

Project Technical Documents

Project Code: DR.0060

Project Name : Bor Flood Risk Management

Title: Bill of Quantities

Date: 19 August 2023



International Organization for Migration (IOM)

The UN Migration Agency

Bill of Quantities

The Bill of Quantities shall be read in conjunction with the drawings and the technical specifications, if any. All the works are to be executed as per the drawing and the supervising engineer's instruction and commitment to the following:-

1- All materials and tools must comply with international standards (ISO or ASTM) and be approved by the procurement committee before be priced.

2-The contractor should include in the offer the catalogues, photos and specifications of materials he will supply.

3-The contractor shall perform the surveying works using the appropriate surveying equipment before starting the installation works to determine the path line of excavation and installation depth.

4- Salt resistant cement is used in all construction works.

5- Commitment to using clean water for curing all concrete, buildings, and plastering works per IOM engineer's instruction.

6- The contractor should commit to partial hand over the completed phases of the works and obtain approval from the IOM's engineers before proceeding to the next phase as per the approved work plan after satisfactory inspection of the quantity and quality of works/goods delivered.

7- Commitment to levelling and cleaning the work site before and after the completion of the works, from the remnants of the waste to sites authorised by IOM engineers or local authorities.

8- The contractor is obliged to use safety and security measures while carrying out all work.

9- The contractor should submit a detailed work plan along with each purchase order after signing the contract.

Ref.	Description	Unit	Quantity	Unit cost (USD)	Cost (USD)
1.00	B-1-2 Gated Culvert				-
1.10	Site Preparation				-
1.1.1	Site cleaning including and not limited to removal of rubbish, stumps and any other material existed onsite that even might hinder the site preparation works, with disposal of removed material as per the pre-agreed disposal sites. And installation of safety barriers. as agreed before commencing the contract and shown in technical specifications.	m2	207.96		

Project Technical Documents

Project Code: DR.0060

Project Name : Bor Flood Risk Management

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Date: 19 August 2023



International Organization for Migration (IOM)

The UN Migration Agency

Bill of Quantities			
1.20	Flap Gates		-
1.2.1	Supply and install 12 mm thick steel flap door (Density = 7850 kg/m3) to fabricate flap gate with dimensions of 1200 mm X 1200 mm	Kilogram	1140.00
1.2.2	Supply and install steel frame (Density = 7850 kg/m3) with dimensions of 12 mm thick X 100 mm wide	Kilogram	270.00
1.2.3	Supply and install Three steel hinges (Density = 7850 kg/m3) with the dimensions of 70 mm ID 90 mm OD 100 mm long	Kilogram	125.00
1.2.4	Supply and install one Seal fabricated from Neoprene sheets (Density = 1230 Kg/m3) with dimensions of 20 mm thick and 50 mm wide	Kilogram	30.00
1.2.5	Supply and install three bushes fabricated from bronze rods (Density = 8770 Kg/m3) with the dimensions of 50 mm ID X 70 mm OD X 100 mm long	Kilogram	105.00
1.2.6	Supply and install three hinges pins fabricated from Stainless Steel Rod (Density = 7850 kg/m3) with the dimensions of 50 mm X 100 mm	Kilogram	95.00
2.00	B-2-1 Gated Culvert		-
2.10	Site Preparation		-
2.1.1	Site cleaning including and not limited to removal of rubbish, stumps and any other material existed onsite that even might hinder the site preparation works, with disposal of removed material as per the pre-agreed disposal sites. And installation of safety barriers. as agreed before commencing the contract and shown in technical specifications.	m2	300.76
2.1.2	Earthwork in excavation for foundation of structures including culverts, Aprones, Head and Wing Walls, and beds of the whole area of site construction in all types of earth. With keeping larger excavation areas than the construction area for all sides to facilitate the construction process. with adhering to the appropriate depths for each site separately, based on the site's survey studies and drawing Number BORFMP-DWGS-001 .	m3	751.91
2.1.3	Sub-base site Leveling course using agreed material boulder stones, sharp sand and laterite and compaction works before the construction as per the drawings and upon the site engineer satisfaction.	m3	90.23

Project Technical Documents

Project Code: DR.0060

Project Name : Bor Flood Risk Management

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The UN Migration Agency

Bill of Quantities			
2.20	Culvert		-
2.2.1	Providing and laying Cement Concrete with 350kg/m3 for beds to construct the large culvert on, with area of 180.48 m2, includes framework and all needed materials to complete the works. As per drawing no. BORFMP-DWGS-001 and Technical Specifications	m3	54.14
2.2.2	Providing and Casting Concrete with 350kg/m3 for both (apron for all & Per Box) , with area of 43.34m2, includes framework and all needed materials to complete the works. As per drawing no. BORFMP-DWGS-001 and Technical Specifications	m3	13.00
2.2.3	Providing and Installing Pre-casted Reinforced Cement Concrete with 350kg/m3 and 12mm diameter bars at 150mm c/c both ways on 2 faces for culverts boxes/barrels and joints in between with centering & shuttering, includes all needed materials and accessories to complete the works. As per drawing no. BORFMP-DWGS-001 & Technical Specifications	m3	220.32
2.2.4	Providing and laying Reinforced Cement Concrete with 350kg/m3 and 12mm diameter bars at 150mm c/c both ways on 2 faces in sub-structure & super-structure for wingwalls and headwalls , with centering & shuttering, includes all needed materials and accessories to complete the works. As per drawing no. BORFMP-DWGS-001 and Technical Specifications	m3	12.99
2.30	Flap Gates		-
2.3.1	Supply and install 12 mm thick steel flap door (Density = 7850 kg/m3) to fabricate flap gate with dimensions of 1200 mm X 1200 mm	Kilogram	1368.00
2.3.2	Supply and install steel frame (Density = 7850 kg/m3) with dimensions of 12 mm thick X 100 mm wide	Kilogram	324.00
2.3.3	Supply and install Three steel hinges (Density = 7850 kg/m3) with the dimensions of 70 mm ID 90 mm OD 100 mm long	Kilogram	150.00
2.3.4	Supply and install one Seal fabricated from Neoprene sheets (Density = 1230 Kg/m3) with dimensions of 20 mm thick and 50 mm wide	Kilogram	36.00
2.3.5	Supply and install three bushes fabricated from bronze rods (Density = 8770 Kg/m3) with the dimensions of 50 mm ID X 70 mm OD X 100 mm long	Kilogram	126.00
2.3.6	Supply and install three hinges pins fabricated from Stainless Steel Rod (Density =7850 kg/m3) with the dimensions of 50 mm X100 mm	Kilogram	114.00

Project Technical Documents

Project Code: DR.0060

Project Name : Bor Flood Risk Management

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International Organization for Migration (IOM)

The UN Migration Agency

Bill of Quantities			
3.00	B-3-1 Gated Culvert		-
3.10	Site Preparation		-
3.1.1	Site cleaning including and not limited to removal of rubbish, stumps and any other material existed onsite that even might hinder the site preparation works, with disposal of removed material as per the pre-agreed disposal sites. And installation of safety barriers. as agreed before commencing the contract and shown in technical specifications.	m2	133.53
3.1.2	Earthwork in excavation for foundation of structures including culverts, Aprones, Head and Wing Walls, and beds of the whole area of site construction in all types of earth. With keeping larger excavation areas than the construction area for all sides to facilitate the construction process. with adhering to the appropriate depths for each site separately, based on the site's survey studies and drawing Number BORFMP-DWGS-001 .	m3	333.82
3.1.3	Sub-base site Leveling course using agreed material boulder stones, sharp sand and laterite and compaction works before the construction as per the drawings and upon the site engineer satisfaction.	m3	40.06
3.20	Culvert		-
3.2.1	Providing and laying Cement Concrete with 350kg/m3 for beds to construct the large culvert on, with area of 122.8m2, includes framework and all needed materials to complete the works. As per drawing no. BORFMP-DWGS-001 and Technical Specifications	m3	17.77
3.2.2	Providing and Casting Concrete with 350kg/m3 for both (apron for all & Per Box) , with area of 31.34m2, includes framework and all needed materials to complete the works. As per drawing no. BORFMP-DWGS-001 and Technical Specifications	m3	13.00
3.2.3	Providing and Installing Pre-casted Reinforced Cement Concrete with 350kg/m3 and 12mm diameter bars at 150mm c/c both ways on 2 faces for culverts boxes/barrels and joints in between with centering & shuttering, includes all needed materials and accessories to complete the works. As per drawing no. BORFMP-DWGS-001 & Technical Specifications	m3	73.44
3.2.4	Providing and laying Reinforced Cement Concrete with 350kg/m3 and 12mm diameter bars at 150mm c/c both ways on 2 faces in sub-structure & super-structure for wingwalls and headwalls , with centering & shuttering, includes all needed materials and accessories to complete the works. As per drawing no. BORFMP-DWGS-001 and Technical Specifications	m3	12.99

Project Technical Documents

Project Code: DR.0060

Project Name : Bor Flood Risk Management

Title: Bill of Quantities

Date: 19 August 2023



International Organization for Migration (IOM)

The UN Migration Agency

Bill of Quantities			
3.30	Flap Gates		-
3.3.1	Supply and install 12 mm thick steel flap door (Density = 7850 kg/m3) to fabricate flap gate with dimensions of 1200 mm X 1200 mm	Kilogram	1368.00
3.3.2	Supply and install steel frame (Density = 7850 kg/m3) with dimensions of 12 mm thick X 100 mm wide	Kilogram	324.00
3.3.3	Supply and install Three steel hinges (Density = 7850 kg/m3) with the dimensions of 70 mm ID 90 mm OD 100 mm long	Kilogram	150.00
3.3.4	Supply and install one Seal fabricated from Neoprene sheets (Density = 1230 Kg/m3) with dimensions of 20 mm thick and 50 mm wide	Kilogram	36.00
3.3.5	Supply and install three bushes fabricated from bronze rods (Density = 8770 Kg/m3) with the dimensions of 50 mm ID X 70 mm OD X 100 mm long	Kilogram	126.00
3.3.6	Supply and install three hinges pins fabricated from Stainless Steel Rod (Density = 7850 kg/m3) with the dimensions of 50 mm X 100 mm	Kilogram	114.00
4.00	H 3-4 Gated Culvert		-
4.10	Site Preparation		-
4.1.1	Site cleaning including and not limited to removal of rubbish, stumps and any other material existed onsite that even might hinder the site preparation works, with disposal of removed material as per the pre-agreed disposal sites. And installation of safety barriers. as agreed before commencing the contract and shown in technical specifications.	m2	102.63
4.1.2	Earthwork in excavation for foundation of structures including culverts, Aprones, Head and Wing Walls, and beds of the whole area of site construction in all types of earth. With keeping larger excavation areas than the construction area for all sides to facilitate the construction process. with adhering to the appropriate depths for each site separately, based on the site's survey studies and drawing Number BORFMP-DWGS-001 .	m3	256.57
4.1.3	Sub-base site Leveling course using agreed material boulder stones, sharp sand and laterite and compaction works before the construction as per the drawings and upon the site engineer satisfaction.	m3	30.79

Project Technical Documents

Project Code: DR.0060

Project Name : Bor Flood Risk Management

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International Organization for Migration (IOM)

The UN Migration Agency

Bill of Quantities			
4.20	Culvert		-
4.2.1	Providing and laying Cement Concrete with 350kg/m3 for beds to construct the large culvert on, with area of 40.32m2, includes framework and all needed materials to complete the works. As per drawing no. BORFMP-DWGS-001 and Technical Specifications	m3	12.10
4.2.2	Providing and Casting Concrete with 350kg/m3 for both (apron for all & Per Box) , with area of 31.34m2, includes framework and all needed materials to complete the works. As per drawing no. BORFMP-DWGS-001 and Technical Specifications	m3	9.40
4.2.3	Providing and Installing Pre-casted Reinforced Cement Concrete with 350kg/m3 and 12mm diameter bars at 150mm c/c both ways on 2 faces for culverts boxes/barrels and joints in between with centering & shuttering, includes all needed materials and accessories to complete the works. As per drawing no. BORFMP-DWGS-001 & Technical Specifications	m3	48.96
4.2.4	Providing and laying Reinforced Cement Concrete with 350kg/m3 and 12mm diameter bars at 150mm c/c both ways on 2 faces in sub-structure & super-structure for wingwalls and headwalls , with centering & shuttering, includes all needed materials and accessories to complete the works. As per drawing no. BORFMP-DWGS-001 and Technical Specifications	m3	10.29
4.30	Flap Gates		-
4.3.1	Supply and install 12 mm thick steel flap door (Density = 7850 kg/m3) to fabricate flap gate with dimensions of 1200 mm X 1200 mm	Kilogram	912.00
4.3.2	Supply and install steel frame (Density = 7850 kg/m3) with dimensions of 12 mm thick X 100 mm wide	Kilogram	216.00
4.3.3	Supply and install Three steel hinges (Density = 7850 kg/m3) with the dimensions of 70 mm ID 90 mm OD 100 mm long	Kilogram	100.00
4.3.4	Supply and install one Seal fabricated from Neoprene sheets (Density = 1230 Kg/m3) with dimensions of 20 mm thick and 50 mm wide	Kilogram	24.00
4.3.5	Supply and install three bushes fabricated from bronze rods (Density = 8770 Kg/m3) with the dimensions of 50 mm ID X 70 mm OD X 100 mm long	Kilogram	84.00
4.3.6	Supply and install three hinges pins fabricated from Stainless Steel Rod (Density = 7850 kg/m3) with the dimensions of 50 mm X 100 mm	Kilogram	76.00

Project Technical Documents

Project Code: DR.0060

Project Name : Bor Flood Risk Management

Title: Bill of Quantities

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The UN Migration Agency

Bill of Quantities			
5.00	B-5-2 Large Culvert		-
5.10	Site Preparation		-
5.1.1	Site cleaning including and not limited to removal of rubbish, stumps and any other material existed onsite that even might hinder the site preparation works, with disposal of removed material as per the pre-agreed disposal sites. And installation of safety barriers. as agreed before commencing the contract and shown in technical specifications.	m2	231.16
5.1.2	Earthwork in excavation for foundation of structures including culverts, Aprones, Head and Wing Walls, and beds of the whole area of site construction in all types of earth. With keeping larger excavation areas than the construction area for all sides to facilitate the construction process. with adhering to the appropriate depths for each site separately, based on the site's survey studies and drawing Number BORFMP-DWGS-001 .	m3	577.91
5.1.3	Sub-base site Leveling course using agreed material boulder stones, sharp sand and laterite and compaction works before the construction as per the drawings and upon the site engineer satisfaction.	m3	69.35
5.20	Culvert		-
5.2.1	Providing and laying Cement Concrete with 350kg/m3 for beds to construct the large culvert on, with area of 65.28 m2, includes framework and all needed materials to complete the works. As per drawing no. BORFMP-DWGS-001 and Technical Specifications	m3	36.86
5.2.2	Providing and Casting Concrete with 350kg/m3 for both (apron for all & Per Box) , with area of 19.34m2, includes framework and all needed materials to complete the works. As per drawing no. BORFMP-DWGS-001 and Technical Specifications	m3	9.40
5.2.3	Providing and Installing Pre-casted Reinforced Cement Concrete with 350kg/m3 and 12mm diameter bars at 150mm c/c both ways on 2 faces for culverts boxes/barrels and joints in between with centering & shuttering, includes all needed materials and accessories to complete the works. As per drawing no. BORFMP-DWGS-001 & Technical Specifications	m3	146.88
5.2.4	Providing and laying Reinforced Cement Concrete with 350kg/m3 and 12mm diameter bars at 150mm c/c both ways on 2 faces in sub-structure & super-structure for wingwalls and headwalls , with centering & shuttering, includes all needed materials and accessories to complete the works. As per drawing no. BORFMP-DWGS-001 and Technical Specifications	m3	10.29

Project Technical Documents

Project Code: DR.0060

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The UN Migration Agency

Bill of Quantities			
5.30	Drainage		-
5.3.1	Excavation of 700 meter long Drainage canals with the dimensions of 0.8 meter depth and 2 meters bottom width, Side slope of the swale 1:2 Slope including suitable grass on of top soil 150 mm	Cubic Meter	1120.00
5.3.2	Supply and installation of wooden footpath passage using well treated and seasoned wood on completion of excavation work at all crossing points to aid movement of people over the drainage channel	LS	1.00
6.00	B-8-1 Gated Culvert		-
6.10	Site Preparation		-
6.1.1	Site cleaning including and not limited to removal of rubbish, stumps and any other material existed onsite that even might hinder the site preparation works, with disposal of removed material as per the pre-agreed disposal sites. And installation of safety barriers. as agreed before commencing the contract and shown in technical specifications.	m2	196.36
6.1.2	Earthwork in excavation for foundation of structures including culverts, Aprones, Head and Wing Walls, and beds of the whole area of site construction in all types of earth. With keeping larger excavation areas than the construction area for all sides to facilitate the construction process. with adhering to the appropriate depths for each site separately, based on the site's survey studies and drawing Number BORFMP-DWGS-001 .	m3	490.91
6.1.3	Removal of existing temporary culverts for foundation works of structures to proceed. These culverts are to be removed carefully in order to avoid damage as they are to be reinstalled in proper alignment with the new precast culverts.	LS	1.00
6.1.4	Sub-base site Leveling course using agreed material boulder stones, sharp sand and laterite and compaction works before the construction as per the drawings and upon the site engineer satisfaction.	m3	58.91

Project Technical Documents

Project Code: DR.0060

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The UN Migration Agency

Bill of Quantities			
6.20	Culvert		-
6.2.1	Providing and laying Cement Concrete with 350kg/m3 for beds to construct the large culvert on, with area of 94.08m2, includes framework and all needed materials to complete the works. As per drawing no. BORFMP-DWGS-001 and Technical Specifications	m3	28.22
6.2.2	Providing and Casting Concrete with 350kg/m3 for both (apron for all & Per Box) , with area of 25.34m2, includes framework and all needed materials to complete the works. As per drawing no. BORFMP-DWGS-001 and Technical Specifications	m3	7.60
6.2.3	Providing and Installing Pre-casted Reinforced Cement Concrete with 350kg/m3 and 12mm diameter bars at 150mm c/c both ways on 2 faces for culverts boxes/barrels and joints in between with centering & shuttering, includes all needed materials and accessories to complete the works. As per drawing no. BORFMP-DWGS-001 & Technical Specifications	m3	73.44
6.2.4	Reinstallation of the removed precast culvert boxes/barrels in alignment with the new precast culverts. Providing and Installing additional Pre-casted Reinforced Cement Concrete with 350kg/m3 and 12mm diameter bars at 150mm c/c both ways on 2 faces for culverts boxes/barrels and joints in between with similar design and size to the removed culvert boxes with centering & shuttering, includes all needed materials and accessories to complete the works. As per drawing no. BORFMP-DWGS-001 & Technical Specifications	m3	21.42
6.2.5	Providing and laying Reinforced Cement Concrete with with 350kg/m3 and 12mm diameter bars at 150mm c/c both ways on 2 faces in sub-structure & super-structure for wingwalls and headwalls , with centering & shuttering, includes all needed materials and accessories to complete the works. As per drawing no. BORFMP-DWGS-001 and Technical Specifications	m3	8.94
6.2.6	Backfill and compaction using excavated material for foundation of structures including culverts, Aprones, Head and Wing Walls, and beds of the whole area of the site	m2	196.36

Project Technical Documents

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Project Name : Bor Flood Risk Management

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Date: 19 August 2023



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The UN Migration Agency

Bill of Quantities			
6.30	Flap Gates		-
6.3.1	Supply and install 12 mm thick steel flap door (Density = 7850 kg/m3) to fabricate flap gate with dimensions of 1200 mm X 1200 mm	Kilogram	684.00
6.3.2	Supply and install steel frame (Density = 7850 kg/m3) with dimensions of 12 mm thick X 100 mm wide	Kilogram	162.00
6.3.3	Supply and install Three steel hinges (Density = 7850 kg/m3) with the dimensions of 70 mm ID 90 mm OD 100 mm long	Kilogram	75.00
6.3.4	Supply and install one Seal fabricated from Neoprene sheets (Density = 1230 Kg/m3) with dimensions of 20 mm thick and 50 mm wide	Kilogram	18.00
6.3.5	Supply and install three bushes fabricated from bronze rods (Density = 8770 Kg/m3) with the dimensions of 50 mm ID X 70 mm OD X 100 mm long	Kilogram	63.00
6.3.6	Supply and install three hinges pins fabricated from Stainless Steel Rod (Density = 7850 kg/m3) with the dimensions of 50 mm X 100 mm	Kilogram	57.00
Total			\$ -

Project Technical Documents

Project Code: DR.0060

Project Name : Bor Flood Risk Management

Title: Detailed overview of modelled interventions

Date: 19 August 2023



International Organization for Migration (IOM)

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List of Locations

Ref.	ID	GPS Coordinates	Intervention type	Scenario	Drawing Reference
1 Khor Hong South					
1	B-1-2	6.152972°, 31.578000°	Increase culvert capacity and add gates to keep river water out	5 barrels at 1.2m x 1.2m	Gated Culvert
2 Khor Hong North					
2	B-2-1	6.261533°, 31.572833°	New culvert	6 barrels at 1.2m x 1.2m	Gated Culvert
3 Bor South					
3	B-3-1	6.193000°, 31.564297°	New dyke culvert with gates	6 barrels at 1.2m x 1.2m	Gated Culvert
4	H 3-4	6.189031°, 31.564769°	New culvert with gates	4 barrels at 1.2m x 1.2m	Gated Culvert
5 Bor Central South					
5	B-5-2	6.211277°, 31.562830°	New culvert - towards Central North	4 barrels at 1.2m x 1.2m 0.7km drainage canal near culvert	Large Culvert
8 Bor Market					
6	B-8-1	6.218177°, 31.547392°	Increase culvert capacity and add gates	2 barrels at 1.2m x 1.2m	Gated Culvert

Project Technical Documents

Project Code: DR.0060

Project Name : Bor Flood Risk Management

Title: Scope Of Work

Date: 19 August 2023



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Scope of Work

Objective 1 : Gated Culvert		
Activities and Tasks	Number of Days Per Location	Output
Mobilization of personnel, workers, materials etc to site	14	Quality Checklist + Photos
Setting out of site and site clearance	2 to 3	Quality Checklist + Photos
Excavation works	1	Quality Checklist + Photos
Removal of existing unaligned culverts for realignment	2	Quality Checklist + Photos
Culvert foundation works (Boulder placement, sharp sand and lean concrete blinding work)	7	Quality Checklist + Photos
Reinstallation of old culverts and new precast culvert installation	7 to 14	Quality Checklist + Photos

Project Technical Documents

Project Code: DR.0060

Project Name : Bor Flood Risk Management

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The UN Migration Agency

Scope of Work

Head and wing walls construction and finishing work	7	Quality Checklist + Photos
Installation of prefabricated flap gates to culvert walls	2	Quality Checklist + Photos
Backfill and compaction work	3	Quality Checklist + Photos
Testing and commissioning	2	Quality Checklist + Photos
Demobilization and site cleaning	2	Quality Checklist + Photos
Handover	7	Quality Checklist + Photos

Project Technical Documents

Project Code: DR.0060

Project Name : Bor Flood Risk Management

Title: Scope Of Work

Date: 19 August 2023



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The UN Migration Agency

Scope of Work

Objective 2 : Large Culvert		
Activities and Tasks	Number of Days Per Location	Output
Mobilization of personnel, workers, materials etc to site	14	Quality Checklist + Photos
Setting out of site and site clearance	2 to 3	Quality Checklist + Photos
Excavation works	2	Quality Checklist + Photos
Removal of existing unaligned culverts for realignment	2	Quality Checklist + Photos
Culvert foundation works (Boulder placement, sharp sand and lean concrete blinding work)	7	Quality Checklist + Photos
Reinstallation of old culverts and new precast culvert installation	7 to 14	Quality Checklist + Photos
Head and wing walls construction and finishing work	7	Quality Checklist + Photos
Backfill and compaction work	3	Quality Checklist + Photos
Testing and commissioning	2	Quality Checklist + Photos
Demobilization and site cleaning	2	Quality Checklist + Photos
Handover	7	Quality Checklist + Photos

Project Technical Documents

Project Code: DR.0060

Project Name : Bor Flood Risk Management

Title: Scope Of Work

Date: 19 August 2023



International Organization for Migration (IOM)

The UN Migration Agency

Scope of Work

Objective 3 : Drainage Network		
Activities and Tasks	Number of Days Per Location	Output
Mobilization of personnel, workers, materials etc to site	14	Quality Checklist + Photos
Setting out of site and site clearance	2	Quality Checklist + Photos
Excavation works	14	Quality Checklist + Photos
Levelling and Compaction work	7	Quality Checklist + Photos
Commissioning	2	Quality Checklist + Photos
Handover	7	Quality Checklist + Photos

Project Technical Documents

Project Code: DR.0060

Project Name : Bor Flood Risk Management

Title: Technical Specifications

Date: 19 August 2023



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Technical Specification	
Description	Item
General Conditions	Samples of the materials to be used in any of the work activities shall be submitted with adequate information about them issued by the equipped company showing their characteristics in detail and specifying the specification under which they were produced and after the approval of the supervising engineer on a model that is signed by the contractor and the engineer and kept with the latter to compare it with the consignments supplied.
	The Contractor acknowledges that he has inspected the site before setting prices and is responsible for facing all the difficulties that may face him due to the nature or condition of the site that appears during the execution process of whatever type and nature and the contractor must make sure for himself to bear the component parts of the building and its accessories on which the works to be carried out are located.
	The contractor shall bear all costs of material damage and maintenance work in the event of any damage to the facilities and infrastructure (service lines, sewage pipes and electrical cables) of the buildings located at the work sites and neighboring areas that he may find during the implementation of breakage, damage or the like, during the period of execution of the works and the restoration of the situation to what it was
	The contractor shall provide water and electricity services to the site and in the quantities and capacity required by the implementation of the project and may contract for this purpose with the relevant authorities or rely on generators, filter units and transport of mobile water for the duration of the implementation and the contractor shall bear the costs of delivering water and electricity and pay the fees and wages that result therefrom and for the duration of the contract and strictly prohibit the use of electricity and water from the people and beneficiaries.
	The contractor shall be solely responsible for all building materials, tools, and other equipment located at the work site.
	Before the delivery phase and completion of the implementation of the works, the contractor must clean the site and remove all excess materials, waste and rubble from inside and outside the site to a landfill approved by the supervising engineer.

Project Technical Documents

Project Code: DR.0060

Project Name : Bor Flood Risk Management

Title: Technical Specifications

Date: 19 August 2023



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Technical Specification	
Description	Item
Leveling excavation and backfill	The contractor shall settle the site and remove rubble, weeds and dirt
	The contractor shall provide the contractor with sufficient information for the planning of the project (for the main planning points or for existing installations) and the contractor shall plan all parts of the project and plant fixed pegs on the heads of the markers in a manner consistent with the plans, provided that such planning is fixed, clear and easily accessible at any stage of the work.
	Excavations of any kind (earthen and rocky) are carried out using mechanical machines and workers according to the annexes of the contract, and the excavation residues are carried over to the places specified by the supervising engineer or used if they are suitable for backfilling in accordance with the directives of the supervising engineer.
	The backfill is carried out using the mechanisms mentioned in the annexes of the contract, with wetting and mud to reach a degree of stacking by 95%, the stacking is done on layers not more than 30 cm before stacking, the quantities after the molting are measured in the appropriate ways determined by the supervising engineer, provided that the final settlement is done using the cradle (creder) and the contractor is not given any compensation for the excess drilling products of the basic excavations that have been used as they are covered by the excavation clause
	In case of backfilling in places that cannot be reached by the landfills, the contractor shall secure small rollers that provide adequate stacking without affecting the existing construction elements and the contractor shall remain responsible for any damage resulting therefrom.
	The cement used in concrete works must be of ordinary Portland cement type 42.5 grade and its shelf life is not more than 3 months from the date of its production Cement bags must be sealed and in a healthy condition and each bag is rejected wet or malfunctioning due to moisture
	Sand and gravel resulting from the cracking of clean hard limestone free of dust, dirt and soft stones are used so that the amount of fine dust does not exceed 10% of the amount of sand
	The water used is potable water
	The texture and operability of the concrete are checked before each pouring by measuring the amount of concrete landing using the Abrams cone provided by the contractor at his own expense.
	Rebar of the highly resistant shaved type so that it is not less than 300 MPa in the diameters and lengths mentioned in the contract attachments, must be of the new type that is not renewed free of rust or other foreign substances with good fixation with tying wires and maintain during casting to provide sufficient thickness coverage

Project Technical Documents

Project Code: DR.0060

Project Name : Bor Flood Risk Management

Title: Technical Specifications

Date: 19 August 2023



International Organization for Migration (IOM)

The UN Migration Agency

Technical Specification	
Description	Item
Concrete works	The work includes the work of the wooden mold (formwork) and securing the materials required to mix, pour and hammer the concrete well and refine it and everything necessary and not to dismantle the mold before the end of the specified period
	The wooden mold must be of the clean type free of twists and defects with the need to use sufficient supports and the mold is not removed until after the period specified in the annexes to the contract
	The steel rods (reinforcing bars) are attached to a steel strip in a way that prevents any movement in them during the pouring of concrete and lifts the skewers from the formwork by means of biscuits that achieve the required coverage distance
	The length of the steel overlap (steel strip) must not be less than 60 times the diameter of the rod
	The dimensions, diameters and lengths of the steel used shall not be less than the measurements required in the plans and instructions, and if the contractor is unable to secure the steel lengths with the required descriptions, he may not replace them with any steel lengths except after obtaining written approval from the supervising engineer.
	The steel is received after it is placed ready for pouring and therefore the pouring of concrete should not be initiated except with the written permission of the supervising team after examining and accepting the steel according to the details contained in the plans and instructions issued during the work and in the case of pouring a section without taking permission the contractor must remove it at his own expense
	Sprinkle all wooden formwork with water before starting the casting process
	The contractor shall secure wooden walkways and regulate the movement of work in a way that does not affect the shape and cleanliness of steel and formwork.
	Mechanical vibrator should be used during casting
	The contractor must equip all electrical and sanitary wiring according to the contract annexes and leave the necessary openings before starting the casting process.
	The contractor corrects the surface for dips and heights and gives it the required inclination during casting with good polishing by spraying cement as directed by the supervising engineer
	Poured concrete must be watered at least three days at the rate of twice a day in the morning and evening

Project Technical Documents

Project Code: DR.0060

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International Organization for Migration (IOM)

The UN Migration Agency

Technical Specification	
Description	Item
Paint for all elements	Painting works for steel sections (for structural steelwork): The sections are first well carved so as to ensure the removal of any trace of rust, bumps or sharp corners and then the work of painting the steelwork is carried out in the following way: The paint is established using a layer base layer and then proceeds with painting the first layer. After drying the first layer, the second and last layer is started with a paint so that the surfaces become completely smooth without a trace of ripples, dirt and small granules or collected in the paint and the color is determined by the supervising engineer, cleaning the site from the traces of paint in case of presence
Structural steelwork	The steel sections are made according to the contract attachments according to the specified sizes of the designs and the pieces are connected to each other by welding according to the conditions imposed on the welding works so that they appear after manufacture as if they are one piece and the difference between the moving and stationary parts should not exceed one millimeter
	The outer surface of the welding must be smooth, without cracks and no residues or any porous holes, free of waste such as slag, the welding must be evenly distributed, sealant, does not contain dissolved/additional substances on the surface (inside/outside), free of scratches, without bends or grafts
	After manufacture, all unfinished ferrous metal surfaces shall receive an anticorrosive protection (heavy coat of varnish or other equivalent material readily removed by commercial solvents).
	Stainless steel parts, non-ferrous metal or galvanized parts shall not receive any protective treatment. The same applies to metal surfaces to be embedded in concrete.
	Where dissimilar metals are in contact, these must be insulated from one another to prevent electrochemical corrosion.
	All protective coating systems must have a high durability such that no maintenance in the first five years is required.
	The steelwork after installation is identical to the building elements adjacent to it, true vertical and horizontal, durable and does not give any vibration
	All surfaces permanently submerged or temporarily submerged shall include: (1) Near-white blast cleaning (2) One coat of zinc-rich epoxy paint, minimum dry film thickness of 75 micrometres (3) Two finish coats of high build epoxy paint, each coat with minimum dry film thickness of 150 micrometres.
	All steel supplies such as hinges and locks are installed according to the requirements of the work

Project Technical Documents

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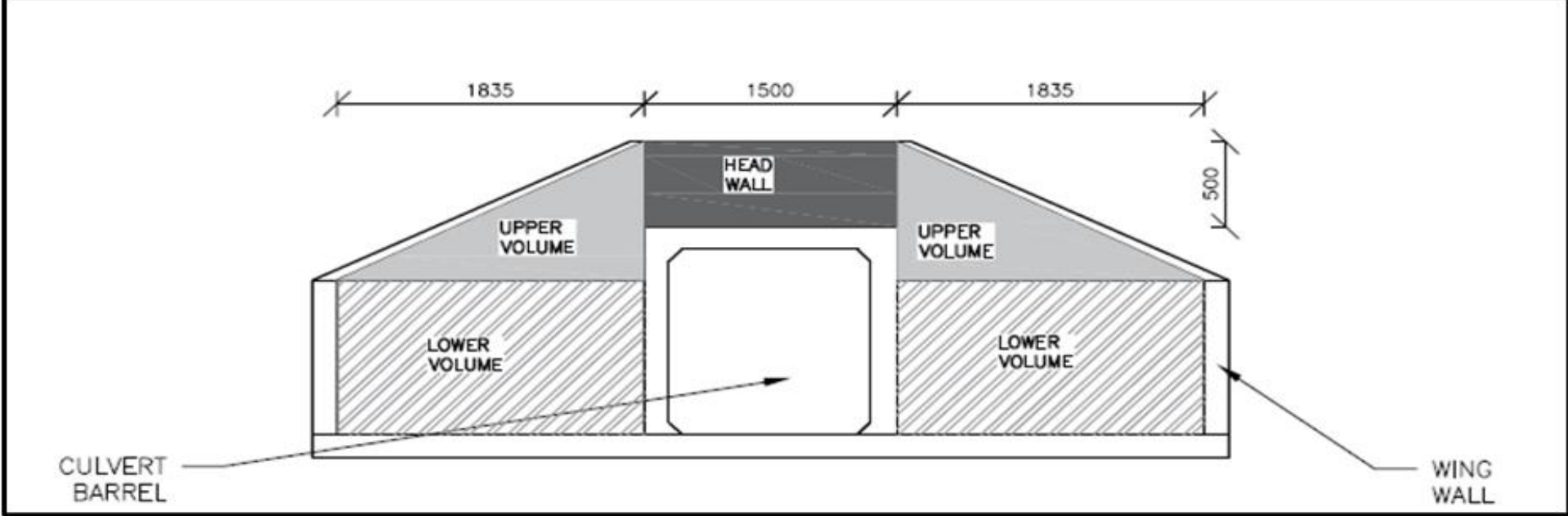
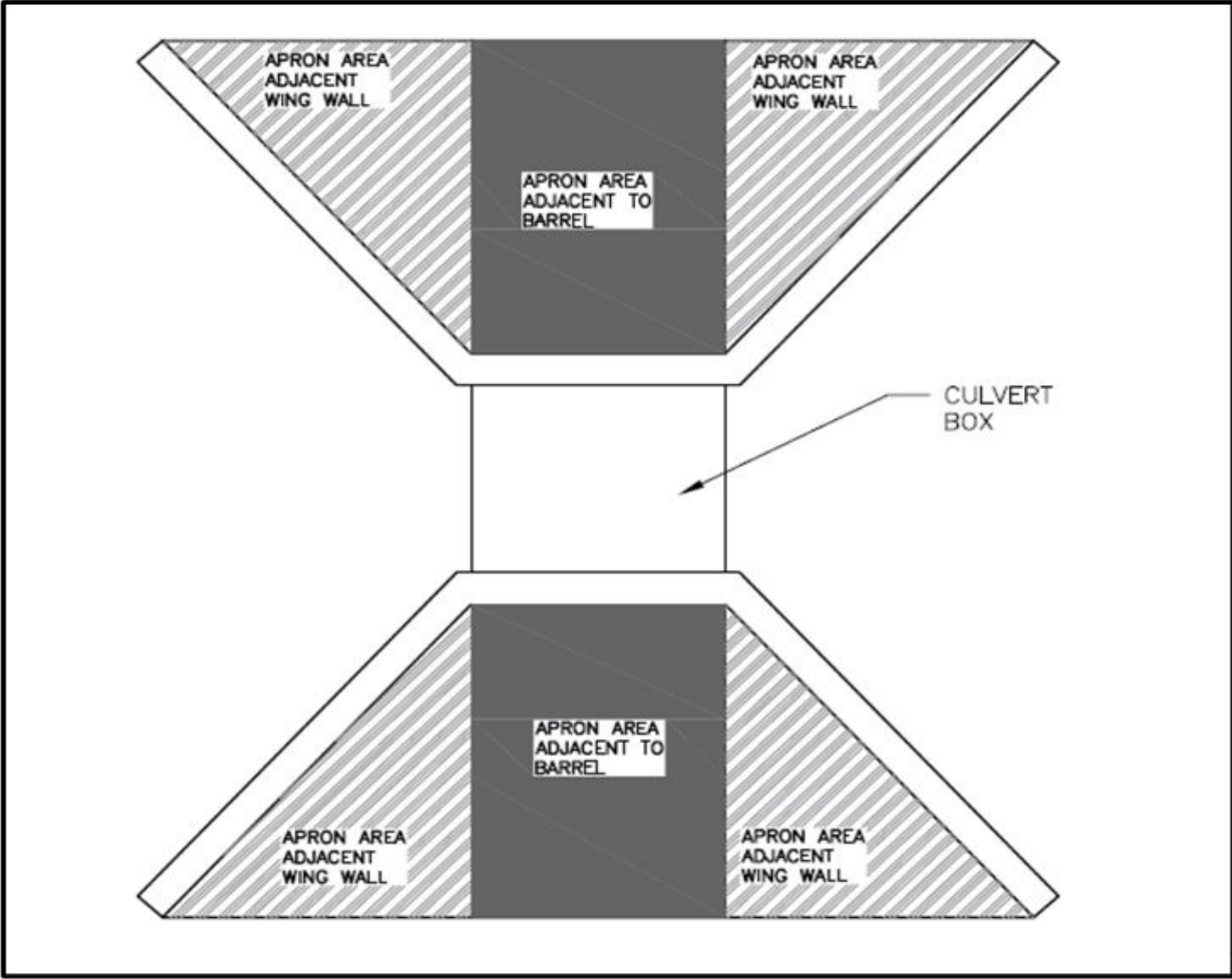
Technical Specification	
Description	Item
Culverts	The maximum culvert barrel will be a 1.2m x 1.2m reinforced concrete box culvert
	The aprons will be concrete and extend on the upstream and downstream side
	The headwalls and wingwalls of the culvert will be reinforced concrete and their function is to retain the soil behind the culverts, to provide erosion protection to the sides of the culvert and to direct water towards the culvert inlet.
	Flap gates are to be installed on the culvert headwalls, these must be designed to withstand the loads imposed by the flap gates both when closed and when open (from 0°-90°)
	Be able to withstand the High river levels expected during flood conditions on the downstream side of the culver
Flap gates	Flap gates manufacturing should consider the ability to weld the flap door and frame without distortion, and the ability to machine (turning, boring, milling)
	No (or low) maintenance requirement. Maintenance should be carried out without need to remove the flap gate door from its hinges
	Safety requirements of the gates should be considered so that risk to population does not increase
	Flap gates shall be of a standard and quality that ensures they will achieve a design life of 30 years in the prevailing operating environment, whilst achieving satisfactory operation without leakage in the closed position
	The prevailing environment will be a freshwater river with a large sediment content
	Materials used for the manufacturing and installation procedures must be of sound quality in accordance with good engineering practice, first class commercial quality, best workshop practice and local health and safety requirements
	All flap gates shall be readily accessible for operation, inspection and maintenance, without stretching or straining, and without resort to temporary scaffold, ladders, etc. Where necessary, operating platforms shall be provided that may be permanent or moveable. Wherever practicable it shall be possible to maintain the flap gates in situ
	Flap gates shall be installed with hinges at the top, as far as is practicable
	Flap gates and fittings shall be corrosion resistant and fabricated or sourced from materials available locally
	All flap gates shall be equipped with outside screws unless otherwise specified or approved
	To reduce the number of valves held as spare parts and requiring maintenance, the Contractor shall as far as possible, provide identical flap gates for all locations.

SUMMARY FOR CALCULATED QUANTITIES PER BOX/BARREL OF CULVERT		
#	Item	Quantity Calculated Unit of Calculation
1 Culvert (To be multiplied by length and no. of barrels)		
	Box	2.88 m3 per box
	Joint	0.18 m3 per box
	Bed	0.72 m3 per box
2 Apron		
	Apron (for all)	2.20 m3 for all (independent of no. of barrels)
	Apron (per box)	1.80 m3 per barrel
3 RC Structure		
	Headwall	0.45 m3 per barrel
	Wingwalls	4.89 m3 for all

Table for material and parameter multiplication			
	per box	per barrel	per asset
Precast Reinfor	2.88		
In Situ Reinforc	-	0.45	4.8857
Joint Filler	0.18		
Concrete	0.72	1.8	2.202

KEY
All input values in blue against dark gray !
All calculated values in green against light

LARGE CULVERT GEOMETRIC PROPERTIES (INITIAL DESIGN SIZING)																							
General Parameters			Culvert Box			Culvert Joint (per box)			Bed (per box)			Apron (adjacent to wing wall) for both upstream and downstream sections			Apron infront of culvert boxes (per barrel) for both upstream and downstream sections			Headwall (per barrel) for both upstream and downstream sections			Wingwalls		
Property	Qty	Unit	Property	Qty	Unit	Property	Qty	Unit	Property	Qty	Unit	Property	Qty	Unit	Property	Qty	Unit	Property	Qty	Unit	Property	Qty	Unit
Box Length	1.6	m	Thickness	0.3	m	Thickness	0.1	m	Thickness	0.3	m	Apron Length	2	m	Apron Length	2.00	m	Height above box	0.5	m	Height	1	m
Box Height	1.5	m	Perimeter	6.00	m	Area	1.80	m2	Width	1.5	m	Apron Width	1.835	m	Apron Width	1.50	m	Thickness	0.3	m	Length	2.71	m
Box Width	1.5	m	Area	1.80	m2	Volume	0.18	m3	Length	1.6	m	Thickness	0.30	m	Thickness	0.30	m	Width	1.50	m	Lower Volume	3.26	m3
			Volume	2.88	m3				Volume	0.72	m3	Volume	2.20	m3	Volume	1.80	m3	Volume	0.45	m3	Upper Volume	1.63	m3



dix A5.1 barrel sizes

Upstream and downstream,

424.94 424.8 0.14 400 2800
0.14 100
0.00035 0.01

FLAP GATES

General Parameters

Height 1200 mm
Width 1200 mm

Flap door assumed to comprise:

1 no. Plate 12 mm thick
3 no. Beams 127 mm UB
3 no. Hinge brackets 70 mm ID
90 mm OD
100 mm long
3 no. Bush 50 mm ID
70 mm OD
100 mm long
3 no. Hinge pins 50 mm OD
100 mm long
1 no. Seal 20 mm thick
50 mm wide

Material

Steel 7850 kg/m³
Steel 15 kg/m
Steel 7850 kg/m³

Bronze

8770 kg/m³

Stainless steel

7850 kg/m³

Neoprene

1230 kg/m³

Flap frame assumed to comprise:

1 no. Plate 12 mm thick
100 mm wide

Material

Steel 7850 kg/m³

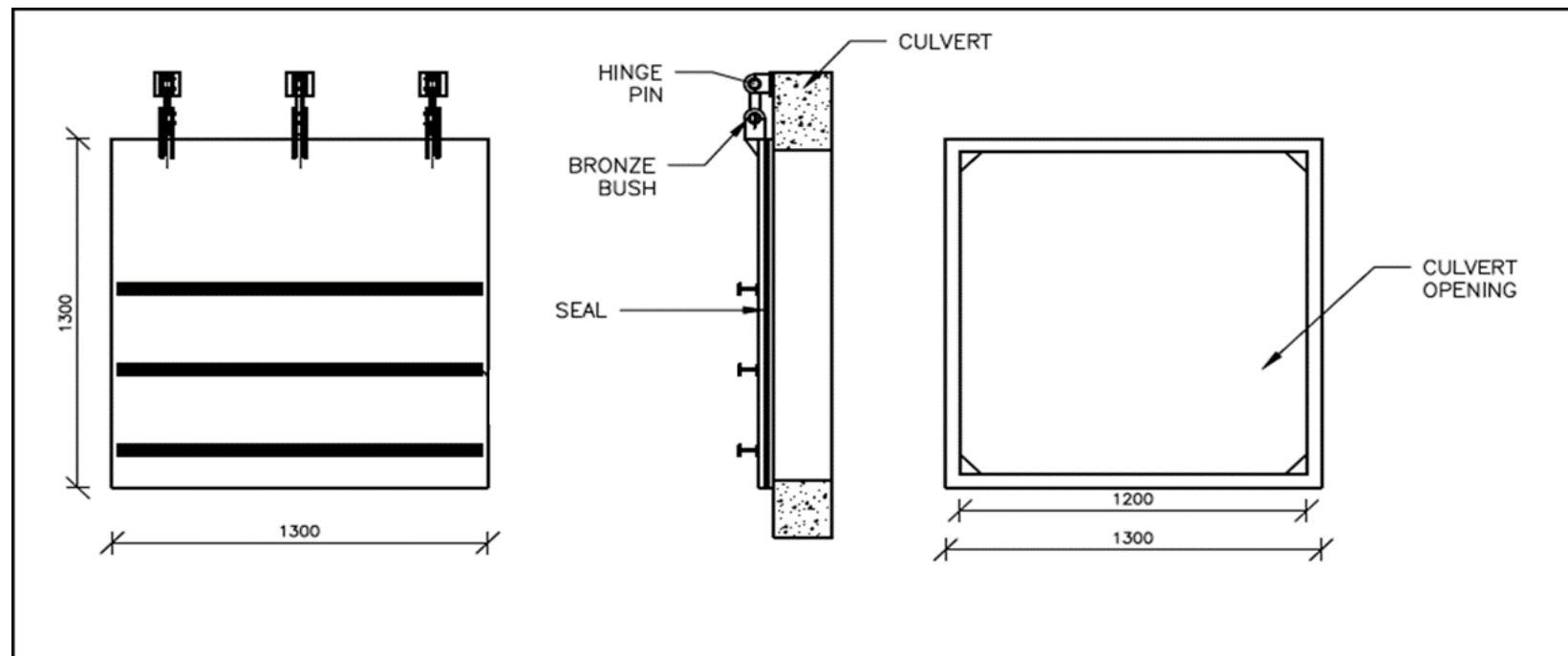
Flap Door Volume= 0.0173 m³
Material= Steel
Mass= 228 kg (inc 20% for welds & paint)
Frame Volume= 0.0058 m³
Material= Steel
Mass= 54 kg (inc 20% for welds & paint)
Hinges Volume= 0.0030 m³
Material= Steel
Mass= 25
Seal Volume= 0.0048 m³
Material= Neoprene
Mass= 6 kg (inc 5% contingency)

Bronze 0.0023 m³
Stainless steel 0.0024 m³
19 kg (inc 5% contingency)

required if good metal to metal seal is not possible
60 to 70 shore
hardness is important
EPDM

Summary for material estimate sheet

Steel	Neoprene	Bronze	Stainless Steel
plates	sheet	rod	rod
307	6	21	19
kg	kg	kg	kg



DRAINAGE CHANNEL CROSS SECTION PROPERTIES

General Parameters (And Summary)		
Property	Qty	Unit
Length	1	m
Slope	2	1 in
Bottom Width	2	m
Height	1	m
Area	4.00	m2
Volume	4.00	m3

KEY
All input values in blue against dark gray background
All calculated values in green against light grey background

