Appendix V3-3G

Hope Bay Project: Madrid North Surface Infrastructure Preliminary Design

TMAC RESOURCES

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Memo

To:	John Roberts, PEng, Vice President Environment	**Client:**	TMAC Resources Inc.
From:	Megan Miller, PEng	**Project No:**	1CT022.004
Reviewed By:	Maritz Rykaart, PhD, PEng	**Date:**	November 29, 2016
Subject:	Hope Bay Project: Madrid North Surface Infrastructure Preliminary Design		

1 Introduction

1.1 General

The Hope Bay Project (the Project) is a gold mining and milling undertaking of TMAC Resources Inc. The Project is located 705 km northeast of Yellowknife and 153 km southwest of Cambridge Bay in Nunavut Territory, and is situated east of Bathurst Inlet. The Project comprises of three distinct areas of known mineralization plus extensive exploration potential and targets. The three areas that host mineral resources are Doris, Madrid, and Boston.

The Project consists of two phases; Phase 1 (Doris project), which is currently being carried out under an existing Water Licence, and Phase 2 which is in the environmental assessment stage. Phase 1 includes mining and infrastructure at Doris, while Phase 2 includes mining and infrastructure at Madrid and Boston located approximately 10 and 60 km due south from Doris, respectively.

Mining and infrastructure at Madrid will comprise of two separate areas; Madrid North and Madrid South, located approximately 5 km apart via an all-weather road. Each of these mining areas will have a single mine portal for accessing separate underground mines, not interconnected with any of the other belt-wide mines. These areas are not self-contained mining complexes like Doris, but rather satellite facilities focused on supporting mining activities with final processing (including tailings) and camp services relied upon at Doris.

Preliminary designs for development of the Madrid North surface infrastructure have been submitted to the Nunavut Water Board as part of the Madrid Advanced Exploration Project (Type B) Water License Application (TMAC 2014), and subsequently updated in 2016 (SRK 2016a). The designs presented herein are the Madrid Advanced Exploration Project designs refined for Phase 2.

1.2 Objectives

This memo provides preliminary engineering design details of the Madrid North surface infrastructure.

2 Design Concept

2.1 Approach

As mentioned, Madrid North is not a self-contained mining complex, but is a satellite mine that shares the processing and camp facilities of Doris. To this end, the Madrid North surface infrastructure is limited to the minimum necessary to support underground mining activities at source, but does include a 1,200 tpd processing plant where gold concentrate will be produced. About 10% of the reprocessed ore at this facility will be trucked as concentrate to the Doris processing plant for further refinement. The floatation tailings produced at Madrid North will be pumped to the Doris tailings impoundment area (TIA).

The overall design concepts for the Madrid North surface infrastructure (i.e. pads, roads and water management facilities) are based on the same principles as used for Doris. All facilities will be constructed either on bedrock or geochemically suitable rock fill pads designed to protect the permafrost. Site layouts are designed to minimize the overall footprint, and minimize the volume of contact water that has to be captured and managed via ponds for appropriate disposal.

Access roads are considered private roads, administered and controlled entirely by TMAC. TMAC has decided that all-site roads should be designed to the minimum haul road requirements set out in the Nunavut Mine Health and Safety Regulations (2015).

2.2 Infrastructure Components

The infrastructure associated with the mining activities at Madrid North consist of infrastructure at the portal and infrastructure at the vent raises. These components, along with limitations on their location are summarized in Table 2.1.

Table 2.1: Summary of Infrastructure Associated with Madrid North

Infrastructure Component	Surface Area	Limitations and Comments
Waste rock pad (and associated waste rock pile)	Location dependant	Haul distance of less than 500 m from portal Haul road grade cannot exceed 7% Minimum storage of 646,000 tonnes (359,000 m^3) of waste rock
Ore pad (and associated ore stockpile)	Location dependant	Haul distance of less than 500 m from portal Haul road grade cannot exceed 7% Minimum storage of 16,000 tonnes (9,000 m^3)
Contact water pond	Location dependant	Downstream of ore and waste rock pads Considered an event pond, (i.e. not designed to retain water for prolonged time periods)
Mine equipment shop	450 m^2 (15x30 m)	Routine servicing of underground mine fleet Major repairs/rebuilds conducted at Doris
Compressor building	25 m^2 (5x5 m)	Attached to the mine equipment shop
Laydown area	1,000 m^2	General outside storage area for equipment and supplies
Diesel generator	19 m^2 (2.5x7.5 m)	Directly adjacent to portal Self-contained unit
Office trailer	30 m^2 (3x10 m)	Trailer

Infrastructure Component	Surface Area	Limitations and Comments
Emergency shelter	30 m^2 (3x10 m)	Trailer
Brine mixing facility	19 m^2 (2.5x7.5 m)	Will likely be placed underground Alternatively, directly adjacent to portal Modified seacan container Also includes area for calcium chloride storage
Water tank (saline underground mine water)	144 m^2 (12x12 m)	Directly adjacent to portal Assumed to be a 50,000 L steel tank with 4.4 m radius, in a lined containment area
Power plant	575 m^2 (25x38 m)	Requires bedrock, or piled foundation
Processing plant (concentrate only)	1,625 m^2 (25x65 m)	Requires bedrock, or piled foundation Near power station to maximize heat recovery opportunity
Fuel storage facility	5,400 m^2 (60x90 m)	Includes fuel transfer station Lined secondary containment area Contains three 1.5 ML fuel tanks Should be founded on bedrock or shallow (<3 m) overburden
Air heating facility	19 m^2 (2.5x7.5 m)	Immediately adjacent to vent raise Updraft vent with electrical power supplied from underground substation
Vent raise pads (3)	625 m^2 (25x25 m)	Vent raise pads with nominal area, infrastructure on these pads to be determined

2.3 Topographic Data

Design of the Madrid North infrastructure pads, access roads and water management structures are based on topographic contour maps with 0.5 m vertical resolution produced from 2008 aerial photography supplied by Hope Bay Mining Limited. Detailed ground surveys have not been completed.

2.4 Foundation Conditions

Numerous geotechnical investigations have been performed at the Project site, though no geotechnical investigation, or laboratory testing have been performed within the footprint of the Madrid North site. The closest geotechnical drill hole to the site is approximately 500 m to the North of the Madrid North Portal (SRK 2009).

Project wide overburden consists of permafrost soils which are mainly of marine clays, silty clay and clayey silt, with pockets of moraine till underlying these deposits. The marine silts and clays contain ground ice ranging from 10 to 30% by volume on average, but occasionally as high as 50% (SRK 2016b). The till typically contains low to moderate ice contents ranging from 5 to 25%. Overburden soil pore water is typically saline due to past inundation of the land by seawater following deglaciation of the Project area. The salinity of the marine silts and clays typically ranges from 37 to 47 parts per thousand which depresses the freezing point and contributes to higher unfrozen water content at below freezing temperatures.

Permafrost at the Project site extends to depths of about 570 m, with an average geothermal gradient of 0.021°C/m. Active layer depths in overburden soil averages 1.0 m, with a range from 0.5 to 1.7 m (SRK 2016c).

Isopach maps developed from exploration and geotechnical drill holes indicate that depths of overburden under the mining infrastructure is expected to range from 0 to 10 m, with most areas having less than 3 m of overburden. The closest drill holes (SRK-07-34, SRK-07-35 and SRK-07-37) indicate that the overburden under the infrastructure pads is likely silty clay or silty sand, and that there could be thin layers of black organic material at a depth of ~11 m. Ice content of the foundation soils could also be in the higher end of those typically found on the Project, as drill hole SRK-07-35 (~700 m northeast of the portal) notes ice contents up to 50% (SRK 2009).

General foundation conditions, material properties for geotechnical analysis, and development of the overburden isopach surface area are described in more detail in SRK (2016b).

2.5 Environmental Setbacks

The following environmental setbacks have been applied when selecting the location of the infrastructure:

- Minimum 31 m setback from waterbodies, 51 m setback where ever possible;
- Minimum 30 m buffer zone from known rare plants; and
- Minimum 30 m buffer zone from known archeological sites.

While priority was given to avoid these areas, in some cases the minimum buffer around archeological sites could not be maintained. In these instances, the archeological site will be mitigated in accordance with the Heritage Resources Management Plan.

3 Alternatives

3.1 Level of Surface Infrastructure Development

Three alternative levels of development were considered for Madrid North as described in Table 2.1.

Table 2.1: Alternative Level of Surface Infrastructure Development

Alternative	Details
No surface Infrastructure, Access via Doris Portal	Access to Madrid North deposits would be underground via the Doris, Connector and Central underground workings, with no surface infrastructure, and no portal. This alternative would result in substantial additional underground development and associated waste rock, a need for additional vent raises, and substantial underground haul distances which are less effective than surface haul.
Full Satellite Mine Development	Vent raise, portal, and infrastructure pads with all-weather road access to Doris. All waste rock would be stored on-site until final deposition underground. Infrastructure pad footprint is not much larger than the minimal development option.
Complete Standalone Mine Development	Construction and operation of a camp and processing facility at Madrid North. This would require extensive additional infrastructure footprint similar to that currently at Doris.
Hybrid Satellite Mien Development	Construction of a nominal concentrator processing facility at Madrid North in addition to all of the remaining facilities planned for the full satellite mine development alternative. No camp facilities. This would require less footprint than a complete standalone mine, but offer the flexibility of local; processing of higher grade ore.

The hybrid satellite mine development alternative is the preferred alternative because it has the smallest surface footprint while maximizing flexibility, produces less waste rock, and surface haul is more effective than underground haul.

3.2 Waste Rock Pile

Waste rock needs to be temporarily stored on surface until it can be returned underground for use as backfill. Table 3.1 describes four waste rock piles that were considered. The west waste rock pile, configures as hilltop facility was selected as the preferred location based on the portal location, water management requirements and overall footprint size.

Table 3.2: Alternative Waste Rock Pile Locations

Alternative	Details
South Waste Rock Pile – Gulley Fill	For this alternative, the waste rock pile would span a gulley to the south of the rock outcrop where the portal will be located. The ore stockpile and portal infrastructure would be located uphill from the waste rock pile. Two contact water ponds would be required to contain contact water, one of which would be expected to have high berms. Extensive no-contact water diversions would be required to prevent freshwater from running onto infrastructure pads. This alternative would have a compact footprint.
South Waste Rock Pile – Sidehill	For this alternative, the waste rock pile would be constructed on the side of the hill south of the rock outcrop where the portal will be located. The ore stockpile and portal infrastructure would be located uphill from the waste rock pile. Two contact water ponds would be required, one of which would be expected to have high berms. This alternative would have a larger footprint, and only minor freshwater diversions would be required.
West Waste Rock Pile - Hilltop	For this alternative the waste rock pile would be constructed on top of the rock outcrop west of the portal location. The ore stockpile would be downhill of the waste rock pile, draining into the same contact water pond. It is expected that one contact water pond with relatively low berms would be required. Development of the portal and infrastructure pad would require cutting into the rock. This alternative would have a relatively compact layout.
East Waste Rock Pile - Hilltop	For this alternative, the waste rock pile would be constructed on top of the rock outcrop to the west of the portal location. The waste rock stockpile would be constructed in part on rock outcrop. Two contact water ponds would be required, both ponds would require low berms. Diversion berms would be required to direct the contact water towards the contact water ponds and reduce run-on from freshwater. This alternative would have a larger footprint.

3.3 Contact Water Ponds

Downstream of waste rock piles, or other surface infrastructure components that may result in impacted contact water, contact water ponds will be constructed. These ponds are event ponds, (i.e. they are intended to be empty except immediately following an event). Two contact water pond designs were considered (Table 3.2).

Table 3.3: Alternative Contact Water Pond Designs

Alternative	Details
Lined Pond (Geomembrane)	The pond is fully lined with a geomembrane. The advantage of this design is that it is a conventional lined pond that will not be affected by climate change and the less complex alternative. The disadvantages of this design are that the geomembrane and bedding layers on the pond floor will thaw the permafrost, which may create a depression resulting in water accumulation and more thaw after the geomembrane is removed at closure. Additionally, placement of the liner could be challenging depending of the terrain.
Unlined Pond (Permafrost)	Water is contained within the unlined pond by permafrost on the bottom of the pond, and a geomembrane within the berm. This design is dependent on the base of the berm remaining frozen. The advantage of this design, provided the pond is properly managed, is the permafrost and vegetation on the pond floor should not be degraded, reducing potential issues at closure. The disadvantage of this design is thick berms are required to ensure the geomembrane tie-in remains frozen. This design is also dependent on the expected temperature changes due to climate change. Higher than expected temperature increases would require modification of the berms to ensure the liner tie-in remains frozen.

The unlined pond is the preferred alternative. The advantage of not placing a geomembrane on the floor of the pond is believed to overcome the disadvantages of thicker berms. Uncertainties in thermal performance of the berms can be addressed by a monitoring program, and additional material can be placed if deemed necessary to protect the thermal integrity of the liner tie-in.

4 System Design

4.1 Waste Rock Pile and Ore Stockpile

4.1.1 Design Criteria

The waste rock pile and ore stockpile are expected to be temporary facilities, with all waste rock being returned underground as mine backfill, and all ore transported to Doris for processing. The design criteria for these two facilities are listed below:

- Minimum waste rock storage capacity of 646,000 tonnes (359,000 m^3, based on an in place density of 1.8 t/m^3);
- Minimum ore storage capacity of 16,000 tonnes (9,000 m^3), based on an in place density of 1.8 t/m^3), which is equivalent to five days storage at maximum production;
- Maximum overall slope angle of 2H:1V (26.5°), assuming inter-bench angle of repose slopes of 1.3H:1V (37.5°), bench heights of 5 m, and bench widths of 6 m;
- Maximum height of 100 m;
- Factors of safety (FOS) as defined in the Mined Rock and Overburden Piles Interim guidelines (Piteau 1991) of:
  - 1.1 for pile surface during construction;
  - 1.3 for short and long term deep seated stability; and
  - 1.1 for pseudo-static deep seated stability;

- Seismic parameters, as defined in the Mined Rock and Overburden Piles Interim Guidelines (Piteau 1991) for an event with a 10% probability of exceedance in 50 years (1:500 year return period); and
- Design vehicle is a loaded Sandvik TH540 (40 tonne) haul truck.

4.1.2 Design

The Madrid North waste rock pile has a maximum available capacity of 652,000 tonnes (359,000 m^3), and a maximum height of approximately 20 m. The waste rock pile is located on a 1 m thick run–of-quarry (ROQ) or geochemically suitable run-of-mine (ROM) waste rock material pad. The waste rock pile pad will cover an area of 42,000 m^2 and the ore stockpile pad will cover an area of 2,500 m^2 within the upper portal pad.

The Madrid North waste rock pile has a dump stability rating of LOW according to the classification standards outlined by the Mined Rock and Overburden Piles Interim Guidelines (Piteau 1991). This rating is due to the shallow foundation slopes, low seismicity, side hill design, thin lifts, and slow dumping rate (Attachment 1).

To evaluate the stability of all site waste rock piles, a stability analysis was performed on the Madrid South waste rock pile, and a conceptual maximum waste rock pile with a height of 100 m. This analysis indicates that waste rock piles on site are expected to be stable, provided that the design vehicle remains 5.5 m from the crest of the pile during operations. Details of the stability analysis including material properties, and seismic parameters used in this assessment are described in SRK (2006a).

4.2 Contact Water Pond

4.2.1 Design Criteria

The contact water pond will be an event pond that will intercept all contact water runoff from the waste rock pile, ore stockpile and portal pads. Specific design criteria are listed below:

- The pond will be normally empty (i.e. the pond will be kept in a dry state);
- Maximum residence time for ponded water is one week;
- 20-year design life;
- Effects of climate change during the 2011 to 2040 time frame will be considered;
- The pond will have the capacity to contain, at a minimum, the contact water from the 1:100 year, 24-hour storm event (55 mm), and the maximum daily snowmelt (18 mm);
- Operational freeboard of 0.3 m;
- Maximum geomembrane slopes of 2H:1V (26.5°);
- Berms that make up the pond will be used as an access road;
- Berms will be constructed from geochemically suitable ROQ rock or ROM waste rock; and
- Permafrost damage within the pond should be minimized.

4.2.2 Design

There will be a single unlined contact water pond at Madrid North, this pond will be located downstream of the waste rock pile and ore stockpile. As described in Section 3.1, the unlined pond design uses the permafrost and naturally low permeability of the foundation materials to contain the contact water on the bottom of the pond, and a geomembrane liner acts as the impermeable layer within the berm. This design hinges on the contact between the geomembrane and permafrost soil remaining frozen.

The key features of the contact water pond berm design are listed below and in Drawing MNP-10 (Attachment 2):

- 8 m wide crest;
- Side slopes of 2H:1V (26.5°);
- 2.5 m minimum thickness thermal insulation to ensure the contact between the geomembrane and permafrost soils remains frozen;
- Two thermistors to monitor thermal performance of the berm. Should monitoring data indicate that temperatures within the berm are warmer than expected and the liner tie-in is in danger of thawing, additional fill material can be placed on top of the berm to provide additional insulation;
- Minimum of 1 m cover between the top of the geomembrane and the driving surface;
- Geomembrane slope of 2H:1V (26.5°);
- Textured high density polyethylene (HDPE) liner sandwiched between two layers of heavy duty non-woven geotextile, except at the liner tie-in;
- Two 0.3 m thick layers of bedding material (crushed and screened geochemically suitable quarry or waste rock material) surrounding the HDPE liner; and
- Surface area of 16,000 m^2.

Thermal modeling was completed to demonstrate that the contact water ponds would perform as expected (SRK 2016d).

4.3 Infrastructure Pads

4.3.1 Design Criteria

The design criteria for the infrastructure pads are listed below.

- Minimum fill thickness of 1 m;
- 1.5H:1V (34°) side slopes when fill thickness are less than 2 m;
- 2H:1V (26.5°) side slopes when fill thicknesses are great than 2 m;
- No cut is allowed in overburden; and
- The floor of bedrock cuts should slope at 1% to shed water.

4.3.2 Design

The pads are designed with a minimum 1 m fill thickness which consists of a minimum of 0.85 m of ROQ of geochemically suitable waste rock material overlain by 0.15 m of surfacing material consisting of crushed quarry or waste rock material. The exception being the waste rock pile and ore stockpile pads which do not have the layer of surfacing material. The mining area pads are sloped at 0.5% towards the contact water pond. Design analysis to demonstrate the suitability of a 1 m thick ROQ pad to protect the permafrost is presented in SRK (2016e).

4.4 Access and Haul Roads

4.4.1 Design Criteria

Five access roads are needed in the Madrid North mining area: (1) an access/haul road that links the mining infrastructure with the Madrid-South all-weather road (upper portal access Road), (2) an access road around the contact water pond berm (pond access road), (3) an access/haul road that links the fuel storage facility with the mining infrastructure and with the Madrid-South all-weather road (fuel storage facility access road), (4) an access road to the Madrid North air heating facility and vent raise (Madrid-North air heating facility access road), and (5) an access road to the two other vent raise pads (vent raise pad access road).

The design criteria for the access and haul roads is similar to that used on other roads at the Project site. Specific criteria are:

- The design vehicles will be crew cab trucks, personnel transfer busses, Super B fuel trucks and Super B trucks, mine trucks, and lowbed trucks. In addition, construction equipment will periodically travel the road, which is expected to include CAT 988 loaders, and CAT 330 excavators.
- Haul roads shall have a maximum grade of 7%, while access roads shall have a maximum grade of 10%.
- The roadway will be crowned at 0.5% to promote drainage.
- Side slopes shall be 2H:1V (26.5°) when fill thickness is greater than 2 m and 1.5H:1V (34°) when fill thicknesses are less than 2 m.
- Unless otherwise noted, roads shall be single lane with turnouts to allow for passing.
- Single lane access road should be a minimum of 8 m wide and dual lane haul roads should be a minimum of 9.5 m wide.
- Where road thickness is greater than or equal to 3 m, safety berms or barriers will be placed along the road edge and the road crest will be widened to accommodate the berms.
- No cut is allowed into overburden.

4.4.2 Design

The upper portal access road is 300 m long and 10.0 m wide and extends from the Madrid-South all-weather road to the portal upper pad. The pond access road will come off the side of this road. These road can be seen on Drawing DEIS-MN-03 (Attachment 2).

The pond access road will run from the portal pad around the contact water pond berms (Drawing DEIS-MN-03, Attachment 2) to the upper portal access road adjacent to the laydown area. This road is 440 m long and 8.0 m wide.

The fuel storage facility access road runs from the Madrid-South all-weather road to the upper portal pad via the fuel storage facility and the waste rock pile pad (Drawing DEIS-MN-03, Attachment 2). This road is 450 m long and 10.0 m wide. A fuel storage facility bypass road links the fuel storage facility access road and the waste rock pile, bypassing the fuel storage facility. The fuel storage facility bypass road is 115 m long and 8.0 m wide.

The Madrid North air heating facility access road is 130 m long and 8.0 m wide, and extends from the Madrid-South all-weather road to the Madrid North air heating facility and vent raise (Drawing DEIS-MN-07, Attachment 2).

The vent raise pad access road is 1,130 m long and 8.0 m wide, and extends from the Madrid-South all-weather road to the south-east (Drawing DEIS-MN-09, Attachment 2).

All roads will be constructed of geochemically suitable ROQ or ROM material, with a 0.15 m thick surfacing layer.

4.5 Fuel Storage Facility

4.5.1 Design Criteria

The fuel storage facility will include a fuel transfer station for refueling of vehicles. Design criteria for the fuel storage facility and fuel transfer station are listed below.

- Fuel storage tank and transfer station will be within a lined facility to provide secondary containment.
- The total fuel tank capacity will be 4.5 ML (three 1.5 ML tanks).
- The design vehicles for the facility are crew cab trucks, and Super B fuel trucks (60,000 L capacity).
- The secondary containment facility will be designed to contain 110% of the largest fuel tank volume, 10% of the fuel transport truck volume, all the rainfall from the 1:100 year, 24-hour storm (55 mm) and the average maximum daily snowmelt (18 mm).
- The containment area should have a minimum slope of 1% towards a sump.

In addition, the fuel storage facilities should be designed to the following codes and guidelines:

- NFPA 30, Flammable and Combustible Liquids Code, 2015 Edition (NFPA 2014);
- SOR/2008-197, Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations (Government of Canada 2012);
- Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products (CCME 2015); and
- ORD-C58.9-1997, Secondary Containment Liners for Underground or Aboveground Tanks.

4.5.2 Design

The entire footprint of the fuel storage area will be lined with an HDPE geomembrane sandwiched between two layers of 12 oz. non-woven geotextile. A 0.15 m thick layer of bedding material will underlie the geomembrane, and a 0.3 m thick bedding layer will overlie the geomembrane. The interior of the facility will also have a 0.3 m thick layer of surfacing material.

The fuel tanks will be located in the center of the facility, a minimum of 3.0 m from the base of the containment area berms to allow access. The containment berms will be constructed of transition material overlain by the geomembrane and bedding layers described above. The berms will have interior slopes of 2H:1V (26.5°) to allow for geomembrane placement, and exterior slopes of 1.5H:1V (34°). The secondary containment facility will have a surface area of approximately 5,400 m^2, and a minimum containment capacity of 2,100 m^3.

The fuel transfer station, will be a 6 m wide ramp allowing vehicles to drive through the facility. It will consist of ramps sloping at 7% entering and exiting the facility and internal ramps sloping at 10% to a 6.7 m long flat area at the center of the facility. The flat area is where the fuel transfer module will be set up and where refueling will occur.

Details of the fuel storage facility design are presented in Drawing DEIS-MN-06 (Attachment 2).

5 Construction Methodology

All construction fill materials will be obtained from geochemically suitable permitted quarries, or geochemically suitable waste rock. Management and monitoring of these quarries will be according to the quarry monitoring plan which will be submitted under another cover. Surfacing (32 mm minus), bedding (19 mm minus), and transition (150 mm minus) materials will be produced at an on-site crusher located within one of the permitted quarries. The estimated construction quantities are provided in Drawing MNP-12 (Attachment 2).

Based on previous surface infrastructure construction on the Project, it is assumed that the construction fleet will consist of CAT 730 haul trucks, CAT 773 haul trucks, CAT D8 dozers, CAT C330 excavator(s), CAT CS563 compactor and a crusher.

Prior to construction, the road alignments and pad areas should be cleared of snow and ice. At no time will disturbance of the tundra vegetation or soils be allowed outside of the road footprint, and no permafrost disturbance will be allowed. Construction fill will be placed by end-dumping on the existing road or pad surface and pushing the dumped material with a bulldozer. Surfacing material will not be placed until the ROQ material layer is at its design grade and level. All construction should be performed in accordance with the technical specifications (SRK, 2011). Where necessary, rock drains will be installed at topographic lows to ensure no standing water is created along the edges of roads or pads. Prior to quarry excavation, all overburden material should be stripped and placed in the overburden dump.

Wherever possible, pads and roads will be constructed in the winter to ensure the foundation materials remain frozen. Summer construction may be required to meet development schedules. Winter and summer construction techniques will be identical; however, summer construction will result in the use of more construction material as greater imbedding of material into the active layer will occur. Summer construction will also require careful screening of the site for nesting birds, and modifications to the construction schedule may be required to avoid disturbing nesting populations.

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Attachment 1:
Waste Rock Pile Dump Stability Rating

Structure Name: Madrid North Waste Rock Pile

Key Factor Affecting Stability	Conditions	Description	Rating Points
Pile height (m)	<50m		0
Pile volume (m³)	Small	< 1 million BCM's	0
Pile slope	Moderate	26 - 35 deg	50
Foundation Slope	Moderate	10%-25%	50
Degree of confinement	Unconfined	-Convex slope in plan or section Sidehill or ridge crest fill with no toe confinements -No gullies or benches to assist development	100
Foundation Type	Weak	- Limited bearing capacity, soft soils - Subject to adverse pore pressure generation upon loading -Adverse groundwater conditions, springs or seeps - Strength sensitive to shear strain, potentially liquifiable	200
Pile Material Quality	High	- Strong, durable - Less than about 10% fines	0
Method of Construction	Favorable	- Thin lifts (<25m thick), wide platforms -Dumping along contours -Ascending construction -Wrap-arounds or terraces	0
Piezometric and Climatic Conditions	Intermediate	- Moderate piezometric pressures, some seeps in foundation - Limited development of phreatic surface in dump possible - Moderate precipitation - High infiltration into dump - Discontinuous snow or ice lenses or layers in dump	100
Dumping rate	Slow	- <25 BCM's per lineal metre of crest per day - Crest advancementrate < 0.1m per day	0
Seismicity	Low	Seismic Risk Zone 0 and 1	0
		Dump Stability Rating (DSR)	

Pile Stability Class	Failure Hazard	Recommended Level of Effort for Investigation, Design and Construction	Dump Stability Rating (DSR)
2	**Low**	- Thorough site investigation - Test pits, sampling may be required - Limited lab index testing - Stability may or may not influence design - Basic stability analysis required - Limited restrictions on construction - Routine visual and instrument monitoring	**500**
Comments: The foundation type listed is for thawed conditions, under frozen conditions the foundation type would be concidered intermediate or competent			

Based on the BC Mine Waste Rock Pile Research Committee; Mined Rock and Overburden Piles Investigation and Design Manual, Interm Guidelines, May 1991.

Attachment 2:
Engineering Drawings for Madrid North Surface Infrastructure

Engineering Drawings for the Madrid North DEIS Surface Infrastructure, Hope Bay Project, Nunavut, Canada

ACTIVE DRAWING STATUS

DWG NUMBER	DRAWING TITLE	REVISION	DATE	STATUS
DEIS-MN-01	Engineering Drawings for the Madrid North DEIS Surface Infrastructure, Hope Bay Project, Nunavut, Canada	A	Nov. 9, 2016	Issued for Discussion
DEIS-MN-02	General Arrangement Doris North Camp to Madrid North Portal	A	Nov. 9, 2016	Issued for Discussion
DEIS-MN-03	Site Layout Portal	A	Nov. 9, 2016	Issued for Discussion
DEIS-MN-04	Portal Pads Access Road Profiles	A	Nov. 9, 2016	Issued for Discussion
DEIS-MN-05	Sections A, B, C and D	A	Nov. 9, 2016	Issued for Discussion
DEIS-MN-06	Fuel Storage Facility Plan and Sections	A	Nov. 9, 2016	Issued for Discussion
DEIS-MN-07	Air Heating Facility Vent Raise Layout	A	Nov. 9, 2016	Issued for Discussion
DEIS-MN-08	Vent Raise Sections G and H	A	Nov. 9, 2016	Issued for Discussion
DEIS-MN-09	Vent Raise Access Road Plan and Profile	A	Nov. 9, 2016	Issued for Discussion
DEIS-MN-10	Contact Water Pond Berm and Details	A	Nov. 9, 2016	Issued for Discussion
DEIS-MN-11	Details	A	Nov. 9, 2016	Issued for Discussion
DEIS-MN-12	Typical Road Plan and Sections	A	Nov. 9, 2016	Issued for Discussion
DEIS-MN-13	Material List and Quantity Estimates	A	Nov. 9, 2016	Issued for Discussion

TMAC RESOURCES

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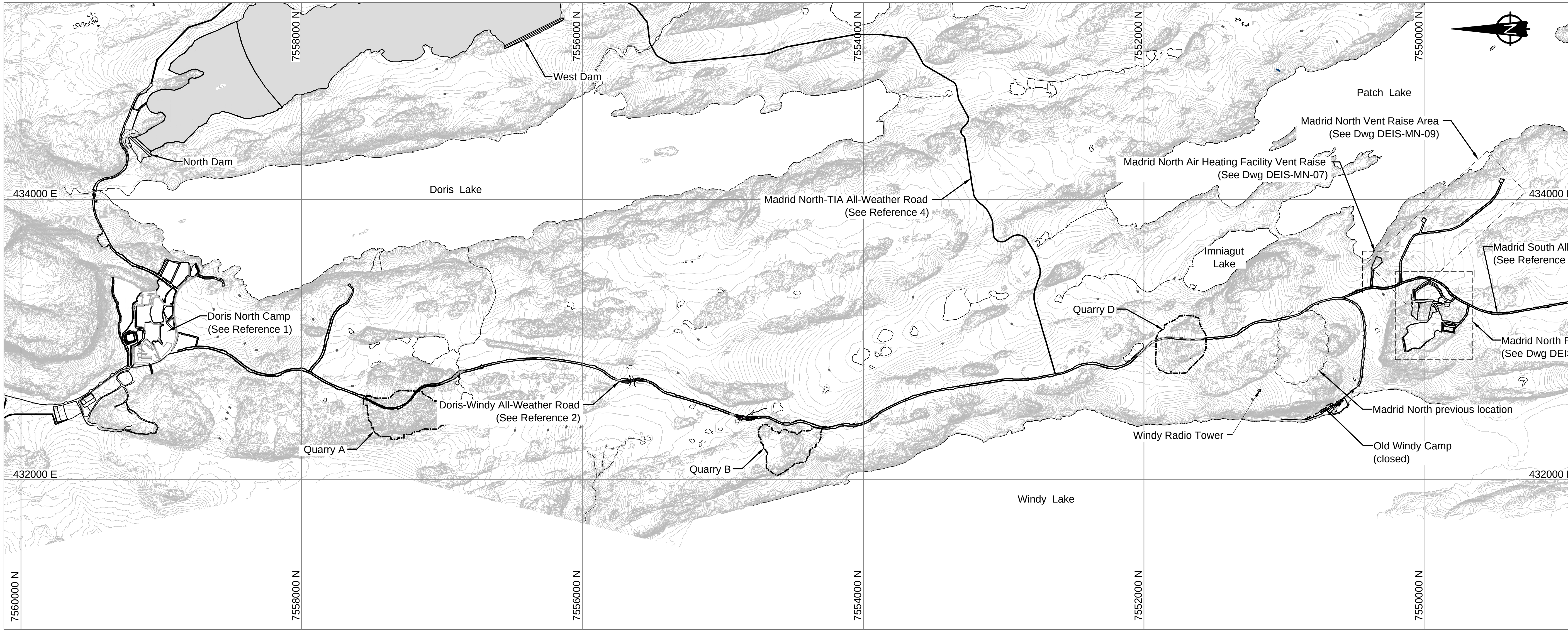
PROJECT NO: 1CT022.004
Revision A
November 9, 2016
Drawing DEIS-MN-01



NOTES

1. Topographic contour data for the terrain model were provided by Hope Bay Mining, and is based on 2007 Aerial Photography. Contour intervals are 1m.
2. The co-ordinate system is UTM NAD 83, Zone 13.
3. All dimensions are in metric units, unless specifically mentioned.
4. Notes in this drawing apply to all other active drawings.

REFERENCES

1) Engineering Drawings for the Doris North Camp Area, Doris North Project, Nunavut, Canada. Revision AB1. As-Built Drawings Prepared for Hope Bay Mining Limited. Project Number 1CH008.033. May 18, 2012
2) Engineering Drawings for the Doris-Windy All-Weather Road, Doris Infrastructure Project, Nunavut, Canada. Revision AB1. As-Built Drawings Prepared for Hope Bay Mining Ltd. Project Number: 1CH008.033/.058. May 11, 2012
3) Engineering Drawings for the Madrid South All-Weather Road, Hope Bay Project, Nunavut, Canada. Revision D. Issued for Discussion Drawings Prepared for TMAC Resources Inc. Project Number 1CT022.001.410. October 31, 2014
4) Engineering Drawings for the Madrid North to TIA All-Weather Road, Hope Bay Project, Nunavut, Canada. Revision A. Issued for Discussion Drawings Prepared for TMAC Resources Inc. Project Number 1CT022.004. November, 2016

0 200 400 600 800 100
Scale in Metres

DRAWING NO.	DRAWING TITLE	DRAWING NO.	DRAWING TITLE
REFERENCE DRAWINGS			

NO.	DESCRIPTION	CHK'D	APP'D	DATE
A	Issued for Discussion	MMM	EMR	9Nov16
REVISIONS				

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DESIGN: MMM | DRAWN: NV | REVIEWED: MMM
CHECKED: MMM | APPROVED: EMR | DATE: Nov. 2016
FILE NAME: 1CT022.004_DEIS_MN-1 Overview.dwg

TMAC RESOURCES

HOPE BAY PROJECT

SRK JOB NO.: 1CT022.004

Madrid North DEIS Surface Infrastructure

DRAWING TITLE:
General Arrangement
Doris North Camp to
Madrid North Portal

DRAWING NO.: DEIS-MN-02 | SHEET 2 OF 13 | REVISION NO. A

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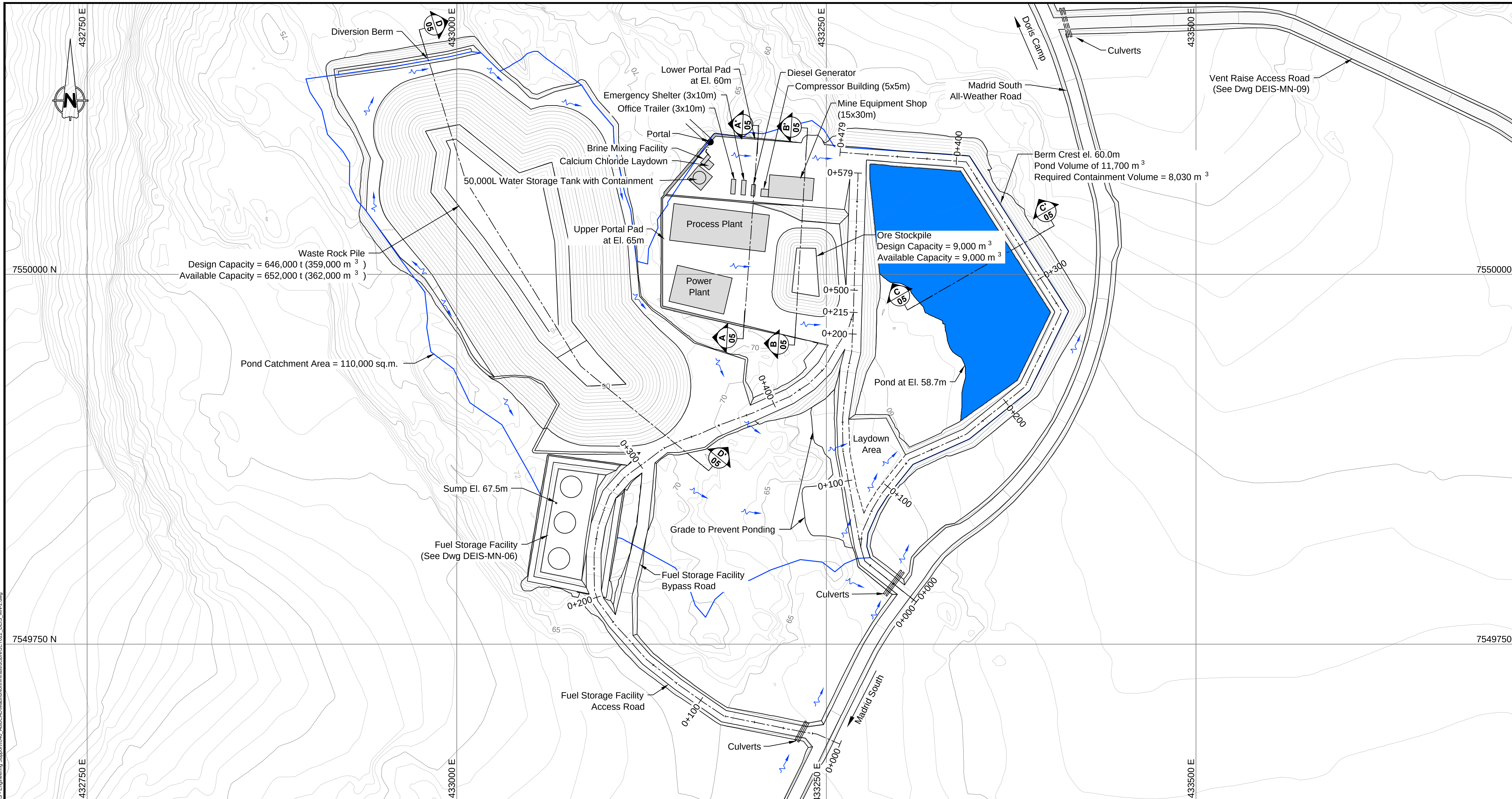

NOTES

1. All dimensions in metres unless noted otherwise.
2. Notes in this drawing apply to all other active drawings.

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Scale in Metres

DRAWING NO.	DRAWING TITLE	DRAWING NO.	DRAWING TITLE
REFERENCE DRAWINGS			

NO.	DESCRIPTION	CHK'D	APP'D	DATE
A	Issued for Discussion	MMM	EMR	9Nov16
REVISIONS				

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srk consulting

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CHECKED: MMM	APPROVED: EMR	DATE: Nov. 2016

FILE NAME: 1CT022.004_DEIS_MN-2.dwg

TMAC RESOURCES

HOPE BAY PROJECT

SRK JOB NO.: 1CT022.004

Madrid North DEIS Surface Infrastructure

DRAWING TITLE:
Site Layout Portal

DRAWING NO.	SHEET	REVISION NO.
DEIS-MN-03	3 OF 15	E

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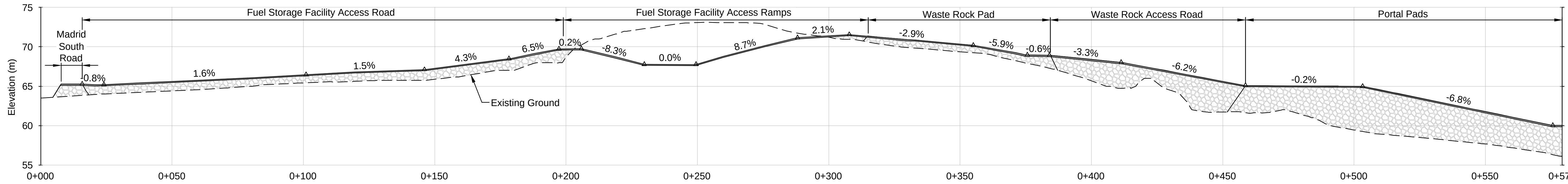
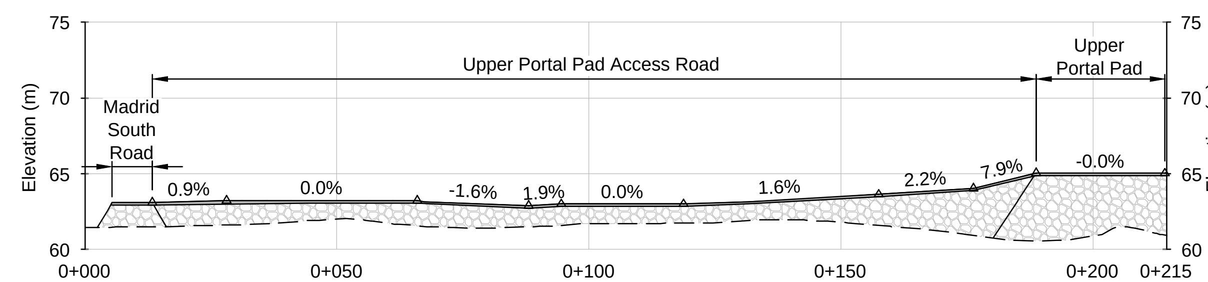


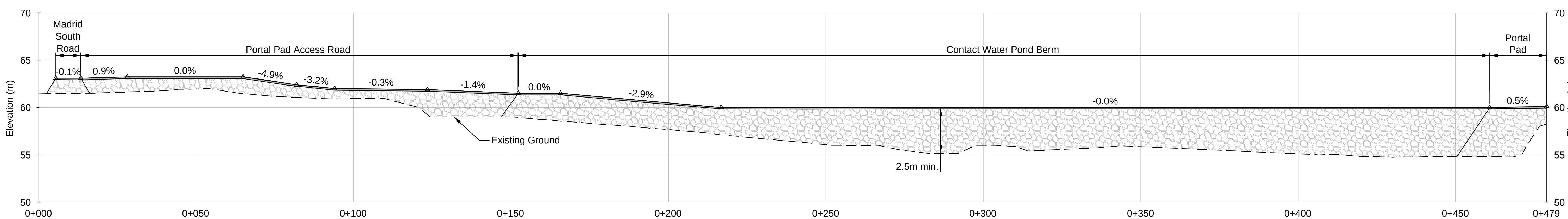
PORTAL PAD VIA FUEL STORAGE FACILITY ROAD PROFILE

0 5 10 15 20 25
Horizontal Scale in Metres
Vertical Exaggeration 3X



UPPER PORTAL PAD ACCESS ROAD PROFILE

0 5 10 15 20 25
Horizontal Scale in Metres
Vertical Exaggeration 3X



PORTAL PAD ACCESS ROAD / CONTACT WATER POND BERM PROFILE

0 5 10 15 20 25
Horizontal Scale in Metres
Vertical Exaggeration 3X

LEGEND

- — — — Existing ground surface
- Surfacing Material
- Run of Quarry Material
- Point of Intersection
- 6.1% Grade

NOTES

1. All dimensions in metres unless noted otherwise.
2. Notes in this drawing apply to all other active drawings.

DRAWING NO.	DRAWING TITLE	DRAWING NO.	DRAWING TITLE
REFERENCE DRAWINGS			

NO.	DESCRIPTION	CHK'D	APP'D	DATE
A	Issued for Discussion	MMM	EMR	9Nov16
REVISIONS				

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FILE NAME: 1CT022.004_DEIS_MN-2.dwg

TMAC RESOURCES

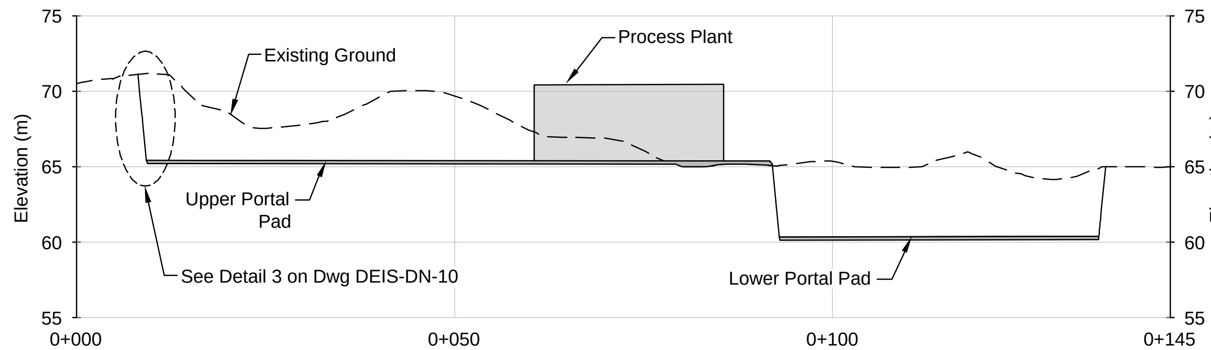
HOPE BAY PROJECT

SRK JOB NO.: 1CT022.004

Madrid North DEIS Surface Infrastructure

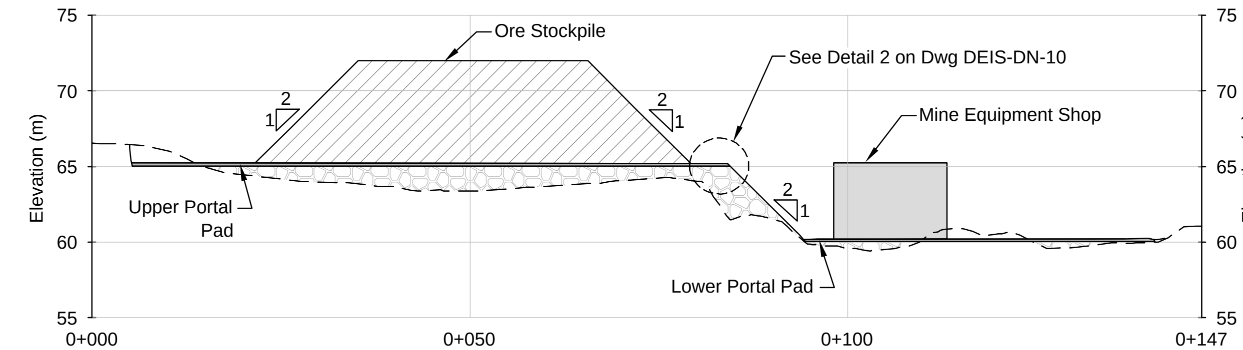
DRAWING TITLE: Portal Pads Access Road Profiles

DRAWING NO. DEIS-MN-04 | SHEET 4 OF 15 | REVISION NO. A



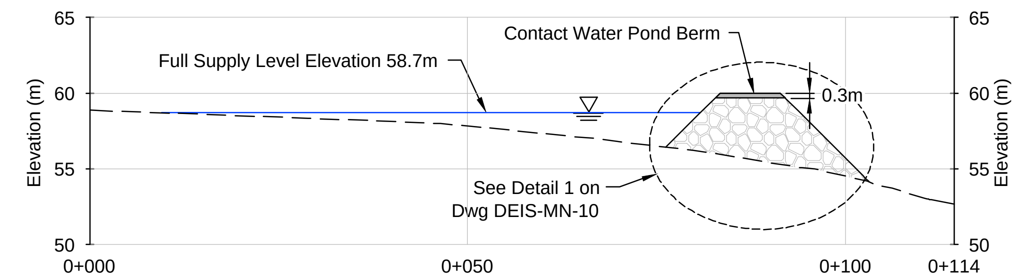
A 03 SECTION A

0 5 10 15 20 25
Horizontal Scale in Metres
Vertical Exaggeration 2X



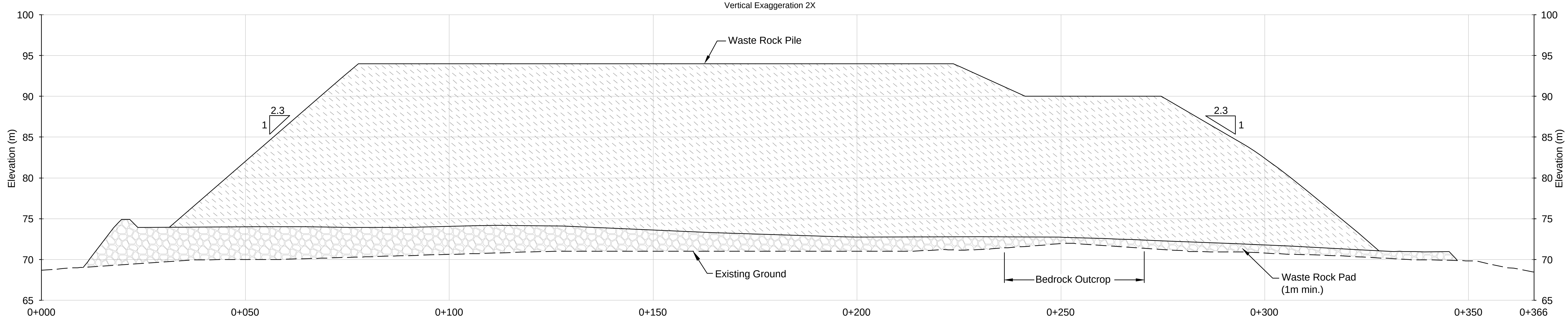
B 03 SECTION B

0 5 10 15 20 25
Horizontal Scale in Metres
Vertical Exaggeration 2X



C 03 SECTION C

0 5 10 15 20 25
Horizontal Scale in Metres
Vertical Exaggeration 2X



D 03 SECTION D

0 5 10 15 20 25
Horizontal Scale in Metres
Vertical Exaggeration 2X

LEGEND

- Existing ground surface
- Surfacing Material
- Run of Quarry Material
- Waste Rock
- Ore Stockpile

NOTES

1. All dimensions in metres unless noted otherwise.
2. Where the thickness of the pads is greater than 3.0m allow for the placement of barriers.
3. The barriers are to consist of boulders larger than 1m in diameter, jersey-barriers (1.82 long X 1.37m high X 0.61m wide) or a rock fill berm 0.5m high. Maximum spacing between barriers is 3.3m.
4. Notes in this drawing apply to all other active drawings.

DRAWING NO.	DRAWING TITLE	DRAWING NO.	DRAWING TITLE	NO.	DESCRIPTION	CHK'D	APP'D	DATE
				A	Issued for Discussion	MMM	EMR	9Nov16

REFERENCE DRAWINGS — REVISIONS

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CHECKED: MMM | APPROVED: EMR | DATE: November 2016
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HOPE BAY PROJECT

SRK JOB NO.: 1CT022.004

Madrid North DEIS Surface Infrastructure

DRAWING TITLE: Sections A, B, C and D

DRAWING NO. DEIS-MN-05 | SHEET 5 OF 15 | REVISION NO. A

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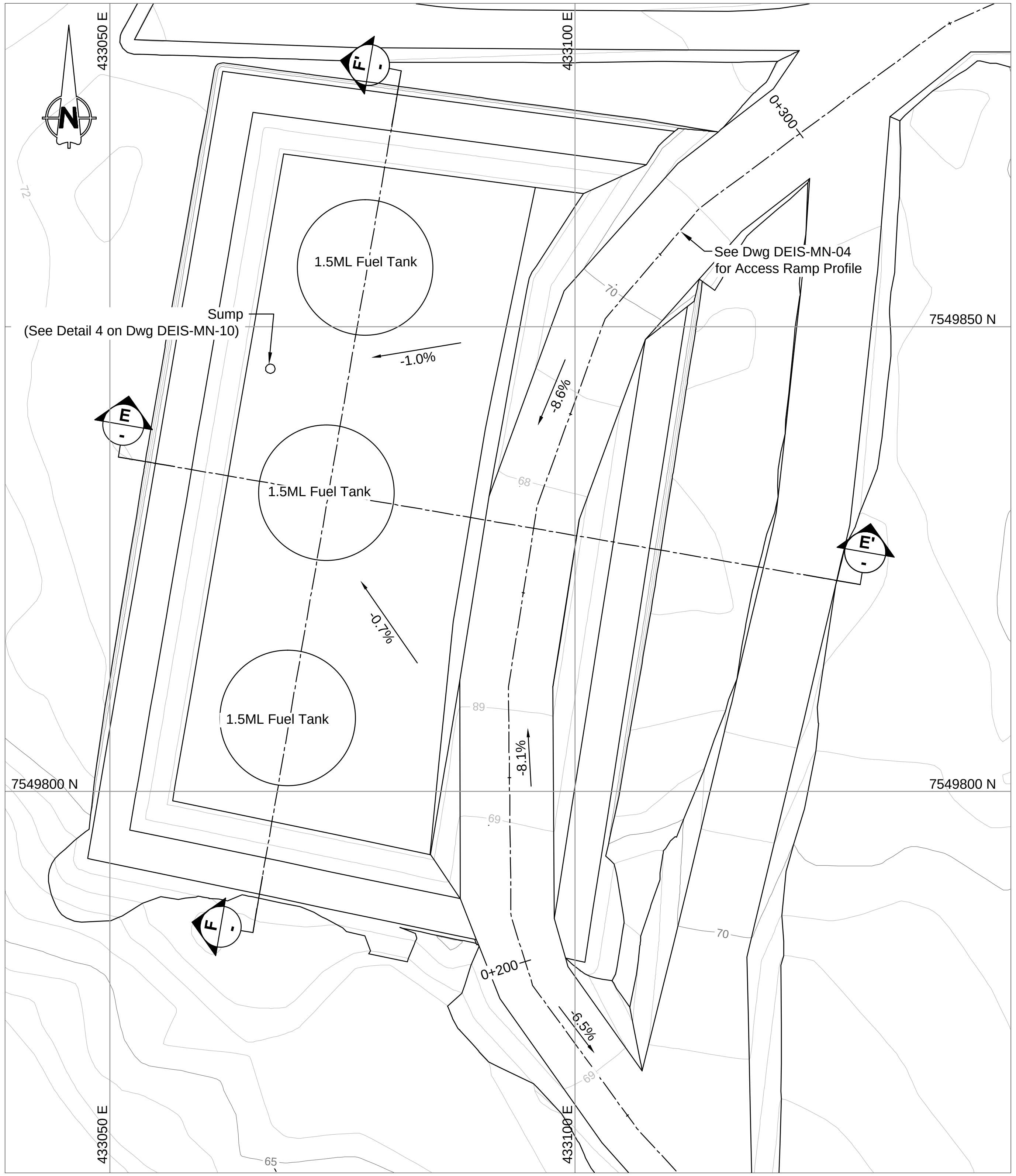
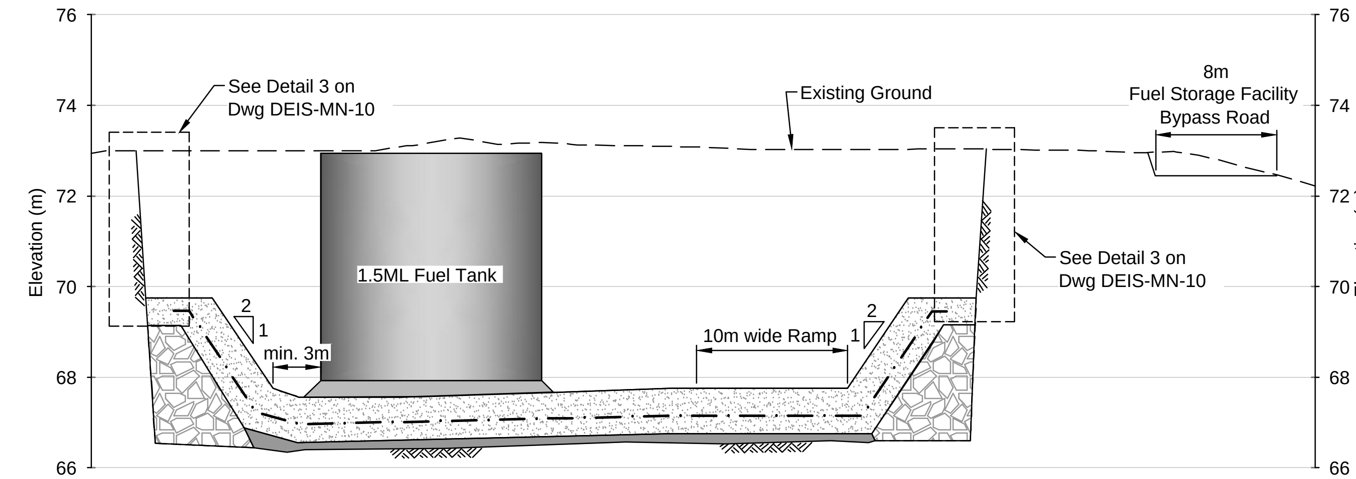


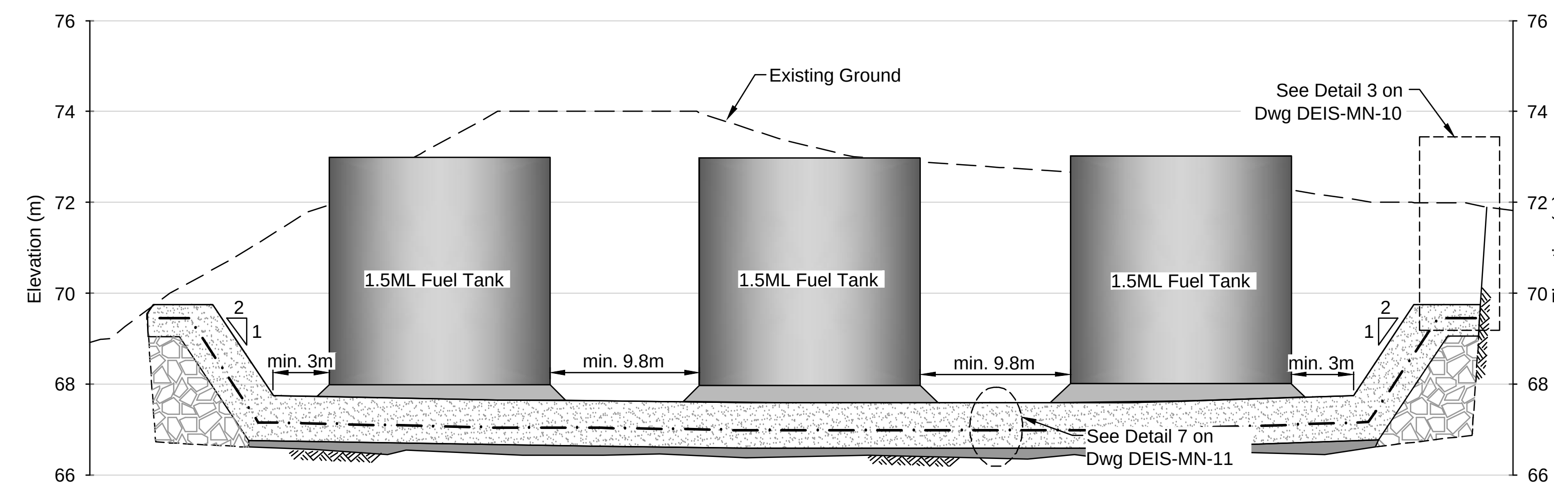
FUEL STORAGE FACILITY PLAN VIEW

0 2 4 6 8 10
Scale in Metres



SECTION E

0 2 4 6 8 10
Horizontal Scale in Metres
Vertical Exaggeration 3X



SECTION F

0 2 4 6 8 10
Horizontal Scale in Metres
Vertical Exaggeration 3X

LEGEND

- Surfacing Material
- Bedding Material
- Run of Quarry Material
- Liner System

NOTES

1. The coordinate system is UTM Zone 13, NAD83.
2. Dimensions in metres unless noted otherwise.
3. Contour labels are oriented facing upslope.

NO.	DESCRIPTION	CHK'D	APP'D	DATE
A	Issued for Discussion	MMM	EMR	9Nov16

REFERENCE DRAWINGS: DRAWING NO. | DRAWING TITLE | DRAWING NO. | DRAWING TITLE

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MAC RESOURCES

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CHECKED: MMM | APPROVED: EMR | DATE: November 2016
FILE NAME: 1CT022.004_DEIS_MN-2.dwg

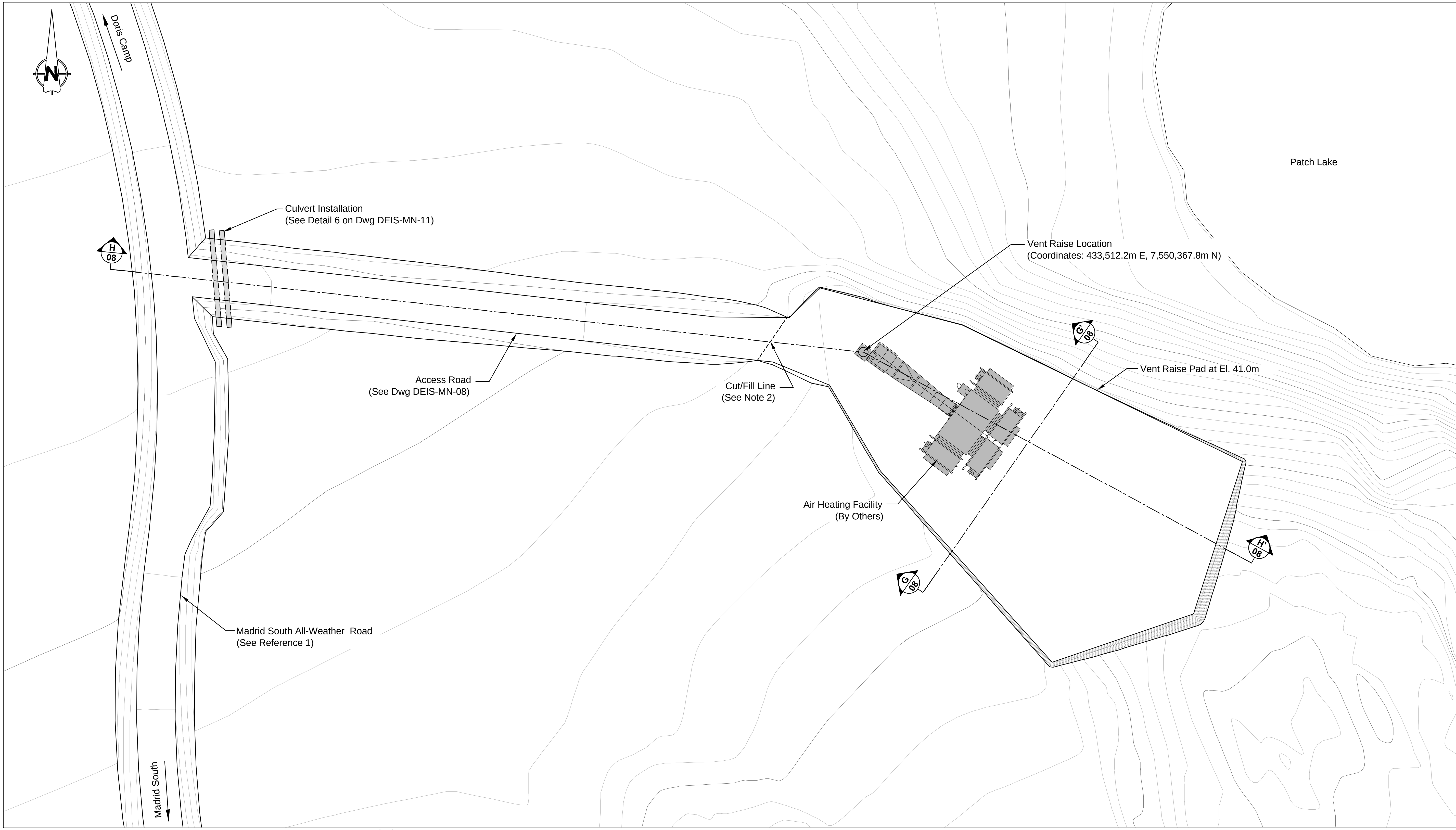
HOPE BAY PROJECT

SRK JOB NO.: 1CT022.004

Madrid North DEIS Surface Infrastructure

DRAWING TITLE:
Fuel Storage Facility
Plan and Sections

DRAWING NO.: DEIS-MN-06 | SHEET 6 OF 13 | REVISION NO. A



NOTES

1. All dimensions in metres unless noted otherwise.
2. Cut into bedrock outcrop required for construction of vent raise collar.
3. Notes in this drawing apply to all other active drawings.

REFERENCES

1) Engineering Drawings for the Madrid South All-Weather Road, Hope Bay Project, Nunavut, Canada. Revision D. Issued for Discussion Drawings Prepared for TMAC Resources Inc. Project Number 1CT022.001.410. October 31, 2014

0 4 8 12 16 20
Scale in Metres

DRAWING NO.	DRAWING TITLE	DRAWING NO.	DRAWING TITLE

REFERENCE DRAWINGS

NO.	DESCRIPTION	CHK'D	APP'D	DATE
A	Issued for Discussion	MMM	EMR	9Nov16

REVISIONS

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CHECKED: MMM	APPROVED: EMR	DATE: November 2016

FILE NAME: 1CT022.004_DEIS_MN-2.dwg

TMAC RESOURCES

HOPE BAY PROJECT

SRK JOB NO.: 1CT022.004

Madrid North DEIS Surface Infrastructure

DRAWING TITLE:
Air Heating Facility
Vent Raise Layout

DRAWING NO.: DEIS-MN-07 | SHEET 7 OF 13 | REVISION NO. A

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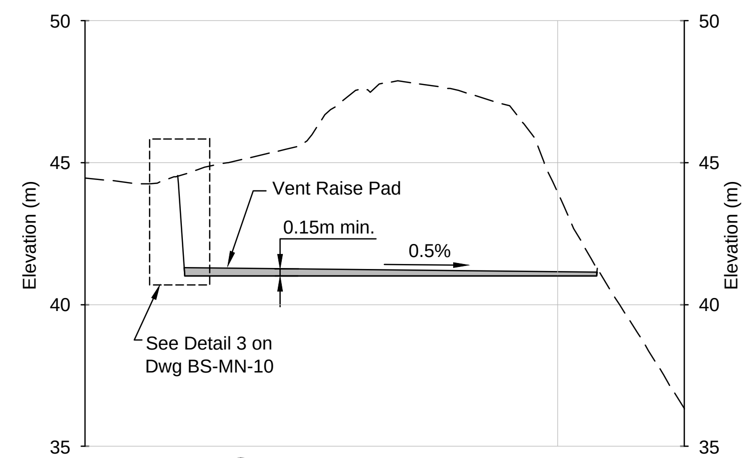
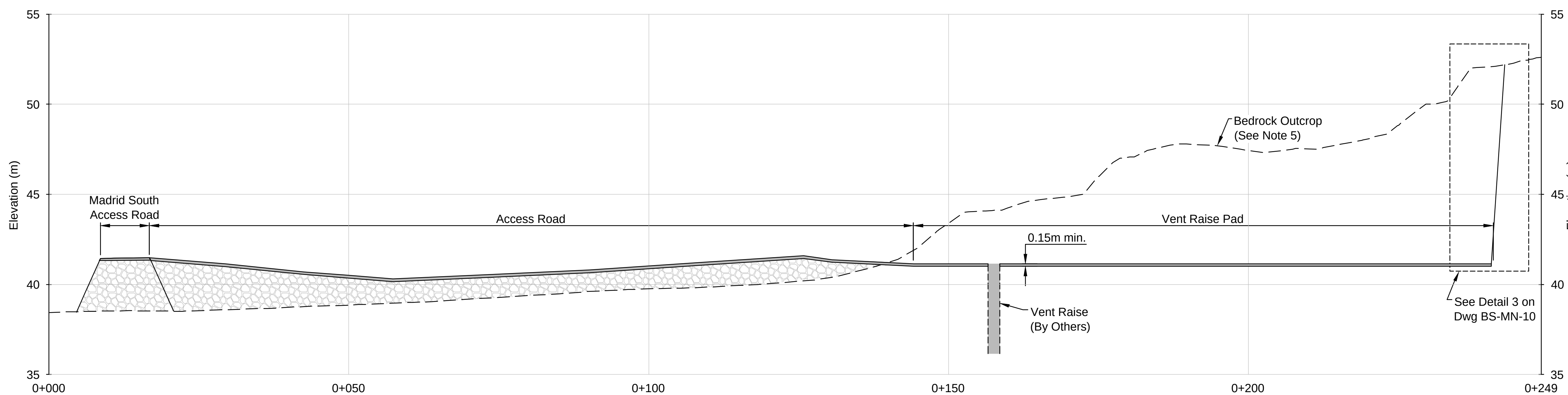


G
07
SECTION G
0 4 8 12 16 20
Horizontal Scale in Metres
Vertical Exaggeration 3X



H
07
SECTION H
0 4 8 12 16 20
Horizontal Scale in Metres
Vertical Exaggeration 3X

LEGEND

- Existing ground surface
- Surfacing Material
- Run of Quarry Material

NOTES

1. All dimensions in metres unless noted otherwise.
2. Where the thickness of the pads is greater than 3.0m allow for the placement of barriers.
3. The barriers are to consist of boulders larger than 1m in diameter, jersey-barriers (1.82 long X 1.37m high X 0.61m wide) or a rock fill berm 0.5m high. Maximum spacing between barriers is 3.3m.
4. Extents of bedrock outcrop are based on 2007 aerial orthophoto and ground inspection. To ensure layouts match site conditions exact extents of bedrock outcrops are to be surveyed prior to any construction activities.
5. Cut into bedrock outcrop required for construction of vent raise collar and pad.
6. Notes in this drawing apply to all other active drawings.

DRAWING NO.	DRAWING TITLE	DRAWING NO.	DRAWING TITLE
REFERENCE DRAWINGS			

NO.	DESCRIPTION	CHK'D	APP'D	DATE
A	Issued for Discussion	MMM	EMR	9Nov16
REVISIONS				

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CHECKED: MMM | APPROVED: EMR | DATE: November 2016
FILE NAME: 1CT022.004_DEIS_MN-2.dwg

TMAC RESOURCES

HOPE BAY PROJECT

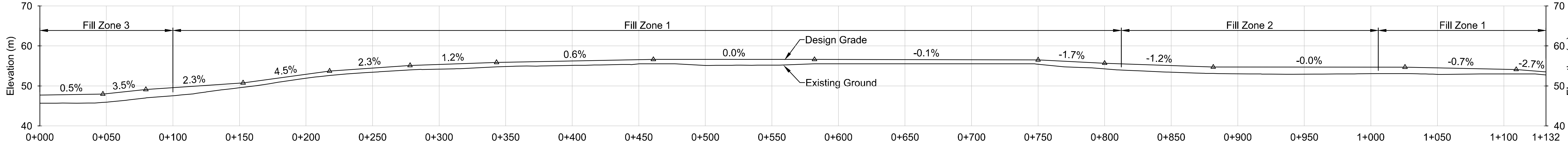
SRK JOB NO.: 1CT022.004

Madrid North DEIS Surface Infrastructure

DRAWING TITLE:

Vent Raise Sections G and H

DRAWING NO. DEIS-MN-08 | SHEET 8 OF 13 | REVISION NO. A

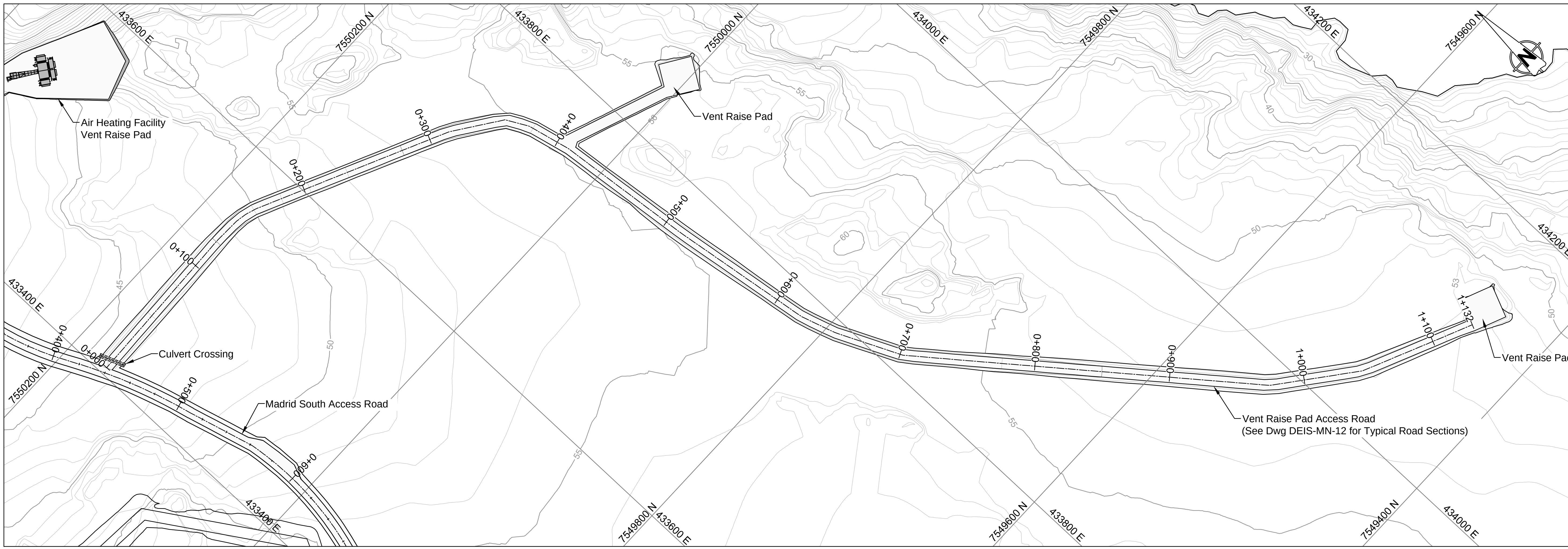


PROFILE LEGEND

△ Point of Intersection
6.1% Grade

PROFILE
VENT RAISE ACCESS ROAD

0 10 20 30 40 50
Horizontal Scale in Metres
Vertical Exaggeration 3X



PLAN VIEW
MADRID NORTH VENT RAISE PADS

0 10 20 30 40 50
Scale in Metres

LEGEND

- △ Point of Intersection
- Road Alignment
- 1+000 Route Centerline
- Crossing Location

NOTES

1. All dimensions in metres unless noted otherwise.
2. Notes in this drawing apply to all other active drawings.

ROAD CONSTRUCTION ZONES TABLE:

Fill Zone 1	1.0m min. Overall Road Thickness with 1.5H:1V Side Slopes
Fill Zone 2	1.5m min. Overall Road Thickness with 1.5H:1V Side Slopes
Fill Zone 3	2.0m min. Overall Road Thickness with 2.0H:1V Side Slopes
Bedrock Zone	0.3m min Road Thickness (ROQ not required) with Side Slopes to be determined in the field

NO.	DESCRIPTION	CHK'D	APP'D	DATE
A	Issued for Discussion	MMM	EMR	9Nov16

REVISIONS

DRAWING NO.	DRAWING TITLE	DRAWING NO.	DRAWING TITLE

REFERENCE DRAWINGS

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DESIGN: MMM | DRAWN: NV | REVIEWED: MMM
CHECKED: MMM | APPROVED: EMR | DATE: November 2016
FILE NAME: 1CT022.004_DEIS_MN-6 Vent Raises.dwg

TMAC RESOURCES
HOPE BAY PROJECT
SRK JOB NO.: 1CT022.004

Madrid North DEIS Surface Infrastructure
DRAWING TITLE:
Vent Raise Access Road
Plan and Profile
DRAWING NO. DEIS-MN-09 | SHEET 9 OF 13 | REVISION NO. A

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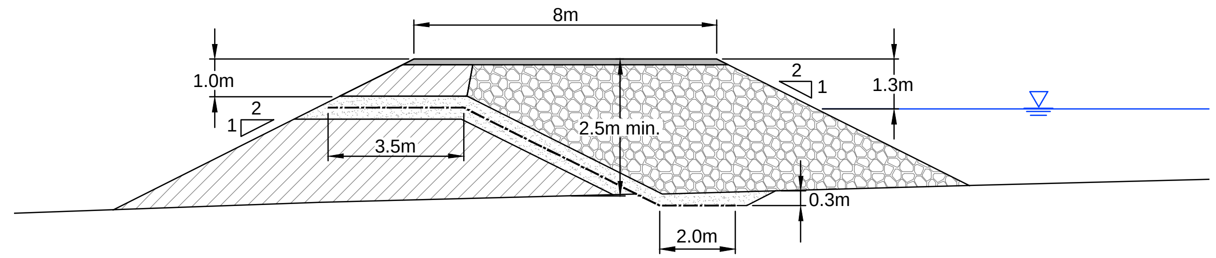
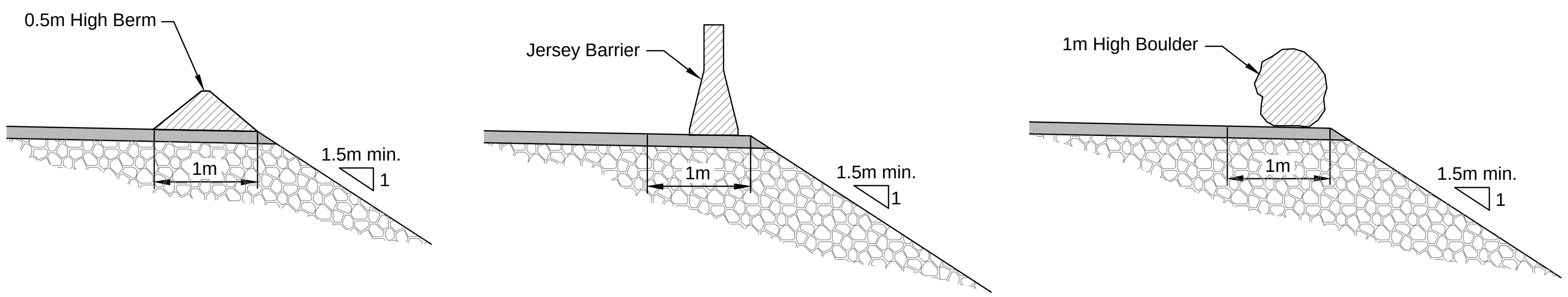
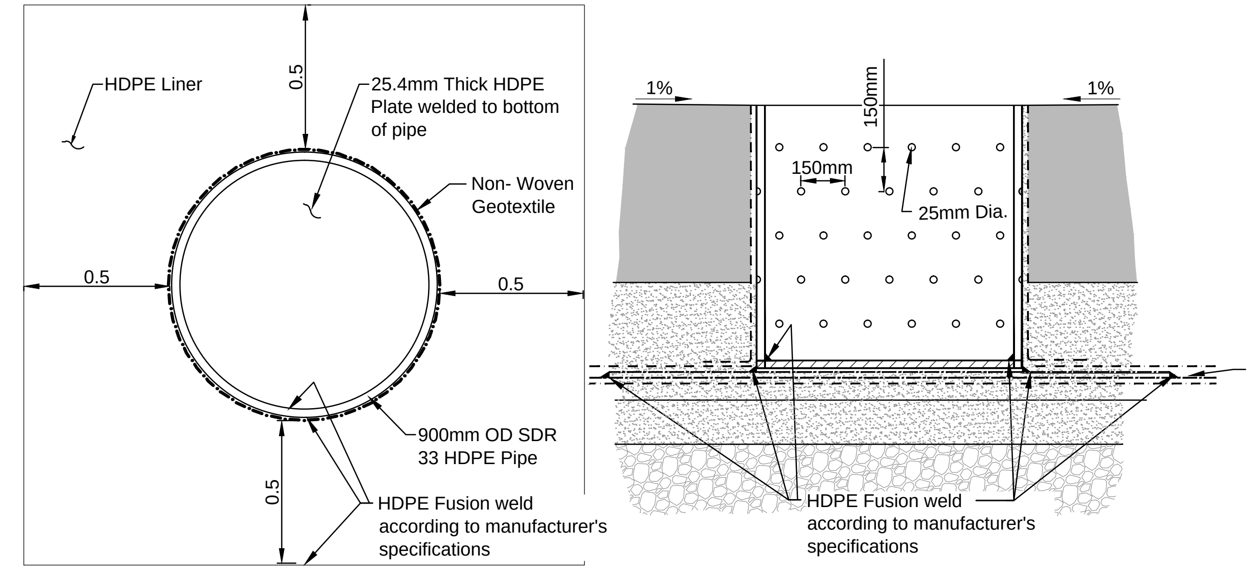


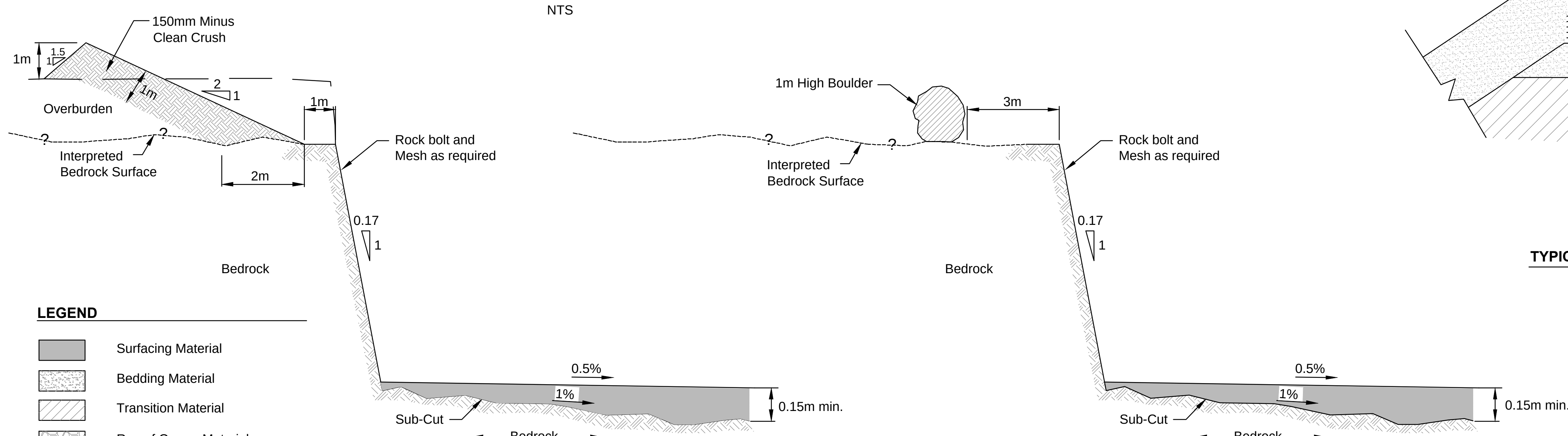
DETAIL 1
TYPICAL CONTACT WATER POND BERM SECTION
NTS



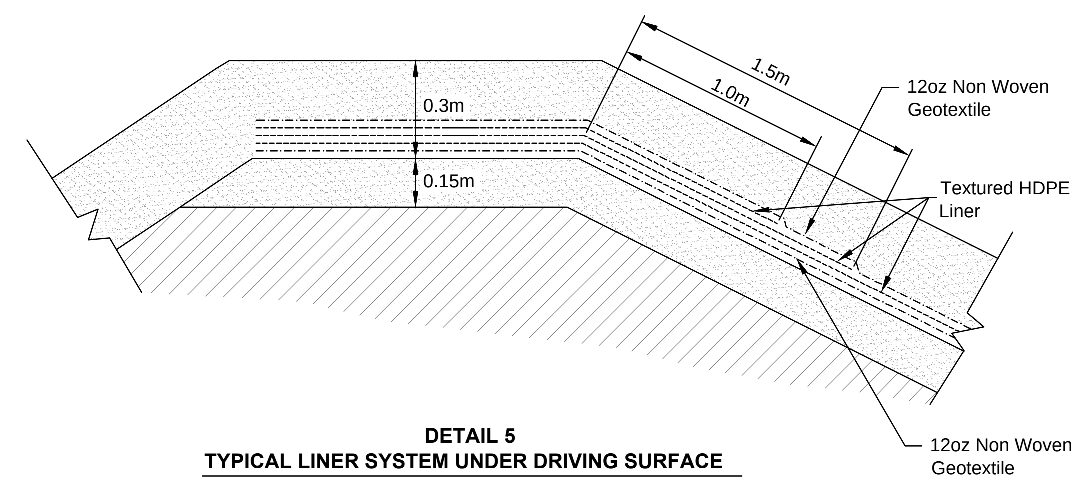
DETAIL 2
TYPICAL BERM BARRIER OPTIONS
NTS



DETAIL 4 - SUMP
NTS



DETAIL 3
TYPICAL SECTIONS OF HIGHWALL SAFETY BERM/BARRIER
NTS



DETAIL 5
TYPICAL LINER SYSTEM UNDER DRIVING SURFACE
NTS

LEGEND

- Surfacing Material
- Bedding Material
- Transition Material
- Run of Quarry Material
- Rip Rap
- Non-woven Geotextile
- HDPE Liner

DRAWING NO.	DRAWING TITLE	DRAWING NO.	DRAWING TITLE

REFERENCE DRAWINGS

NO.	DESCRIPTION	CHK'D	APP'D	DATE
A	Issued for Discussion	MMM	EMR	9Nov16

REVISIONS

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DESIGN: MMM | DRAWN: NV | REVIEWED: MMM
CHECKED: MMM | APPROVED: EMR | DATE: Nov. 2016
FILE NAME: 1CT022.004_DEIS_MN-4 Details.dwg

TMAC RESOURCES

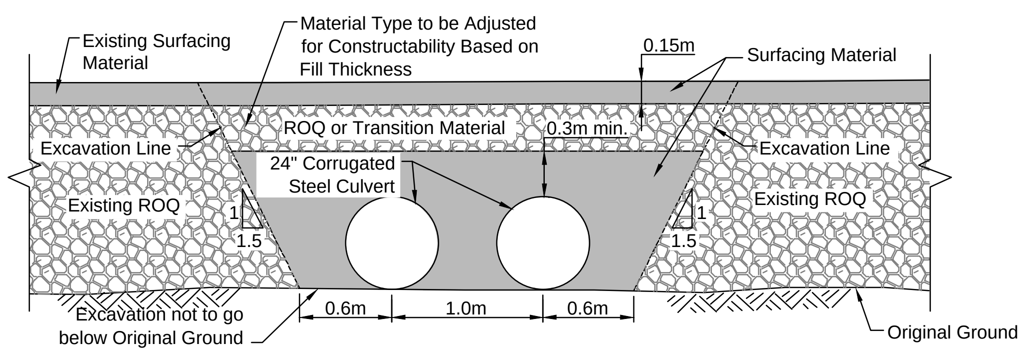
HOPE BAY PROJECT

SRK JOB NO.: 1CT022.004

Madrid North Surface Infrastructure

DRAWING TITLE: Contact Water Pond Berm and Details

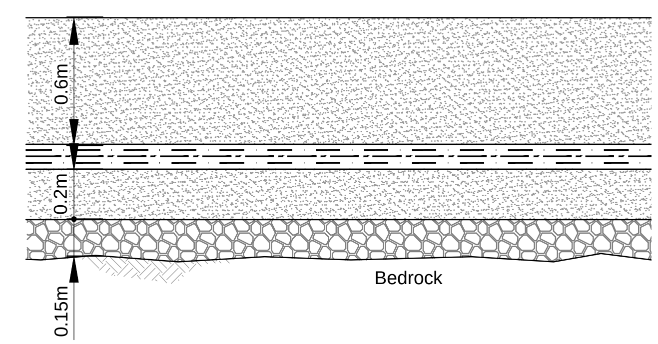
DRAWING NO.: DEIS-MN-10 | SHEET 10 OF 13 | REVISION NO. A



DETAIL 6

6 **TYPICAL CROSS SECTION OF CULVERT CROSSING**

NOT TO SCALE



DETAIL 7

7 **TYPICAL LINER SYSTEM WITHIN FUEL STORAGE FACILITY**

NOT TO SCALE

LEGEND

- Surfacing Material
- Bedding Material
- Run of Quarry Material
- Non-woven Geotextile
- HDPE Liner

NOTES

1. All dimensions in metres unless noted otherwise.
2. Locations for animal crossings will be identified by Land Owner and Elders once road construction is completed.

DRAWING NO.	DRAWING TITLE	DRAWING NO.	DRAWING TITLE
REFERENCE DRAWINGS			

NO.	DESCRIPTION	CHK'D	APP'D	DATE
A	Issued for Discussion	MMM	EMR	9Nov16

REVISIONS

PROFESSIONAL ENGINEERS STAMP

srk consulting

DESIGN: MMM | DRAWN: NV | REVIEWED: MMM

CHECKED: MMM | APPROVED: EMR | DATE: Nov. 2016

FILE NAME: 1CT022.004_DEIS_MN-5 Specs.dwg

TMAC RESOURCES

HOPE BAY PROJECT

SRK JOB NO.: 1CT022.004

Madrid North DEIS Surface Infrastructure

DRAWING TITLE:

Details

DRAWING NO.: DEIS-MN-11 | SHEET 11 OF 12 | REVISION NO. A

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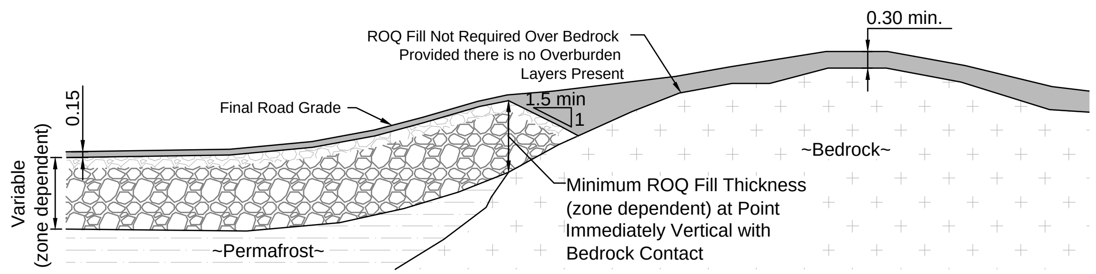
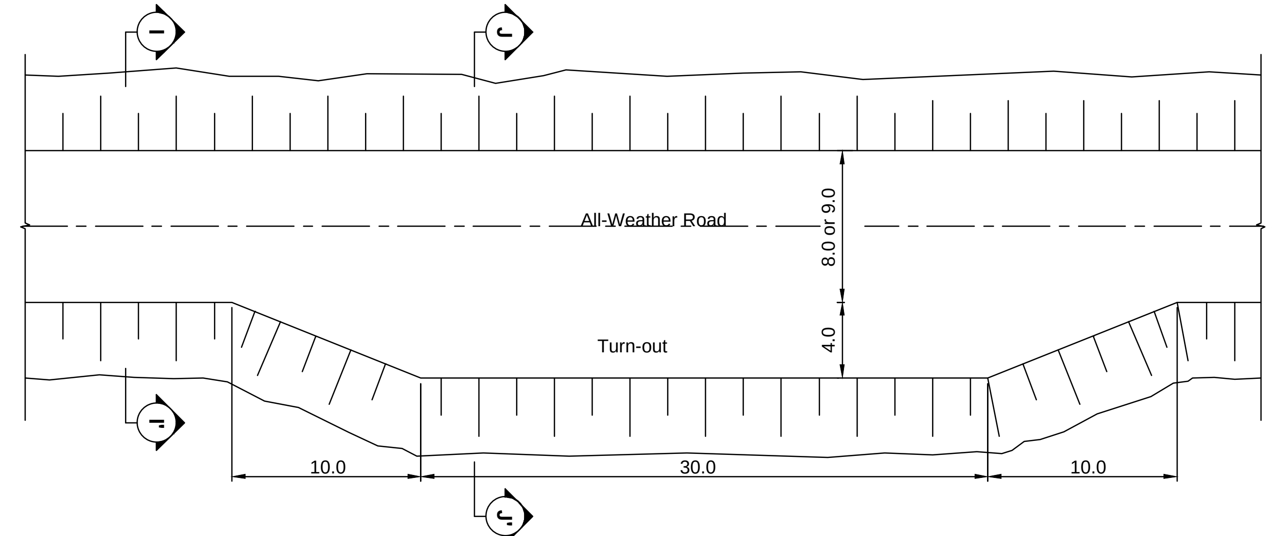


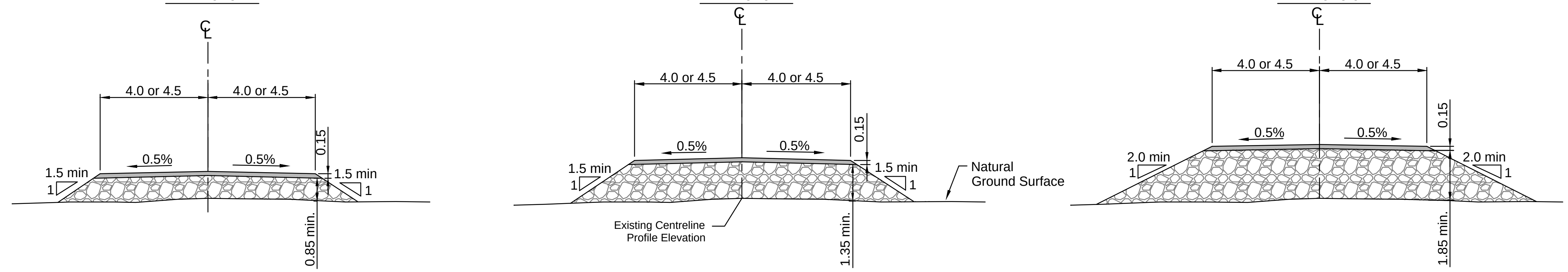
ALL-WEATHER ROAD PROFILE
TRANSITION FROM PERMAFROST TO BEDROCK

0 1 2 3 4 5
Scale in Metres



PLAN
TYPICAL ALL-WEATHER ROAD & TURNOUT

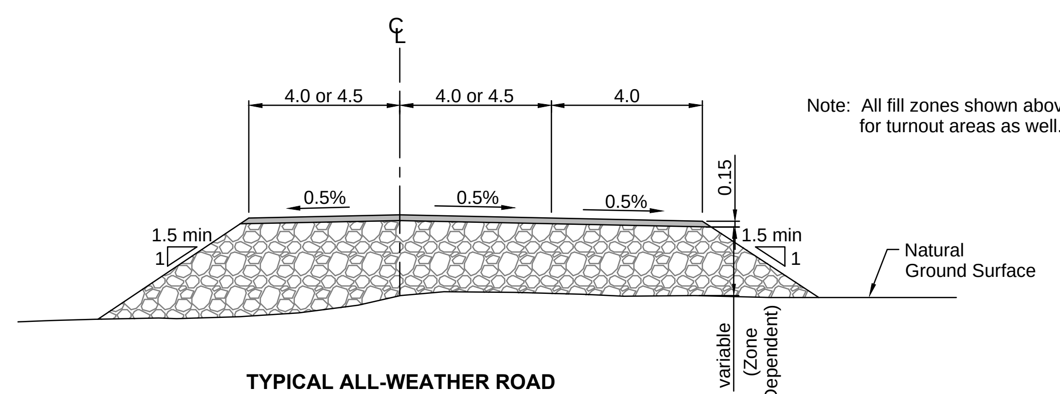
0 2 4 6 8 10
Scale in Metres



I

TYPICAL
ALL-WEATHER ROAD SECTIONS

0 1 2 3 4 5
Scale in Metres



Note: All fill zones shown above apply for turnout areas as well.

J

TYPICAL ALL-WEATHER ROAD
WITH TURN-OUT SECTION

0 1 2 3 4 5
Scale in Metres

LEGEND

- Surfacing Material
- Run of Quarry Material

NOTES

1. All dimensions in metres unless noted otherwise.
2. Minimum design thickness must be maintained for all sections of the all-weather road including turnouts.
3. Notes in this drawing apply to all other active drawings.

DRAWING NO.	DRAWING TITLE	DRAWING NO.	DRAWING TITLE
REFERENCE DRAWINGS			

NO.	DESCRIPTION	CHK'D	APP'D	DATE
A	Issued for Discussion	MMM	EMR	9Nov16
REVISIONS				

PROFESSIONAL ENGINEERS STAMP

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DESIGN: MMM	DRAWN: NV	REVIEWED: MMM
CHECKED: MMM	APPROVED: EMR	DATE: Nov. 2016

FILE NAME: 1CT022.004_DEIS_MN-3 Road Secs.dwg

TMAC RESOURCES

HOPE BAY PROJECT

SRK JOB NO.: 1CT022.004

Madrid North DEIS Surface Infrastructure

DRAWING TITLE:
Typical Road
Plan and Sections

DRAWING NO.	SHEET	REVISION NO.
DEIS-MN-12	12 OF 13	A

Materials List and Quantity Estimates

Item	Quantity / Area / Volume	ROQ (cu.m.)	Cut (cu.m.)	Description
1. Run of Quarry Material	Portal Pads	24,400	45,100	Approximate In-Place Neat-line Volume (3D volume based on Civil 3D surfaces - no allowance has been made for losses and/or tundra embedment)
	Waste Rock Pad	95,500		
	Vent Raise Pad		21,550	
	Vent Raise Pads	760		
	Laydown Area Pad	1,350		
	Madrid South Rd to Contact Water Pond Berm	1,260		
	Upper Portal Pad Access Road	5,130		
	Upper Portal Pad to Waste Rock Pad	3,580		
	Fuel Storage Facility Access Road	2,900		
	Fuel Storage Facility Bypass Road	780		
	Air Heating Facility Vent Raise Access Road	2,050		
	Vent Raise Access Road	15,560		
	Total	153,270	66,650	
2. Surfacing Material	Pads:			Approximate In-Place Neat-line Volume
	Portal Pads including Ramp	2,850		
	Laydown Area Pad	220		
	Vent Raise Pad	585		
	Vent Raise Pads	240		
	Roads:			
	Madrid South Rd to Contact Water Pond Berm	170		
	Upper Portal Pad Access Road	160		
	Upper Portal Pad to Waste Rock Pad	170		
	Fuel Storage Facility Access Road	360		
	Fuel Storage Facility Bypass Road	125		
	Air Heating Facility Vent Raise Access Road	150		
	Vent Raise Access Road	1,440		
	Total	6,470		

Materials List and Quantities for Contact Water Pond Berm

Item	Quantity / Area / Volume		Description
Run of Quarry Material		19,000 m³	Approximate In-Place Neat-line Volume
Surfacing Material		370 m³	
Bedding Material	OverLiner in Key Trench	220 m³	Volumes approximated by typical section and key trench lengths
	Overliner & Underliner in Berm	1620 m³	
Liner	Geomembrane Liner (in Key Trench and Berm)	3430 m²	Textured HDPE 60 mil or Equivalent
Geotextile (2 layers)	Geotextile Overliner (in Key Trench and Berm)	3430 m²	12 oz. Non Woven
	Geotextile Underliner (in Key Trench and Berm)	3430 m²	

Tolerances Road Material Placement:

Location	Fill (mm)	Excavation (mm)
Vertical Tolerance on Roads	0 to +75	n/a
Horizontal Tolerance on Roads	-150 to +150	

Note: Grade shall not be uniformly high or low.

Materials List and Quantities (Fuel Storage Facility)

Item	Quantity / Area / Volume		Description
Excavation Cut		26400 m³	Volumes derived by Civil 3D - Side slopes 2H:1V Unless otherwise noted
Run of Quarry	Berm Walls	7540 m³	
Bedding Material	OverLiner	2820 m³	
	UnderLiner	940 m³	
Surfacing Material	Floor Leveling beneath underliner	405 m³	
Geotextile (2 Layers)	Geotextile OverLiner	4500 m²	12 oz. Non Woven
	Geotextile UnderLiner	4500 m²	
	Sump	5 m²	
Liner	Geomembrane Liner	4500 m²	Textured HDPE 60 mil or Equivalent
	Sump	5 m²	

DRAWING NO.	DRAWING TITLE	DRAWING NO.	DRAWING TITLE

REFERENCE DRAWINGS

NO.	DESCRIPTION	CHK'D	APP'D	DATE
A	Issued for Discussion	MMM	EMR	9Nov16

REVISIONS

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DESIGN: MMM | DRAWN: NV | REVIEWED: MMM
CHECKED: MMM | APPROVED: EMR | DATE: Nov. 2016

FILE NAME: 1CT022.004_DEIS_MN-5 Specs.dwg

TMAC RESOURCES

HOPE BAY PROJECT

SRK JOB NO.: 1CT022.004

Madrid North DEIS Surface Infrastructure

DRAWING TITLE: Material List and Quantity Estimates

DRAWING NO. DEIS-MN-13 | SHEET 13 OF 13 | REVISION NO. A

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