



Fig. 1: Project location

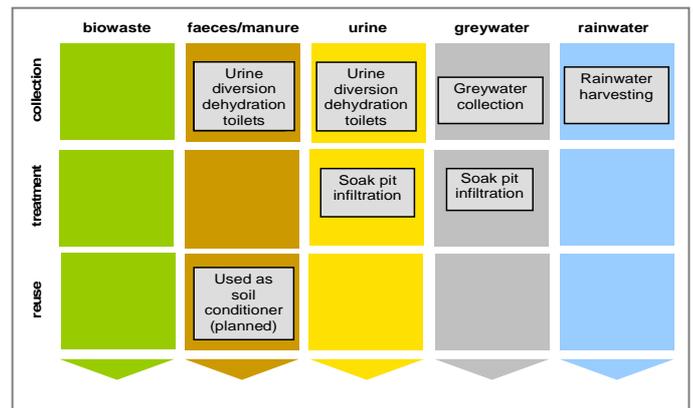


Fig. 2: Applied sanitation components in this project (greywater from handwash basins)

## 1 General data

### Type of project:

Rural school sanitation project (new, extension, rehabilitation), full scale

### Project period:

Start of construction: 2006

End of construction: 2010

Start of operation: 2008 (for some schools)

Project end: Jan. 2010 (operation of toilets continues)

### Project scale:

30 schools with urine diversion dehydration toilets (overall approx. 80 schools were included in this project)

Approximately EUR 7,500 per school for one toilet block with five cubicles

School size: 3 to 20 classrooms

Overall project budget for 80 schools was about 10 million Euro

### Address of project location:

30 different locations in two governorates of Yemen (Hajja and Marib)

### Planning institution:

Ministry of Education Yemen

with support by GOPA Consultants, Germany

### Supporting agency:

German Federal Ministry for Economic Cooperation and Development (BMZ) through German Development Bank (KfW)

*Note: this document is still being worked one. Text which still needs to be checked is indicated in blue and yellow.*

## 2 Objective and motivation of the project

The “Basic Education Improvement Project Phase II” in Hajja and Marib is a project implemented by the Yemeni Ministry of Education financed through KfW (German Bank for Development) on behalf of the German Ministry of Economic Cooperation and Development (BMZ).

The overall objective of this project is the sustainable improvement of access to basic education in the governorates Hajja and Marib through construction, extension or rehabilitation of schools, with special focus on girls’ schools. 80 new, mostly rural primary and secondary schools were built under this project. The primary and secondary schools serve for 60 – 800 pupils from grade 1-12 depending on the type of school.

The focus of this case study is the 30 schools where urine diversion dehydration toilets (UDDTs) were built. Suitable, clean and hygienic toilets are (or should be) an integral part of any school building.



Fig. 3: Urine diversion dehydration toilets at school in Almaraha, showing the red access hatches to the four faeces vaults of the four cubicles (source: GOPA, May 2008).

### 3 Location and conditions

The schools where UDDTs were installed are all in the rural areas of Yemen (governorates Hajja and Marib). They are in the mountains (up to 2000 m above sea level) as well as in tropical low lands (Tihama) and in desert areas (Marib).

Please provide more photos; + photos of the schools and children?

The surrounding settlements have no sanitation infrastructure at all and people practice open defecation. Water supply is the women's responsibility. They get the drinking water from public wells or surface water (e.g. cistern) or water from nearby wadis. The water is traditionally carried on the women's head or on donkeys.

As the surrounding area is rural, faeces could be used as soil conditioner. However, the people of Yemen have strong objections about dealing with human waste. People of Yemen are not even talking about anything released from their bodies.

The first phase of the project started in 2006 and was completed in 2008. During the first project phase standard water closets were installed. During the evaluation of this phase, it was observed, that the installed water closets were malfunctioning or not functioning at all after a short period of time. The main reason was the lack of sufficient water resources. In agreement with the Ministry of Education and KfW it was decided that all schools without existing water supply line, shall be supplied with UDDTs.

The schools in the mountains are equipped with a cistern with a volume of about 15 to 20 m<sup>3</sup>. The rainwater is collected from the roofs of the school and if it is sufficient, it may fill up the existing cisterns. However, it does not rain often in this region and the quantities are low.

With the application of UDDTs, the collected rainwater should cover most of the needed water for anal cleansing and hand washing. Hand wash basins are equipped with self-closing water taps. Certainly the rainwater would not be sufficient for the use of water-flushed toilets.

In Yemen, the under-five child mortality rate is currently **69 children per 1000**, which is a remarkable achievement given that in 1970 the value was still as high as 324 per 1000!<sup>1</sup>.

### 4 Project history

The start of construction of schools with UDDTs was in 2006. The construction was complete in March 2010. The first schools with UDDTs started operating in 2008.

The project funding from KfW side ended in January 2010. Further project monitoring activities are not foreseen from KfW.

<sup>1</sup> The under-five mortality rate is the probability (expressed as a rate per 1,000 live births) of a child born in a specified year dying before reaching the age of five if subject to current age-specific mortality rates (<http://www.childinfo.org/mortality.html> and <http://www.childmortality.org/>).

### 5 Technologies applied

The toilets built in these rural schools are urine diversion dehydration toilets (UDDTs).

Similar systems had been used in Sana'a (the capital of Yemen) previously, but are more or less rejected nowadays as being too "back ward" (who did and how exactly were those systems built?). In fact; it took a long time to convince the responsible engineers as well as the communities of the advantages of sustainable sanitation measures like UDDTs for the schools in these rural locations.

Since there was no experience about composting toilets in the project areas, the decision in favour of UDDTs instead of composting toilets, also to keep maintenance for these toilets as low as possible.

The long summertime holiday period of 2-3 months allows for the full dehydration of the faeces in the faeces vaults<sup>2</sup>. After that period the dried faeces can be removed and used as fertiliser just before school reopens again. That means only one set of faeces chambers, respectively toilets is/are necessary. Urine and greywater<sup>3</sup> from toilets is diverted into a soak pit for infiltration

Hand held shower heads (so called "Muslim Showers") are installed in the toilets to comply with the requirements for Muslim hygiene measures after toilet use (i.e. anal cleansing with water). The installed shower heads are designed for low water consumption, by letting water flow only by continuous pressing on the valve.

The advantage of diverting the urine is fewer odours, less flies and better (faster) drying of the faeces.

### 6 Design information

The toilets are built in a way that there is always access to the faeces chambers from the back. Each toilet consists of an elevated concrete floor including a urine diversion ceramic squatting pan (produced by Shital Cermic, India – imported to Yemen). (photo of the squatting pan) From the squatting pan, faeces fall into the faeces dehydration chamber. Urine and anal cleansing water is led to a nearby soak pit.

The toilet buildings are constructed of hollow concrete blocks and concrete slabs. Ceramic tiles are applied as floor finishing for easy cleaning.

The faeces chambers have a steel cover (painted red), installed at a 45 degree angle to attract heat from the sun and are ventilated with intake and exhaust pipes<sup>4</sup>.

<sup>2</sup> It is assumed, that content of the faeces vault is fully dried, because of the installed ventilation and the hot and dry air in this climate. Pre-condition is the proper usage of the UDDTs.

<sup>3</sup> This "greywater" is a mixture of water from handwashing and water from anal washing.

<sup>4</sup> At other locations, it has been found that inclined covers for the faeces vault make little difference in terms of heat increase and they are therefore not deemed to be necessary anymore (straight vertical covers having the same end result in terms of drying but lower construction costs).

The design of the UDDTs was done by GOPA Worldwide Consultants and was adapted to local standards.

The exact dimensions of the vault and the soak pit have yet to be find out from GOPA.

Are photos available?

The people in Yemen are used to squat for defecation. Therefore no additional waterless urinals for boys were needed. Currently it is not evaluated how many children are actually using the new UDDTs.

Design figure for the faeces vaults? When would it be filled up? Enough for one school period?

The toilets for girls and boys are built in a single block unit and are separated by a wall, as can be seen in Fig. 6. The numbers of the toilets can easily be adapted to the local needs by adding or deducting of cubicles, as can be seen in Fig. 4 and Fig 5. The hand wash basins are located in front of the toilet building, on each side near the staircases.

Inside the toilet cubicle there is a "Muslim shower" (see above) for anal cleansing. Rainwater harvesting is the only economic way to provide water in the toilets. If the rain water is insufficient, the water has to be bought and delivered by a water truck (which is expensive).

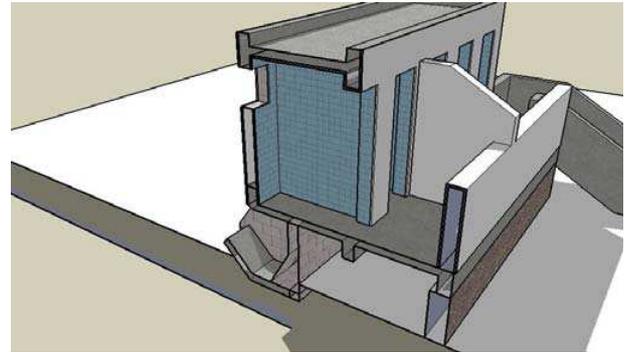


Fig. 6: Schematic view of UDDT block in side view (GOPA 2007)

## 7 Type and level of reuse

Due to the resentments among the local population the reuse of urine was not a priority of the project.

The dried fecal matter can be removed and used as fertiliser by the local farmers.

So far it is unknown, whether the faeces will be reused. Further information is needed.

## 8 Further project components

The main focus of the project is the extension of access to education by building more schools in rural areas.

So far it cannot be clarified, how successful the overall project is. It is even unclear, whether there are enough teachers in the country for the education of the pupils.

Hygiene education is currently done by GTZ, but so far the impact of the program is unknown.

Further information is needed.

## 9 Costs and economics

A cost breakdown of the project is not available. The budget for the construction of the 80 schools was about 10 Mio. Euros and financed by KfW.

The government of Yemen funded about 15% of the construction project.

The budget for the school administration and the running costs is still a major unsolved problem.

## 10 Operation and maintenance

So far 5 schools out of 30 are part of a maintenance program developed by GOPA. The maintenance program has been established parallel to the school construction and also contains the maintenance of the toilets.

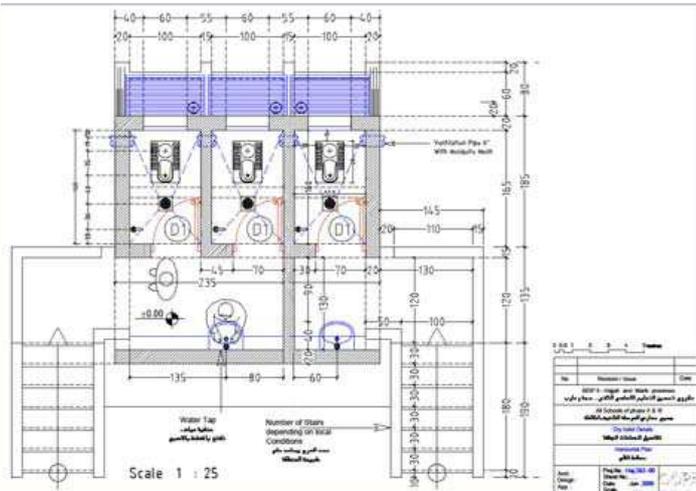


Fig. 4: Drawing (plan view) of UDDT block with three cubicles (GOPA, 2007)

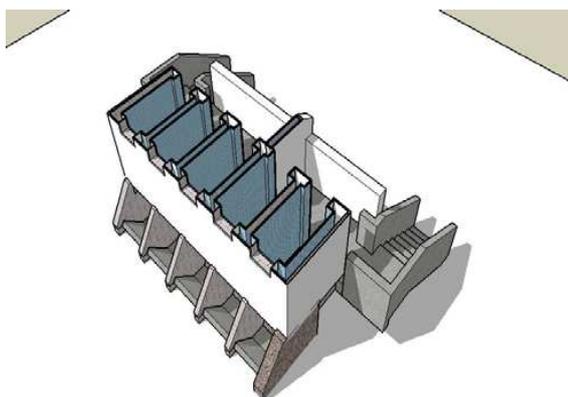


Fig. 5: Schematic view of UDDT block without roof, three cubicles are for girls, two for boys (GOPA 2007)

The schools, which were included in the maintenance program and their respective villages have also participated in a 3-day seminar of the “total community lead sanitation”. The seminar was held by experts from the Social Fund for Development Yemen (SFD)<sup>5</sup>

The other schools have not yet been included, since the construction has just been finished (status: March 2010). Apparently the seminar of SFD was successful, as it was confirmed, that the school administrations take the responsibilities for maintenance.

The school administrations are also responsible for cleaning and emptying of the toilet vaults when necessary. So far there are no experiences available.

### 11 Practical experience and lessons learnt

Since the projects were only recently finished, it is difficult to reflect on discrepancies, missing installations or mistakes.

One very important experience is that most of the regular WC’s installed in schools were locked up after some time due to the lack of water.

Please mention something about the difficulties in visiting the project areas due to security problems!

### 12 Sustainability assessment and long-term impacts

A basic assessment (Table 1) indicates five sustainability criteria for sanitation, according to vision of SuSanA, document 1. The project has its strengths and weaknesses.

**Table 1:** Qualitative indication of sustainability of system. A cross in the respective column shows assessment of the relative sustainability of project (+ means: strong point of project; o means: average strength for this aspect and – means: no emphasis on this aspect for this project).

Sustainability criteria	collection and transport			treatment <sup>a</sup>			transport and reuse <sup>a</sup>		
	+	o	-	+	o	-	+	o	-
• health and hygiene		X							
• environmental and natural resources	X								
• technology and operation		X							
• finance and economics			X						
• socio-cultural and institutional		X							

<sup>a</sup> not part of this project or not documented (yet)

### Sustainability criteria for sanitation:

**Health and hygiene** include the risk of exposure to pathogens and hazardous substances and improvement of livelihood achieved by the application of a certain sanitation system.

**Environment and natural resources** involve the resources needed in the project as well as the degree of recycling and reuse practiced and the effects of these.

**Technology and operation** relate to the functionality and ease of constructing, operating and monitoring the entire system as well as its robustness and adaptability to existing systems.

**Financial and economic issues** include the capacity of households and communities to cover the costs for sanitation as well as the benefit, e.g. from fertiliser and the external impact on the economy.

**Socio-cultural and institutional aspects** refer to the socio-cultural acceptance and appropriateness of the system, perceptions, gender issues and compliance with legal and institutional frameworks.

For details on these criteria, please see the SuSanA Vision document "Towards more sustainable solutions" (www.susana.org).

With regards to long-term impacts of the project it is too early to observe any impacts yet, although the following impacts are expected from the project design:

1. Lower drop-out rate of adolescent girls compared to schools without hygienic school toilets.
2. Improved hygiene behavior of pupils (no more open defecation at school).
3. Less pollution around the school resulting from open defecation.
4. Lower water consumption compared to schools with flush toilets

These impacts are currently not monitored/analysed or it is not known who is monitoring the project.

### 13 Available documents and references

Design documents for the UDDTs should be available at KfW.

Further information is needed

<sup>5</sup> <http://www.sfd-yemen.org/>

**14 Institutions, organisations and contact  
persons**

**Ministry of Education Yemen  
Projects Sector (owner of infrastructure)**

no information available

**GOPA Worldwide Consultants – Germany (design and  
implementation)**

<http://www.gopa.de>

**KfW Yemen (financing)**

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**Case study of SuSanA projects**

***Urine diversion dehydration toilets in rural schools, Yemen***

SuSanA 2010

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