KENO HILL SILVER DISTRICT MINING OPERATIONS

ROAD DEVELOPMENT AND OPERATIONS PLAN

February 2023

Prepared by:

HECLA YUKON

Prepared for:

Alexco Keno Hill Mining Corp.

VERSION HISTORY

	SECTION	RELEVANCE AS IT RELATES TO ROAD DEVELOPMENT AND OPERATIONS
BELLEKENO ADVANCE UNDERGROUND EXPLORATION & DEVELOPMENT, KHSD (ACG, 2008)		
	Whole document	Proposed activities have been superseded by completed road development for the operation of the Bellekeno Mine and the District Mill.
CONSTRUCTION SITE PLAN, REVISION1, BELLEKENO PROJECT YUKON (ACG, 2009)		
1	Introduction	Proposed activities have been superseded by mine development
2	Project Schedule	No longer applicable
3	Land Tenure and Mineral Claims	Remains relevant; the Christal Lake Road and Bellekeno Haul Road with the associated mineral claims are illustrated, and third-party land tenure is explained Figure incorporated into current version
4	Construction Plans	Subsection 4.1 General Site Construction Plans as it relates to roads has been superseded by the current approved Water Management Plan, Traffic Management Plan, Waste Rock Management Plan, and Closure and Reclamation Plan. The Borrow Areas discussion has been updated and incorporated into the current version
5	Environmental Management & Monitoring for Construction Activities	Section as it relates to roads superseded by current version (see Best Management Practices)
	Appendices	Superseded by as-built drawings and current approved management plans. The Civil Design Criteria has been referenced in subsequent road construction plans
LIGHTNING CREEK BYPASS ROAD CONSTRUCTION AND OPERATION PLAN, QML-0009, BELLEKENO PROJECT (ACG, 2010)		
1	Introduction	Incorporated into YESAA Concordance Tables in current version
2	Lightning Creek Bypass Construction	Incorporated into current version
3	Haul Roads	Superseded by Section 3.0 Road Development Overview (ACG, 2012), and the current approved Dust Abatement and Monitoring Plan and Traffic Management Plan
4	Highway Access Controls	Superseded by the current approved Traffic Management Plan
5	Communications and Notification Protocols	Superseded by the current approved Emergency Response Plan
	Attachments	Superseded by as-built drawings included in Appendix A
ROAD CONSTRUCTION PLAN – KENO CITY BYPASS ROAD, KHSD MINING OPERATIONS, QML-0009 (ACG, 2012)		
1	Introduction	Superseded
2	Site Description	Removed from current version, see current Site Characterization Report
3	Road Development Overview	Remains relevant and incorporated into current version
4	Site Preparation	Remains relevant and incorporated into current version
5	Road Design and Specifications	Remains relevant, except subsection 5.3 which has been superseded by the current approved Traffic Management Plan, and Closure and Reclamation Plan Subsection 5.1 Haul Road Specifications and Subsection 5.2 Access Tie-in and Staging Areas incorporated into current version
6	Borrow Sources	Remains relevant and incorporated into current version

	SECTION	RELEVANCE AS IT RELATES TO ROAD DEVELOPMENT AND OPERATIONS
7	Geochemical Evaluation	Remains relevant and incorporated into Revision 3
8	Geotechnical Testing	Remains relevant and incorporated into Revision 3
9	Best Management Practices	Remains relevant and incorporated into Revision 3
ROAD CONSTRUCTION PLAN, KHSD MINING OPERATIONS, QML-0009, REVISION 3 (AKHM, 2015)		
1	Introduction	Superseded
2	Site Description	Removed from current version, see current Site Characterization Report
3	Road Development Overview	Remains relevant and incorporated into current version
4	Site Preparation	Remains relevant and incorporated into current version
5	Road Design and Specifications	Remains relevant and incorporated into current version, except subsection 5.3 which has been superseded by the current approved Traffic Management Plan, and Closure and Reclamation Plan
6	Borrow Sources	Remains relevant and incorporated into current version
7	Geochemical Evaluation	Remains relevant and incorporated into Revision 4
8	Geotechnical Testing	Remains relevant and incorporated into Revision 4
9	Best Management Practices	Remains relevant and incorporated into current version
ROAD CONSTRUCTION PLAN, KHSD MINING OPERATIONS, QML-0009, REVISION 4 (AKHM, 2018)		
1	Introduction	Superseded
2	Site Description	Removed from current version, see current Site Characterization Report
3	Road Upgrade Overview	Remains relevant and incorporated into current version
4	Site Preparation	Remains relevant and incorporated into current version
5	Road Design and Specifications	Remains relevant and has been incorporated into current version, except subsection 5.3 which has been superseded by the current approved Traffic Management Plan, and Closure and Reclamation Plan
6	Borrow Sources	Remains relevant and incorporated into current version
7	Geochemical Evaluation	Remains relevant and incorporated into current version
8	Geotechnical Testing	Remains relevant and incorporated into current version
9	Best Management Practices	Remains relevant and incorporated into current version

YESAA DECISION DOCUMENT CONCORDANCE TABLE

TERM	DECISION DOCUMENT	TERM & CONDITION	WHERE ADDRESSED
1	2008-0039	All construction and upgrades that utilize non-AML waste rock shall be done in a manner conductive to monitoring run-off as per the Adaptive Management Plan. This consideration is required as part of the engineered drawings for the road	Section 7
47	2008-0039	The proponent shall ensure that the bridge is capable of supporting the weights that will be crossing it and provide documentation to that effect to the regulator	Table 5-1
49	2008-0039	Prior to constructing the proposed new haul road, proponent must demonstrate that soil conditions beneath and in proximity to the proposed right-of-way are stable to support the intended construction and use	Section 3.3
50	2008-0039	New roads shall be constructed in such a way that minimizes permafrost degradation	Section 3
53	2008-0039	Effective temporary and permanent erosion and sediment control measures shall be implemented on disturbed areas during and after exploration, to prevent sediment from entering any waterbodies and/or water courses	Table 5-1
1	2009-0030	All road construction and upgrades that utilise non-AML waste rock shall be done in accordance with project-specific developed quality assurance and quality control practices (i.e. periodic screening and sampling of waste rock used for road material) that govern the project's waste rock management plan and in a manner conducive to monitoring run-off as per the Adaptive Management Plan. Run-of in areas utilizing non-AML waste rock shall be monitored Monitoring of these areas must be added to the Adaptive Management Plan	Section 3 Section 4.3 Section 7
2	2009-0030	The key Best Management Practices ("BMP") that will be implemented to protect fish and fish habitat when constructing the Lightening Creek clear span bridge include: • Minimize the riparian area temporarily disturbed by access activities along the adjacent upland property. Use existing trails, roads, or cut lines where possible to avoid disturbance to the riparian vegetation. • Avoid building on meander bends, braided streams, alluvial fans, active flood plains, or any other area that is inherently unstable and may result in the alteration of natural steam functions or erosion and scouring of the bridge structure • Removal of select plants within the road right-of-way (ROW) may be required to meet operational and/or safety concerns for the crossing structure and the approaches. • This removal should be kept to a minimum and within the road right-of-way. When practicable, prune or top the vegetation instead of uprooting. • Trees will be felled away from watercourses to reduce damage to stream banks and beds. To maintain bank stability, trees within 10 m of watercourses will be close cut and stumps left in place except along the trench line. • Ensure that the clear span bridge is properly designed to address river and channel processes at flows above the ordinary high water mark. • Design and construct approaches so that they are perpendicular to the watercourse to minimize loss or disturbance to riparian vegetation. • Design the bridge so that storm water runoff from the bridge deck, side slopes and approaches is directed into a retention pond or vegetated area to remove suspended solids, dissipate velocity and prevent sediment and other deleterious substances from entering the watercourse. • Generally there are no restrictions on timing for the construction of clear-span structures as they do not involve in-water work. However, if there are any activities with the potential to disrupt sensitive fish life stages (e.g. crossing of watercourse by machinery), these shall adhere to the timing window outlined above. • Machinery fording the watercourse to bring equipment required for construction to the opposite side is limited to a one-time event (over and back) and should occur only if an existing crossing at another location is not available or practical to use. • To exercise this option, the stream bed at the fording site must be comprised of stable gravel or bedrock and the stream banks must be low and stable.	Section 5.2

TERM	DECISION DOCUMENT	TERM & CONDITION	WHERE ADDRESSED
		• If minor rutting is likely to occur, stream bank and bed protection methods (e.g. swamp mats, pads) shall be used provided they do not constrict flows or block fish passage. • Grading of the stream banks for the approaches shall not occur. • If the stream bed and banks are steep and highly erodeable (e.g. dominated by organic materials and silts) and erosion and degradation are likely to occur as a result of equipment fording, then a temporary crossing structure or other practice shall be used to protect these areas. • Time the one-time fording to prevent disruption to sensitive fish life stages by adhering to appropriate fisheries timing window. • Fording shall occur under low flow conditions and not when flows are elevated due to local rain events or seasonal flooding.	
3	2009-0030	Install effective sediment and erosion control measures, such as silt fencing, temporary diversion berms, clear crush check dams or straw bales, before starting work to prevent the entry of sediment into the watercourse. Inspect them regularly during the course of construction and make all necessary repairs if any damage occurs. Work that will disturb soils shall be stopped during periods of high precipitation if it is likely to lead to sediment deposition into Lightening Creek	Table 5-1
8	2009-0030	Vegetate any disturbed areas by planting and seeding with native trees, shrubs or grasses and cover such areas with mulch to prevent erosion and to help seeds germinate. All seeding and/or planting trees shall follow the DFO guidance on Riparian Revegetation. If there is insufficient time remaining in the growing season, the site shall be stabilized (e.g. cover exposed areas with erosion control blankets to keep the soil in place and prevent erosion) and vegetated the following spring. Maintain effective sediment and erosion control measures until re-vegetation of disturbed areas is achieved.	Table 5-1 Section 6
68	2009-0030	Best management practices for the industry indicate that dust releases must be minimized through the application of a number of preventative measures, including the following. Haul road surfacing - frequently used roads near Keno shall be hard surfaced to the extent possible	Table 5-1
72	2009-0030	The proponent shall ensure that the bridge is capable of supporting the weights that will be crossing it and provide documentation to that effect to the regulator	Table 5-1
78	2009-0030	Prior to constructing the new access road to the Flame and Moth Mill site and the Keno City bypass, the proponent must demonstrate that soil conditions beneath and in proximity to the proposed right-of-way are stable to support the intended construction and use.	Section 3.3
79	2009-0030	New road construction shall not cause degradation of permafrost.	Section 3
6	2011-0315	The proponent shall ensure that N-AML waste rock with elevated zinc content used as construction and upgrade materials is set back an appropriate distance from surface water to avoid impacts; and shall establish appropriate maximum zinc content for the use of these materials for construction purposes.	Section 3 Section 4.3 Section 7
15	2011-0315	The proponent shall ensure that during winter months breaks in snow-banks on main access roads are created in order to facilitate wildlife crossing and exiting the road.	Section 4
22	2011-0315	The proponent shall install effective erosion control measures before starting work to prevent degradation of soil.	Table 5-1
24	2011-0315	The proponent shall test for permafrost prior to work in an area to determine a better understanding of the permafrost layer.	Section 3.3
25	2011-0315	The proponent shall make best efforts to avoid work in areas of permafrost, where permafrost cannot be avoided the proponent shall take appropriate measures to avoid or minimize damage to and loss of permafrost.	Section 3.3

TERM	DECISION DOCUMENT	TERM & CONDITION	WHERE ADDRESSED
52	2011-0315	The proponent shall ensure that access along roads and trails for the purpose of project activities does not result in unnecessary rutting or increased levels of garbage and litter along the routes.	Table 5-1
2	2017-0176	Non-acid metal leaching waste materials to be used for construction or segregated for other purposes outside the Waste Rock Storage Area, shall be subject to a revised waste rock screening criteria which incorporates consideration of the effective-NP/AP value required to effectively maintain neutral pH conditions.	Section 3 Section 4.3 Section 7
20	2017-0176	A heritage resources overview assessment shall be completed in advance of ground disturbing activities. Areas with elevated potential for the presence of archaeological or historic sites shall be avoided until such time as a heritage resources impact assessment can be completed.	Section 3.2
21	2017-0176	A heritage resources impact assessment shall be completed in advance Agree of ground disturbing activities in areas with elevated potential for the presence of archaeological or historic sites.	Section 3.2

YESAA PROPONENT COMMITMENT CONCORDANCE TABLE

YESAB ONLINE REGISTRY (YOR)	PROPONENT COMMITMENTS	WHERE ADDRESSED
YOR 2011-0315-032-1	Road building material will not be sourced from historic low grade ore stockpiles. Historic low grade ore piles located on top of Onek waste rock dump are able to be visually differentiated due to mineralization.	Section 3 Section 4.3 Section 7
YOR 2011-0315-032-1	Alexco will monitor any seepage observed at the tow of the historic dumps used for borrow material.	Section 7
YOR 2011-0315-032-1	N-AML material will be used for general construction purposes and surface capping of existing site access roads	Section 3
YOR 2011-0315-032-1	Alexco will monitor seepages from the Bypass road and onsite access roads built with N-AML material, and implement adaptive management responses, if required, as outlined in the approved Adaptive Management Plan.	Section 7
YOR 2011-0315-032-1	Cleared vegetation and topsoil from construction of the Bypass road will be stockpiled along the road right-of-way for road reclamation.	Section 3.6
YOR 2011-0315-083-1	The surrounding ground that has been previously disturbed will be scarified and re-seeded to eventually establish a vegetation barrier to dampen noise and improve site aesthetics.	Section 6
YOR 2011-0315-035-1	At closure roads will be re-sloped and scarified, culverts removed and seeded in areas where erosion control is necessary	Section 6
YOR 2011-0315-032-1	At closure as part of road decommissioning, culverts will be removed and natural drainage restored.	Section 6
YOR 2011-0315-032-1	Ditching along the road will facilitate appropriate drainage.	Section 3.6 Section 4.1

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LIST OF ACRONYMS AND ABBREVIATIONS

ACG	Access Consulting Group
AKHM	Alexco Keno Hill Mining Corp.
BK	Bellekeno
CLR	Christal Lake Road
DOC	Dissolved Organic Carbon
ERDC	Elsa Reclamation and Development Company
FNNND	First Nation of Na-Cho Nyak Dun
ICP	Inductively Coupled Plasma
KHSD	Keno Hill Silver District
N-AML	Non acid generating or metal leaching
QML	Quartz Mining Licence
ROW	Right of Way
TSS	Total Suspended Solids
WL	Water Licence
YESAA	Yukon Environmental and Socio-economic Assessment Act

1 INTRODUCTION

1.1 OVERVIEW

This Road Development and Operations Plan describes typical road construction considerations, and operating protocols for roads utilized by Alexco Keno Hill Mining Corp. (AKHM) for the Keno Hill Silver District (KHSD) Mining Operations. Road construction and management activities in the following documents has been consolidated into this plan:

- *Water License Application & Mining Land Use Approval Amendment Request, Bellekeno Advanced Underground Exploration & Development, Keno Hill Silver District, Yukon, January 2008* (ACG, 2008),
- *Construction Site Plan, Revision 1, Bellekeno Project, Yukon*, (ACG, 2009),
- *Lightning Creek Bypass Road Construction and Operation Plan, QML-0009, April 2010* (ACG, 2010),
- *Road Construction Plan, Keno City Bypass Road, Keno Hill Silver District Mining Operations, QML-0009*, (ACG, 2012),
- *Road Construction Plan, Keno Hill Silver District Mining Operations, QML-0009, Revision 3* (AKHM, 2015), and
- *Road Construction Plan, Keno Hill Silver District Mining Operations, QML-0009, Revision 4* (AKHM, 2018).

1.2 SITE DESCRIPTION

The KHSD Mining Operations is 354 km north of Whitehorse, in the vicinity of Keno City in the central Yukon (Figure 1-1). AKHM owns and operates of a series of small underground silver/lead/zinc mines with a centralized mill as described in Table 1-1. On September 7, 2022, Alexco Resource Corp. (doing business as Hecla Yukon), the parent company of AKHM, was acquired by Hecla Mining Company.

Table 1-1: Keno Hill Silver District mining operations overview

MINES / ORE DEPOSITS	Bellekeno (production 2010 – 2013, suspended 2013 – 2020, production 2020, temporary closure 2021) Flame & Moth (development 2018, suspended 2018 – 2020, development and production 2020 - present) New Bermingham (advanced exploration 2017 – 2018, development and production 2020 - present) Lucky Queen, Onek 990 (advanced exploration 2013, not active)
MILL	District Mill located in Flame & Moth Mine area (Constructed 2010) Tailings placed in Dry Stack Tailings Facility (Established 2010) or underground as backfill
WORK FORCE	~ Camp capacity of 250 employees and contractors during active mine and reclamation operations (as per YESAA 2018-0169 Decision Document)
AIRSTRIP	Village of Mayo, YT
CAMP FACILITIES	Flat Creek camp facilities include a trailer camp, kitchen facility, welcoming center and dry Four refurbished houses and a bunkhouse located nearby in the townsite of Elsa
POWER	Hydro grid power Yukon Energy, diesel power backup
WATER SUPPLY AND USE	Fresh water supply from Flat Creek and adjacent well Water treatment plants at Bellekeno 625, Flame & Moth, and New Bermingham for mine effluent Process water is recycled from the Mill Pond to the plant
FIRST NATIONS	First Nation of Na-Cho Nyak Dun (FNNND)

The Keno Hill mining camp has a long mining history and is a brownfields site. AKHM develops the mineral resources, operates the KHSD mines and undertakes receiving environmental monitoring and treatment of mine discharge waters. Hecla Yukon's wholly owned subsidiary Elsa Reclamation and Development Company Ltd. (ERDC) undertakes care and maintenance, environmental monitoring and water treatment of historic adit drainages, district-wide closure planning, studies, and remediation of the historic environmental liabilities.

1.3 ASSOCIATED PERMITS AND AUTHORIZATIONS

AKHM has all permits and authorizations in place for development and production of KHSD mines Bellekeno, Flame & Moth, and New Bermingham, and operations of the District Mill. Approvals, permits, licences and operational management plans associated with the Road Development and Operations Plan are listed in Table 1-2. This plan should be read in conjunction with these documents.

Table 1-2: Related approvals, permits, licences and operational management plans

YESSA APPROVALS	• Decision Documents and Evaluation Reports for projects #2008-0039, #2009-0030, #2011-0315, #2013-0161, #2017-0086, and #2017-0176
QUARTZ MINING ACT APPROVALS	• Class 4 Mining Land Use Approval LQ00476 expires 2028 • Quartz Mining Licence QML-0009, updated January 2023, expires 2037
WATER LICENCES	• Type A Water Licence QZ18-044 expires 2037 (AKHM) • Type B Water Licence QZ17-076 expired 2022, QZ21-012 pending (ERDC)
MANAGEMENT PLANS	• Management Health and Safety Program / Emergency Response Plan • Dust Abatement and Monitoring Plan • Environmental Monitoring, Surveillance and Reporting Plan • Mill Development and Operations Plan • Mine Development and Operations Plan • Reclamation and Closure Plan • Spill Contingency Plan • Waste Rock Management Plan • Water Management Plan • Wildlife Protection Plan

Quartz Mining Licence QML-0009 authorizes AKHM access for the KHSD Mining Operations via the Silver Trail Highway and Wernecke Road and to construct, maintain, and utilize:

- the haul road between the Bellekeno East Portal and Bellekeno 625 Adit,
- the Bellekeno Haul Road,
- the Lightning Creek Bypass Road,
- the Christal Lake Road,
- the Keno City Access Road,
- the Flame & Moth Access Road,
- the Bermingham Access Road,
- the Calumet Road, and
- a section of the Duncan Creek Road (between the District Mill and New Bermingham Mine).

475,000 477,500 480,000 482,500 485,000 487,500

7,092,500 7,090,000 7,087,500 7,085,000

N W E S

South

HANSON MCQUESTEN ROAD

Christal Creek

South McQuesten River

Sandy Creek

SILVER TRAIL HIGHWAY

Christal Creek

KENO SUMMIT

Star Creek

No Cash Creek

WERNECKE ROAD

Erickson Gulch

Charity

SIGN POST ROAD

CALUMET DRIVE

BERMINGHAM ACCESS ROAD

GALENA HILL

CHRISTAL LAKE

CHRISTAL LAKE ROAD

FLAME AND MOTH PORTAL

DISTRICT MILL SITE

BELLEKENO HAUL ROAD

KENO CITY

FLAT CREEK CAMP

FORMER ELSA TOWNSITE

Porcupine Gulch

Brefalt Creek

NEW BERMINGHAM PORTAL

HISTORIC BERMINGHAM 200 ADIT

DUNCAN CREEK ROAD

Lightning Creek

BELLEKENO 625

BELLEKENO EAST PORTAL

Thunder Gulch

Flat Creek

SOURDOUGH HILL

1:40,000 (when printed on 11 x17 inch paper)

0 0.5 1 2 Kilometres

Datum: NAD 83; Map Projection: UTM Zone 8N

- Adit
- AKHM / ERDC Quartz Claims
- Silver Trail Highway
- Other Road
- Limited-Use Road
- Tailings Area
- Waterbody
- Watercourse
- Contours (100 ft intervals)

Hecla YUKON

ENSERO solutions

FIGURE 1-1

KENO HILL SILVER DISTRICT MINING OPERATIONS OVERVIEW

DECEMBER 2022

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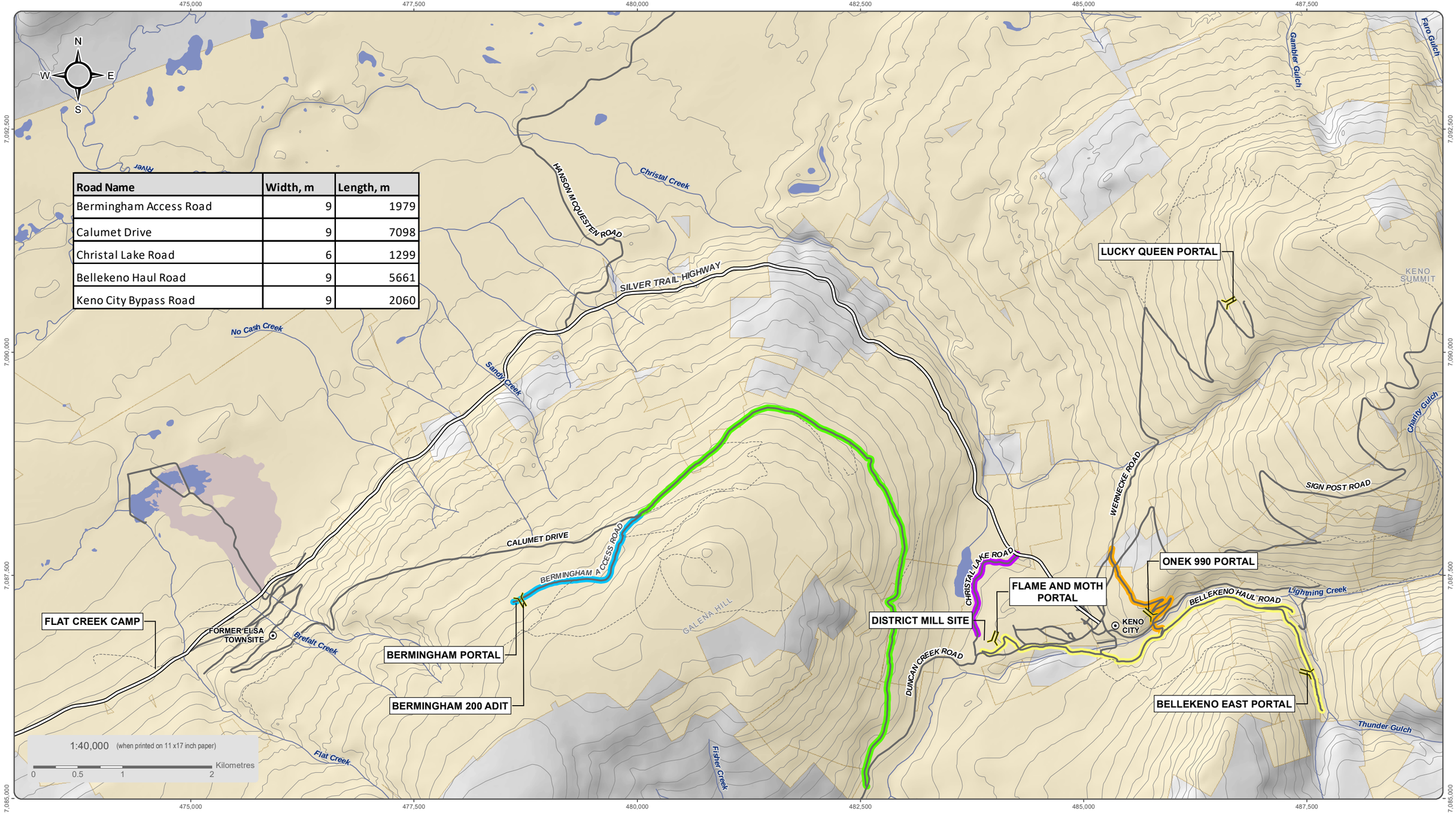
The access roads utilized for KHSD Mining Operations have been referred to by a variety of names since the original application for road development was prepared in 2008. Table 1-3 provides a summary of the access route names, the locations they have been applied to, and their current description as applied in this plan. Figure 1-2 illustrates the access road names utilized in the current operational management plans.

Table 1-3: Access road descriptions

ROUTE	DESCRIPTION
Haul Road between BK East Portal and BK 625 Adit	Haul road constructed from the existing Powerline Road to the decommissioned exploration road (Figure 2-2, ACG, 2008) across at the north side of Bellekeno East Portal which crossed Thunder Gulch within Bardusan Placers Ltd. placer mining activities. Also referred to as Bellekeno Haul Road (ACG, 2009; AKHM, 2021), Powerline Road (ACG, 2010)
Bellekeno Haul Road	Haul road between Duncan Creek and the Bellekeno East Portal laydown area Includes the haul road between BK East Portal and BK 625 Adit, the Lightning Creek Haul Road, a section of the Sourdough Trail between the Lightning Creek Haul Road, the Powerline Road and Bellekeno Project Bypass Road North Also referred to as Bellekeno Access Road (ACG, 2012), Bellekeno Project Bypass Road South (AKHM, 2018)
Bermingham Access Road	Haul road between the Hector Adit on Calumet Road and the New Bermingham Mine
Bermingham Haul Road	Haul road between Duncan Creek Road and the New Bermingham Mine Includes the Bermingham Access Road and a section of Calumet Road from Duncan Creek to the Hector Adit
Calumet Road	Public road that extends from Duncan Creek to the Elsa Townsite Also referred to as Galena Hill Road (AEG, 2008, 2009), Calumet Drive (AKHM, 2018)
Christal Lake Road	Access road from Silver Trail Highway to Duncan Creek Road, passing through the District Mill and the historical Mackeno Mill site The road was originally constructed in the 1950s to haul ore to the Mackeno Mill, and it entered Duncan Creek Road approximately 325 m to the west of its current location; the southern 450 m of was original road was not upgraded by AKHM Also referred to as Keno City Bypass Phase I (ACG, 2009, 2010), Bellekeno Project Bypass Road North (AKHM, 2018)
Duncan Creek Road	Public road
Flame & Moth Access Road	Proposed haul road to replace the section of the Bellekeno Project Bypass Road North (the extension of the Bellekeno Haul Road north of Duncan Creek Road) to allow for the DSTF phase II expansion
Keno City Access Road	Also referred to as the Keno City Bypass Road (ACG, 2012) Pioneering of the Keno City Bypass Road and the installation of the Onek Bridge is complete. Further improvements are required to satisfy haul road specifications
Lightning Creek Haul Road	Haul road constructed across third party claims between the Sourdough Trail and Duncan Creek Road Also referred to as the Keno City Bypass Road (ACG, 2009), the Bellekeno Haul Road (AKHM, 2018)
Powerline Road	A section of the Bellekeno Haul Road that was upgraded from a pre-existing powerline right-of-way
Sourdough Trail	Public road
Silver Trail Highway	Public road maintained year-round by the Yukon Government, Department of Highways
Wernecke Road	Public road

Road Name	Width, m	Length, m
Bermingham Access Road	9	1979
Calumet Drive	9	7098
Christal Lake Road	6	1299
Bellekeno Haul Road	9	5661
Keno City Bypass Road	9	2060



National Topographic Data Base (NTDB) compiled by Natural Resources Canada at a scale of 1:50,000. Cadastral data compiled by Natural Resources Canada. Reproduced underlicense from Her Majesty the Queen in Right of Canada, Department of Natural Resources Canada. All rights reserved.

Datum: NAD 83; Map Projection: UTM Zone 8N

- Chistal Lake Road
- Bellekno Haul Road
- Keno City ByPass
- Calumet Drive
- Bermingham Access Road

- Place of Interest
- Adit
- Alexco/ERDC Quartz Claims

- Tailings Area
- Waterbody
- Silver Trail Highway
- Road
- Limited-Use Road

AKHM

ALEXCO KENO HILL MINING CORP.

FIGURE 1-2

KENO HILL SILVER DISTRICT MINING OPERATIONS ACCESS ROADS

OCTOBER 2021

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2 ROAD MANAGEMENT APPROACH

2.1 OBJECTIVES

Proper road management is required to ensure worker safety, maintain environmental integrity, avoid wildlife encounters, and support ongoing site compliance and mine operations.

The objectives of this Plan are to:

1) ensure employees and contractors are trained to manage the KHSD Mining Operations access roads in a safe and compliant manner, and
2) outline appropriate road development and maintenance measures to ensure environmental protection.

2.2 UPDATED APPROACH

This Road Development and Operation Plan focuses on the road operation and maintenance requirements for roads utilized for the KSHD Mining Operations. The typical civil design criteria used for construction of haul roads for the KHSD Mining Operations are provided. As-built drawings for completed haul roads and bridges are appended.

2.3 ACCESS CONTROL

Signs are posted at all intersections which enter onto private haul roads. These signs indicate that road is not for public entry and only for authorized traffic. All haul and auxiliary vehicle traffic between the KHSD mines and the District Mill site is radio controlled for safety and speed control. The Bellekeno Haul Road above the Sourdough Trail is gated, and the gate locked as deemed necessary. Traffic and access control measures for the Christal Lake Road and Bellekeno Haul Road as implemented in 2010 are illustrated on Figure 2-1. Updated details on access control including the Bermingham Haul Road are provided in the current approved Traffic Management Plan.

During road construction or decommission AKHH consults with Energy Mines and Resources Client Services and Inspections, and Government of Yukon Highways and Public Works, Transportation Branch to determine appropriate methods for limiting access to the sites.

ALEXCO KENO HILL MINING CORP.

BELLEKENO PROJECT

CHRISTAL LAKE ROAD AND BELLEKENO HAUL ROAD
ACCESS CONTROL

DATE: 4/16/2010	**FIGURE 2-1**	SCALE:* 1:15,000
DRAWN BY:EA/MD	CHECKED BY:RLM	*scale on all inset maps is 1:2500
D:\Project\All\projects\Alex-05-01\\Bellekeno\GIS\mxd\QML Plans\Lightning Creek Bypass Plan_mod_24032010.mxd		

Layout and final construction may vary as dictated by final engineering design and site conditions encountered during construction.

Haul Roads
- Haul/Public; Two Way
- Haul Road; One Way
- Haul Road; Two Way

Other Roads
- Silver Trail Highway
- Public Road
- Site Road; No Haul Truck Traffic

Traffic Management and Access Control
- Private Haul Road Do Not Enter Authorized Traffic Only
- Haul Truck Pullout

0 250 500 750 1,000 Meters

N W E S

Mill Site
Keno City
Silver Trail Highway
Christal Lake Road
Mill Access South
Lightning Creek Bypass Road
Duncan Creek Road
Powerline Road
Sourdough Trail

A B C D E F G

Aerial photograph obtained from Geodesy Remote Sensing Inc., Calgary Alberta. Imagery acquired September 13 and14 2006

Bellekeno East Portal

3 ROAD DEVELOPMENT

For the construction, and upgrades of access routes, AKHM adheres to the following:

- Ensure that soil conditions beneath, and in proximity to, any proposed right-of-way is stable to support the intended construction and use,
- Non acid generating or metal leaching (N-AML) material is used for road construction and maintenance,
- All construction, and upgrades utilize N-AML waste rock is done in a manner conducive to monitoring run-off as per the current approved Waste Rock Management Plan,
- New roads are constructed in such a way that minimizes permafrost degradation, and
- Access routes are constructed or upgraded in the following manner:
    - Routes are selected from topographic maps and aerial photos, and walked to evaluate ground conditions and inspect for heritage resources and flagged prior to earthmoving,
    - Routes are to avoid creek crossings and aim to minimize amount of earth moving,
    - Routes are to be located on well drained ground,
    - Areas where ponding occurs are to be avoided,
    - Seeps, marshes, and springs are to be avoided, and
    - Areas disturbed for road construction and upgrades are to be stabilized to prevent long term soil erosion, slumping and subsidence, and to provide conditions suitable to the re-establishment of the vegetative mat.

3.1 CLEARING

In general, a dozer or excavator is used for clearing. Trees within 10 m of a water body are to be close cut and stumps left in place, and the banks and riparian areas cleared with a brush mower or chainsaw.

3.2 HERITAGE RESOURCES PROTECTION

The road routings are to be ground-truthed by AKHM personnel and a knowledgeable community member prior to upgrades or development. The Heritage Resources Protection Plan for KHSD Mining Operations applies within the road right-of ways (ROW).

3.3 GEOTECHNICAL TESTING

AKHM engineers are to ground-truth the road alignments to assess the geotechnical stability of the road bed. Routing is to follow areas of existing linear disturbance. To the extent possible, routing with sufficient overburden underlain with competent rock is to be selected. Areas showing signs of underlying permafrost (stunted trees, ground slumping) are to be avoided to the extent possible. In areas of potential permafrost ground protection measures, such as installation of additional road foundation material, are to be applied.

3.4 HAUL ROAD SPECIFICATIONS

All haul roads utilized by the KHSD Mining Operations are subject to the Yukon Occupational Health and Safety Regulations (Part 15.42 and 15.43), which set out minimum design criteria for safety considerations. In addition, mine haul road design guidelines developed by the University of Alberta (Tannant and Regensburg, 2001), or as subsequently updated for haul roads in northern climates, are to be referenced during the development of the road construction plans.

3.4.1 Haul Road Design Criteria

Civil design criteria for haul roads within the KHSD were developed by Wardrop Engineering Inc. (Civil Design Criteria, Appendix C, Construction Site Plan, Revision 1(ACG, 2009)). The road design criteria used for road construction and upgrades are listed in Table 3-1. The design vehicle used as the basis of design criteria is provided in Table 3-2.

Table 3-1: Road design criteria

HAUL ROAD	
Operating Width*	5.88[1] or 8.82[2] m
Design Speed	50 km/hr
Cross fall	2%
Maximum Grade	8%
Surface	200 mm
Base	300 mm
Sub-base	500 mm
Cut Side Slope	1.5 : 1
Fill Side Slope	2 : 1
Subgrade Compaction	>80%
Granular Compaction	>85%

** Excludes berms and ditches on both side of haul roads*
1. One way traffic
2. Two way traffic (passing)

Table 3-2: Design vehicle Volvo A30E

Volvo A30E	Dimension	
Width	2.94 m	
Length	10.3 m	
Height	3.3 m	
Wheel Base	2.216 m	
Tire Pressure	267 kPa	
Weight	**Loaded**	**Empty**
Gross Vehicle Weight	51 060 kg	28 000 kg
Front Axle	14 990 kg	12 500 kg
Drive Axle	36 070 kg	15 560 kg

3.4.2 Haul Road Construction Guidelines

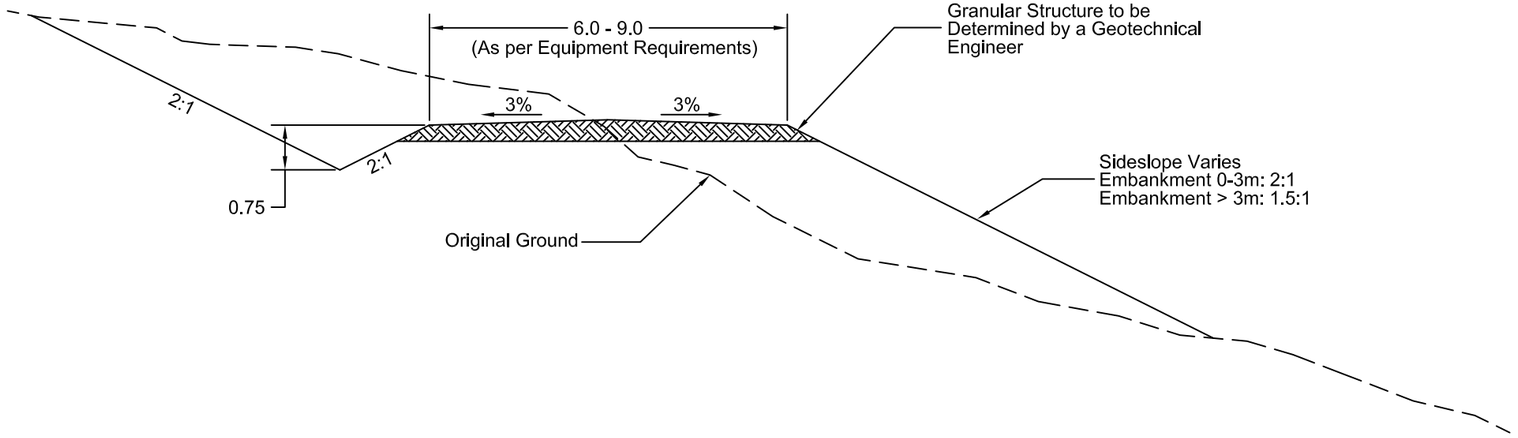
A typical conceptual road section is shown in Figure 3-1 and a typical conceptual bridge design is shown in . General guidelines for haul road construction include:

- haul roads shall be all-weather construction,
- safety berm will be constructed on all fills >3.0 m,
- height of safety berm will be 1.25 m (0.75x the diameter of tire on Volvo A30E articulated haul truck),
- breaks in the safety berm will not exceed the width of the blade of the equipment constructing and maintaining the breaks to allow for drainage, snow clearance and wildlife crossing,
- sideslope will be maximum 2:1 if embankment is between 0-3 m,
- sideslope will be maximum 1.5:1 if embankment is between >3 m,
- alternating vehicular pull-outs will be used at each end of one-way traffic road segments,
- pull outs length equals 1.5 times the vehicle length,
- pull outs width equals 1.5 times the operating width, and
- a clearly marked emergency runaway lane or retardation barrier capable of bringing a runaway vehicle to a stop will be provided and maintained below where road grade exceeds 5%.

3.5 ACCESS TIE-IN AND STAGING AREAS

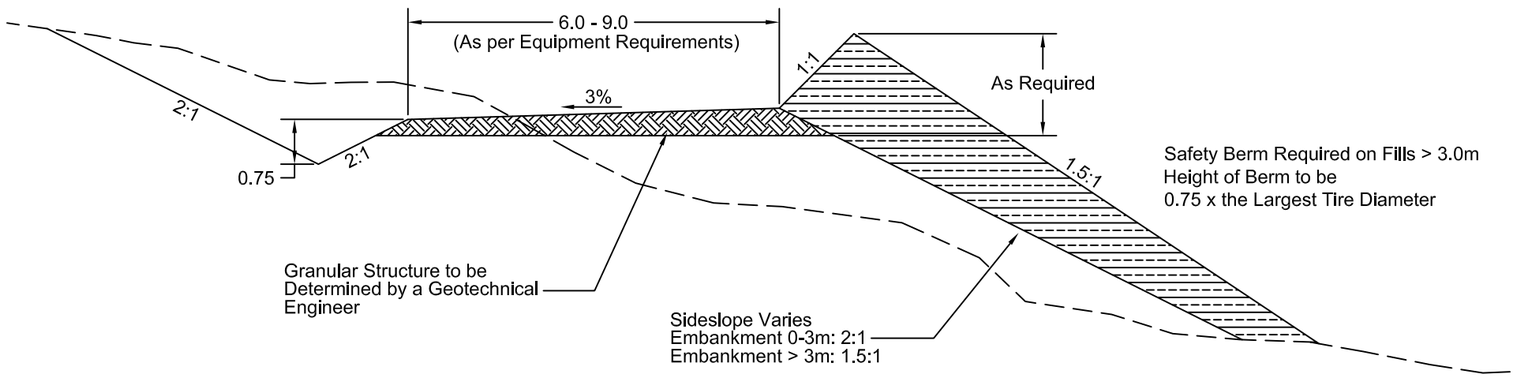
Pre-existing disturbance areas are used for staging construction and road maintenance equipment and material (e.g., N-AML waste rock, sand).

Typical Cross-Section
Access Road



NOT FOR CONSTRUCTION

Typical Cross-Section - Safety Berm
Haul Road



Notes:

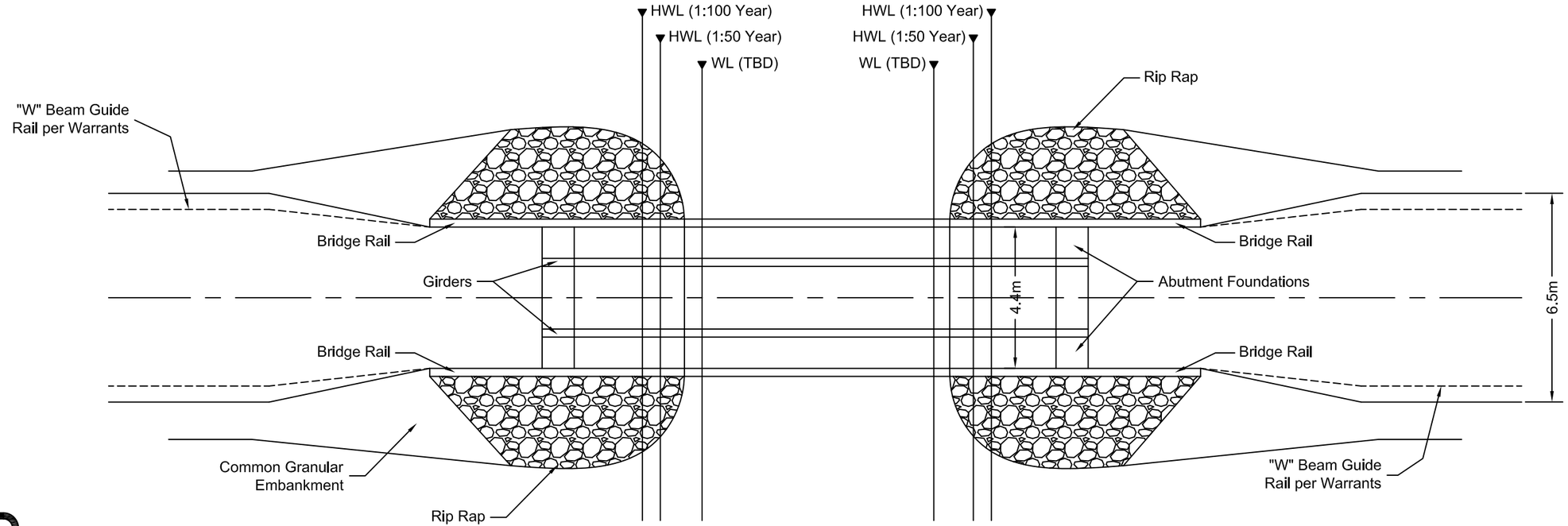
1. Drawings not for construction.
2. Cut and fill as appropriated to suit topography and soil conditions.
3. Contour interval 2m.
4. See detail for typical bridge installation.
5. Pullouts will be required. Locations to be determined and are dependant on the intervisibilty of pullouts.
6. Safety berms required along length of roadway. Height of berm shall be 3/4 the diameter of the largest vehicle tire.
7. Additional roadwidth required to accommodate safety berm construction.
8. Shown for single lane radio controlled application, for two-way traffic road width will be 3x the width of the largest vehicle.

ALEXCO RESOURCE CORP

DEPT.	APPROVED BY	DATE	COMMENTS
SURVEY			Based on Y.E.S Conceptual Drawing E10012.DWG
ENGINEERING			
GEOLOGY			
ALEXCO MANAGER			
PROCON SUPER			

TITLE: *Typical Conceptual Road Section*
Keno Hill Silver District
Mining Operations

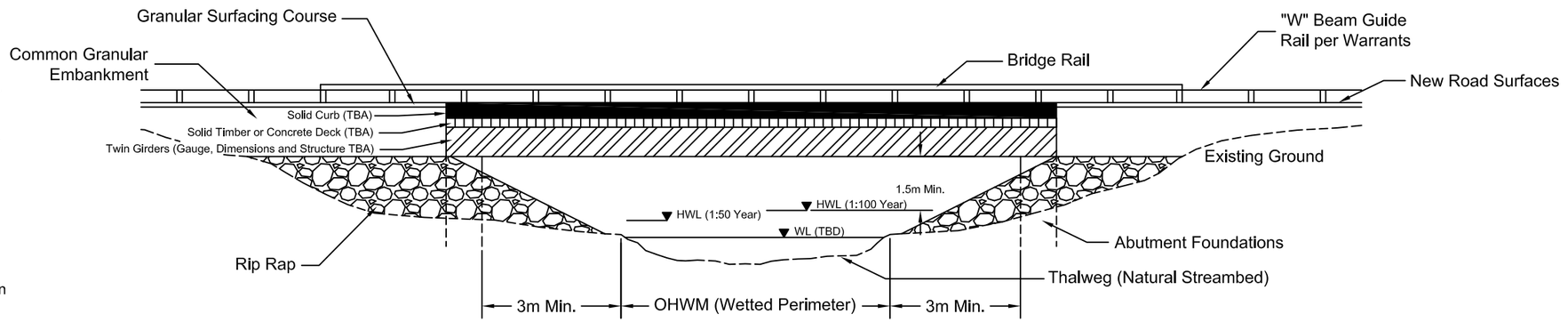
Drawn by: *D. Silander* | Scale: *1:100*
Date: *June 23, 2012* | Approval: | Date:
File:



NOT FOR CONSTRUCTION

Notes:

1. Bridge elevation, length and abutment positions to be determined by contributing drainage area calculations to a 1:100 year flood event. Governing criteria for the height of the bottom of the bridge girders (lowest Obstacle over the stream) was provided by Transport Canada, marine safety who requires that this elevation be at least 1.5m above the 1:100 flood event elevation. (TBD)
2. Rip rap gradation to be confirmed subject to maximum stream velocity calculations at a 1:100 year flood event.
3. Abutment type and foundation deign to be determined subject to geotechnical investigations and recommendations.
4. Silt fencing to be deployed during installation as required.
5. No machine clearing to be employed within 30m of the wetted perimeter (OHWM).
6. Detailed designs will be sealed by a professional engineer registered in the Yukon, and submitted to the appropriate agencies prior to construction.
7. Determine navigable waters protection act applicability first by using "Minor Works and Water User Guide" (Transport Canada).



ALEXCO RESOURCE CORP

DEPT.	APPROVED BY	DATE	COMMENTS
SURVEY			Based on Y.E.S Conceptual Drawing E10012.DWG
ENGINEERING			
GEOLOGY			
ALEXCO MANAGER			
PROCON SUPER			

TITLE: *Typical Conceptual Bridge Design*
Keno Hill Silver District
Mining Operations

Drawn by: *D.Silander* | Scale: *1:150*
Date: *June 22, 2012* | Approval: | Date:
File:

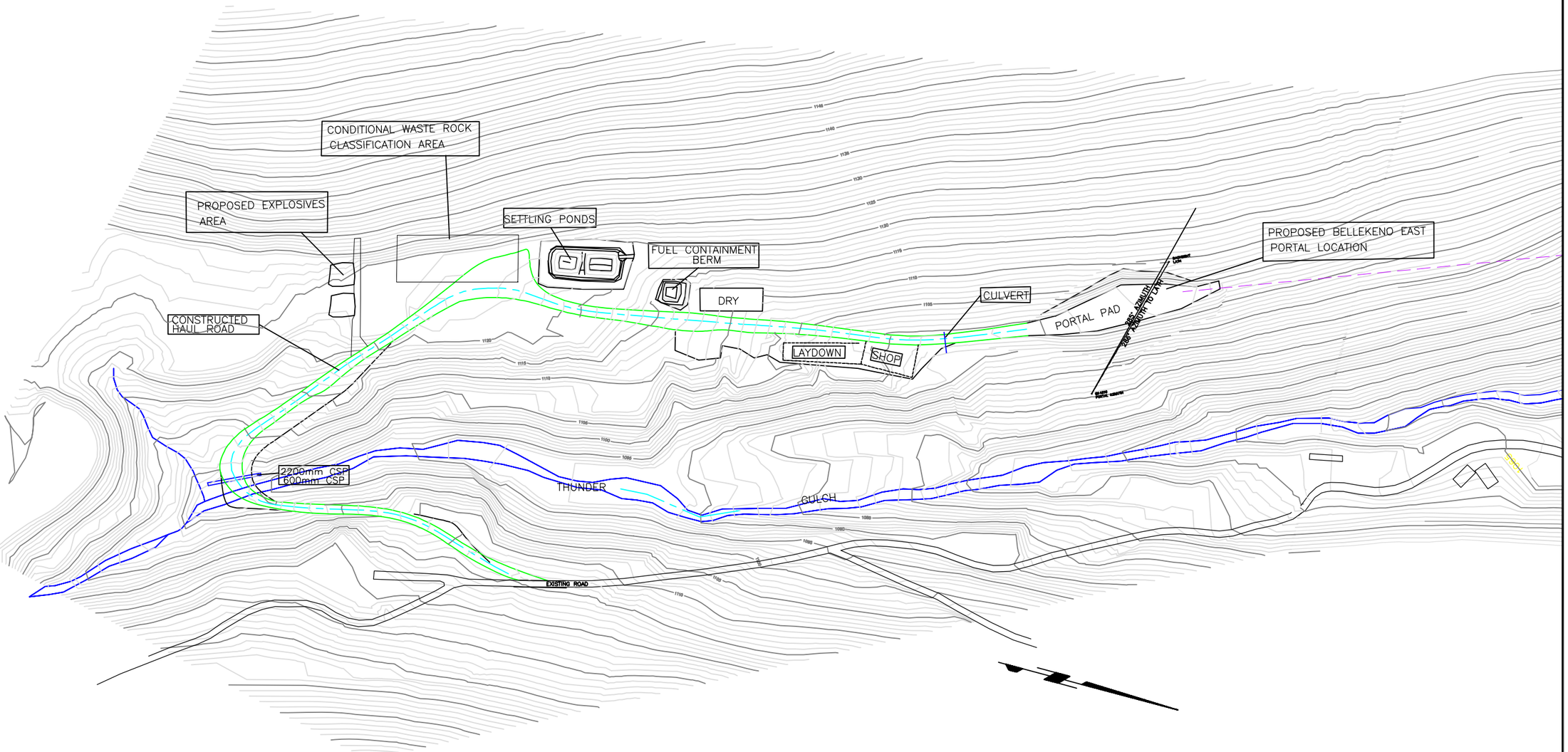
3.6 OVERVIEW OF ROAD CONSTRUCTION

3.6.1 Bellekeno Haul Road

An as-built of a haul road that provided access to the Bellekeno East Portal area prior to the development of the Bellekeno Haul Road was included in the 2008 Bellekeno underground exploration and development application for a water licence and mining land use amendment (see Figure 3-3). The access road proposed to connect the Bellekeno 625 Adit to the Bellekeno East Portal Area and the existing Powerline Road to be upgraded that extended from the Sourdough Trail to the Bellekeno 625 Adit is illustrated on Figure 3-4 (ACG, 2008).

In 2009, the Lightning Creek Bypass Road Construction and Operation Plan was prepared to obtain the necessary permits and authorizations to construct a haul road that would bypass the community of Keno City. The route extends from the Sourdough Trail to the District Mill area and crosses quartz and placer claims held by third parties, as illustrated in Figure 3-5.

The as-built drawings for the Bellekeno Haul Road and Lightning Creek Bridge are included in Appendix A.



ACG File: D:\Project\allProjects\ALEX-05-01\cad\UKHM\Bellekeno_UG_MUL_MLU_Dec07\Fig2_2_SitePlan_2_4_Schem.dwg/Fig2-2

ALEXCO

NO	DESCRIPTION	BY	DATE

NO	DESCRIPTION	BY	DATE
	Modifided by Access Consulting Group	HD	Jan. 2008

SECTION:	
SCALE: 1:2000	DATE
DESIGNED BY: RSC	15/10/07
DRAWN BY: RSC	12/12/07
CHECKED BY:	
APPROVED BY:	

FILENAME:	PROJECT NUMBER	DRAWING NUMBER	REV.
PORTAL.DWG	ED7049	ASBUILT	0

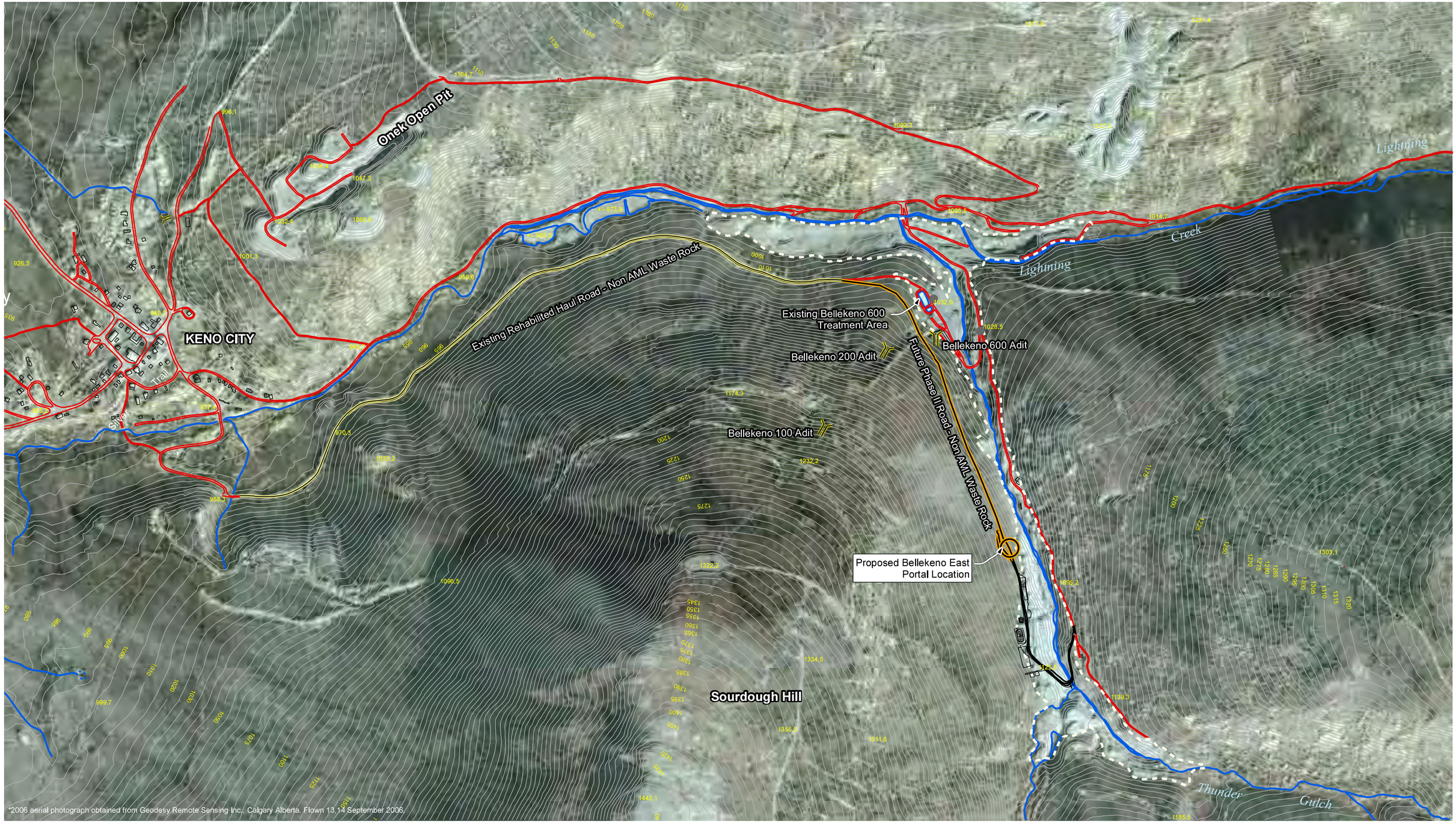
YUKON ENGINEERING SERVICES

FIGURE 2-2 BELLEKENO EAST SITE PLAN

BELLEKENO PROJECT

ALL WEATHER ACCESS ROAD AND SITE WORKS AS-BUILT

PLAN SHEET ACCESS ROAD



N

1:10,000
(when plotted on 11x17 inch sheet)

0 100 200 400 600 m

Legend

- Adit
- Proposed Portal Location
- Proposed Road
- Existing Rehabilitated Haul Road
- Public Road
- Exploration roads
- Contour
- Surface water (actual and potential)
- Placer Mining Area

ALEXCO RESOURCE CORP.

WATER LICENCE APPLICATION & MINING LAND USE APPROVAL AMENDMENT REQUEST

BELLEKENO LOCATION MAP

Drawn By: HD	Date: December 2007	**FIGURE 3**
Checked by: NS/DC	File: D:\Projects\MI\Projects\ALEX-05-01\gdm\cd\UKHM\Bellekeno\LIG_MXD_MLU_Dec07\Fig1_3_Bellekeno_DV.mxd	

Aerial photograph obtained from Geodesy Remote Sensing Inc., Calgary Alberta. Imagery acquired September 13 and14 2006.

Quartz and placers claim boundaries are current as of Feb. 24th 2010. Data source: http://geomaticsyukon.ca.

1:9,000 (when plotted on 11x17 inch sheet)

0 100 200 300 400 Meters

Quartz Claim Owners

- AKHM/ERDC
- Matthias Bindig
- Mega Silver Inc.
- Silverquest Resources Ltd.

Placer Claim Owners

- Frank Taylor
- Duncan Creek Golddusters Ltd.

Roads

- Haul/Public, Two Way
- Halu Road; One Way
- Haul Road; Two Way
- Silver Trail Highway
- Public Road
- Site Road; No Haul Truck Traffic

Other

- Highway Crossing
- Powerline
- Right-of-Way
- Easement

Layout and final construction may vary as dictated by final engineering design and site conditions encountered during construction.

ALEXCO

ACCESS CONSULTING GROUP

BELLEKENO MINE PROJECT

FIGURE 3-5

LIGHTNING CREEK BYPASS HIGHWAY ACCESS AND WORK WHITHIN RIGHT-OF-WAY

Drawn By: MD/EA	March 2010	Verified by: RM

D:\Project\AllProjects\ALEX-05-01\Bellekeno\GIS\mxd\QML Plans\New_Roads_Survey_March2010_wt_Claims.mxd

3.6.2 Bermingham Haul Road

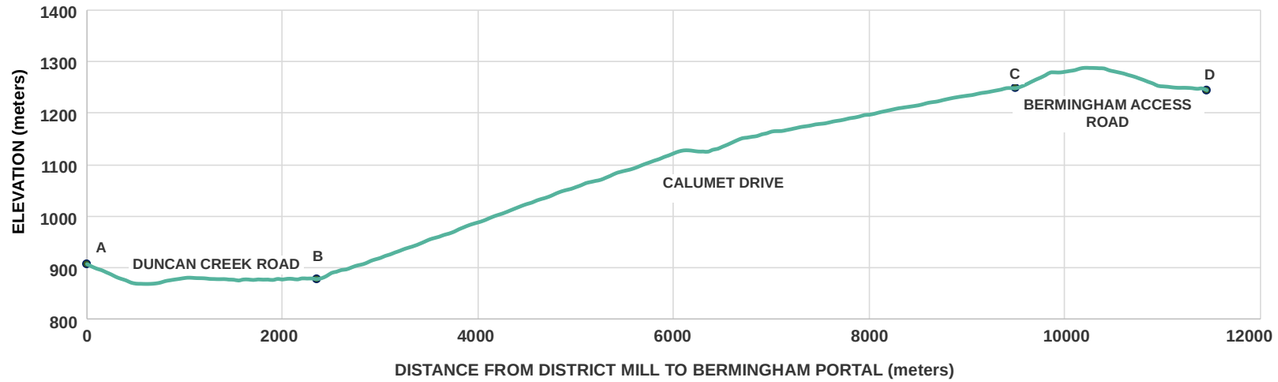
In 2018, Revision 4 of the KHSD Mining Operations Road Construction Plan was issued to obtain the necessary permits and authorizations to upgrade existing public and private roads for mine traffic associated with the New Bermingham Mine. The Bermingham Haul Road includes the Bermingham Access Road, and sections of the Calumet Road Duncan Creek Road as shown on Figure 3-6. As-built drawings are included in Appendix A.

3.6.3 Flame & Moth Access Road

To accommodate the DSTF Phase 2 expansion an alterative route for the haul road currently in place on the north side of the Duncan Creek Road at the District Mill and Flame & Moth Mine area will need to be established. A conceptual routing for the Flame & Moth access road as envisioned in 2015 is illustrated in Figure 3-7. The design for the haul road will be updated to incorporate the design of the DSTF Phase 2 expansion, existing infrastructure, and future plans for the utilization of the area. The visibility of the haul road from the Duncan Creek Road and opportunities to abate noise and dust are to be considered when updating the conceptual road design.

BERMINGHAM ROAD UPGRADE PROFILE

DISTRICT MILL TO BERMINGHAM PORTAL VIA DUNCAN CREEK ROAD, CALUMET DRIVE AND BERMINGHAM ACCESS ROAD



Datum: NAD 83; Map Projection: UTM Zone 8N

- Adit
- KHSD Mill
- Alexco/ERDC Quartz Claims
- Proposed Road Upgrades
- Silver Trail Highway
- Other Road
- Limited-Use Road
- Waterbody
- Watercourse
- Contours (100 ft intervals)

AKHM

Alexco Environmental Group

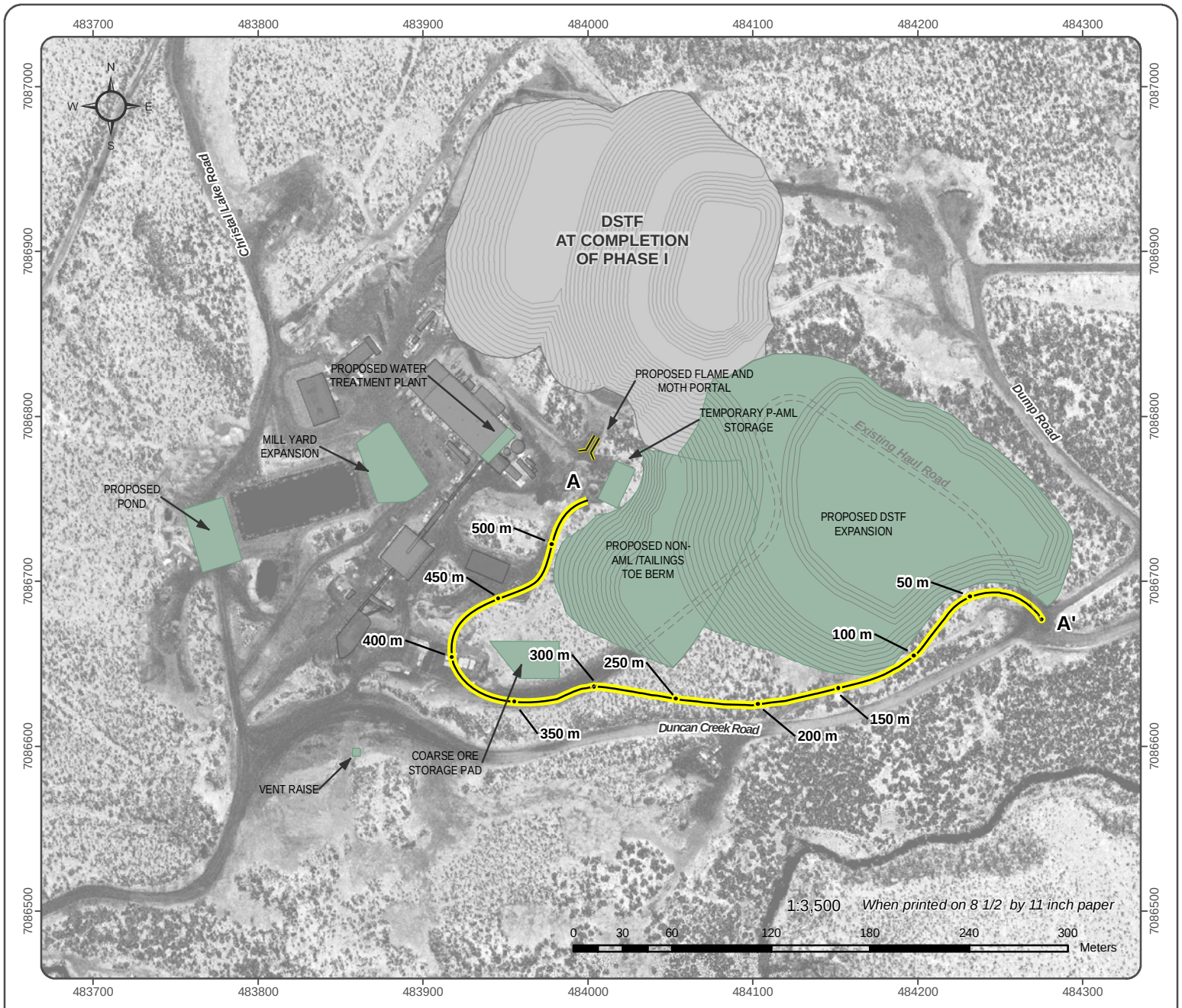
ALEXCO KENO HILL MINING CORP.

FIGURE 3-6

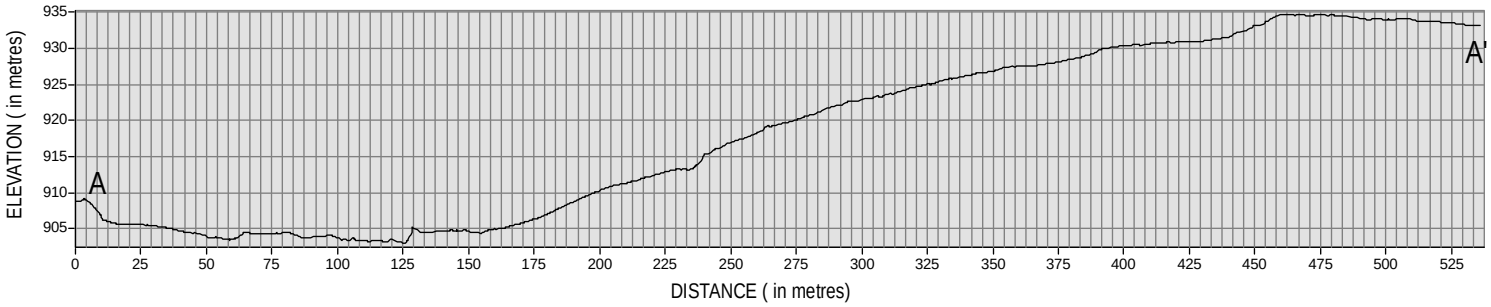
BERMINGHAM ROAD UPGRADES

SEPTEMBER 2018

D:\Projects\AllProjects\Keno_Area_Mines\BERM\Maps\01-Overview\04-SpecificTopics\Traffic Management\Berm_overview_road_upgrade_profile_20180924.mxd
(Last edited by: amalashevska,24/09/2018/14:23 PM)



CONCEPTUAL ROAD DESIGN - ORIGINAL GROUND PROFILE



MineFeaturePoint

Proposed Road

Proposed Builing/Structure

Existing Building/Structure

DSTF End of Phase I Extent

AKHM

ACCESS

KENO DISTRICT MINE OPERATIONS

FIGURE 3-7

CONCEPTUAL FLAME & MOTH ACCESS ROAD

JUNE 2015

Background imagery and elevation data from LiDAR survey conducted September 25th 2014

Datum: NAD 83; Projection: UTM Zone 8N

I:\Keno_Area_Mines\FM\Map\01_Overview\SpecificTopics\Road_Profile\Road_Profile_20150623.mxd
(Last edited by: mducharme; 6/23/2015/12:54 PM)

3.6.4 Keno City Bypass Road

The Keno City Bypass Road routing is required to accommodate mine traffic associated with the Lucky Queen and Onek mine sites. Installation of the Onek Access Bridge (as-built is included in Appendix A) and the pioneering of the route from the Wernecke Road to the Bellekeno Haul Road is complete.

The Keno City Bypass Road route extends from the Wernecke Road, crossing Sign Post Road, along the historic Onek power line, to the Onek 990 Portal, crossing Lightning Creek Road and the Onek Access Bridge across Lightning Creek to the Bellekeno Haul Road. The Bypass Road is to be a single-lane radio-controlled road, approximately 2.1 km long and 6 – 9 m wide. Some portions of the road will be wide enough to safely accommodate passing mine traffic. It is to be developed with cut/fill construction, using the fill material supplemented by some additional N-AML waste rock material (~15,000 m^3 in total required). The N-AML waste rock will be sourced from KHSD Mining Operations in accordance with the current approve Waste Rock Management Plan.

The routing does not cross or come within 30 m of any watercourse or waterbody other than at the approach to Lightning Creek and at the Onek access bridge. Ditching along the road will facilitate appropriate drainage. Culverts will be installed at the intersections with Wernecke Road, Lightning Creek Road, Bellekeno Haul Road and Sign Post Road for drainage. Additional culverts may be established along the bridge approaches. The cleared vegetative debris and topsoil will be stockpiled along the routing in natural cleared areas for road reclamation.

A 6.5 m wide access road will be established on the north and south side of Lightning Creek to the Onek Access Bridge. Two overflow culverts will be installed within the 1:100 year flood event zone. N-AML waste rock will provide the fill material for the access road and abutments. The banks and riparian area will be cleared with a brush mower or pushed aside with a dozer.

484000 485000 486000 487000

7091000 7090000 7089000 7088000 7087000

INSET 1

WERNEKE ROAD

STOP DO NOT ENTER SPEED LIMIT 40

INSET 2

STOP DO NOT ENTER SPEED LIMIT 20 STOP STOP DO NOT ENTER SPEED LIMIT 40

INSET 3

SPEED LIMIT 40 STOP DO NOT ENTER STOP DO NOT ENTER SPEED LIMIT 50 DO NOT ENTER STOP

N W E S

EXISTING LUCKY QUEEN ADIT

INSET 1

Erickson Gulch

WERNECKE ROAD

SILVER TRAIL HIGHWAY

CHRISTAL LAKE ROAD

Christal Lake

HISTORIC ONEK 400 ADIT

INSET 2

ONEK 990 PORTAL AND PAD

TO BELLEKENO MINE

HAUL ROAD

BELLEKENO

INSET 3

KENO CITY

DISTRICT MILL

DUNCAN CREEK ROAD

1:15,000 *(when printed on 11 x 17)*

Meters 0 250 500 1,000

484000 485000 486000 487000

Existing Private Road, Haul Road
Proposed Private Road, Haul Road
Existing Public Road, Haul Road
Road Right of Way
Watercourse
Waterbody

This map is for illustrative purposes only. This is not a legal document. Quartz claim boundaries are current as of March 26, 2012. Placer claim boundaries are current as of Feb 26th, 2012. Land Disposition data obtained from Canada Lands Survey System, current as of March 2012. Site hydrography and contours derived from 2006 aerial imagery obtained from Aero Geometrics, Calgary Alberta. Aerial photograph obtained from Geodesy Remote Sensing Inc., Calgary Alberta. Imagery acquired September 13th and 14th 2006.

Datum: NAD 83; Projection: UTM Zone 8N

ALEXCO

ACCESS

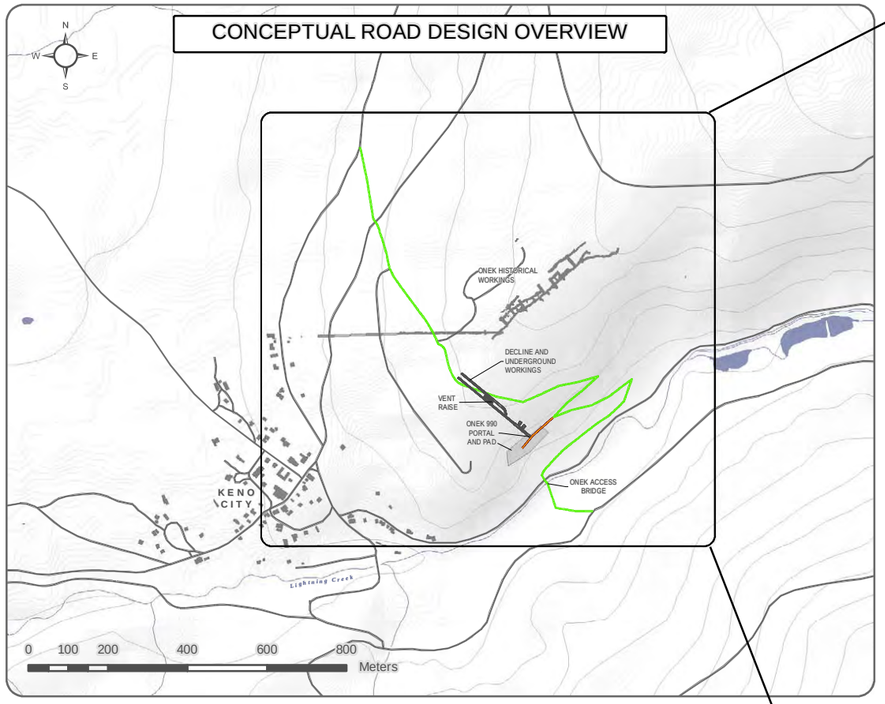
ALEXCO KENO HILL MINING CORP.
ONEK AND LUCKY QUEEN

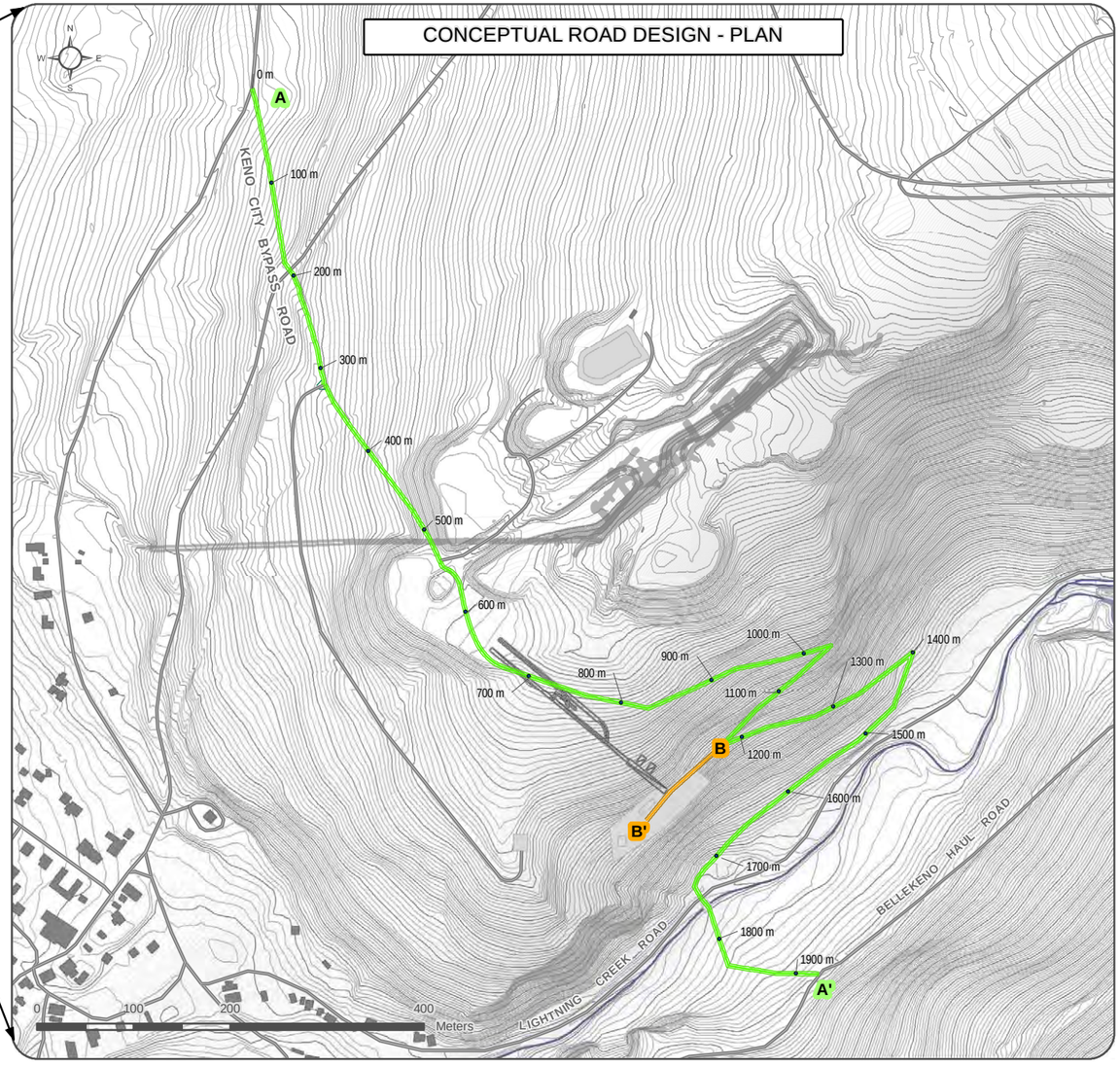
FIGURE 3-8

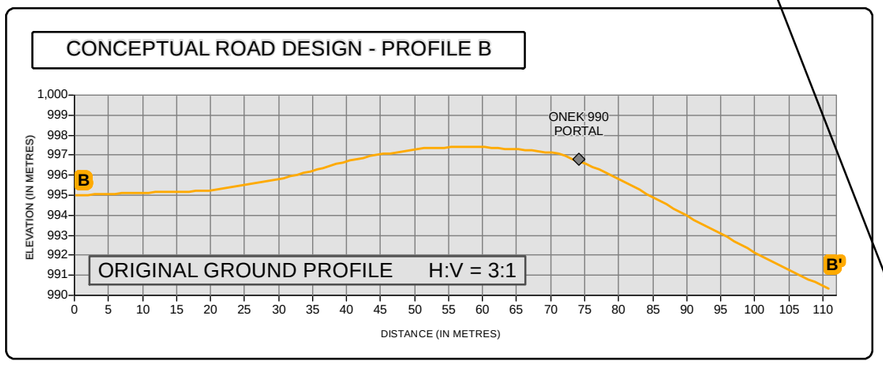
KENO CITY BYPASS ROUTING AND ACCESS MANAGEMENT

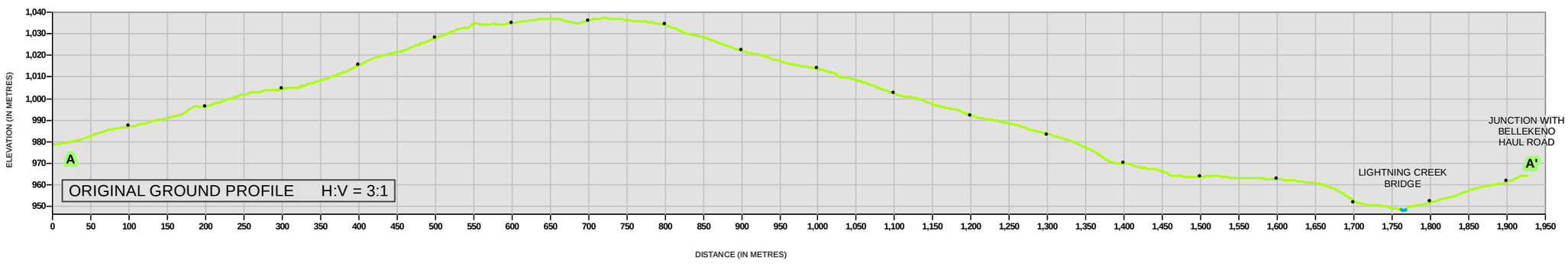
DRAWN BY MD	NOVEMBER 2012	VERIFIED BY KW

I:\Keno_Area_Mines\ONEK\Maps\2_Permitting\Traffic\Road_Construction_Bypass_Plan_20121114.mxd
(Last edited by: jpan;11/14/2012/15:07 PM)









KENO HILL SILVER DISTRICT MINING OPERATIONS

FIGURE 3-9

CONCEPTUAL KENO CITY BYPASS ROAD DESIGN

- Profile A Distance Markers (distance in meters)
- Profile A
- Profile B
- Existing Roads

NOT FOR CONSTRUCTION

Profiles derived from 1 meter contour data derived from 2006 aerial imagery obtained from Aero Geometrics, Calgary Alberta.and Site hydrography and contours derived from 2006 aerial imagery obtained from Aero Geometrics, Calgary Alberta.

NAD 83 UTM Zone 8N

NOVEMBER 2012

AKHM ACCESS

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(Last edited by: mduchame;19/11/2012/15:19 PM)

4 ROAD MAINTENANCE

4.1 HAUL ROAD MAINTENANCE

Periodic grading and resurfacing as deemed necessary will be employed to keep the haul roads in good repair. During the winter, haul roads will be plowed and sanded to ensure proper traction is maintained. Breaks in snowbanks on the main access roads are to be created to facilitate wildlife crossing. By March 31 of each year, all ditches and culverts are to be cleared of ice, snow and debris that would affect their operational capacity and be maintained free of such obstructions until at least October 31 of each year in accordance with the terms and conditions of Water Licence QZ18-044.

4.2 BORROW SOURCES

Borrow material for the construction, and maintenance of access roads for the KHSD Mining Operations may be extracted from the following sources, in accordance with approved construction plans under QML-0009:

- placer tailings,
- fill from road cuts,
- borrow from near road sources within KHSD Mining Operations right of ways or development footprint, and
- borrow from the District Mill area.

4.3 USE OF WASTE ROCK AND GEOCHEMICAL EVALUATION

Waste rock from the Bellekeno, Lucky Queen, Onek, Flame & Moth and New Bermingham mines, may be used for road construction, upgrades, and maintenance. The KHSD Mining Operations Waste Rock Management Plan is applied when selecting N-AML material appropriate for construction. N-AML waste rock from the New Bermingham and Bellekeno mines may be used for construction purposes throughout the KHSD. N-AML waste rock from the Flame & Moth Mine may only be used at the District Mill and immediately adjacent infrastructure. The use of N-AML waste rock within 30 m of a surface water body additional restrictions apply, as listed in the Waste Rock Management Plan and Water Licence QZ18-044.

To produce suitable sized material from waste rock for construction purposes additional crushing and screening may be required. 2023 upgrades to the District Mill crushing plant will enable the belt below the crusher to be reversed, thus allowing non-ore rock to be stockpiled separately from ore. The Flame & Moth crushed waste rock is to be stockpiled at the District Mill in an area that is not accessible to the public. The New Bermingham crushed waste rock will be staged in pre-existing disturbance areas within existing right of ways or the development footprint and near to sites where the material will be utilized for construction or maintenance.

5 BEST MANAGEMENT PRACTICES

5.1 HAUL TRUCK CLEANLINESS

Haul trucks will be subject to periodic maintenance at the Flame & Moth and New Bermingham mobile maintenance shops. This maintenance may include washing, with care taken that all wash water be recycled or directed to the Flame & Moth water treatment pond, the Mill Pond or captured within the floor drains of the shops.

5.2 ROAD MAINTENANCE

Table 5-1 outlines the best management practices applied to road maintenance for the KHSD Mining Operations to protect environmental conditions and minimize disturbance to the local community.

Table 5-1: Road maintenance best management practices

ENVIRONMENTAL COMPONENT	MITIGATION
Runoff, Sediment and Erosion Control	• Only N-AML material is used for road maintenance • The roads are graded to allow surface water to drain off the road. • Any runoff from the road surface or staging areas is conveyed into permeable roadside ditches and culverts, where it will likely infiltrate in the subsurface. During large storm events it is expect that some runoff volume will reach Lightning Creek and other waterbodies near the access roads. It is expected this volume will not be large enough to cause flooding issues downstream because the road area represents a very small percentage of the overall watershed areas. • As part of road maintenance, ruts that could be prone to erosion will be filled in • Vegetation removal will be minimized to the extent possible • Water bars will be constructed to promote proper drainage, if required • During bridge construction/ adjacent road development, temporary sediment control, such as silt fences or temporary diversion berms, will be installed, monitored, and maintained to prevent sediment runoff into the creek • If minor rutting is likely to occur, stream bank and bed protection methods (e.g. swamp mats, pads) shall be used provided they don not constrict flows or block fish passage • All vehicles will be operated to avoid rutting and gouging of roads and trails
Dust Control	• Application of water or non-petroleum dust suppression agents will be employed if required to control fugitive dust from haul road surfaces during the summer months. Run of mine ore from underground operations is generally wet, coarse grained and free of fines and ill not create dust • See current approved Dust Management Plan
Site Isolation	• Temporary trails will be blocked to prevent further vehicular access • During bridge construction and road construction adjacent water, banks and riparian areas will be cleared with a brush mower or chainsaw. Trees within 10 m of a Creek will be close cut and stumps left in place • Use existing trails, roads, or cut lines where possible to avoid disturbance to the riparian vegetation
Culvert Installation	• Ensuring that the bridges over Lightning Creek can support the weights that cross it • All storm water management culverts will be constructed to divert water beneath the roadway between road ditches and will not impact existing systems

6 ROAD DECOMMISSIONING AND SITE RECLAMATION

The closure objectives specific to access roads are to:

- protect public safety, and
- enable pre-mining human and wildlife utilization of linear infrastructure.

6.1.1 Temporary Access Closure

To limit access during temporary closure, pylons and signage will be used to warn road users, and gates will be installed, as required. Bridges will not be decommissioned during a temporary closure.

During a temporary closure road will be visually inspection for signs of instability/erosion, the road surface, ditches, and culverts will be maintained.

6.1.2 Permanent Access Closure

The KHSD Mining Operations Reclamation and Closure Plan addresses the following site access roads:

- Bellekeno Haul Road from District Mill to Bellekeno East Portal (including the Lightning Creek bridge),
- Christal Lake Road (from Silver Trail Highway to the District Mill),
- Keno City Bypass Road from Bellekeno Haul Road to Wernecke Road (including the Lightning Creek bridge #2), and
- Bermingham access road from New Bermingham portal to Calumet Drive.

The roads identified for closure above range in width from six to nine meters and are either newly developed or reconstructed/upgraded from existing roads. Standard road decommissioning and reclamation measures at closure are described in the Reclamation and Closure Plan and include culvert removal, re-sloping banks and removal of safety berms to reflect the natural topography as well as provide stability, and surface scarification to encourage natural revegetation. Decommissioning measures will involve removal of the two clear span bridges (and abutments) across Lightning Creek. The banks will be stabilized through revegetation and strategic placement of the existing rip rap. Existing public roads are to remain in place post closure.

7 INSPECTIONS, DOCUMENTATION AND REPORTING

Annual reports submitted under Quartz Mining License QML-009 include a description of any change to road management practices and summaries of road maintenance activates. Annual reports submitted under the QML-0009 include a description of activities undertaken in the previous calendar year, a workplan for the current year, along with additional reporting requirements specified in the license. All annual reports are provided to the FNNND.

Engineered road structures in use for KHSD Mining Operations are inspected weekly by AKHM and annually by an independent engineer in accordance with terms and conditions outlined in QML-0009 and Water Licence QZ18-044. The annual geotechnical inspection by an independent engineer is to be reported under QML-0009 withing ninety (90) days of the inspection. The weekly inspections conducted by AKHM must be reported quarterly under Water Licence QZ18-044 and the annual geotechnical inspection is to be submitted with the annual Water Licence report.

Use of waste rock for construction purposes requires monthly inspections between May and October of each year and the following data must be submitted with the Water Licence QZ18-044 annual report:

a) a record the following during all inspections and provide the details as part of the annual report,

b) any physical instability including erosion,

c) upstream ponding of water and downstream seepage,

d) the location of ponding and seepage,

e) the rate of flow, field pH, conductivity and concentrations of inductively coupled plasma (ICP) metals of ponding or seepage,

f) visual evidence of sulphide oxidation including snow melt areas or the presence of oxidation products, and

g) trends in pH, conductivity, and concentrations of ICP metals for any recurring seepage or ponding.

Any drainage or seeps observed between May and October from areas where waste rock was used for road construction is monitored for estimated flow volume and basic field parameters of pH and conductivity. Evidence of sulphide oxidation such as snow melt areas or the presence of sulphide oxidations products are also be noted. This monitoring occurs in conjunction with the monthly regional surface and groundwater monitoring program.

To date, no seeps have been detected from areas where N-AML waste rock was used for road construction. Should the presence of an on-going seep be detected it will also be tested monthly on-site zinc analysis between May and October. If seepage quantity is sufficient, samples will be submitted for dissolved ICP metals, Ammonia-N, Nitrite-N, Nitrate-N, phosphorous, sulphate, dissolved organic carbon (DOC), hardness, alkalinity, total suspended solids (TSS), pH, conductivity and toxicity testing on a quarterly seasonal basis (see current approved Adaptive Management Plan for additional details).

8 REFERENCES

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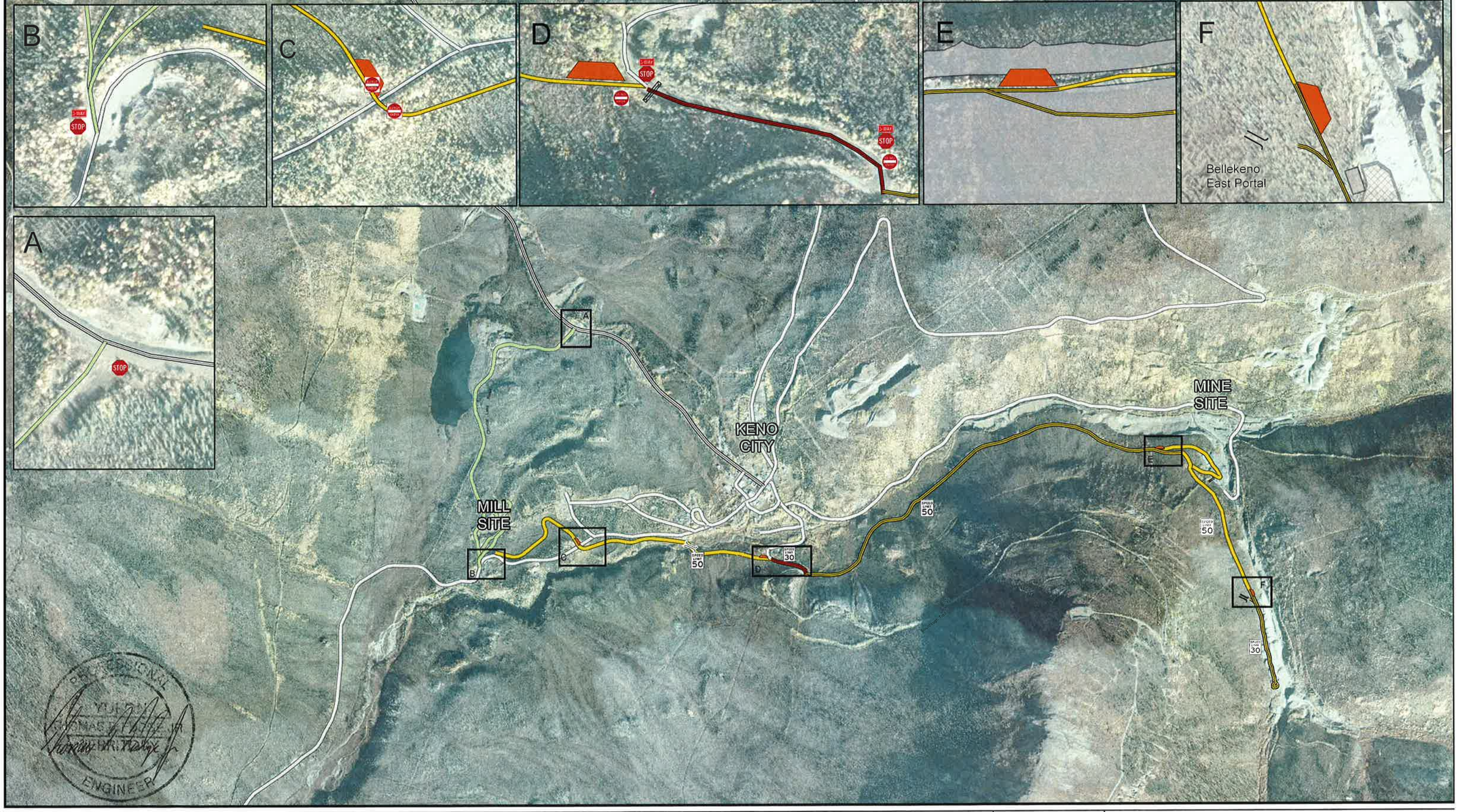
Tannant D.D. & Regensburg B. 2001. *Guidelines for Mine Haul Road Design*. University of Alberta, School of Mining and Petroleum Engineering, Department of Civil and Environmental Engineering.

APPENDIX A:

AS-BUILT DRAWINGS



Aerial photograph obtained from Geodesy Remote Sensing Inc., Calgary Alberta. Imagery acquired September 13 and 14 2006. Site hydrography and contours provided by Aero Geometrics LTD, derived from aerial photograph.

Datum: NAD 83; Map Projection: UTM Zone 8N

Main Map: 1:17,000

All Inset Maps: 1:2,500 (when printed on 11 x17 inch paper)

0 250 500 750 1,000 Meters

Haul Roads

- Haul Road, Two Way
- Haul Road, One Way
- Haul Road, Two Way

Other Roads

- Highway
- Local Road
- Mill Access, No Haul Trafic

Traffic Management and Access Control

- Haul Truck Pullout
- Private Haul Road Do Not Enter Authorized Traffic Only
- Gate

ALEXCO

ACCESS

ALEXCO KENO HILL MINING CORP.

BELLEKENO HAUL ROAD

DRAWN BY MD	MARCH 2012	VERIFIED BY VB

I:\ALEX-05-01\Bellekeno\GIS\mxd\Annual_Reports\2011\HaulRoad\BellekenoHaulRoadDesignSiteMap20120307.mxd
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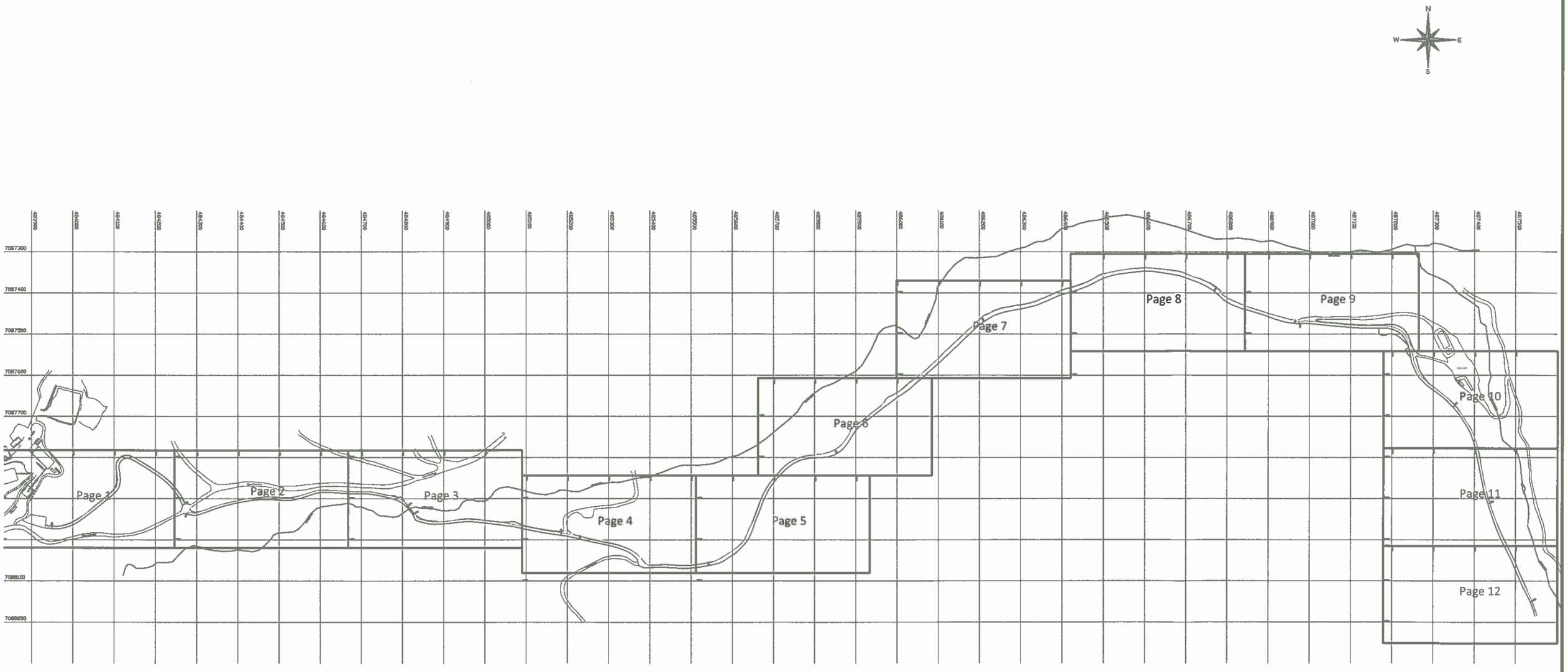


Legend	
Existing Road	
Min. Single Lane Width	
Min. Double Lane Width	

ALEXCO

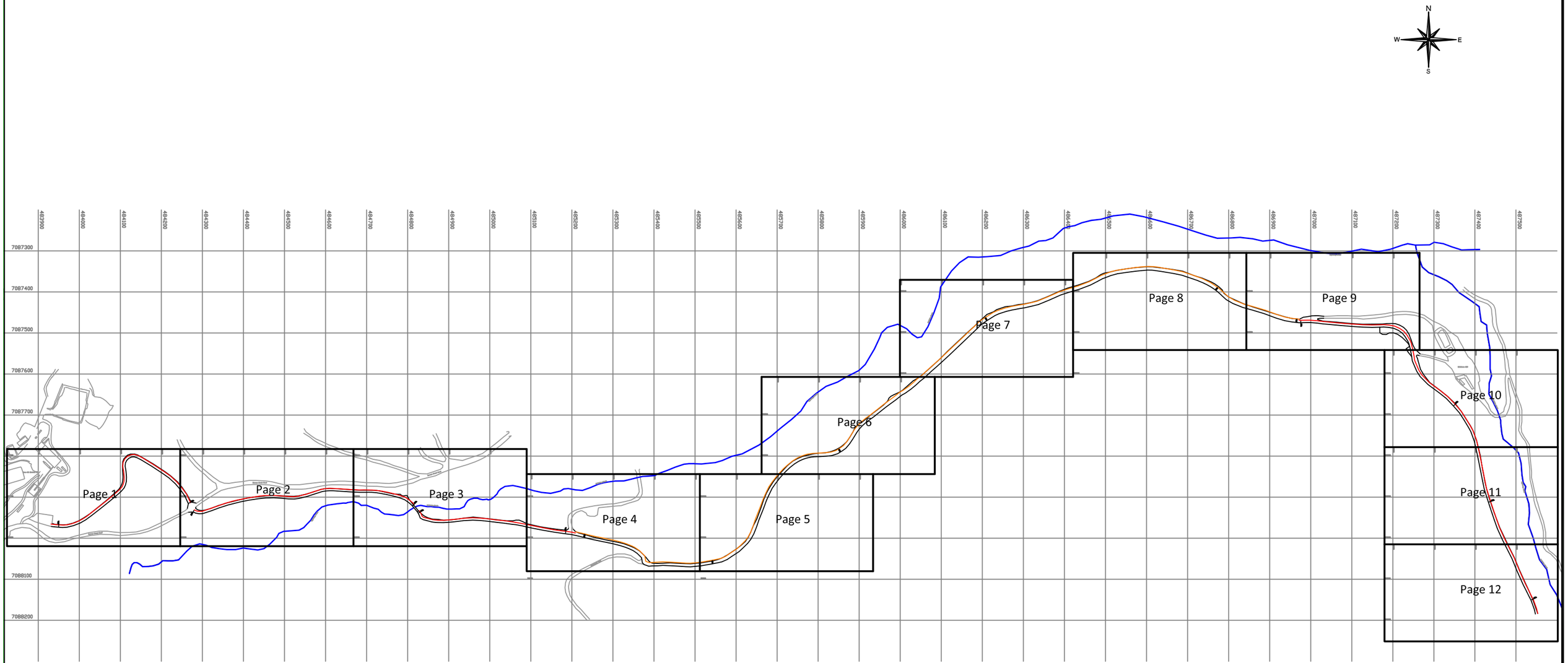
ALEXCO RESOURCE CORP
Bellekeno Mine

DEPT.	APPROVED BY	DATE	COMMENTS
SURVEY			
ENGINEERING			
GEOLOGY			
ALEXCO MANAGER			
PROCON SUPER			

PROFESSIONAL ENGINEER
YUKON TERRITORY
THOMAS P. FUDGE JR.

TITLE: *Bellekeno Haul Road*
As-Built

Drawn by: DS	Scale: 1:10000
Date: Nov. 22, 2011	Approval: Date:
File:	



Legend	
Existing Road	
Min. Single Lane Width	
Min. Double Lane Width	

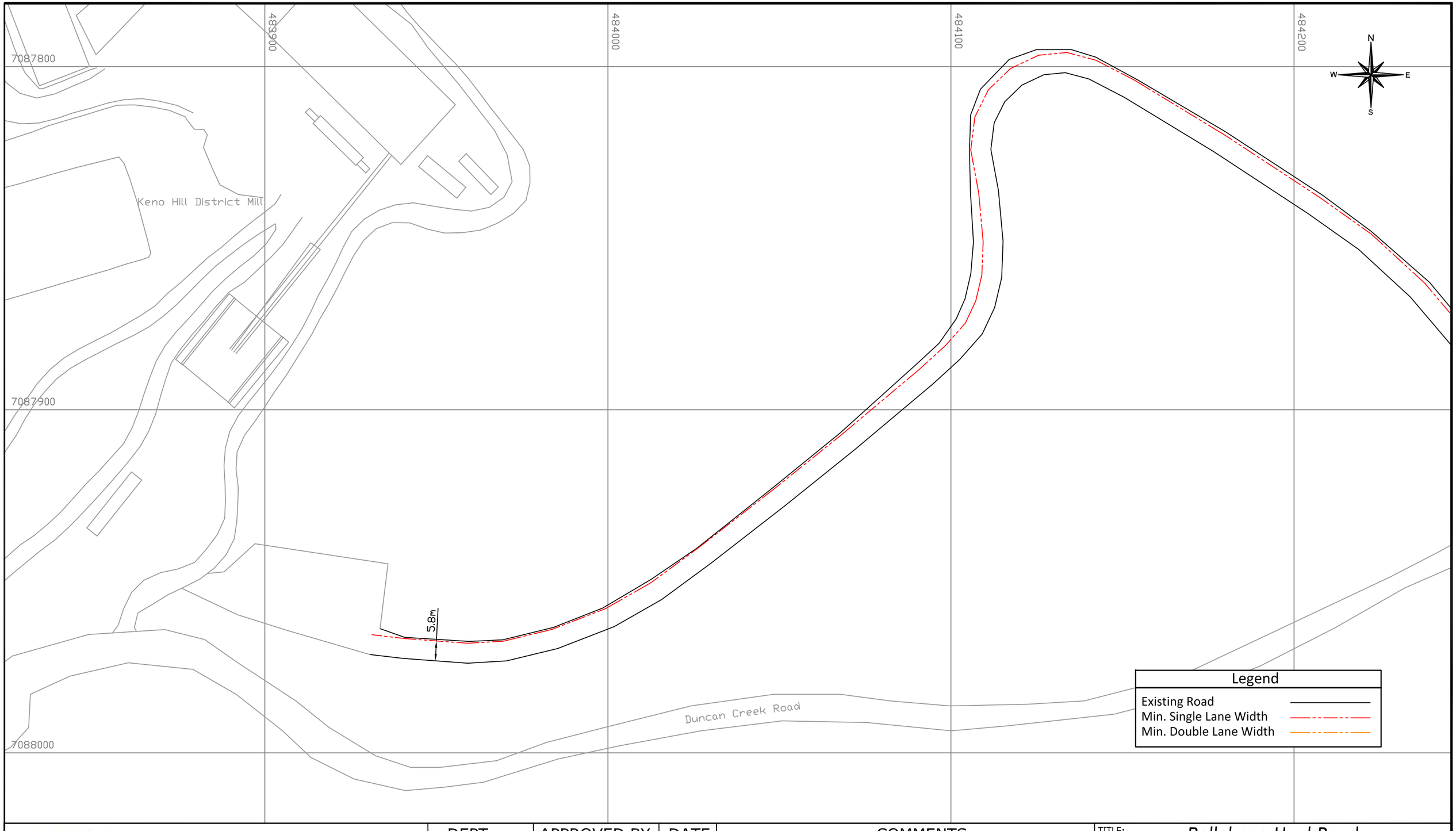
ALEXCO

ALEXCO RESOURCE CORP
Bellekeno Mine

DEPT.	APPROVED BY	DATE	COMMENTS
SURVEY			
ENGINEERING			
GEOLOGY			
ALEXCO MANAGER			
PROCON SUPER			

TITLE: *Bellekeno Haul Road*
As-Built

Drawn by: *DS* | Scale: *1:10000*
Date: *Nov. 22, 2011* | Approval: | Date:
File:



ALEXCO

ALEXCO RESOURCE CORP
Bellekeno Mine

DEPT.	APPROVED BY	DATE	COMMENTS
SURVEY			
ENGINEERING			
GEOLOGY			
ALEXCO MANAGER			
PROCON SUPER			

TITLE: *Bellekeno Haul Road*
As-Built
Page 1 of 12

Drawn by: *DS* | Scale: *1:1000*
Date: *Nov. 22, 2011* | Approval: | Date:
File:

484300
484400
484500
484600
7087800
7087900
7088000
N
W
E
S
Duncan Creek Road
5.8m
5.8m
Lightning Creek

Legend	
Existing Road	
Min. Single Lane Width	
Min. Double Lane Width	

ALEXCO

ALEXCO RESOURCE CORP
Bellekeno Mine

DEPT.	APPROVED BY	DATE	COMMENTS
SURVEY			
ENGINEERING			
GEOLOGY			
ALEXCO MANAGER			
PROCON SUPER			

TITLE: *Bellekeno Haul Road*
As-Built
Page 2 of 12

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Date: *Nov. 22, 2011*	Approval: Date:
File:	

484700
484800
484900
485000
7087800
7087900
7088000
N
W
E
S
Duncan Creek Road
Lightning Creek
5.8m
5.8m

Legend	
Existing Road	
Min. Single Lane Width	
Min. Double Lane Width	

ALEXCO

ALEXCO RESOURCE CORP
Bellekeno Mine

DEPT.	APPROVED BY	DATE	COMMENTS
SURVEY			
ENGINEERING			
GEOLOGY			
ALEXCO MANAGER			
PROCON SUPER			

TITLE: *Bellekeno Haul Road*
As-Built
Page 3 of 12

Drawn by: *DS* | Scale: *1:1000*
Date: *Nov. 22, 2011* | Approval: | Date:
File:

485100
485200
485300
485400
485500
7087900
7088000
Lightning Creek
Sourdough Trail
5.8m
8.7m
N
W
E
S

Legend
Existing Road
Min. Single Lane Width
Min. Double Lane Width

ALEXCO

ALEXCO RESOURCE CORP
Bellekeno Mine

DEPT.	APPROVED BY	DATE	COMMENTS
SURVEY			
ENGINEERING			
GEOLOGY			
ALEXCO MANAGER			
PROCON SUPER			

TITLE: *Bellekeno Haul Road*
As-Built
Page 4 of 12

Drawn by: *DS* | Scale: *1:1000*
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485600

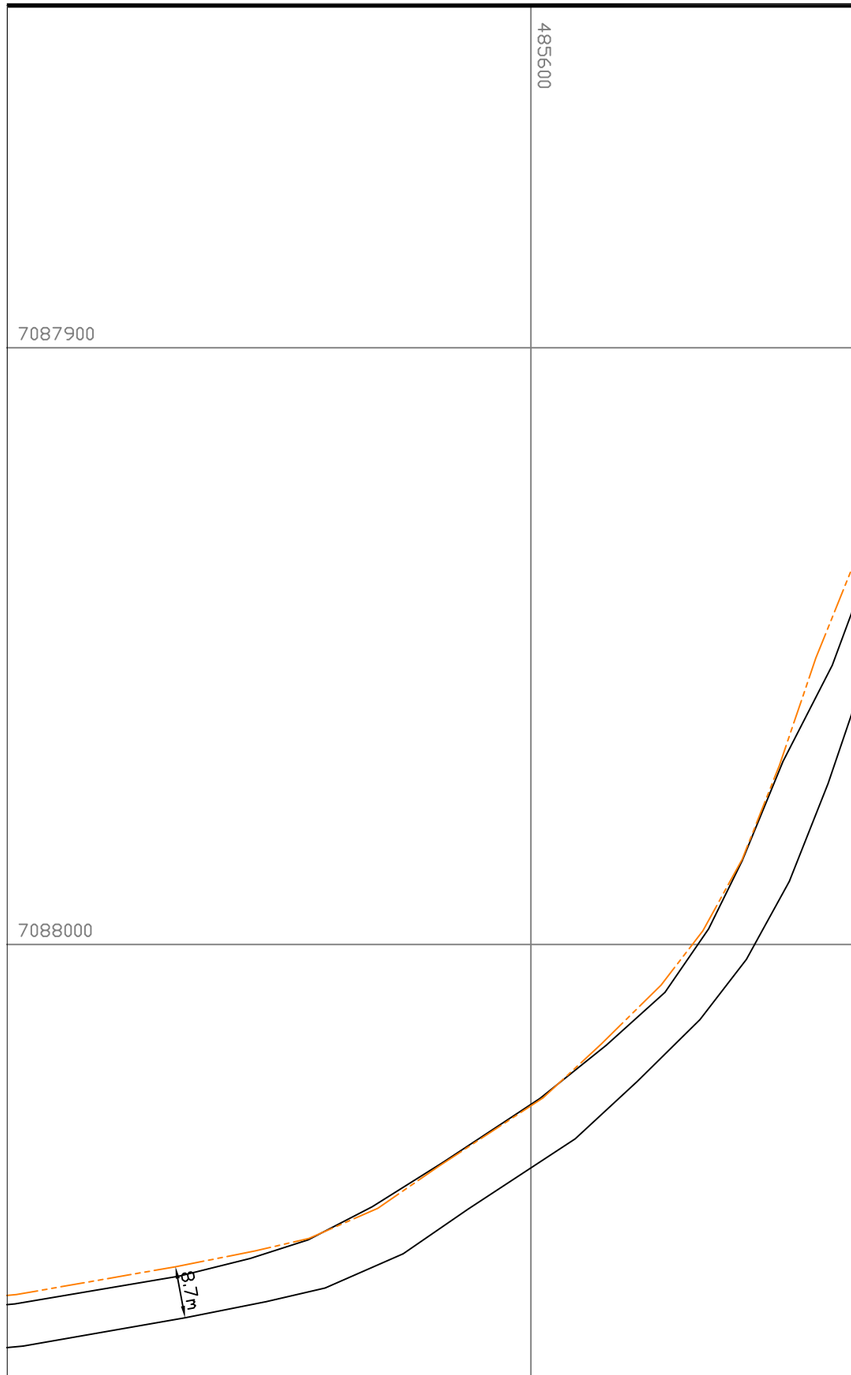
485700

485800

485900

7087900

7088000



N

W

E

S

Legend	
Existing Road	
Min. Single Lane Width	
Min. Double Lane Width	

ALEXCO

ALEXCO RESOURCE CORP
Bellekeno Mine

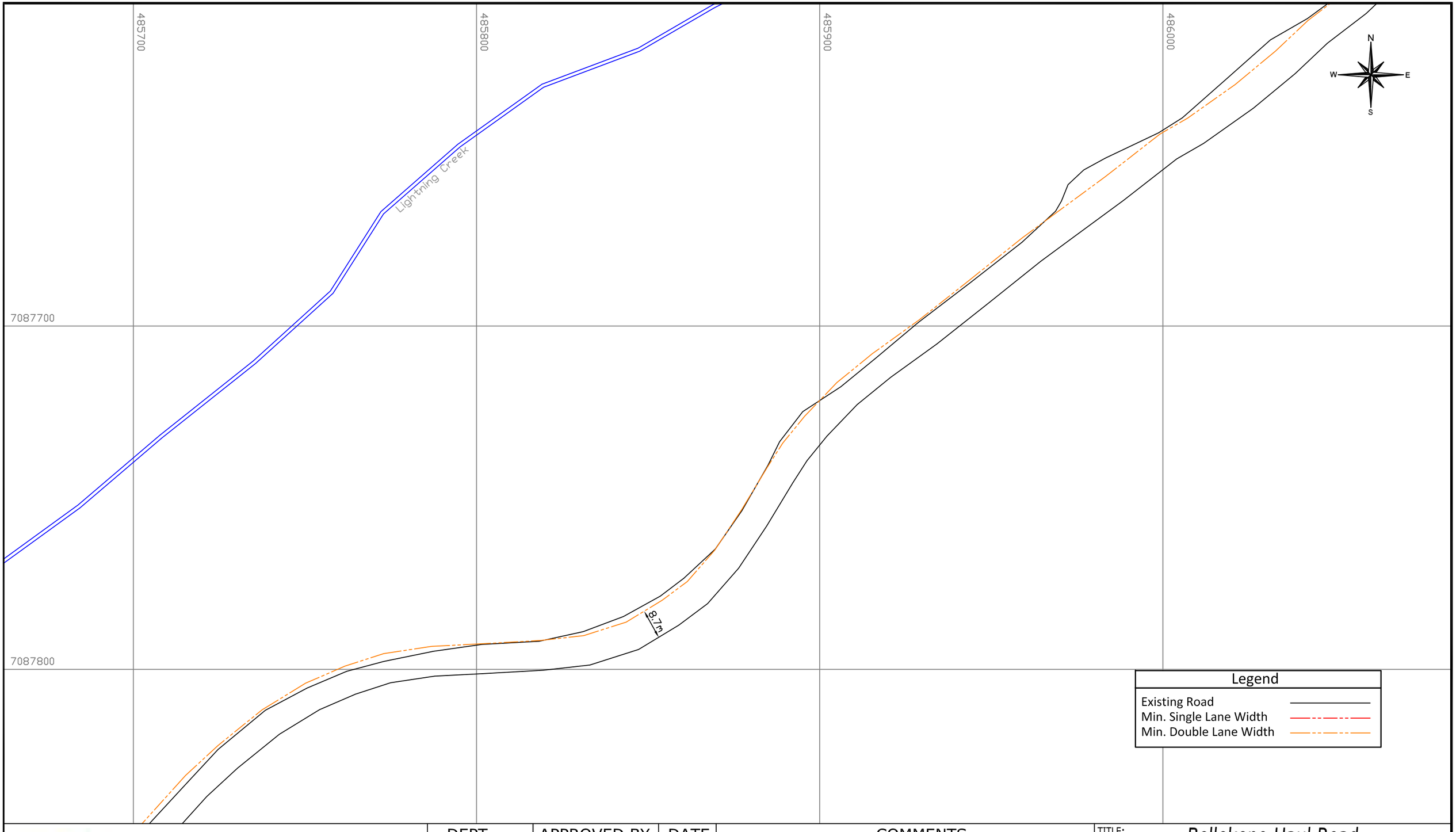
DEPT.	APPROVED BY	DATE	COMMENTS
SURVEY			
ENGINEERING			
GEOLOGY			
ALEXCO MANAGER			
PROCON SUPER			

TITLE: *Bellekeno Haul Road*
As-Built
Page 5 of 12

Drawn by: *DS* | Scale: *1:1000*

Date: *Nov. 22, 2011* | Approval: | Date:

File:



ALEXCO

ALEXCO RESOURCE CORP
Bellekeno Mine

DEPT.	APPROVED BY	DATE	COMMENTS
SURVEY			
ENGINEERING			
GEOLOGY			
ALEXCO MANAGER			
PROCON SUPER			

TITLE: *Bellekeno Haul Road*
As-Built
Page 6 of 12

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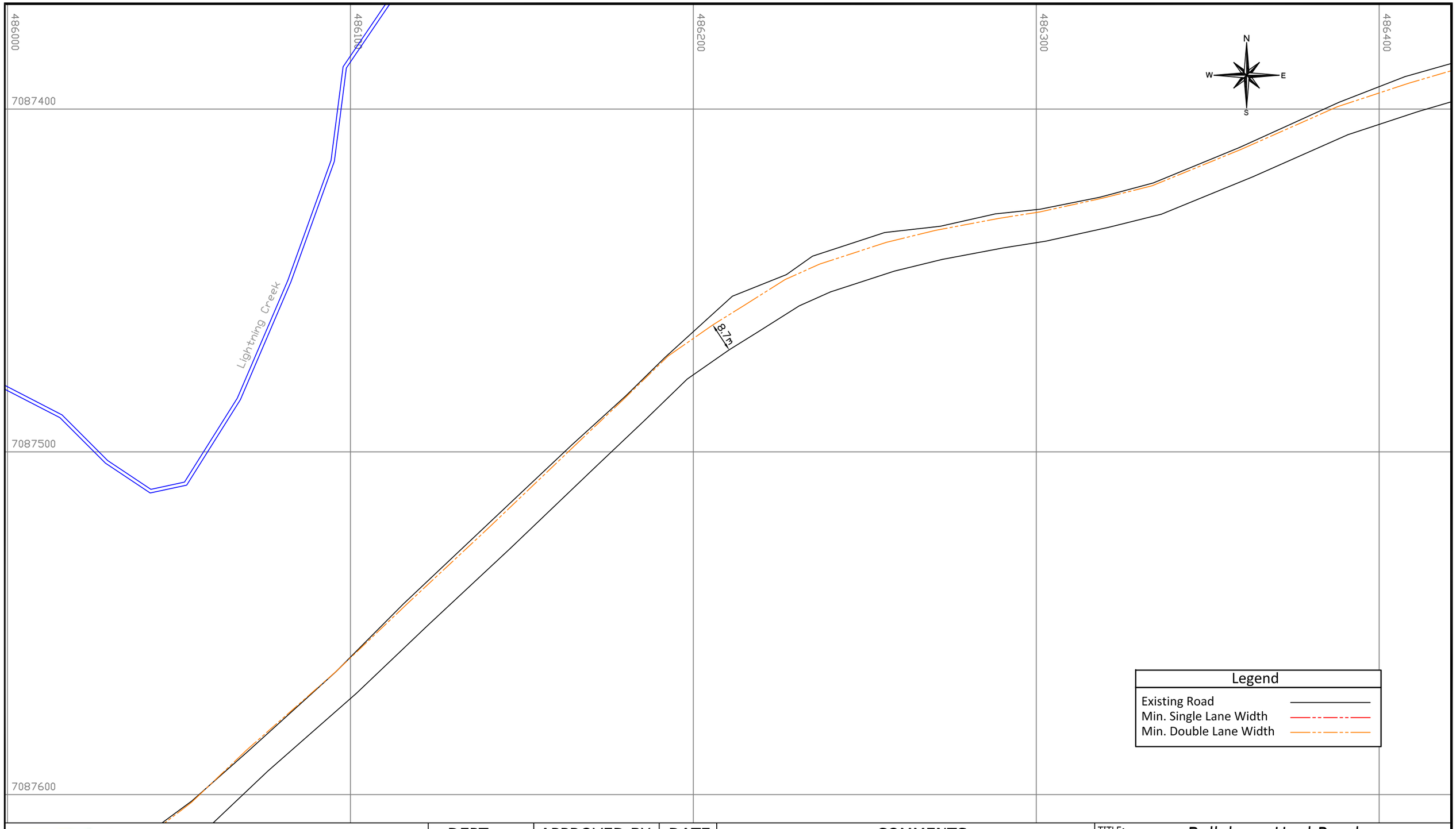

ALEXCO RESOURCE CORP
Bellekeno Mine

DEPT.	APPROVED BY	DATE	COMMENTS
SURVEY			
ENGINEERING			
GEOLOGY			
ALEXCO MANAGER			
PROCON SUPER			

TITLE: *Bellekeno Haul Road*
As-Built
Page 7 of 12

Drawn by: *DS* | Scale: *1:1000*
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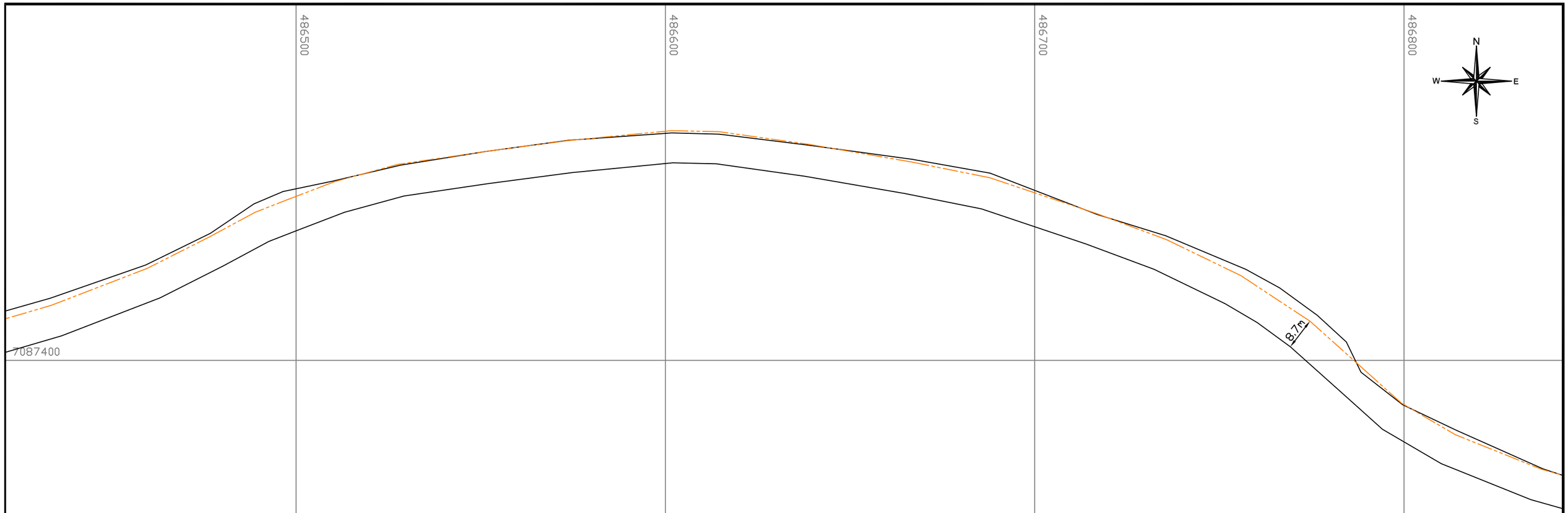
File:



Legend	
Existing Road	
Min. Single Lane Width	
Min. Double Lane Width	

ALEXCO

ALEXCO RESOURCE CORP
Bellekeno Mine

DEPT.	APPROVED BY	DATE	COMMENTS
SURVEY			
ENGINEERING			
GEOLOGY			
ALEXCO MANAGER			
PROCON SUPER			

TITLE: *Bellekeno Haul Road*
As-Built
Page 8 of 12

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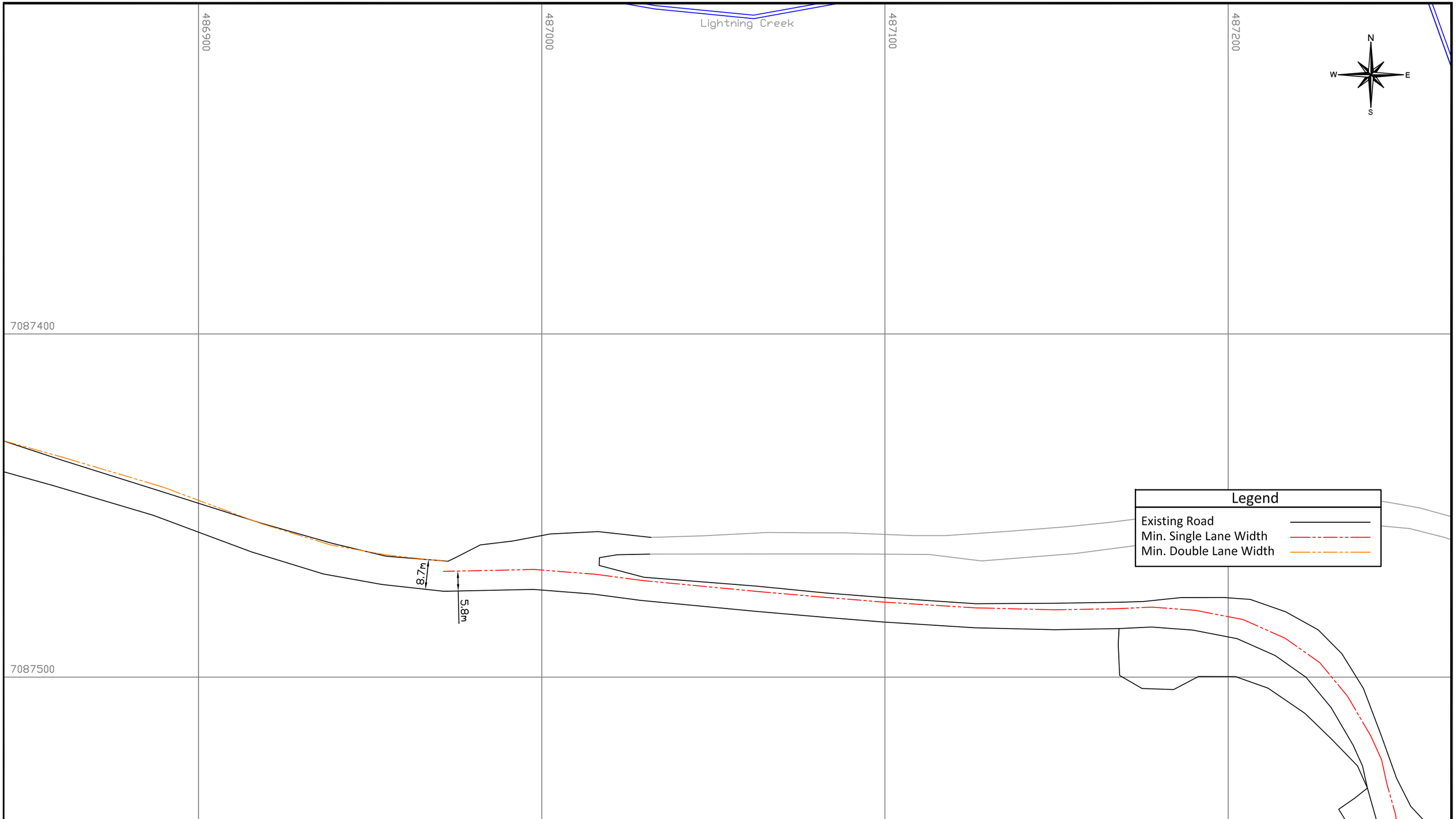

ALEXCO

ALEXCO RESOURCE CORP
Bellekeno Mine

DEPT.	APPROVED BY	DATE	COMMENTS
SURVEY			
ENGINEERING			
GEOLOGY			
ALEXCO MANAGER			
PROCON SUPER			

TITLE: *Bellekeno Haul Road*
As-Built
Page 9 of 12

Drawn by: *DS* | Scale: *1:1000*
Date: *Nov. 22, 2011* | Approval: | Date:
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ALEXCO

ALEXCO RESOURCE CORP
Bellekeno Mine

DEPT.	APPROVED BY	DATE	COMMENTS
SURVEY			
ENGINEERING			
GEOLOGY			
ALEXCO MANAGER			
PROCON SUPER			

TITLE: *Bellekeno Haul Road*
As-Built
Page 10 of 12

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Date: *Nov. 22, 2011* | Approval: | Date:
File:

487200
487300
487400
487500
7087800
7087900
7088000
N
W
E
S
Lightning Creek
5.8m

Legend	
Existing Road	
Min. Single Lane Width	
Min. Double Lane Width	

ALEXCO

ALEXCO RESOURCE CORP
Bellekeno Mine

DEPT.	APPROVED BY	DATE	COMMENTS
SURVEY			
ENGINEERING			
GEOLOGY			
ALEXCO MANAGER			
PROCON SUPER			

TITLE: *Bellekeno Haul Road*
As-Built
Page 11 of 12

Drawn by: *DS* | Scale: *1:1000*
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487200

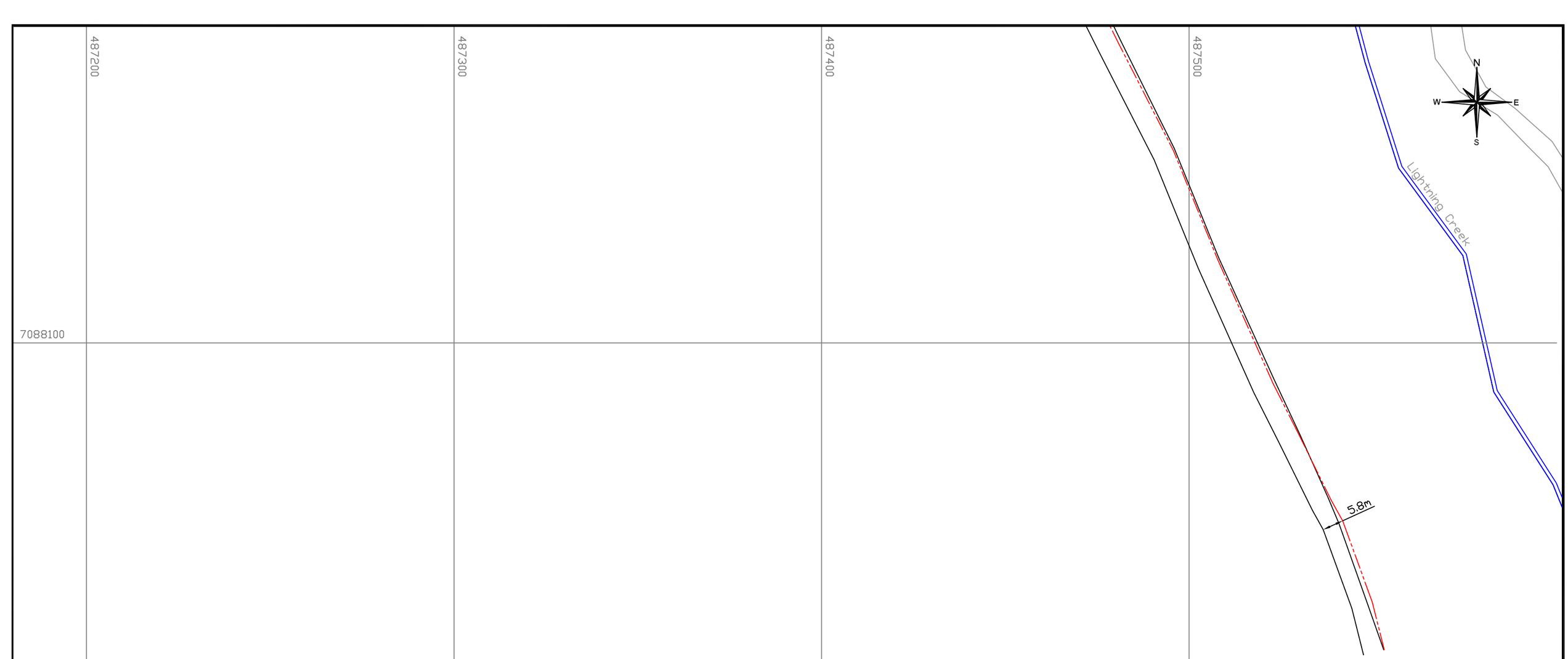
487300

487400

487500

7088100

7088200



Legend	
Existing Road	
Min. Single Lane Width	
Min. Double Lane Width	

ALEXCO

ALEXCO RESOURCE CORP
Bellekeno Mine

DEPT.	APPROVED BY	DATE	COMMENTS
SURVEY			
ENGINEERING			
GEOLOGY			
ALEXCO MANAGER			
PROCON SUPER			

TITLE: *Bellekeno Haul Road*
As-Built
Page 12 of 12

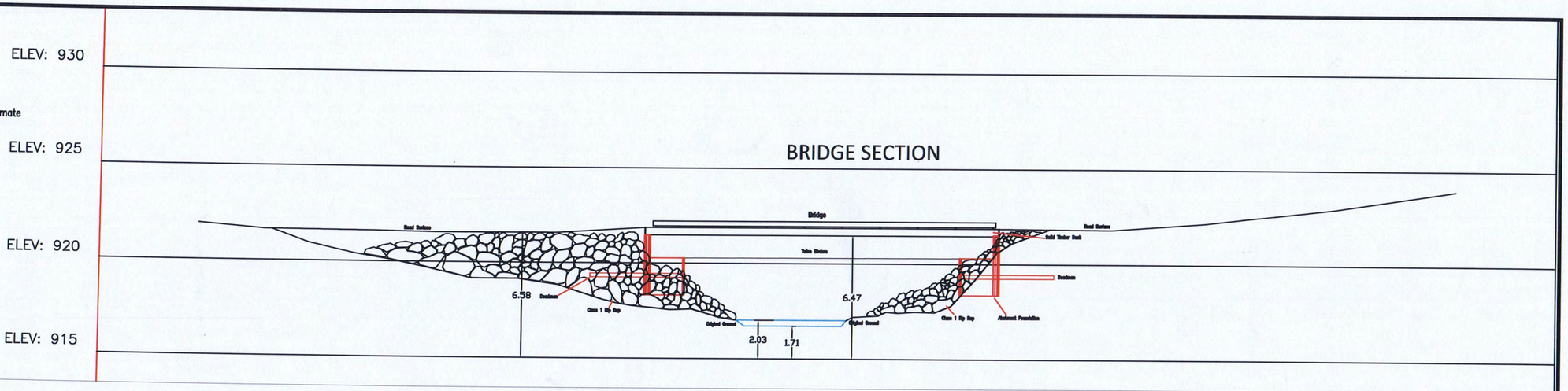
Drawn by: *DS* | Scale: *1:1000*
Date: *Nov. 22, 2011* | Approval: | Date:
File:

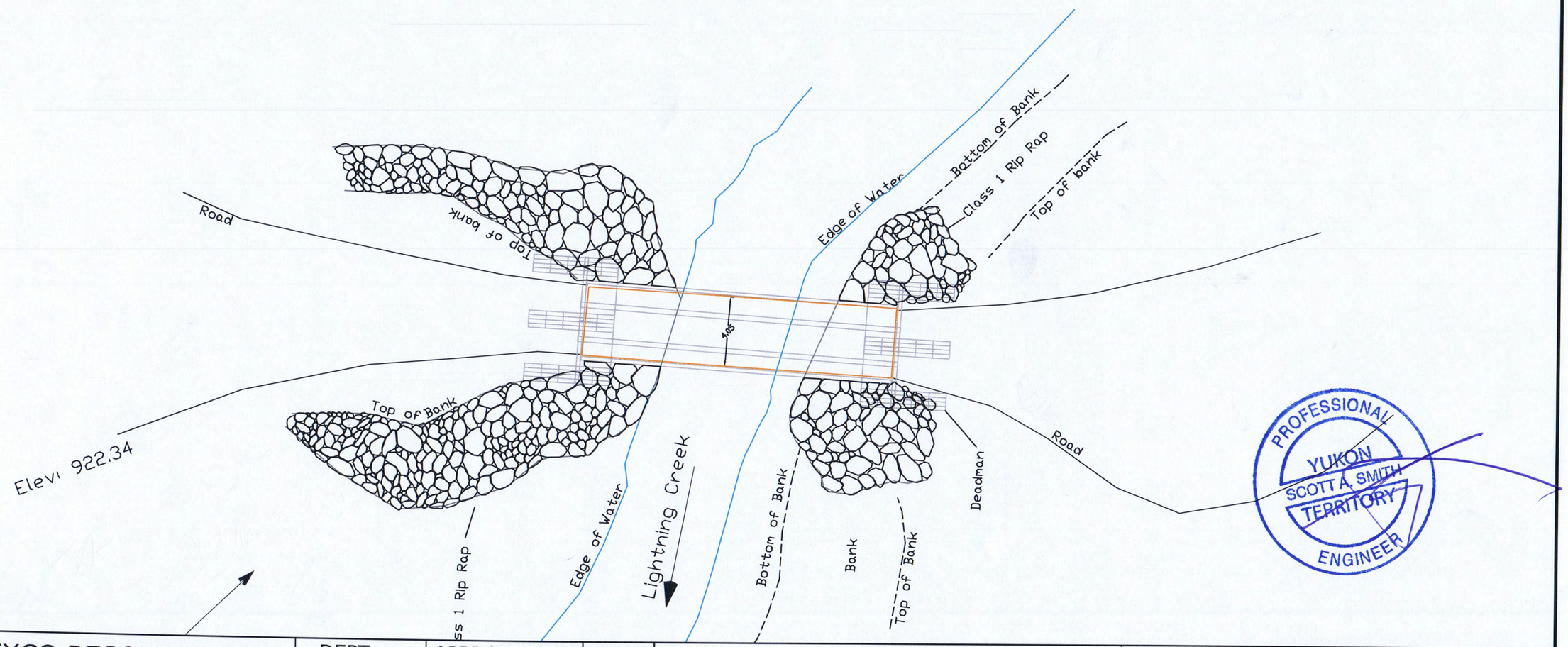
Note:

Road Surface Elevation: 921.6m
Creek Bed Elevation: 916.7m
Creek H.W.L Elevation: 917.03m
Bridge Deck Elevation: 921.6m
BKR North side Rip Rap Volume: 431.7m3
BKR South Side Volume: 121.2m3

Interface between original ground and Compacted Granular Embankment is an estimate due to lack of pre-construction survey data

BRIDGE SECTION





PROFESSIONAL ENGINEER
YUKON TERRITORY
SCOTT A. SMITH

ALEXCO

ALEXCO RESOURCE CORP
BELLKENO MINE

DEPT.	APPROVED BY	DATE	COMMENTS
SURVEY			
ENGINEERING			
GEOLOGY			
ALEXCO MANAGER			
PROCON SUPER			

TITLE: **BELLEKENO BRIDGE**
Location B.K.R 2

Drawn by: SURVEYOR
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Date: 02/18/2013
Approval: Date:
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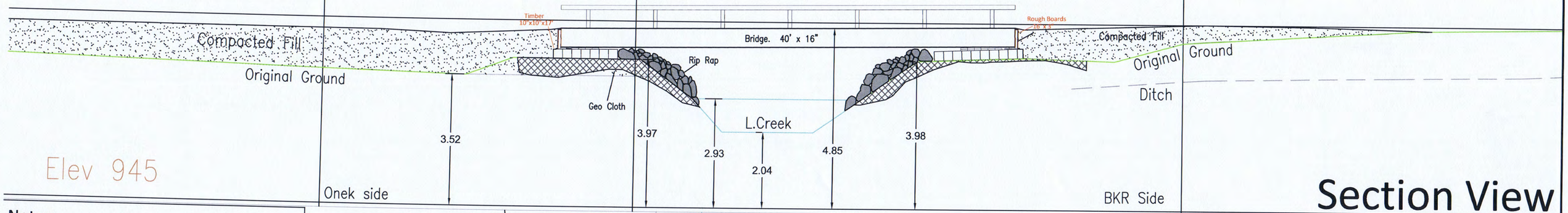
Onek Bridge



Section View

Notes:

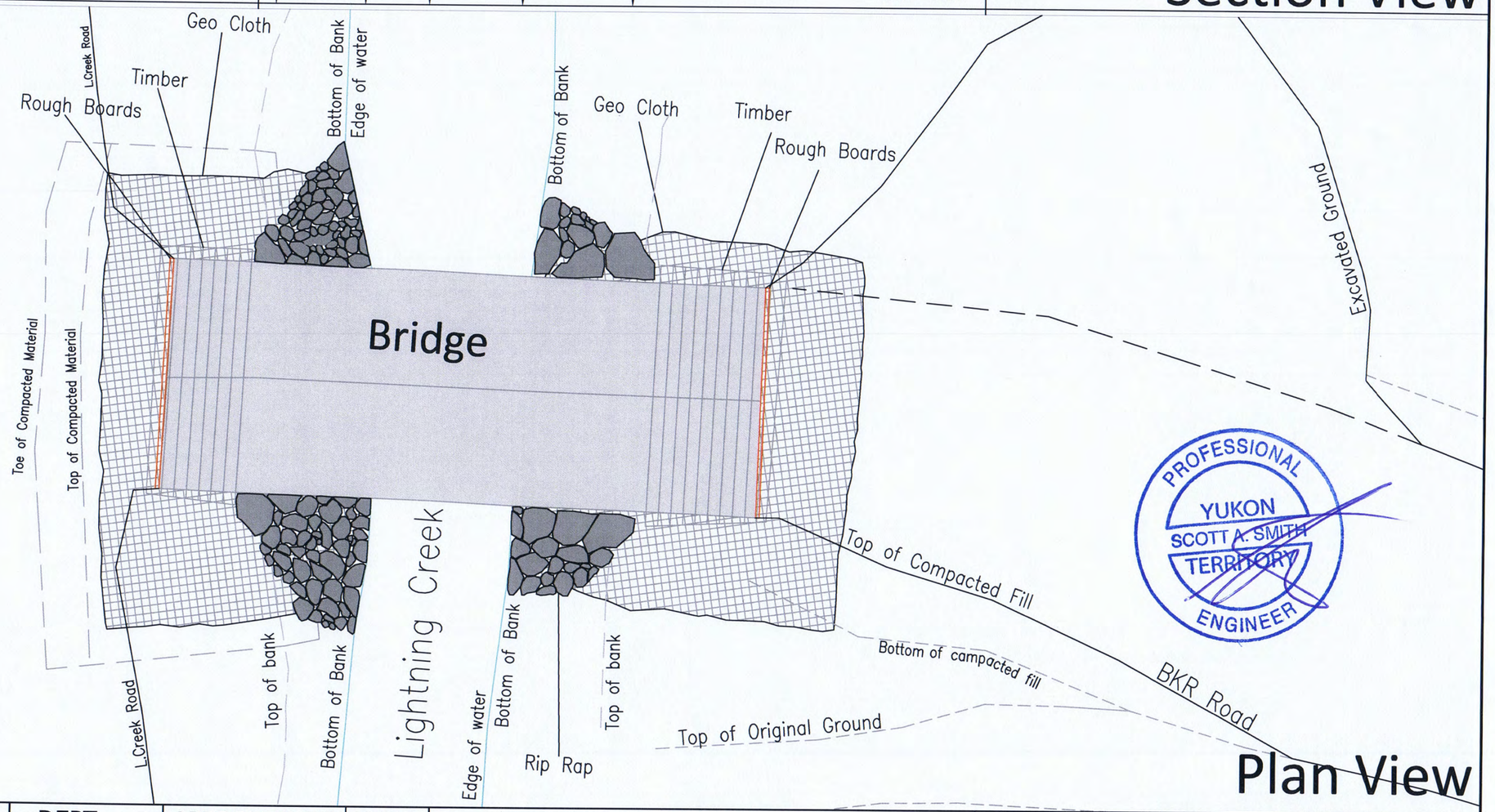
Bridge: 40' x 16'
Total Timber used: 17 (10"x 10"x 17')
Total Rough Boards Used: 4 (16"x 3")

Elevations:

Top of bank Elev: 949.0m
Bridge deck: Elevation= 949.85m
Lightning Creek H.W.L.= 947.93m
Lightning Creek bed Elevation= 947.04m

Volumes:

Onek Compacted Fill Volume: 365.0m3
BKR Compacted Fill Volume: 64.26m3
Rip Rap Total Volume= 18.1m3
Geo Cloth: 94.1m2



Plan View

PROFESSIONAL ENGINEER
YUKON TERRITORY
SCOTT A. SMITH

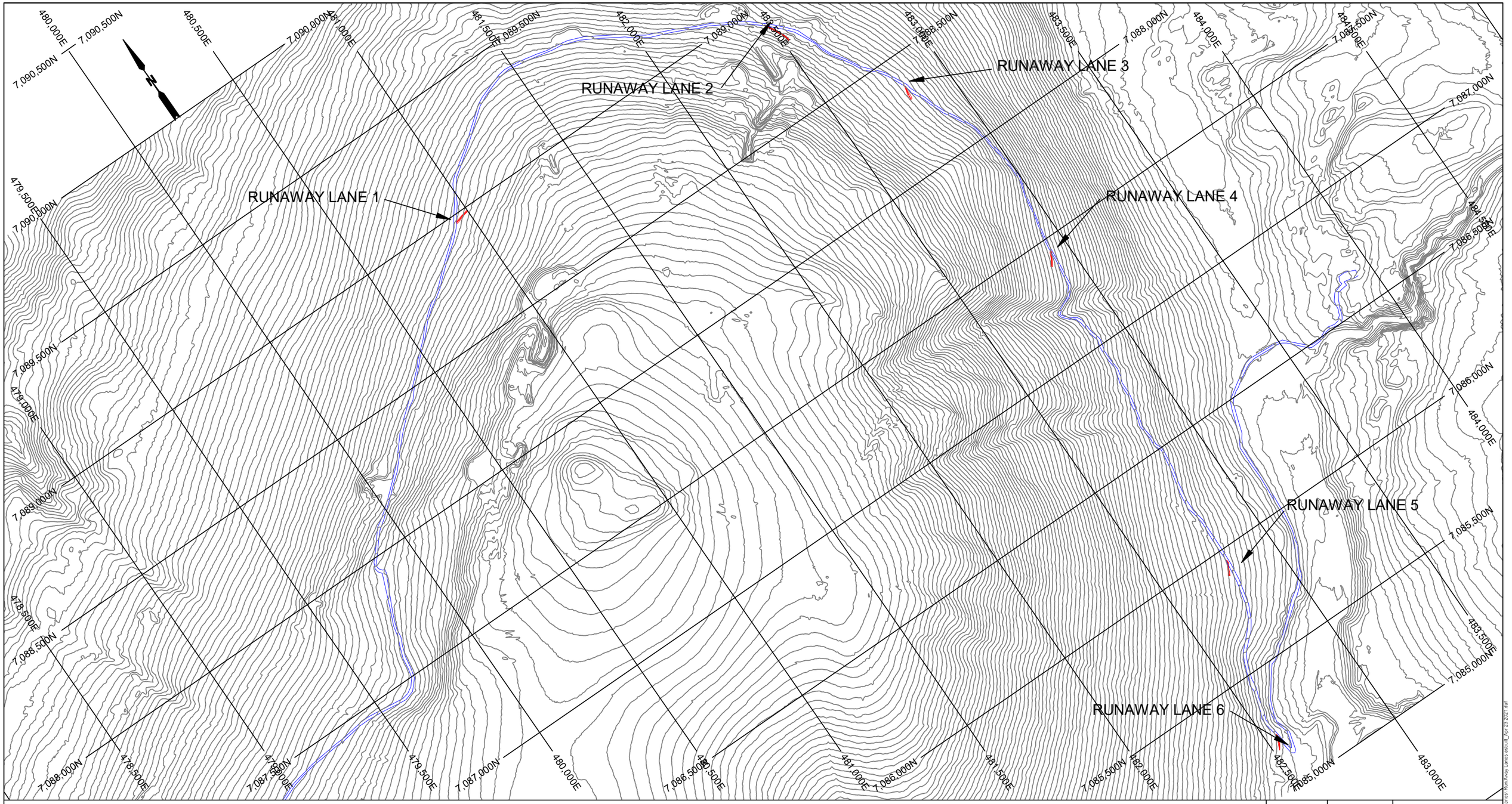
ALEXCO

ALEXCO RESOURCE CORP
BELLKENO MINE

DEPT.	APPROVED BY	DATE	COMMENTS
SURVEY			
ENGINEERING			
GEOLOGY			
ALEXCO MANAGER			
PROCON SUPER			

TITLE: ONEK BRIDGE

Drawn by: SURVEYOR | Scale: 1:100
Date: 05/04/2013 | Approval: | Date:
File:



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DATE DRAWN	24/02/2023
SCALE	1:15000
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ALEXCO

BM Runaway Lanes

Runaway Lanes

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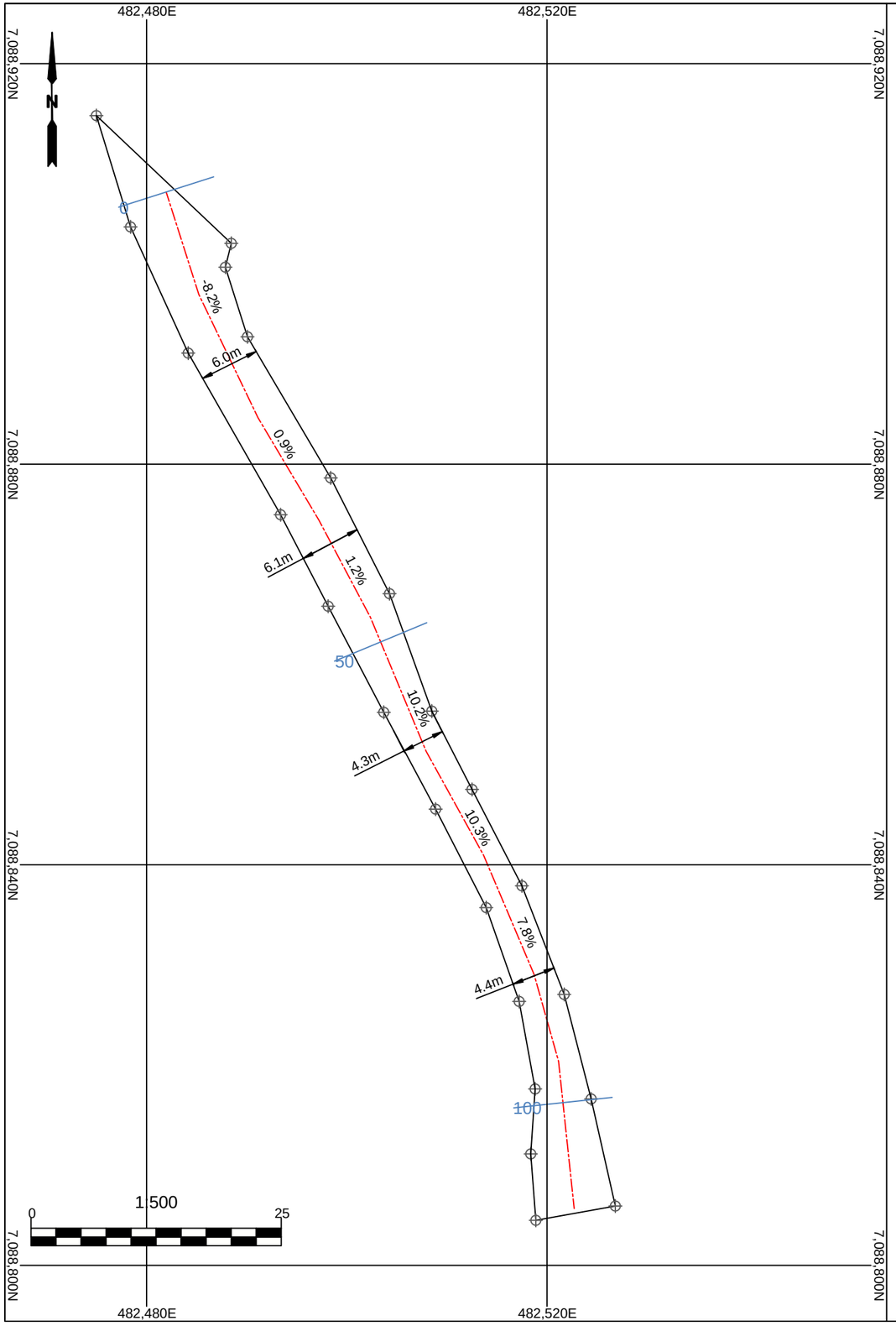

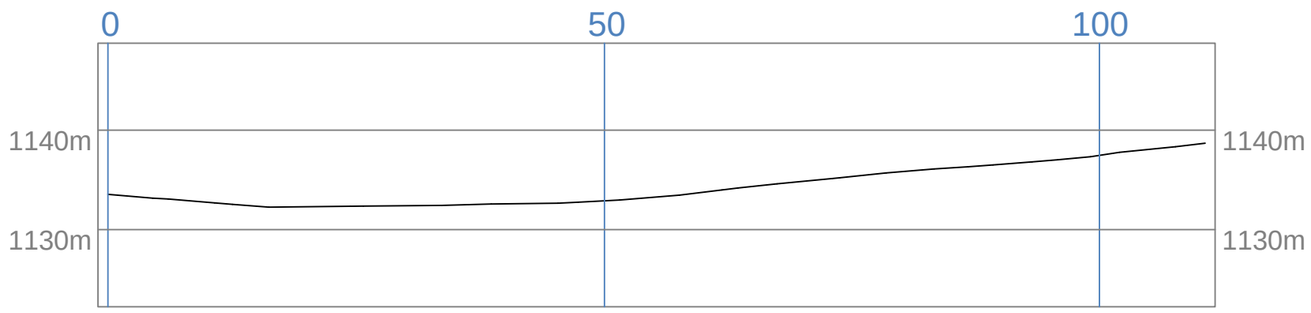

DRAWN BY	kfife
DATE DRAWN	11/05/2021
SCALE	As Noted
PAPER SIZE	11x17

ALEXCO

BM Runaway Lanes

Runaway Lane 1

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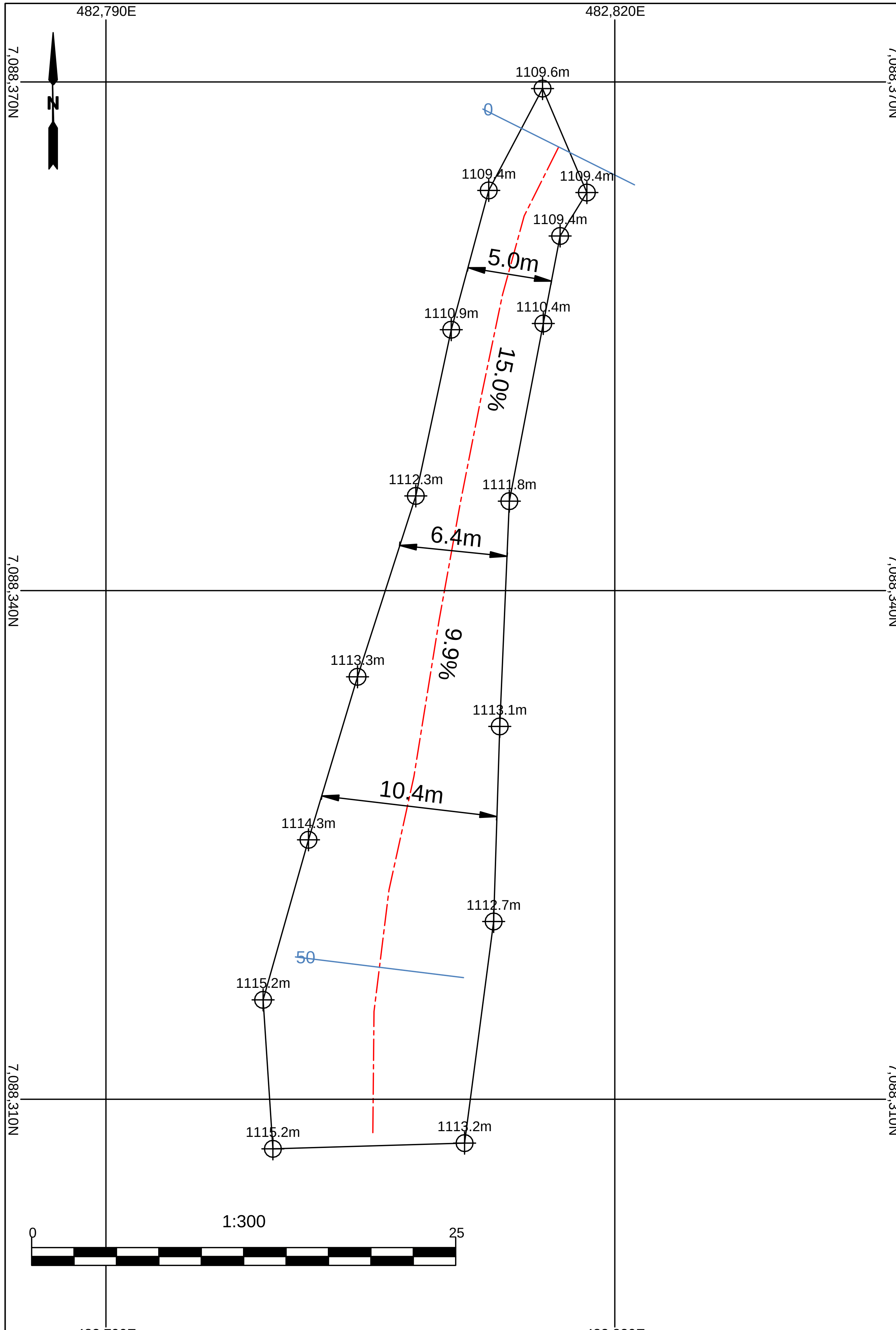
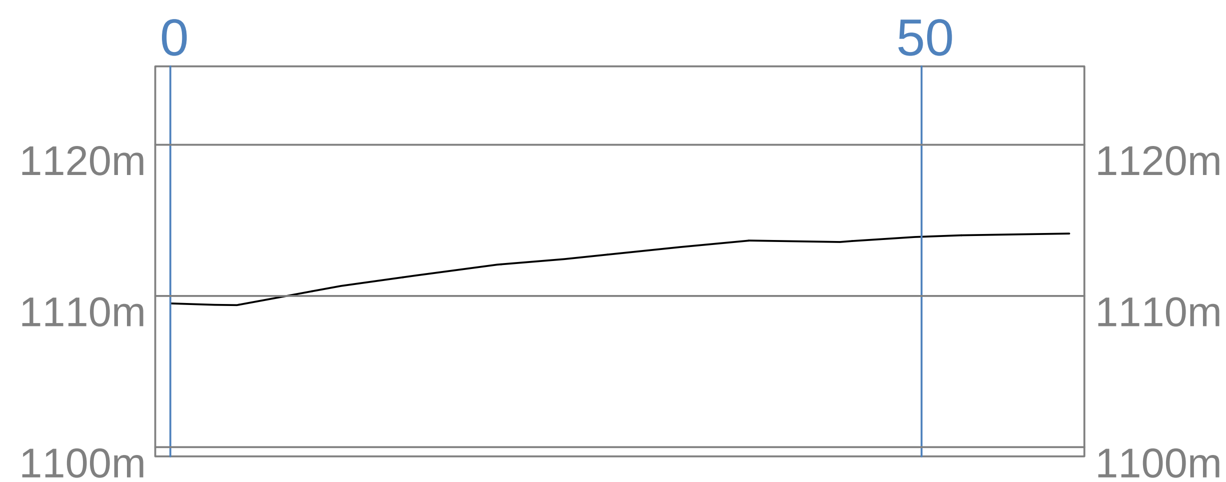




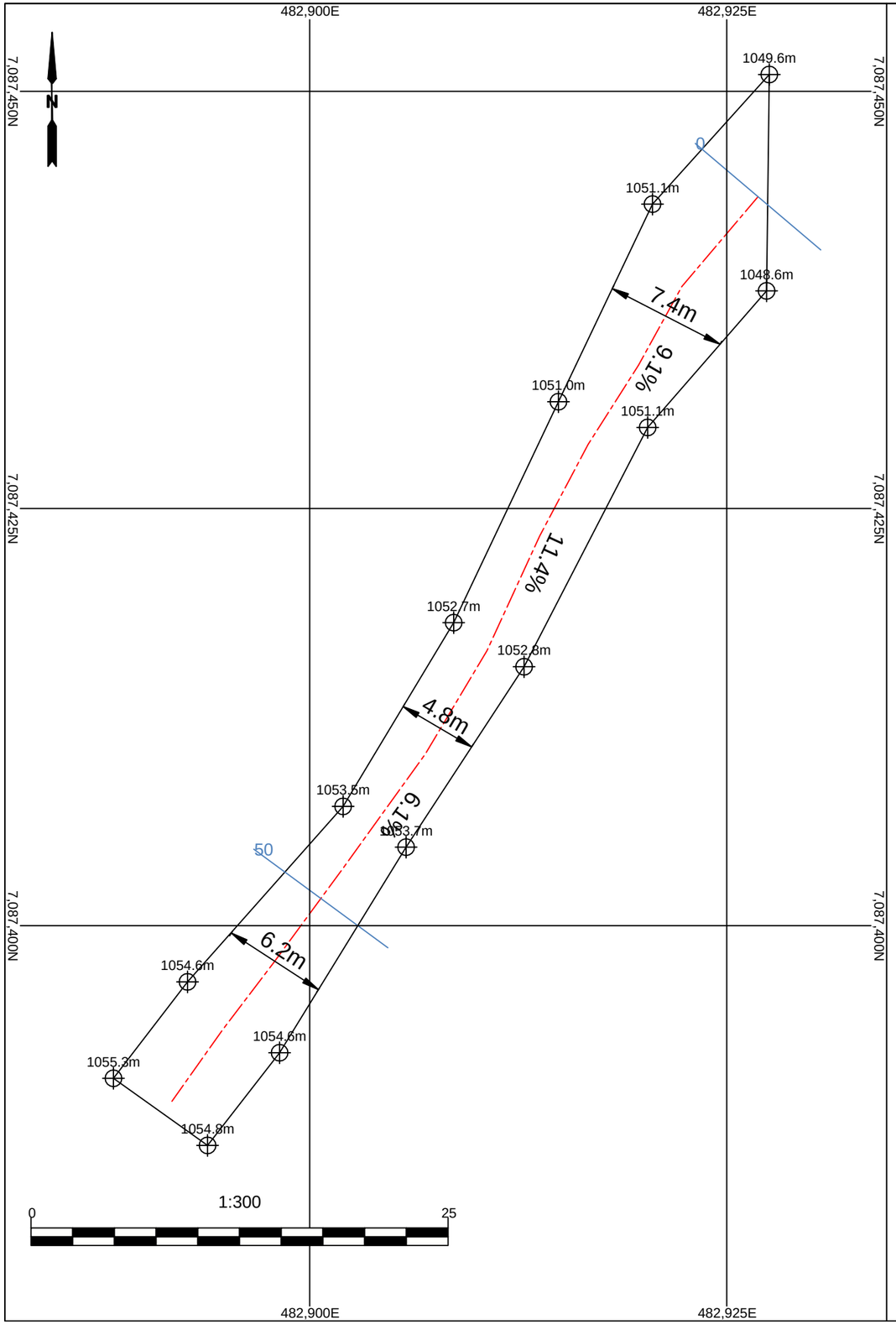
DRAWN BY	kfife
DATE DRAWN	11/05/2021
SCALE	As Noted
PAPER SIZE	11x17

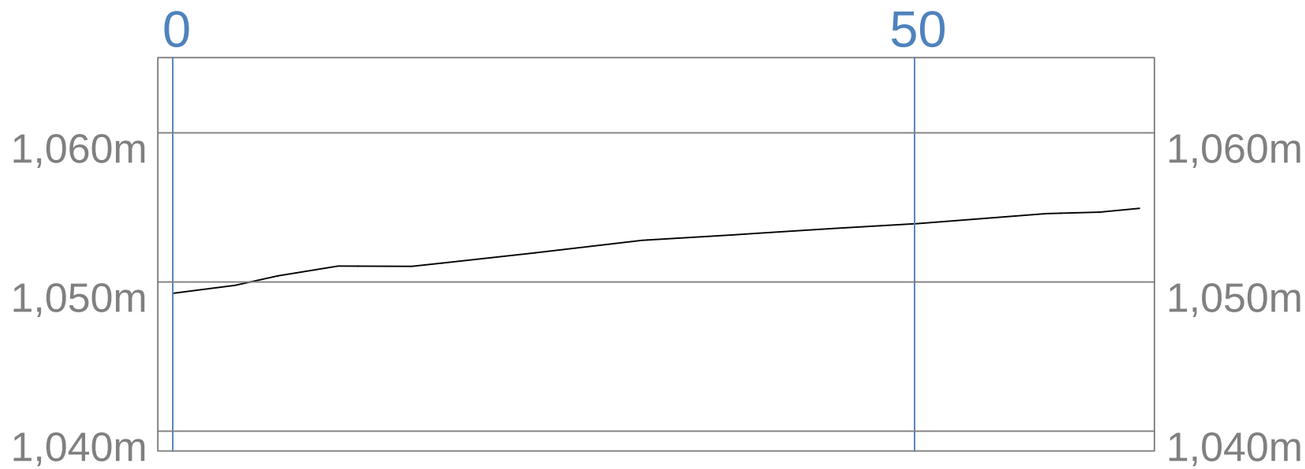
ALEXCO

BM Runaway Lanes

Runaway Lane 2

Z:\ Operations\ Tech Services\ 01 Deswik Model\ (Surface) Survey\ District\ Run Away Lanes\ Run Away Lanes asbuilt_Apr 23 2021.duf





DRAWN BY	kfife
DATE DRAWN	11/05/2021
SCALE	As Noted
PAPER SIZE	11x17

ALEXCO

BM Runaway Lanes

Runaway Lane 3

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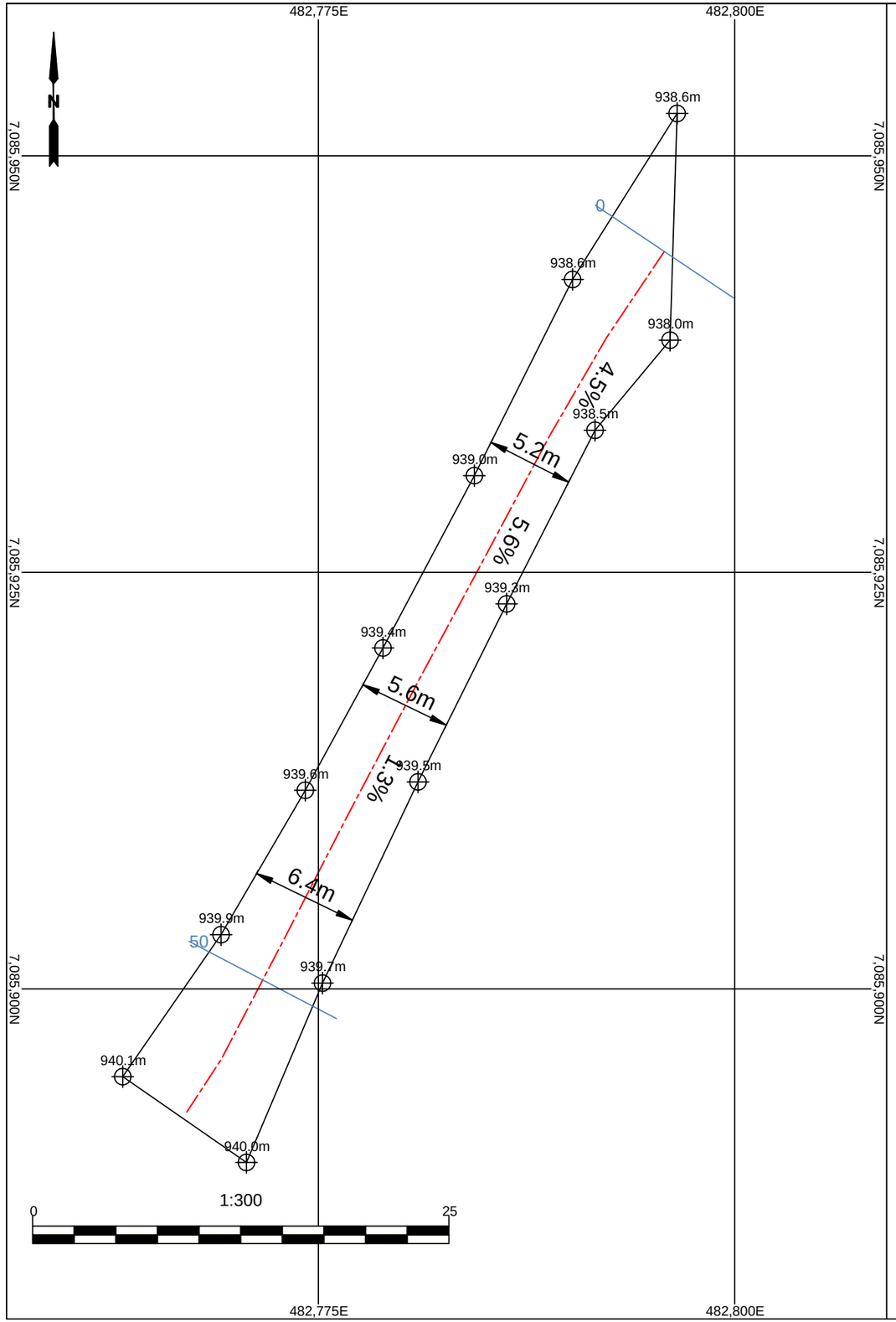

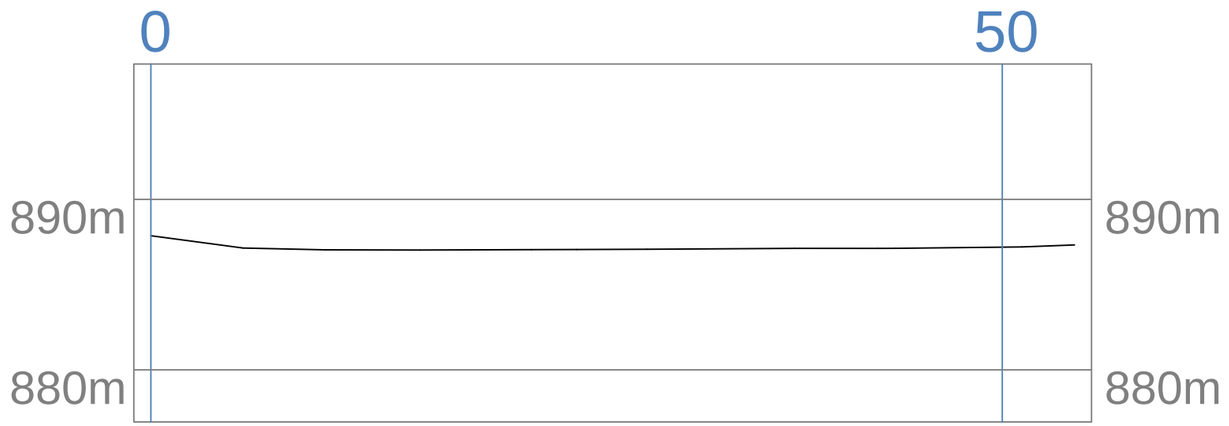

DRAWN BY	kfife
DATE DRAWN	11/05/2021
SCALE	As Noted
PAPER SIZE	11x17

ALEXCO

BM Runaway Lanes

Runaway Lane 5

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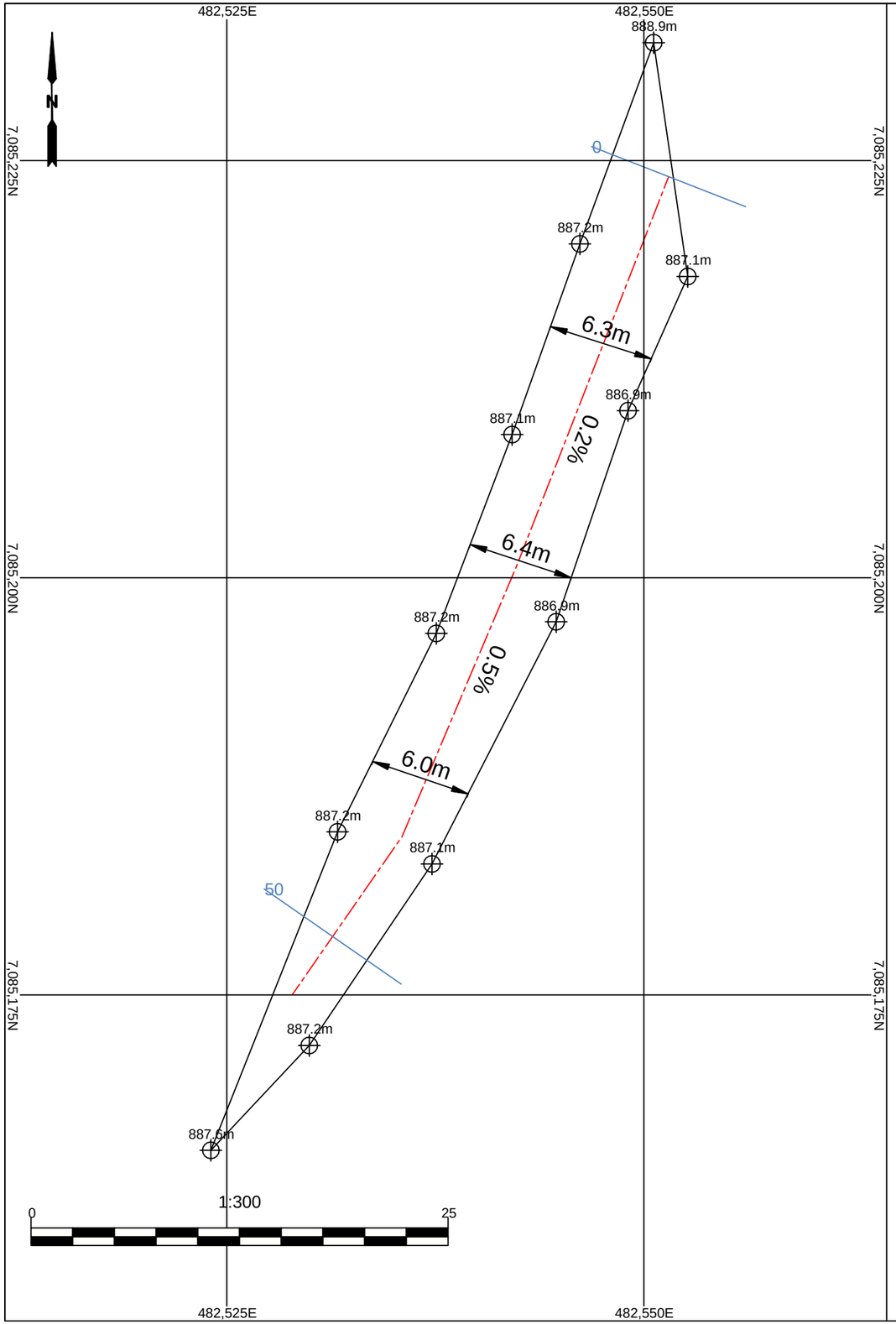

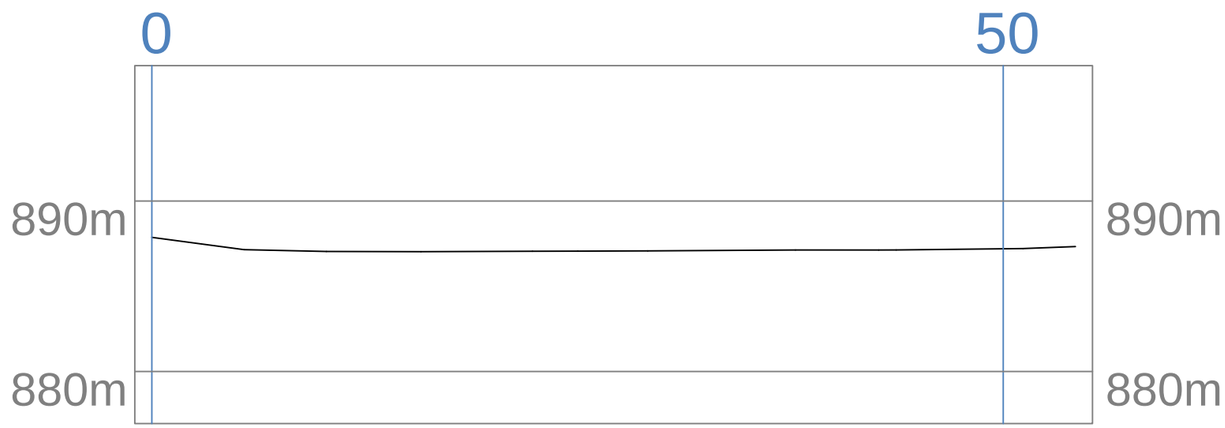

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DATE DRAWN	11/05/2021
SCALE	As Noted
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ALEXCO

BM Runaway Lanes

Runaway Lane 5

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