The IFSTN team should ensure that they have a contingency stock available, including various types and sizes of tees, reducers, couplings, clamps, and other necessary components.

### Pipeline Cut and Block

IFSTN team should be prepared and keep an open eye to trace any pipeline cutting issues inside the camp due to accidental , agricultural , site development, facility installation / other type of excavation. As soon the information is received, repairing team should be mobilized (Can be from the existing desludging/ transfer team skilled person ) . 63mm Compression coupler mostly used to repair in quickest time.

While repairing the residual sludge of the pipe will be spilled in that location so prior excavation of a small pit to accommodate the sludge should be ensured. After repairing the pit to be backfilled mixing with lime for sensitizing. Repairing team to wear proper PPE while responding to the cutting issues as it most prone to P risk.

If any section of the pipeline is clogged which can be traced with no pumping / low flow rate at next transfer station, then the location need to be traced and cleaned following same process as above. Mostly team should check for the flexed section (Before and after a hill/ downslope) and pipe joint/ coupling locations. With new rodding point / inspection pit installed the chances of clogging should be minimum if network is properly maintained.

### Inspection Pit and Rodding Points

For all pipeline reaches, Inspection Pits are installed at most of the intermediate junction where sewer lines meet together. Inspection chambers are also available at a regular interval in longer reaches, at a 90 degree bend or at the both side of bridge and culvert crossings. For pumped sections or the reaches along flat land, a chamber box with 'Y' connection should serve as inspection pit and rodding point.

The rodding points can be utilized for inspecting and resolving potential disruptions within the pipelines. They can also be used to flush fresh water into sewer lines in case of any blockages or the accumulation of solid sludge.

## INSPECTION PIT/RODDING POINTS

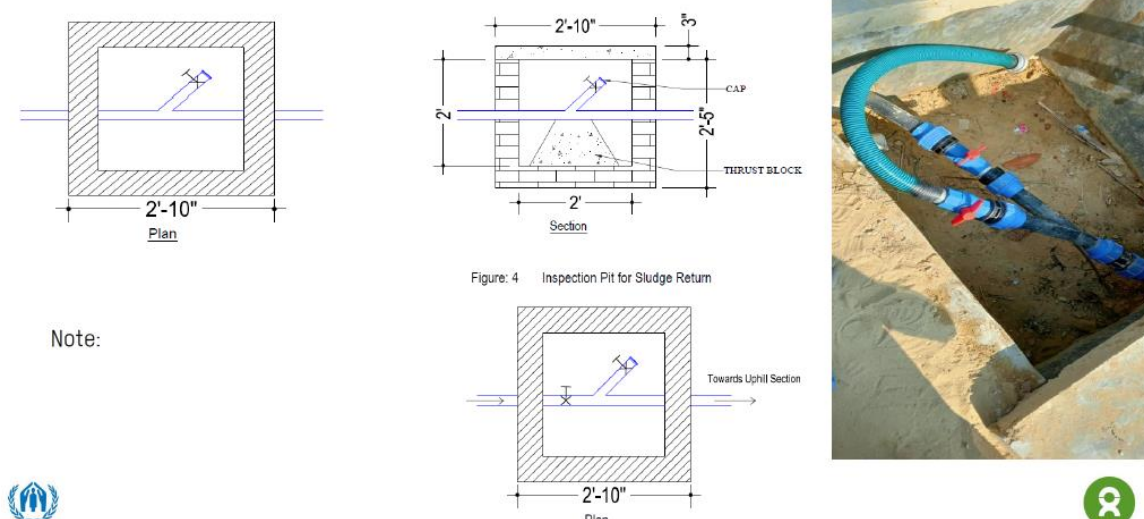




Figure: 4 Inspection Pit for Sludge Return

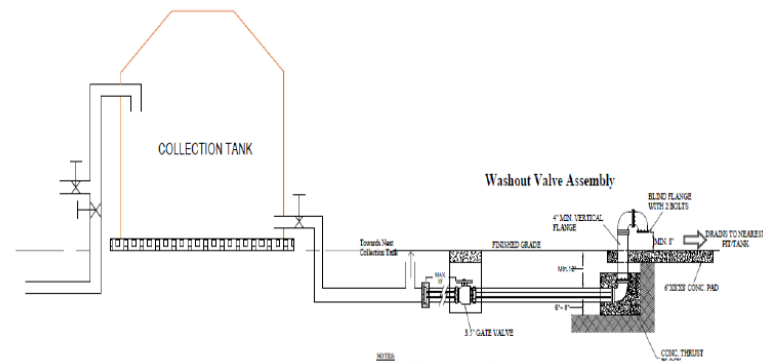
Note:



### Wash Out Assembly

To maintain a regular washout program for the whole system, a provision for washout assembly has been kept at specific proposed collection tank locations. To address the accumulation of solid sludge exceeding 50mm to 100mm in collection and transfer tanks, it is necessary to drain them using a washout assembly, directing the sludge towards the nearest septic tank or pits. It is important to prioritize stirring during the pumping process to prevent any further deposition of sludge and ensure its effective removal from the system.

## WASH OUT ASSEMBLY

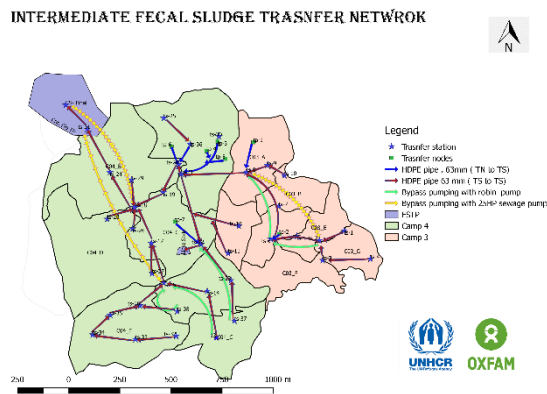


1. WASHOUT PIPE SHALL DRAIN TO THE NEAREST TANKS/PITS. NO FLUSHING SHALL FLOOD ANY PRIVATE PROPERTY.
2. ALL SEWER MAINS SHALL HAVE WASHOUT ARRANGEMENT AS SHOWN.
3. GATE VALVE DIAMETER SHALL BE MINIMUM 3.5" (DN 90 MM). WASHOUT PIPE SHALL HAVE EQUIVALENT DIAMETER.
4. THRUST BLOCKS MAY BE PROVIDED WERE REQUIRED.
5. A WASHOUT MARKER POST SHALL BE PROVIDED FOR EACH ARRANGEMENT. SEE DRAWING FOR DETAILS OF THIS MARKER POST.

## Bypass Lines

For long distance sludge transfer and to utilize the pumping head more efficiently, bypass lines have been installed and designed across the IFSTN in different sections. Bypass lines are not a separate line rather there is a special valve arrangements while bypassing any junctions of the network . Transferring sludge from any primary transfer tank/node to secondary transfer tank/node and/or to primary collection tank bypassing any junction has been denoted as Primary bypass line. For transferring from collection tank to collection tank, these bypasses have been denoted as Secondary bypass line in the map.



For efficient operation, the operator of the IFSTN should have a comprehensive understanding of each bypass line and be able to effectively utilize them to optimize fuel costs and save time

Marker post have been installed in strategic location to identify the pipeline orientation inside the camp without using digitized map , shape files/ map.

### MARKER POST (EXAMPLE)


#### MARKER POST

Intermediate Junction Point – J06\_003

63mm HDPE Sewer line

76m Up to Next Junction (PCT: 04XB\_C05)

80m Up to Next Junction (SCT: 04XB\_C06)




184m Up to Next Junction (Int. Jun: J06\_002)

1m (Underground)


Location – Camp 4 extension , Block - B


INTERMEDIATE FECAL SLUDGE TRANSFER NETWORK-1

Funded by -



Constructed By -





## Pumps repairing and troubleshooting

- There is two type of pump operational in IFSTN .
  - o Regular robin pump ( 5 Hp ) used for desludging from pit latrines and short distance transfer.
  - o Stationary 25 or 18HP heavy duty pump in transfer stations

Pumps should be regularly checked, and engine oil need to be changed timely. A detailed guide for diesel/ Petrol engines O and M can be found here <https://oxfam.box.com/s/7oje7vkxc9qn86q795phautwdkarowng> , most importantly the stationed pumps base should be in level surface to protect the shaft and all rotating parts.

## Annex

1. Different monitoring formats for IFSTN <https://oxfam.box.com/s/gxewbv2bb9ilw4foqwye0u13kb7h1>