

# DUSUP GUIDELINES FOR PROTECTION OF HYDROCARBON PIPELINES

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## 1 INTRODUCTION

Dubai Supply Authority (DUSUP) provides energy supply (Natural Gas) to Emirate of Dubai to meet the needs of electricity generation and water desalination through its pipeline network. Through the production of natural gas (which is processed into gas and condensate products), the purchase of pipeline gas and LNG (and its regasification), gas storage and the operation of the pipeline network, DUSUP plays a key role in the growth and development of Dubai.

DUSUP has assigned Dubai Petroleum Establishment (DPE) the responsibility for operating DUSUP assets and authorized DPE to manage all emergency events occurring on its own operated facilities, pipelines and assets within pipeline corridors in liaison with other governmental entities.

DPE-DUSUP designs operates and maintains DUSUP's onshore pipelines and related facilities to International Standards in order to ensure an uninterrupted flow of gas and other hydrocarbons across Dubai. The onshore hydrocarbon pipeline network consists of approximately 700 kilometres of pipelines ranging from 48" high pressure gas pipelines down to 10" condensate lines. The gas pipelines operate at high-pressures up to 960-psig and transport highly explosive and flammable natural gas. A number of jet fuel and fuel oil pipelines share the corridors with the gas and condensate pipelines.

The majority of the onshore hydrocarbon pipeline network is laid-out in designated DUSUP corridors that are secured by fences and controlled access gates. Parts of the onshore pipeline network run in the Right of way, Public way and in unfenced corridors - due to the close proximity of road infrastructure.

## 2 PURPOSE

The purpose of this document is to provide procedural guidance regarding the minimum protection required for the construction of metallic pipeline and related asset within the DUSUP corridor.

DUSUP Guidelines for protection of non-metallic pipelines are covered under the separate document (Ref DP-OPSON-0230).

## 3 REFERENCES

- a) DUSUP NOC Standard Conditions - DP-OPSON-0056
- b) DUSUP Guidelines for Land Use Planning - DP-OPSON-0144
- c) DUSUP Guidelines for Road & Rail Infrastructure Crossing Pipelines DP-OPSON-0152
- d) DP-OPSON-0154-DUSUP Guidelines for Road & Rail Infrastructure Parallel to Pipelines
- e) DUSUP Guidelines for protection of non-metallic pipelines are covered under the separate document (Ref DP-OPSON-0230).
- f) DUSUP Guidelines for Utilities Crossing HC Pipelines DP-OPSON-0158
- g) Typical Detail of Gas Pipeline Crossing Road 900-08-001-001
- h) Typical Detail of Gas Pipeline Crossing Road 900-08-001-001
- i) Typical Detail Cable Crossing Above Pipeline 900-08-057-001
- j) Typical Detail Cable Crossing Above Pipeline 900-08-057-001
- k) Typical Detail R0 Water Crossing Above Pipeline 900-08-060-001
- l) Typical Detail Water Crossing Below Pipeline 900-08-061-001
- m) Typical Detail Water Crossing Below Pipeline 900-08-061-001
- n) Typical Detail Minimum Separation OHL to Pipeline 900-08-059-001-R0
- o) Gas Transmission and Distribution Piping Systems – ASME B31.8
- p) Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids - ASME B31.4
- q) Steel pipelines for high pressure gas transmission - IGEM/TD/1
- r) Steel and PE pipelines for gas distribution - IGEM/TD/3

## 4 ABBREVIATIONS AND DEFINITIONS

### 4.1 Abbreviations

Abbreviation	Description
DEL	Dolphin Energy Limited
DEWA	Dubai Electricity and Water Authority
DPE	Dubai Petroleum Establishment
DUSUP	Dubai Supply Authority
EGA	Emirates Global Aluminium(DUBAL)
EMARAT	Emirates General Petroleum Corporation
EMDAD	EMARAT, Air BP and Shell Joint Venture
ENOC	Emirates National Oil Company
GCS	Gas Control Station
MOP	Maximum Operating Pressure
NOC	No Objection Certificate
OHL	Overhead Line
PTW	Permit to Work
ROW	Right of Way
RTA	Roads and Transport Authority

### 4.2 Definitions

At Grade Crossing	For the purpose of pipeline protection, the carriageway at same level of adjacent ground or not more than 5'-0" (1.5meter) above adjacent ground/pipeline corridor to be considered as "At Grade Crossing".
DPE	DPE is the government entities that operates DUSUP assets as Onshore Operations Team and has authority to manage all emergency events occurring on its own operated facilities, pipelines and all crisis occurring within pipeline corridors in liaison with other governmental entities.
DUSUP	DUSUP is the legal commercial entity that own Margham Field, Margham Plant Facilities, Gas Control Station, LNG Platform and Onshore Pipelines within pipeline corridors and has given to DPE full operatorship of all its facilities.
DUSUP Corridor	DUSUP Corridor is the land allocated by Dubai Municipality or other statutory government authority to DUSUP for the construction, operation and maintenance of gas and fuel pipelines in the emirates of Dubai.
Onshore Hydrocarbon Pipelines Network	Approximately 700 kilometres of onshore hydrocarbon pipelines operating in Dubai. The network consist of gas, condensate, jet fuel and fuel oil pipelines. The gas pipelines operate at high-pressures up to 960-psig and

	transport highly explosive and flammable natural gas. The jet fuel and fuel oil pipelines operate at 653-psig share the same corridors. The condensate pipeline operate at 1000-psig and also share corridor with other pipeline.
Pipeline Owners	Owners or Owners designated Operator of the existing Gas / Liquid Fuel Pipelines in onshore hydrocarbon pipeline network (ENOC Group, EMDAD, DEL & DEWA).
No Go Zone	5.0 meters either sides of existing DUSUP/DPE pipelines.
No Objection Certificate (NOC)	A document issued by the Traffic and Roads Agency of RTA, authorizing the party to whom it has granted permission to implement works in the Right of Way or create Traffic Diversions.
Trenchless Crossing method /NDCM	Trenchless crossing method or Non-disruptive crossing method (NDCM) is a subsurface crossing method for the installation of utilities under the existing infrastructure such as road, buildings or other utilities that requires minimum excavation at the ends or no continuous trenches. E.g. Micro Tunnelling, Thrust boring, Horizontal directional drilling etc.,
Utility Owners	Owners of other utilities such as: drainage lines (DM), Electricity & Water(DEWA), ITS Services(RTA), Telephone(Etisalat, Du), Other communication cables(UAE Armed Forces), etc.,

## 5 UNDERGROUND PIPELINE PROTECTION

Hydrocarbon pipelines are important infrastructure elements as they transport natural gas, condensate, jet fuel and other liquid fuels over long distances. The pipelines are buried in soil due to safety, environmental and economic reasons. Minimum depth of burial varies as per the size, material and use.

### 5.1 Burial Depth

Buried pipelines shall be installed with minimum depth of soil cover in accordance with API RP 1102, ASME B31.4/B31.8 and minimum burial depth required from the ground level to the crown of the pipeline is 1.20 meters. Additional mitigations such as local berm or protection slab etc. shall be considered where the cover requirement cannot be met.

Note: Refer to "DUSUP Typical Road Crossing Arrangement" drawing reference: 900-08-03-01 (Attachment 1).

### 5.2 Minimum Separations between Existing and Proposed Pipeline

The separation distances between the pipelines mentioned below are based on the DUSUP/DPE past experience and IGEM/TD/1 recommendation for the Natural Gas pipelines of MOP  $\leq$  80 bar.

Any reduction of recommended separations mentioned below and where MAOP for natural gas pipeline exceeds 80 bar, the designer must demonstrate (via modelling) that adjacent gas or liquefied pipelines are outside the ground crater generated.



The recommended separation distances are based on the assumption that both pipelines are at the same depth and that this depth is 1.20 meter.

### 5.2.1 Natural Gas Pipelines

Minimum horizontal separation for the construction of new pipelines are:

Pipe Size (OD) in Inches	Horizontal Clearance (m)
<= 24	10.00
32	12.00
36	12.50
48	15.00

*Note: Linear Interpolation can be done for the sizes in between those mentioned in the above table.*

### 5.2.2 Liquid Fuel Pipelines

Minimum horizontal separation between the liquid fuel pipelines is 10.0 meters.

### 5.2.3 Natural Gas & Liquid Fuel Pipelines

Minimum horizontal separation requirement between the natural gas and liquid fuel pipelines are same as between the Natural gas pipelines mentioned under item 5.2.1.

## 6 CROSSINGS

New pipelines may require to cross existing hydrocarbon pipelines, road & railway infrastructures and utilities etc., the crossing requirements may vary as per the type of crossings:

### 6.1 Crossing Existing Roads

- Where practicable, pipeline shall cross the road at approximately right angles thereto but preferably at not less than 45°.
- Pipeline constructed by open cut excavation must cross the road at minimum 1.2 meter below road foundation layer or 2.0 meter below finished road level or comply with crossing requirements of existing utilities within the ROW; whichever is greater.
- Where a pipeline is to cross a road by open cut excavation, the pipeline must be protected as per the protection design shown on "DUSUP Typical Road Crossing Arrangement" drawing reference: 900-08-03-01 (Attachment 1).
- Pipeline protection must extend beyond the edge of the road shoulder (or toe of the embankment whichever is greater) as follows:
  - Roundabout, Curved road, \*Elevated road with embankment slope of 1:3 of steeper and bridge crossing - 20 meters.
  - At grade straight road - 10 meters.
  - Straight Road with embankment of 1:3 or flatter slop - 10 meters.

\*Road raised 1.5 meter and or more above the grade level.

- e) Crossing of existing major road is typically permitted by trenchless (non-Disruptive) methods only. As various utility corridors are located within the ROW, crossing requirements of both RTA and other existing utilities are applicable. DUSUP/DPE require minimum clear vertical separation of 2.0 meters or two times the diameter of trenchless crossing sleeve, whichever is more to the bottom of lowest utility.
- f) Crossing sleeve / Casing of the proposed pipeline shall be extended minimum 5.0 meters beyond the edge of road or 1.5 m beyond the toe of the side slope or to where unrestricted maintenance access will be available in future.
- g) For road crossings < 10 m in width, as a minimum new Cathodic Protection (CP) test posts for the pipeline(s) must be installed at the road crossing on the downstream side. For road crossings with a width  $\geq 10\text{m}$ , two monitoring test posts, and one at each side shall be provided. Test posts are preferably located within the fenced corridor. For road widening works, existing CP post shall be relocated accordingly. CP Test post in open area shall be protected with approved metal or concrete crash barriers.
- h) Pipeline warning signs shall be installed on either side of road on approaching of corridor. The cumulative kilometre reading with pipeline identification code, the Road Crossing (RX) reference number will be shown on the bottom white strip of the signage panel as shown on the drawing reference : 900-08-004 (See Attachment 2).

Note: Refer to DUSUP Guidelines for Road & Rail Infrastructure Crossing (Ref. DP-OPSON-0152) for further details.

- i) In case of crossing sleeve / casing or pipeline crossing with a viaduct, vents shall be provided on either end of the sleeve for escaping of contaminated gases. Vent shall always be vertical or shall be upward sloping. Vent pipes in open area shall be protected with approved metal or concrete crash barriers.
- j) Non-metallic centralizers shall be provided between the pipelines and casing; if required, casing shall be protected with sacrificial cathodic protection system.

## **6.2 Crossing Existing Railway/Metro:**

Pipeline crossing “At Grade” or “Elevated” Railway/Metro lines shall be protected to the full width of railway protection zone or 30 meters either side of railway protection barrier or from the edge of Railway Bridge; whichever is greater and to comply with the Railway Agency requirements.

### **6.2.1 Pipeline Crossing under “At Grade” Railway**

Pipeline crossing under “At Grade” railway must be constructed by trenchless method at minimum 3.0 meter below finish grade level at the railway track or at the level where vibration level from the railway operation to pipeline remain less than 40mm/sec or as per the Railway Agency vertical separation requirements; whichever is deeper to the approval of Pipeline Technical Authority (TA) of DUSUP/DPE.

Note: Refer to DUSUP Guidelines for Road & Rail Infrastructure Crossing (Ref. DP-OPSON-0152) for further details.

### **6.2.2 Pipeline Crossing under Railway on Soil Embankment**

Pipeline crossing under the railway on soil embankment (elevated) must be constructed by trenchless method. The pipeline must cross at minimum 3.0 meter below finish grade level at the railway track or at the level where vibration level from railway operation remain less than

40mm/sec or as per the Railway Agency vertical separation requirements; whichever is deeper to the approval of Pipeline Technical Authority (TA) of DUSUP/DPE.

Note: Refer to DUSUP Guidelines for Road & Rail Infrastructure Crossing for further details.

### 6.3 Pipeline located within High Water Table

For pipelines that are constructed in areas with a high water table, dewatering shall be conducted to ensure the safe installation of the pipeline. Once the land has been adequately dewatered, the pipeline shall be laid with the appropriate coating to reduce the potential for external corrosion.

Once dewatering of the area is conducted, there is a risk that over time, the pipeline will “float” to the service due to buoyancy issues, in particular for gas pipelines. Under these circumstances, buoyancy calculations of the pipelines shall be carried out as part of design to indicate whether buoyancy mitigation measures of the pipeline is required or not.

For shallow water table areas, sand bags / concrete saddle blocks etc on top of the pipelines may be utilised to provide stability, however this shall be reviewed and approved with Pipeline Technical Authority (TA) of DUSUP/DPE. Concrete weight coating maybe utilised for longer lengths of pipeline.

### 6.4 Crossing Existing Utilities

- a) Existing utilities information must be obtained from the services authorities through the information NOC in RTA's e-NOC system. Information provided by the utility companies may not be accurate therefore to be verified at site.
- b) Various utilities are constructed outside ROW and cross DUSUP corridor to serve neighbouring communities. DUSUP as the custodian and primary user of the corridor, shall construct the pipeline within corridor by open cut excavation method. Therefore other utility crossing must be constructed below the lowest existing hydrocarbon pipeline in the corridor complying with the DUSUP's vertical separation requirements and shall run at the same level throughout the width of corridor.
- c) DUSUP requirements of clear vertical separation for the utility crossing below existing pipeline(s) are as detailed in DP-OPSON-0158 DUSUP Guidelines for Utilities Crossing HC Pipelines.
- d) For the utility crossing above a pipeline, a reinforced concrete slab 150mm thick shall be provided between the proposed crossing and existing DUSUP pipeline. The slab shall be pre-cast concrete, reinforced with A393 welded mesh and coated with minimum two coats of approved bituminous coating. Alternatively, the concrete protection slab(s) may be provided in smaller sections of 500mm x 500mm x 50mm thick - these slabs shall be fiber reinforced concrete. Either slab option shall be a minimum 600mm wider than the size of the HC pipeline diameter, and the slabs shall extend minimum 1.0 m from edge of utility / pipeline crossing (Refer to standard crossing detail drawings mentioned in design requirements item 7.6.1 below.)
- e) An initial pre-concreting visual quality check on the precast protection slab must be carried out by the project consultant in the presence of a DUSUP representative. A copy of consultants approved quality check documents for the slabs must be provided to DUSUP representative at site before commencement of the installation of slabs.

- f) CP test post (Foreign Pipeline Crossing Bond Box) shall be provided at pipeline to pipeline crossings. Installation of the test posts shall be carried out by Contractor approved by DUSUP.
- g) All existing utilities including unforeseen utilities encountered during the construction must be accurately recorded with the description, elevation (DM datum) and location coordinates (DLTM) on the as built drawing for DUSUP record. Upon encountering an unforeseen utility, the owner of the utility shall be notified.

Note: Refer to DUSUP Guidelines for Utilities Crossings Existing Pipeline (Ref. DP-OPSON-0158) and relevant typical drawings for further details.

- h) For pipeline parallel to or crossing under the existing High Voltage OHL, an interference study must be conducted to determine the possible impact on hydrocarbon pipeline(s) and approved mitigation measure shall be implemented. DEWA's requirements for crossing of DEWA OHL are also applicable. Based on impact study recommendations, Polarization and Grounding Cells may be installed in OHL Crossings area, if required.

## **7 PIPELINE BERM**

Where pipeline is not covered with the protection slab or other approved protection, pipeline shall be protected with approved soil berm as follows:

### **7.1 Pipeline Berm at Curved Road /Interchange Crossing**

When pipeline crosses a curved road, i.e. within roundabouts and/or interchange loop sections - where slab or other approved protection is not available - pipeline shall be protected with the pipeline berm as shown on DUSUP drawing reference 900-08-055 (Attachment 3).

### **7.2 Pipeline Berm within Corridor**

Pipeline berm inside the fenced corridor shall be constructed as per the DUSUP standard drawing reference: 900-08-011 (Attachment 3 and 4).

### **7.3 Pipeline Berm out with Corridor**

Where a pipeline is located out with the pipeline fence, pipeline berms (as reasonably practicable) shall be provided to ensure adequate protection. Further protection measures like pipeline protection slabs with proper signages and markers shall be provided for identification of pipeline route.

## **8 PIPELINE SIGNS**

Pipeline signs shall be installed where it is considered necessary to indicate the presence of a pipeline, such as at road crossings, desert crossing points, along the pipeline, corridor fence & gates, and at pipeline facilities. Pipeline signs are also be installed to show the pipeline owner, product description, emergency contact details and kilometre distances along the pipeline route.

### **8.1 Pipeline Warning Signs at Road and Desert Crossings**

To assist in the correct identification of the approved high way crossings or desert crossings (given that there are numerous crossings on each pipeline corridor), the crossings shall be preceded by a number that defines the pipeline corridor, and the pipeline corridors have been identified as set out in the table below:

Corridor Number	Corridor Location
Corridor <u>1</u>	Margham Plant to JAFZA Pig trap
Corridor <u>2</u>	Sharjah Border to Sheikh Zayed Road
Corridor <u>3</u>	16" along Lehabab road Opposite Dubai Investment Park to Roundabout 3 in JAFZA
Corridor <u>4</u>	Sheikh Zayed Road to Dewa End
Corridor <u>5</u>	48" RM-2 Jebel Ali Industrial Area - DEWA JAPS
Corridor <u>6</u>	Corridor -1 (Jebel Ali Industrial Area ) - DEWA HASSYAN Power Plant
Corridor <u>7</u>	Margham Plant to Khubai Well Pad

Thus road-crossing number 1 on the Margham Corridor would read RX101, and desert-crossing number 1 on the Margham Corridor would read DX101.

Similarly road-crossing number 1 on the Sharjah Corridor would read RX201 and desert-crossing number 1 on the Sharjah Corridor would read DX201.

Pipeline Warning Signs shall be installed at a height of six feet from finished ground level as shown on drawing reference 900-08-004-001 (See Attachment 2).

## 8.2 Pipeline Identification & Warning Signs

In order that members of the Emergency Services such as the Civil Defence and Police can identify the pipeline and pipeline location in the event of an emergency; all Pipeline Warning Signs shall have a Pipeline Identification reference included.

This identification reference can be quoted to the DUSUP Emergency Control Room thus identifying the pipeline. Pipeline identification shall be as described in the table below:

Signage KP	Pipeline	Start	End
KP 7+871 48RM2	48" Ring Main 2	Gas Control Station	DEWA Power Station

## 8.3 Pipeline Warning Signs along Pipeline Route

Pipeline Warning Signs shall be installed adjacent to the pipeline berm at 250 meter intervals, e.g. KM26+250, KM26+500, etc. The pipeline warning signs shall indicate cumulative kilometres from the reference station; cumulative Chainage zero starts from centre line of 1st valve at pig trap and usually going in the direction of product flow. The cumulative kilometre reading with pipeline identification code shall be shown on the bottom white strip of the signage panel (see picture below).



Figure 1 DUSUP Warning Sign



Figure 2 ENOC / EPPCO Warning Sign and Marker



Figure 3 EMDAD Warning Sign



Figure 4 DEL Warning Signs

The spacing of signs may be reduced to suit site conditions such as in JAFZA or to indicate a change of pipeline direction.

The signage foundation shall be installed at a 1.5 meter offset from the centre of the pipeline, except in heavily congested areas such as JAFZA, in which case the offset shall be determined after verification of site conditions.

In most cases more than one pipeline is running in parallel with another, with the starting kilometre point being slightly different. Where the pipelines are running in parallel, all warning signs shall be placed in line with the adjacent pipeline, perpendicular to the pipeline route.

Road Crossings (RX) - Pipeline Warning Signs shall be installed either side of highway crossings; they shall be set back slightly from the edge of the road shoulder or behind crash barriers and at the approaching edge of the corridor. The crossing identification (RX number) shall be included on the signage panel.



Figure 5 Road Crossing (RX) Sign

Desert Crossing (DX) - Pipeline Warning Signs shall be installed either side of desert crossing locations at the approaching edge of the corridor. The crossing identification (DX number) shall be included on the signage panel.



Figure 6 Desert Crossing (DX) Sign

#### 8.4 Pipeline Warning Signs on Corridor Fence & Gates

Pipeline Warning Signs on the corridor fence shall be installed at intervals of every 500 meters along the corridor and on every double leaf gate installed at approved desert & road crossing locations. In areas of high density population such as in Jebel Ali Labour Camp Area or in sensitive areas such as Lussaili, the distance between signage on the fence shall be reduced in order to maximize the effect of the signage. Refer to drawing : 900-08-047-001( Attachment 5).

#### 8.5 Restricted Area Signs

Restricted Area Signs shall be installed on the facility fence of restricted areas such as Block Valve Stations, Pigging Stations and Dubai Corner Manifold Facility as shown in Attachment 6. The restricted area signs are detailed in Arabic, English, Urdu and Hindi.



## 8.6 Pipeline Markers

- a) Pipeline Markers shall be installed on the pipeline berm mid-way between the Pipeline Warning Signs, i.e. every 125 meters. The result will be that there is an indication that a pipeline exists every 125 meters along the pipeline corridor. Also pipeline signs and markers shall be installed to show the kilometre distances along the pipeline route.
- b) Parallel pipelines shall have these markers placed in line with the adjacent pipeline (perpendicular to the pipeline route). A typical Pipeline Marker is shown in (Attachment 7).
- c) Where Dubai Municipality has allocated additional land for pipeline corridors, pipeline markers will be installed at the edge of the new pipeline corridor at 50 meter intervals and shall be maintained until such time the new corridor is fenced.
- d) Where DUSUP corridor and RTA ROW intersects, pipeline markers shall be installed at 50 meter intervals between the edge of the pipeline corridor fence to the edge of the carriageway hard shoulder or footpath to increase awareness that pipeline(s) are crossing.

## 8.7 Underground Utility Signs

The route of underground services such as water, drainage, electricity, telephone etc., are installed by the concerned utility owners such as DEWA, Dubai Municipality ETISALAT and Du and are generally installed upon completion of the utility crossing.

# 9 ABOVE GROUND PIPELINE/BLOCK VALVE STATION PROTECTION

Above ground pipeline facility such as Block Valve Stations (BVS) shall be provided with heavy duty crash protection in addition to chain-link fence with restricted area signs.

## 9.1 Crash Protection

Above ground Pipeline and BVS facility outside the plant boundary fence shall be provided with approved crash protection as shown in (Attachment 8).

## 9.2 Fencing

Above ground Pipeline and BVS facility outside the plant boundary fence shall be fenced with approved facility fence as shown in (Attachment 9).

## 9.3 Wind Socks

Wind Socks shall be provided for Block Valve Stations (BVS) and fenced Plant areas as shown on (Attachment 10).

## 9.4 Access Control

Access for non-routine operation activities to the above ground pipeline facility such as BVS area DUBAL Corner facility is managed with DPE Permit to Work System.

## 9.5 Lighting & CCTV for Fenced Facility

CCTV Camera and Lighting shall be provided for restricted areas such as Block Valve Stations, Pigging Stations and DUBAL Corner Manifold Facility as follows:

### 9.5.1 Lighting System:

All outdoor type lighting fixtures shall be LED type. The LED type Flood Light fixture with fully weatherproof, dustproof (IP66), corrosion resistant, suitable for environmental conditions shall be used for outdoor areas. Fittings installed in hazardous areas shall be Ex 'd', Gas Group IIB, T3.

All outdoor lighting shall be photocell and timer based control with selection arrangements. Indoor (building) lighting if any shall be manually controlled.

All outdoor lighting fixtures shall be suitable and certified for ambient temperature. Luminaries shall be as per IEC 60598.

All light fittings and associated junction boxes in outdoor area shall be fully weatherproof (min, IP-66), corrosion resistant and certified for use in the specified hazardous area classification.

Unless specified otherwise, following illumination level shall be maintained in different areas:

AREA	ILLUMINATION LEVEL(LUX)	ELEVATION
Process area, Valves, Manifold	50	Ground
Maintenance or Operation Platform	50	Floor

### 9.5.2 CCTV Camera:

CCTV Camera shall be provided with following minimum features:

- 360° Pan-Tilt-Zoom (minimum 30X Optical zoom).
- ONVIF compliant, IP based digital signal format with Ethernet based video encoder.
- 2MP, Full HD resolution as minimum.
- Multiple, individually configurable streams in H.264 and Motion JPEG.
- PoE enabled cameras to use Power over Ethernet feature.
- Day/Night functionality in indoor/outdoor environment with Wide Dynamic Range.
- IR illuminator to assist in producing high quality video in low light and night-time conditions.
- Production of colour image in low light & dark conditions as well
- Range of reach 200 m (1300 ft) or more depending on the scene
- Auto Iris lens to regulate light received by Outdoor cameras & protect sensor from sunlight.
- Weatherproof to NEMA4X
- Dome Type PTZ Explosion-proof cameras required at Re-injection Train Enclosures (2 nos.)
- Weather proof and vandal proof housing
- Comply with temperature, humidity, wind, etc. requirements.

- o) Image stabilization due to vibration, Defogger, Image rotation, white-balance, and auto-focus.
- p) Camera video and control shall be via the CCTV system at Control room.
- q) Sun shields and self-cleaning window wiper, and where needed, 50 Hz hum eliminators.
- r) Wash wiper kit with functional washing tank and accessories.
- s) Video Motion Detection, Loitering Guard, Camera tampering alarm, etc.
- t) Record video: Inbuilt memory, SD card and network share; Pre-and post-alarm video.
- u) Support for SD card and encryption; recording to network-attached storage (NAS).
- v) PTZ pre-set, start/stop guard tour, auto-tracking, etc.
- w) Sturdy mounting equipment shall be used to avoid vibration caused by strong winds.
- x) Camera mounts to mechanically couples the camera housing to supports (e.g. a tilt over mast)

**CCTV Camera Installation Requirements:**

- a) Installation of cameras shall be on existing structures as far as possible.
- b) In case existing structure is not suitable, a new hinged pole (10-12 meter) shall be provided with the tilting down till grade for ease of maintenance & suitable foundation fixed on Ground level.
- c) Cameras can share tillable lighting pole as well; mounting accessories shall be provided.
- d) Video cameras shall be mounted so that dead zone is minimized to the user requirements.
- e) Cameras shall be mounted such that all effects of shudder due to camera vibration from wind or from vibrations due to the surrounding equipment are not visible on the image displayed.

**10 PIPELINE SAFETY ZONE**

Quantitative Risk Analyses are necessary to find a safe passage of gas pipeline and other hydrocarbon pipelines.

DUSUP and Dolphin Energy (DEL) independently carried out Quantitative Risk Assessment (QRA) studies to assess the risk from existing pipelines (for land use planning purposes) in the areas adjacent to hydrocarbon pipelines. Subsequently DUSUP and DEL issued guidelines to limit the use of the land adjacent to the pipeline corridor - based on their distance from the pipeline. Land Use Planning Zones may extend up to 500 meters beyond the Pipeline corridor limit and are divided into 4 and 5 Land Use Zones for DUSUP and DEL respectively, with corresponding restrictions for LUP. Refer to DUSUP Guidelines for Land Use Planning - DP-OPSON-0144 for further details.

## **11 PIPELINE CORRIDOR /CORRIDOR FENCE**

### **11.1 Pipeline Corridor:**

DUSUP corridors are reserved for the construction and operation of natural gas pipelines and other hydrocarbon pipelines such as condensate, jet fuel pipelines and Diesel Fuel Oil pipeline. The operational corridors are numbered for the identification and signage purposes as described in item 8.1.

For the total list of corridors allocated to DUSUP, refer to Attachment: 11

### **11.2 Corridor Fence:**

Majority of DUSUP and Jet Fuel Line corridors are secured with 2.4 meter high chain-link fence with 2 (two) gates on each side of road or desert crossings. Refer to DUSUP Standard drawings for corridor Fence & Gates on Attachment 11 & 12.

## **12 PIPELINE SEGMENTATION**

Long pipelines shall be divided into smaller segments that can be isolated in an emergency case or when needed to allow for operation, inspection and maintenance activities. Location of the valves provided for segmentation should be accessible to authorized personnel and protected from damage and tampering.

Valve spacing shall be determined based safety studies. In the absence of safety studies, the spacing of valves in the pipeline shall be:

- Class 1 location: 32 km
- Class 2 location: 24 km
- Class 3 location: 16 km
- Class 4 location: 8 km

The spacing may be adjusted by up to 25% based on operational, maintenance, access and system design factors.

If there is a risk of pipeline class change in the future, additional valves / segments may be required.

Isolation valve may be designed to operate from remote stations subjected to reaction time required to operate manually.

As a minimum, alternate valves shall be provided with depressurization system.

## **13 PIPELINE INTEGRITY MANAGEMENT**

Pipeline integrity management strategy is designed to address the maintenance integrity stage, and covers the operational phase of the pipeline system from commissioning and up to and including abandonment.

The integrity management system is a long term and iterative process that involves planning, execution, evaluation and documentation of:

- Integrity control activities which cover inspection, monitoring, testing, and integrity assessments.
- Integrity improvement activities which cover internal mitigation, external intervention, and repair activities.

A brief description of operational practices considered as important to prevent or minimize integrity risks are:

- Representative integrity threat assessments, i.e. Susceptibility and identification.
- Validated Risk Assessments for prioritizing actions in a timely matter
- Appropriate, accurate and timely inspections such as Closed Visual Inspection (CVI), Non-Destructive Examinations (NDE), In-Line Inspections (ILI), Cathodic Protection (CP) surveys for applicable integrity threats.
- Mitigation via operational measures such as overpressure controls etc.
- Mitigation via maintenance practices such as inhibition, cleaning etc.
- Mitigation via integrity such as repairs, pressure reduction etc.
- Mitigation via design of system modification such as trap installation, variable frequency drive pumps etc.
- Effective cathodic protection and coating repairs minimizing corrosion initiation and growth.
- Smooth system operation minimizing both controller human factor effects, and material fatigue and upsets causing crack initiation and growth.
- Periodic monitoring of integrity hazards (i.e., threat susceptibility) and existing threats establishing growth and new emerging threats.
- Effective damage prevention measures such monitoring / controlling 3rd party activities through NOC and daily Patrolling.

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- Integrity control activities which cover inspection, monitoring, testing, and integrity assessments
- Integrity improvement activities which cover internal mitigation, external intervention, and repair activities.

## 14 POLYETHYLENE PIPELINE CONNECTION

Maximum design pressure for Polyethylene (PE) pipeline shall not exceed 125 psig for distribution pipelines installed in class 3 and 4 locations.

PE pipes shall not be used where pipeline operating temperature exceed 60°C or below -29°C. However appropriate de-rating factor shall be applied if operating temperature exceeds 20°C.

PE pipeline shall be designed and installed in accordance with IGEM/TD/3, Steel and PE pipelines for gas distribution.

Pip size shall not exceed 300mm and a design factor of 0.3 or less shall be used for establishing the required wall thickness. The wall thickness of plastic pipe shall not be less than 0.062 in (1.57mm).

Note: For further details refer to "DUSUP Guidelines For Protection of Polyethylene Pipelines" DP-OPSON-0230

## 15 PIPELINE NOC MANAGEMENT

DUSUP-DPE operates a No Objection Certificate (NOC) system across the Emirate of Dubai through Government of Dubai e-NOC portal operated by Roads and Transport Authority (RTA). The NOC System is in place in Dubai to review and pre-approve any work on a Public Way or in the Right of Way or to create any Traffic Diversions. The same system is also used to review, approve and set conditions for monitoring and controlling third parties activities in the vicinity of onshore pipelines.

DUSUP Pipeline corridor is shared by ENOC Group, EMDAD, Dolphin Energy and DEWA. NOC for the pipelines are reviewed by respective pipeline Owners or Operators (ENOC Group, EMDAD & DEL) and processed through Government of Dubai e-NOC portal.

NOC for DEWA pipelines are processed directly by DEWA through e-NOC system.

### 15.1 NOC Zone

DUSUP NOC is applicable for any restricted activity or other construction-related activities within the NOC Zones classified as follows:

- a) 60 meter either side from the center of pipeline owners pipelines or 60 meter from DUSUP Corridor limit / pipeline owners facilities.
- b) 10 meter either side of the pipelines located within DEWA or EGA (DUBAL) Plot limits.
- c) 5 meter either side from the center of 8" Shell pipeline (Abandoned, Positively Isolated).
- d) Margham Field Safety Zone.
- e) 10m radius buffer for all abandoned wells (Positively Isolated).
- f) 500m buffer for LNG Terminal and associated pipeline.
- g) 300 meter for High Voltage Over Head Lines parallel to hydrocarbon pipelines/pipeline corridor.
- h) 500 meter for Subsea Pipelines.
- i) 500 meter for Land Use Planning adjacent to DUSUP Pipeline/Pipeline Corridor.
- j) ½ LFL distance from credible leak scenario i.e. above ground flanges / valves.

## 15.2 Minimum Requirements for Working within NOC Zone

- a) Approved NOC and drawings and documents must be available at site.
- b) Site Supervisor must attend DUSUP Pipeline Safety Training and be in possession of a Pipeline Safety Card.
- c) Any work within 10 meters of pipeline / within corridor must be carried out in the presence of DUSUP Pipeline Representative.
- d) No Machine Excavation is permitted within 5.0 meters of pipeline.

## 15.3 Gas In / Commissioning NOC

For piping / pipelines tying into existing DUSUP network, or for independent pipelines being constructed and commissioned within DUSUP's corridor, a Gas In / Commissioning NOC is required from the Contractor and Customer to ensure that all relevant documentation is reviewed and endorsed by DUSUP. Contractor shall raise a "DUSUP NOC" for the eNOC submission and the minimum documentation required shall be as follows:

For Gas-In NOCs that tie into DUSUPs pipeline network or are laid within DUSUPs pipeline corridors, the following minimum details shall be provided in the NOC:

- Scope of Work
- Method Statement
- Task Risk Assessment
- Pre-Start Up Safety Review. Note the Pre-Start Up Safety Review shall be discussed and reviewed by DUSUP Pipeline Operations Superintendent.
- Recommendation Close Out Sheets from the following studies:
  - QRA
  - HAZID
  - HAZOP
- Confirmation that DUSUP Guidelines have been implemented, in particular with respect to Onshore Pipeline Integrity Management.
- Construction QA documents must be submitted for DUSUP to perform sample audit.
- All metering skid related documents to have been reviewed and approved by DUSUP Measurement team.
- Downstream design must be verified and ensure the compliance with minimum standards for gas piping systems and electrical Ex design and Dusup Measurement Standard SOP-GCS-772.
- Customer shall provide New Metering Skid Modbus Map from Customer RTU to DUSUP at earliest convenience.

- DUSUP Measurement Specialist shall witness test of all new Metering Data points from Customer Metering RTU through to DUSUP Gas Control Station DCS
- Metering skid equipment shall be calibrated and validated by the skid vendor and shall witness by DUSUP measurement representative
- Customer must submit an emergency response plan for gas related emergencies.
- Communication protocol from customer control room to DUSUP GCS must be developed and submitted to DUSUP.
- Detailed commissioning procedure and plan must be submitted for DUSUP review.
- DUSUP shall witness leak test once gas in is undertaken.
- Final as built details.

For independent pipelines being constructed and commissioned within DUSUP's corridor, the above shall also apply with the following included:

- Hydrotest details

Depending on the end location of the independent pipeline, downstream of design may not be require to be verified by DUSUP.

Additional requirements may be specified by the NOC Engineer handling the Commissioning / Gas-In NOC.

Note, for independent pipelines commissioned within DUSUP Corridor, the Pipeline Quantitative Risk Assessment already conducted by DUSUP will require to be updated. The pipeline owner shall bear the cost of the update in the QRA.

Gas in NOCs shall be reviewed by DUSUP Onshore Pipeline Superintendent, who may consider forwarding it for review to Pipeline Technical Authority and other Discipline Engineers.

## **16 PIPELINE PATROLING**

Pipeline patrols are a means to detect activities that may have a negative impact on the pipelines or facilities. The information on pipeline patrol reports is used to take proactive measures to protect people, property, and the environment.

The pipeline corridor patrol must be carried out with safety in mind.

Pipeline Patrol shall report accurately all patrol observations, including work locations observed during daily patrol, liaise with Pipeline Representatives working on DUSUP owned or DUSUP administered pipelines and stop any unauthorized work or activity.

The patrol frequencies shall be not less as stated in the ASME B31.4 and B31.8 codes. Currently the patrols are performed on a twice-daily basis, or more frequently if required.

Note: For further details refer to "DP-OPSON-0170 DUSUP Guidelines for Hydrocarbon Pipeline Patrolling"



## **17 PIPELINE EMERGENCY MANAGEMENT**

### **Control of Emergency**

In the event of any emergency within the pipeline network, the affected pipelines owner shall be responsible for the coordination of the emergency response actions. It includes the following actions:

- Manage the emergency at the location,
- Coordinate the emergency response actions with government emergency departments
- Inform DUSUP GCS Control Room 04 880 1867.
- DUSUP GCS will contact control rooms of pipelines owners having pipelines on the affected corridor and inform about the emergency situation.

For serious incident of any nature (medical, fire, gas release, spill, security, etc.) that requires personnel, equipment or resources to support the response from third party and government entities, DPE GCS (Control room) will contact control rooms of pipelines owners having pipelines on the affected corridor and inform about the emergency situation. The internal escalation shall be actioned according to each pipeline owner's internal procedure.

## **18 DUSUP GUIDELINES**

Various Guidelines for DUSUP/DPE Onshore pipelines have been developed for use. Reference can be made to the following link: <https://dusup.ae/dusup-noc-guidelines/>

**GENERAL NOTES:**

- Pipeline road crossing designed in accordance with latest revision of API RP 1102, ASME B31.4/ B31.8.
- Pavement width is considered vehicular loading with weather paved, crushed stone or sand.
- Wherever possible roadways shall cross the pipeline at right angles. Where a roadway is to cross a pipeline, the pipeline must be surveyed for existing defects to assess the need for any repairs. If repairs are required, the pipeline must be excavated & sand blasted then after inspection, any repairs to the pipeline are to be primed and recoated according to DUSUP specification. This work is to be done by or under supervision of DUSUP personnel at the expense of those persons carrying out the work.
- Completion of backfills shall be as follows:
  - < 400mm all around : By hand tamping equipment in lifts not greater than 100mm.
  - 400mm - 1000mm : By manually operated vibratory plate in lifts not greater than 100mm.
  - > 1000mm : By conventional earth moving equipment, other than vibratory rollers.
- Vibratory rollers to a maximum steel weight of 15 t cannot be used within a distance of 3m offset. Vibratory rollers of a greater weight are subject to approval.
- Safety barrier length to be minimum 20m approaching, 8m leaving. Offset distance from pavement shall be defined with local authority at site. Necessary approval shall be obtained from Govt. or other relevant authorities for safety barrier design and construction, where required.

**SLAB PROTECTION NOTES:**

- Slab protection required as per approved NOC.
- Slab detail typical only. Bars are high yield steel grade 460 (Type 2).
- Dimensional specification:
  - To be machined, minimum 950.
  - Road pavement + 10m either side.
  - Maximum gap between slabs shall be 20mm.
  - Slabs shall be maximum weight of 2.0 tonne.
- Concrete particulars as follows:
  - Grade  $\geq 30$
  - Minimum cement content 660 kg/cyd
  - Maximum water cement ratio 0.40
  - No admixtures shall be used.
  - Cement for all concrete construction shall be Type-I Sulphate resisting cement.
  - Concrete shall be mechanically vibrated.
  - Slab shall be treated with bitumens 1200-1C or equivalent.
  - membrane installed as per manufacturers' recommendations.
  - Slabs shall be cured in accordance with normal UAE practice.
- If slab is located at ground surface level, then dependent upon crossing location, 10m material of 2m width to be added to slab perimeter to prevent local scouring, may be specified.

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**GENERAL NOTES:**

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED OTHERWISE.
2. THE CONTRACTOR SHALL DESIGN THE SIGNAGE FOUNDATION, ANCHOR BOLTS, SIGN POST AND FIXINGS FOR MAXIMUM WIND SPEED 150 km/hr. DESIGN CALCULATION AND DRAWINGS SHALL BE SUBMITTED FOR MODE REVIEW.
3. SIGNAGE SHALL BE SINGLE SIDED WITH 3mm THICK POWDER COATED ALUMINIUM SHEET. GRAPHICS AND BACKGROUND SHALL BE OF 3M ENGINEERING GRADE REFLECTIVE VINYL FILM.
4. SIGNAGE SHALL BE MOUNTED ON SINGLE POST HOT DIP GALVANISED TO B5 MICRONS AND PAINTED AS FOLLOWS:
  - i) DE-GREASE, APPLY MORDANT WASH ETCH, PRIMER.
  - ii) PRIME COAT WITH TWO-PACK EPOXY POLYIMIDE TO DFT 125 MICRONS.
  - iii) TWO-PACK POLYURETHANE TOP COAT TO 50 MICRONS.

**FOUNDATION AND POST DETAILS**  
SCALE=1:10

**WARNING SIGN FORMAT**  
SCALE=1:15

**PIPELINE WARNING SIGN**  
FOUNDATION AND POST DETAIL

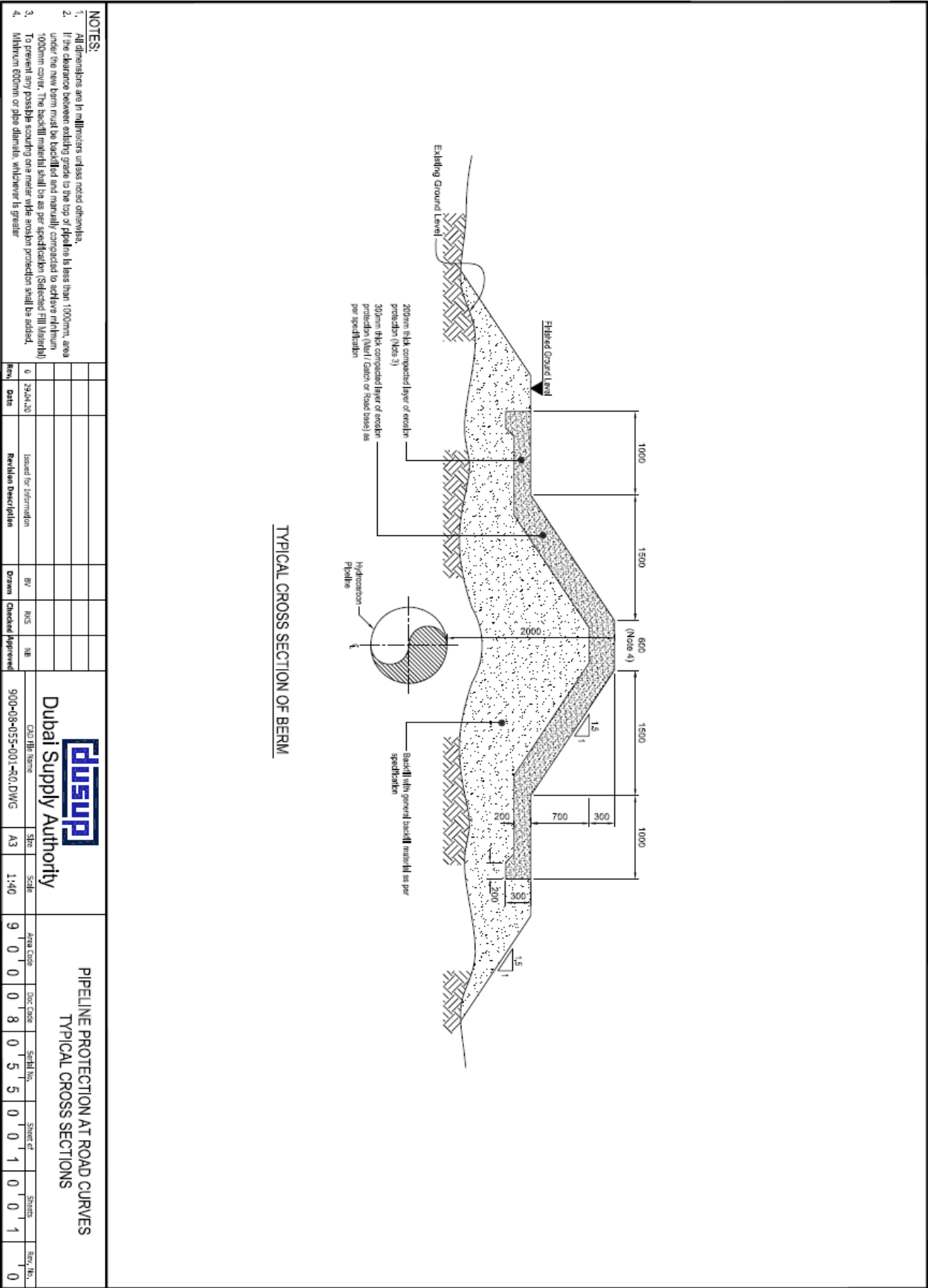
REV	DATE	REVISION DESCRIPTION	BY	CHKD	APPROVED
3	06/10/24	REVISED AS C.O.0073	BY	CHKD	APPROVED
2	03/04/24	COLOR CODE ADDED	BY	CHKD	APPROVED
1	15/02/24	REVISED ACCORDING WARNING SIGN DATA	BY	CHKD	APPROVED
0	08/07/23	SIGNED FOR TENDER	BY	CHKD	APPROVED

**Dubai Supply Authority**

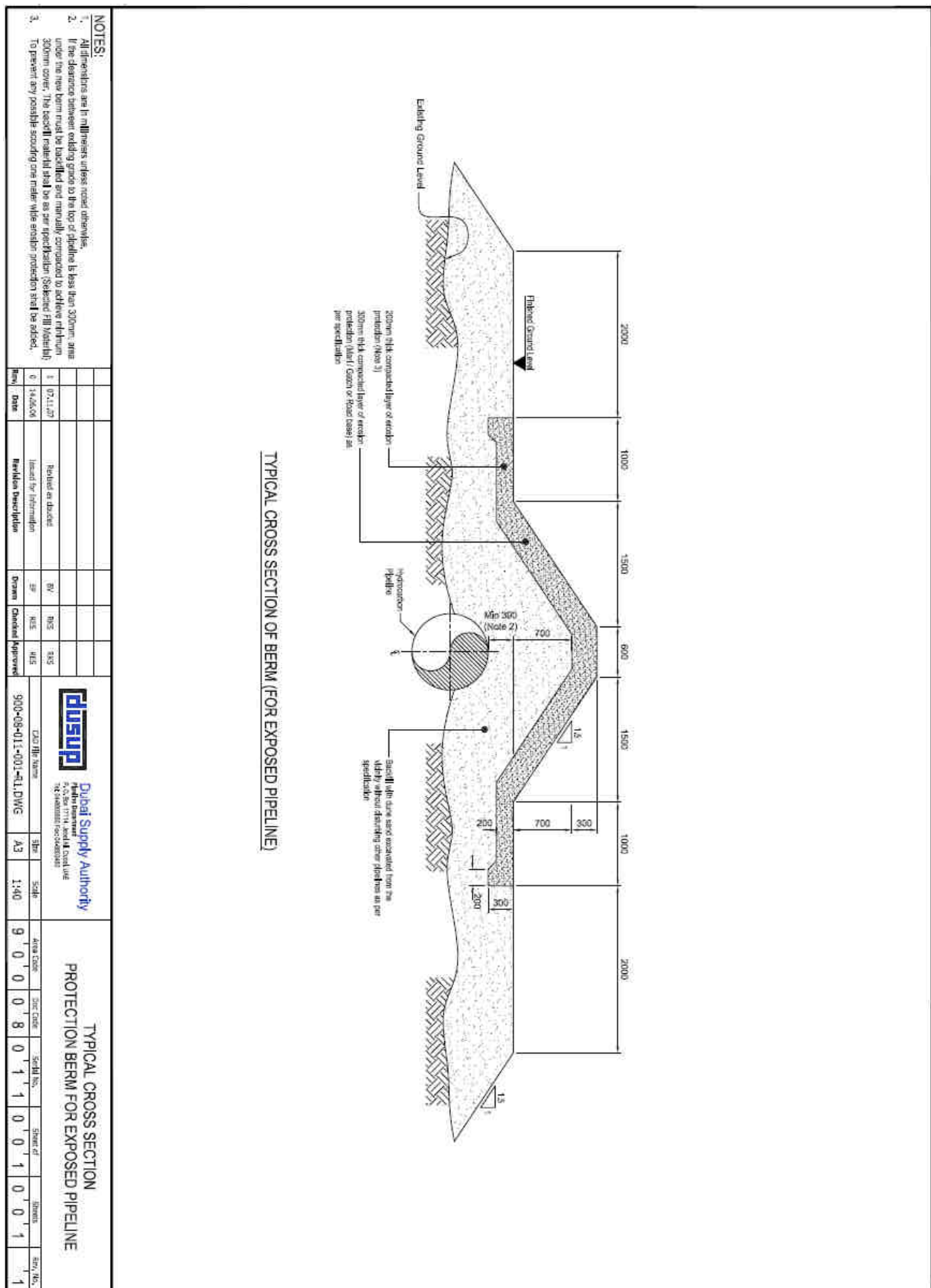
**PIPELINE WARNING SIGN**  
FOUNDATION AND POST DETAIL

AREA CODE	DOC CODE	SERIAL NO.	SHEET OF	SHEETS	REV. NO.
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0	0	0	4	0	0
0	0	1	0	0	1
0	0	1	0	0	1

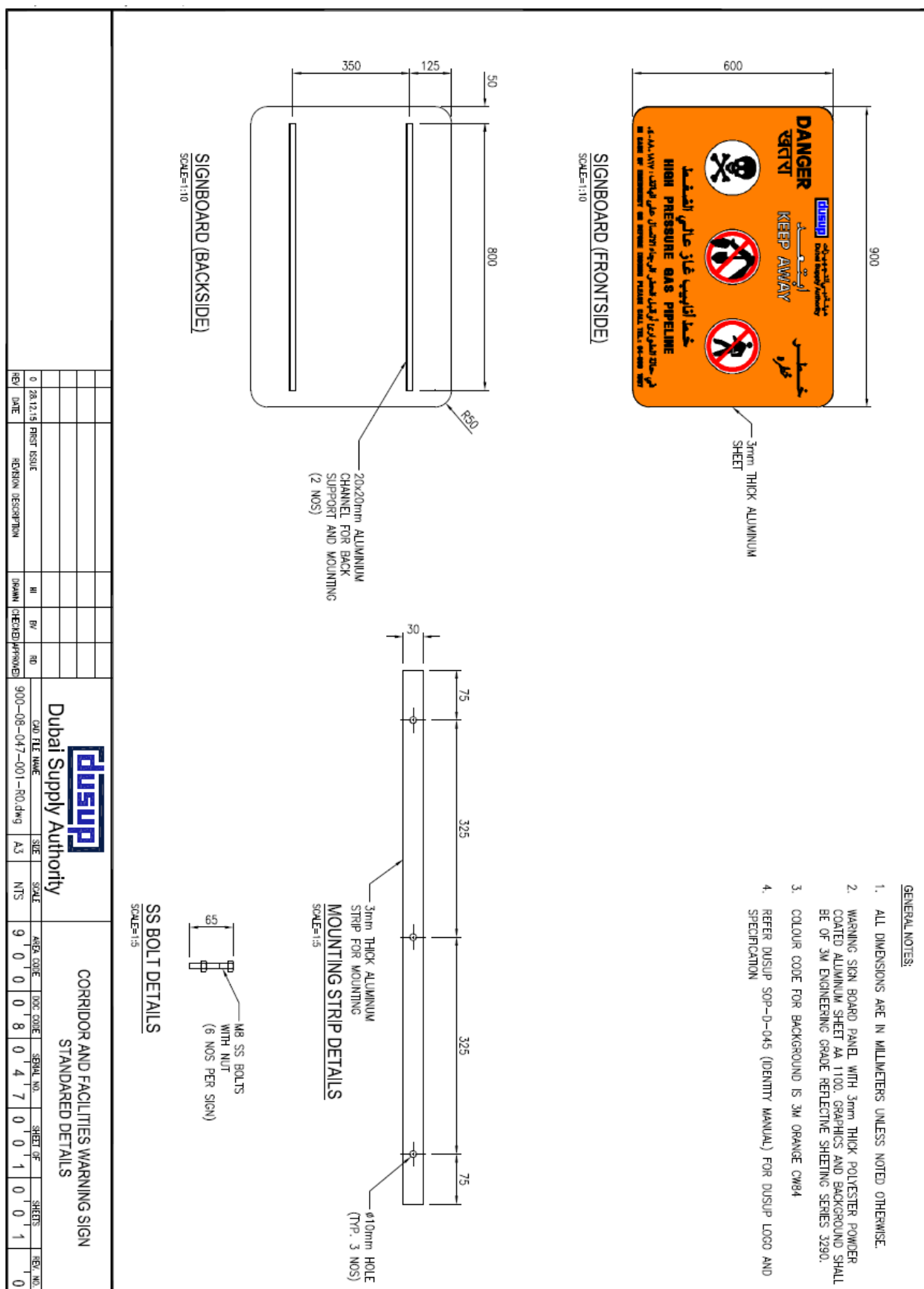
ATTACHMENT 3: BERM PROTECTION



## ATTACHMENT 4: BERM PROTECTION FOR EXPOSED PIPELINE

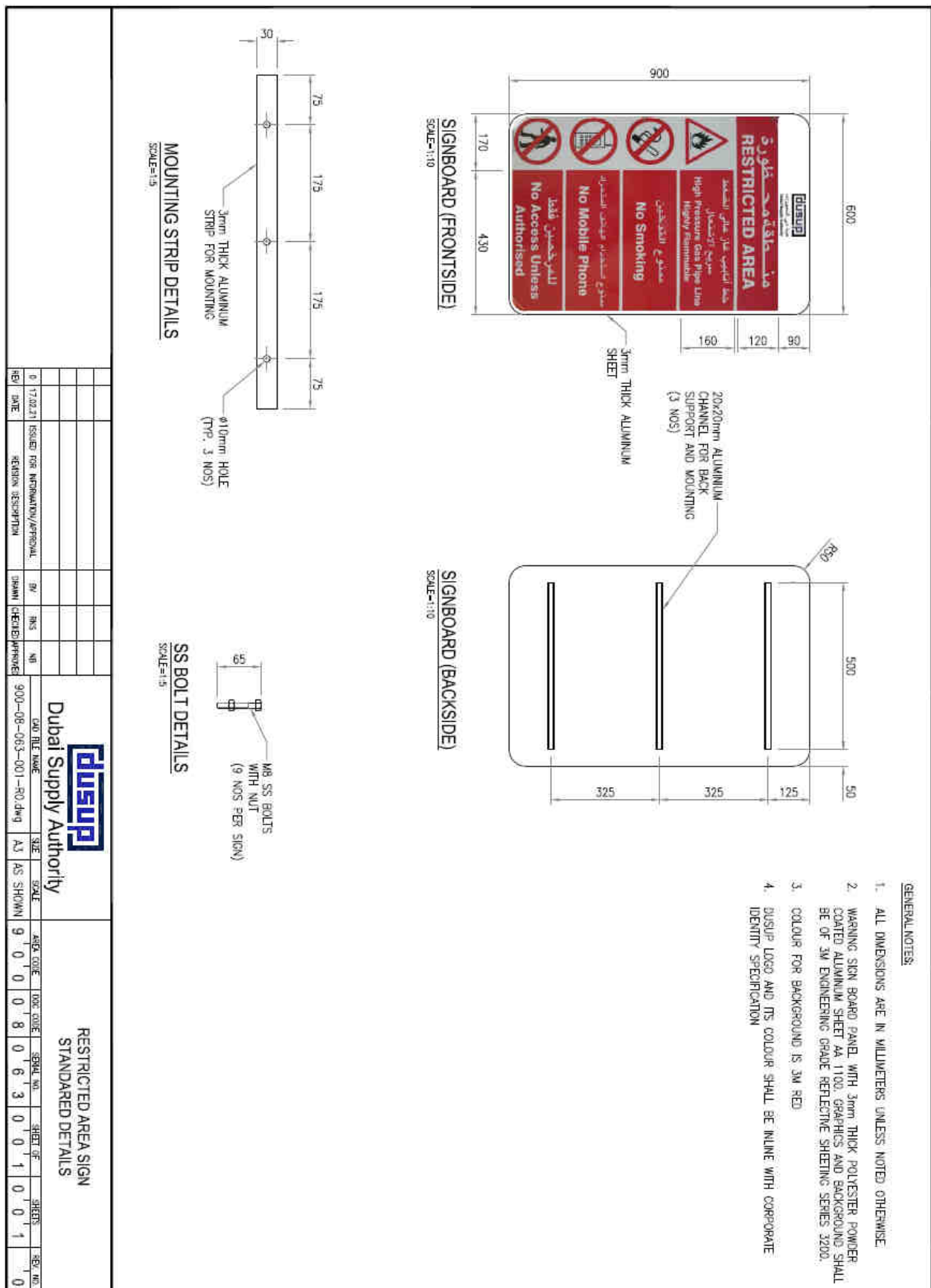


## ATTACHMENT 5: WARNING SIGN ON FENCE





## ATTACHMENT 6: RESTRICTED AREA SIGN DRAWING

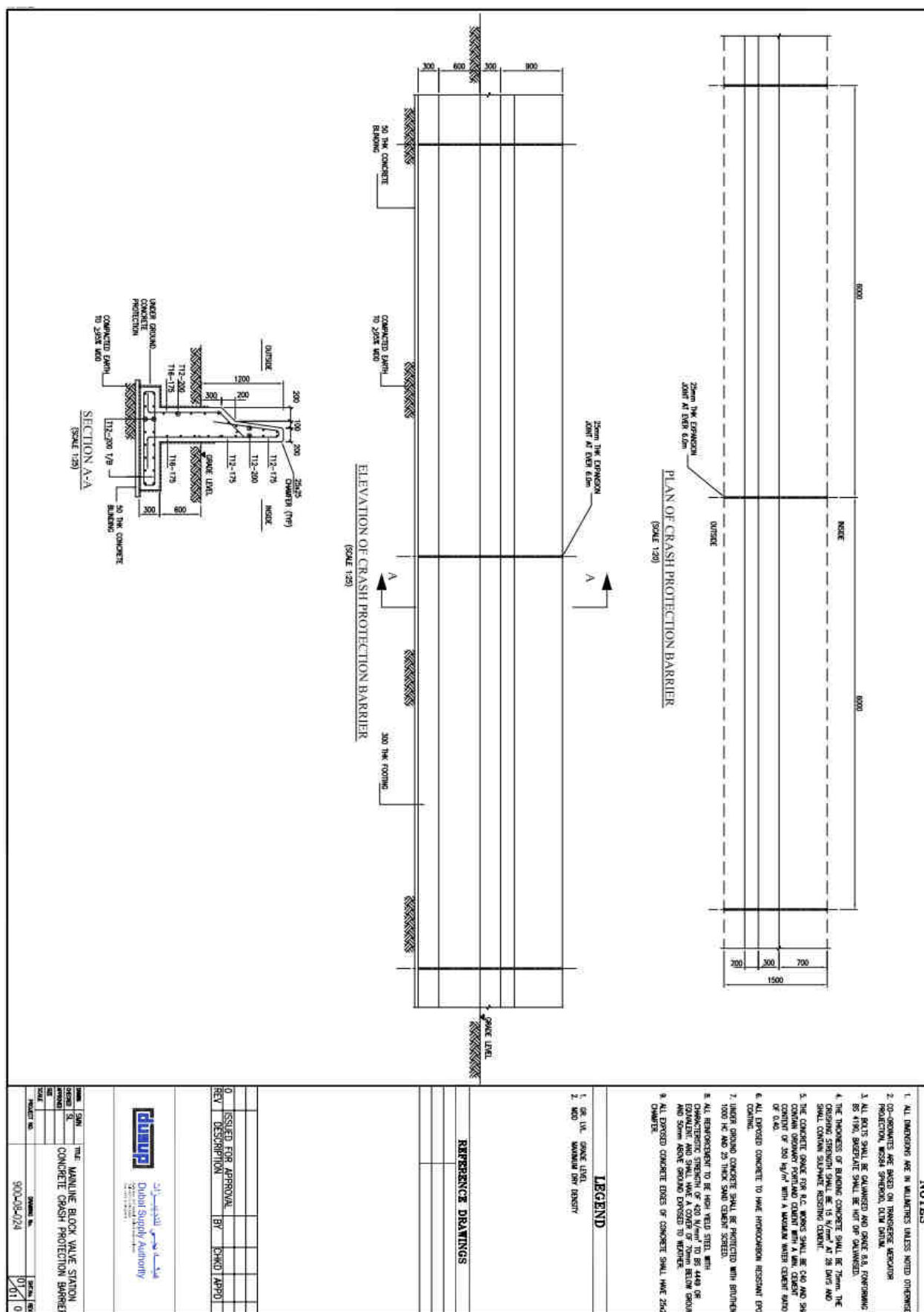


ATTACHMENT 7: PIPELINE MARKER

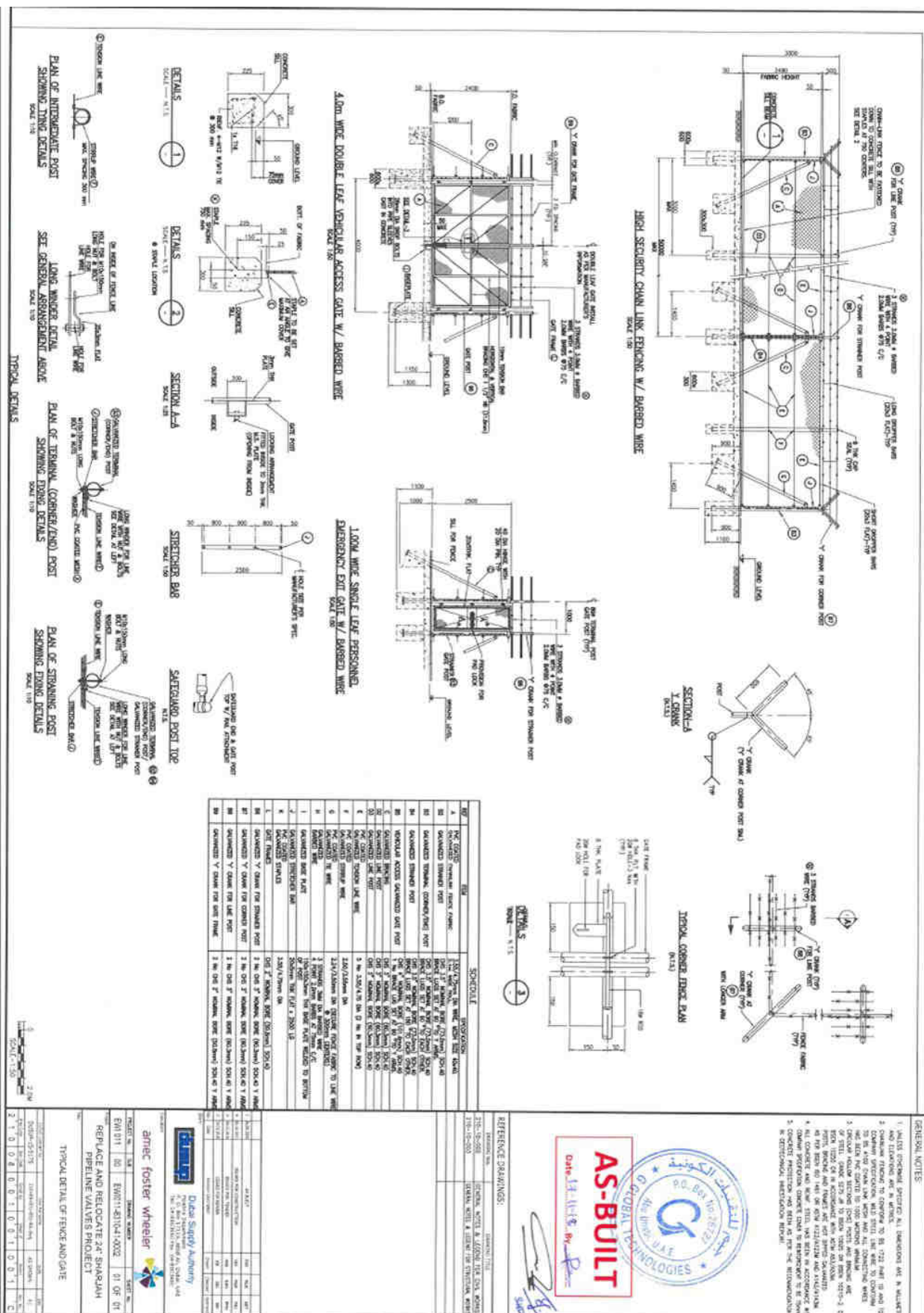




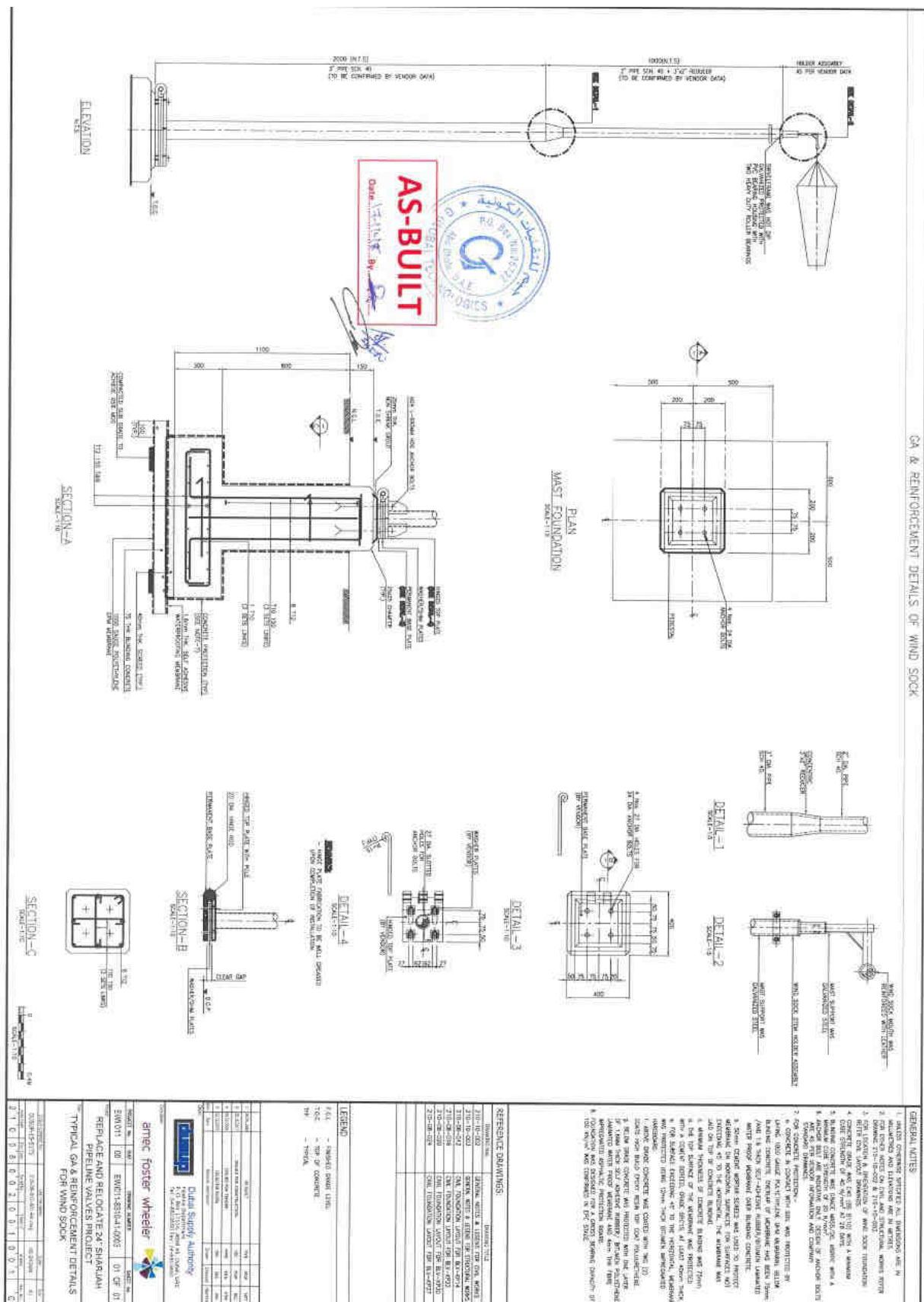
## ATTACHMENT 8: CRASH BARRIERS AT BVS



## ATTACHMENT 9: FACILITY AREA FENCE



## ATTACHMENT 10: WIND SOCKS



**STANDARD DRAWING**  
**PIPELINE CORRIDOR CHAIN LINK MESH FENCE**  
**DETAILS (SHEET 1 OF 2)**

**Dubai Supply Authority**

**NOTES:**

- All dimensions are in millimeters unless noted otherwise.
- All wires & Fence shall be PVC Coated (BS).
- All metals shall be Hot Dip Galvanized to BS EN ISO 1461 & Polyester Powder Coated in Green colour (RAL-6003).
- All foundations shall be minimum concrete, Post shall be minimum concrete minimum 300mm above foundation.

**DETAILS:**

**DETAIL - X**

**BRACE DETAILS**

**ELEVATION OF FENCING SYSTEM**

**DETAILS OF STRETCHER BAR**



ATTACHMENT 12: CORRIDOR GATE DRAWING

