

**Mercy Corps - Afghanistan**

**SCOPE OF WORKS (SoW)**

**“Supporting Transformation for Afghanistan's Recovery (STAR)” Program**

**Rehabilitation/ construction of Water and Sanitation Systems in Schools at Koshk-e-Rabat Sangi** **District of Herat Province, Afghanistan**

# 1. Background and Procedure

Supporting Transformation for Afghanistan’s Recovery (STAR) is a sustainable program that aims to ensure that critical water and sanitation needs of target communities living in districts of Herat are met and adopted improved hygiene practices, and WASH facilities maintenance (established communal well, water supply networks etc.). The program has interventions planned in WASH (Water supply Sanitation and Hygiene promotion).

The rehabilitation/ construction of water supply and sanitation system of health centers are one of the planned activities of STAR Program in the targeted communities.

This scope of the work covers the bullet items below:

* Drilling of new borehole tube well with 13 inches in diameter and casing PVC pipe.
* Installation of submersible pumps.
* Installation of solar panels.
* Installation of galvanized iron elevated water tank with the height of 6 meters and capacity of 10cubic meters.
* Rehabilitation of toilet blocks.
* Rehabilitation of hand wash basins.
* Construction of hand wash stations.
* Construction of septic tanks.
* Construction of soak away pits.
* Construction of potable water stations

**1.1 Employer’s Objective**

Mercy Corps objective is to select the general contractor to proceed the work as describe in this document.

##  1.2 Contractor obligations

To achieve these objectives, the contractor will be expected to conduct the project as per scope of work, specifications, and technical drawings as below:

* Observation of engineering standards for all the project aspects including water elevated tank, hand wash station, septic tank, toilet blocks, solar panel, and other work implementations.
* Cooperate with Mercy Corps Engineers/Site supervisors in project implementation.
* Cooperate with Mercy Corps Engineers/ Site supervisors in conducting necessary test records at any PCC/RCC casting, pump test, compressive strength test, continuously monitoring, measuring, and recording of mentioned activities.
* making sure of any activity performed at site must be cooperated with MC field engineers/site supervisors.

## 1.3 Employer obligation/special condition to apply

Mercy Corps has carried out a physical study to select the locations of boreholes, water elevated tank, hand wash station, soak away pit, septic tank, and other water accessories. There is possibility of change in location of any intervention at the targeted Schools as the probable location is in the drawing sheet, but for further information, the exact location of any intervention will be defined with guidance of field engineer/site supervisors at each site. The contractor shall follow strictly the results of this study while estimating the works to be done.

Any deviation to the suggestion/instruction included in the physical report provided by Mercy Corps shall be outlined in the bid and if not, it might cause disqualification of the bidder. The Contractor must take this situation into account while estimating the cost and duration of projects since he is going to obey Employer decision with this regard.

Finally, consider that other partners are working on their parts are interested by the projects, Mercy Corps will liaise with these partners to make sure that the Contractor is not affected by their eventual misconduct. The Contractor remains fully responsible of the works to be done, including any eventual extra works needed to cope with the abovementioned lacks. In this latter an amendment will be agreed prior to any implementation start.

##  2. Site Information

## 2.1 Description of the Site and Access

The project is located at Koshk -e- Rabat Sangi district, (Khalifa Rahmat village, Yeke Derakht Village and Doqi Sabzaki Village) in Herat Province of Afghanistan.

As mentioned above, to be applicable both for village and district, Mercy Corps will coordinate and manage on the most reasonable way to mitigate and limit interference between the works and the activities.

The Contractor is required to pay high attention to the following aspects, with particular attention to:

* Mitigate noise and air pollutions for prevention of environmental risk reduction.
* Plan the working hours in coordination with School admin and community leaders.
* Ensure adequate environmental measures have must be taken to avoid any impact on the village and the school.
* Ensure appropriate protective measures (fencing, warning tape) must be taken to minimize the risk of damage to public, staff, and to other.

## 2.2 Facilities to be provided by the Contractor

The Contractor shall provide one office for his site personnel. The Contractor is responsible for payments and connections regarding the supply of electrical power and all other services, including water supply, sanitation, and telephones. None of these services will be provided to the Contractor by Mercy Corps.

The Contractor shall identify a specific construction compound in collaboration with Mercy Corps Engineer/Site Supervisors for this Project/Contract. The compound must be fenced temporarily fencing and must be at least 1800 mm high.

## 2.3 Security of Contractors Personals and Construction Equipment

The Contractor shall be responsible for the security of his own site and site facilities, his personnel, construction plant, and materials on and around the site of the projects after the site handing over. The warning tape around the site should be considered to minimize the risk of any danger and isolate the construction site from public accessibility.

No claim in this regard will be considered by Mercy Corps in the case of any site incidences.

## 2.4 Site Acquaintances

The contractor requires to get acquainted with all site details needed and hence will not be entitled to any claim related to the site condition, unless they clearly and significantly change by the ones verified during the site visit.

# 3. Scope of Work (SoW)

## General Description of Work

The scope of the works requires the drilling of new borehole well, Construction of hand wash station, rehabilitation of toilet blocks, Rehabilitation of hand wash basins, construction of septic tank, construction of soak away pit, Construction of potable water stations, installation of steel galvanized iron elevated water tank in height of 6 meters and capacity of 10-cubic meter, installation of submersible pump and solar panels. The goal of these works is to improve the water and sanitation system at the Khalifa Rahmat School, Yeke Derakht High School and Sabzaki Girl's School at Koshk -e- Rabat Sangi district of Herat province. All the activities are going to be rehabilitated or constructed at the specified locations which is cleared in drawings.

Contractor shall ensure that s/he is conversant with the technical specification and applicable standards. Hence, rehabilitation or construction of mentioned facilities/activities shall hereby include the following:

### 3.2 Site Clearance and setting up

The site should be cleared for a 5m radius from the any structure constructed inside the school site. The ground should be levelled, and barriers are set up to demarcate the working area. The layout of the well construction sites should allow for easy access to the wells for moving the materials. according to MC staff guide, during all activities excavated and cuttings materials should transfer far from working area almost 500 meters away and similar at completion stage of project, the area will be made clean so that the staff have access for monitoring of all works.

### 3.3 Drilling of Boreholes for water wells

Drilling of wells will take place at surveyed and selected sites as per guidance of MC Engineers as per site condition. MCA staff will guide the contractor regarding selected sites for wells drilling.

Drilling depth of each well will be varied, and the casing diameter of each well is 13”. All the wells are supposed to be drilled by hammer. There are some specifications as well as below: Borehole diameter is 13 inches.

* Ensure that the safety measures are applied during the project.
* Sampling from every 3 meters in ground layer and storing it.
* Site setting - up shall be properly coordinated with Mercy Corps Engineer/site supervisors.
* Mobilization of tools and equipment for the borehole drilling.
* Drilling of the borehole for productive yield.
* Lodging of soil aquifer and timing.

### 3.3.1 Well Casing Pipe:

These pipes will protect well from soil collapse inside borehole of wells. The allowable casing and screen material is specified in below:

* **Type of Pipe**: well casing pipe is PVC Class C (9 bar pressure resistant) with 8 inches nominal diameter and minimum 7.8 mm wall thickness. Connection of pipes should be performed by glue and pin and the These pipes should be according to the British standard BS 3505/3506
* **Physical Test Requirements**: The internal and external surface of the pipes shall be smooth and clean, and free from grooving and other defects. A length of pipe sample of 400 ± 20 cm shall not alter in length by more than 5 percent.

All wells will be cased 0.5 meters above grade (i.e., base of pit, ground surface, etc.) and be fitted with a lockable cap with air gap (vacuum relief during pumping). Each section of casing will be joined with standard couplings and full-threaded joints, so that all joints are sounded and watertight. Well casing alignment shall not interfere with the proper installation and operation of the pump. The bottom of the casing shall be fitted with a cap that will permit maximum transmission of water without clogging. The minimum length of screen shall be at least 3 m.

### 3.3.2 Well Filter Pipe

The casing will be fitted with a well filter pipe that will permit optimal transmission of water without clogging. Filter pipes shall only be placed in the interval of the aquifer targeted. To prevent flow of mud, sand particle and other contaminants typically found at the groundwater surface, wells must be screened below the confining specified above. The material of filter pipe is PVC Class C (9 bar pressure resistant) with 8 inches nominal diameter and minimum 7.8 mm wall thickness. These pipes should be according to the British standard BS 3505/3506. The slot will be in shape of lines, slot length= 60mm slot width= 1.5mm (1.5 mm X 60mm)

### 3.3.3 Filter gravel Pack

The filter/gravel pack shall consist of at least 5-10 cm gravel, preferably rounded (avoiding lateritic gravel sand limestone), distributed evenly around the well PVC filter pipe. The gravel pack must extend 1.5 m above the top of the topmost filter pipe interval. Its role is to keep out fine particles of earth while admitting water. It is therefore an essential part of the intake. All aggregate shall be free of soil and other material.

### 3.3.4 Clay Sealing

Above the filter pack, the annular space between the casing and the borehole must be filled with clay soil without granular size as follows:

* A neat cement grout seal must be placed from the top of the Clay seal to within 1.5 m beneath the ground surface. The cement grout shall be placed in one continuous mass and shall be impermeable.

### 3.3.5 Compressor and Pump Test Condition

Before commencing of pump test for each established well, compressor will be used for its cleaning. The developing equipment shall be sufficient capacity to remove all drilling fluids, sand, rock cuttings or any other external matter. After it, pump test will start with submersible pump having outflow around 2m3/hr. for time till equilibrium of dynamic level reach and the turbidity is less than 5 NTU. The contractor will make sure availability of generator, raising main, electric line and other essential equipment needed for conducting of compressor and pump test. MCA staff will regularly monitor the water level dynamic and recovery of static water level. At the end of pump test, exact location for pump cylinder will determine in addition to conformation of aquifer water capacity.

### 4. Water Supply

### 4.1 Submersible pump

PEDROLLO series submersible pumps should be installed, and the pump description shown on the Drawings and the BoQs for each School. Pumps should be lowered into the borehole, by means of the delivery pipe, to such a depth (min.1m and at least 3 meters from the bottom) that it is completely immersed during operation when the level of water in the borehole may reduce a prob sensor 1m lower than the pump should be install. It is good practice to secure the pump by attaching a rope to the anchorage points present on the delivery body. Contractor should connect submersible pump to the elevated water storage tanks inclusive of all plumbing (pipes, fittings, and accessories). Connect submersible pumps to the automatic valve control system of the elevated water storage tanks.

### 4.2 Electric work For Water Supply

For water uplifting, submersible pump as per the mentioned specifications will be used. Meghan electric cable will be utilized for carrying electricity. Regarding the size of the cable for connecting solar panels in series and then connecting solar system with inverter cable of 2\*6 will be used, while for remaining work cable 4\*2.5 will be used (shown on drawings and BoQ). Contractor will install 8 monocrystalline solar cells of certified TOMMATECH 270W Poly crystalline 38.00V 9.21A. All the solar cells will be fixed tightly on the frame with theft prevention mechanism. The price will also include painting of the frame section. For converting DC into AC electricity, inbuilt type inverter of Vacon IP66 2.2kw 220V will be used. This inverter will contain inner control panel. For nonstop provision of water, changeover having two inlets and switching option of 100A will be used. For protection and safety of inverter, Steel Box of size 40cmX40cmX25cm of 3 mm steel plate with painting will be used.

### 4.3 Protection Box for Borehole

Construction of borehole box will contain PCC work, brick masonry and plastering work. All these works will be done according to the technical drawings. Contractor will use 1st class brick, having strength of around 105 kg/cm2 of brick area in sand cement mortar. Brick wall will be plastered for both sides and it will be painted outside only. For supporting the rope, contractor will supply and fit 50 cm steel rod having 20mm thickness. Further on top of protection box, steel lid with both sides painted will be supplied and fix at site according to the drawings.

# 5. Sanitation

# 5.1 Ceramic and Tile Work

Tile work will be done for walls and ceramic for floor of toilets, hand wash station, Pardis type, Contractor will use 1st class of ceramic and tiles for floors and walls of toilets during rehabilitation of toilets blocks. The strength of tiles for walls and ceramic work of floor will be around 250 kg/cm2. Tiles will not absorb more than 0.5 % of water placed on floor and walls. Ceramic and Tile work includes all supply, fixing and materials required for fixing of ceramic and tiles.

### 5.2 Pipe Work

Pipe work shall be of the material, pressure rating and nominal diameter shown on the Drawings. The pipes and fittings and method of installation shall comply in every respect with the following specifications, unless otherwise directed by the MC Engineers or shown on the Drawings.

The Contractor shall exercise care during the loading, transport and unloading of pipes to avoid damage to the pipes, surface finish and protective coating. Loading and unloading shall be carried out in such a way that the pipes are always under control. Under no circumstances shall pipes, fittings or jointing materials be dropped or dragged. Pipes and fittings shall be stored on Site in accordance with the manufacturer's instructions. All pipes and fittings shall be inspected and approved by the MC Engineers representative immediately prior to laying and any defective or damaged component shall be rejected.

All the distribution pipes should be Polyethylene (PE100PN16) with 16 ATM pressure and according to ASTM D 2239 and D 3035.

Water Supply and installation of special faucet used for washing tap in sterilization room with best quality. Water Supply work will include taking connection from 1" or 1.5” HDPE main pipeline with 1” or 0.5" PPR pipe for connecting the structures. for all inner use PPR pipe Class D should be used. This work will include cutting of walls and re-plastering of walls for fixing the pipes inside walls of toilets and tile works with the height of 1.5-meter. The work will include all fittings required for mentioned work and plumbing work. Further details and information are available in technical drawing. connection of reservoirs to the branches, using high quality fittings and tabs, using high durability and workability materials for the water supply network to provide a high reasonable output, and having a durable usage, PPR 0.5" pipe class D of required length, taps, valves, flexible hoses of 1m length, hand washing station made of ceramic materials. The contractor will fix all these instruments as per MCA engineering team guidance and approval.

### 5.3 Sanitary Work

Sanitary work for School will include supply and fixing of 110 mm,125mm, 90 mm, and 63mm PVC pipe class D of required length including required fittings for connecting Indian commode to septic tank and hand washing pedestal to septic tank. The commodes will be Indian seat commodes of white color made of ceramic material with flush tank and hand wash basins white color made of ceramic material should be use. The contractor will carry out all sanitary work as per MCA engineering team guidance.

### 6. Construction Works

* 1. **Excavation**

Excavation will take place for footing of elevated tank, septic tank, soak away pit and even more hand wash station and will take as per drawing. MCA will provide technical drawing to contractor for understanding dimensions of excavation for each part of the construction. All the filling materials should be according to the drawings.

As far as practicable, all suitable materials from the excavations shall be used in embankment and backfill for structures. The Contractor shall dispose of unsuitable or excess soil of the excavated materials in a place that is acceptable to the local community and so that they do not interfere with proper functioning of the works.

The bottom and side slopes of excavation against which concrete is to be placed shall be finished accurately to the dimension shown on the drawings or as prescribed by the Engineer and the surface so prepared shall be moistened with water and tamped or rolled with suitable tools or equipment for the purpose of securing a firm foundation. If at any point the natural foundation material is disturbed during the excavation process or otherwise, it shall be compacted in place, or it shall be removed and replaced with suitable earth materials or concrete at the expense of the Contractor.

* 1. **Trench Excavation**

Trenches for all pipelines shall be excavated. The trench shall be of sufficient width to enable the pipes to be properly laid and jointed. No excavation shall be filled in or covered with concrete until the MCA Engineer has inspected it and the Contractor has been authorised to proceed with the works. All surplus excavated materials from such excavation not required for refilling shall be carted away to tips or otherwise disposed of as directed. The length of the trench opens ahead of pipe laying shall not exceed 200 m.

Trenches shall have a width not less than that shown on the drawings and shall have vertical sides unless the MCA Engineer has approved the use of sloping sides in lieu of timbering. The bottom 50 mm of trench shall be left undisturbed until immediately before the pipe is to be laid when it shall be trimmed accurately by hand to the correct grade. If no bedding is required joint holes shall be formed as necessary so that the pipe, when laid is bedded on the entire length of its barrel on the firm and undisturbed bottom of the trench.

* 1. **Back Filling**

In all excavations where the excavated material is required to be returned as backfilling, suitable material shall be set during backfilling and shall be kept free from contamination with topsoil, vegetable matter or other unsuitable material, unless the Contractor shall import suitable material from elsewhere on his own expense. Excessively dry backfilling material shall be watered during backfilling. No back filling shall be carried out without the permission of the MC Engineer that will normally only be given when the Work has been inspected, tested, and approved. all back filling shall be carried out in layers not exceeding 200 mm, such layers being brought up evenly around and above the work and well consolidated before the next layer is placed. Where compaction is carried out by hand, rammers of not less than 6 kg in weight shall be used, contractor can use water for improving the density of compacted soil and the ratio of men employed in ramming and filling shall be two to one.

* 1. **Back filling of Trenches**

Back filling of trenches up to a level of 200 mm above the pipe shall be carried out with suitable fine sand material with a maximum particle size of 6 mm and shall be placed in layers not exceeding half the diameter of the pipe, kept at the same level on each side of the pipe, and carefully rammed under and around it. Compressible and other unsatisfactory material on the bottom of the trenches shall be removed as directed before laying the pipes.

Where embankments are required to ensure sufficient cover to the pipes, they shall be constructed to the dimensions shown on the drawings or indicated by the MC Engineer. They shall be built up evenly over their full width in layers not exceeding 200 mm and consolidated using tampers or mechanical compacting equipment. The cost of trimming the sides to shape and forming drainage ditches at the toe shall be included in the rates.

* 1. **Stone masonry**

Stone for all purposes shall be the best of its kind, sound and durable, free from flaws and from soft, weathered or decomposed parts. In general, the stones should be from mountain and have uniform size to avoid voids between stones. The stone and the quarry from which it is obtained shall be subject to the approval of the MCA Engineers before being used or placed. All the stones shall have a specific gravity of not less than 2.5. All masonry stone shall be kept slightly moist at the time of use. Stone used for masonry shall be two-thirds of the wall thickness.

Stone masonry will be done with cement & sand mortar of 1:4 (One part of Portland cement to four part of sand)

After stone masonry, Joints on the face of all stone masonry exposed to view shall be pointed. The mortar in the joints of the stone masonry shall first be removed to a depth of three (3) cm. The joint shall then be cleaned thoroughly with a wire brush of all loose materials and filled with cement mortar with a mix proportion of one Portland cement and four parts of sand (1:4). The surface of the face stone shall be cleaned of all mortar upon completion of the finishing operation.

* 1. **Brick Masonry of Wall**

Contractor will use 1st class brick during construction. The strength of bricks will be around 105 kg/cm2 of brick area. During brick moulding no saline deposit should be used. Bricks should not absorb water more than 20% of brick weight when immersed in water for 24 hours. For brick masonry sand & cement mortar of 1:4 will be used. All the thickness of brick masonry walls is indicated in technical drawings and perform as load bearing walls, thus essential care is required during its constructing regarding alignment, curing and mortar quality.

* 1. **Plastering**

Cement sand plastering is required for walls and floor to ensure prevention of leakage with cement sand mortar (1:4) and the inner and outer of the toilet blocks where it is not covered by ceramic and tile works should be plastered if needed. The plaster will be straight and not having vertically and horizontally up and downs beyond 5 mm. Before starting plaster, contractor will ensure curing of plastering surface to ensure the quality of plaster. After finishing plaster, curing is required for 14 days and is responsibility of the contractor.

* 1. **Concrete Works**

Concrete shall consist of cement, well graded aggregate, and water thoroughly mixed, placed and compacted as specified. Before starting to concrete the Contractor shall obtain formal written permission for casting from the MC Engineer or his representative on site.

Unless otherwise authorized by the MC Engineer, concrete shall be machine mixed at site. All classes of concrete shall be mixed for a period not less than 1½ minutes after all materials, including water, are in the mixer.

All concrete aggregates (sand & gravel) shall be furnished by the Contractor from any source approved by the MC Engineer. They shall be free from organic material, lumps of soft material, clay, chalk, lime, peat, loam, soft clayey shale or decomposed stone, vegetable and other impurities that may be harmful to concrete. Fineness modulus for sand should be 2.5. Gravel for concrete shall be uniformly graded and consist of hard and dense rock. The gravel shall be free of materials finer than 6 mm and the surface shall be clean. Gravel for use in concrete shall be crushed rock.

All cement shall be from reputable manufacturers and conform to international standards. Cement shall be stored where it cannot be damaged by rain or moisture and shall be free of lumps when used. Cement according to ASTM C150 will be used in making concrete mix.

Clean fresh water is to be used for the mixing of all concrete and mortar. Water that is safe to drink shall be considered suitable for making concrete.

* + 1. **Concrete Classes**

The classes of concrete to be used in the Works shall be as shown on the drawings, Bills of Quantities or as directed by the Engineer. The concrete is classified based on its compressive strength at twenty-eight (28) days as well as the maximum size of the aggregate as shown below, and nominal mix proportions shall be used only as a guide.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Concrete Max Slump(mm) | Concrete Class | Characteristic Cube Strength at 28 days (kg/cm2) | Maximum Aggregate size(mm) | Maximum water/ cement ratio (%) | Approx. cement content | Nominal Mix proportions (Kg/m3) |
| 75 | M25 | 250 | 20 | 45 | 400 | 1: 1: 2 |
| 75 | M20 | 200 | 20 | 45 | 400 | 1: 1.5: 3 |
| 75  | M15 | 150 | 40 | 50 | 310 | 1: 2: 4 |
| 100  | M10 | 100 | 80 | 55 | 220 | 1: 3: 6 |

* 1. **Steel Reinforcement Bars**

Steel reinforcement shall be steel bars manufactured to international standards with a minimum yield stress of 250N/mm² or high ultimate tensile stress of 420N/mm2 steel grade 60 as indicated in the drawings and Bill of Quantities or as directed. it must comply with BS 4449, BS 4461, or another approved standard. Steel fabrics shall comply with BS 4483.The Contractor shall be responsible for the accuracy of the cutting, bending, and placing of the reinforcement. Reinforcement will be inspected for compliance with the requirements as to grade, size, shape, length, splicing locations, position, and amount after it has been placed. Minimum concrete cover to reinforcement should be 50 mm measured from the outside of the bar, unless shown on the drawings or directed by the MC Engineer.

The Contractor must inform the Engineer from the completion of any reinforcement in time, to facilitate his/her inspection and check of conformity with the Working Drawings well before the concrete is placed.

### 6.10 Painting

Painting of walls, inner slabs and parapet walls will be carried out by the contractor. Contractor will provide and apply three coats of washable oil painting emulsion paint to interior plastered surfaces and water repellent, high breathable painting to exterior faces walls. MCA-Herat staff will select color and brand of paint. Painting of Steel members, they should be at first clean then anti rust paint and 2 coat of oil painting should be done.

### 6.11 Septic Tank

Septic tanks will be constructed for the toilet blocks at School. In construction phase, contractor will take care of sizes or dimensions of each part of septic tank as they are very critical. All sizes are shown in detail in technical drawings. Before starting work, contractor will receive drawings of School. The septic tanks should be possible to evacuate by vacuumed trucks to be transported out of access. After completion of process of rehabilitation, the septic tanks should be closes securely and covered by a PCC layer to prevent external materials. All PCC and RCC used in septic tank should be according to drawings mark with crushed gravel free from soil and dust.

### 6.12 Insulation

Contractor will use Isogamy 4mm after plastering and smoothing of walls on top of roof as shown in drawings. The contractor will carry out all work as per MCA engineering team guidance.

### 6.13 Soak Away Pit

Soak away pit construction will take place for each School that shall ensure no ponding, flooding, or collection of runoffs adjacent to the hand wash station. The depth of excavation will be 2m with 0.8m diameter. After the excavation, there is 2.5-5 cm stone patching with river/mountainous rounded stone, and a 5cm PCC on top of it to elimination of water from soil.

### 6.14 Metallic Door and windows

Metallic doors with 40\*180\*2 mm framing will be fixed in the toilets of the school for privacy during its usage. All the doors will be made of Russian steel and minimum weight of each door with frame will be around 25 kg. This work will include supply, fixing, repairing, and locking etc. All these doors will have painted as per MCA staff recommendation.

### 6.15 Steel Elevated Water Tank

Galvanized steel reservoir of minimum 10 cubic meter volume, and 6-meter elevation, using high quality and strength iron materials, connections with anticorruption base and galvanized welding according to the drawings and estimations. Steel water tank would be galvanized with thickness of 5mm in floor, and 4mm in surrounding wall and roof. It must be weld properly. Water Reservoir Having a RCC foundation with dimensions shown in drawings, inlet and outlet pipes appropriately should be secured from freezing, corrosion, and heating in all seasons with 10 cm Glass wool. High quality valves and fittings should be used for construction and the guard rails should be completely safe and secure for all users.