



TECHNICAL ASSESSMENT FOR SITES EXPOSED TO FLOOD

(8 Sites)

September 2023
Updated in (April 2024)



Technical Assessment for 8 Sites Exposure to Flood

Overview

Yemen is facing a humanitarian crisis due to the ongoing conflict, displacement, food insecurity, and disease outbreaks. Among the challenges faced by the internally displaced persons (IDPs) are the recurrent floods that affect their living conditions, health, safety, and dignity. According to verified reports from humanitarian partners, 73,854 families across the country suffered damages in 2022. Most of them reside in displacement sites and settlements where their shelters, livelihoods, and water sources were affected (OCHA Flood Snapshot, September 2022). According to the CCCM Flood Hazard Analysis in 2023, one in four IDP sites in Yemen are at high risk of flooding. The floods also pose risks to the humanitarian assets, services, and resources that are provided to the IDPs in the hosting sites.

To address this issue, a joint team composed of technical focal points from the clusters (CCCM, Shelter, WASH, Protection), OCHA, the Civil Defense and SCMCHA conducted technical assessments of 8 IDP sites at high risk of recurrent flooding. The objectives of the assessments were:

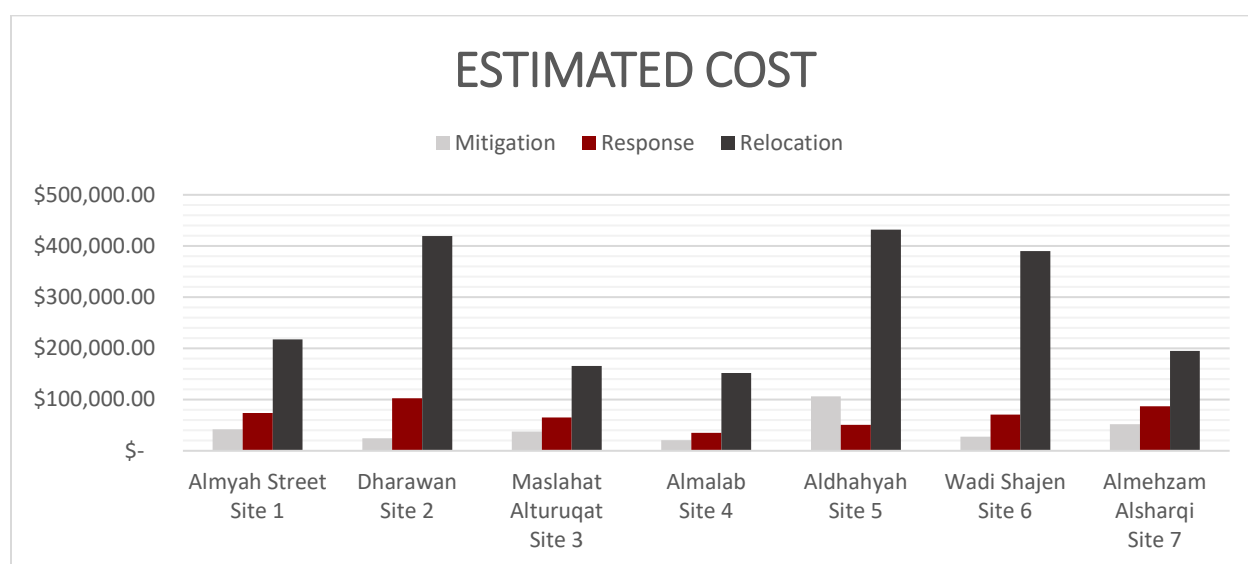
- Assess the infrastructural vulnerabilities and risks that make the sites susceptible to flooding.
- Assess the extent of possible damage to humanitarian assets, services, and resources in these sites.
- Identify possible solutions or mitigation measures that can reduce the impact and protect lives and assets from loss.
- Assess the cost benefit analysis of humanitarian response to the flood situation of these sites since its establishment in comparison to the cost to mitigate the severe impacts to properties and lives.

It was found that the optimal solution is to relocate the sites to safer location. However, the estimation cost for relocation is the highest as compared to mitigation and response. In addition, most of the sites are in the proximity of markets and preferable to the IDPs for their livelihood. For all sites, the mitigation measures are cost-effective as compared to relocation.

Feasibility Assessment

No	Governorate	District	Site	Mitigation	Response	Relocation
1	Sana'a	Sanhan	Almyah Street	\$ 41,899.00	\$ 73,702.20	\$ 217,503.00
2		Hamdan	Dharawan	\$ 24,743.29	\$ 102,382.28	\$ 419,304.60
3	Ibb	Almashanah	Maslahat Alturuqat	\$ 37,839.23	\$ 65,295.23	\$ 165,651.20
4	Hajjah	Abs	Almalab	\$ 20,810.79	\$ 35,321.00	\$ 151,866.00
5			Aldhahyah	\$106,642.25	\$ 50,743.55	\$ 431,917.20
6	Aljouf	Alhazm	Wadi Shajen	\$ 27,590.42	\$ 71,020.95	\$ 389,875.20
7			Almehzam Alsharqi	\$ 52,257.92	\$ 87,154.21	\$ 195,080.60
8	Taiz	Magbanah	Alsaylah	(1)		

Notes: Operational cost was added to the estimated costs in the BOQs.



From the analysis, it is evident that mitigation is the preferred cost-effective actions given HLP challenges and preference of the IDPs.

Recommendations:

- Considering the high costs for response to the flood situation, implementing mitigation interventions is recommended.
- While relocation may offer a comprehensive and more longer-term solution, HLP issues, the intentions of IDPs, and the high costs should be carefully weighed against the benefits and potential risks.
- Involve stakeholders, including the affected IDPs, in the mitigation process to ensure their perspectives and needs are considered.
- Environmental assessment (NEAT+ Tool) is needed to mitigate severe impacts.

(1) Some information about the 8th site were not available during the preparation of this report. Therefore, it was not reflected in the analysis.

Site 1 – AL-Meyah Street

- **Location:** Sana'a Governorate – Sanhan wa Bani Bahlul District
- **Camp Name:** AL-Meyah Street
- **Establishment:** 2015
- **Date of visit:** 3 September 2023
- **Number of households in the camp:** 145

- **Ownership of Land:**

The IDP camp is located on one side of the 100-meter street in Sanhan and Bani Bahloul district, Sana'a governorate. The IDPs self-settled in a land that belongs to the state without prior agreement or permission from authorities. It should be noted that there are some conflicts between displaced families and groups claiming ownership of some of the land at the edges of the site near to the main street, and therefore displaced families cannot decongest or expand by erecting new tents in that direction.

- **Problem:**

Water accumulation and stagnation at the site during the rainy season, which leads to the inundation of many shelters/tents that were built in the low-level part of the land. This problem is a recurring one in many IDP sites. One possible explanation for this problem could be that IDPs often settle in less desirable lands that are of less importance for people and often the ownership of these lands is public. It could be also private land but is often not commercial, which does not encourage owners to develop it. For example, many IDPs settle next to the flood-prone lands.

Based on interviews with beneficiaries, the camp is submerged for three months annually during the rainy season after exposure to heavy rains and around 20% of shelters are flooded. From the CCCM records, during the period between mid-2021 and September 2023, the annual average recorded damages are as follows:

- 34 completely damaged shelters
- 107 partially damaged shelters
- 73 damaged NFI kits
- 27 partially damaged bathrooms
- 25 food baskets

According to the residents of the site, the height of the water reaches 20 cm during the heaviest rains and at some points, the depth of the stagnant water reaches 2 meters. People are evacuating flooded shelters until the stagnant water leak out to soil (which takes long period).



Some photos for the camp during rainy season



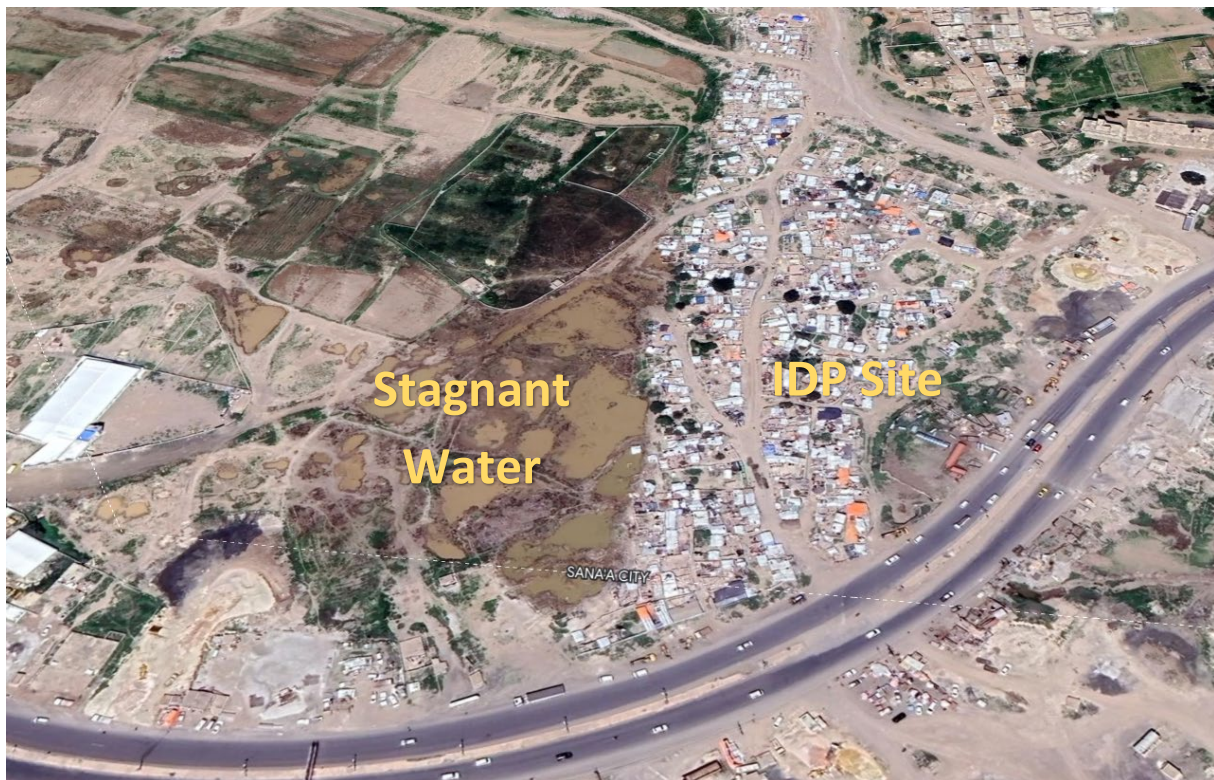
Some photos for the camp during rainy season

- **Technical Evaluation:**

The site is located next to the road between Sana'a and Dhamar at a collection point for rainwater from the surrounding mountains (as the lowest level before the road) and the highest level between two roadside. Often when roads are built at similar points, culverts are designed and implemented to allow water to pass under the road from the higher-level side of the road to the lower level.



Based on technical assessment, it was found that the culvert under the road is blocked by the accumulation of dirt and garbage waste. When moving to the other side of the road (the lower-level side), it was found that there were some new backfills that close the water stream and contribute to accumulation of stagnant water on the other side of the road (the side with the highest level, which is the camp side). In addition, the camp was established in a position that blocks water from reaching the culvert, which helped to trap and accumulate water.



- **Proposed Technical Solutions:**

The solution to the problem of water accumulation next to the road is to open a path for water to cross to the lower-level side of the road. Since there are three obstacles to water crossing, solutions must be done for these obstacles.

- 1- **Opening a route for water to pass to the culvert through the camp:**

A 3-4 meters wide path should be opened through the camp and the shelters located on this path should be moved to a more suitable (higher) location. Both sides of the path must be supported by a retaining wall (gabions).

- 2- **Cleaning the culvert from waste and dust:**

Maintenance and cleaning of the culvert blocked by the accumulation of dust and waste must be carried out to allow water to pass through it.

- 3- **Removing backfill soil from the other side of the road:**

Backfill clearance must be done to allow water in the culvert to pass to the other side of the road.

It should be noted that the (Yemeni General Union of Sociologists, Social Workers, and Psychologists) YGUSSWP has begun to implement part of the above-mentioned solutions according to the available resources for camp maintenance. However, due to the constraints of these resources, not all solutions have been implemented, threatening the persistence of the problem.

- **Intervention Modality:**

For the suggested interventions, it is recommended to be implemented through a contractor modality because they need to use heavy equipment for earth-cutting works to reach the appropriate levels for the movement of rainwater as required. There are some works that should be done by cash for work to assist contractor in transporting shelter in the path of the water to a suitable area.

- **Effectiveness of Solutions:**

The camp is located at water collection point from the surrounding mountains. It was established without prior leveling and raising of camp level based on a topographical survey and hydrological studies to determine the alternative path of water. Such studies and interventions are significant and difficult to be classified as humanitarian response. Therefore, some alternative solutions have been proposed and are expected to reduce the damage that occurs annually by 70%.

- **Attachments:**

- BOQs for excavation works (earth cut) that were previously carried out with the cleaning of the culvert.
- BOQs for the transporting of some shelters located in the waterway or in areas with low levels (previously completed).
- BOQs for the costs of transporting some shelters located in the waterway or in areas with low levels (need intervention).
- BOQs for remaining excavations (earth cut) that were not carried out because of resource constraints.
- BOQs for the gabion wall works for side soil support.

- **Feasibility Study:**

A study of the feasibility was done to compare the planned interventions with the needed annual response during the rain season:

- 1- **Annual emergency response estimations**

Shelter and non-food needs:

34 emergency shelters: $34 * \$400 = \$13,600$

107 Shelter maintenance: $107 * \$200 = \$21,400$

73 bags of non-food items: $73 * \$180 = \$13,140$

FSL and WASH needs:

25 food bags: $25 * \$55 = \$1,375$

27 Bathroom maintenance: $27 * \$75 = \$2,025$

Total costs for need during the emergency response to the rainy season = **\$51,540**

- 2- **Cost estimates of proposed interventions**

Costs of moving shelters located in the waterway or in areas with low levels (need intervention) = \$12,600

Remaining excavations (earth cut) that were not carried out because of resource constraints = \$4,100

Earthen deed works by Gabion walls = \$12,600

Total intervention costs = **\$29,300**

- 3- **Camp transportation costs**

In the bills of quantities, the costs of relocating the camp were calculated with the basic interventions associated with the transfer of 145 families to another location that is not under flood risk. The estimated cost was found to be \$182,520, which is very large compared to the proposed interventions. This is in addition to the other challenges that expected to be faced like difficulty to provide land and people intentions.

Total relocation cost = **\$152,100**

Note:

Estimations above are for the direct cost and excluding support and operation cost.

Recommendations:

The first recommendation that will solve the issue is relocation. However, due to the high cost of this solution, the difficulty to find a near land, it is possible to go for the above technical solutions that will reduce the risk of flood. In general, the authorities don't mind looking for a new land. However, experience showed that providing a new land is difficult. Moreover, intention survey should be held in case resources and land are available for relocation.



A picture of the canal that was cut through the camp.



A photo of the basin where water collects and some flooded shelters.



A picture of the culvert from the other side with the backfill that blocks the water from the other side of the road



Photo of the culvert during the cleaning work

Site 2 – Dharwan

- **Location:** Sana'a Governorate – Hamdan District
- **Camp Name:** Darwan
- **Establishment:** 2015
- **Date of visit:** 3 September 2023
- **Number of families in camp:** 289

Ownership of the Land :

Darwan camp for displaced people is in Hamdan district, Sana'a governorate. The land where the IDP shelters were erected is considered (Waqf) land, which is divided into squares (3 squares). Each square belongs to a different owner. It should be mentioned that there is no documented agreement between the owners of the Waqf land and the displaced families, but there is some cooperation with these displaced families and welcoming for humanitarian intervention to serve them, such as bathrooms, night lights. An exception for the owner of one of the camp squares where owner request to get part of the assistance (Food baskets and cash). Moreover, it was noticed that there are no transitional shelters, and all shelters are emergency which was reported because of HLP issues. Therefore, it should be expected to face some challenges during implementing flood mitigation interventions especially in areas near to the market where land is more expensive.

• Problem:

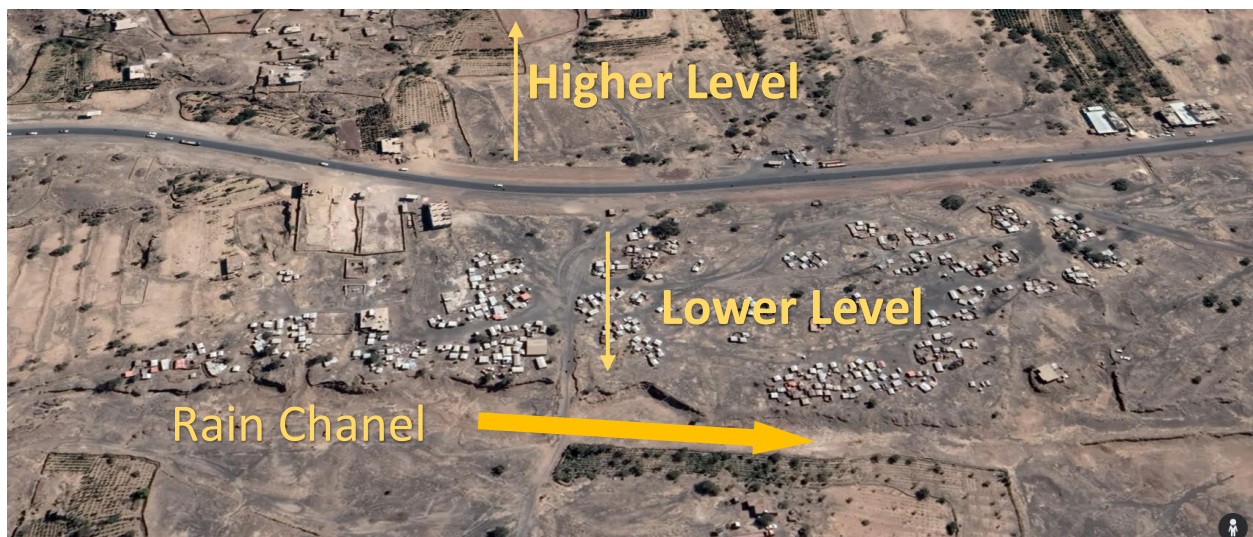
Through the field visit and the meeting with the beneficiaries, the residents of the site confirmed that during the rainy season, most families are affected by the entry of rainwater into the shelters as a result of the discharge of water from the upper part of the area to the lower part, but at a low level due to the absence of suitable drainage channels for rainwater inside the site. The last flooding occurred only in part of the camp nearly two years ago. There is also a problem raised by the beneficiaries which is exposure to rain and hail when it falls. It should be noted that most of the displaced people in the camp live in an emergency shelter consisting of wood and plastic sheets and have not been able to upgrade and develop their shelter due to problems related to land ownership, as they live on private land. The commercial area is considered to have a high land yield, which makes it difficult to make an agreement between IDPs and landowners. Between July 2021 and July 2022, the annual average recorded damage was as follows:

- 48 shelters completely damaged
- 207 partially damaged shelters
- 48 damaged NFI bags
- 12 damaged food bags
- 22 damaged and maintenance-needed pigeons
- 2 lost/damaged personal documents.



- **Technical Evaluation:**

There are problems with some shelters that are located at lower levels compared to the surrounding land and that may be prone to water accumulation. However, these problems are considered non-critical because there is a nearby channel for rainwater with a low level and simple channels can be opened to drain water into that channel and avoid its accumulation.



- **Proposed Technical Solutions:**

- 1- **Making small channels to determine the path of water away from tents:**

With simple tools and by the IDPs themselves, it is possible to dig channels 30 cm wide and 30 cm deep in a direction parallel to the slopes of the ground so that the rainwater path is directed and does not enter the shelters.

- 2- **Making larger channels from culverts to the rain channel:**

In the places where the culverts are located on the road, a water path 50 cm wide and 50 cm deep should be dug to ensure that the water route is determined from the road until it reaches to the rain channel without passing through shelters.

- 3- **Making soil barriers shelters or raising shelters level:**

As needed, earth mounds 30 cm high and 30 cm wide can be made around some shelters to prevent water from seeping into the shelters. In some cases where it is not enough to make a soil berm, the shelter level can be raised so that it is less likely to enter water.

Note: The shelters will still exposure to the problem of heavy rain and hail which can only be solved by improving of shelters. Due to HLP, it is difficult to replace emergency shelters with transitional ones. Advocacy should be done in this regard.

- **Intervention Mechanism:**

For the previously mentioned interventions it is recommended to be carried out by distributing the necessary tools for digging. Implementation is done by IDPs either as community participation or through cash for work.

- **Effectiveness of Solutions:**

Through discussions among the technical team that carried out the visit, it was discussed that there are no radical solutions to the problems raised by the beneficiaries as the main problem is rainfall from above, which leads to shelter damage and not flooding. This is because the tents used are emergency shelters designed for simple use but were not developed due to problems with landowners. The above solutions are intended to mitigate flood risks that may arise in rare cases. Which are less critical than other sites.

- **Attachments:**

- BOQs with simple digging and safety tools
- BOQs for excavation work for small channels between camps (cash for work)
- BOQs for excavations of large channels between camps (cash for work)
- BOQs for the work of raising the level of some shelters (cash for work)
- BOQs for the works of earth mounds around tents (cash for work)

- **Feasibility Study:**

A study of the feasibility was done to compare the planned with the needed annual response during the rain season:

- 1- **Annual emergency response estimations**

Shelter and non-food needs:

48 emergency shelters: $48 \times 400 = \$19,200$
 207 Shelter maintenance: $207 \times 200\$ = 41,400\$$
 48 bags of non-food items: $48 \times 180\$ = 8,640 \$$

FSL and WASH needs:

12 food bags: $12 \times 55 = \$660$
 22 Bathroom maintenance: $22 \times 75\$ = \$1,650$
 2 Extraction of documents: $2 \times 23\$ = 46\$$

Total costs of shelter needs during emergency response to the rainy season = **\$71,596**

- 2- **Cost estimations of proposed interventions**

- Simple drilling tools with safety tools costs \$383
- Excavation costs for small canals between camps (cash for work) \$ 230
- Excavation costs for large canals between camps (cash for work) \$1104
- Costs of raising the level of some tents (cash for work) \$ 3706
- Costs of earth mounds around tents (cash for work) \$ 345

Total site maintenance costs / Block = \$5768
 Total site maintenance costs for the three blocks = **\$17,303**

- 3- **Camp transportation costs**

In the bills of quantities, the costs of relocating the camp were calculated with the basic interventions associated with the relocation of 289 families to another location that is not at risk. It was found that the estimated cost is up to \$ 293,220 which is very large compared to the proposed interventions.

Total relocation cost = **\$293,220**

Note:

Estimations above are for the direct cost and excluding support and operation cost.

Recommendations:

Technical interventions are recommended for this site because it is not at high risk of flood. Moreover, the main problem is the rain itself and not the flood which expected to be the same situation in other near lands.

Site 3 – Maslahat Alturuqat

- **Location:** Ibb Governorate – Almashanah District
- **Camp Name:** Maslahat Alturuqat
- **Establishment:** 2015
- **Date of visit:** 4th October 2023
- **Number of families in camp:** 108

- **Land Ownership:**

From assessment, it was found that land is public and there is no expected challenge to implementing improvements to the site to protect it from flood. It should be noted that there was no agreement or prior permission by the state to establish these tents belonging to the IDPs.

- **Problem:**

Through the visit and the meeting with the BNFs, it was noticed that the site is affected by the heavy rains during the rainy season, and most HHs are affected as the rain enters their shelters. This occurs because the site is located on the edge of flooding channel. Last year, flooding affected a part of the site, because of the highwater level of the flooding channel which reached more than two meters. There is also a problem that was raised by the BNFs, which is the exposure to rain and hail during heavy rains. It should be noted that most of the displaced HHs in the site live in ESKs, and the site has not been targeted with shelter assistance because NGO didn't want to support a camp which at a real flood risk. During the period between May 2023 and August 2023, the annual average recorded damages were as follows:

- 24 completely damaged emergency shelters
- 84 partially damaged emergency shelters
- 108 damaged food kits
- 37 maintenance-needed and damaged latrines
- 2 lost/damaged personal documents.



Photos that show flood during heavy rain



Photos that show damages happened due to flood

- **Technical assessment:**

There are problems with some shelters located on the edge of the flooding channel, which may be more vulnerable to damage in the event of flooding and rising water levels. This is in addition to ESK sensitivity to heavy rain and hail.



- **Proposed technical solutions:**

1- Implement drainage channels to determine the path of water away from the shelters inside the site:

With simple tools and by the IDPs themselves, it is possible to dig channels 30 cm wide and 30 cm deep in a parallel direction to the slopes of the ground so that the rainwater path is directed away from the shelters.

2- Implement a gabion protecting wall to protect these tents/Shelters with a length of 200 m:

Implement a gabion protection wall to protect the site from heavy rains and flooding with average height (2.5) m, width (1-1.5) m and a length of 250 m on the edge of the flooding channel.

Note: The shelters will still exposure to the problem of heavy rain and hail which can only be solved by improving of shelters. Due to extreme crowding of shelter, it is difficult to replace emergency shelters with transitional ones.

- **Intervention mechanism:**

For drainage channel interventions, it is recommended to be carried out by distributing the necessary tools for digging. The Implementation is to be done by IDPs either as community participation or through cash for work.

For the gabion protection wall, it is advised that the implementation is to be done by a contractor where IDPs are trained during the implementation work.

- **Solutions Effectiveness:**

Through discussions between the technical team that carried out the visit, it was discussed that if the gabion protection wall is implemented as well as the drainage channels are solving the issue. It was found that there is

no radical solutions to the problems raised by the BNFs. The above solutions are intended to mitigate the risk of flooding that may happen and reduce the expected annual damages by 80%.

- **Attachments:**

- BoQs of maintenance tools with safety tools.
- BoQs for excavation work for small canals between tents (cash for work)
- BoQs for the construction of the gabion protection wall (contracting)

- **Feasibility Study:**

A study of the feasibility was done to compare the planned interventions with the needed annual response during the rain season:

1. **Annual emergency response estimations**

Shelter & NFIs needs:

- 24 ESKs: $24 \times \$400 = \9600
- 84 Shelter maintenance: $84 \times 200\$ = 16800\$$
- 84 NFIs: $84 \times 180\$ = 15120 \$$

FSL and WASH needs:

- 24 Food baskets: $24 \times 55 = \$1320$
- 37 Latrines maintenance: $37 \times 75\$ = 2775\$$
- 2 Issuing of documents: $2 \times 23\$ = 46 \$$
- Total costs of shelter need during the emergency response to the rainy season = **\$45,661**

2. **The Estimated Cost of proposed interventions:**

- The cost of basic digging tools with safety tools, is \$561
 - Excavation cost for small canals between tents (CFW) is \$900
 - The cost of the gabion protection wall (contracting) is \$ 25000
- The estimated total cost of the site maintenance = **\$ 26461**

3. **The cost of moving displaced HHs to another site:**

In the bills of quantities, the costs of moving the displaced HHs including the basic interventions associated with the relocation of 108 HHs to another location that is not at flooding risk were calculated. It was found that the estimated cost is up to \$115,840, which is very high compared to the proposed interventions. It should be noted that people mostly prefer staying in the same site as it is near to the market and services and alternatives in Ibb are too far due to high cost of land.

Total relocation cost = **\$115,840**

Note:

Estimations above are for the direct cost and excluding support and operation cost.

Recommendations:

The first recommendation that will solve the issue is relocation. However, due to the high cost of this solution, the difficulty to find a near land, it is possible to go for the above technical solutions that will reduce the risk of flood. In general, the authorities don't mind looking for a new land. However, experience showed that providing a new land is difficult. Moreover, intention survey should be held in case resources and land are available for relocation.

Site 4 – Almalab

- **Location:** Hajjah Governorate - Abs District
- **Site name:** Al-Malab
- **Establishment:** 2015
- **Sub site:** (Al-Matawilah)
- **Date of visit:** September 5, 2023
- **Number of families in Al-Malaab site:** 281 HHs
- **Number of families in sub site (Al-Matawla) :** 65 HHs

- **Land Ownership:**

The ownership of the site land is private, knowing that there was no agreement or prior permission by the landowner to establish these shelters belonging to the IDPs. However, the landowner doesn't have any object to do interventions on behalf of the IDPs.

- **Goals:**

The goal of this field visit was to assess the size and scope of damage due to floods and rain, and to identify the main problems and urgent needs to repair and improve the damaged housing of displaced people. The field visit also aims to develop an effective action plan to provide sustainable solutions to the observed damages.

- **Methodology:**

The field visit was carried out over a period of one day. The field visit included assessing the damages and problems and proposing solutions, using the following:

- Tool (technical evaluation form for sites).
- Focus group discussion session with displaced people (FGD).
- Discussion with community committees.

- **Damage Assessment:**

Physical damage was assessed to displaced housing, including structures, ceilings, walls and floors. The damage was classified and assigned emergency levels based on the size and impact of the damage.

- **Problem:**

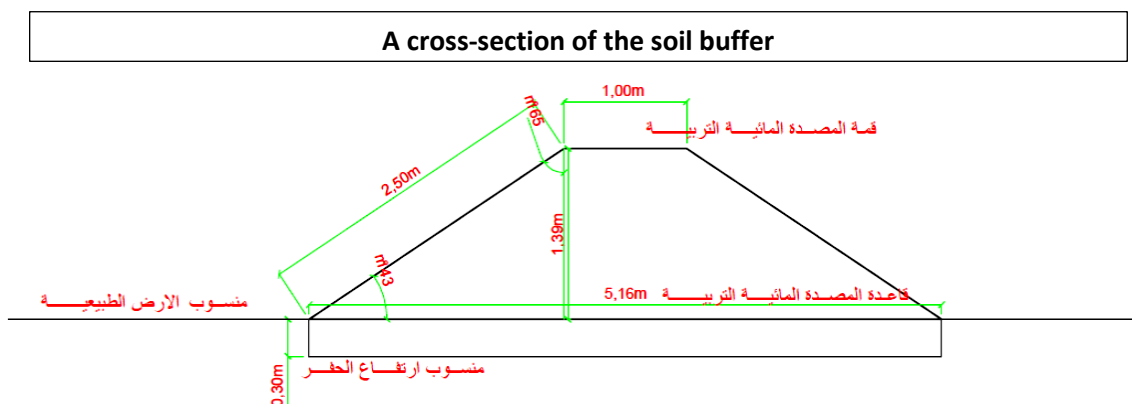
Interviews were conducted with affected IDPs to understand basic problems and needs. A study of the surrounding environment was conducted to determine the risks resulting from floods and rain. Because the sub-site called Al-Matawilah is located in a lower area than the lands around it, this causes rainwater to flow from higher areas when accumulate in that low area in Al-Matawilah, causing a threat to the displaced people as a result.



- **Proposed Technical Solutions:**

Based on the damage assessment and problem and needs analysis, an action plan to improve IDP housing was developed. The plan included making options to repair and strengthen damaged structures, and developing an effective water drainage system, by making an earthen mound that drains water and prevents it from entering the homes of the IDPs.





- **Intervention efficiency:**

The proposed solution will mitigate the damage caused by floods that enter the shelter, and as for the damage caused by heavy rains and winds, they are not within the feasibility of the solution.

- **Intervention Mechanism:**

It is recommended to implement the proposal through contractor because it requires the use of heavy equipment for digging, bringing mud, and doing relative compaction to reach the required and appropriate percentage to ensure sustainable work.

- **Feasibility Study:**

A study of the feasibility was done to compare the planned interventions with the needed annual response during the rain season:

1. **Annual Response:**

Shelter & NFIs needs:

- 65 Shelter maintenance: $65 \times 200\$ = 13000\$$
- 65 NFIs: $65 \times 180\$ = 11700 \$$

Total costs of shelter need during the emergency response to the rainy season = **\$24,700**

2. **The Estimated Cost of proposed interventions:**

- Site leveling, is \$500
- Digging works is \$928
- Backfilling, leveling and compacting the water is \$ 13125

The estimated total cost of the site maintenance = **\$ 14,553**

3. The cost of moving displaced HHs to another site:

In the bills of quantities, the costs of moving the displaced HHs including the basic interventions associated with the relocation of 65 HHs to another location that is not at flooding risk were calculated. It was found that the estimated cost is up to \$106,200, which is very high compared to the proposed interventions.

Total relocation cost = **\$106,200**

Note:

Estimations above are for the direct cost and excluding support and operation cost.

Recommendations:

The first recommendation that will solve the issue is relocation. However, due to the high cost of this solution, the difficulty to find a near land, it is possible to go for the above technical solutions that will reduce the risk of flood. In general, the authorities don't mind looking for a new land. However, experience showed that providing a new land is difficult. Moreover, intention survey should be held in case resources and land are available for relocation.

After Flood Photos



During the field visit



While the team was in the Al-Malaab site



During the field visit



Focus Group Discussion



Site 5 – Aldhahyah

- **Location:** Hajjah Governorate - Abs District
- **Site name:** Al Dhahyah
- **Establishment:** 2017
- **Sub site:** Al Dhahyah
- **Date of visit:** September 5, 2023
- **Number of families in the site:** 280 HHs

- **Land Ownership:**

The ownership of the site land is private, knowing that there was no agreement or prior permission by the landowner to establish these shelters belonging to the IDPs. However, SCMCHA confirmed they are doing efforts to do an agreement with landowners.

- **Goals:**

The goal of this field visit was to assess the size and scope of damage due to floods and rain, and to identify the main problems and urgent needs to repair and improve the damaged housing of displaced people. The field visit also aims to develop an effective action plan to provide sustainable solutions to the observed damages.

- **Methodology:**

The field visit was carried out over a period of one day. The field visit included assessing the damages and problems and proposing solutions, using the following:

- Tool (technical evaluation form for sites).
- Focus group discussion session with displaced people (FGD).
- Discussion with community committees.

- **Damage assessment:**

Physical damage was assessed to displaced housing, including structures, ceilings, walls and floors. The damage was classified and assigned emergency levels based on the size and impact of the damage. From the CCCM records, during 2022, recorded damages are as follows:

- 52 completely damaged shelters
- 24 partially damaged shelters
- 52 damaged NFI kits
- 7 partially damaged bathrooms

- **Problem:**

The site is located close to the valley, and the displaced people live in separate gatherings. According to SCMCHA records, the total number of displaced people in the site reaches 280 HHs. It was noticed that there are a gathering of 21 HHs living in a critical area which made them exposed to the threat of floods. It was found that technically, there is no effective solution other than moving them to a safe place.

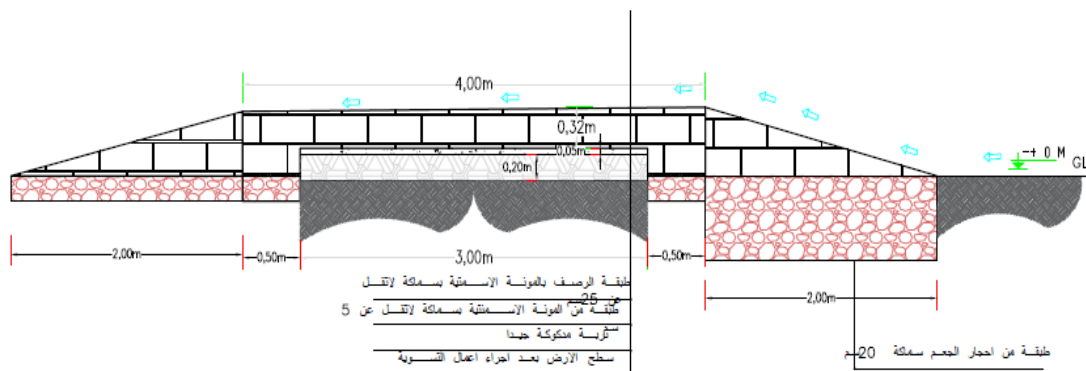
Another problem is the road in the middle of the site is located at the flood way, it is vulnerable to damage and the road is cut off until the stream ends. Thus, reaching most of the homes is difficult. This condition causes many problems and enforce people go through long distances to reach the main road or to access the site for days until the road become dry.



- **Proposed technical solutions:**

Based on the damage assessment and analysis of problems and needs, there is no solution other than moving the 21 HHs displaced to a safe place. In regard to the new location, RADF is managing the site, and it coordinated with SCMCHA who confirmed that the new location is available. Further coordination will be done in case there is available service.

The second issue related to the road can be solved with paving a rocky road with designing the needed drainage for the rain water to facilitate access during rainy season.



Cross-section view -Side -For the surface water stream

- **Solutions Effectiveness:**

In these solutions, the technical team focused on the critical part of the site to solve the main problems happening during flood which are damage of shelters exposure directly to flood and the cut of the road during flood. It should be noted that some less critical damages are expected during rainy season but solution would be to work on strengthening and improve designs of shelters which will need to work at shelter level.

- **Intervention mechanism:**

It is recommended to implement the proposal through a contractor mechanism because it requires the use of heavy equipment for digging, bringing mud, and doing relative compaction to reach the required and appropriate percentage to ensure sustainable work.

- **Feasibility Study:**

A study of the feasibility was done to compare the planned interventions with the needed annual response during the rainy season:

1. **Annual Response:**

Shelter & NFIs needs:

- 52 Emergency Shelters: $52 \times 400 = 20800$ \$
- 24 Shelter maintenance: $24 \times 200\$ = 4800$ \$
- 52 NFIs: $52 \times 180\$ = 9360$ \$

WASH needs:

- 7 Latrines maintenance: $7 \times 75\$ = 525\$$

Total costs of shelter need during the emergency response to the rainy season = **\$35,485**

2. **The Estimated Cost of proposed interventions:**

- Relocation of 21 HHs, is \$39900
- Paving of road is \$34675

The estimated total cost of the site maintenance = **\$ 74575**

3. **The cost of moving displaced HHs to another site:**

In the bills of quantities, the costs of moving the displaced HHs including the basic interventions associated with the relocation of 298 HHs to another location that is not at flooding risk were calculated. It was found that the estimated cost is up to \$302,040 which is very high compared to the proposed interventions.

Total relocation cost = **\$302,040**

Note:

Estimations above are for the direct cost and excluding support and operation cost.

Recommendations:

The first recommendation that will solve the issue is relocation to a safer location. However, due to the high cost of this solution, the difficulty to find a near land, it is possible to go for the above technical solutions that will reduce the risk of flood and do relocation for these shelters at high risk (21 HHs). In general, the authorities don't mind looking for a new land. However, experience showed that providing a new land is difficult. Moreover, intention survey should be held in case resources and land are available for relocation.

**Some of the families exposed
to floods in Al-Dahiya site**



**A picture showing the erosion of
soil due to floods in Al-Dahiya site**



**Some of the families exposed
to floods in Al-Dahiya site**



**Some of the families exposed
to floods in Al-Dahiya site**



Site 6 – Wadi Shajen

- **Location:** Al-Jawf Governorate – Al-Hazm District
- **Site Name:** Wadi Shajen
- **Date of visit:** 17 October 2023
- **Number of households in the site:** 268

- **Ownership of Land:**

The IDP hosting site Wadi Shajen in Al-Hazm district of Al-Jawf Governorate. Displaced people tend to settle in vacant lands with less importance to the community. The land belongs to multiple individuals, , and land ownership may not be confirmed per individual but owned by tribe. There was no written agreement. However, the owners gave prior verbal permission to set up the tents for the displaced people. There haven't been any issues so far.

- **Problem:**

The site is essentially a valley (semi-desert), and during the rainy season, the crossing of the torrent submerges many of the shelters/tents erected in the low-lying and level parts of the land. This is a recurring problem in many IDP sites. The internally displaced people prefer to settle in this site as it's close to the market in a rural area and the site land is wide expendable not used by owners which encouraged IDP to settle and this is a common practice at most of the IDPs hosting sites.

Based on interviews with beneficiaries, the site is mostly affected by flood during raining season and the flood would overflow all over the shelters, items and properties of IDP, including access challenge as no one could walk or cross the site during the heavy rain where the flood level covers all the site ground, about 60% of the shelters are flooded with water. The annual damage rate recorded is as follows: (according to last two year incidents 2022/2023)

- 24 Totally damaged shelters
- 112 partially damaged shelters
- 115 damaged NFI kits.
- 73 food baskets.

According to residents of the site, the water reaches 30 cm height during heavy rains, and at some points the depth of standing water reaches 50 cm.

Some photos for the site during rainy season

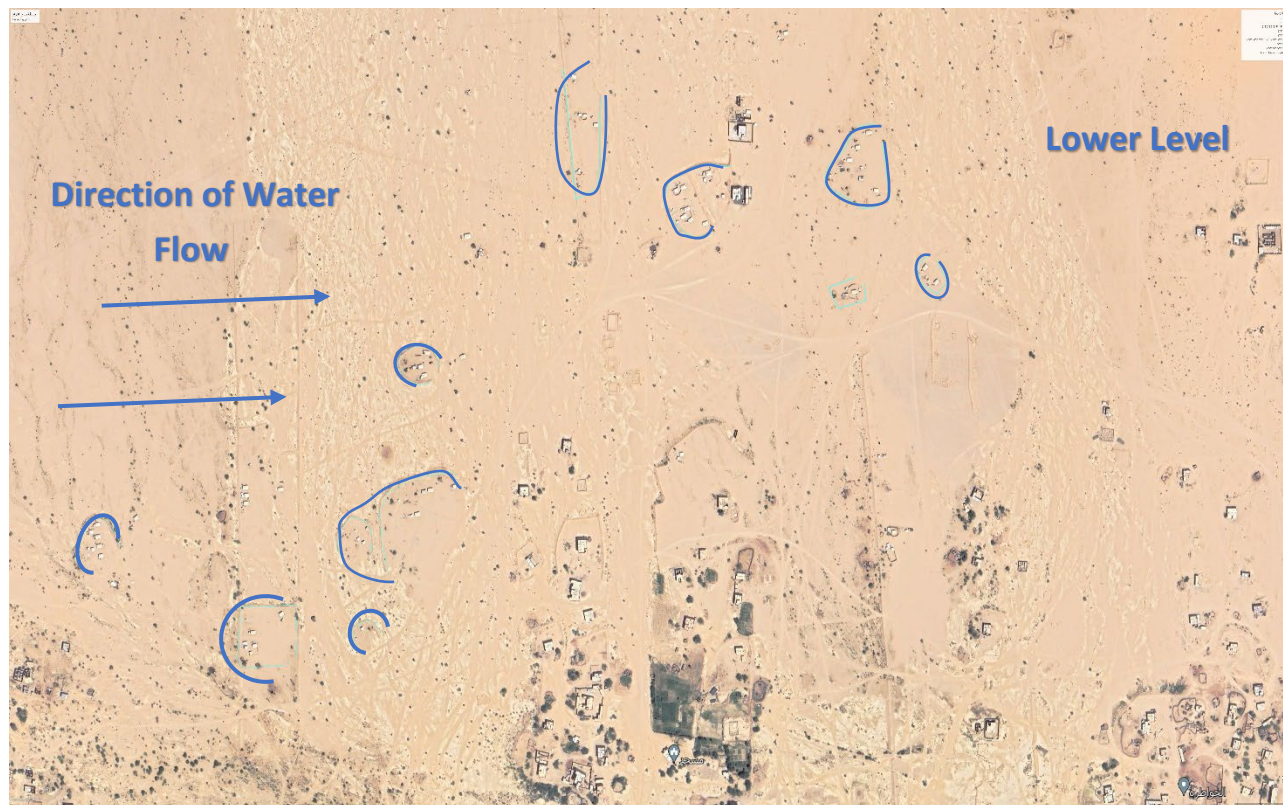


Some photos for the site during rainy season



- **Technical Evaluation:**

The site is a valley that gets flooded during the rainy season, resulting in shelters and tents being submerged. The site has an issue which is fragmentation of families into separate gathering points and difficulties in assembling them in one location due to cultural considerations and local traditions. Light and moderate rain floods the site for three days, while heavy rain continues for two weeks, resulting in 60% of the shelters being submerged. Worth to mention that the strong winds specially during rain or dust wave still a threat to IDP shelters casing damages and lose of property and this require regular shelter maintenance and enhancement.



Above is a picture showing the direction of the floods and the gatherings of IDPs

Proposed Technical Solutions:

The solution to the problem of water accumulation in the middle of the site is to create soil barriers surrounding the site (from three directions) and open internal and main external sub-channels that change the path of water to the lower side of the site.



- **Intervention Modality:**

The problem of water accumulation in the middle of the site can be solved by creating earth barriers around the site using bulldozers and compaction and creating major internal and external sub-channels to redirect the flow of water. Through workers, this solution ensures a safe and comfortable environment for IDPs in the sites.

- **Effectiveness of Solutions:**

Earth/soil barriers would solve the problem by up to 80%, especially if the rainfall is very heavy because the damage will remain from the amount of rainfall and not just floods, as well there is a need to provide site maintenance tool kits including flood mitigation through regular site maintenance and improvement.

- **Attachments:**

- BOQs for Construction work of earth barriers to protect the site.
- BOQs for Site relocation costs.
- BOQs for safety tools.

Feasibility Study:

A study of the feasibility was done to compare the planned with the needed annual response during the rainy season:

4- Annual emergency response estimationsShelter and non-food needs:

24 emergency shelters: $24 * \$400 = \9600
 112 Shelter maintenance: $112 * 200\$ = 22400\$$
 115 kits of non-food items: $115 * \$180 = \20700

FSL and WASH needs:

73 food bags: $73 * 55 = \$4015$
 2 Bathroom maintenance: $2 * 75\$ = \150

Total costs for need during the emergency response to the rainy season = \$56,745

5- Cost estimations of proposed interventions (flood mitigation):

- Simple drilling tools with safety tools costs **\$544**
- Construction work of earth barriers to protect the site. **14560\$**
- Supplying excavation Draining canals **4100\$**

Total flood mitigation and site maintenance costs = \$19.204

6- Site relocation estimated costs:

In the bills of quantities, the costs of moving the site were calculated with the basic interventions associated with the transfer of *268 families to another location that is not under flood risk*. The estimated cost was found to be **\$272,640**, which is very large compared to the proposed interventions. This is in addition to the other challenges that expected to be faced like difficulty to provide land and people intentions, the local practice of families settling at a distance from each other which make it challenging to plan or provide services such as water points.

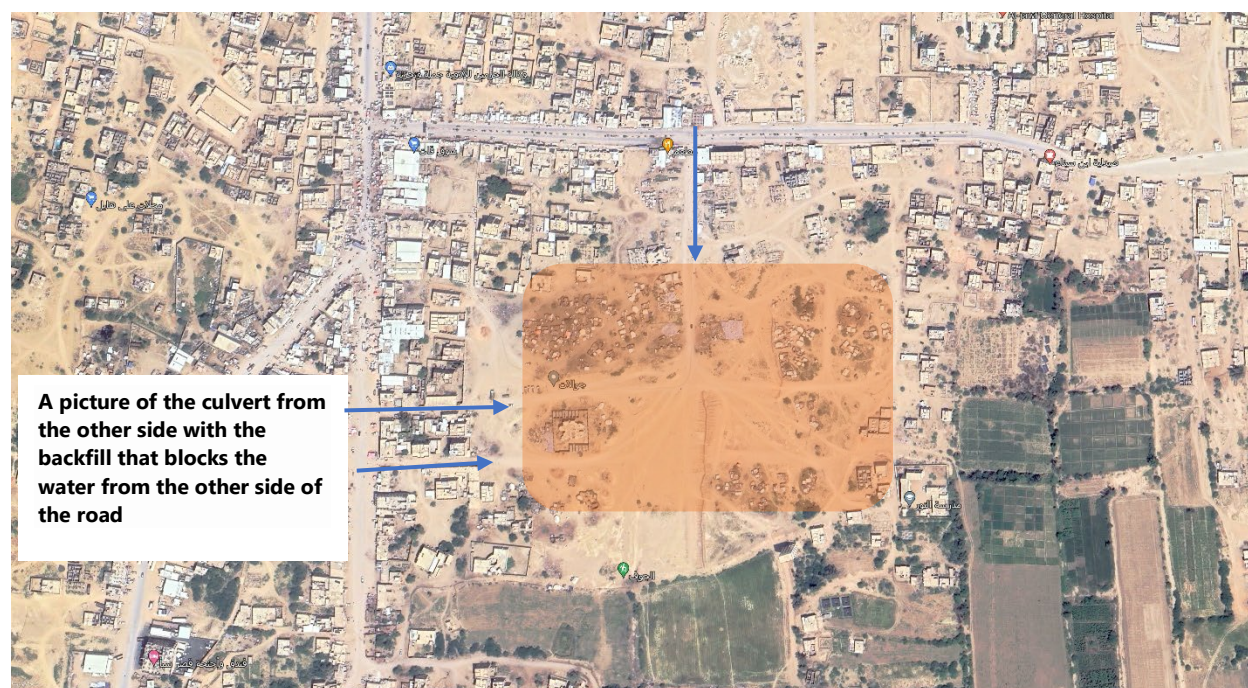
Total relocation cost = **\$272,640**

Site 7 – Al-Mahzam Al-Sharqi

- **Location:** Al-Jawf Governorate - Al Hazm
- **Site Name:** Al-Mahzam Al-Sharqi
- **Date of visit:** 17 October 2023
- **Number of families in site:** 129 HHs

Ownership of the Land:

Al-Mahzam Al-Sharqi site for displaced people is located in Al-Hazm District in Al-Jawf Governorate. The land on which shelters for the displaced were built is considered private property. It should be noted that there is no documented agreement between landowners and displaced families, but there is some cooperation with these displaced families and welcoming humanitarian intervention to serve them, such as bathrooms and night lighting. An exception is for the owner of one of the site's yards, as the owner requests a portion of the aid (food and cash baskets). Moreover, it was noted that there are no transitional shelters, and all the shelters are emergency due to the reluctance of the landowner. This is because of the owner's view that he will no longer be able to recover his land if more durable materials were used. Therefore, it is expected to face some challenges while implementing interventions to mitigate the effects of floods, especially in areas close to the market where land is more expensive..



- **Problem:**

After conducting a field visit and meeting with the site's residents, it was confirmed that during the rainy season, most families are affected by rainwater entering their shelters. This happens due to the discharge of water from the upper part of the area to the lower part, but at a low level because there are no suitable drainage channels for rainwater inside the site. Although the last flooding was only partial and occurred nearly a year ago, the beneficiaries raised concerns about exposure to rain and hail. It is important to note that most displaced people live in emergency shelters, and have not been able to upgrade or develop their shelter due to problems related to land ownership, as they are living on private land. There is a disagreement between IDPs and landowners about the commercial area, which is considered to have a high land yield. From 13 July 2022 to Aug 2023, the annual average recorded damage was as follows:

- 6 shelters completely damaged
- 134 partially damaged shelters (as some large Families has more than one shelter space)
- 140 damaged NFI bags
- 115 damaged food bags
- 6 lost/damaged personal documents.



Some photos for the site during rainy season

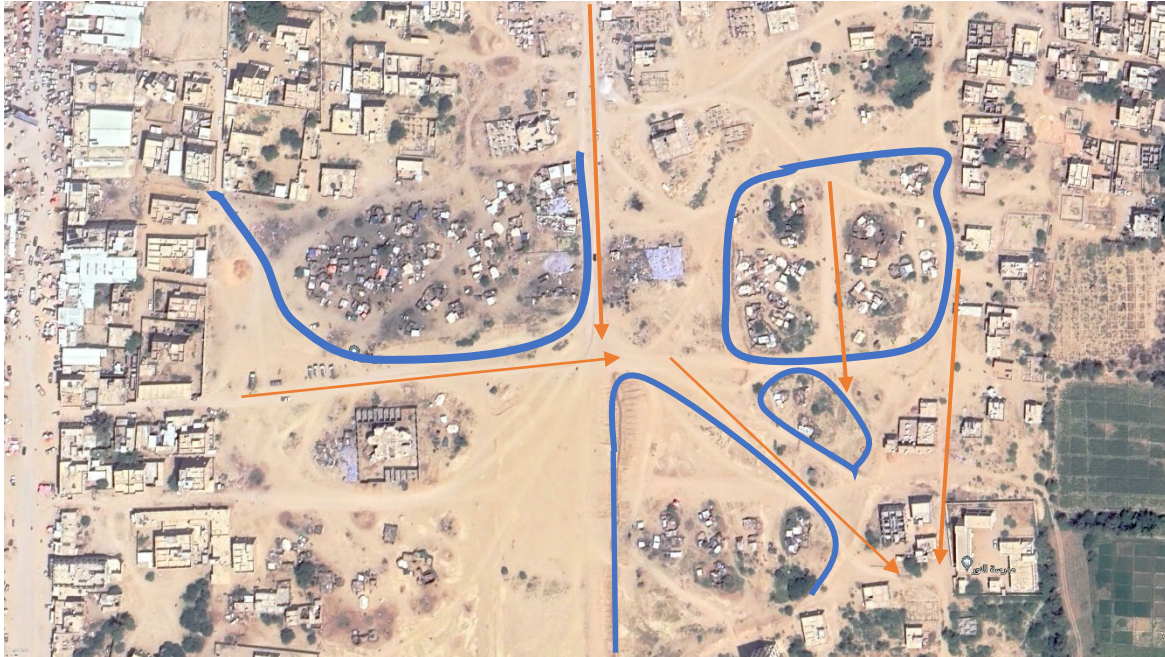
- **Technical Evaluation:**

It is recommended to establish earth barriers around the houses and facilities to prevent water infiltration into the residential area. These barriers can help redirect the flow of water away from the dwellings and reduce flood impacts.



- **Proposed Technical Solutions:**

- Establish an Earthen Berm mixed with stones from the same area (height: 180 - 200 cm, width: 50 - 150 cm) to hold off the torrents from overflowing over the nearby shelters, where construction is carried out by Loader, and the process of backfilling the sand in layers - every 30 cm - with spraying and good tamping of the soil and maintaining lateral tendencies
- Making small channels to determine the path of water away from tents: With simple tools and by the IDPs themselves, it is possible to dig channels 30 cm wide and 30 cm deep in a direction parallel to the slopes of the ground so that the rainwater path is directed and does not enter the shelters.



- **Effectiveness of Solutions:**

Earth barriers will solve the problem by up to 80% and not radically, especially if the rainfall is very heavy because the damage will remain from the amount of rainfall and winds and not limited to floods. Provision of T-shelters and/or regular site maintenance is required as IDP lives in a poor shelter.

- **Attachments:**

- BOQs for Construction work of earth barriers to protect the site.
- BOQs for Site relocation costs.
- BOQs for safety tools.

- **Feasibility Study:**

A study of the feasibility was done to compare the planned with the needed annual response during the rain season:

1- Annual emergency response estimations

Shelter and non-food needs:

6 emergency shelters: $6 \times 400 = \$2400$
 134 Shelter maintenance: $134 \times 200\$ = 26800\$$
 140 bags of non-food items: $140 \times 180\$ = 25200 \$$

FSL and WASH needs:

115 food bags: $115 \times 55 = \$6325$
 6 Extraction of documents: $6 \times 37\$ = 222\$$
 No latrines at the site.

Total costs of shelter need during emergency response to the rainy season = \$60,947

2- Cost estimations of proposed flood mitigation/interventions

- Simple drilling tools with safety tools costs **\$544**
- Construction work of earth barriers to protect the site. **32.000\$**
- Supplying excavation Draining canals **4000\$**

Total site maintenance costs = **\$36.544**

3- Site relocation transportation costs

In the bills of quantities, the costs of relocating the site were calculated with the basic interventions associated with the relocation of 129 families to another location that is not at risk. It was found that the estimated cost is up to \$ 136,420 which is very large compared to the proposed interventions.

Total relocation cost = **\$136,420**

Joint Team:

Office for the Coordination of Humanitarian Affairs (OCHA)

Yemen Shelter Cluster

Yemen CCCM Cluster

Yemen Protection Cluster

The International Organization for Migration (IOM)

The United Nations High Commissioner for Refugees (UNHCR)

Yemeni General Union of Sociologists, Social Workers, and Psychologists (YGUSSWP)

Rawabi Al-Nahdhah Developmental Foundation (RADF)

Civil Defense Authority

The Supreme Council for the Management and Coordination of Humanitarian Affairs (SCHMCHA)