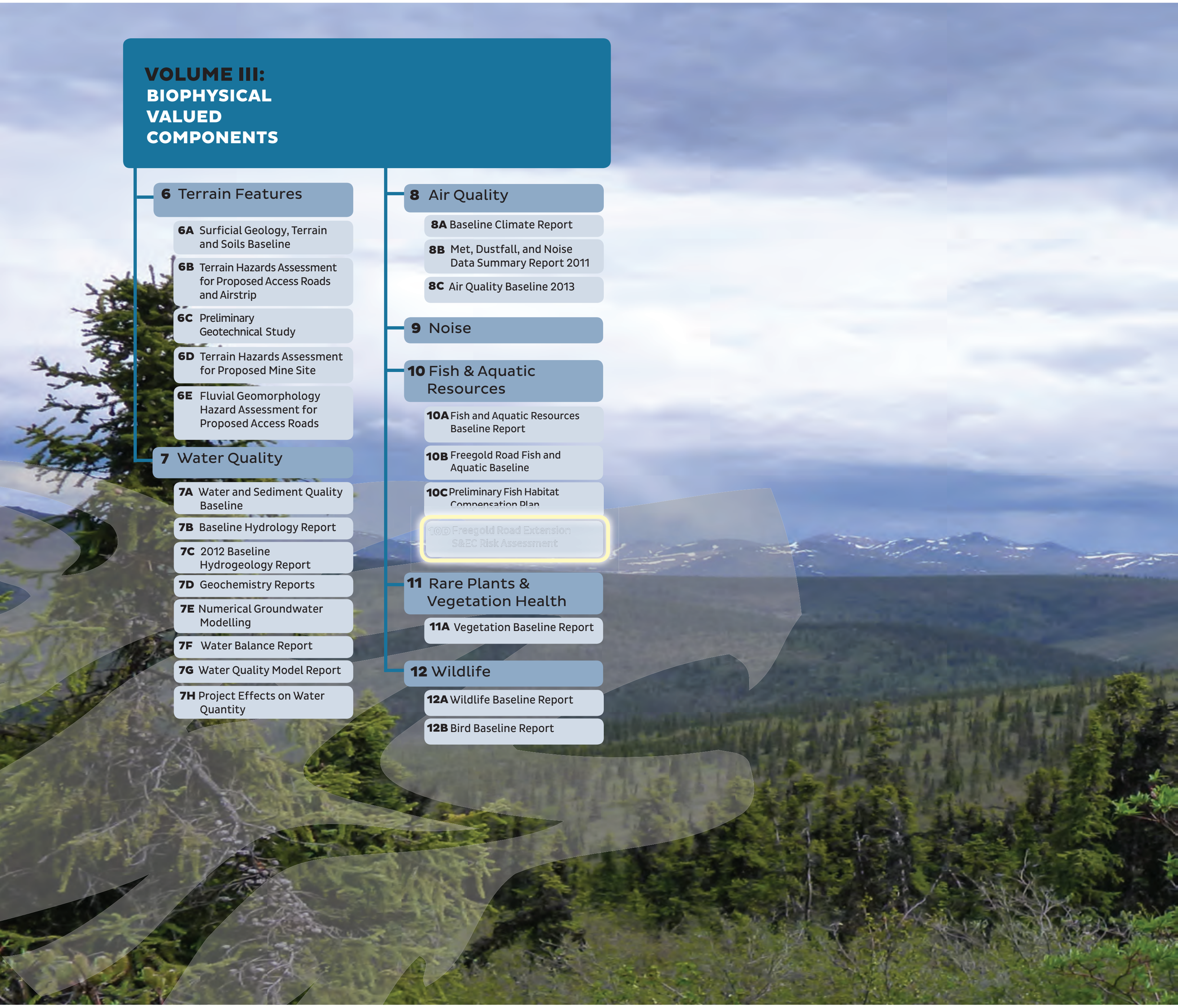
APPENDIX 10D: FREEGOLD ROAD EXTENSION S&EC RISK ASSESSMENT



PALMER
ENVIRONMENTAL
CONSULTING
GROUP INC.

Casino Project: Freegold Road Extension – Erosion and Sedimentation Risk Assessment Report

Prepared for

Casino Mining Corporation

October 25, 2013

October 25, 2013

Jesse Duke
Project Director
Casino Mining Corporation
2050-1111 West Georgia Street
Vancouver, BC V6E 4M3

Dear Mr. Duke,

**Re: Casino Project:
Freegold Road Extension – Erosion and Sedimentation Risk Assessment Report**

Palmer Environmental Consulting Group Inc. is pleased to submit the attached report describing the results of our GIS-based Erosion and Sedimentation Risk Assessment for the Freegold Road Extension for the Casino Project. If there are any questions or comments on this report, please contact the undersigned.

We appreciate the opportunity to work with you on this project.

Yours truly,

Palmer Environmental Consulting Group Inc.

Rick Palmer, M.Sc. R.P. Bio
President, Senior Fisheries Biologist

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1 Introduction

The Casino Project is owned by the Casino Mining Corporation (CMC). It is a proposed porphyry copper-gold-molybdenum mine located in west-central Yukon, at 611300E 695800N, approximately 300 km northwest of the territorial capital of Whitehorse.

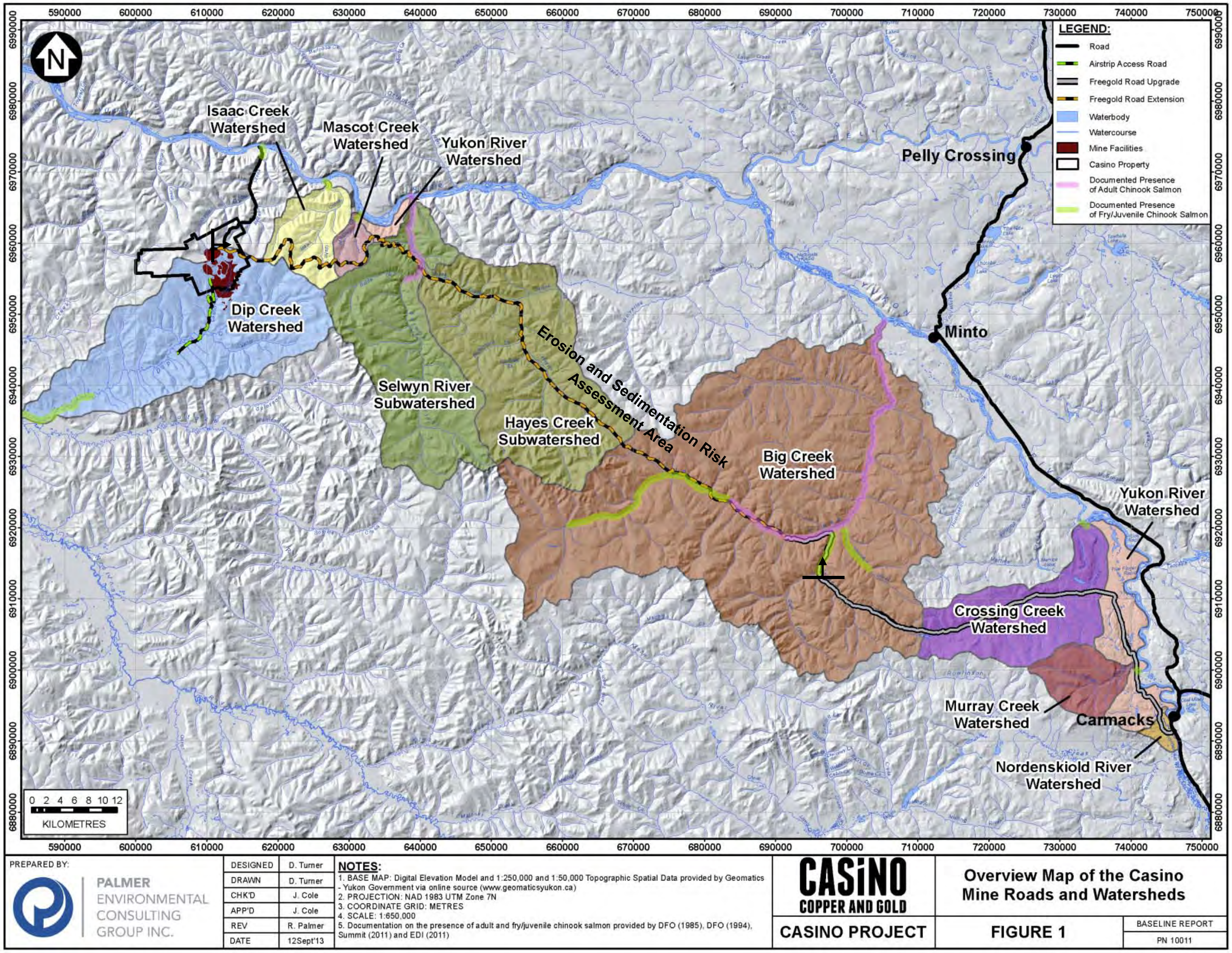
Access to the proposed Casino Mine is currently limited to fixed-wing aircraft, helicopter, and Yukon River barge, with some limited winter access for heavy equipment available along an existing winter road. To provide year-round access for heavy equipment, fuel and haulage trucks, CMC plans to construct a new all-weather resource road that connects the Casino mine site with the western edge of the existing Freegold Road, located approximately 85 km northwest of the village of Carmacks (**Figure 1**). This new road is referred to as the Freegold Road Extension, and is planned to be a 120 km long, two-lane (8.2 m wide), gravel resource road (AE, 2013).

To support the submission of the project proposal to the Yukon Environmental and Socio-economic Assessment Board (YESAB), Palmer Environmental Consulting Group (PECG) has prepared an *Erosion and Sedimentation Risk Assessment* for the full length of the Freegold Road Extension (area of analysis shown on **Figure 1**). This assessment was completed for the Freegold Road Extension, in order to provide a practical means of identifying and mitigating erosion and sedimentation risks during its construction along a corridor of such length and width. Application of this approach to the Freegold Road Upgrade, where a road already exists, was deemed unnecessary at this stage of project planning. More site-specific investigations and plans for erosion and sediment control at the Casino Mine site and its comparatively short Airstrip Access Road, preclude the need for this detailed planning-level assessment.

Yukon regulations require that all reasonable care be taken to prevent sediment from entering a water body. Depositing sediment into fish bearing or fish habitat streams is prohibited under Section 36(3) of the *Fisheries Act*, and Section 9.(1) of the *Yukon Waters Act* prohibits the deposit of any waste (defined as any substance that is detrimental to people, animals, fish or plants), including sediment, into any water body. In addition, CMC aims to demonstrate to the Department of Fisheries and Oceans Canada (DFO) that it has taken all reasonable measures to ensure the protection of fish habitat during construction, in addition to quantifying and compensating for unavoidable impacts to fish habitat.

Therefore, the purpose of this risk assessment, which has been completed in association with submission of the project proposal, is to identify areas that may pose a risk to the natural environment when disturbed during construction. By identifying potential risk areas early in the design process, CMC is better prepared to mitigate the risks from erosion and sedimentation and prevent adverse effects to fish and fish habitat. This will allow for erosion and sediment control measures to be designed such that they are commensurate with the level of potential risk to the natural environment, and will allow priority locations to be identified.

It is intended that this assessment will proactively address the concerns of YESAB and DFO at the project proposal stage. Thus, this assessment is intended to streamline the approvals process and provide the foundation for cost-effectively developing a comprehensive and targeted erosion and sediment control plan for the construction phase of the project.


LEGEND:
Road
Airstrip Access Road
Freegold Road Upgrade
Freegold Road Extension
Waterbody
Watercourse
Mine Facilities
Casino Property
Documented Presence of Adult Chinook Salmon
Documented Presence of Fry/Juvenile Chinook Salmon
Isaac Creek Watershed
Mascot Creek Watershed
Yukon River Watershed
Pelly Crossing
Dip Creek Watershed
Minto
Erosion and Sedimentation Risk Assessment Area
Selwyn River Subwatershed
Hayes Creek Subwatershed
Big Creek Watershed
Yukon River Watershed
Crossing Creek Watershed
Murray Creek Watershed
Carmacks
Nordenskiold River Watershed
0 2 4 6 8 10 12
KILOMETRES
PREPARED BY:
PALMER ENVIRONMENTAL CONSULTING GROUP INC.
DESIGNED D. Turner
DRAWN D. Turner
CHK'D J. Cole
APP'D J. Cole
REV R. Palmer
DATE 12Sept'13
NOTES:
1. BASE MAP: Digital Elevation Model and 1:250,000 and 1:50,000 Topographic Spatial Data provided by Geomatics - Yukon Government via online source (www.geomaticsyukon.ca)
2. PROJECTION: NAD 1983 UTM Zone 7N
3. COORDINATE GRID: METRES
4. SCALE: 1:650,000
5. Documentation on the presence of adult and fry/juvenile chinook salmon provided by DFO (1985), DFO (1994), Summit (2011) and EDI (2011)
CASINO COPPER AND GOLD
CASINO PROJECT
Overview Map of the Casino Mine Roads and Watersheds
FIGURE 1
BASELINE REPORT
PN 10011

2 Background

2.1 Freegold Road Extension

2.1.1 Description

As described in Section 4 of the Project Proposal, the proposed Freegold Road Extension is a proposed all-weather resource road that will connect the Casino mine site with the western edge of the existing Freegold Road (referred to as the Freegold Road Upgrade), located approximately 85 km northwest of the village of Carmacks (**Figure 1**). Details on the proposed Freegold Road Extension can be found in "Casino Mine Project Access Overview for Submission to YESAB", prepared by Associated Engineering (AE, 2013).

The Freegold Road Extension is planned to be a 120 km long, two-lane, gravel resource road designed to meet the BC Ministry of Forests and Range Forest Road Engineering Guidebook (2nd Edition, 2002) guidelines for a 70 km/h design speed with some 50 km/h sections where road geometry is limited by the terrain. This roadway is required to support the level of traffic anticipated with year round haulage of materials into and out of the Casino mine site during operations.

In order to maximize the design speed and avoid unstable terrain, the route has been located as much as possible in valley bottoms and along flat ridgelines. In valley bottom areas, fill materials will be used to ensure that the road surface elevation is at least 2.0 m above the existing ground. This raised grade height will help stabilize the road against washouts and protect against permafrost degradation. In regions where the road climbs out of the valley bottoms, road construction methods will include both cut and fill sections. Areas rich in permafrost may require buttressing of cut slopes with a layer of angular rock fill on top of filter fabric to prevent permafrost degradation and act as a retaining structure to improve slope stability.

To facilitate initial construction of the mine and the Freegold Road Extension, during the first year of construction, CMC plans to construct a single lane "tote road" to provide a continuous route from the village of Carmacks to the Casino mine site (AE, 2013). The tote road will allow slow moving construction vehicles, fuel trucks and heavy equipment suitable for rough roads to access the site during the early stages of construction. To the extent practical, permanent stream and river crossings will be constructed during this stage to provide a limited access road capability within the first construction year. In some instances it may be necessary to employ temporary bridges until the permanent crossing structures can be constructed.

2.1.2 Construction Summary

The construction of the Freegold Road Extension and tote road is anticipated to proceed from the western limit of the existing Freegold Road moving westward towards the Casino mine site. At the same time, construction will proceed in a generally easterly direction from the Casino mine site to meet the construction front originating from the western limit of the existing Freegold Road.

Construction of the Freegold Road Extension will require numerous permanent stream and river crossings. Fish-bearing streams and rivers will be crossed with single-span bridge structures, while non fish-bearing streams may be crossed with either 1500 mm or 2400 mm diameter corrugated steel pipe (CSP) culverts (AE, 2013). In some cases, it may be necessary to use temporary bridges until the permanent infrastructure can be constructed.

2.2 Scope of Work and Study Objectives

This *Erosion and Sediment Risk Assessment* report and its accompanying maps have been prepared as a basis for identifying areas of concern and recommending a level of effort for erosion and sediment control measures that reflects an understanding of local soil and permafrost conditions, and environmental sensitivities. The Freegold Road Extension alignment is generally classified into areas of similar erosion and sedimentation risk – Low, Moderate or High. Three maps series have been produced, where the third map series is derived from a combination of the first two maps:

1. Erosion Potential (**Appendix A**);
2. Potential Ecological Consequence (**Appendix B**); and
3. Overall Erosion and Sedimentation Risk (**Appendix C**).

The third series map provides a framework for determining the appropriate “level of effort” for erosion and sediment control to mitigate risks. Recommendations for the most appropriate erosion and sedimentation control approach (e.g., best management practices) are provided in **Section 5.1** of this document. This assessment provides the basis for the development of a construction-phase Erosion and Sediment Control Plan, which is typically completed during the Detailed Design Stage. In this way the design team can identify and plan for appropriate mitigation at an earlier stage to facilitate approval agency review.

2.3 Summary of Existing Conditions

An understanding of the physical setting along the proposed Freegold Road Extension is paramount for assessing the potential for erosion and sedimentation during the construction phase and for designing mitigation measures to reduce the overall risk.

2.3.1 Physiography and Surficial Geology

The Casino Mine site and the Freegold Road Extension are located in the Dawson Range within the Klondike Plateau. Topography is typically rolling with broad ridges, convex slopes, v-shaped incised valleys and heavily vegetated hills (Bond and Lipovsky, 2012). Soil development along the proposed roadway varies from coarse talus (colluvium) and immature soil horizons at higher elevations to mature soil profiles and thick organic accumulations in valley bottoms. Bedrock outcrops are common on ridge crests.

The Freegold Road Extension is located beyond the extent of the most recent (Wisconsin) glacial advance and the surficial geology consists of unglaciated deposits. Ridges and hill tops are comprised of exposed bedrock and thin veneers of colluvial sediments. Windblown silt (loess) is commonly found intermixed with colluvial sediments and where present, tends to be ice-rich.

Hill slopes are generally covered by a veneer of colluvium, with the upper slopes containing a mixture of silt and fine sand with angular, weathered bedrock clasts, and the lower slopes or aprons consisting of colluvium sheetwash sediments intermixed with loess and organic soils.

Alluvium and ice-rich organic deposits (peat) are found near creeks and along flat valley bottoms. Alluvium generally consists of sands and gravelly sands that contain cobbles and small boulders.

2.3.2 Climate

The climate in the Casino Project area is characterized by long, cold, dry winters and by short, mild, wet summers. Snow can typically be expected on the ground between September and June. The average annual precipitation at the Casino Mine site is approximately 500 mm (KPL, 2012a). Precipitation is generally highest during July and August and lowest during February, March and April. Based on the Casino Project climate station, the mean annual temperature is approximately -2°C (KPL, 2012a), with July being the warmest month and January being the coldest.

2.3.3 Drainage

The Freegold Road Extension crosses six watersheds, including Big Creek, Seymour Creek, Hayes Creek, Selwyn River, Mascot Creek and Isaac Creek (**Figure 1**). Each of these watersheds drains northwards towards the Yukon River.

Surface drainage within the study area is influenced by the depth of the permafrost table as well as the texture of surficial soils. In general, areas of higher elevation (i.e., summits and ridgelines) tend to be well-drained. Colluvial slopes with low silt content and a deep permafrost table tend to be moderately well drained. Soils with increased fine contents tend to be more poorly drained. Permafrost features associated with poor drainage include peat plateaus, hummocky tussock fields, and thick colluvial aprons, which are commonly found in valley bottom areas.

2.3.4 Permafrost

Permafrost in the northern Dawson Range is widespread but discontinuous (Bond and Lipovsky, 2011; McKillop et al., 2013). Permafrost is most commonly found on north-facing slopes and in valley bottoms where thick deposits of fine-grained loess, colluvium, alluvium, and peat have accumulated. South-facing slopes, and well drained soils and rock, are generally free from permafrost. The distribution of permafrost along the Freegold Road Extension has been inferred by PECG based on interpretation of large-scale, colour aerial photography, detailed topographic data and extensive soil and permafrost investigations conducted in the Dawson Range (McKillop et al., 2013).

2.3.5 Aquatic Ecology

The six watercourses crossed by the Freegold Road Extension host a variety of fish species including Chinook salmon (*Oncorhynchus tshawytscha*), chum salmon (*Oncorhynchus keta*), Arctic grayling (*Thymallus arcticus*), slimy sculpin (*Cottus cognatus*), and round whitefish (*Prosopium cylindraceum*) (PECG, 2013).

Arctic grayling typically spend the spring and summer in smaller tributary streams and migrate to the lower reaches of large river systems to overwinter (McPhail, 2007). Spawning occurs shortly after spring ice-out within coarse gravel and cobble beds. Slimy sculpin spend their entire life cycle within a single stream system (von Finster, 1998). As a result, the presence of overwintering habitat (either in groundwater-fed pools or river systems) and a lack of movement barriers are keys to success of this species. Barriers to fish movement are common within the study area and are generally identified by steep gradients or boulder pavements found within creek channels. Burbot and round whitefish tend to be present within large river systems or major tributaries and are not commonly found within small or headwater tributaries (von Finster, 1998).

The areas of known adult Chinook salmon utilization and the areas of known Chinook salmon presence at other life stages (i.e., fry and juvenile) are presented on **Figure 1**. The areas shown are based on numerous historical studies conducted on Chinook habitat, presence, and spawning in the area (i.e., DFO, 1985; DFO, 1994; Yukon River Panel, 2008, EDI, 2011). Big Creek and the Selwyn River are known to be utilized by adult Chinook salmon for spawning habitat (DFO 1985, Yukon River Panel, 2008), and the tributaries of Seymour Creek, Bow Creek, Stoddart Creek, Hayes Creek, and Dip Creek have all been shown to contain fry and juvenile Chinook (DFO, 1994, von Finster, 1998). Juvenile Chinook salmon have also been documented in the lower reaches of Britannia Creek, Isaac Creek, Mascot Creek, Crossing Creek and Murray Creek, near the confluence with the Yukon River (DFO, 1994, EDI, 2011).

Protection and management of fish habitat is provided by DFO. Of particular concern is the potential delivery of fine sediments from construction areas into watercourses. The identification of areas with the greatest erosion potential (Map Series 1 – **Appendix A**) and potential ecological consequence of off-site sediment transport (Map Series 2 – **Appendix B**) is a critical step in the development of measures designed to prevent sediment originating in disturbed areas during construction from entering nearby aquatic environments.

3 Methods and Rationale for the Overall Approach

The approach used in the assessment of the Erosion and Sedimentation Risk was based on the *Ministry of Transportation Ontario (MTO) Environmental Reference for Highway Design* (October 2006) (hereinafter referred to as the “ERD”) and the *MTO Environmental Guide for Erosion and Sediment Control During Construction of Highway Projects* (February 2007) (hereinafter referred to as the “ESC Guide”), which outlines a multi-disciplinary design approach to erosion and sediment control. The approach outlined in the above listed documents was modified based on guidance provided in “*Best Management Practices for Works Affecting Water in Yukon*” (Water Resources Branch Environment Yukon, 2011) and professional judgment to suit the unique conditions of the Yukon (e.g., permafrost).

The ESC Guide defines risk as “a quantitative or qualitative expression of possible loss that considers both the probability that a hazard will cause harm and the consequences of that event”. With this in mind, PECG, in association with 43 North GIS Consultants Inc. (43 North), have developed a methodology for assessing the erosion and sedimentation risk for the Freegold Road Extension. This method considers the probability that a hazard will cause harm, based on the physical conditions at a specific location, and the consequences of that effect, based on the existing natural environment conditions.

Data collected by PECG and AE through field investigations associated with the project were used as the basis for determining the erosion and sedimentation risk. Pertinent information for this risk assessment include the following:

- Terrain mapping along the Freegold Road Extension corridor (based on air photo interpretation and ground truthing) (KPL, 2012b);
- Regional surficial geological mapping;
- Digital elevation model (DEM) of the study area (10 m grid cell interpolated from 40 m cell), and associated 2 m-interval topographic contours;
- Stream sensitivity and fish presence/absence assessments (PECG, 2013); and
- Permafrost probability mapping completed by PECG along the alignment.

The data collected for the project was managed and analyzed by 43 North using a GIS-based platform. The GIS approach allowed PECG to take advantage of existing spatial data, standardize the analysis procedure, increase the efficiency of map creation and overlay, and query key layers using ArcGIS tools/editors. Three sets of maps of the study area were produced to display the results of the three analyses described in Section 2.1.2: Erosion Potential (**Appendix A**), Potential Ecological Consequence (**Appendix B**), and Overall Erosion and Sedimentation Risk (**Appendix C**).

3.1 Map Series 1 – Erosion Potential

Map Series 1 **(Appendix A)** presents the *Erosion Potential* for the soils along the length of the Freegold Road Extension.

For the purposes of this study, *Erosion Potential* is a physical measure of an area’s susceptibility to erosion. This susceptibility is primarily dependent on its surficial material, including its composition and depositional origin, and its slope gradient, but other factors such as climate and groundwater table depth also play an important role. Slope length was necessarily excluded as a factor because of the narrowness of the road corridor relative to the DEM cell size. Section 5.3 of the MTO ESC Guide, following the Revised Universal Soil Loss Equation (RUSLE) (Renard et al., 1996), suggests the following factors be considered to assess the erosion potential of an area:

- soil texture;
- topography;
- climate;
- cover characteristics; and
- shallow groundwater.

The evaluation of the erosion potential used in this assessment focused primarily on soil textures and topography. In addition to these factors, the probability of permafrost presence was also included with the erosion potential of an area. The soil textures were determined from the field-checked terrain mapping completed along the corridor by KPL (2012b). Because the soil textures were only verified along the proposed corridor of the Freegold Road, the erosion potential was accordingly only assessed within its footprint. The topography within and outside the transportation corridor was determined from a 10 m grid-size DEM, interpolated from the base 40 m DEM. More subtle surface expression and micro-topography was characterized based on stereoscopic interpretation of aerial photography.

Climate and precipitation trends did not specifically influence the erosion potential in this study, for two main reasons. First, precipitation amounts and intensity vary relatively little across the study area. Second, the length of the construction period is such that it will cover all seasons and the exact location of construction during a particular climatic period is unable to be predicted at this stage of planning.

The Erosion Potential analysis and mapping are based on two key criteria: (1) the *Soil Erodibility*, which is a characteristic of the soil genesis and texture, and (2) the *Slope Gradient*, which is derived from the topography. Erosion potential is thus best understood according to the following relation:

$$\textit{Erosion Potential} \quad = \quad f(\textit{Soil Erodibility, Slope Gradient})$$

In other words, erosion potential is the combined ease with which soils can be eroded by surface runoff and the likelihood for surface runoff to have sufficient velocity to mobilize the soils. It should be noted that this analysis is based project proposal level design data and is dependent on the availability and reliability of the data. Site-specific investigations were not conducted over all areas of the Freegold Road Extension corridor, as would typically occur if the erosion potential was being assessed during the Detailed Design of a project.

3.1.1 Soil Erodibility

Soil Erodibility is the inherent resistance of soil to erosional processes (Bryan, 2000). It is one of the principal variables in the aforementioned (Section 3.1) RUSLE (Renard et al., 1996), which was originally developed to predict annual soil loss from sheet and rill erosion in agricultural areas, but has also been applied to construction sites. Soil erodibility is a function of a number of factors, including the soil's texture and genesis (depositional origin).

The texture, or grain size distribution, of the soil matrix is perhaps the most important determinant of a soil's erodibility. In general, silts are most erodible, sands are moderately erodible and clay-rich soils are least erodible. Silty soils are most prone to erosion because individual grains are light enough to be readily entrained by flowing water, but they do not exhibit the cohesive bonds like clay. Silty soils are also prone to localized "piping," where very shallow groundwater can propagate through small but discrete pathways in the shallow subsurface in areas of seepage. Commonly, a thin, discontinuous crust forms downslope of the "pipes" as the silt dries, which accelerates runoff and leads to the development of rills

(Bryan, 2000). Coarse sand requires a relatively high velocity to be entrained and typically moves in surface runoff by rolling, limiting its transport distance. The electrostatic forces within clayey soils generate cohesion that bonds particles together and resists erosion.

Areas underlain by permafrost, particularly where ice-rich, are more sensitive to erosion than areas without permafrost. Each summer, the uppermost layer of permafrost, known as the active layer, thaws. The permafrost table below inhibits infiltration, and the meltwater remains trapped near surface. The saturated soils have reduced shear strength and are highly susceptible to erosion. Where vegetation removal and grading are required, frozen ground becomes exposed to surface temperatures and promotes thawing. The rates of erosion, as well as re-vegetation success, are dependent upon permafrost depths, lateral extent and water/ice content. Of particular concern are fine grained soils with high moisture contents, which when thawed, can result in failures even on very gentle slopes.

Qualitative ratings of Soil Erodibility – Low, Moderate or High – were assigned to each distinct terrain polygon that was mapped along the Freegold Road Extension by KPL (2012b), based on combinations of soil type and permafrost probability (**Table 1**). Permafrost-free bedrock and blocky weathered bedrock are least erodible (i.e., Low Soil Erodibility), whereas silt-rich colluvium, fluvial deposits and organic material with permafrost are most erodible (i.e., High Soil Erodibility).

Soil erodibility was deemed to be the more important of the two components that determine an area's erosion potential. Therefore, it is weighted slightly more than slope steepness in the Erosion Potential analysis.

Table 1. Soil Erodibility Classification

Low	Moderate	High
R1	C1	C4
R2	C2	C5
R3	C3	O1
R4	D4	O2
R5	D5	O3
D1	F1	O4
D2	F2	O5
D3	A3	F3
A1	A4	F4
A2	A5	F5

Terrain Code Key:
R = bedrock
D = weathered bedrock
A = anthropogenic materials
C = colluvium
F = fluvial sediments
O = organic materials

Permafrost Presence:
1 – very low probability
2 – low probability
3 – moderate probability
4 – high probability
5 – very high probability

3.1.2 Slope Gradient

Slope Gradient, or steepness, is paired with slope length in the principal Topography variable in the aforementioned (Section 3.1) RUSLE (Renard et al., 1996). The gradient of a slope influences the velocity of surface runoff. Water flowing down a steep slope converts more of its gravitational potential energy into kinetic energy; hence, velocity increases. As velocity increases, there is a corresponding increase in the shear stress exerted on individual soil particles. The particle size that can be mobilized by flowing water increases as the velocity increases, although the velocity necessary to entrain silts, sands and fine gravels is less than that required to erode clay.

As described in Appendix A of MTO's ESC Guide, slopes with gradients less than 5%, and more generally less than 10%, commonly function as depositional areas. Hasholt et al. (1997) notes that rill frequency increases on steep slopes, and found that rills are common on slopes with gradients between 9 and 12%. A gradient of about 30% represents an approximate lower limit for the transport of saturated flows of soil debris. Therefore, the erosion potential in this assessment was based partly on the following assignments:

- Slope gradient <10% = Low
- Slope gradient 10-30% = Moderate
- Slope gradient >30% = High

3.1.3 Erosion Potential Mapping

ArcGIS was used to identify and rank the *Erosion Potential* of all areas within the transportation corridor according to the following "ratings" equation:

Erosion Potential = *(Soil Erodibility)(0.6) + (Slope Gradient)(0.4)*

where the Low, Moderate and High ratings of each factor have been assigned values of 1, 2 and 3, respectively. The resultant Erosion Potential is assigned according to the following classes: 1.00 < Low ≤ 1.67, 1.67 < Moderate ≤ 2.33 and 2.33 < High ≤ 3.00. For example, the Erosion Potential within a 10 m by 10 m area within the transportation corridor with moderate (2) soil erodibility and a high (3) slope gradient (>30%), would be estimated as follows:

Erosion Potential = (2)(0.6) + (3)(0.4) = 2.4 = High

As shown on Map Series 1 (**Appendix A**), areas of Low Erosion Potential are shown in green, areas of Moderate Erosion Potential are shown in yellow and areas of High Erosion Potential are shown in red. Thus, the 10 m by 10 m area in the above example would be coloured red.

3.2 Map Series 2 – Potential Ecological Consequences

Map Series 2 (**Appendix B**) presents the *Potential Ecological Consequences* of sediment mobilization from construction of the Freegold Road Extension.

Two factors are fundamental to understanding the potential ecological consequence of off-site sediment transport:

- the Sensitivity of the Ecological Receptor; and
- the Potential for Sediment Delivery into an Ecological Receptor.

PECG has characterized and mapped ecological receptors in the vicinity of the Freegold Road Extension as part of the project proposal. The work included the characterization of fish presence/ absence and fish habitat at all 95 stream crossing locations (PECG, 2013) along the proposed roadway extension.

The analysis from which Map Series 2 was derived takes into account the presence of a sensitive ecological receptor, the natural drainage pattern of the land surface and the distance along the flow path. The relation can be expressed as follows:

Potential Ecological Consequence = f(Sensitivity of Receptor, Flow Path, Distance)

It should be noted that this analysis is based on existing surface drainage patterns (controlled by existing ground surface topography) and recognition that existing vegetation downslope of the construction footprint will greatly impede the transport of sediment. Local drainage patterns will undoubtedly be altered by construction of the transportation corridor, especially surrounding areas of cut and fill and through drainage ditching, but the focus of this assessment is on the conditions that will be encountered at the start of construction.

3.2.1 Sensitivity of Ecological Receptors to Sedimentation

The *Sensitivity of an Ecological Receptor to Sedimentation* is a key factor in determining the potential ecological consequence of off-site sediment transport from any given area within the transportation corridor. Increased sedimentation in watercourses can reduce the ability of fish to absorb oxygen. The ability of fish to reproduce is reduced by fine sediments covering eggs and spawning habitat. Sedimentation can also affect the food supply of some or all fish species by smothering benthic organisms. The delivery of sediment to surface water features is particularly a concern if the biota that the watercourse supports are particularly sensitive to sedimentation. Watercourses such as Big Creek and the Selwyn River are known to host Chinook salmon spawning habitat, which would be highly sensitive to the effects of sedimentation.

Although certain fish and fish habitats are more sensitive to sedimentation than others, PECG has adopted the conservative approach that, “if a watercourse supports fish and/or fish habitat, regardless of the sensitivity of the watercourse, the potential consequences of work in the area with respect to erosion and sediment control are high”. Therefore, for the purposes of this analysis, all watercourses that support fish or fish habitat were assigned a High Sensitivity to sedimentation. As part of the Fish and Aquatic Resource Assessment for the Freegold Road (PECG, 2013), a fish and fish habitat sensitivity assessment was completed for all watercourses that cross, or parallel in close proximity, the Freegold Road Extension. The results of this assessment, combined with a fisheries biologist’s professional judgment of whether or not the watercourse was considered “fish bearing” were used to make the following assignments of ecological sensitivity to sedimentation:

- Watercourse does not support fish or fish habitat (e.g., ephemeral drainage swale) = Low
- Watercourse supports fish or fish habitat (low, moderate or high sensitivity) = High

Consideration was also given to potential downstream effects. Even if a particular watercourse does not support fish habitat (e.g., ephemeral swale), it may ultimately drain and deliver sediment into a fish-bearing stream. Each crossing was studied at large scale using high-resolution aerial photography, combined with drainage mapping, to assess whether there is a direct connection between the non fish-bearing watercourse (swale) and fish habitat within 1 km downstream. Several ephemeral swales terminate at toe slope positions, in wet meadows well back from fish-bearing watercourses; their sensitivity to sedimentation was considered low. If there is a direct connection, however, that non fish-bearing watercourse was considered to have a High sensitivity to sedimentation. This information was incorporated into Map Series 2 (**Appendix B**).

3.2.2 Potential for Sediment Delivery to Ecological Receptors

A critical step in the determination of the potential ecological consequence of sediment transport from a particular area within the Freegold Road corridor is the estimation of the *Potential for Sediment Delivery to Ecological Receptors*. The main factors that influence this potential are the length, direction and configuration of the flow paths between potential sediment sources and receptors. The location of fish bearing watercourses and aquatic habitat were the primary ecological receptors considered for this analysis.

Ecological receptors more than 300 m from the potential sediment source are considered to have No Potential for sedimentation. This makes physical sense, as it is highly unlikely that overland flow would maintain the necessary depth and velocity to transport a significant amount of sediment such long distances through dense ground vegetation (e.g., mosses, shrubs) over ground with surface irregularities that act as localized sediment traps. Given the right conditions, the potential exists for overland sediment transport to exceed 100 m. This is particularly a risk when the proposed road alignment is oriented upslope-downslope, perpendicular to topographic contours. For construction in close proximity to ecological receptors, a commonly used development setback from fish bearing streams is 30 m, which provides the necessary undisturbed, vegetated separation to filter out fine sediments, attenuate local runoff and improve water quality.

Therefore, for the purposes of this assessment, the potential for sediment delivery to an ecological receptor has been defined as follows:

- Flow path to ecological receptor >300 m = No Potential
- Flow path to ecological receptor 100 – 300 m = Low
- Flow path to ecological receptor 30 – 100 m = Moderate
- Flow path to ecological receptor <30 m = High

3.2.3 Potential Ecological Consequence Mapping

ArcGIS was used to identify and rank the *Potential Ecological Consequences* of all areas along the Freegold Road Extension alignment according to the following "ratings" equation:

Potential Ecological Consequence of Off-Site Sediment Transport	=	*Sensitivity of Ecological Receptor * Potential for Sediment Delivery*

The Low, Moderate and High ratings for the Sensitivity of Ecological Receptor have been assigned values of 1 for Low sensitivity and 3 for High sensitivity. The rating factors for the Potential for Sediment Delivery have been assigned values of 0, 1, 2 and 3, for No Potential, Low, Moderate and High, respectively. The resultant Erosion Potential is assigned according to the following classes: 0, 1, 2 = Low; 3 = Moderate; and 6,9 = High.

For example, the Potential Ecological Consequence at a location that is between 100 and 300 m downslope from a high sensitivity feature would be estimated as follows:

*Potential Ecological Consequence = (1) * (3) = 3.0 = Moderate*

On Map Series 2 (**Appendix B**), areas of Low Potential Ecological Consequence are shown in green, areas of Moderate Potential Ecological Consequence are shown in yellow and areas of High Potential Ecological Consequence are shown in red. Thus, the 10 m by 10 m area in the above example would be coloured yellow.

3.3 Map 3 – Overall Erosion and Sediment Risk

Map Series 3 (**Appendix C**) presents the Overall Erosion and Sedimentation Risk mapping for the Freegold Road Extension.

Map Series 3 is derived from the combination of Map 1 (Erosion Potential) and Map 2 (Potential Ecological Consequence). It represents the *Overall Erosion and Sedimentation Risk* along the road alignment, which takes into account an area's physical susceptibility to erosion, the sensitivity of nearby downslope ecological receptors and the likelihood that sediment-laden surface runoff will actually reach the receptors. The overall risk was determined using the following equation:

Overall Erosion and Sedimentation Risk	=	*Erosion Potential* + *Potential Ecological Consequence*

where the ratings for both the Erosion Potential and the Potential Ecological Consequence are Low = 1, Moderate = 2 and High = 3. The resultant overall risk is assigned according to the following classes:

Low = 2 – 3, Moderate = 4, and High = 5 – 6. **Table 2** summarizes all possible scenarios (Map Series 1 and Map Series 2) that yield overall risks (Map Series 3) of Low, Moderate and High. On Map Series 3 (**Appendix C**), areas of Low overall risk are shown in green, areas of Moderate overall risk are shown in yellow and areas of High overall risk are shown in red.

Table 2. Overall Erosion and Sedimentation Risk Matrix

	Map Series 1 Erosion Potential	Map Series 2 Potential Ecological Consequence	Map Series 3 Overall Erosion and Sedimentation Risk
Site Ranking	Low	Low	Low
	Low	Moderate	Low
	Low	High	Moderate
	Moderate	Low	Low
	Moderate	Moderate	Moderate
	Moderate	High	High
	High	Low	Moderate
	High	Moderate	High
	High	High	High

Areas along the Freegold Road Extension with the highest overall risk exhibit high and moderate risk characteristics on one or more of the two map series. For example, a steep, permafrost-rich, silt-blanketed valleyside directly above a fish bearing stream represents a High Overall Erosion and Sedimentation Risk. Hayes Creek, shown on **Map Sheet 16 (Appendix C),** is a good example of this scenario. At the other extreme, a low to moderate slope with permafrost-free, stoney colluvial soils, located more than 300 m from a fish bearing watercourse, represents a Low Overall Erosion and Sedimentation Risk. A good example of this scenario, shown on **Map Sheet 8 (Appendix C)**, is the green area on the north side of Big Creek.

The objective of the Overall Erosion and Sedimentation Risk mapping is to highlight critical areas where a more rigorous level of erosion and sedimentation control is anticipated to be required, while not being overly conservative such that the level of erosion control would be impractical. Map Series 3 is designed to be both descriptive and practical, so CMC, DFO, YESAB and other stakeholders can better understand the erosion and sedimentation risk associated with construction of the Freegold Road Extension and can minimize the risk moving forward to the Detailed Design Stage.

4 Discussion of the Map Results

4.1 Map Series 1 – Erosion Potential

From a practical point of view, the results of the Erosion Potential mapping reflect the physical conditions of the study area. The Freegold Road Extension area generally has a Moderate (65% of total area) to Low (25% of total area) Erosion Potential, which reflects route selection methodology to focus on valley bottom areas and permafrost-free slopes, wherever possible (Map Series 1 – **Appendix A**) (**Table 3**). Areas of High Erosion Potential (10% of total area) are generally limited to very steep valleysides or north facing slopes with silt or silty colluvial soils.

Table 3. Proportions of Erosion Potential, Potential Ecological Consequence and Overall Risk

No.	Map	Low	Moderate	High
1	Erosion Potential	25%	65%	10%
2	Potential Ecological Consequence of Off-Site Sediment Transport	68%	21%	11%
3	Overall Erosion and Sedimentation Risk	68%	23%	9%

4.2 Map Series 2 – Ecological Consequence

Although most watercourses crossed by the Freegold Road Extension are fish bearing, the alignment of the roadway is generally located more than 100 m upslope from these features or along flat, valley bottom areas. Therefore, the majority of Freegold Road Extension area has a Low (68% of total area) or Moderate (21% of total area) Ecological Consequence (Map Series 2 – **Appendix B**) (**Table 3**).

The exception to this occurs where the roadway physically crosses a watercourse or where topographical constraints have resulted in the road alignment being positioned in close proximity to, and up-gradient of, a fish bearing watercourse. Streams where fish and/or fish habitat were identified are all buffered by an approximately 30 m-wide High ecological sensitivity boundary strip. This suggests that the ecological consequence of sediment delivery is high for these areas and that a higher level of erosion and sedimentation control will likely be required for these areas. This is reflective of what would need to be done in practice to mitigate the erosion and sedimentation risk for a construction project that was occurring near a sensitive stream. All watercourses where fish and/or fish habitat was *not* identified are buffered by a strip of Moderate ecological sensitivity ranking, unless another sensitive feature was identified in the area that would increase the ranking. This moderate ranking reflects the potential downstream consequences of sediment transport in the watercourse. Within 30 m of any watercourse, no low ecological consequence rankings were determined through the analysis, as should be expected.

The overall goal of any erosion and sediment control program is determine the potential risk and to mitigate potential ecological impacts. This is consistent with a need to reduce exposure to potential legal consequences associated with the deposition of sediment in receiving waterbodies and ecologically significant areas (e.g., HADD violation). For these reasons, it was imperative that an overall conservative approach was taken when assessing the ecological risk for this project.

Another key feature of this mapping is the consideration of natural surface runoff flow paths around the Freegold Road Extension. The rationale behind the flow path is that ecologically sensitive features located upslope of the Freegold Road Extension are not at risk from sedimentation because sediment cannot be physically transported to these features from the proposed roadway. A high sensitivity feature could be located less than 30 m upslope of the construction zone, but there would be no risk of sedimentation to this feature.

Building the effects of flow path direction into the model is intended to prevent the over-estimation of the potential ecological consequence of off-site sediment transport. It is believed that this will provide justification to use less intensive erosion and sedimentation control measures around ecologically sensitive areas where sediments from the construction area are unlikely to reach the receptor, while at the same time highlight areas were more rigorous effort will be required.

4.3 Map Series 3 – Overall Erosion and Sedimentation Risk

The Overall Erosion and Sedimentation Risk mapping (Map Series 3 **– Appendix C**) integrates an area's physical Erosion Potential (Map Series 1 **– Appendix A**) with its Potential Ecological Consequence (Map Series 2 – **Appendix B**). The combination of these two analyses provides the framework for determining the appropriate levels of erosion and sediment control measures. This mapping is designed to highlight areas that will require more rigorous approaches to erosion and sediment control due to the physical properties of the location (soil type, slope gradient) and to the potential ecological (or legal) consequences of sedimentation.

The Overall Erosion and Sediment Risk mapping generally shows that the majority (68%) of the Freegold Road Extension alignment has a Low Risk from erosion and sedimentation (**Table 3**). This is expected given the large areas that cross south-facing slopes, low gradient valley bottoms, and weathered bedrock soils. The Moderate Risk area is the second most common (23%), which reflects the steep slopes present in the study area and more erosion-prone soils, as well as the 30 – 100 m flow path to fish bearing watercourses. The High risk areas are the least common (9%) and are commonly found at fish bearing watercourse crossings (or non-fish bearing watercourses that drain into a fish bearing watercourse) or areas where steep flow paths with highly erodible soils are directed towards sensitive watercourses.

Consideration must also be given to even small areas that are highlighted as High Risk. Although these areas may appear to be insignificant or unimportant, the erosion and sediment algorithms were calibrated to identify these small features. A good example of a High Risk area that may be overlooked is on Map 3 of Map Series 3 (**Appendix C**), where the Freegold Road Extension is located close to Seymour Creek even though it does not cross it. During future design stages, it will be important that this small area gets identified as having a High Overall Erosion and Sedimentation Risk, and that mitigation measures get designed to reflect this sensitivity.

5 Recommendations for Erosion and Sediment Control Plan Development

5.1 Erosion and Sediment Control Approaches

This Overall Erosion and Sedimentation Risk Assessment provides a basis for designing and ultimately preparing an Erosion and Sediment Control Plan (ESCP) for construction of the Freegold Road Extension during subsequent project phases. An ESCP is used to demonstrate the operational procedures and best management practices which minimize potential effects to the environment and ensure the stability of infrastructure on site. Development of this plan is done in consultation with Regulatory Agencies to ensure that the strategy meets the project's environmental requirements. The benefit of conducting this assessment is that it allows areas to be differentiated based on their level of erosion and sedimentation risk. Erosion and sediment control (ESC) measures can then be designed and implemented that are commensurate with the level of risk identified (i.e., Low, Moderate, and High) for each area of the Freegold Road Extension.

Based on the erosion and sedimentation control practices described in "Best Management Practices for Works Affecting Water in Yukon" (Water Resources Branch Environment Yukon, 2011 p. 12-13), the following risk-commensurate ESC measures are suggested for construction of the Freegold Road Extension:

- **Low Risk**: General preventative best management practices (BMPs); minimal monitoring
- **Moderate Risk**: Active sediment controls and BMPs; periodic monitoring
- **High Risk**: Active sediment controls and, where applicable, active erosion controls; priority for monitoring

Further description of the level of effort suggested for each recommended risk category is provided below.

Low Risk: General Preventative BMPs
A broad range of planning measures that can be utilized to prevent or minimize off-site sediment movement without the use of active ESC measures. These measures focus on project planning measures such as minimizing the size of the disturbed area, maximizing the amount of vegetation retained, and avoiding working on steep, unstable or permafrost-covered slopes, where practical. Emergency ESC supplies should be readily available and deployed as required. ESC monitoring should focus on storm events when the rainfall intensity is greatest.

The use of general preventative BMPs as an effective ESC strategy is only suggested for lower risk areas where additional ESC effort is not justified based on site conditions. These areas may have a low erosion and sedimentation risk based on the physical conditions of the site, require less complex construction methods, and have no regulatory requirements for construction (e.g., *Fisheries Act* authorizations).

Moderate Risk: Active Sediment Controls
ESC measures aimed at preventing the escape of sediment into the environment. These measures can include perimeter controls (e.g., silt fence), velocity controls (e.g., rock check dams), and/ or sediment removal devices (e.g., sediment traps or ponds). General measures to minimize soil erosion, such as vegetation retention and BMPs, must still be implemented. A monitoring plan should be implemented to assess ESC measures particularly following storm events.

The use of ESC measures aimed at preventing the escape of sediment into the environment.is suggested for areas where erosion prevention controls are not likely to be required due to the sites only having moderate erosion and sedimentation risk. The majority of these sites are not expected to require regulatory authorizations, but this should be assessed on a site-specific basis prior to initiating the construction phase of the project.

High Risk: Active Sediment and Erosion Controls
Active ESC measures aimed at preventing erosion and, if erosion occurs, to prevent the escape of sediment into the environment. These types of measures are typically implemented for construction areas of higher ESC risk, such as stream crossings, steep slopes, and moderate cuts and fills. Active erosion and sediment control measures may include, covering and stabilizing disturbed areas as soon as possible, runoff diversions, sediment velocity controls, sediment traps, and the use of perimeter controls around construction areas. The implementation and use of more general BMPs is still recommended for these areas. A plan for regular monitoring, inspection and maintenance of the ESC measures should be implemented.

This level of ESC measures is reserved for the higher risk areas, where there is a high erosion and sedimentation risk based on physical conditions and/or a high ecological consequence if sedimentation were to occur. These areas will commonly have strict regulatory permitting requirements (e.g., *Fisheries Act* authorizations) and construction timing windows based on fish species present.

In all three approaches, the Contractor is responsible for installing, maintaining and removing the ESC measures, in accordance with the contract drawings and specifications and, if applicable, the ESCP. Regular and post-storm inspections are an essential means of identifying early any concerns that require attention. Ultimately, the Contractor is responsible for any erosion and sedimentation caused by their operations.

5.2 Project Limitations

This Erosion and Sedimentation Risk Assessment is provided as a planning tool and is based on GIS analyses of primary and secondary source, project-specific data sets, as well as territorial-scale data sets covering large areas. Its site-specific accuracy thus depends on the accuracy of input data. The types of analyses have been designed to match the dominant “resolution” of the data sets, although some minor inconsistencies may result in site-specific anomalies. For example, the territorial (1:50,000) watercourse linework does not always perfectly coincide with the DEM-based drainage alignments. In some cases, then, flow paths may have appeared to have unusual in close proximity to a particular watercourse line. This was a primary reason for assigning areas within 30 m of the watercourse line as having higher likelihoods of sediment delivery. Also, there is inherent variability in terrain map units (polygons) that cannot be accurately represented in this type of analysis. Erodibility ratings have thus been made conservatively, considering the most erodible soils within the polygon. The interpolation of a 40 m-grid DEM into a 10 m-grid DEM assists with representation of surface runoff processes, but localized irregularities may introduce variability not represented at this mapping scale.

The results of the Erosion and Sedimentation Risk Assessment for the Freegold Road Extension are based upon *existing* conditions along the alignment of the proposed Freegold Road Extension. As the project enters Detailed Design phase, it will be important to determine what affects the proposed *design* conditions (i.e., cuts, fills and drainage ditching) have on the erosion potential, potential ecological consequence and overall risk. The ratings are expected to change in accordance with earth works. In fact, redoing the analysis according to design grades and slope geometry would valuable information on which to base final design refinements.

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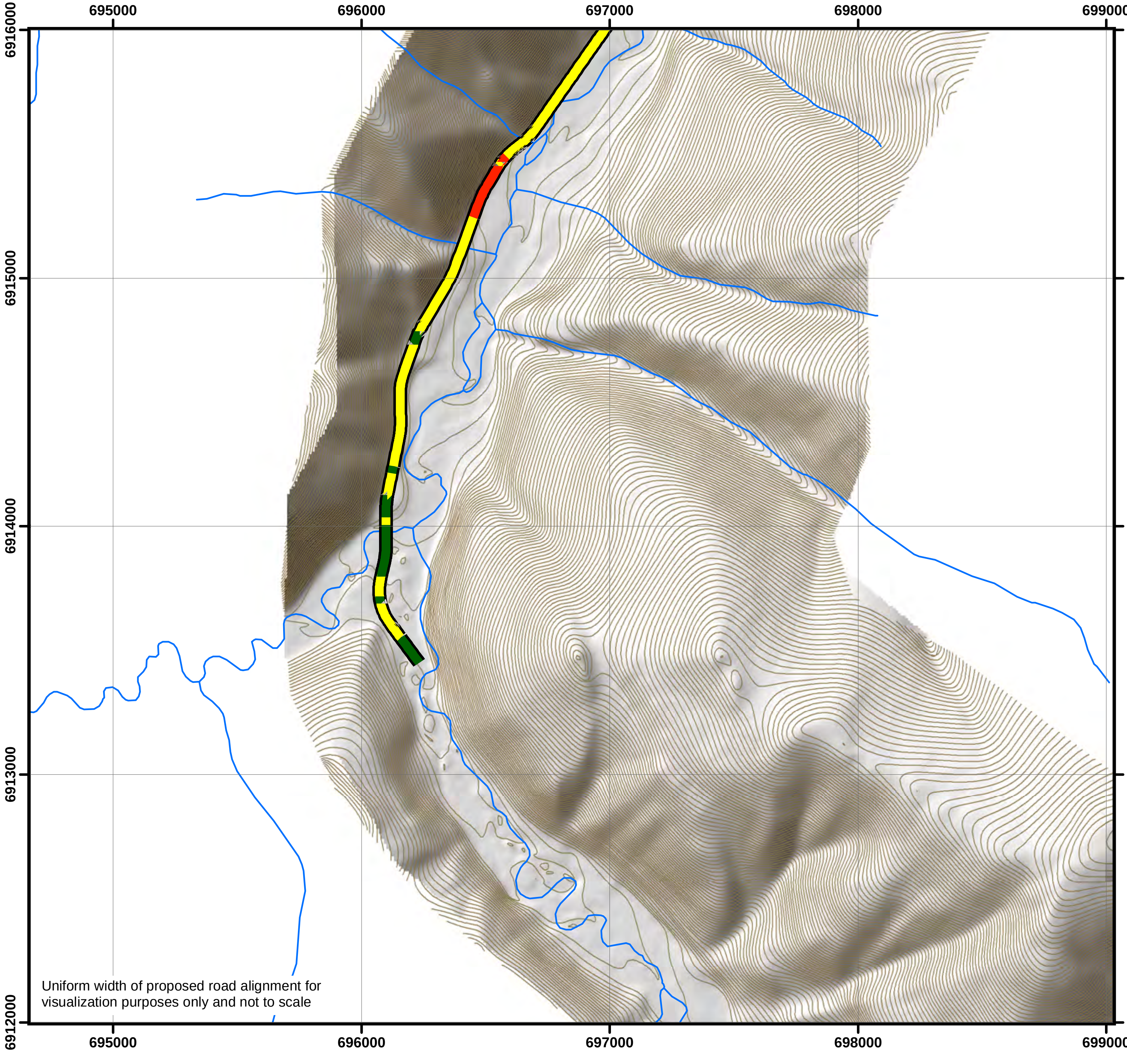
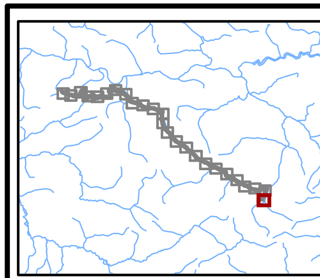
Appendix A

Map Series 1 – Erosion Potential





Legend

Erosion Potential

High

Moderate

Low

Streams

Non-Permanent

Permanet Water

Contours (5m)

0 125 250 500 750 m

1:20,000

Grid: UTM Zone 7N

Casino Mining Corporation

Freegold Road Extension

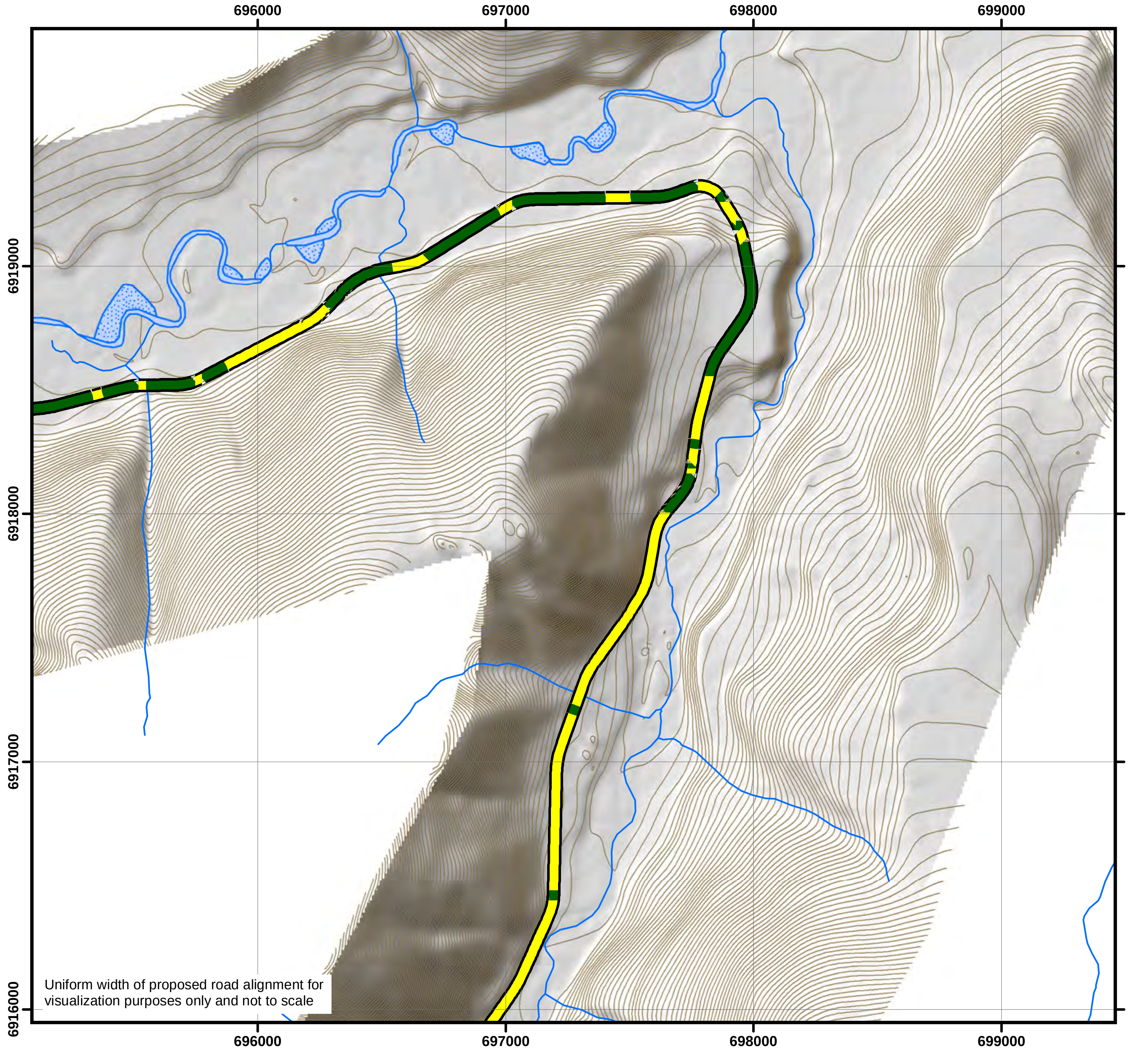
Map 1

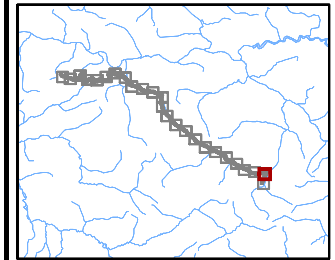
Erosion Potential

CASINO COPPER AND GOLD

PALMER ENVIRONMENTAL CONSULTING GROUP INC.

Sheet 1 of 25





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Erosion Potential

High
Moderate
Low
Streams
Non-Permanent
Permanet Water
Contours (5m)

0 125 250 500 750 m

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Grid: UTM Zone 7N

Casino Mining Corporation

Freegold Road Extension

Map 1
Erosion Potential

CASINO COPPER AND GOLD

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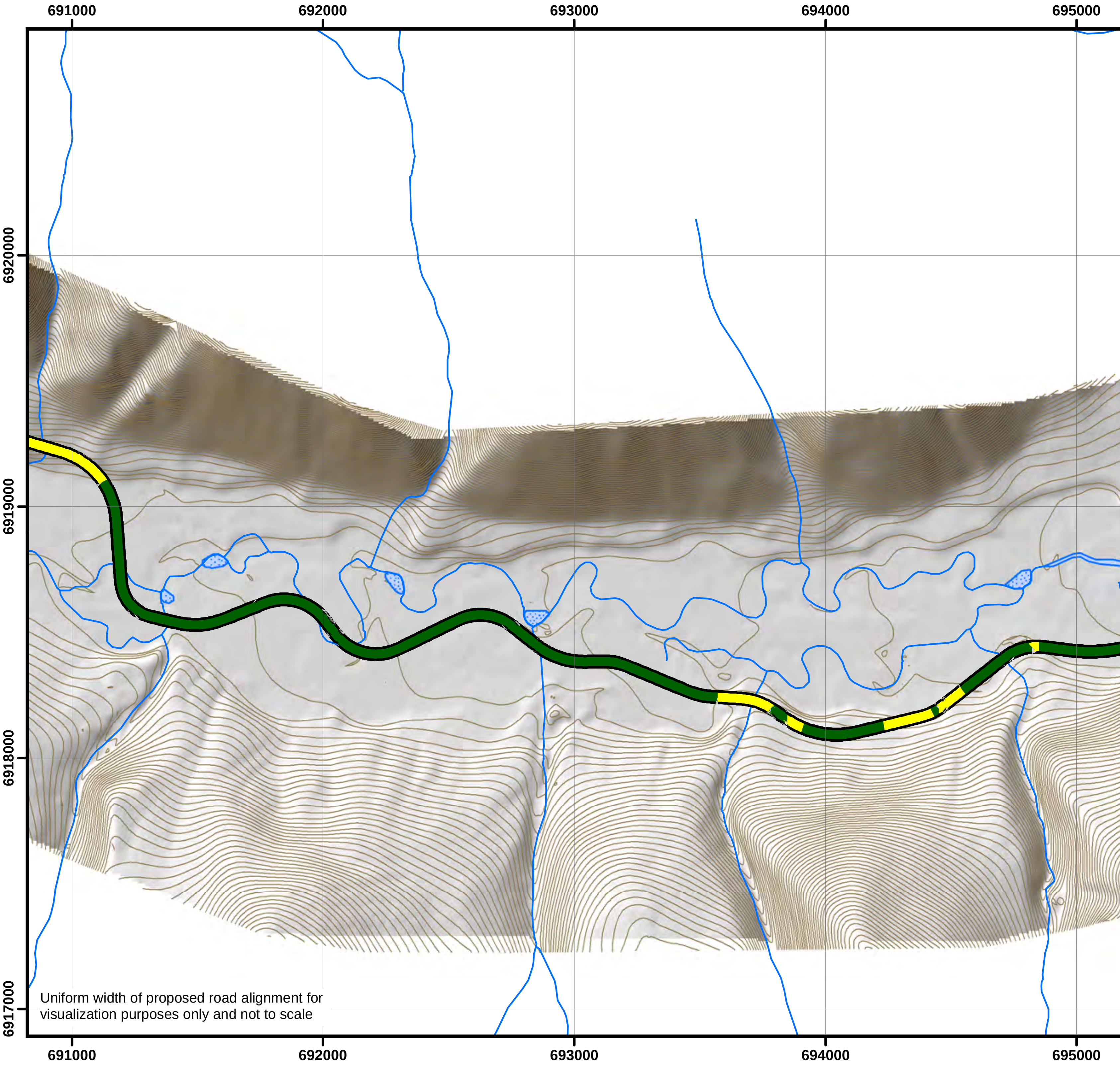
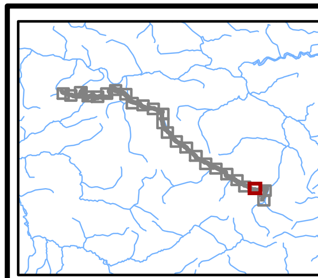
Sheet 2 of 25





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Erosion Potential

High
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Low
Streams
Non-Permanent
Permanet Water
Contours (5m)

0 125 250 500 750 m

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Grid: UTM Zone 7N

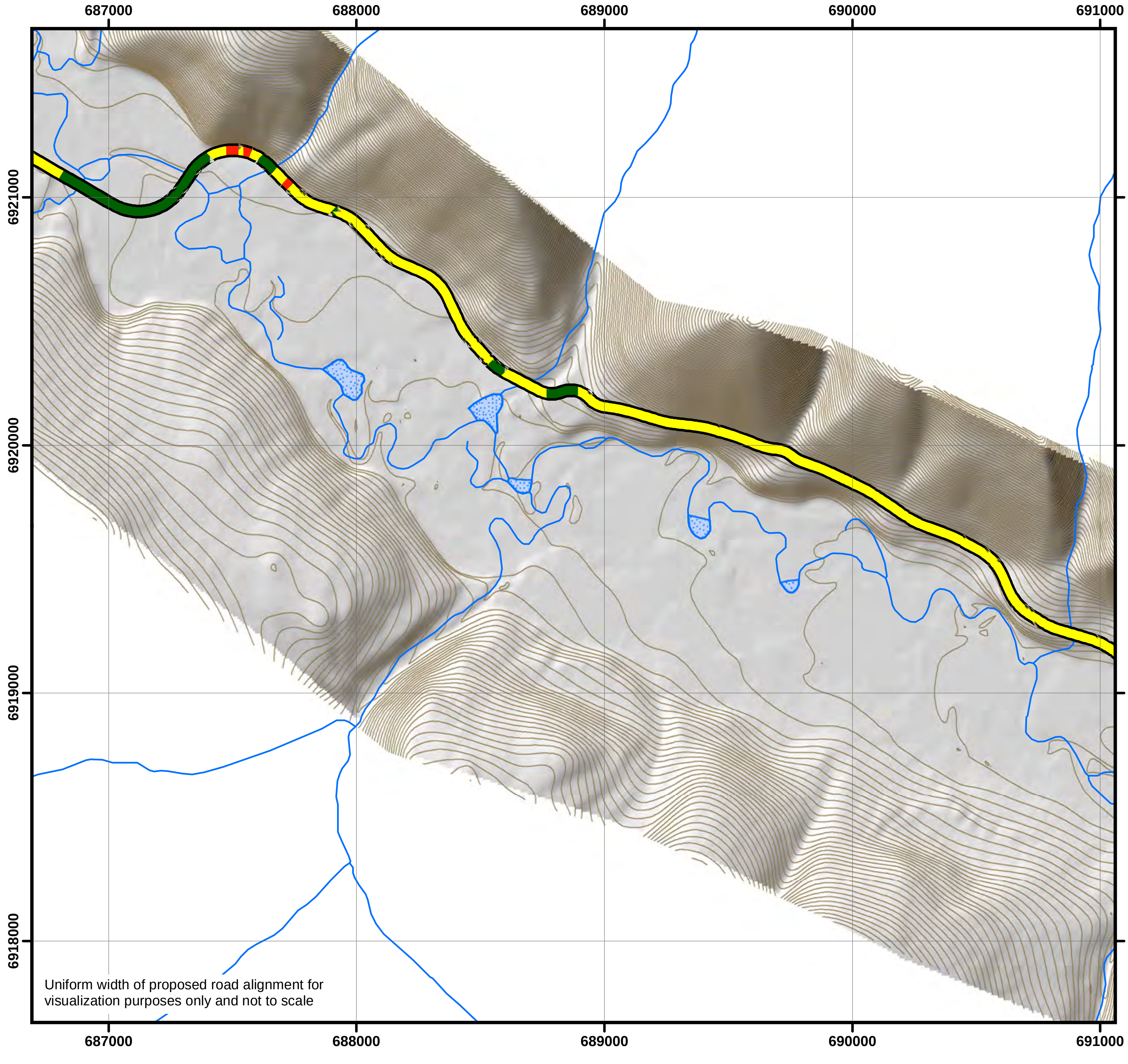
Casino Mining Corporation

Freegold Road Extension

Map 1
Erosion Potential

CASINO COPPER AND GOLD

PALMER ENVIRONMENTAL CONSULTING GROUP INC.



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Erosion Potential

- High
- Moderate
- Low
- Streams
- Non-Permanent
- Permanet Water
- Contours (5m)

0 125 250 500 750 m

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Grid: UTM Zone 7N

Casino Mining Corporation

Freegold Road Extension

Map 1

Erosion Potential

CASINO COPPER AND GOLD

PALMER ENVIRONMENTAL CONSULTING GROUP INC.

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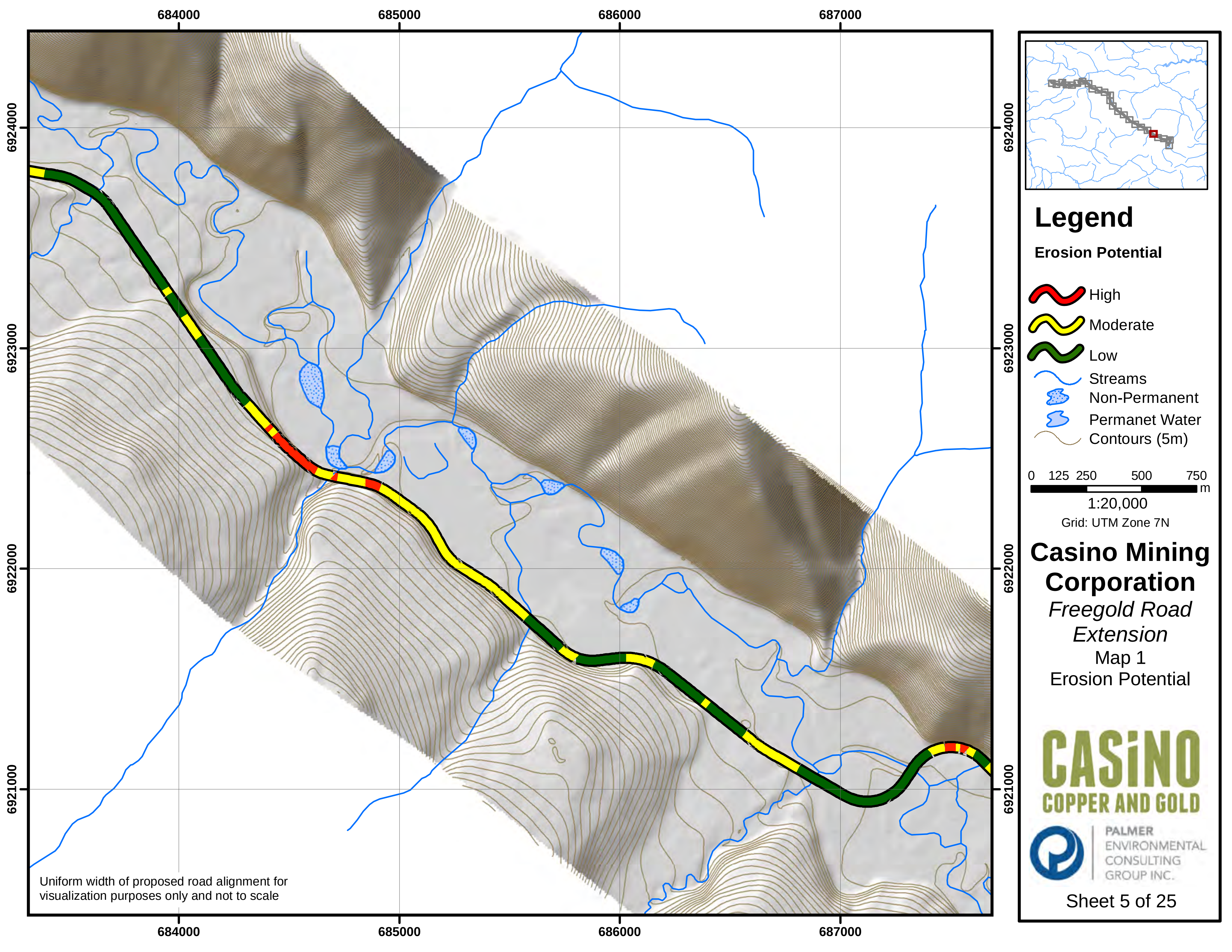
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Uniform width of proposed road alignment for
visualization purposes only and not to scale
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Erosion Potential
High
Moderate
Low
Streams
Non-Permanent
Permanent Water
Contours (5m)
0 125 250 500 750
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Grid: UTM Zone 7N
Casino Mining Corporation
Freegold Road Extension
Map 1
Erosion Potential
CASINO
COPPER AND GOLD
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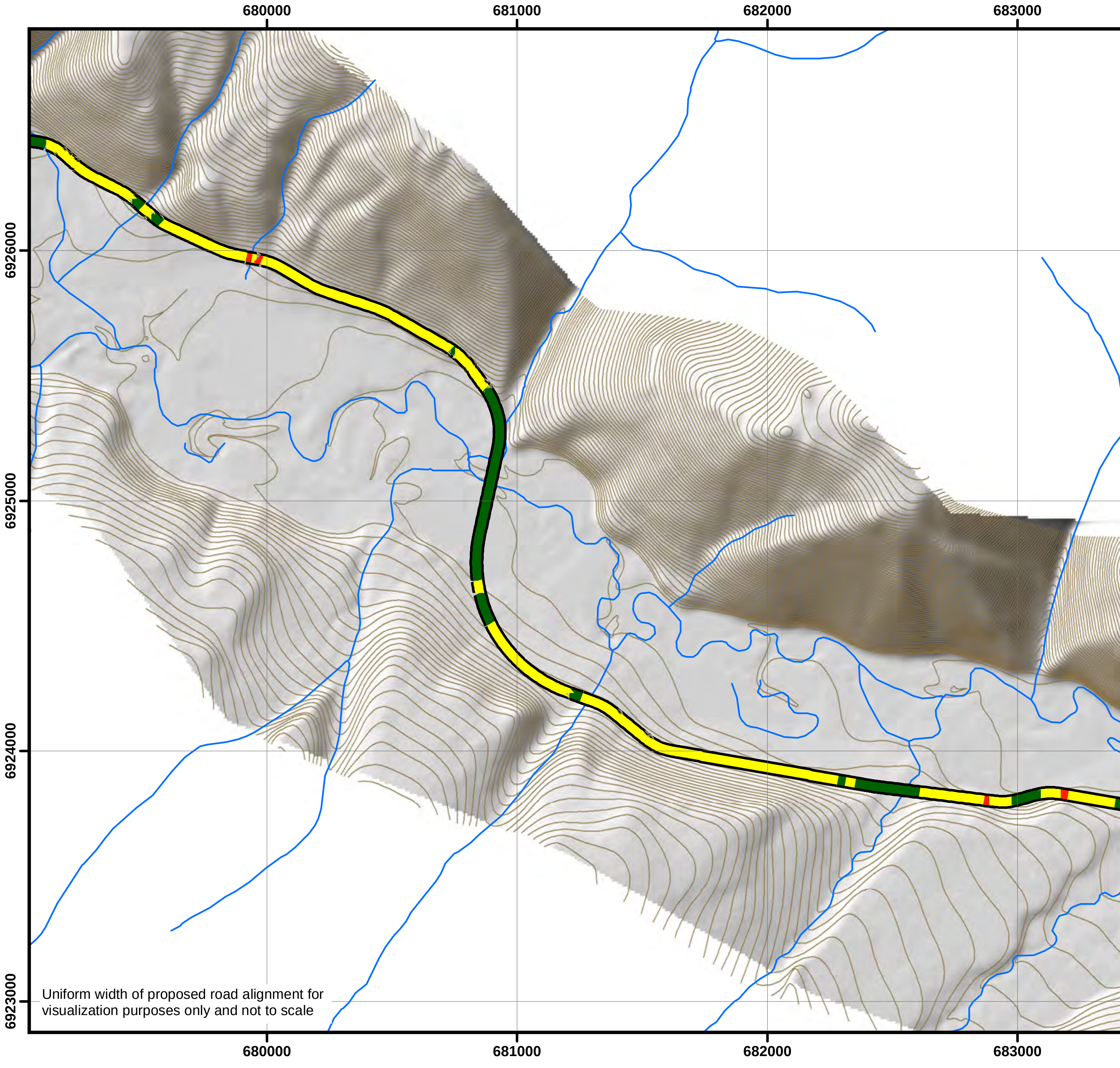
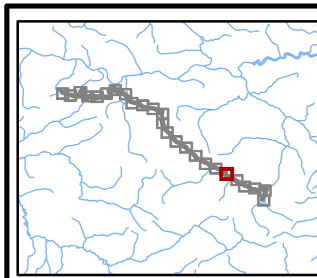
CONSULTING
GROUP INC.
Sheet 5 of 25





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Erosion Potential

High
Moderate
Low
Streams
Non-Permanent
Permanet Water
Contours (5m)

0 125 250 500 750 m
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Grid: UTM Zone 7N

Casino Mining Corporation

Freegold Road Extension

Map 1
Erosion Potential

CASINO COPPER AND GOLD

PALMER ENVIRONMENTAL CONSULTING GROUP INC.

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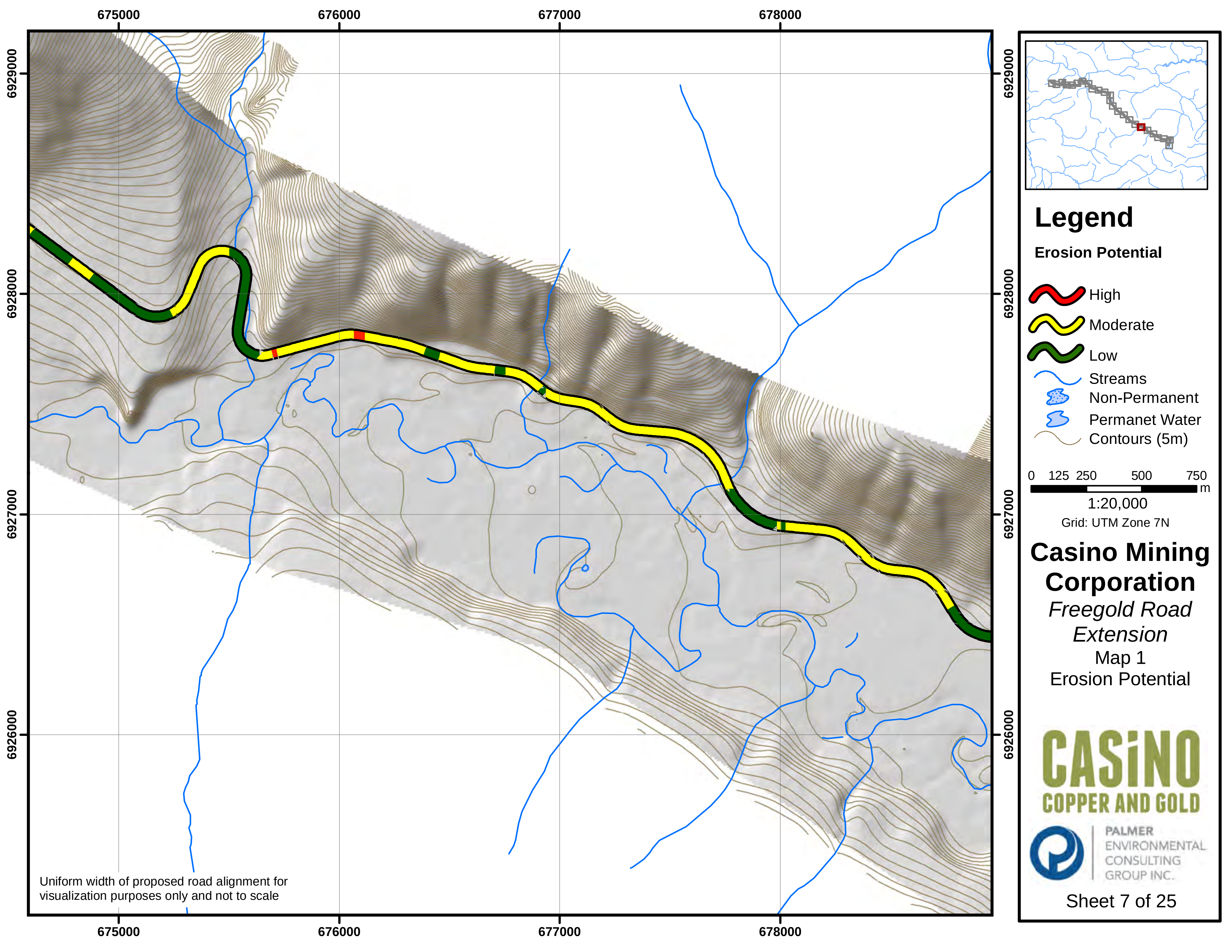
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Uniform width of proposed road alignment for
visualization purposes only and not to scale
Legend
Erosion Potential
High
Moderate
Low
Streams
Non-Permanent
Permanet Water
Contours (5m)
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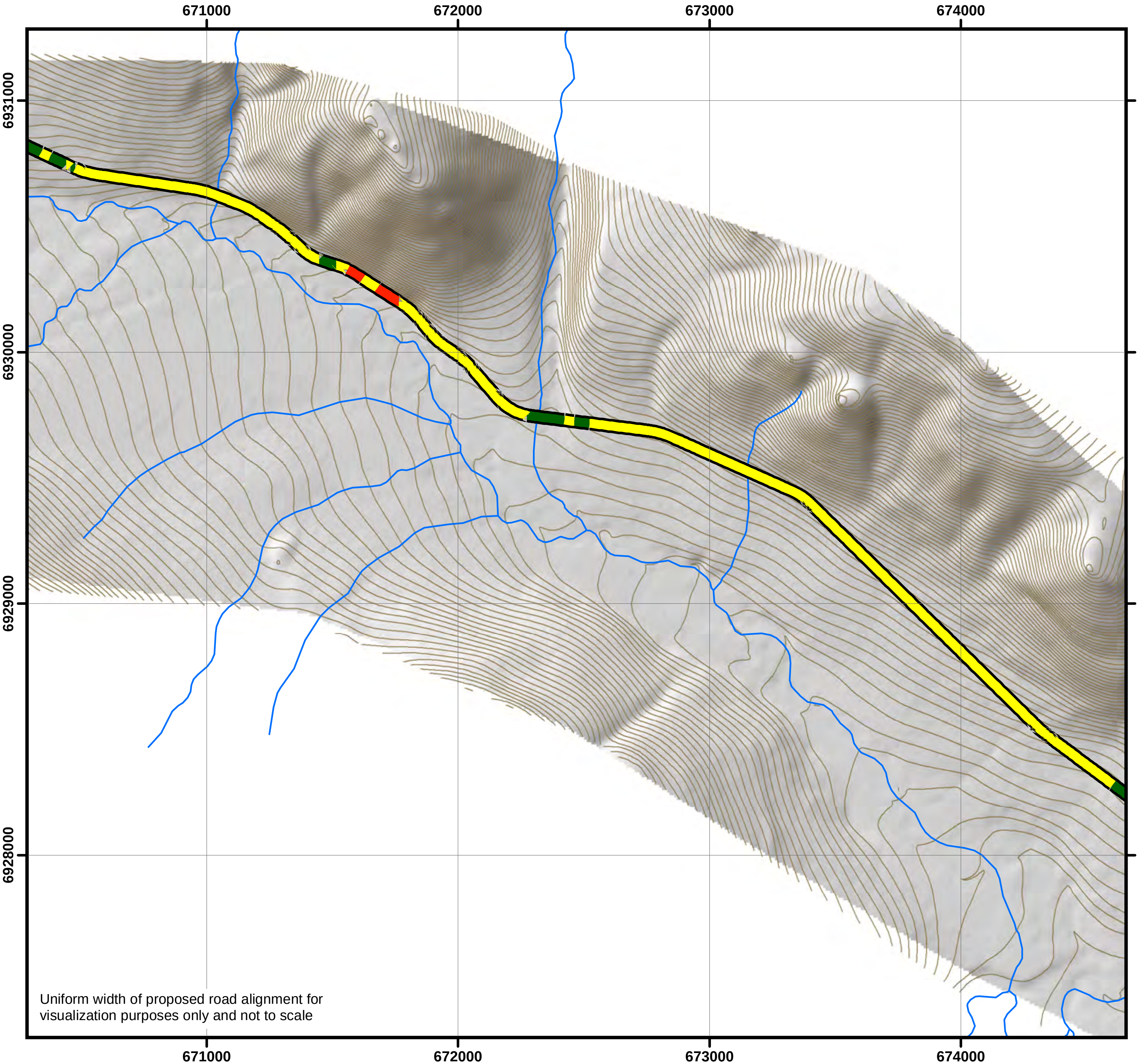
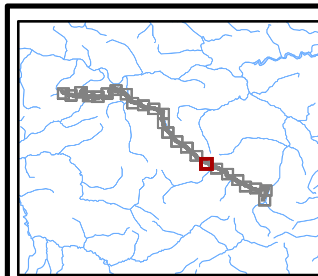
Grid: UTM Zone 7N
Casino Mining Corporation
Freegold Road Extension
Map 1
Erosion Potential
CASINO
COPPER AND GOLD
PALMER
ENVIRONMENTAL
CONSULTING
GROUP INC.
Sheet 7 of 25





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Erosion Potential

High
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Streams
Non-Permanent
Permanet Water
Contours (5m)

0 125 250 500 750 m

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Grid: UTM Zone 7N

Casino Mining Corporation

Freegold Road Extension

Map 1
Erosion Potential

CASINO
COPPER AND GOLD

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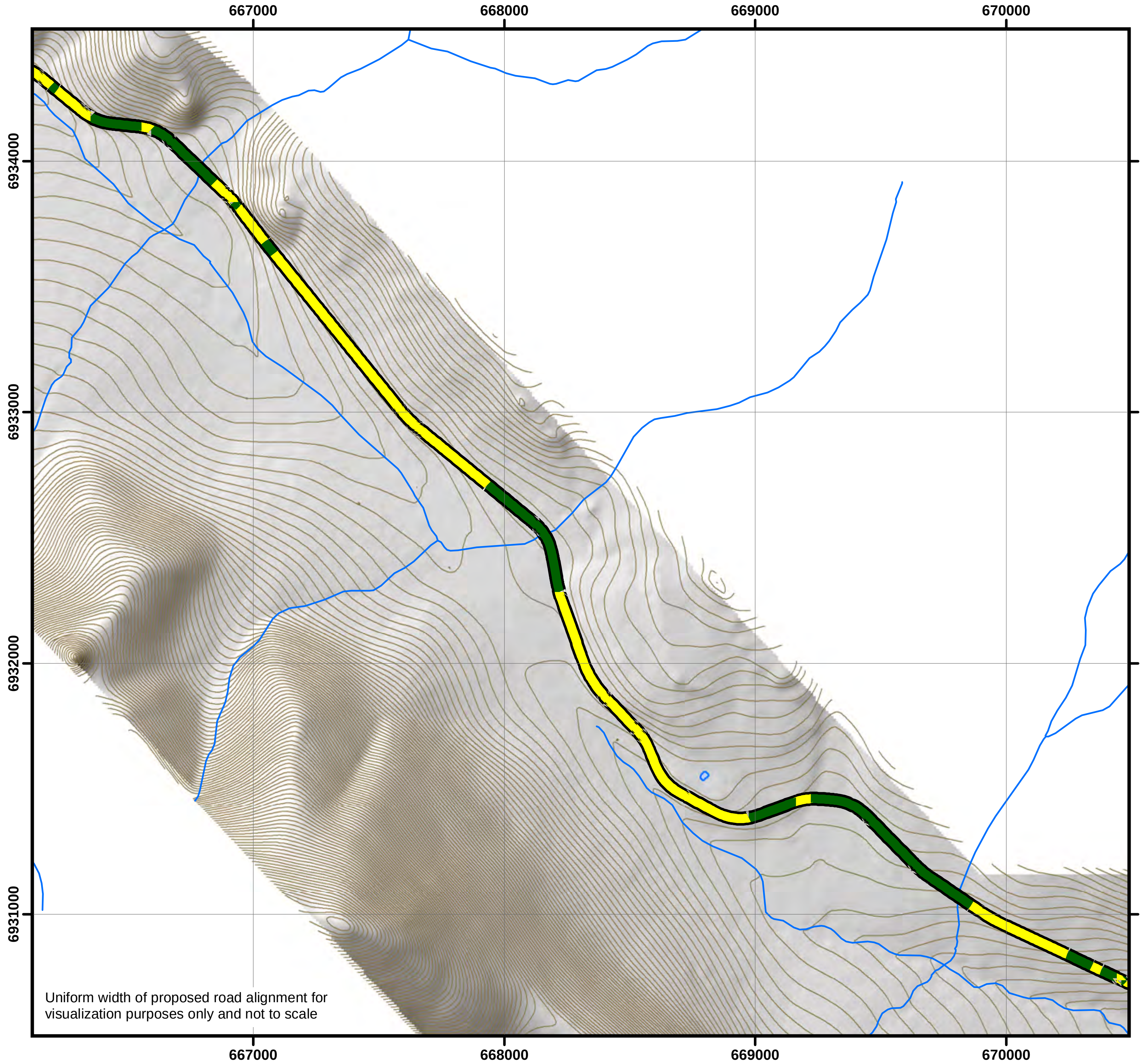
ENVIRONMENTAL
CONSULTING
GROUP INC.



Legend

Erosion Potential

High
Moderate
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Streams
Non-Permanent
Permanet Water
Contours (5m)

0 125 250 500 750 m

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Grid: UTM Zone 7N

Casino Mining Corporation

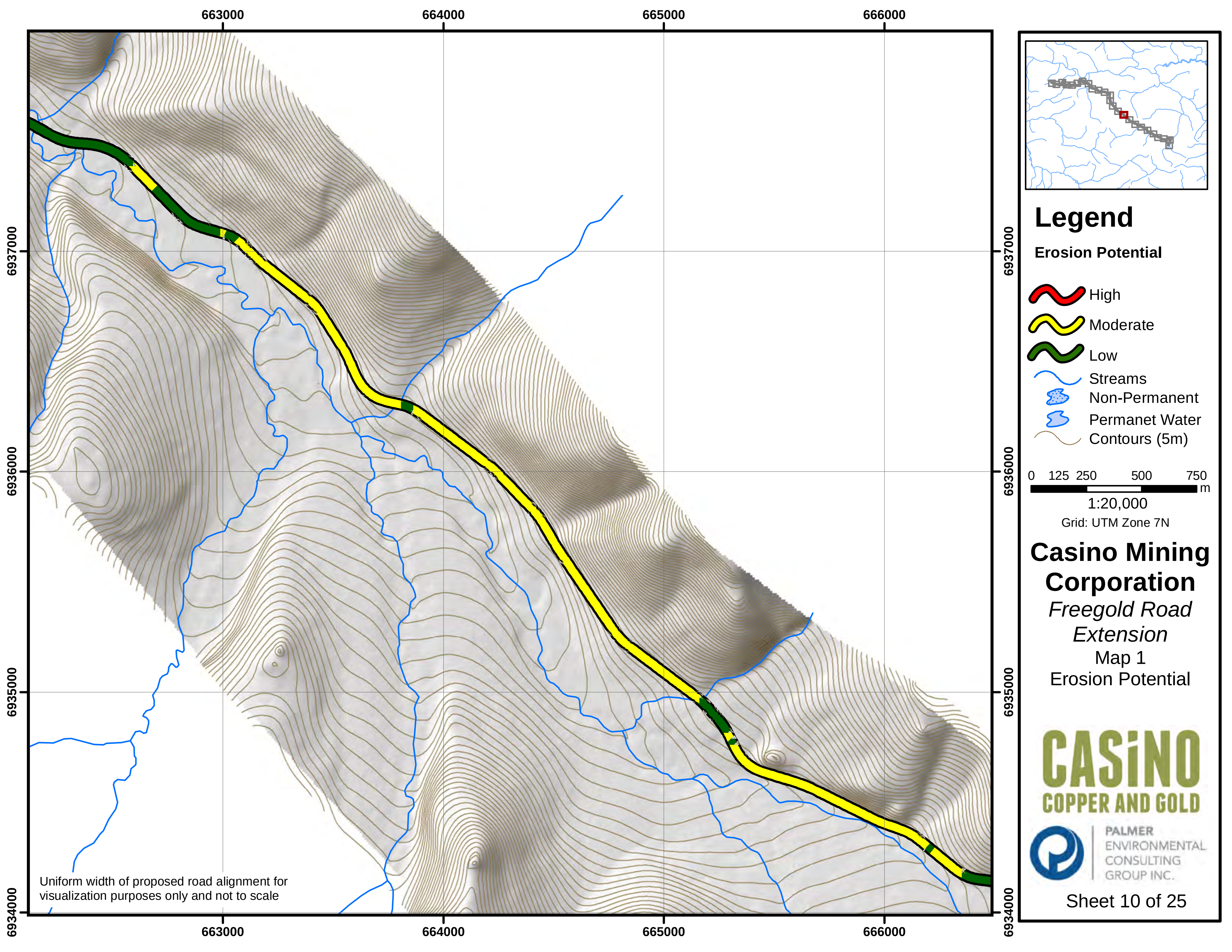
Freegold Road Extension

Map 1

Erosion Potential

CASINO COPPER AND GOLD

PALMER ENVIRONMENTAL CONSULTING GROUP INC.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Uniform width of proposed road alignment for visualization purposes only and not to scale
Legend
Erosion Potential
High
Moderate
Low
Streams
Non-Permanent
Permanet Water
Contours (5m)
0 125 250 500 750 m
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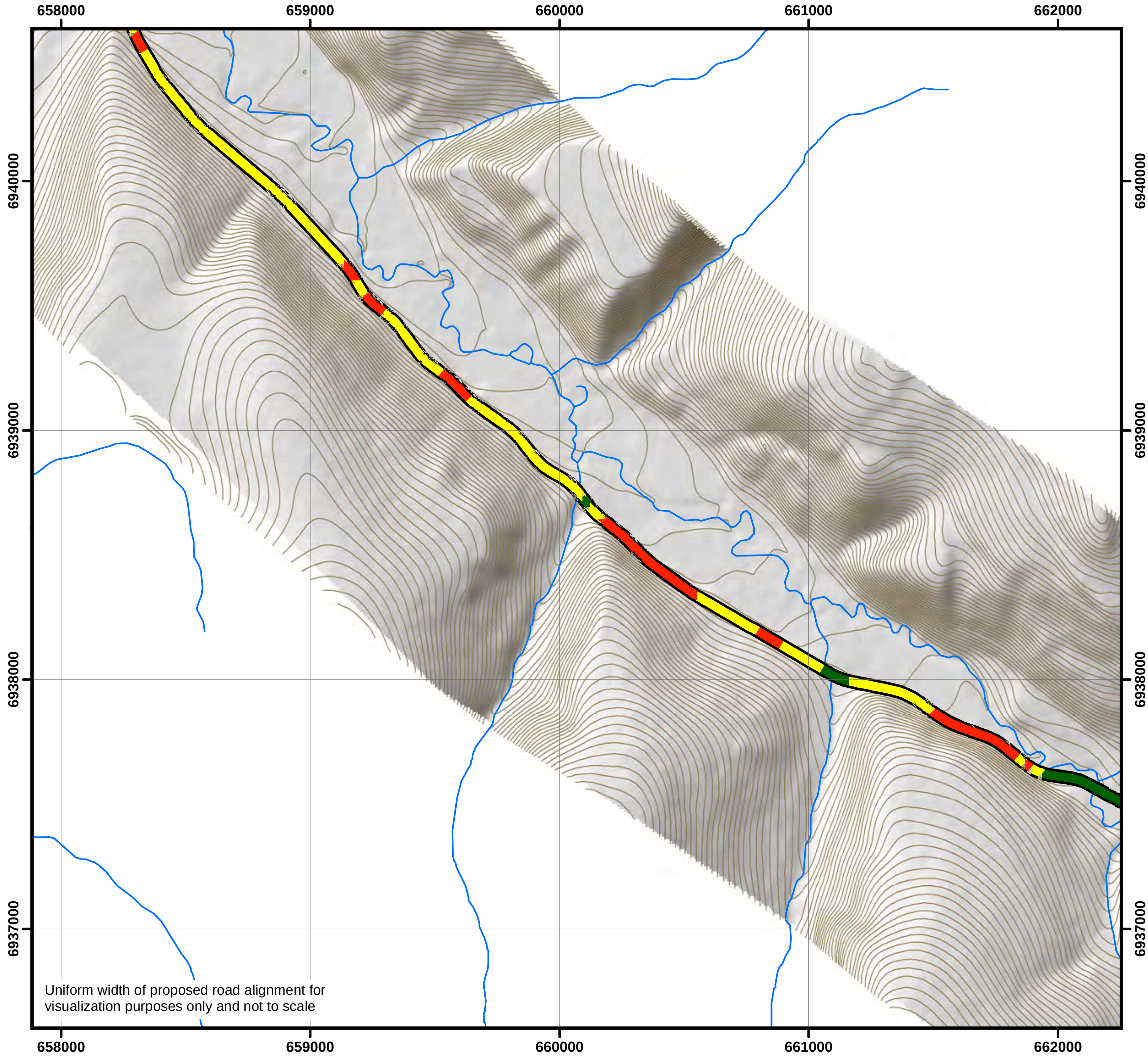
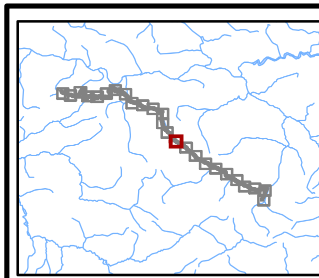
Grid: UTM Zone 7N
Casino Mining Corporation
Freegold Road Extension
Map 1
Erosion Potential
CASINO COPPER AND GOLD
PALMER ENVIRONMENTAL CONSULTING GROUP INC.
Sheet 10 of 25





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Erosion Potential

- High
- Moderate
- Low
- Streams
- Non-Permanent
- Permanet Water
- Contours (5m)

0 125 250 500 750 m

1:20,000

Grid: UTM Zone 7N

Casino Mining Corporation

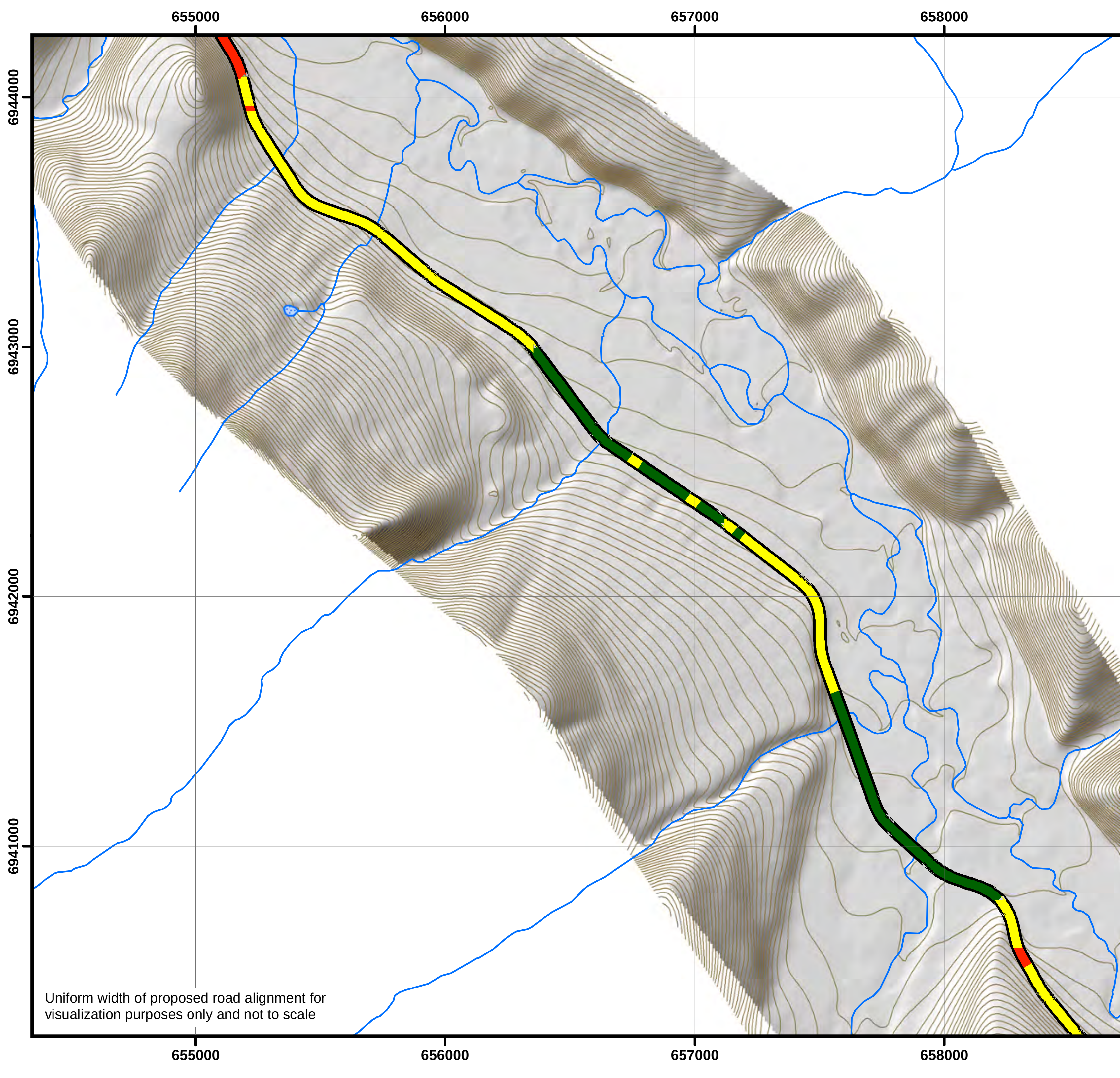
Freegold Road Extension

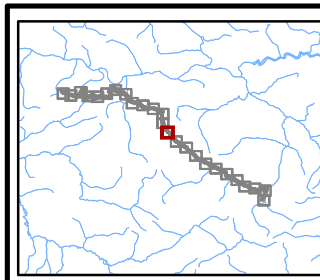
Map 1

Erosion Potential

CASINO COPPER AND GOLD

PALMER ENVIRONMENTAL CONSULTING GROUP INC.





Legend

Erosion Potential

- High
- Moderate
- Low
- Streams
- Non-Permanent
- Permanet Water
- Contours (5m)

0 125 250 500 750 m

1:20,000

Grid: UTM Zone 7N

Casino Mining Corporation

Freegold Road Extension

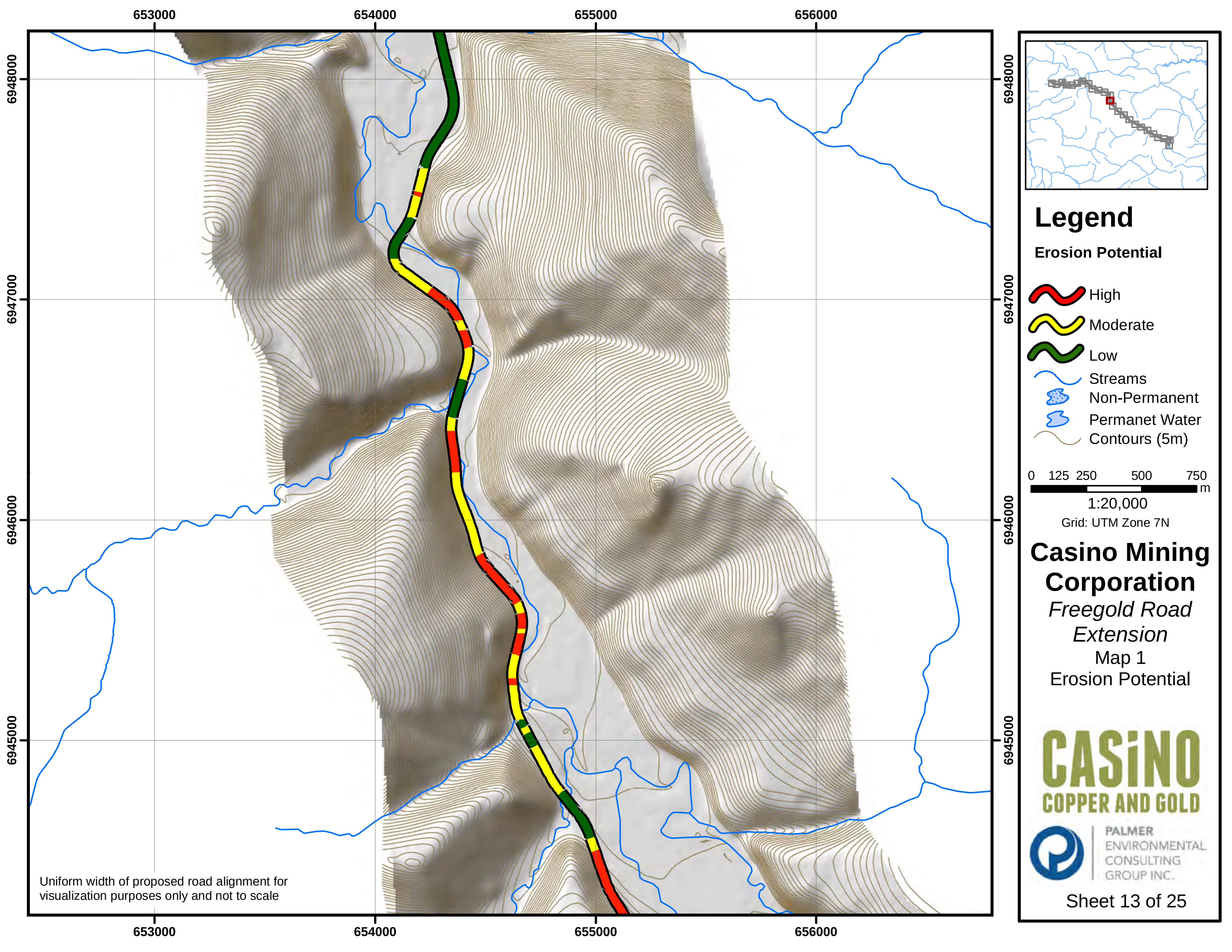
Map 1

Erosion Potential

CASINO COPPER AND GOLD

PALMER ENVIRONMENTAL CONSULTING GROUP INC.

Sheet 12 of 25



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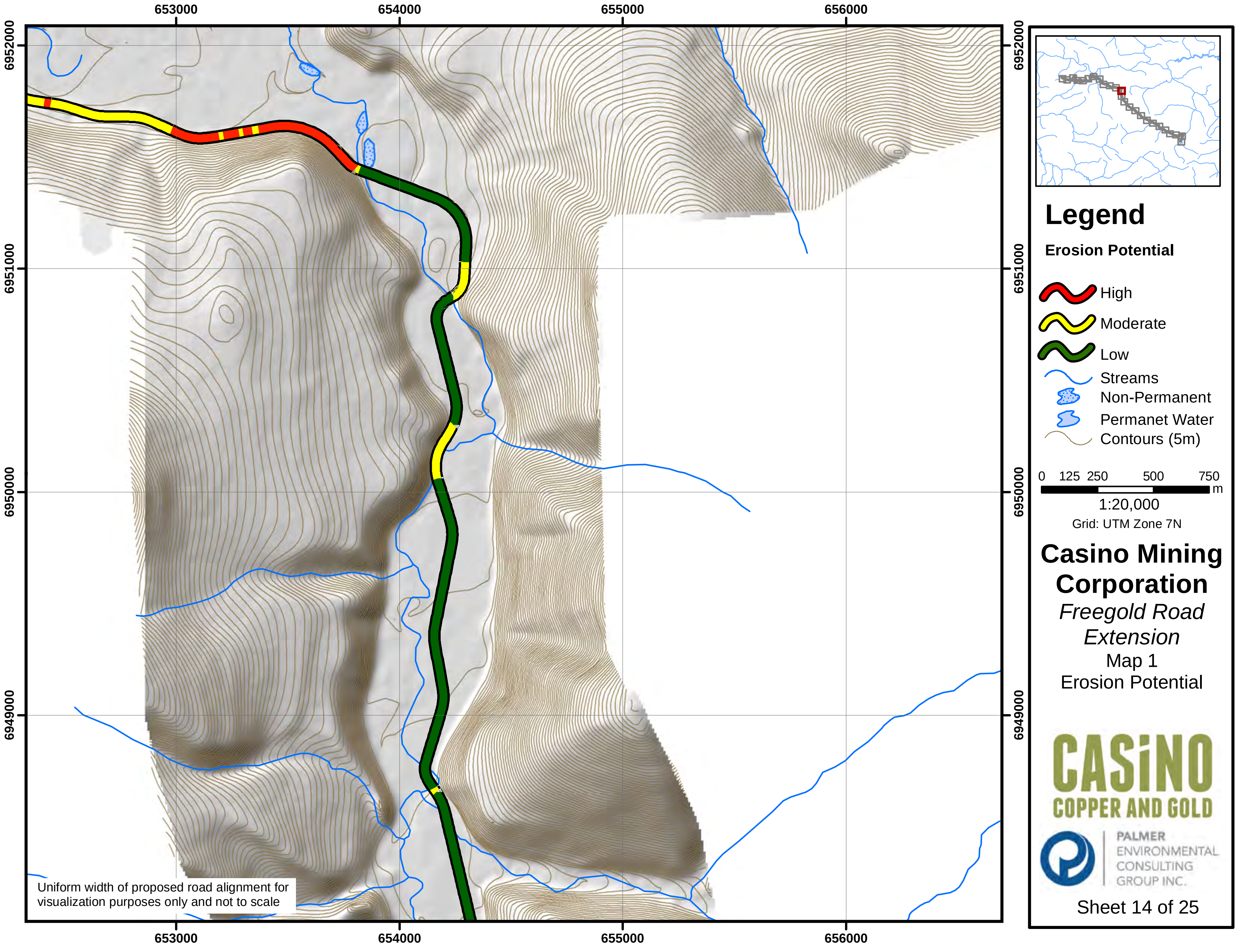
Legend
Erosion Potential
High
Moderate
Low
Streams
Non-Permanent
Permanet Water
Contours (5m)
0 125 250 500 750 m
1:20,000
Grid: UTM Zone 7N
Casino Mining Corporation
Freegold Road Extension
Map 1
Erosion Potential
CASINO COPPER AND GOLD
PALMER ENVIRONMENTAL CONSULTING GROUP INC.
Sheet 13 of 25
Uniform width of proposed road alignment for visualization purposes only and not to scale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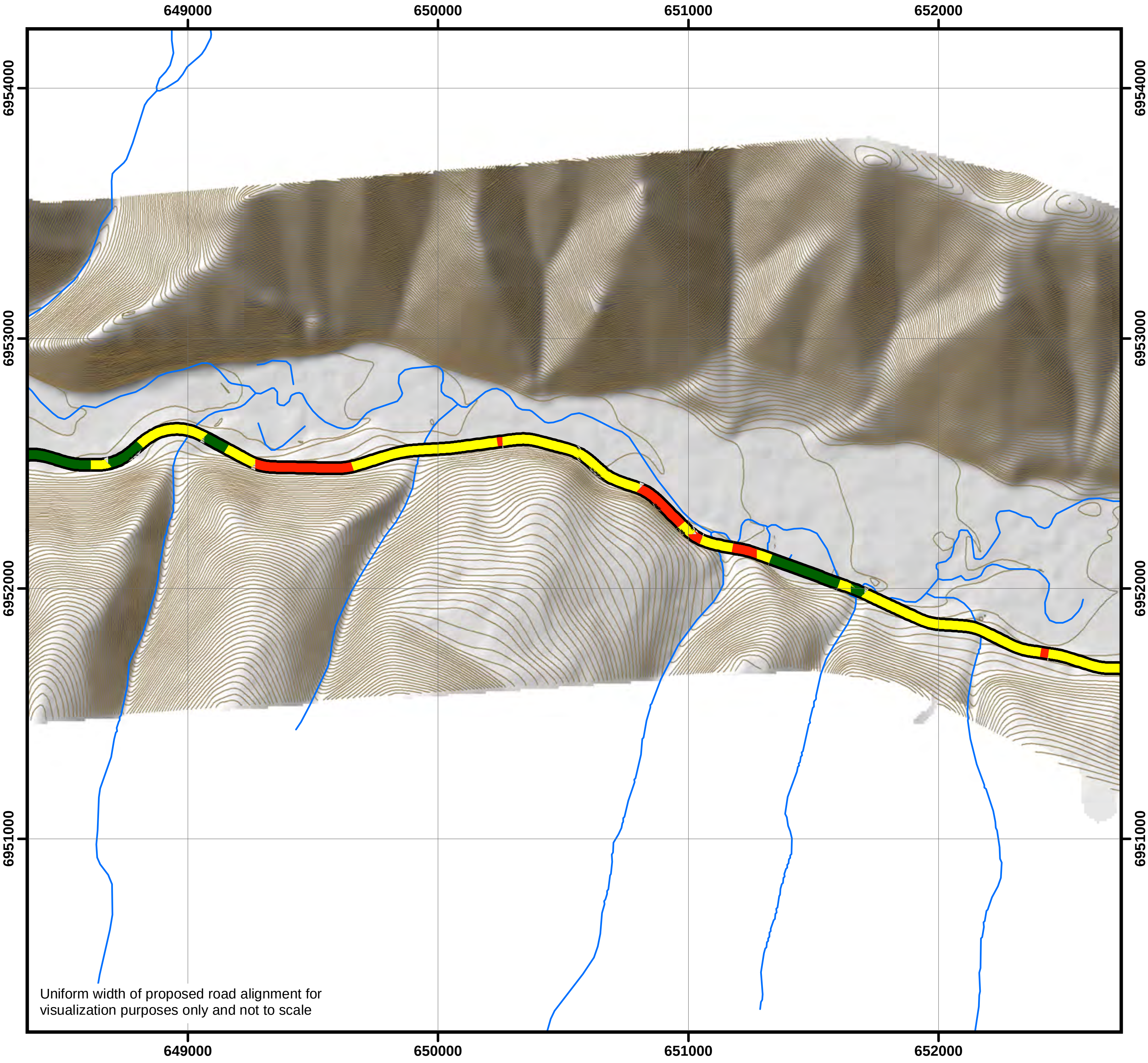
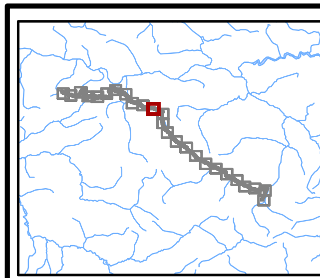
Uniform width of proposed road alignment for visualization purposes only and not to scale
Legend
Erosion Potential
High
Moderate
Low
Streams
Non-Permanent
Permanent Water
Contours (5m)
0 125 250 500 750
m
1:20,000
Grid: UTM Zone 7N
Casino Mining Corporation
Freegold Road Extension
Map 1
Erosion Potential
CASINO
COPPER AND GOLD
PALMER
ENVIRONMENTAL
CONSULTING
GROUP INC.
Sheet 14 of 25





Legend

Erosion Potential

High
Moderate
Low
Streams
Non-Permanent
Permanent Water
Contours (5m)

0 125 250 500 750 m

1:20,000

Grid: UTM Zone 7N

Casino Mining Corporation

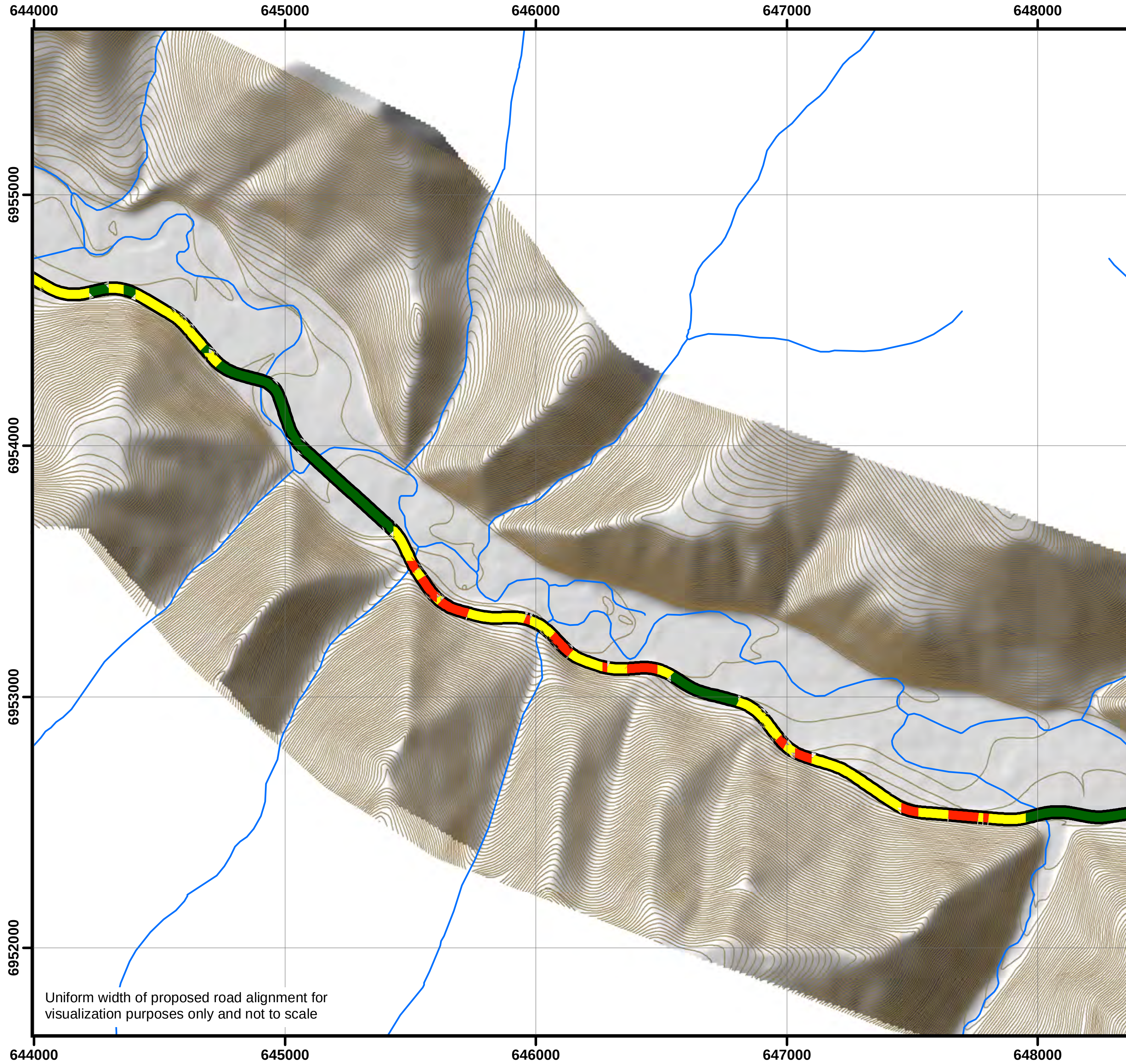
Freegold Road Extension

Map 1

Erosion Potential

CASINO COPPER AND GOLD

PALMER ENVIRONMENTAL CONSULTING GROUP INC.



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Erosion Potential

High
Moderate
Low
Streams
Non-Permanent
Permanet Water
Contours (5m)

0 125 250 500 750 m

1:20,000

Grid: UTM Zone 7N

Casino Mining Corporation

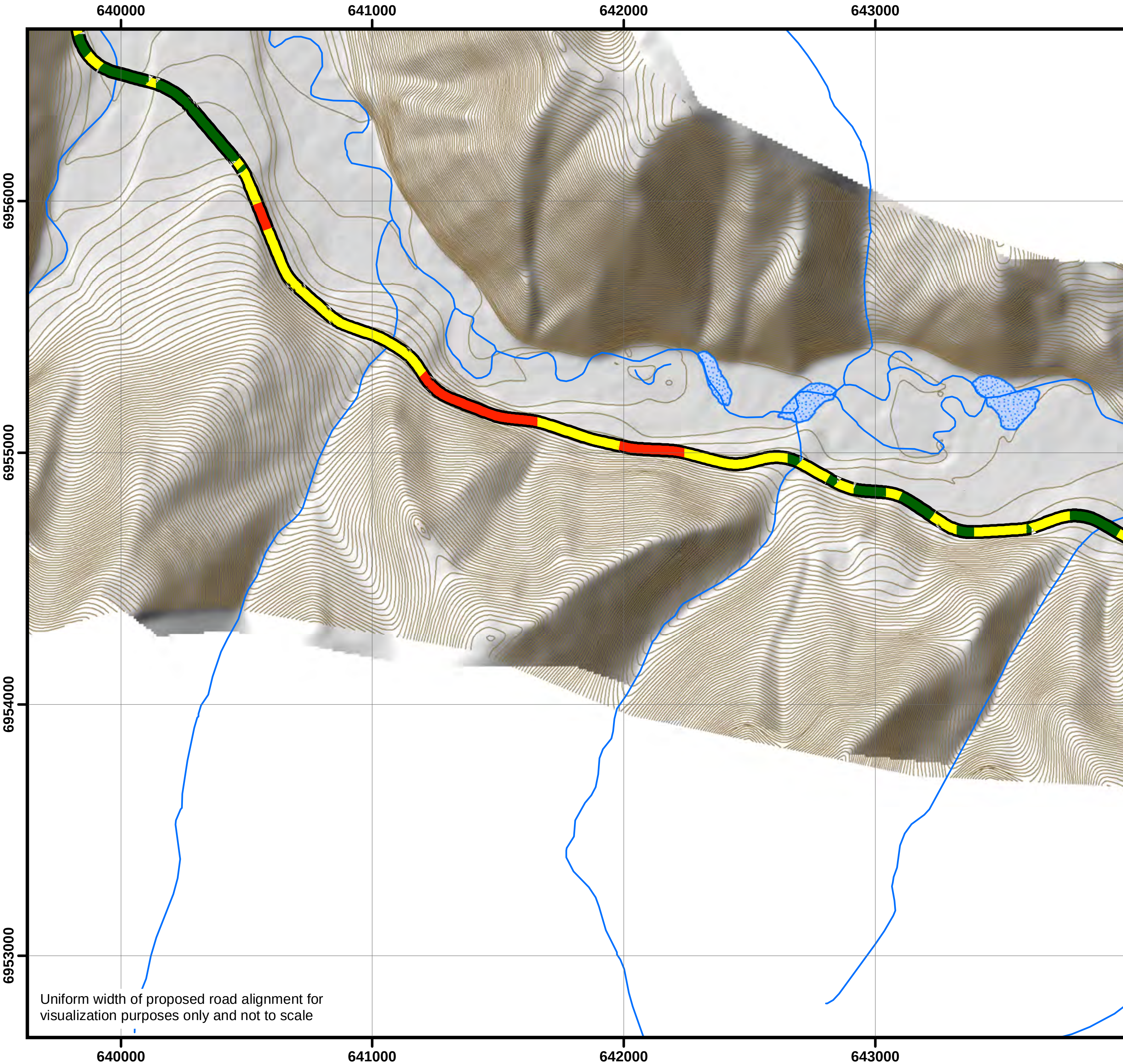
Freegold Road Extension

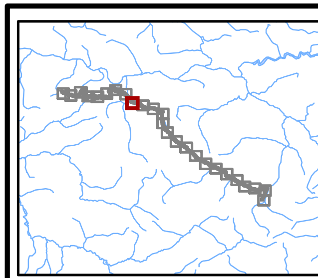
Map 1

Erosion Potential

CASINO COPPER AND GOLD

PALMER ENVIRONMENTAL CONSULTING GROUP INC.





Legend

Erosion Potential

- High
- Moderate
- Low
- Streams
- Non-Permanent
- Permanet Water
- Contours (5m)

0 125 250 500 750 m

1:20,000

Grid: UTM Zone 7N

Casino Mining Corporation

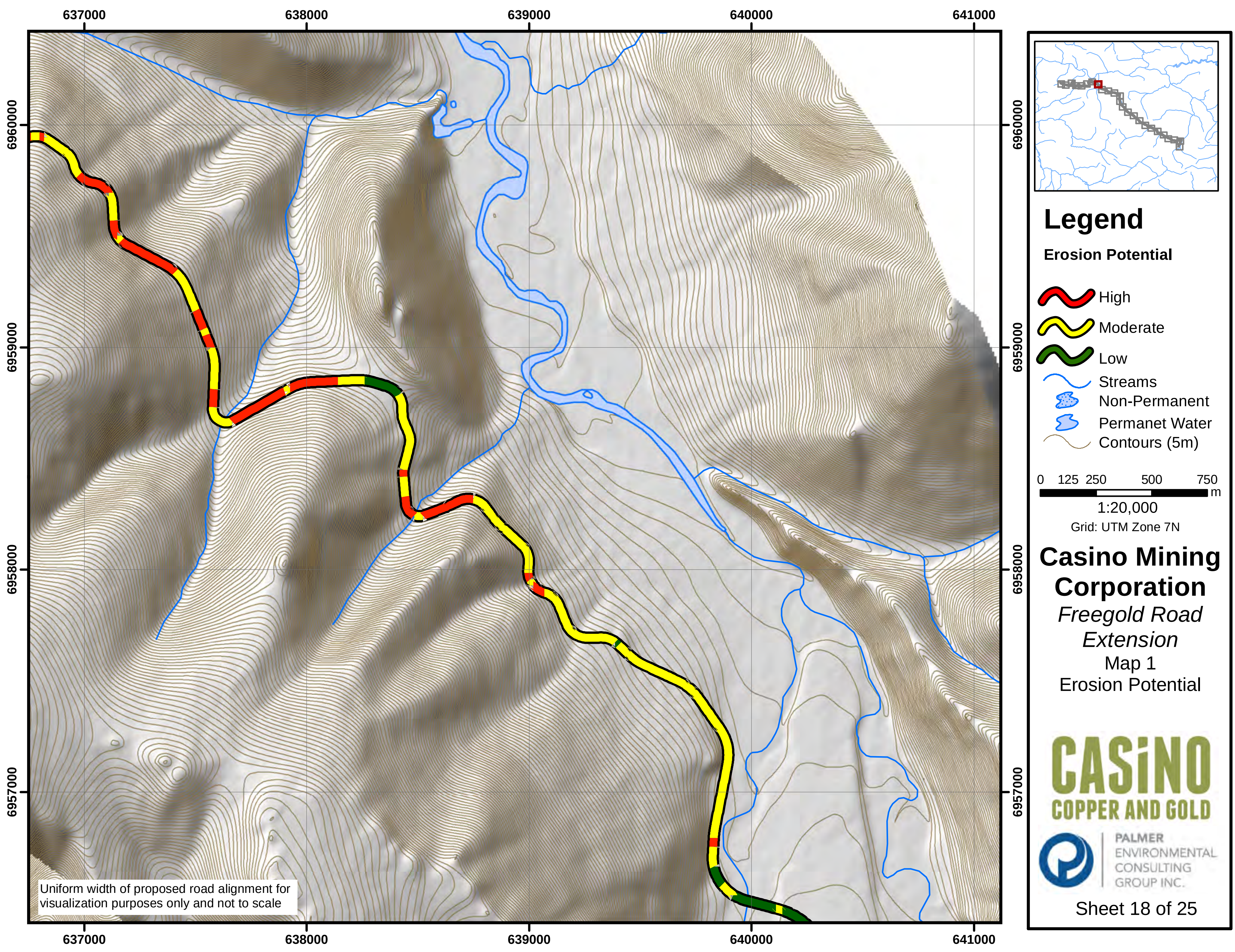
Freegold Road Extension

Map 1

Erosion Potential

CASINO COPPER AND GOLD

PALMER ENVIRONMENTAL CONSULTING GROUP INC.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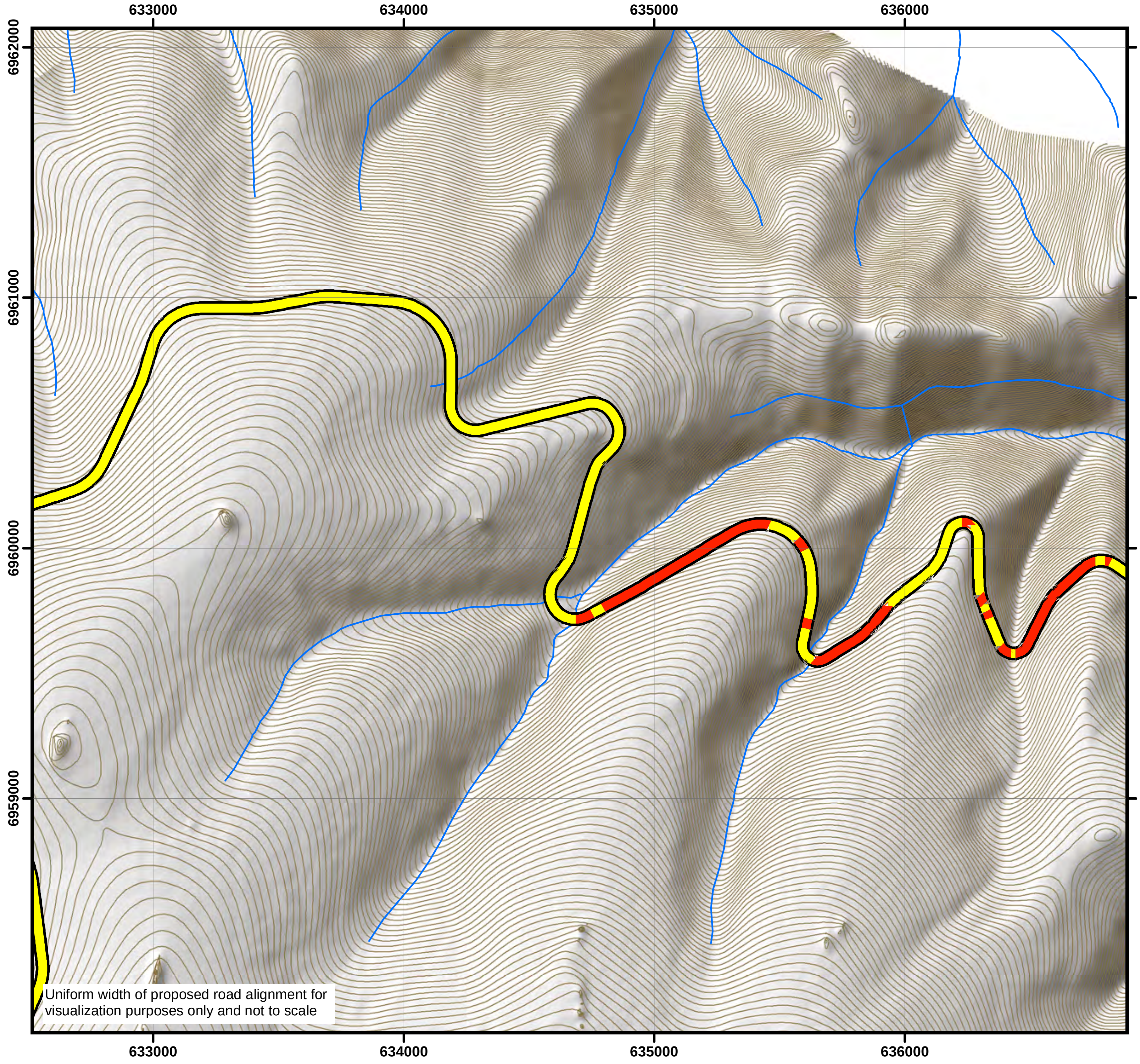
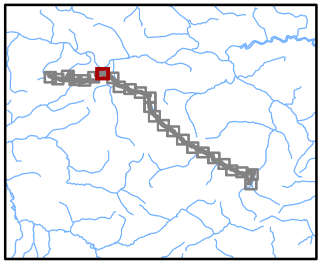
Uniform width of proposed road alignment for visualization purposes only and not to scale
Legend
Erosion Potential
High
Moderate
Low
Streams
Non-Permanent
Permanet Water
Contours (5m)
0 125 250 500 750
m
1:20,000
Grid: UTM Zone 7N
Casino Mining Corporation
Freegold Road Extension
Map 1
Erosion Potential
CASINO
COPPER AND GOLD
PALMER
ENVIRONMENTAL
CONSULTING
GROUP INC.
Sheet 18 of 25





Legend

Erosion Potential

High
Moderate
Low
Streams
Non-Permanent
Permanet Water
Contours (5m)

0 125 250 500 750 m

1:20,000

Grid: UTM Zone 7N

Casino Mining Corporation

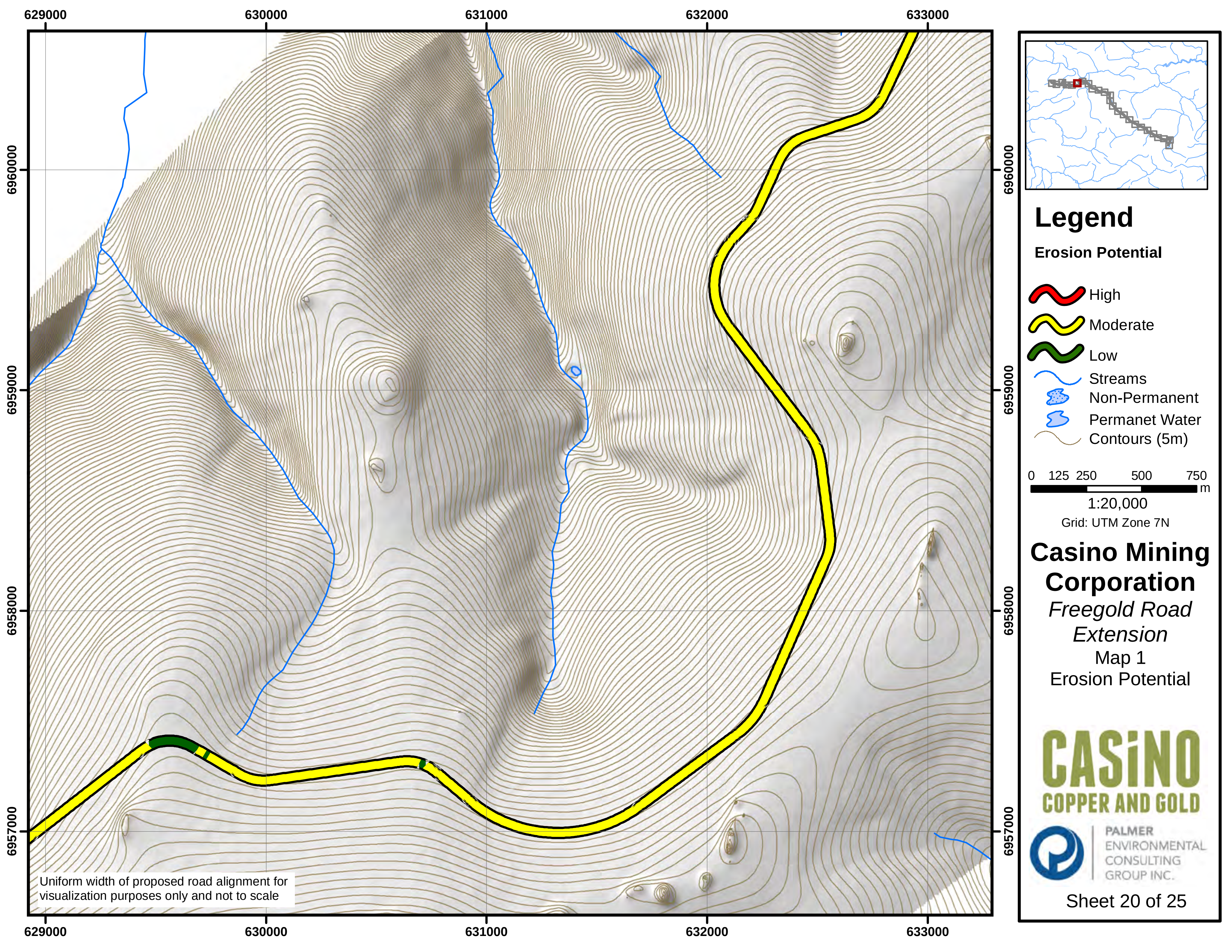
Freegold Road Extension

Map 1

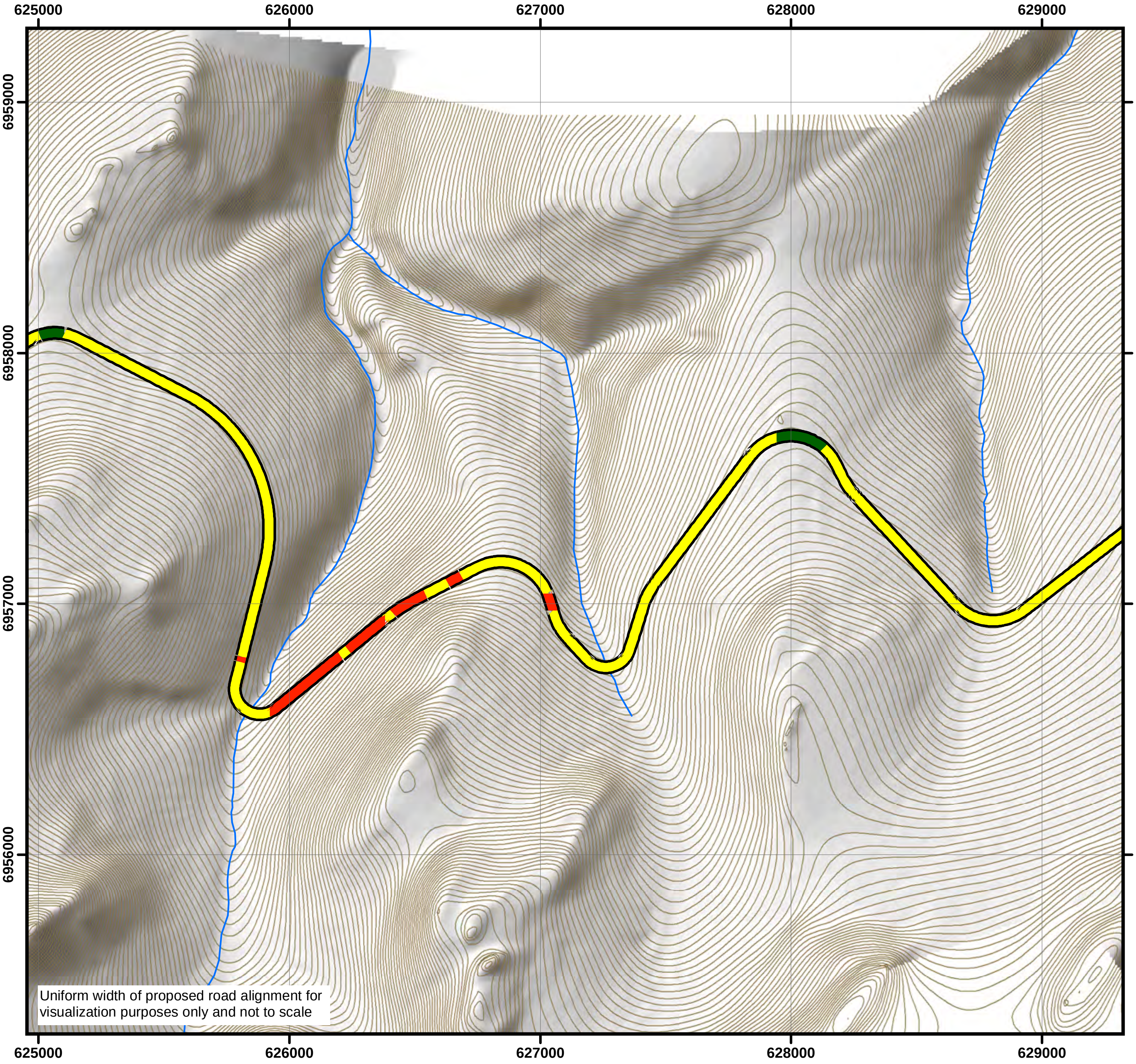
Erosion Potential

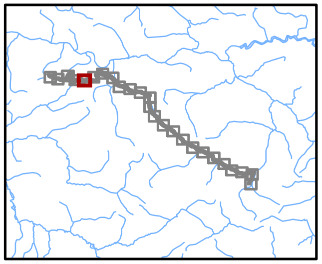
CASINO COPPER AND GOLD

PALMER ENVIRONMENTAL CONSULTING GROUP INC.



629000
630000
631000
632000
633000
6960000
6959000
6958000
6957000
Uniform width of proposed road alignment for visualization purposes only and not to scale
Legend
Erosion Potential
High
Moderate
Low
Streams
Non-Permanent
Permanet Water
Contours (5m)
0 125 250 500 750
m
1:20,000
Grid: UTM Zone 7N
Casino Mining Corporation
Freegold Road Extension
Map 1
Erosion Potential
CASINO
COPPER AND GOLD
PALMER
ENVIRONMENTAL
CONSULTING
GROUP INC.
Sheet 20 of 25





Legend

Erosion Potential

High
Moderate
Low
Streams
Non-Permanent
Permanet Water
Contours (5m)

0 125 250 500 750 m

1:20,000

Grid: UTM Zone 7N

Casino Mining Corporation

Freegold Road Extension

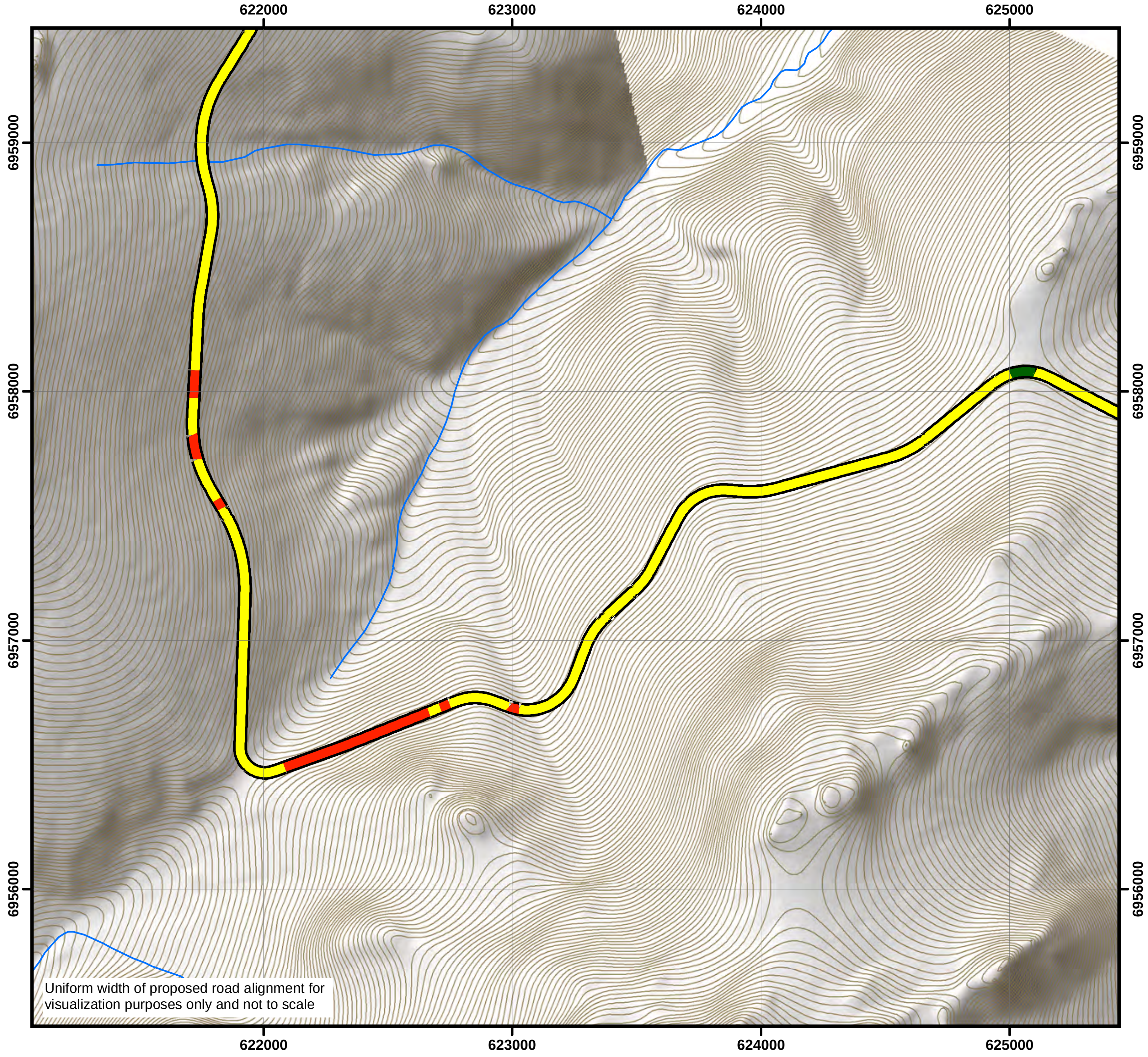
Map 1

Erosion Potential

CASINO COPPER AND GOLD

PALMER ENVIRONMENTAL CONSULTING GROUP INC.

Sheet 21 of 25



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Erosion Potential

High

Moderate

Low

Streams

Non-Permanent

Permanet Water

Contours (5m)

0 125 250 500 750 m

1:20,000

Grid: UTM Zone 7N

Casino Mining Corporation

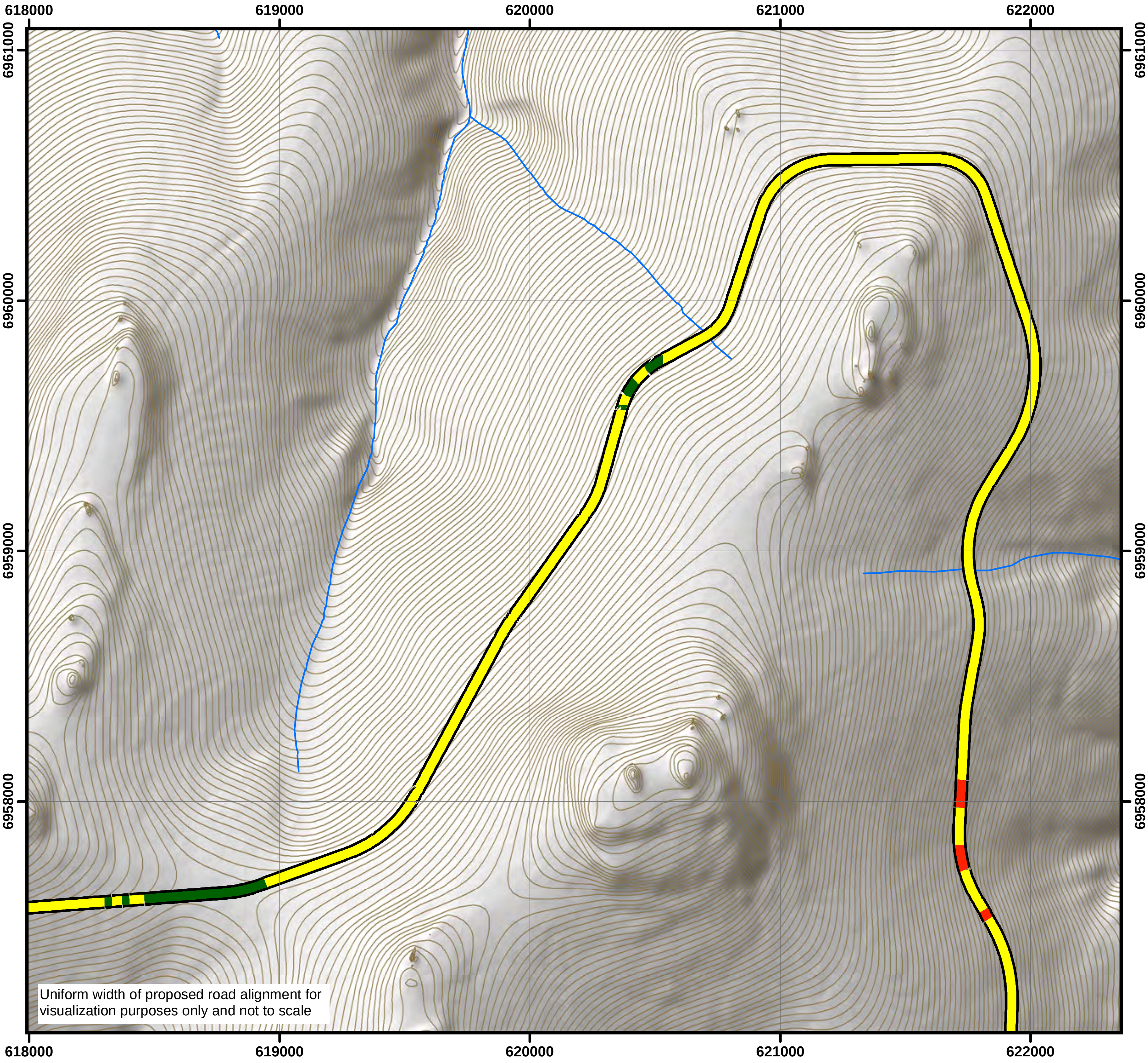
Freegold Road Extension

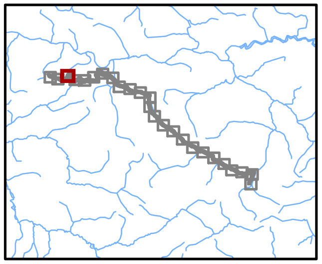
Map 1

Erosion Potential

CASINO COPPER AND GOLD

PALMER ENVIRONMENTAL CONSULTING GROUP INC.





Legend

Erosion Potential

- High
- Moderate
- Low
- Streams
- Non-Permanent
- Permanet Water
- Contours (5m)

0 125 250 500 750 m

1:20,000

Grid: UTM Zone 7N

Casino Mining Corporation

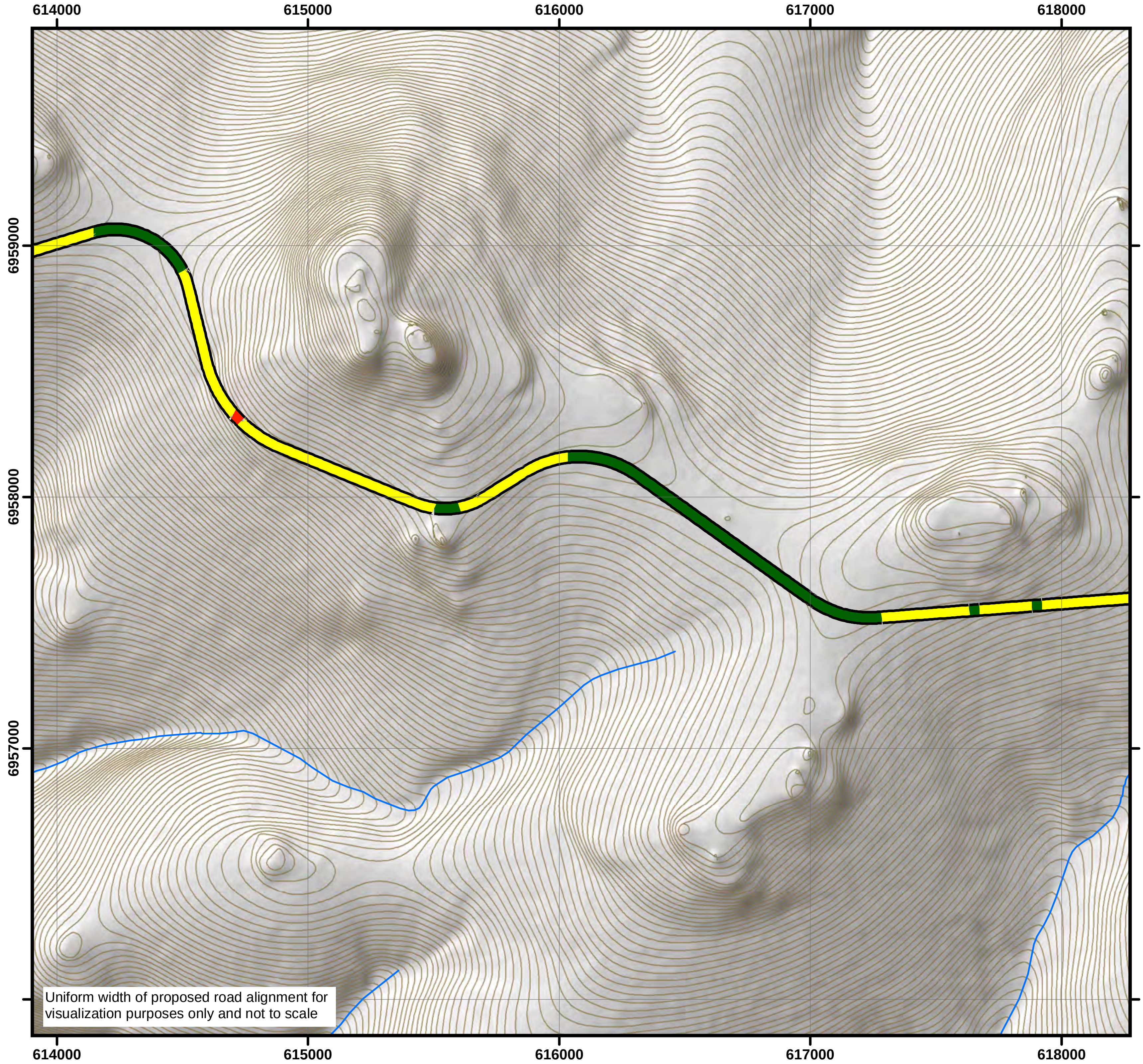
Freegold Road Extension

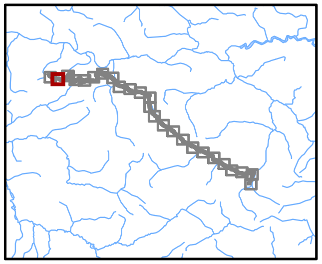
Map 1

Erosion Potential

CASINO COPPER AND GOLD

PALMER ENVIRONMENTAL CONSULTING GROUP INC.





Legend

Erosion Potential

- High
- Moderate
- Low
- Streams
- Non-Permanent
- Permanet Water
- Contours (5m)

0 125 250 500 750 m

1:20,000

Grid: UTM Zone 7N

Casino Mining Corporation

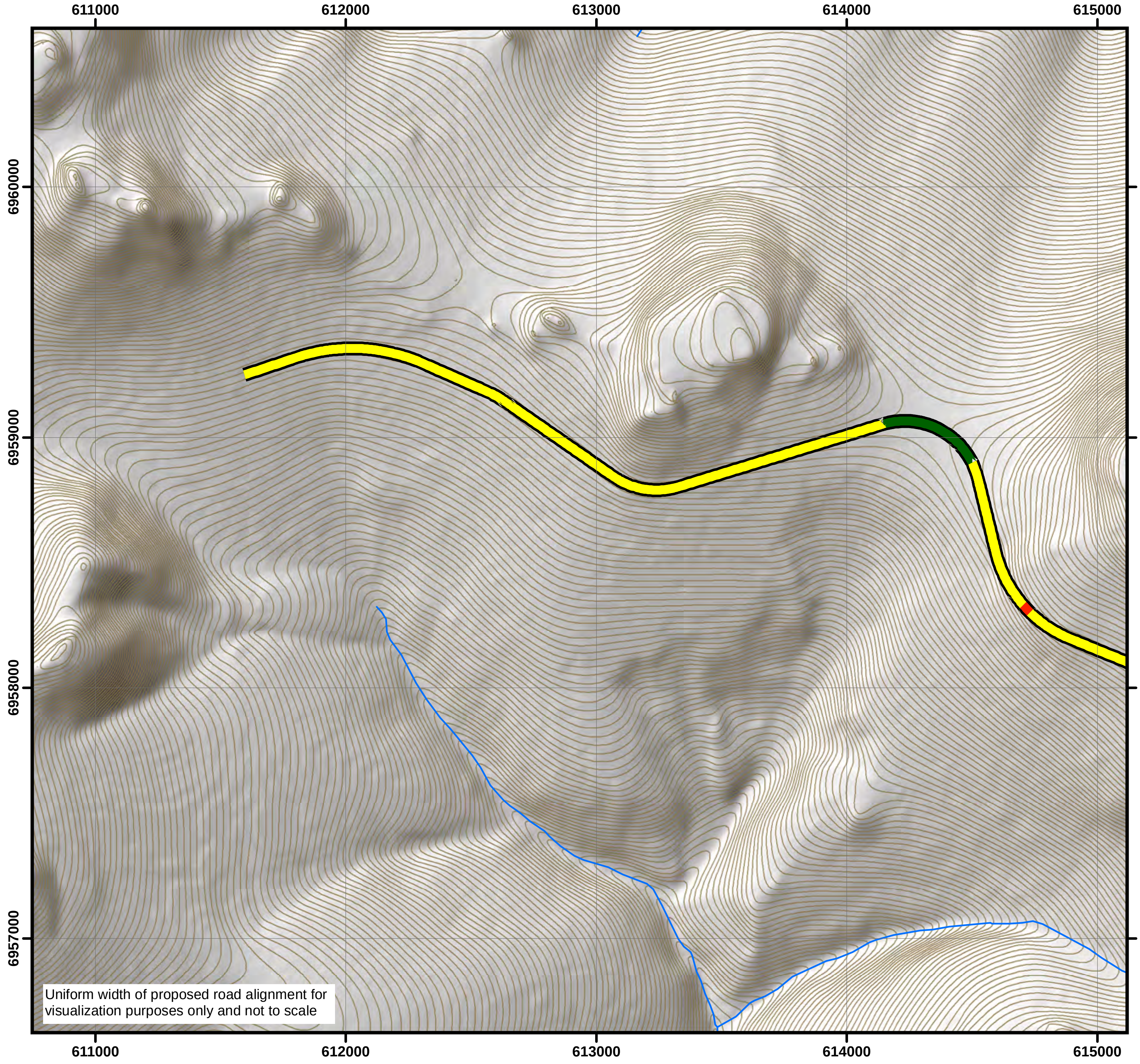
Freegold Road Extension

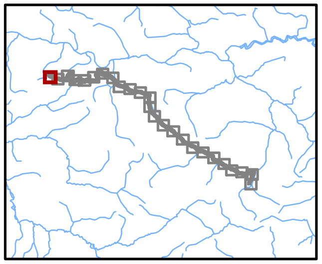
Map 1

Erosion Potential

CASINO COPPER AND GOLD

PALMER ENVIRONMENTAL CONSULTING GROUP INC.





Legend

Erosion Potential

High
Moderate
Low
Streams
Non-Permanent
Permanet Water
Contours (5m)

0 125 250 500 750 m

1:20,000

Grid: UTM Zone 7N

Casino Mining Corporation

Freegold Road Extension

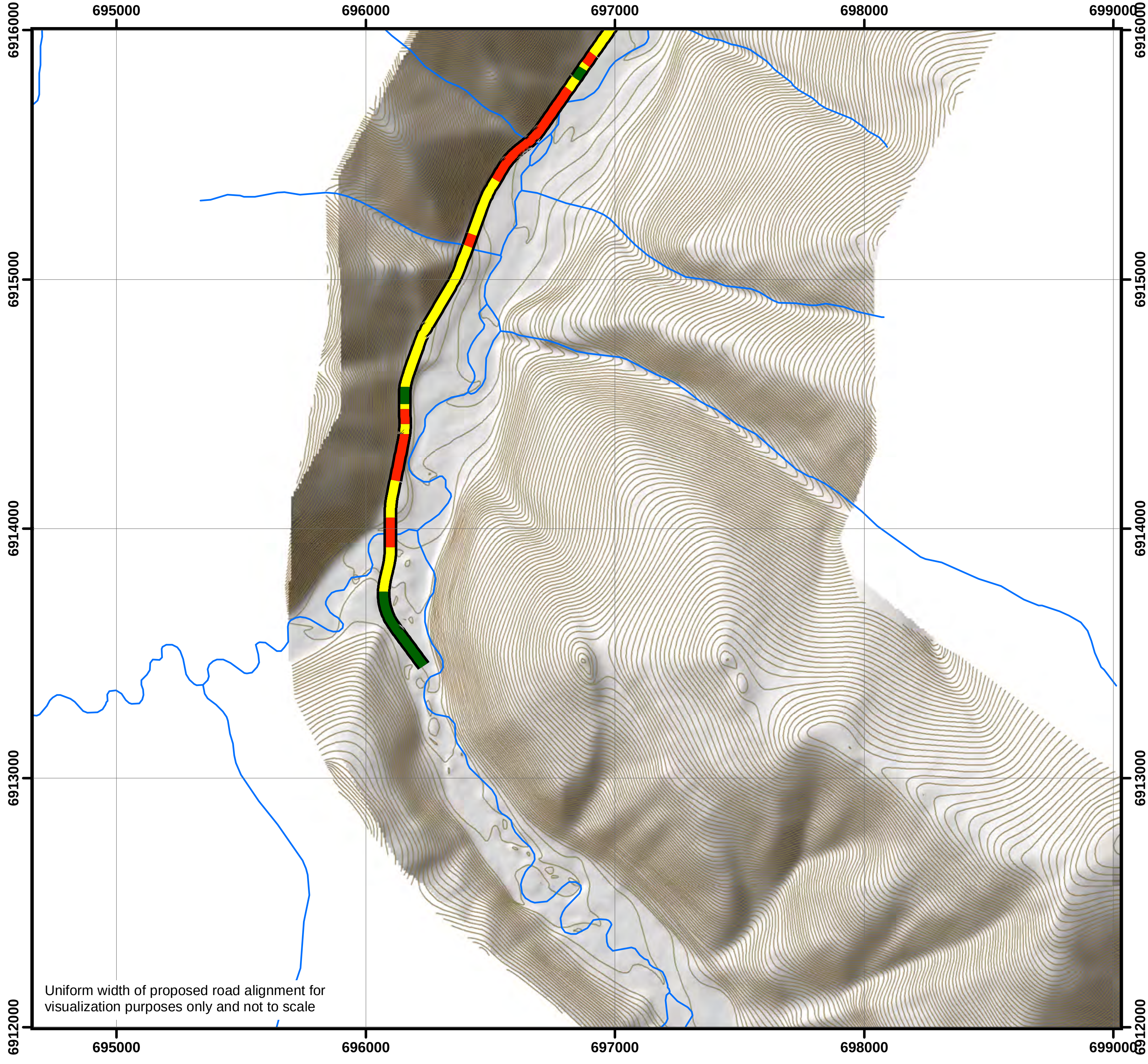
Map 1
Erosion Potential

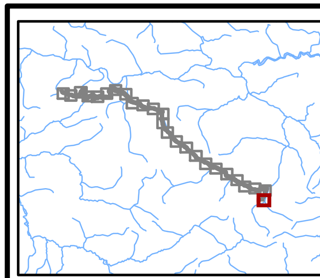
CASINO COPPER AND GOLD

PALMER ENVIRONMENTAL CONSULTING GROUP INC.

Appendix B

Map Series 2 – Potential Ecological Consequences





Legend

Potential Ecological Consequence

- High
- Moderate
- Low
- Streams
- Non-Permanent
- Permanet Water
- Contours (5m)

0 125 250 500 750 m

1:20,000

Grid: UTM Zone 7N

Casino Mining Corporation

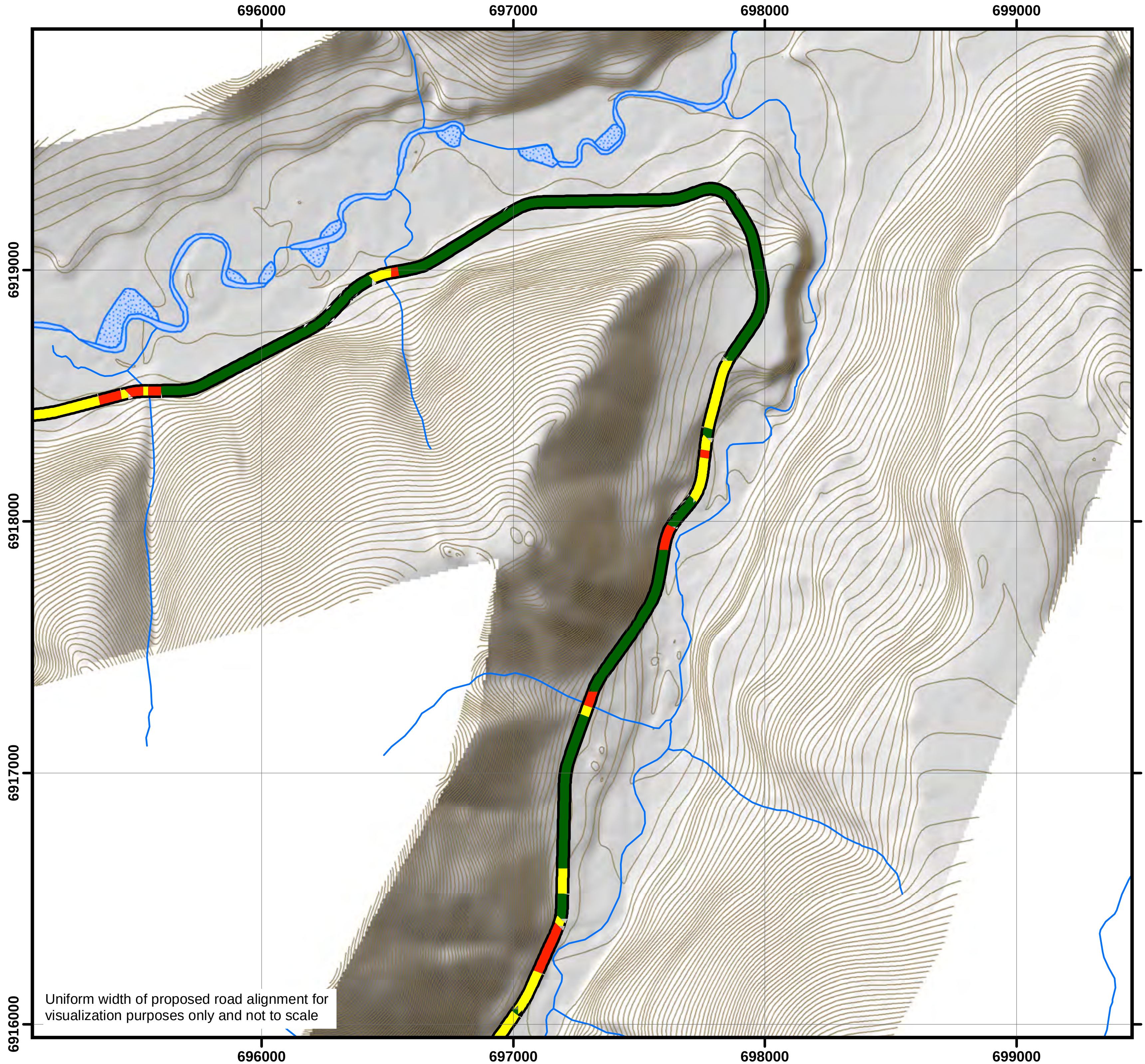
Freegold Road Extension

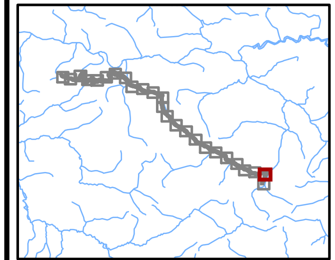
Map 2

Potential Ecological Consequence

CASINO COPPER AND GOLD

PALMER ENVIRONMENTAL CONSULTING GROUP INC.





Legend

Potential Ecological Consequence

High
Moderate
Low
Streams
Non-Permanent
Permanet Water
Contours (5m)

0 125 250 500 750 m

1:20,000

Grid: UTM Zone 7N

Casino Mining Corporation

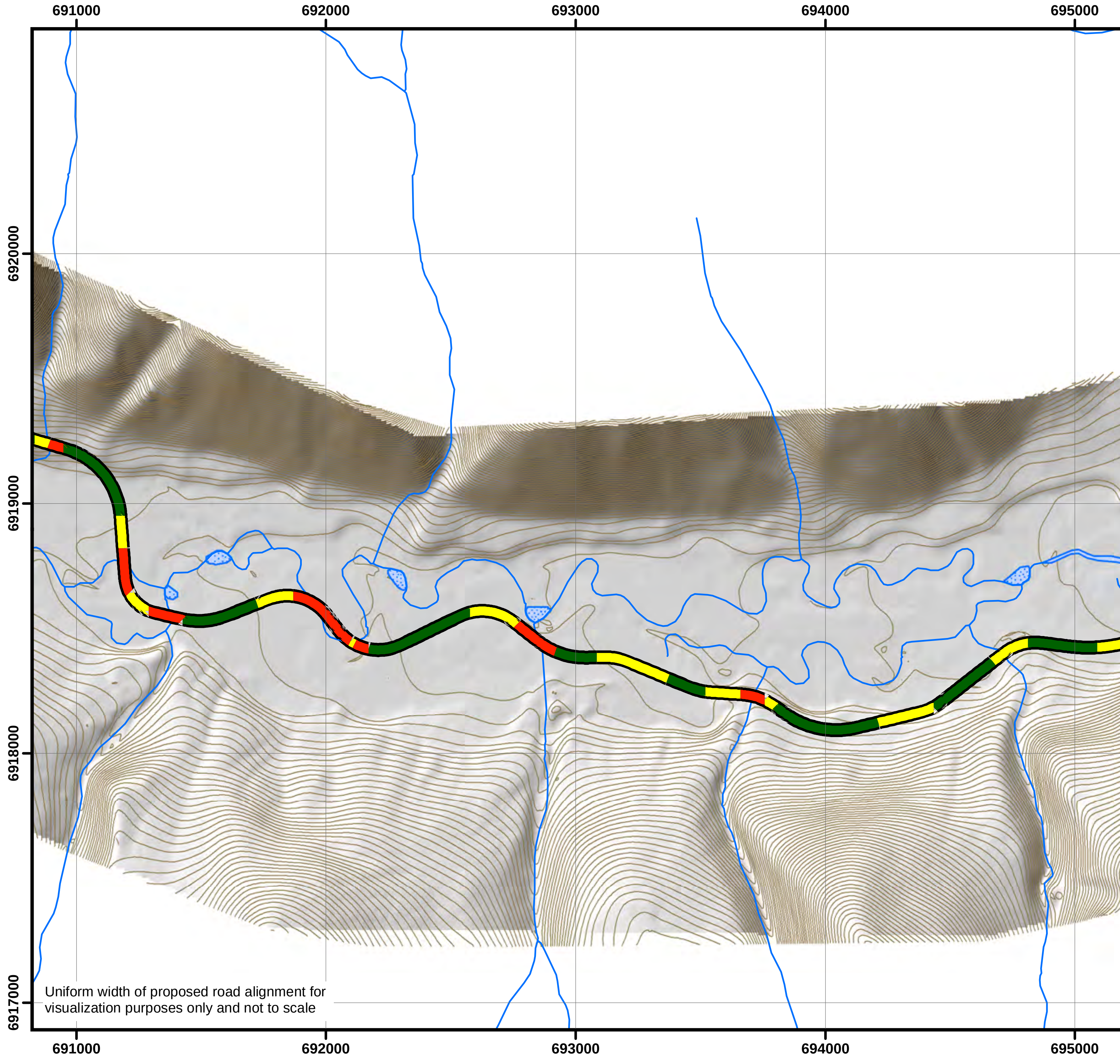
Freegold Road Extension

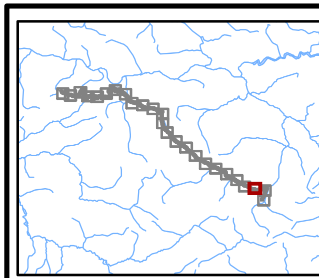
Map 2

Potential Ecological Consequence

CASINO COPPER AND GOLD

PALMER ENVIRONMENTAL CONSULTING GROUP INC.





Legend

Potential Ecological Consequence

- High
- Moderate
- Low
- Streams
- Non-Permanent
- Permanet Water
- Contours (5m)

0 125 250 500 750 m

1:20,000

Grid: UTM Zone 7N

Casino Mining Corporation

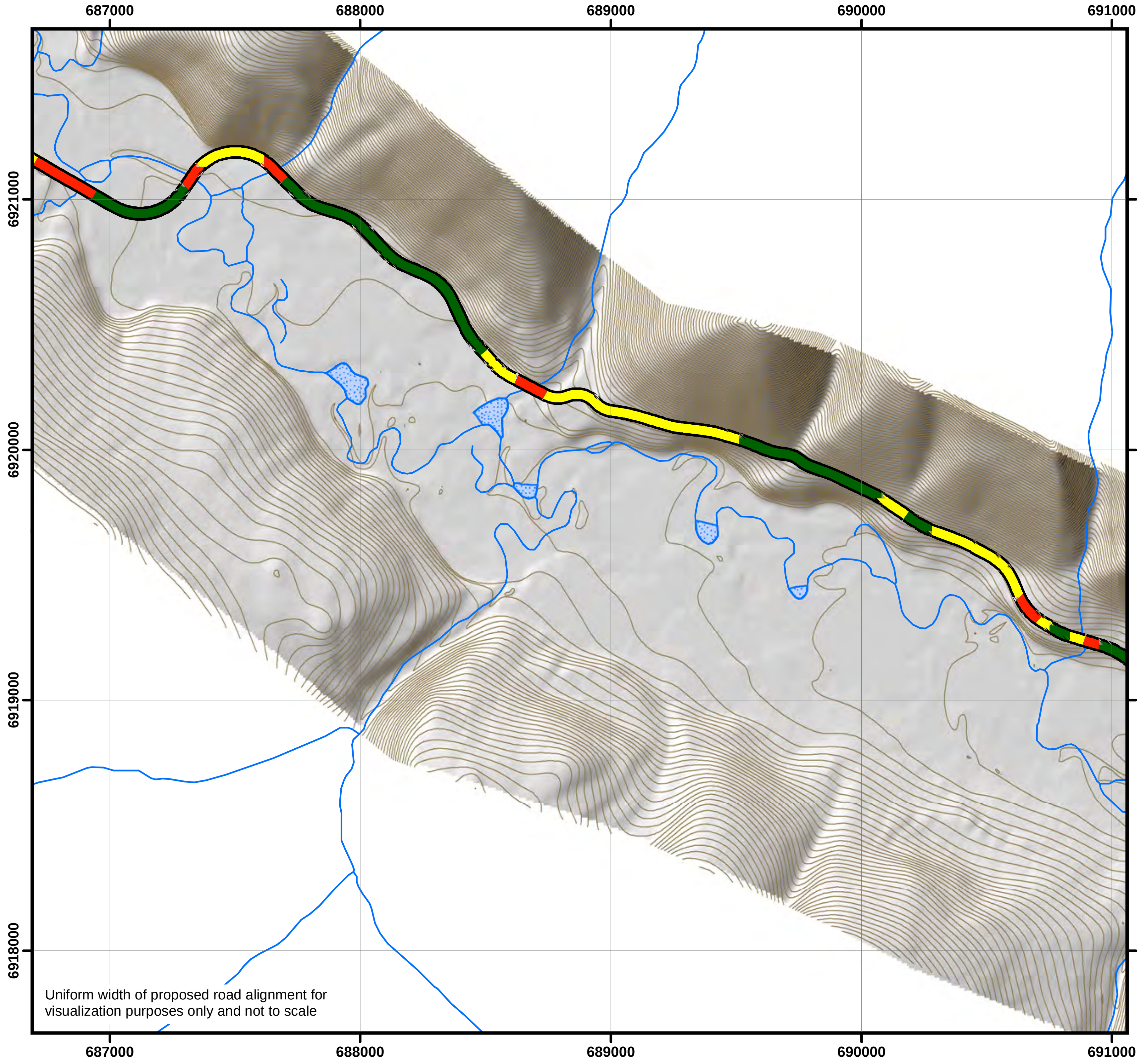
Freegold Road Extension

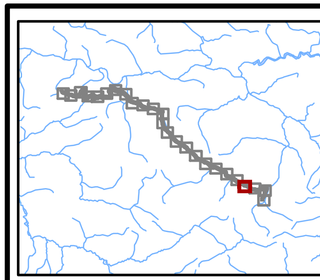
Map 2
Potential Ecological Consequence

CASINO
COPPER AND GOLD

PALMER
ENVIRONMENTAL
CONSULTING
GROUP INC.

Sheet 3 of 25





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Potential Ecological Consequence

High
Moderate
Low
Streams
Non-Permanent
Permanet Water
Contours (5m)

0 125 250 500 750 m

1:20,000

Grid: UTM Zone 7N

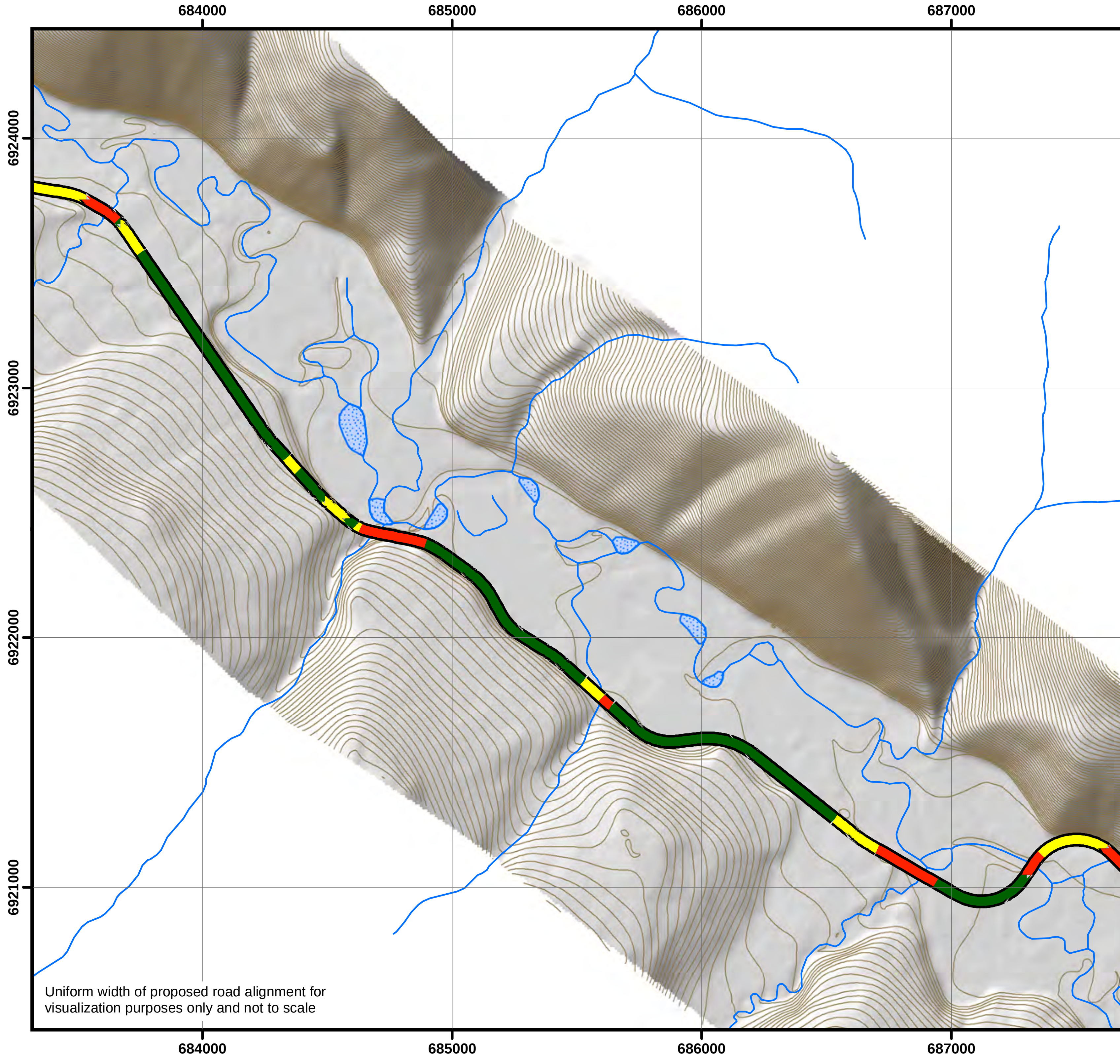
Casino Mining Corporation

Freegold Road Extension

Map 2
Potential Ecological Consequence

CASINO
COPPER AND GOLD

PALMER
ENVIRONMENTAL
CONSULTING
GROUP INC.



Legend

Potential Ecological Consequence

High
Moderate
Low
Streams
Non-Permanent
Permanent Water
Contours (5m)

0 125 250 500 750 m

1:20,000

Grid: UTM Zone 7N

Casino Mining Corporation

Freegold Road Extension

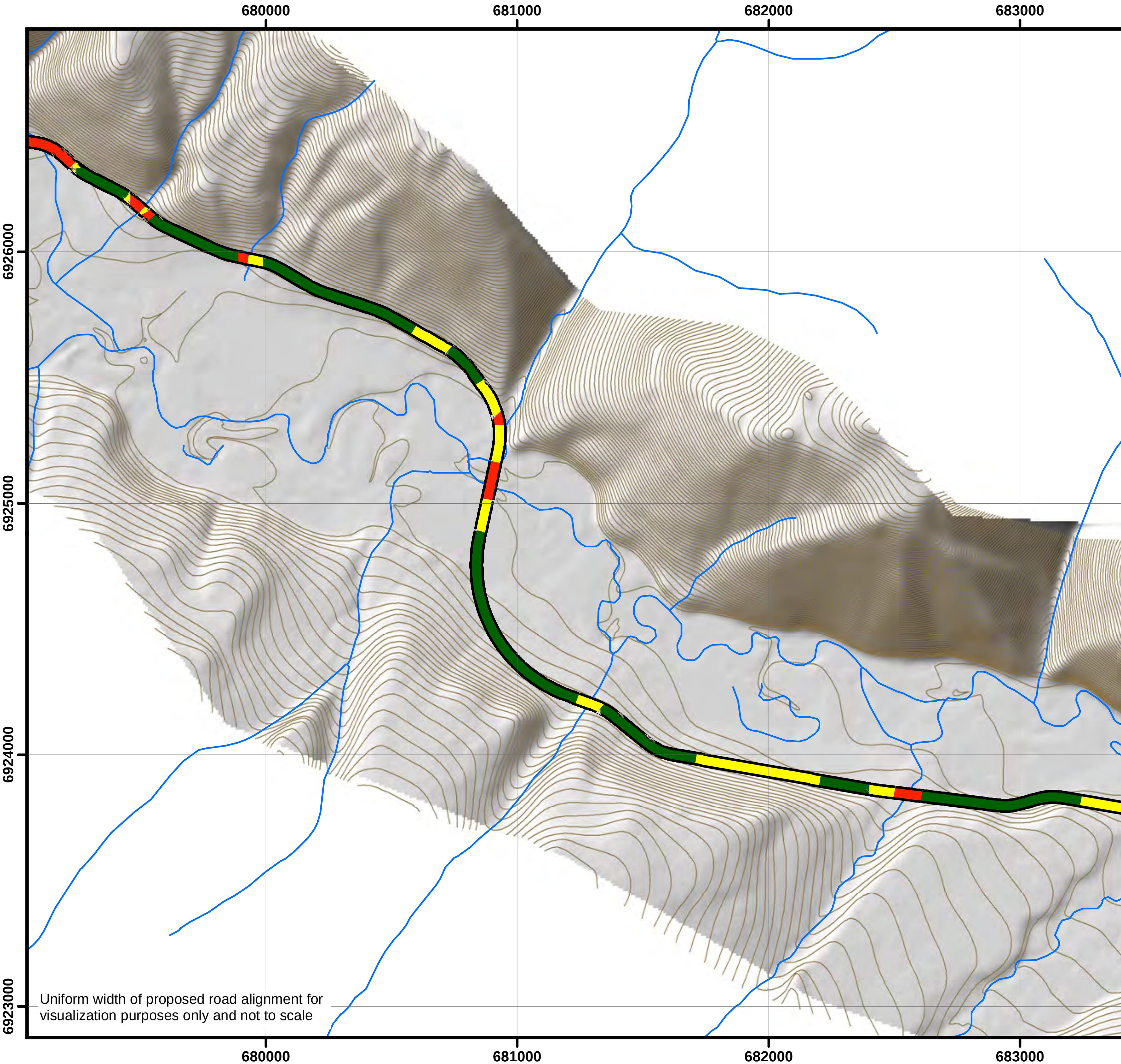
Map 2

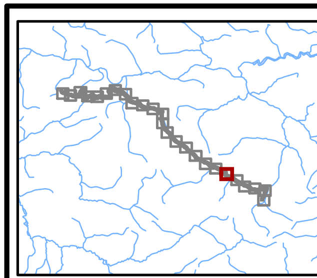
Potential Ecological Consequence

CASINO COPPER AND GOLD

PALMER ENVIRONMENTAL CONSULTING GROUP INC.

Sheet 5 of 25





Legend

Potential Ecological Consequence

- High
- Moderate
- Low
- Streams
- Non-Permanent
- Permanet Water
- Contours (5m)

0 125 250 500 750 m

1:20,000

Grid: UTM Zone 7N

Casino Mining Corporation

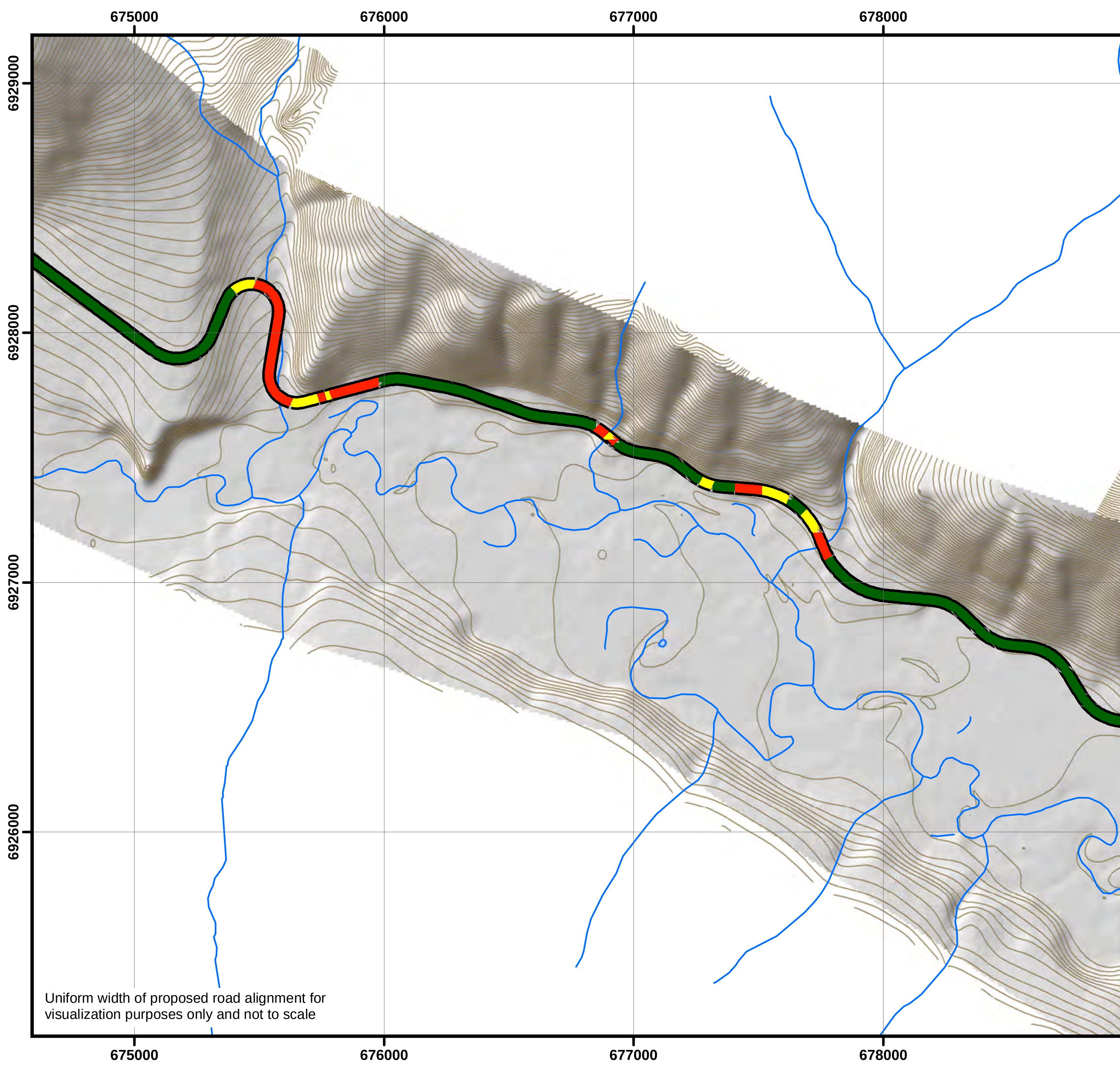
Freegold Road Extension

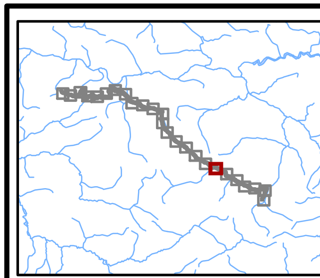
Map 2

Potential Ecological Consequence

CASINO COPPER AND GOLD

PALMER ENVIRONMENTAL CONSULTING GROUP INC.





Legend

Potential Ecological Consequence

- High
- Moderate
- Low
- Streams
- Non-Permanent
- Permanet Water
- Contours (5m)

0 125 250 500 750 m

1:20,000

Grid: UTM Zone 7N

Casino Mining Corporation

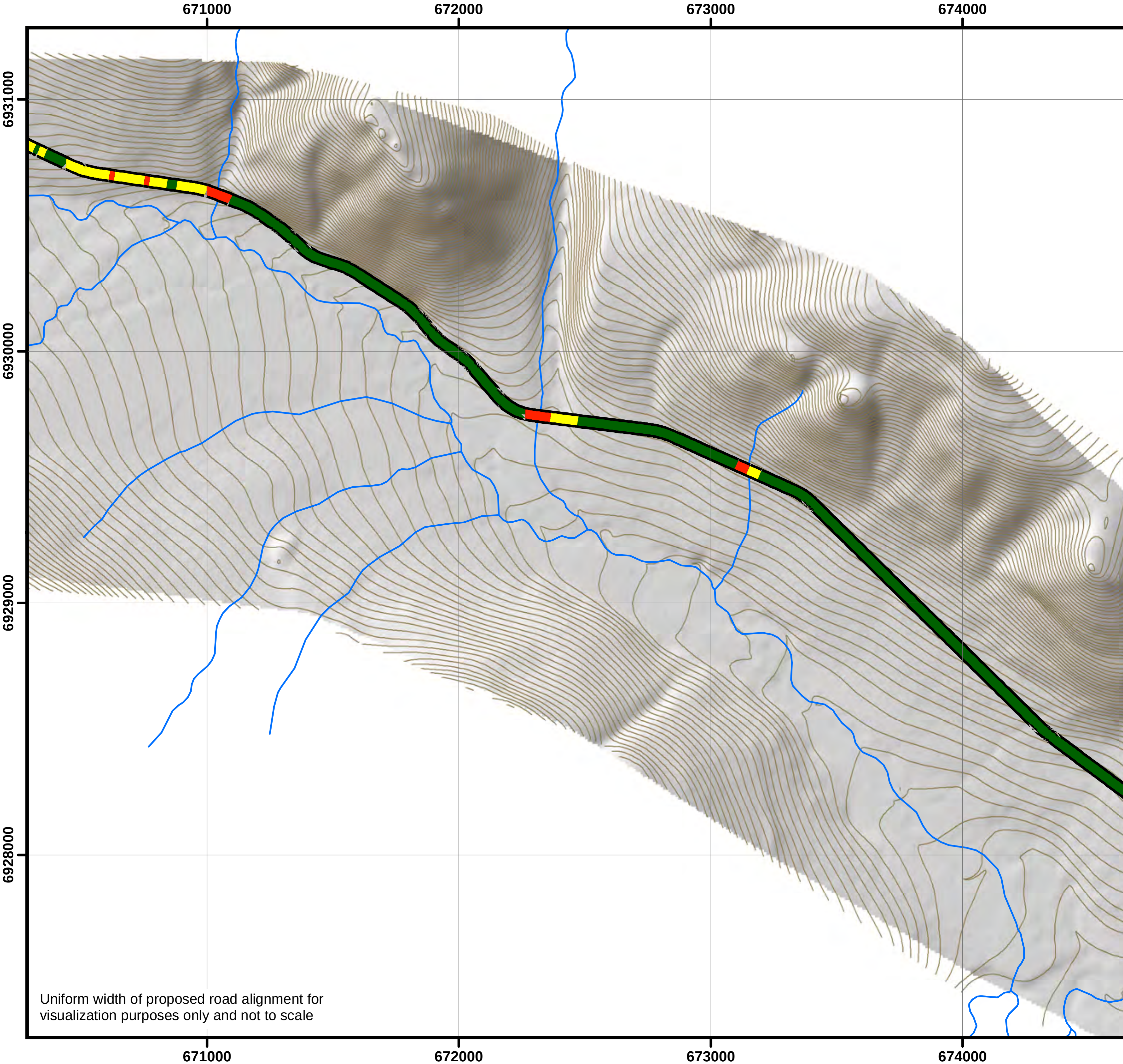
Freegold Road Extension

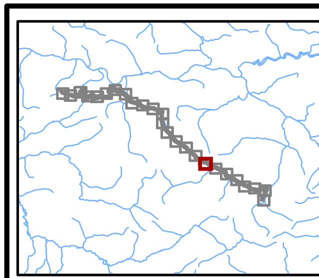
Map 2

Potential Ecological Consequence

CASINO COPPER AND GOLD

PALMER ENVIRONMENTAL CONSULTING GROUP INC.





Legend

Potential Ecological Consequence

High
Moderate
Low
Streams
Non-Permanent
Permanet Water
Contours (5m)

0 125 250 500 750 m

1:20,000

Grid: UTM Zone 7N

Casino Mining Corporation

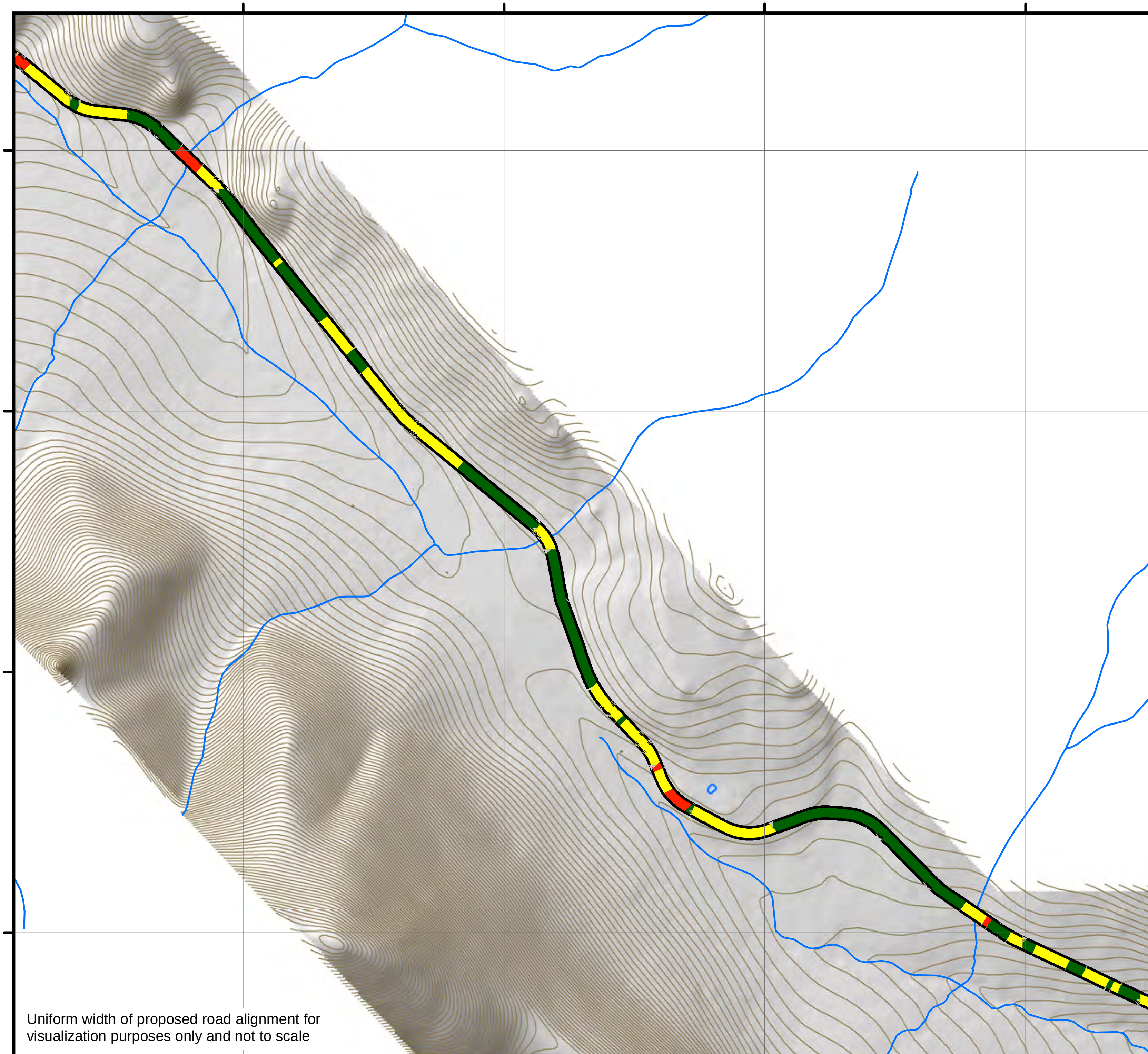
Freegold Road Extension

Map 2

Potential Ecological Consequence

CASINO COPPER AND GOLD

PALMER ENVIRONMENTAL CONSULTING GROUP INC.



Legend

Potential Ecological Consequence

High
Moderate
Low
Streams
Non-Permanent
Permanet Water
Contours (5m)

0 125 250 500 750 m

1:20,000

Grid: UTM Zone 7N

Casino Mining Corporation

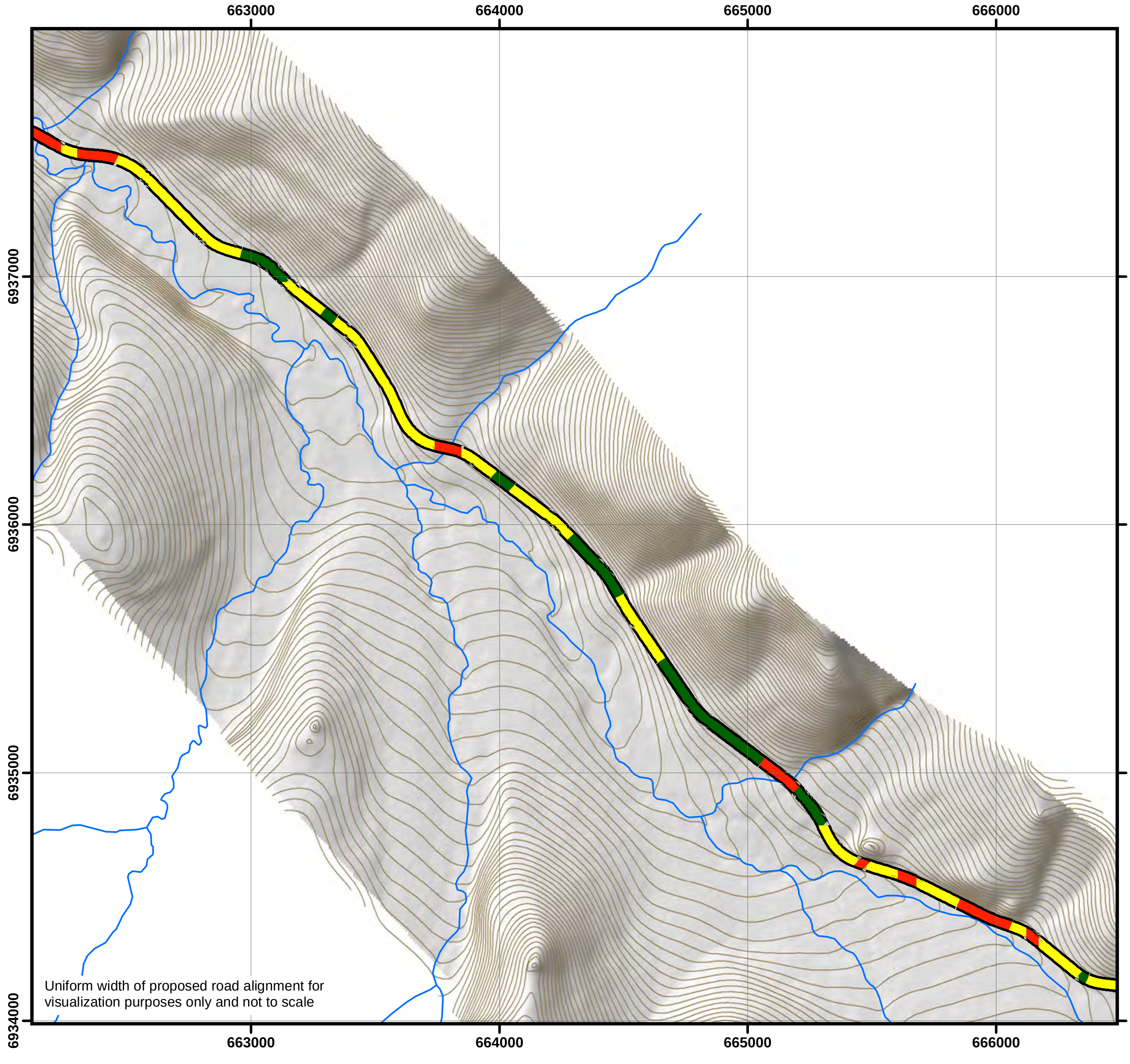
Freegold Road Extension

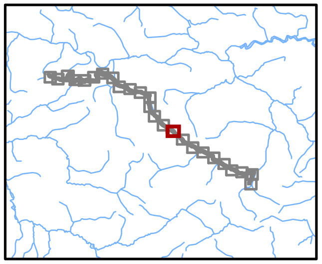
Map 2

Potential Ecological Consequence

CASINO COPPER AND GOLD

PALMER ENVIRONMENTAL CONSULTING GROUP INC.





Legend

Potential Ecological Consequence

- High
- Moderate
- Low
- Streams
- Non-Permanent
- Permanet Water
- Contours (5m)

0 125 250 500 750 m

1:20,000

Grid: UTM Zone 7N

Casino Mining Corporation

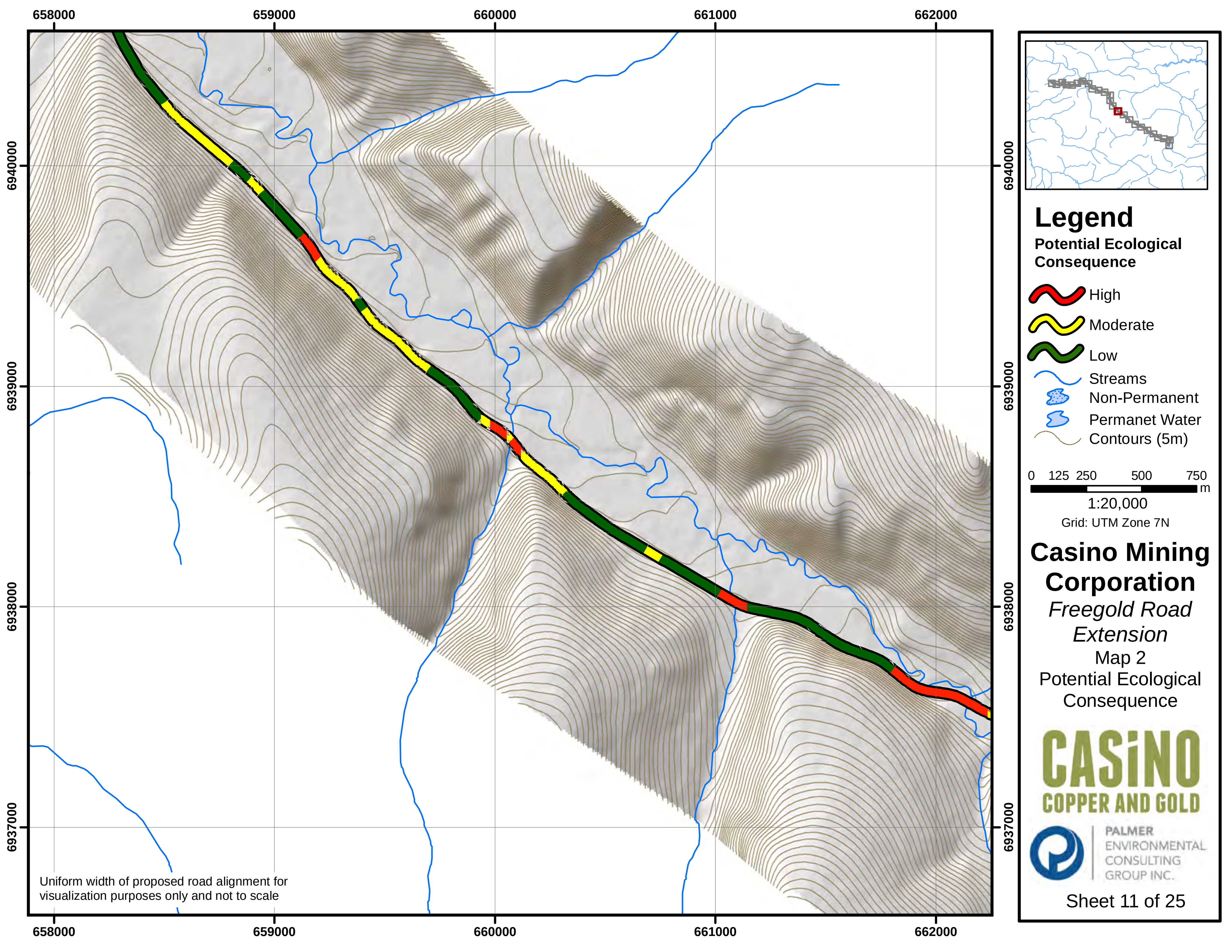
Freegold Road Extension

Map 2

Potential Ecological Consequence

CASINO COPPER AND GOLD

PALMER ENVIRONMENTAL CONSULTING GROUP INC.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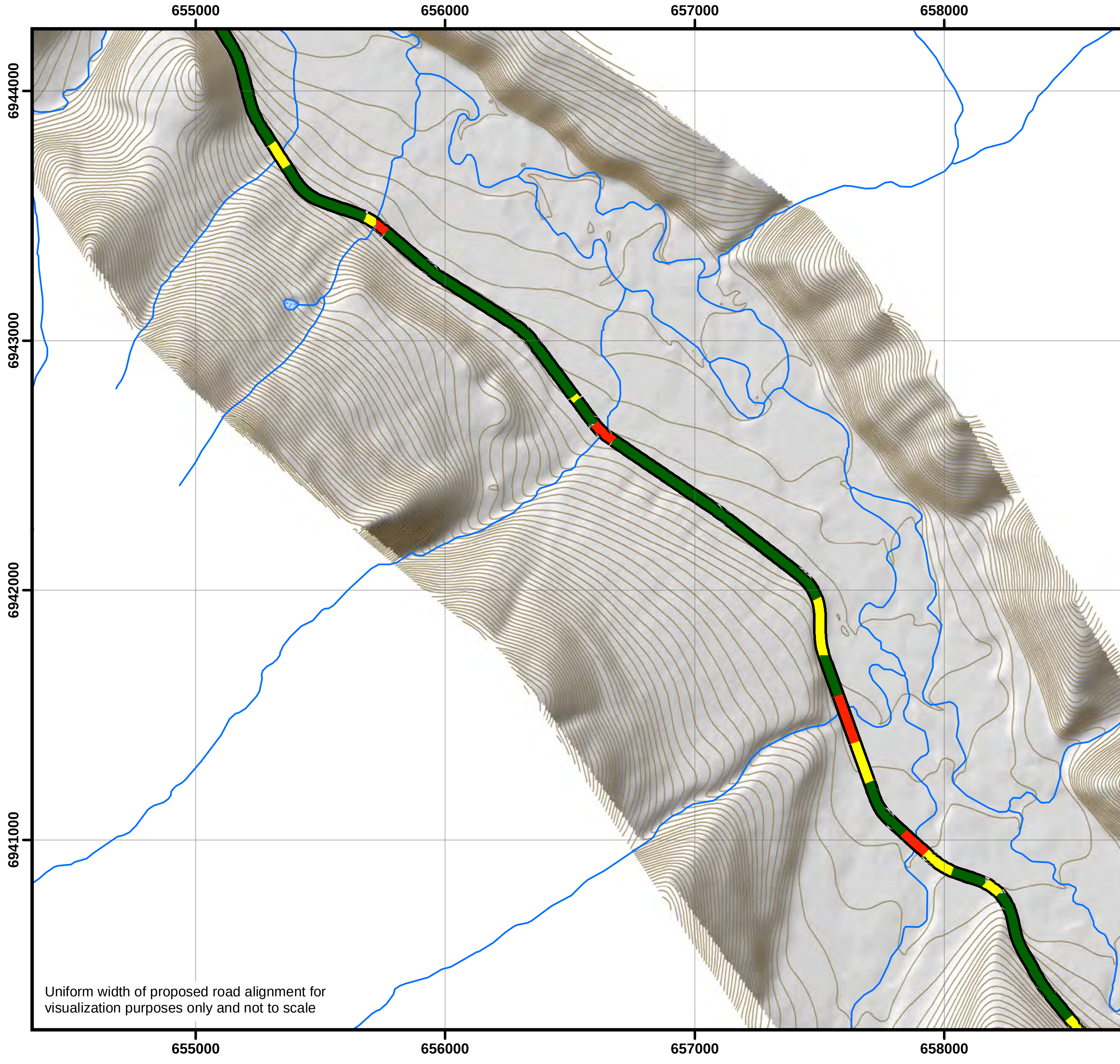
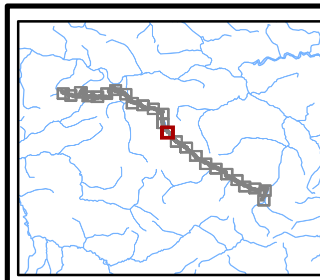
Uniform width of proposed road alignment for
visualization purposes only and not to scale
Legend
Potential Ecological Consequence
High
Moderate
Low
Streams
Non-Permanent
Permanet Water
Contours (5m)
0 125 250 500 750 m
1:20,000
Grid: UTM Zone 7N
Casino Mining Corporation
Freegold Road Extension
Map 2
Potential Ecological Consequence
CASINO
COPPER AND GOLD
PALMER ENVIRONMENTAL CONSULTING GROUP INC.
Sheet 11 of 25





Legend

Potential Ecological Consequence

High
Moderate
Low
Streams
Non-Permanent
Permanet Water
Contours (5m)

0 125 250 500 750 m

1:20,000

Grid: UTM Zone 7N

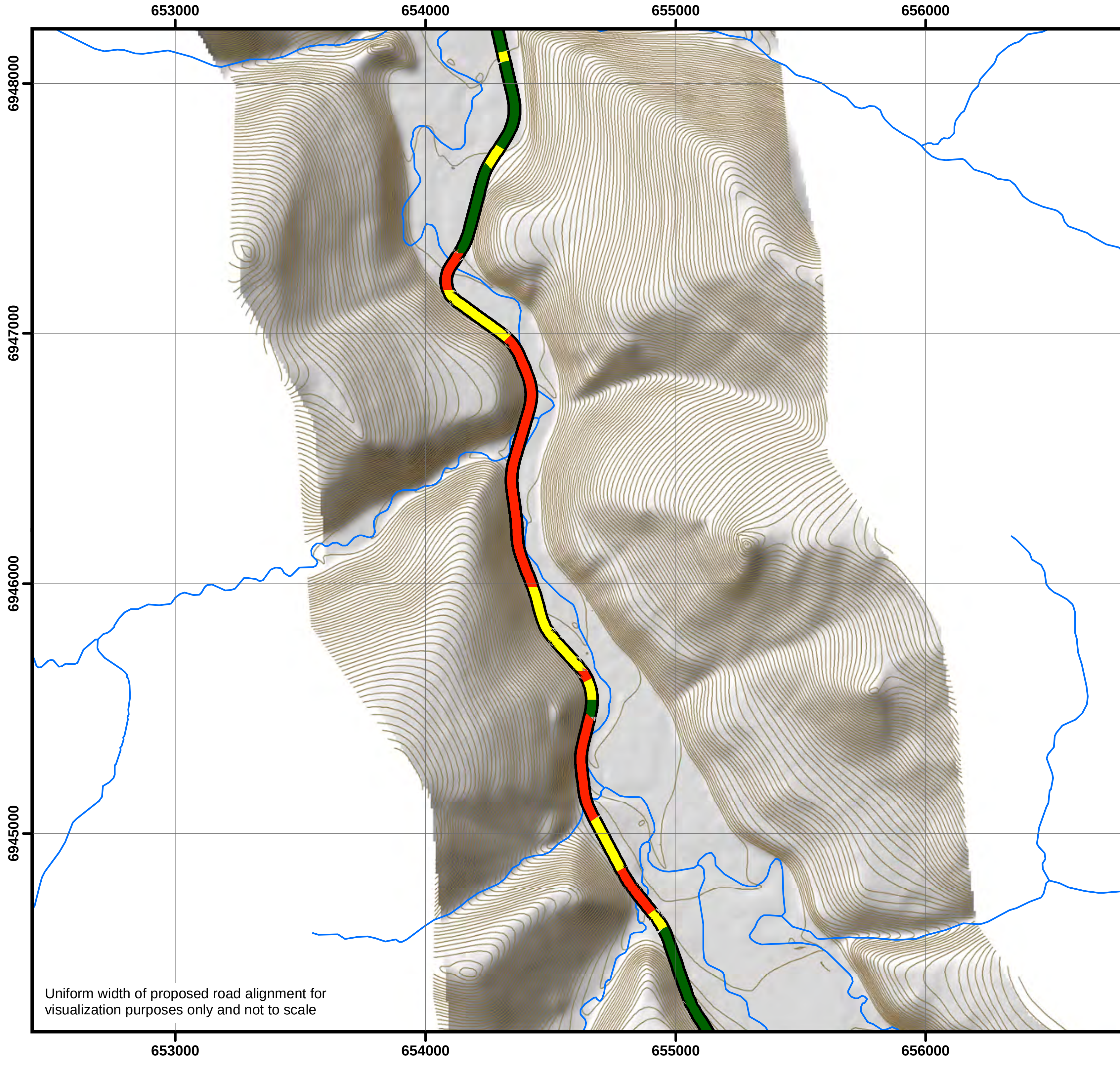
Casino Mining Corporation

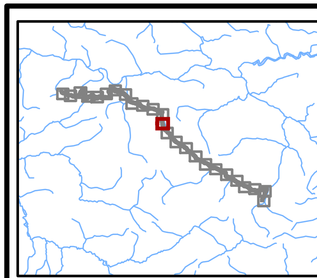
Freegold Road Extension

Map 2
Potential Ecological Consequence

CASINO COPPER AND GOLD

PALMER ENVIRONMENTAL CONSULTING GROUP INC.





Legend

Potential Ecological Consequence

High

Moderate

Low

Streams

Non-Permanent

Permanet Water

Contours (5m)

0 125 250 500 750 m

1:20,000

Grid: UTM Zone 7N

Casino Mining Corporation

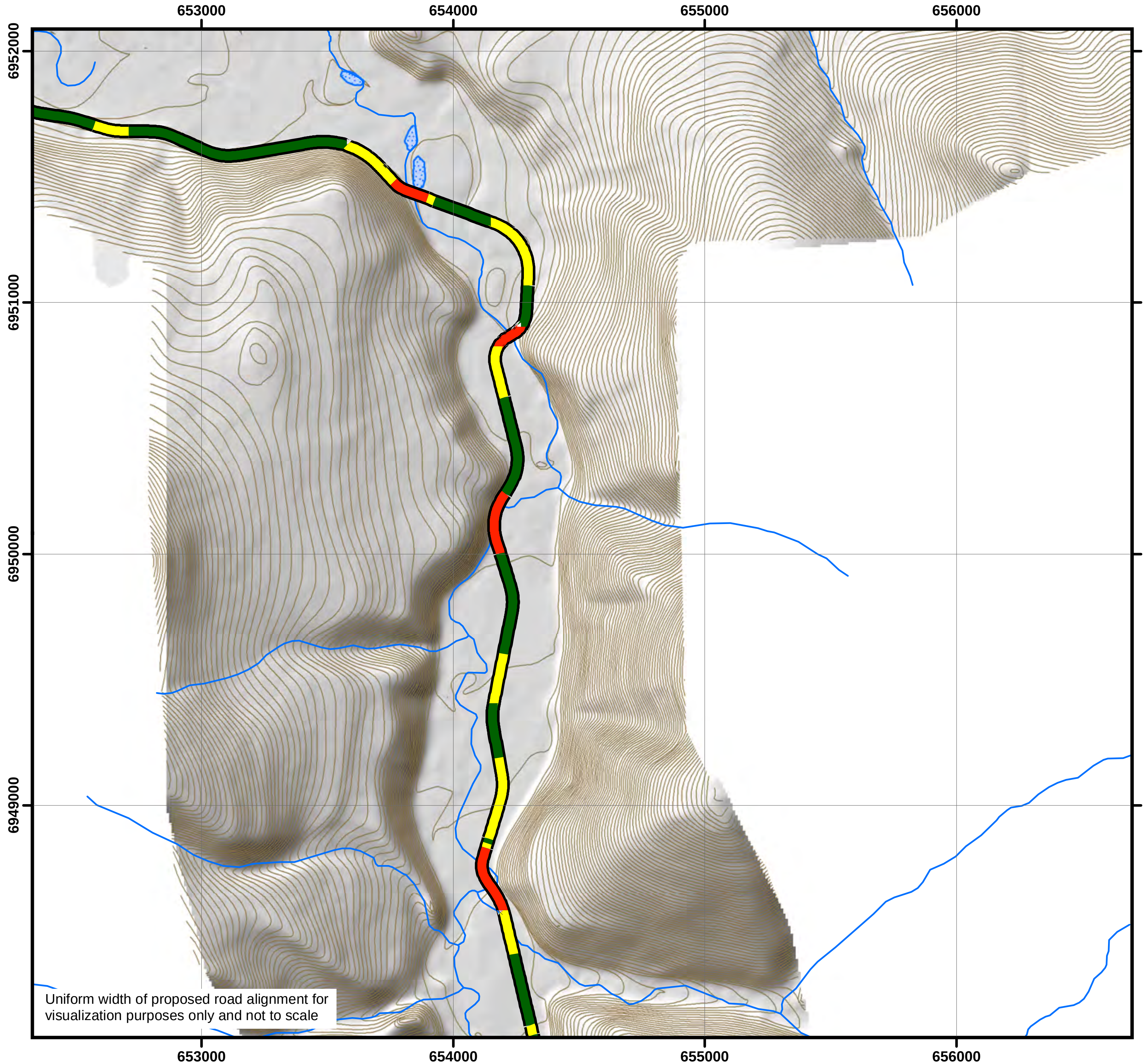
Freegold Road Extension

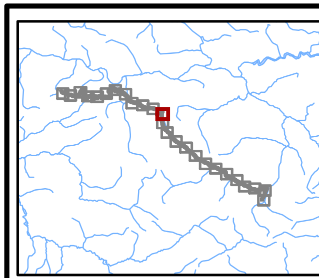
Map 2

Potential Ecological Consequence

CASINO
COPPER AND GOLD

PALMER
ENVIRONMENTAL
CONSULTING
GROUP INC.





Legend

Potential Ecological Consequence

- High
- Moderate
- Low
- Streams
- Non-Permanent
- Permanent Water
- Contours (5m)

0 125 250 500 750 m

1:20,000

Grid: UTM Zone 7N

Casino Mining Corporation

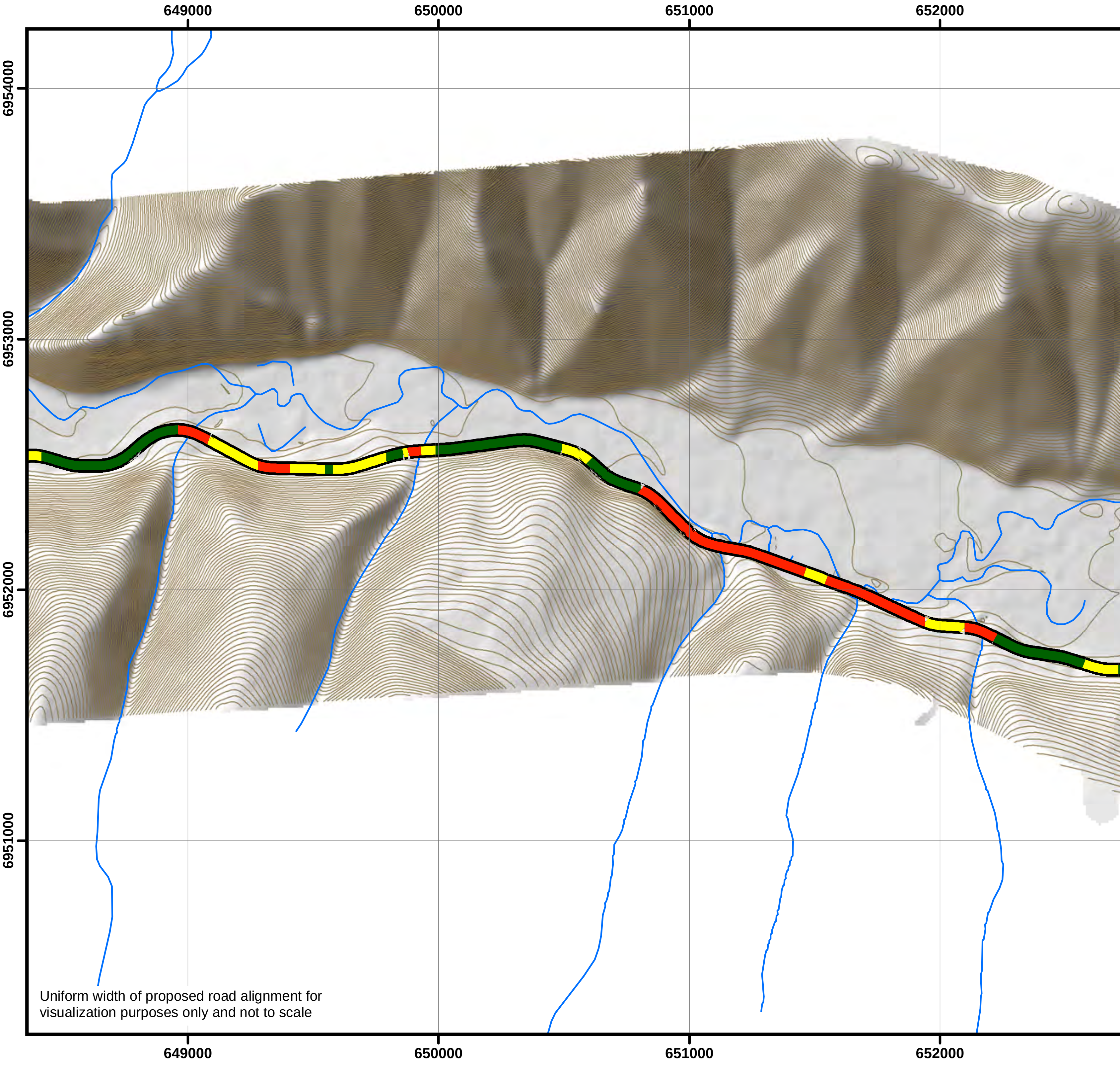
Freegold Road Extension

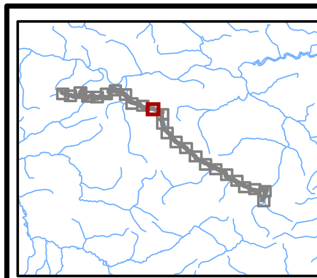
Map 2

Potential Ecological Consequence

CASINO COPPER AND GOLD

PALMER ENVIRONMENTAL CONSULTING GROUP INC.





Legend

Potential Ecological Consequence

- High
- Moderate
- Low
- Streams
- Non-Permanent
- Permanent Water
- Contours (5m)

0 125 250 500 750 m

1:20,000

Grid: UTM Zone 7N

Casino Mining Corporation

Freegold Road Extension

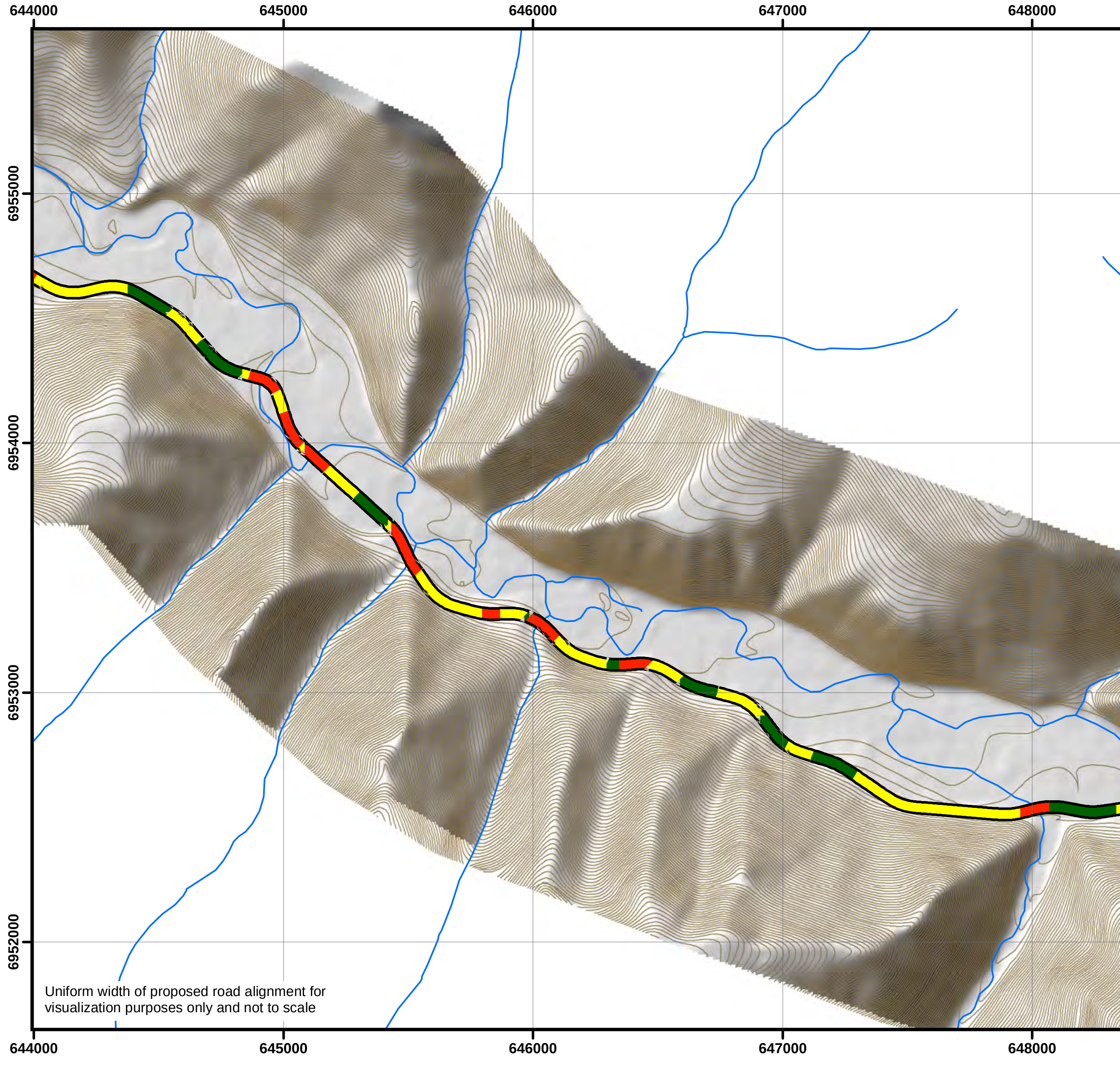
Map 2

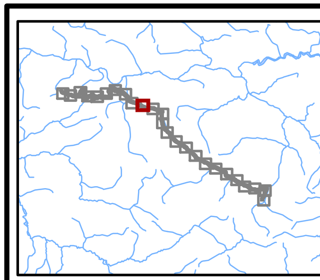
Potential Ecological Consequence

CASINO COPPER AND GOLD

PALMER ENVIRONMENTAL CONSULTING GROUP INC.

Sheet 15 of 25





Legend

Potential Ecological Consequence

- High
- Moderate
- Low
- Streams
- Non-Permanent
- Permanet Water
- Contours (5m)

0 125 250 500 750 m

1:20,000

Grid: UTM Zone 7N

Casino Mining Corporation

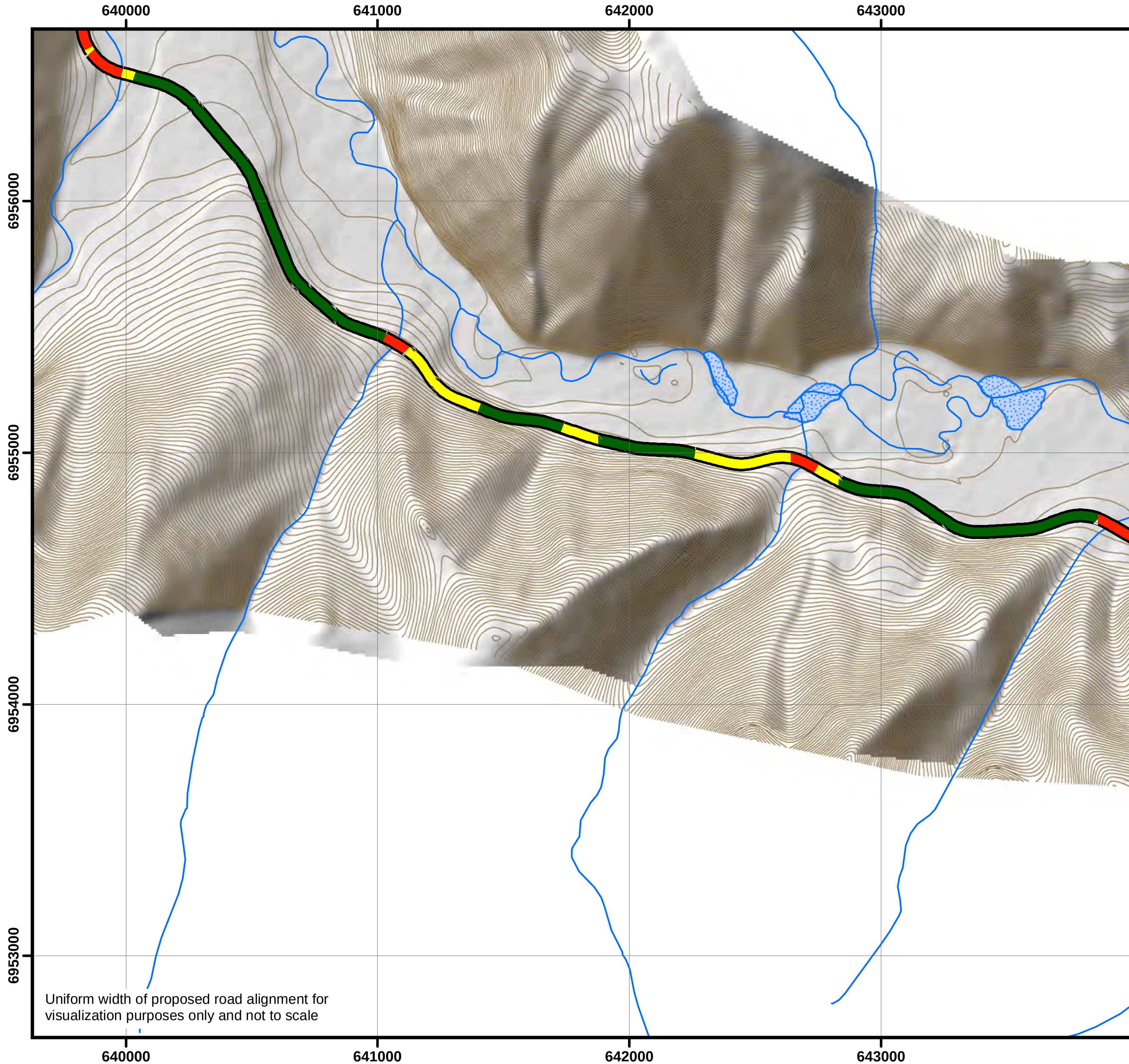
Freegold Road Extension

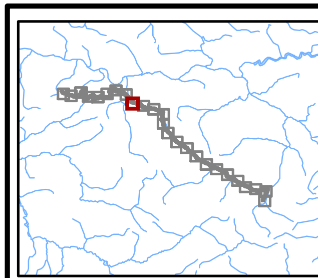
Map 2

Potential Ecological Consequence

CASINO COPPER AND GOLD

PALMER ENVIRONMENTAL CONSULTING GROUP INC.





Legend

Potential Ecological Consequence

High
Moderate
Low
Streams
Non-Permanent
Permanet Water
Contours (5m)

0 125 250 500 750 m

1:20,000

Grid: UTM Zone 7N

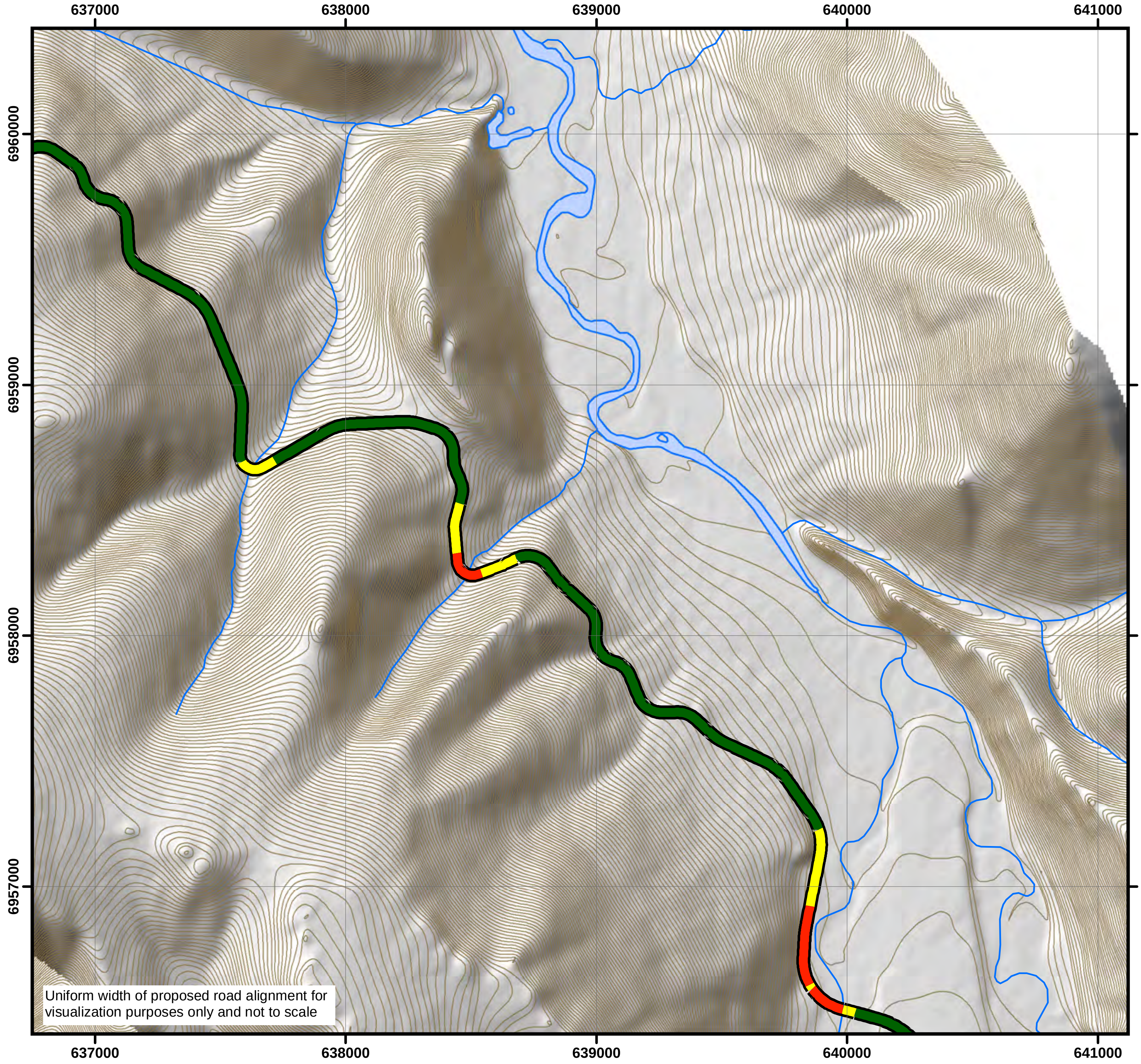
Casino Mining Corporation

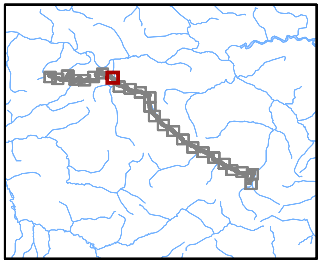
Freegold Road Extension

Map 2
Potential Ecological Consequence

CASINO COPPER AND GOLD

PALMER ENVIRONMENTAL CONSULTING GROUP INC.





Legend

Potential Ecological Consequence

- High
- Moderate
- Low
- Streams
- Non-Permanent
- Permanet Water
- Contours (5m)

0 125 250 500 750 m

1:20,000

Grid: UTM Zone 7N

Casino Mining Corporation

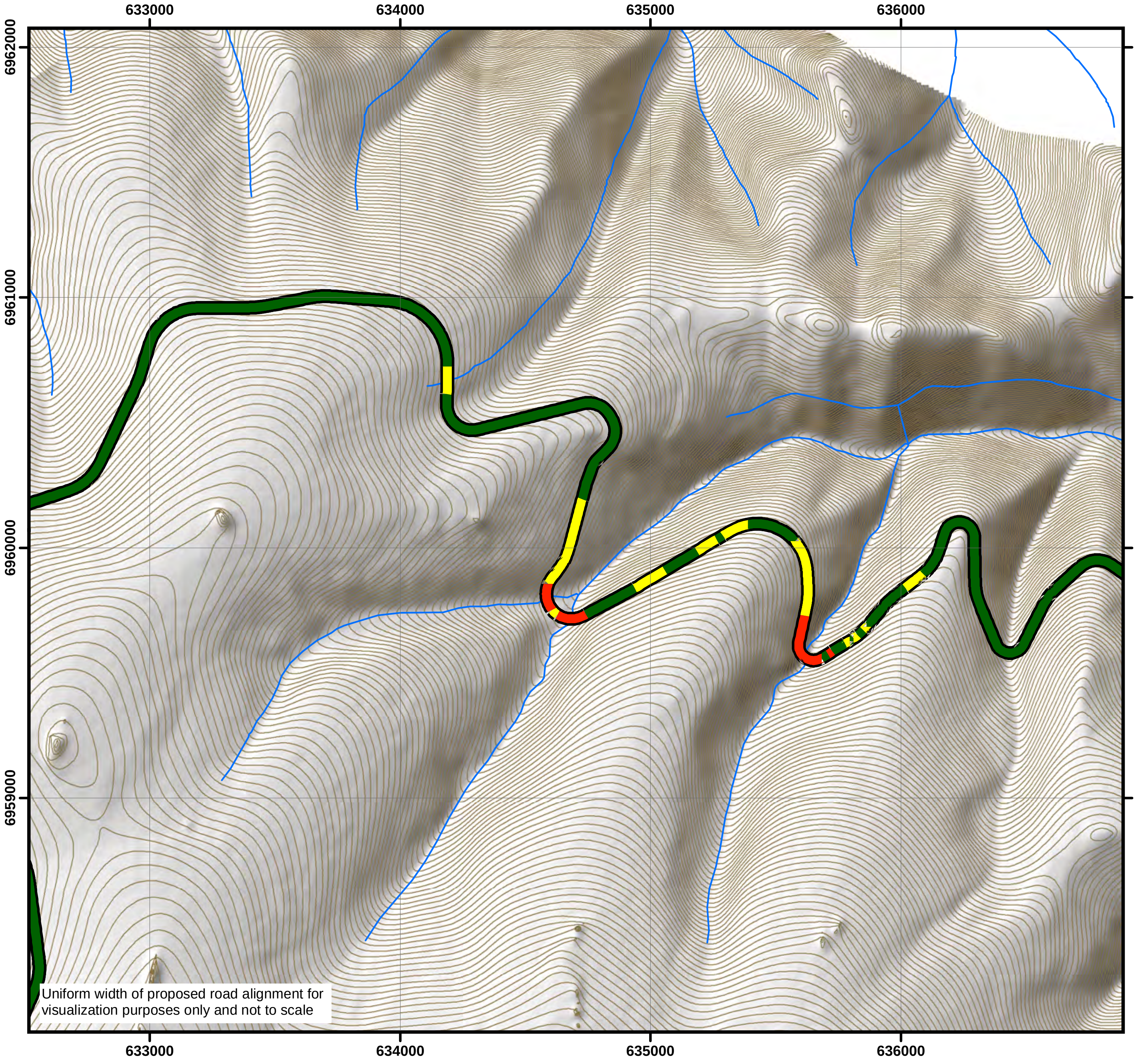
Freegold Road Extension

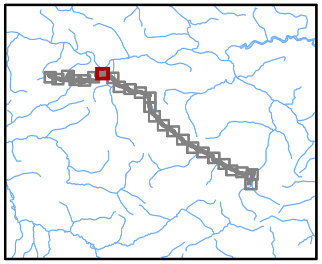
Map 2

Potential Ecological Consequence

CASINO COPPER AND GOLD

PALMER ENVIRONMENTAL CONSULTING GROUP INC.





Legend

Potential Ecological Consequence

High
Moderate
Low
Streams
Non-Permanent
Permanet Water
Contours (5m)

0 125 250 500 750 m

1:20,000

Grid: UTM Zone 7N

Casino Mining Corporation

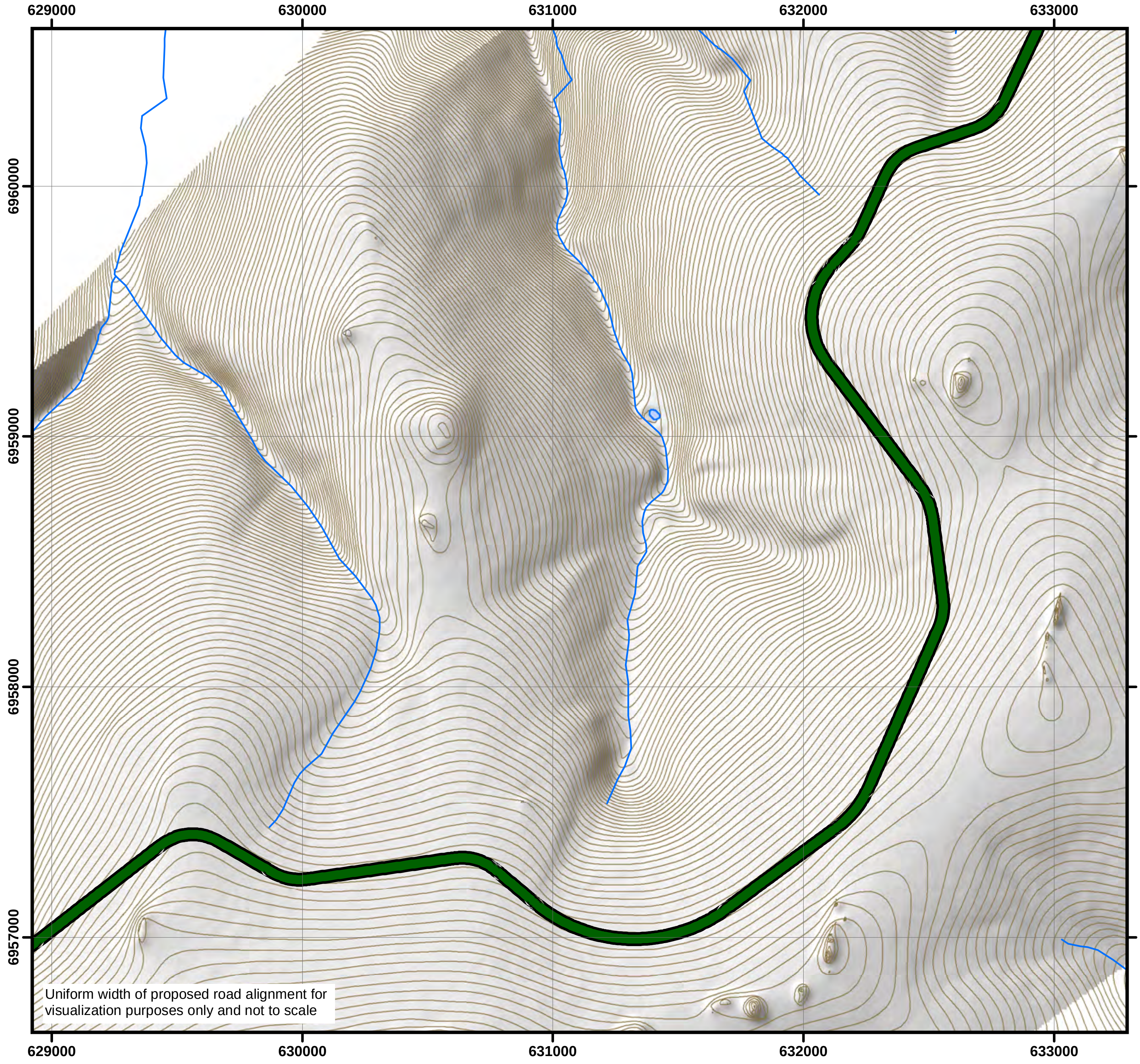
Freegold Road Extension

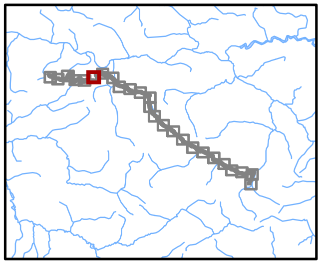
Map 2

Potential Ecological Consequence

CASINO COPPER AND GOLD

PALMER ENVIRONMENTAL CONSULTING GROUP INC.





Legend

Potential Ecological Consequence

- High
- Moderate
- Low
- Streams
- Non-Permanent
- Permanet Water
- Contours (5m)

0 125 250 500 750 m

1:20,000

Grid: UTM Zone 7N

Casino Mining Corporation

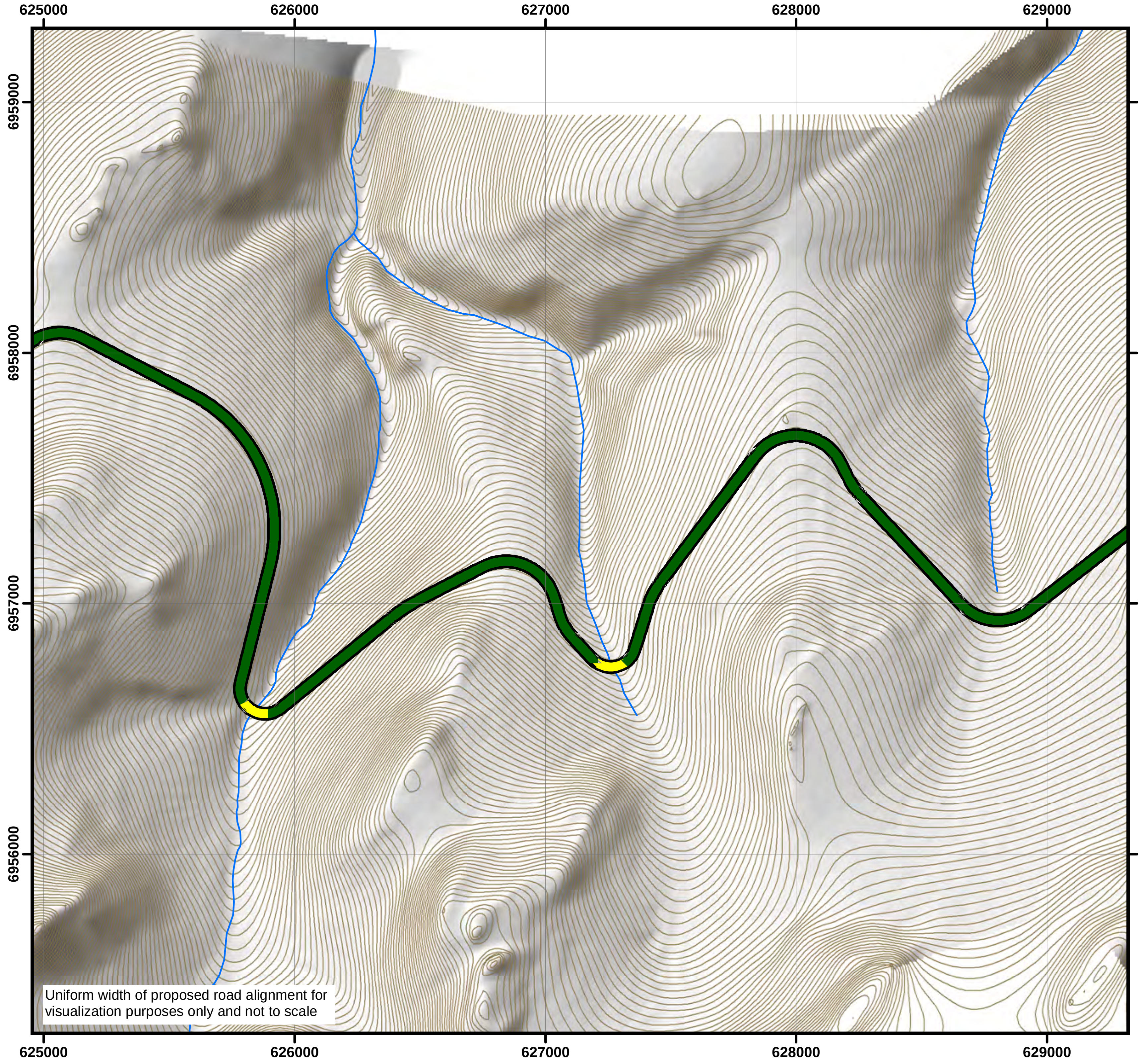
Freegold Road Extension

Map 2

Potential Ecological Consequence

CASINO COPPER AND GOLD

PALMER ENVIRONMENTAL CONSULTING GROUP INC.



Legend

Potential Ecological Consequence

- High
- Moderate
- Low
- Streams
- Non-Permanent
- Permanet Water
- Contours (5m)

0 125 250 500 750 m

1:20,000

Grid: UTM Zone 7N

Casino Mining Corporation

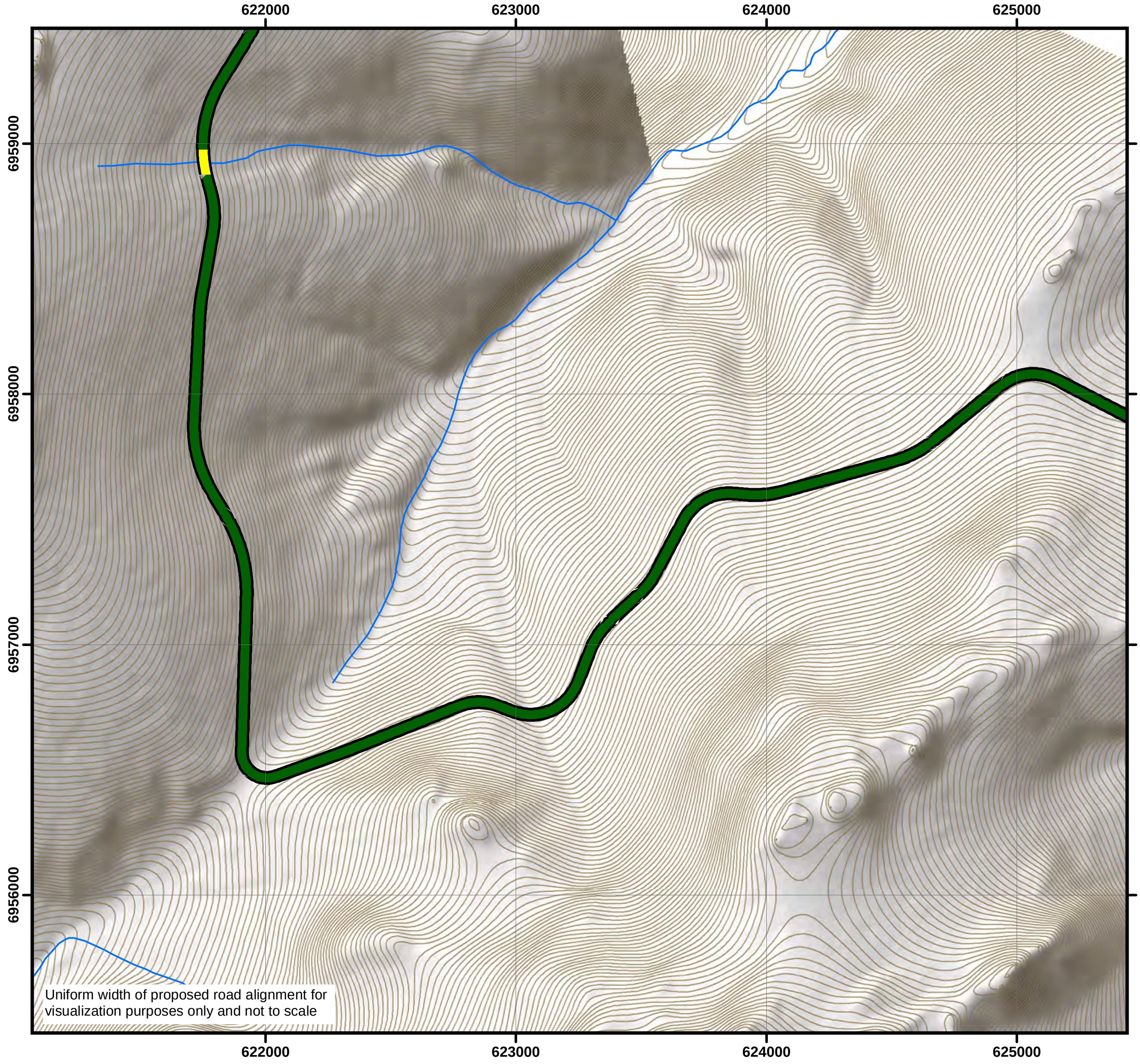
Freegold Road Extension

Map 2

Potential Ecological Consequence

CASINO COPPER AND GOLD

PALMER ENVIRONMENTAL CONSULTING GROUP INC.



Legend

Potential Ecological Consequence

High
Moderate
Low
Streams
Non-Permanent
Permanet Water
Contours (5m)

0 125 250 500 750 m

1:20,000

Grid: UTM Zone 7N

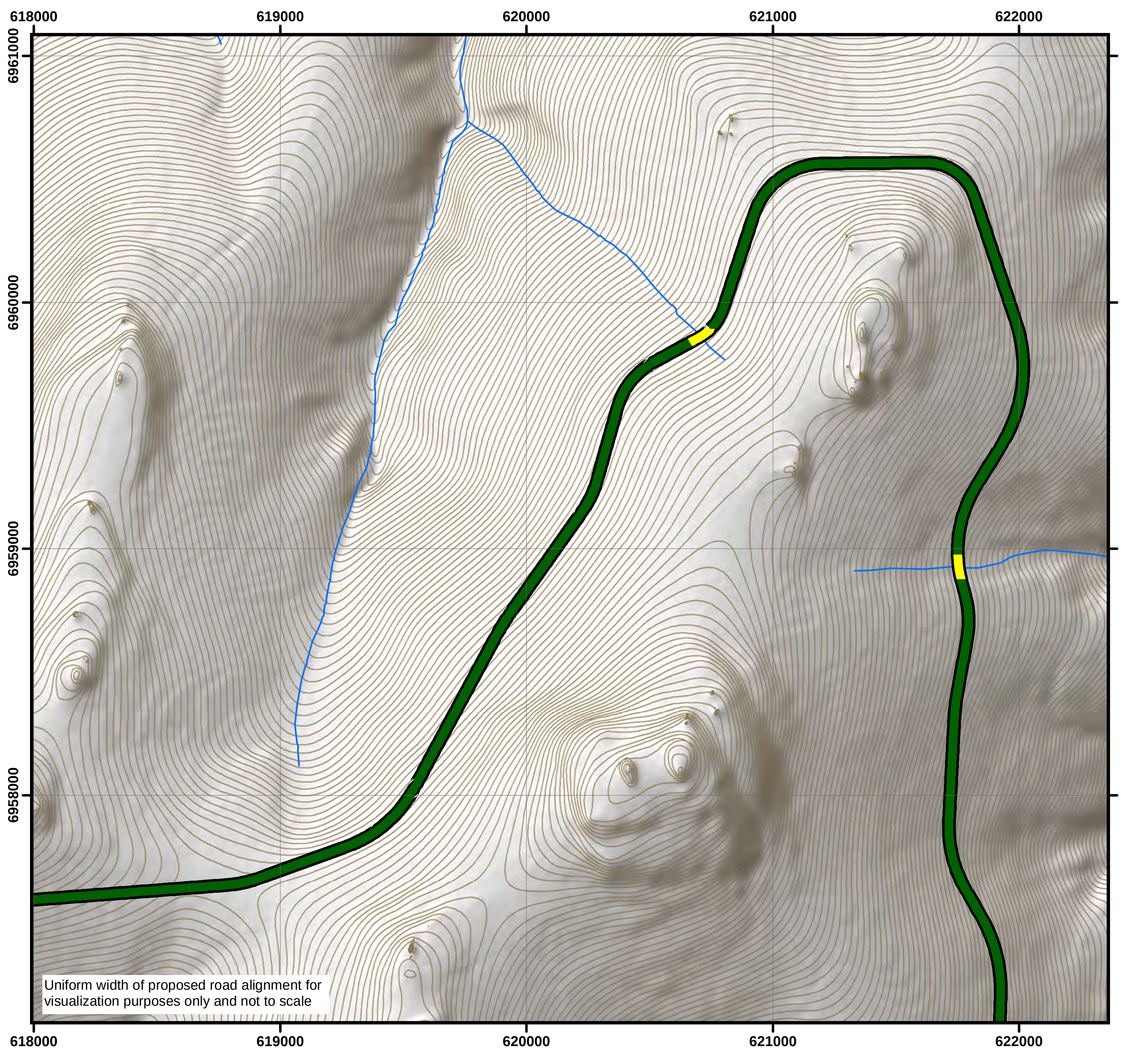
Casino Mining Corporation

Freegold Road Extension

Map 2
Potential Ecological Consequence

CASINO COPPER AND GOLD

PALMER ENVIRONMENTAL CONSULTING GROUP INC.



Legend

Potential Ecological Consequence

- High
- Moderate
- Low
- Streams
- Non-Permanent
- Permanet Water
- Contours (5m)

0 125 250 500 750 m

1:20,000

Grid: UTM Zone 7N

Casino Mining Corporation

Freegold Road Extension

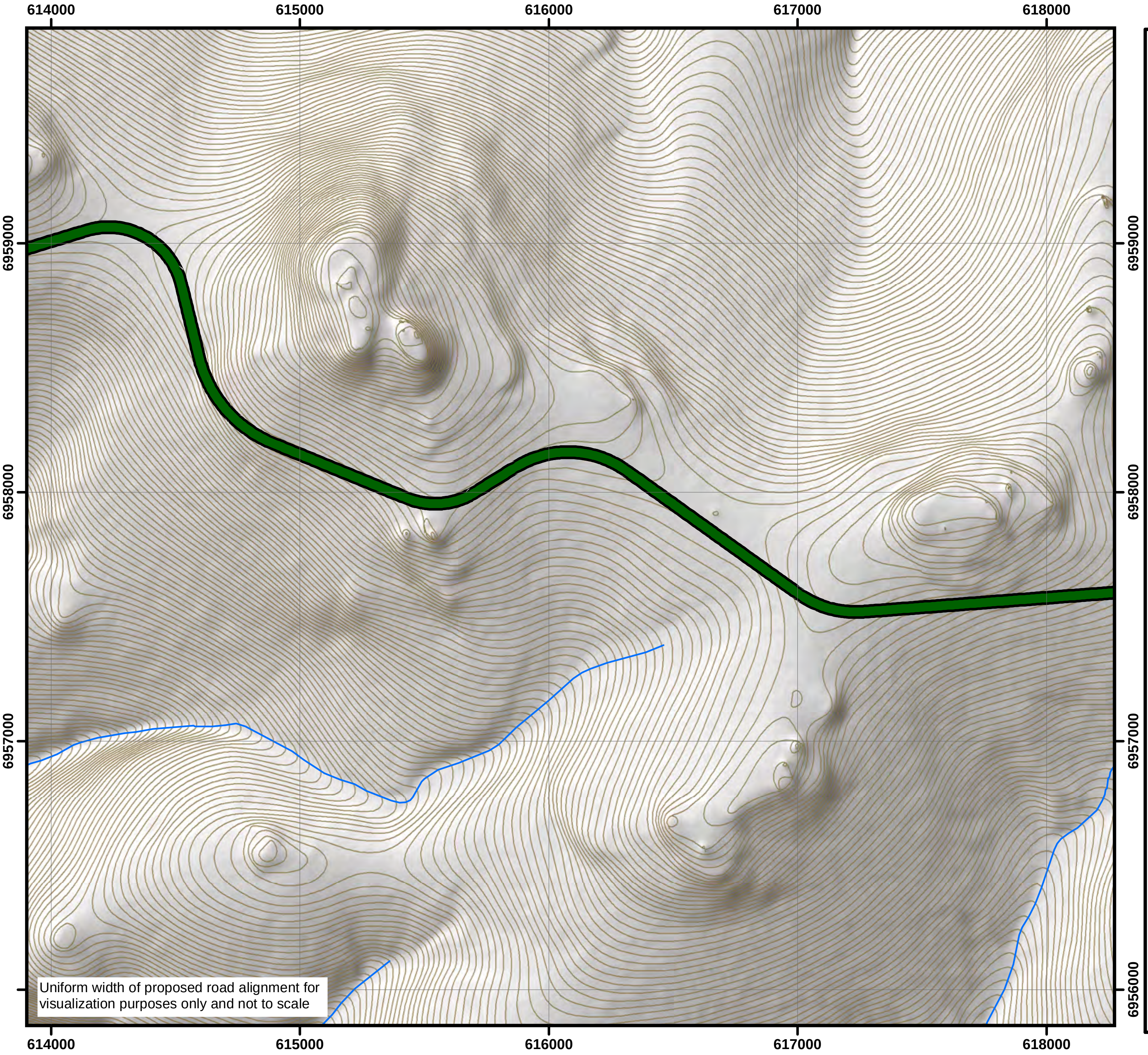
Map 2

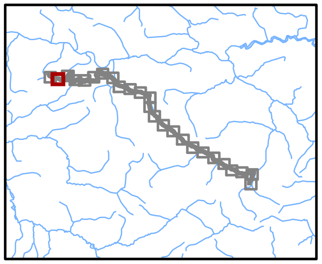
Potential Ecological Consequence

CASINO COPPER AND GOLD

PALMER ENVIRONMENTAL CONSULTING GROUP INC.

Sheet 23 of 25





Legend

Potential Ecological Consequence

- High
- Moderate
- Low
- Streams
- Non-Permanent
- Permanet Water
- Contours (5m)

0 125 250 500 750 m

1:20,000

Grid: UTM Zone 7N

Casino Mining Corporation

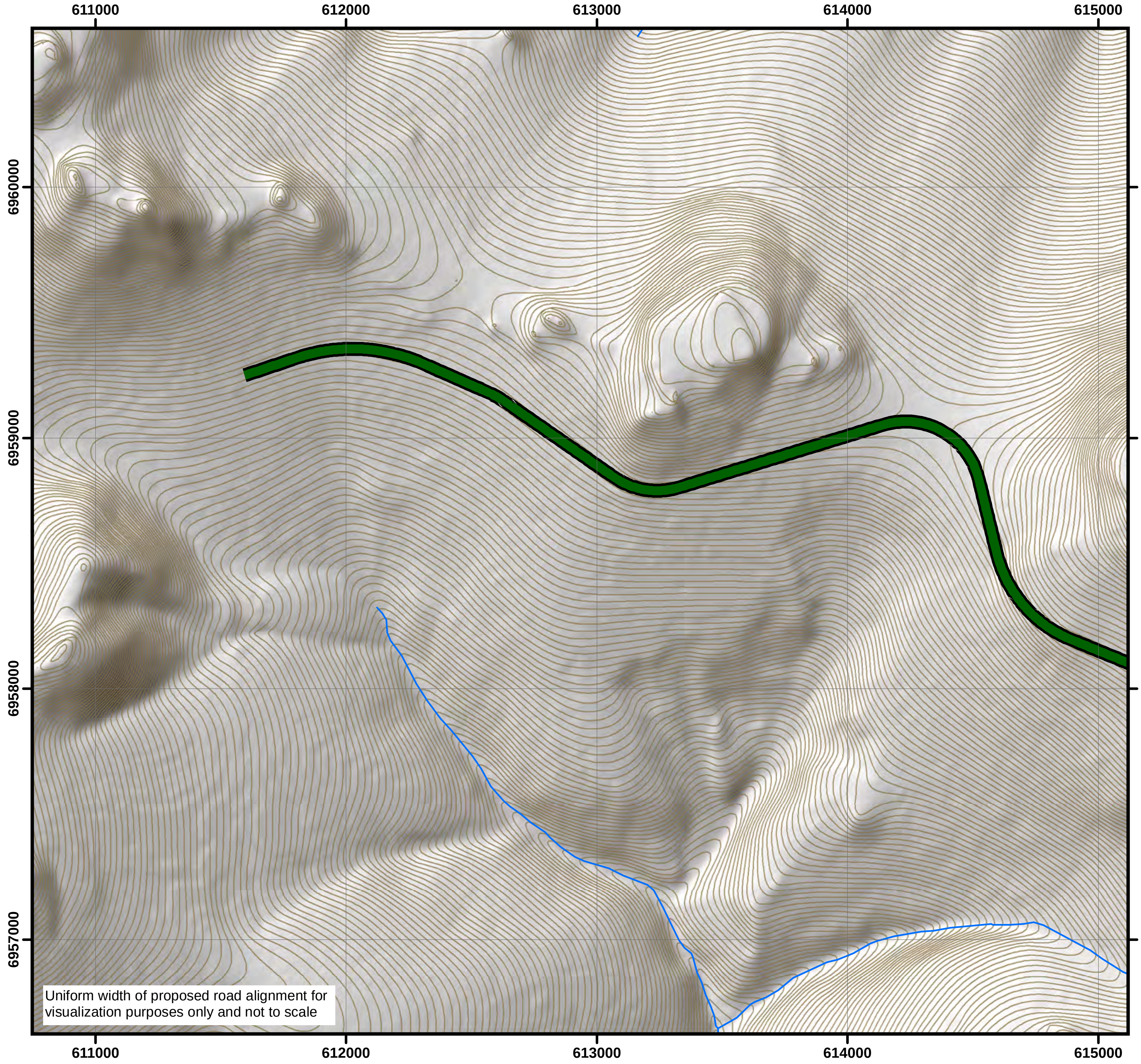
Freegold Road Extension

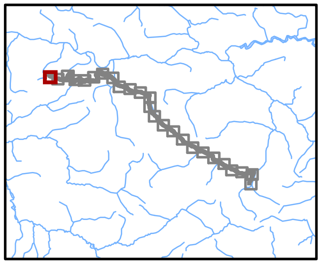
Map 2

Potential Ecological Consequence

CASINO COPPER AND GOLD

PALMER ENVIRONMENTAL CONSULTING GROUP INC.





Legend

Potential Ecological Consequence

- High
- Moderate
- Low
- Streams
- Non-Permanent
- Permanet Water
- Contours (5m)

0 125 250 500 750 m

1:20,000

Grid: UTM Zone 7N

Casino Mining Corporation

Freegold Road Extension

Map 2

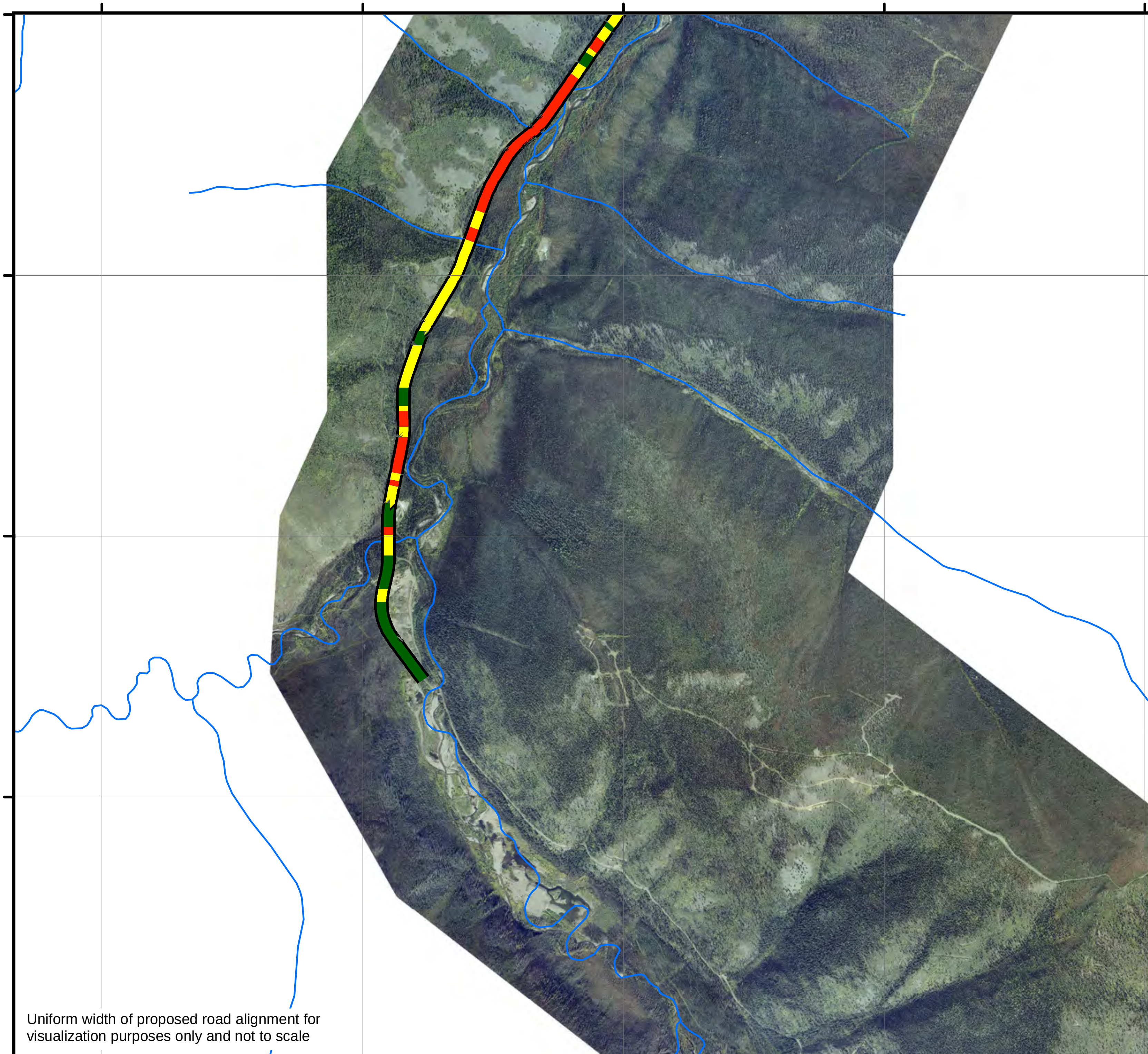
Potential Ecological Consequence

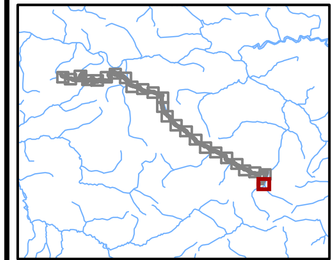
CASINO COPPER AND GOLD

PALMER ENVIRONMENTAL CONSULTING GROUP INC.

Appendix C

Map Series 3 – Overall Erosion and Sedimentation Risk





Legend

Overall Erosion and Sedimentation Risk

- High
- Moderate
- Low
- Streams
- Non-Permanent
- Permanent Water
- Contours (5m)

0 125 250 500 750 m

1:20,000

Grid: UTM Zone 7N

Casino Mining Corporation

Freegold Road Extension

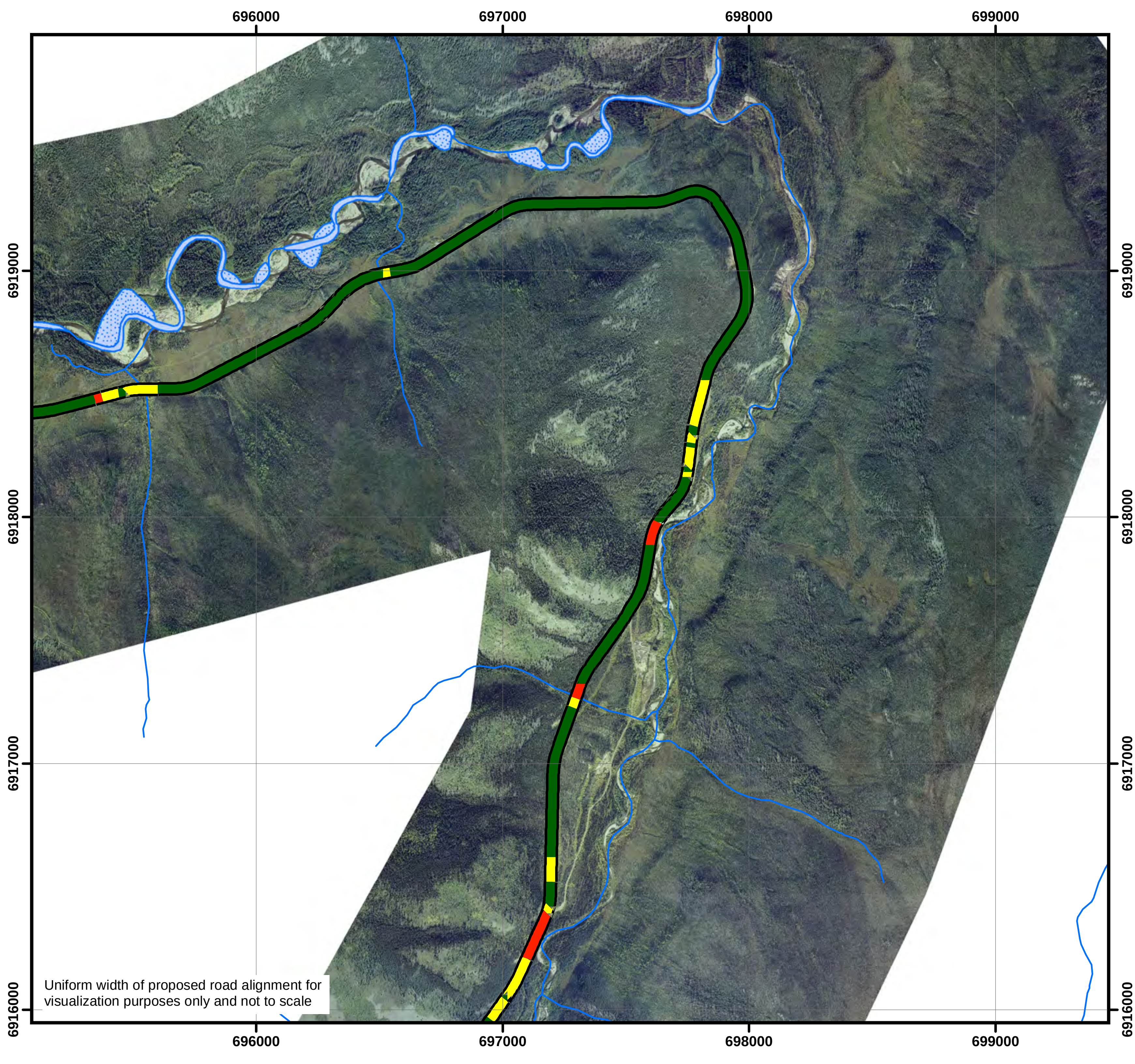
Map 3

Overall Erosion and Sedimentation Risk

CASINO COPPER AND GOLD

PALMER ENVIRONMENTAL CONSULTING GROUP INC.

Sheet 1 of 25



Legend

Overall Erosion and Sedimentation Risk

- High
- Moderate
- Low
- Streams
- Non-Permanent
- Permanet Water
- Contours (5m)

0 125 250 500 750 m

1:20,000

Grid: UTM Zone 7N

Casino Mining Corporation

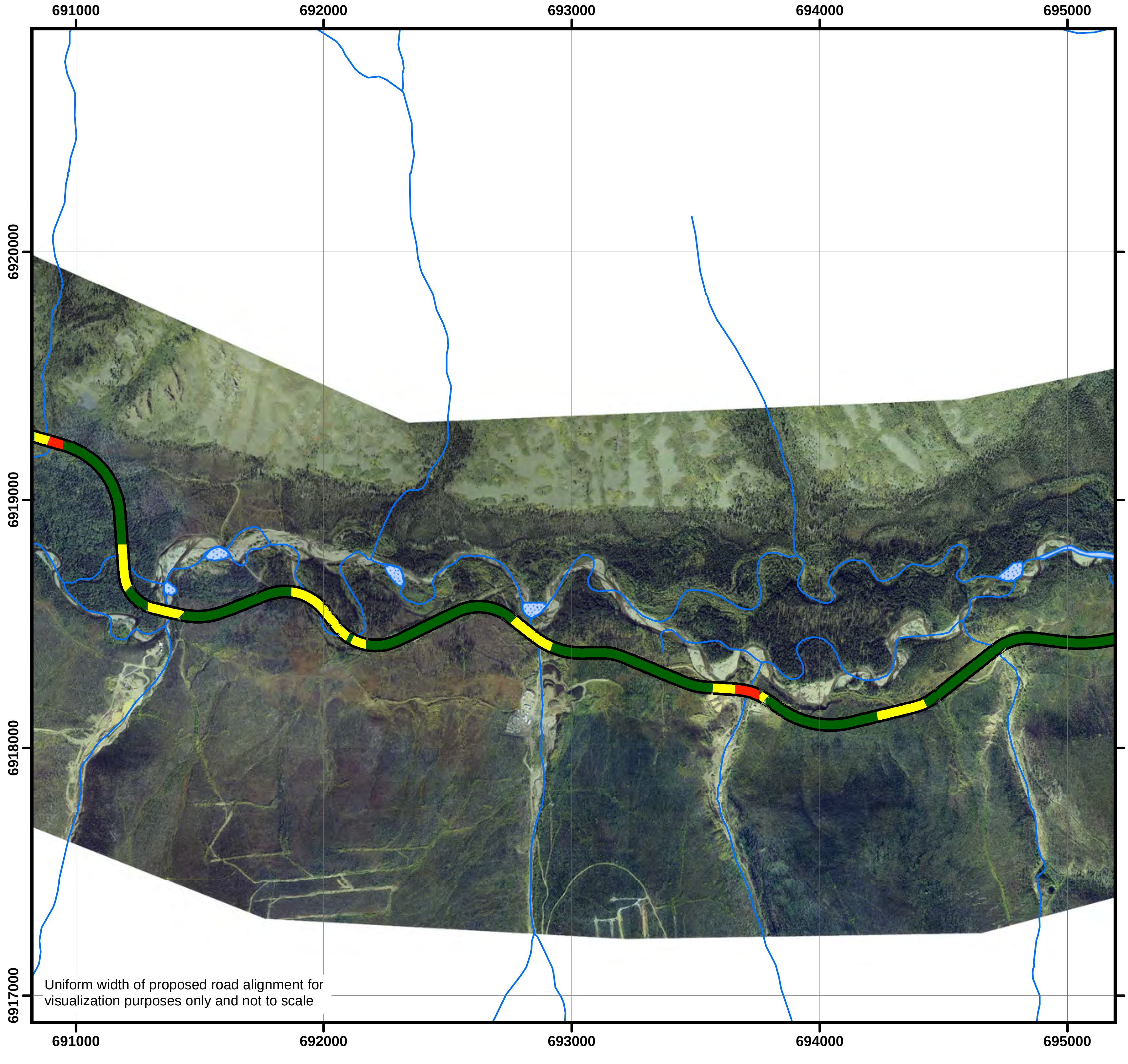
Freegold Road Extension

Map 3

Overall Erosion and Sedimentation Risk

CASINO COPPER AND GOLD

PALMER ENVIRONMENTAL CONSULTING GROUP INC.



Legend

Overall Erosion and Sedimentation Risk

High
Moderate
Low
Streams
Non-Permanent
Permanet Water
Contours (5m)

0 125 250 500 750 m

1:20,000

Grid: UTM Zone 7N

Casino Mining Corporation

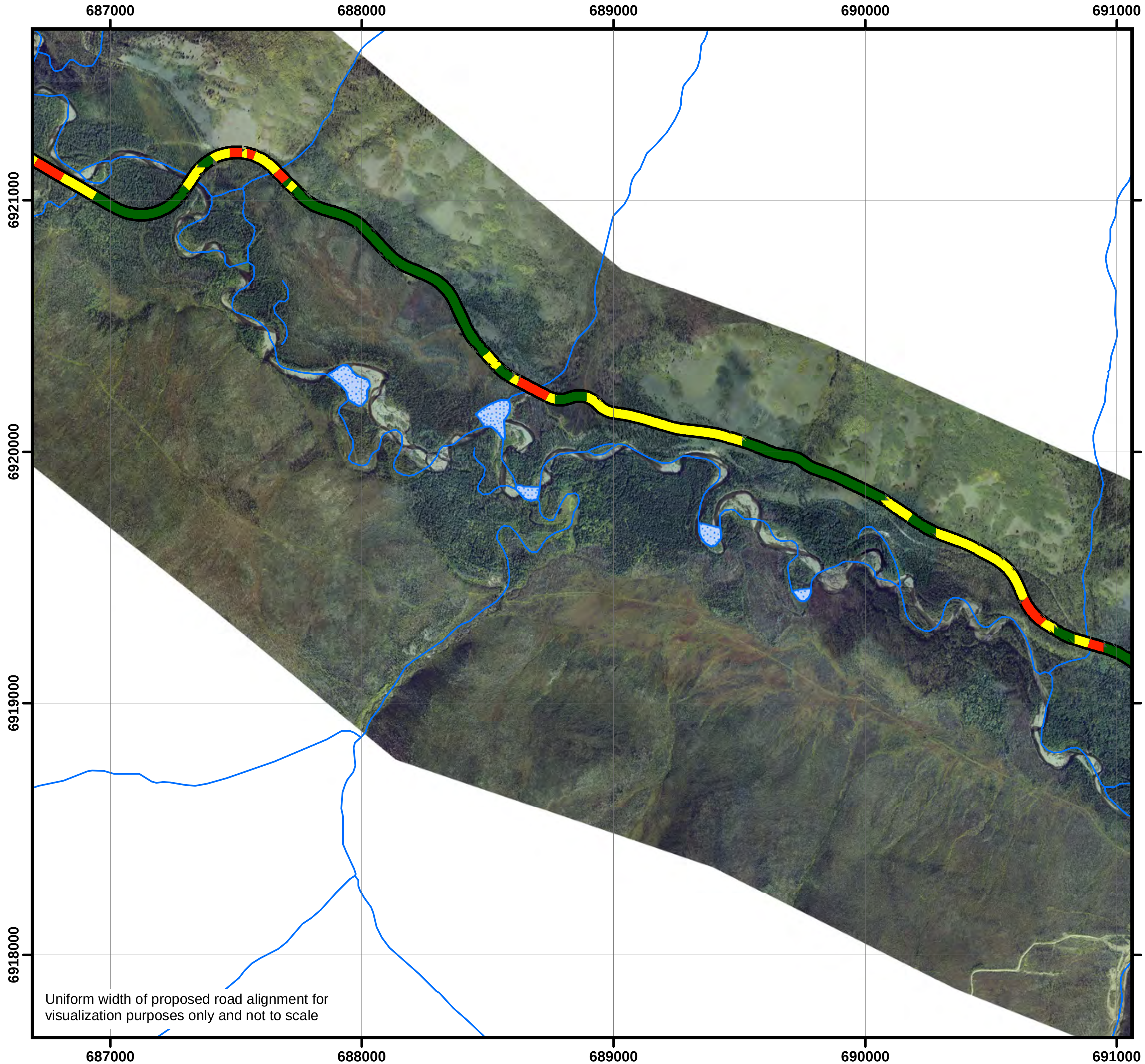
Freegold Road Extension

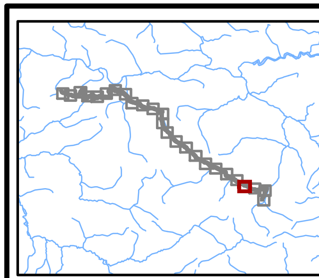
Map 3

Overall Erosion and Sedimentation Risk

CASINO COPPER AND GOLD

PALMER ENVIRONMENTAL CONSULTING GROUP INC.





Legend

Overall Erosion and Sedimentation Risk

- High
- Moderate
- Low
- Streams
- Non-Permanent
- Permanet Water
- Contours (5m)

0 125 250 500 750 m

1:20,000

Grid: UTM Zone 7N

Casino Mining Corporation

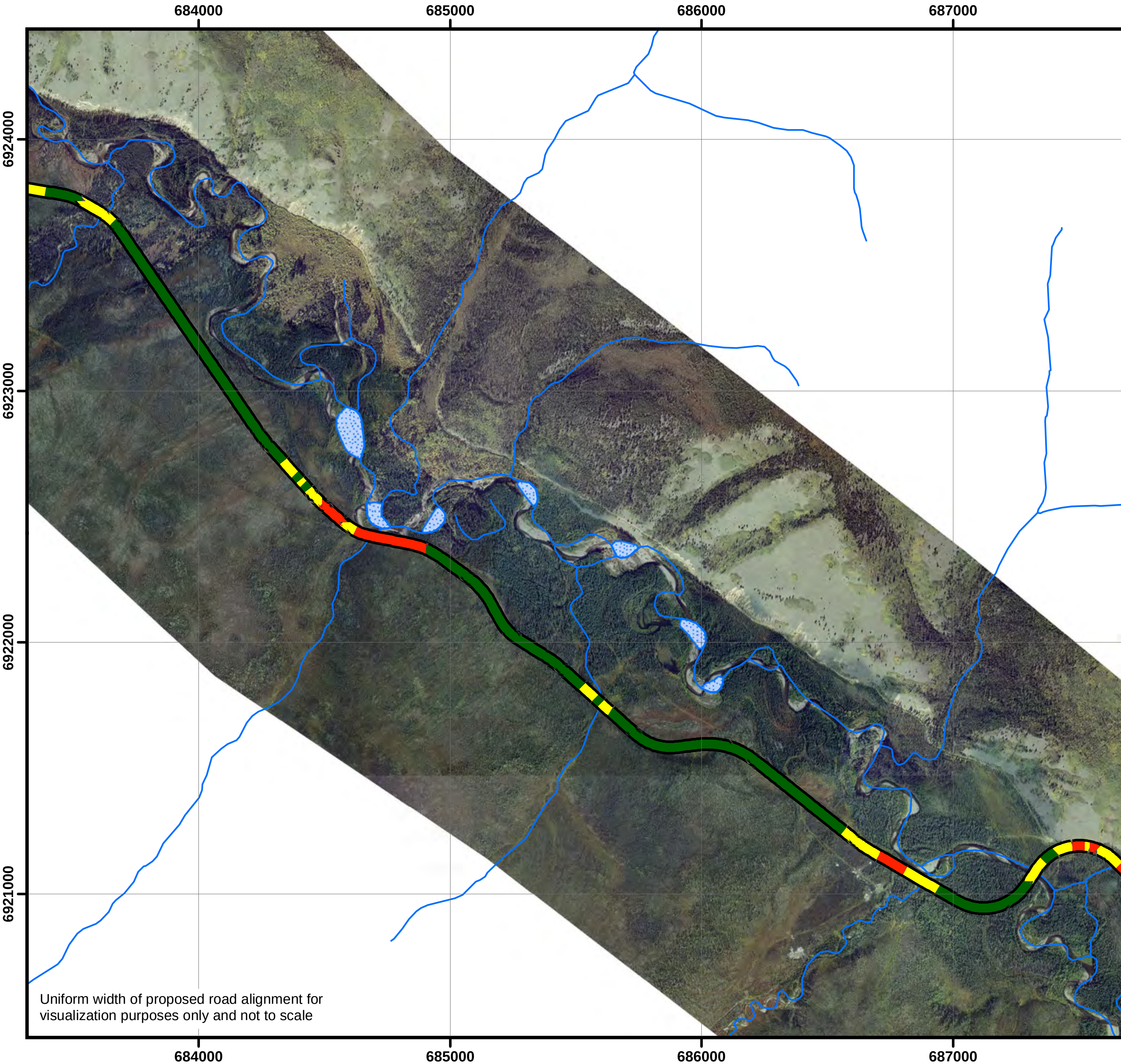
Freegold Road Extension

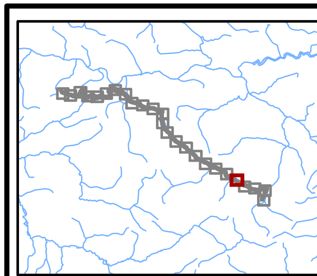
Map 3

Overall Erosion and Sedimentation Risk

CASINO COPPER AND GOLD

PALMER ENVIRONMENTAL CONSULTING GROUP INC.





Legend

Overall Erosion and Sedimentation Risk

- High
- Moderate
- Low
- Streams
- Non-Permanent
- Permanet Water
- Contours (5m)

0 125 250 500 750 m

1:20,000

Grid: UTM Zone 7N

Casino Mining Corporation

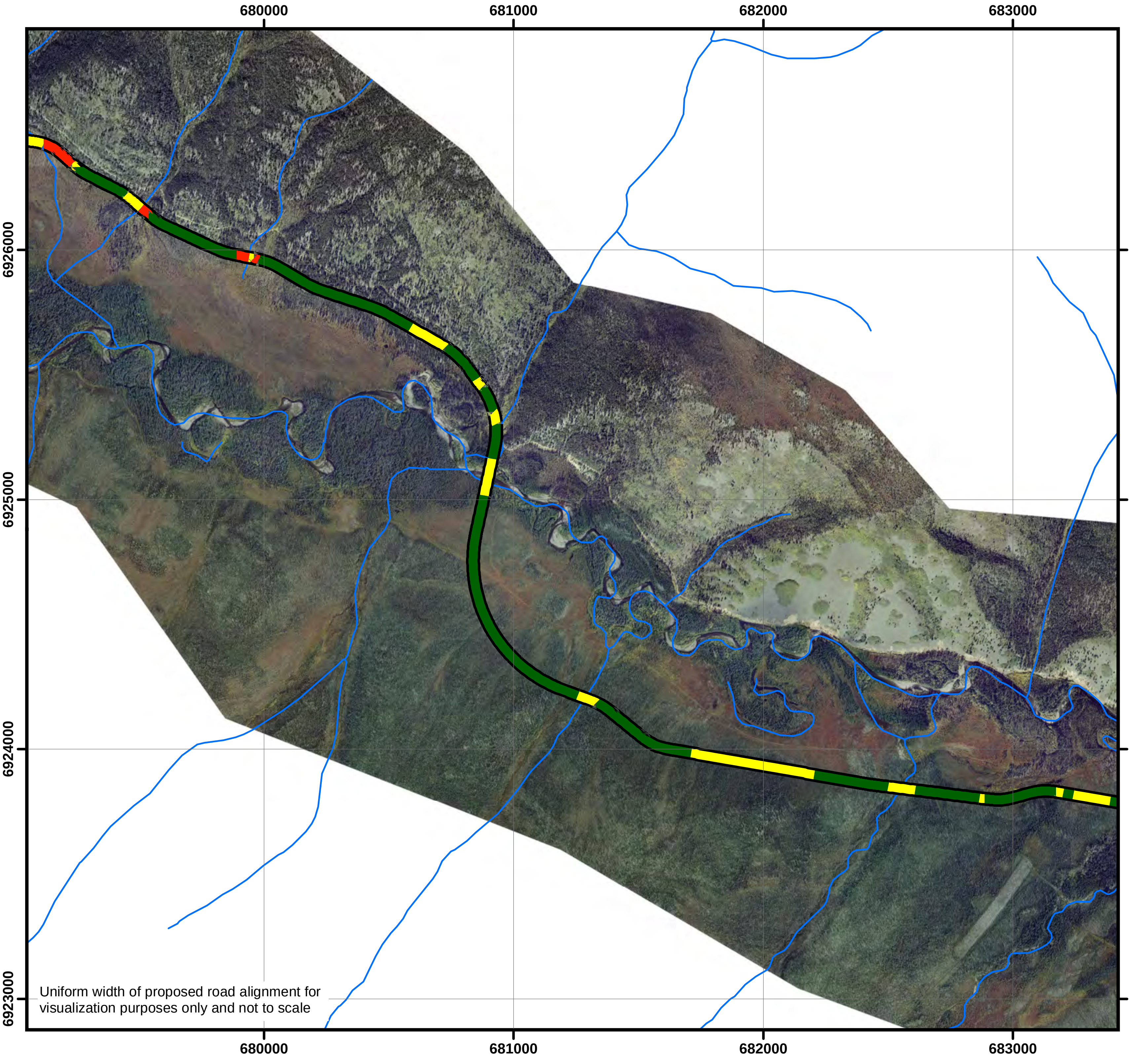
Freegold Road Extension

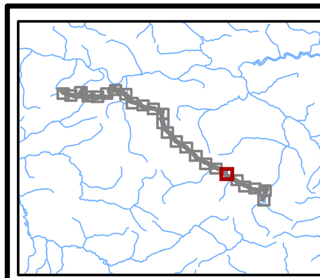
Map 3

Overall Erosion and Sedimentation Risk

CASINO COPPER AND GOLD

PALMER ENVIRONMENTAL CONSULTING GROUP INC.





Legend

Overall Erosion and Sedimentation Risk

High
Moderate
Low
Streams
Non-Permanent
Permanet Water
Contours (5m)

0 125 250 500 750 m

1:20,000

Grid: UTM Zone 7N

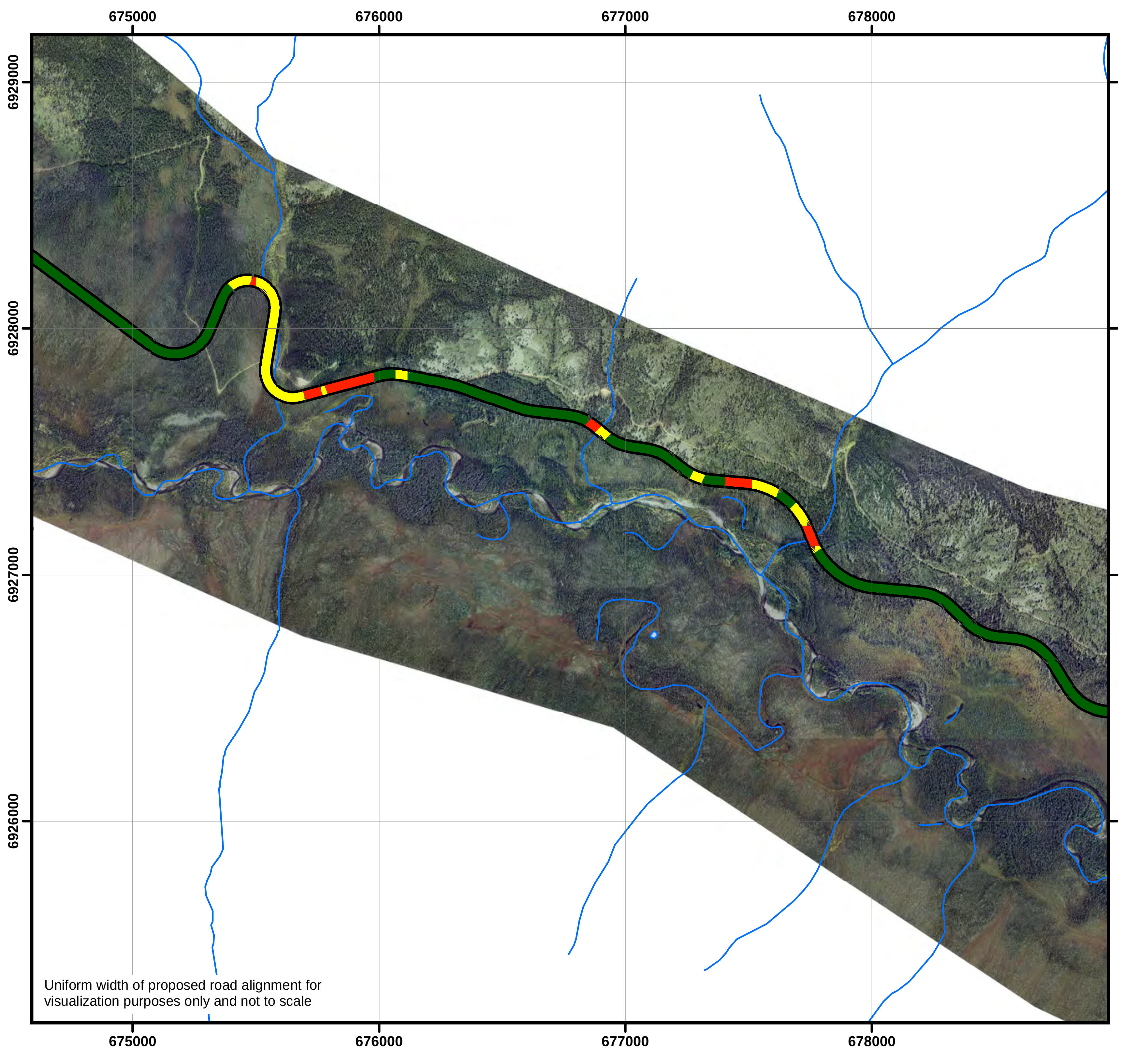
Casino Mining Corporation

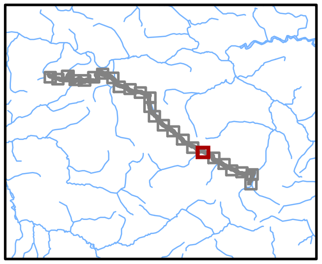
Freegold Road Extension

Map 3
Overall Erosion and Sedimentation Risk

CASINO COPPER AND GOLD

PALMER ENVIRONMENTAL CONSULTING GROUP INC.





Legend

Overall Erosion and Sedimentation Risk

- High
- Moderate
- Low
- Streams
- Non-Permanent
- Permanet Water
- Contours (5m)

0 125 250 500 750 m

1:20,000

Grid: UTM Zone 7N

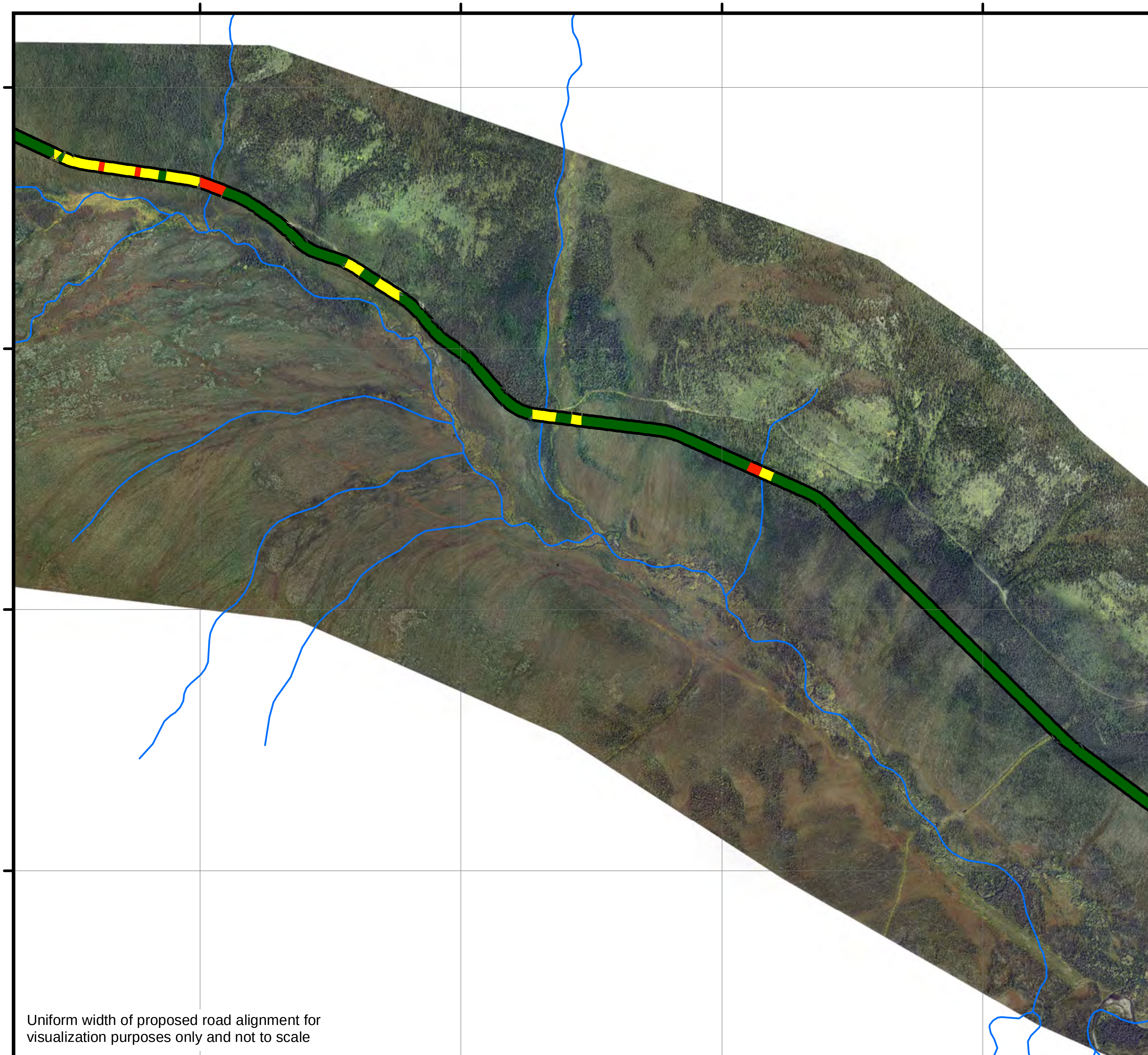
Casino Mining Corporation

Freegold Road Extension

Map 3
Overall Erosion and Sedimentation Risk

CASINO COPPER AND GOLD

PALMER ENVIRONMENTAL CONSULTING GROUP INC.



Legend

Overall Erosion and Sedimentation Risk

High
Moderate
Low
Streams
Non-Permanent
Permanet Water
Contours (5m)

0 125 250 500 750 m

1:20,000

Grid: UTM Zone 7N

Casino Mining Corporation

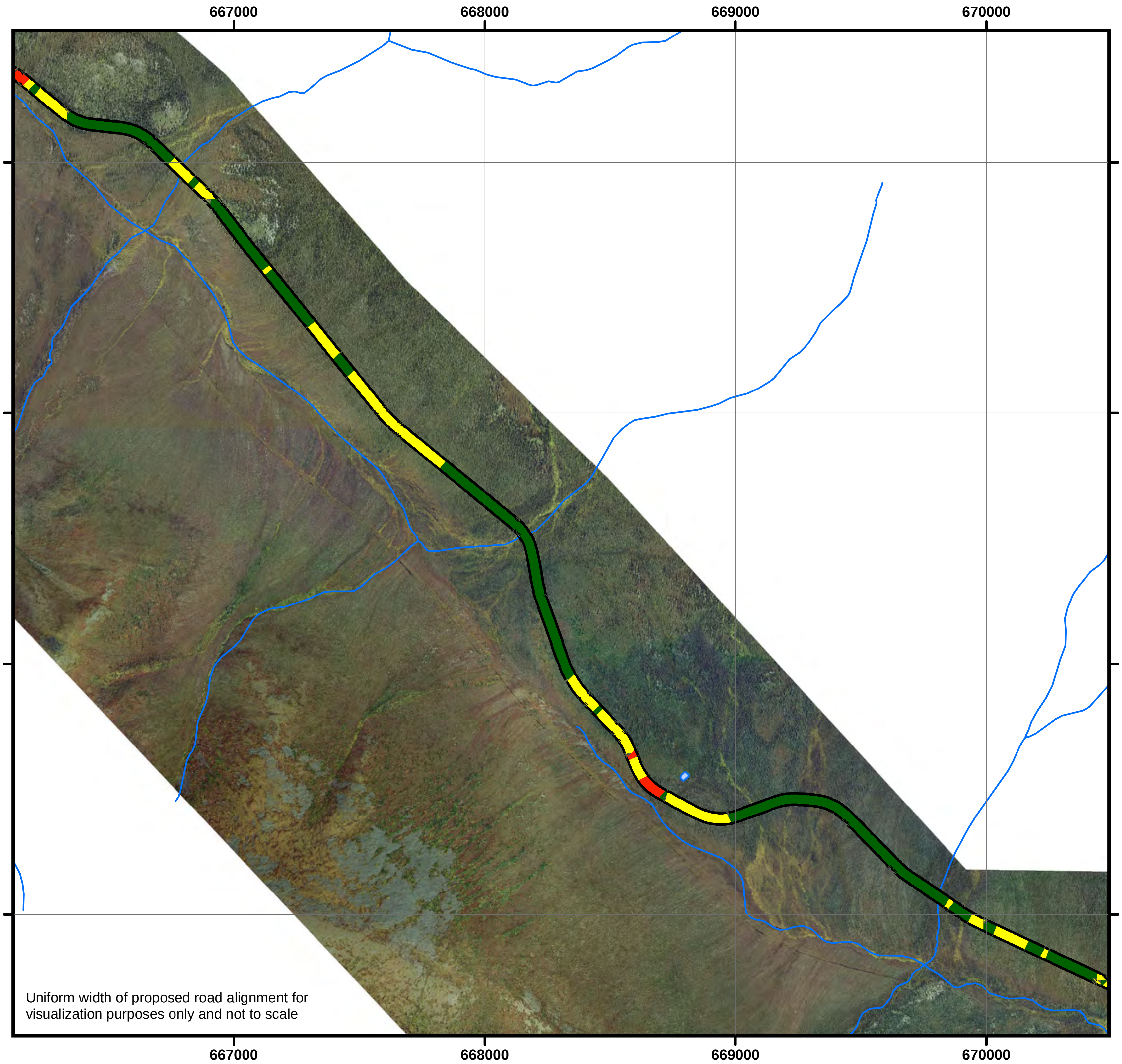
Freegold Road Extension

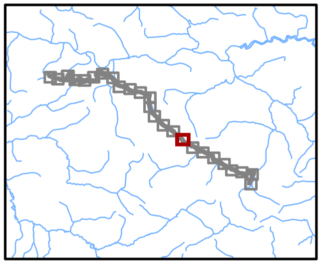
Map 3
Overall Erosion and Sedimentation Risk

CASINO COPPER AND GOLD

PALMER ENVIRONMENTAL CONSULTING GROUP INC.

Sheet 8 of 25





Legend

Overall Erosion and Sedimentation Risk

- High
- Moderate
- Low
- Streams
- Non-Permanent
- Permanet Water
- Contours (5m)

0 125 250 500 750 m

1:20,000

Grid: UTM Zone 7N

Casino Mining Corporation

Freegold Road Extension

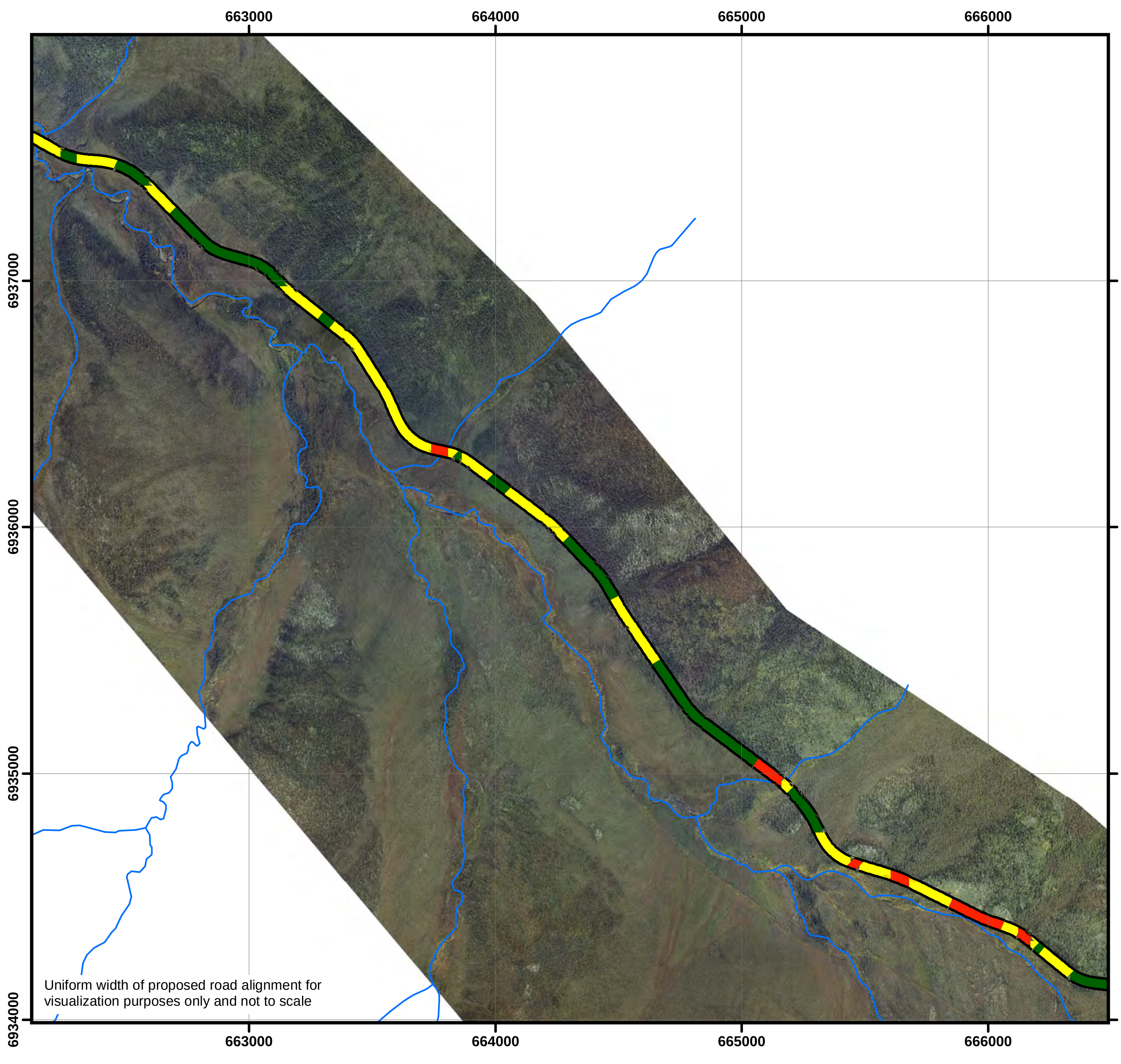
Map 3

Overall Erosion and Sedimentation Risk

CASINO COPPER AND GOLD

PALMER ENVIRONMENTAL CONSULTING GROUP INC.

Sheet 9 of 25



Legend

Overall Erosion and Sedimentation Risk

- High
- Moderate
- Low
- Streams
- Non-Permanent
- Permanet Water
- Contours (5m)

0 125 250 500 750 m

1:20,000

Grid: UTM Zone 7N

Casino Mining Corporation

Freegold Road Extension

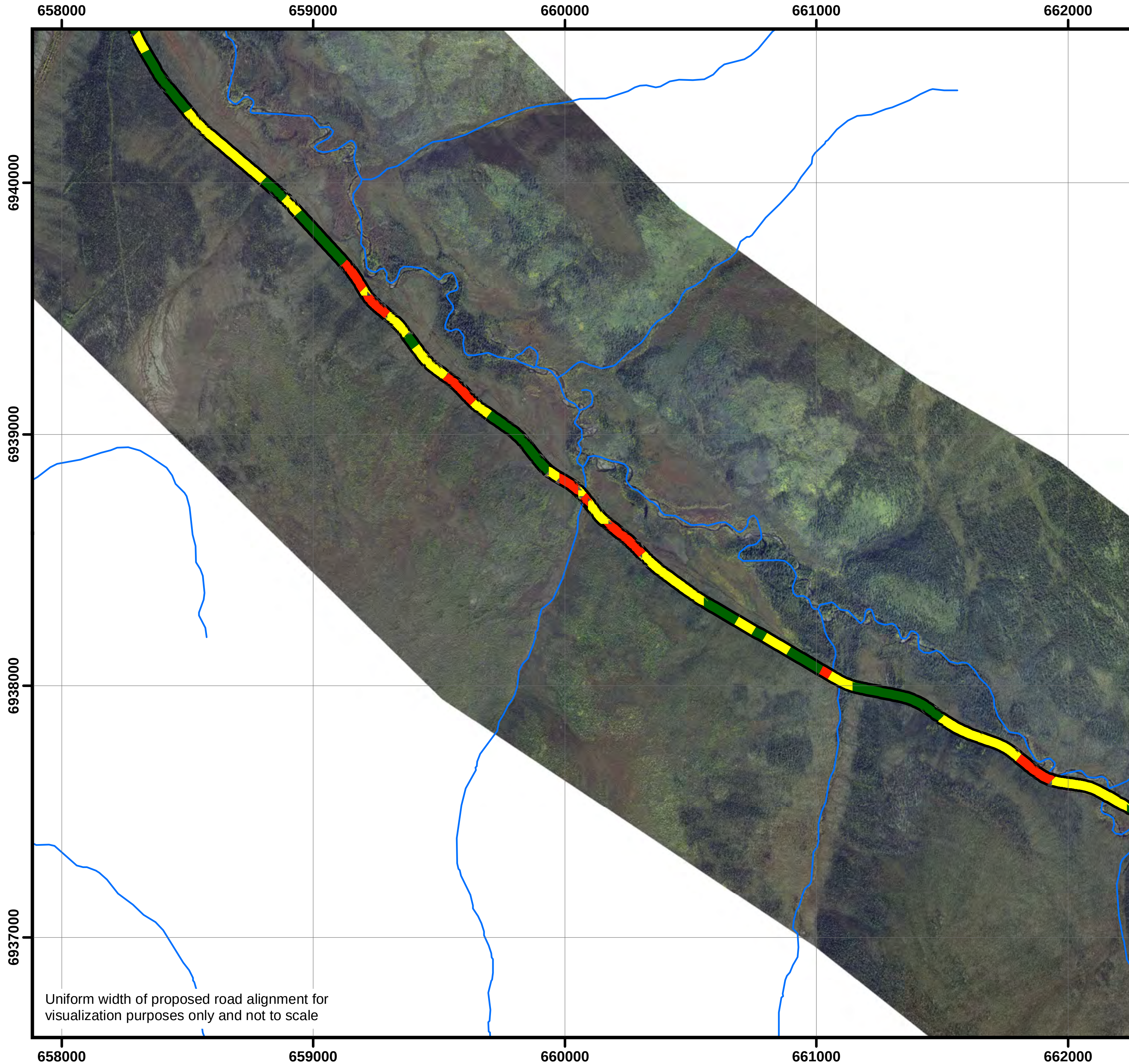
Map 3

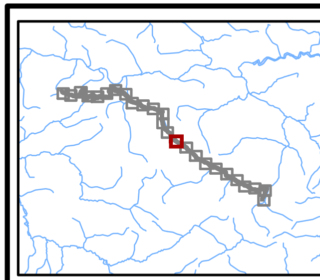
Overall Erosion and Sedimentation Risk

CASINO COPPER AND GOLD

PALMER ENVIRONMENTAL CONSULTING GROUP INC.

Sheet 10 of 25





Legend

Overall Erosion and Sedimentation Risk

- High
- Moderate
- Low
- Streams
- Non-Permanent
- Permanet Water
- Contours (5m)

0 125 250 500 750 m

1:20,000

Grid: UTM Zone 7N

Casino Mining Corporation

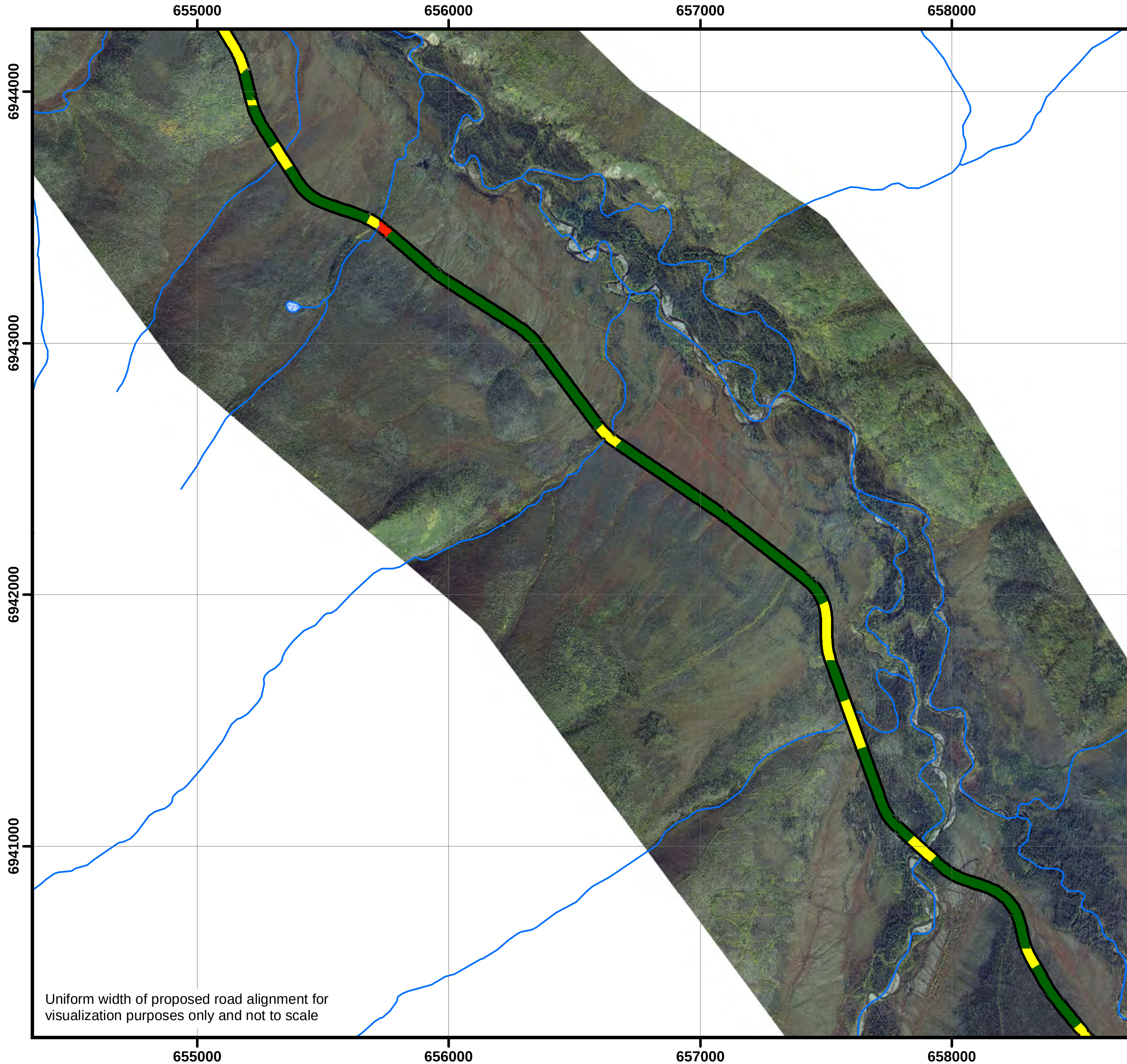
Freegold Road Extension

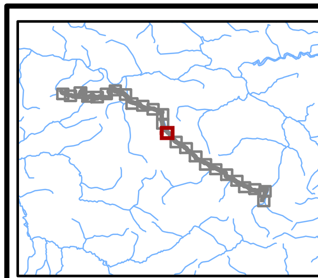
Map 3

Overall Erosion and Sedimentation Risk

CASINO COPPER AND GOLD

PALMER ENVIRONMENTAL CONSULTING GROUP INC.





Legend

Overall Erosion and Sedimentation Risk

- High
- Moderate
- Low
- Streams
- Non-Permanent
- Permanent Water
- Contours (5m)

0 125 250 500 750 m

1:20,000

Grid: UTM Zone 7N

Casino Mining Corporation

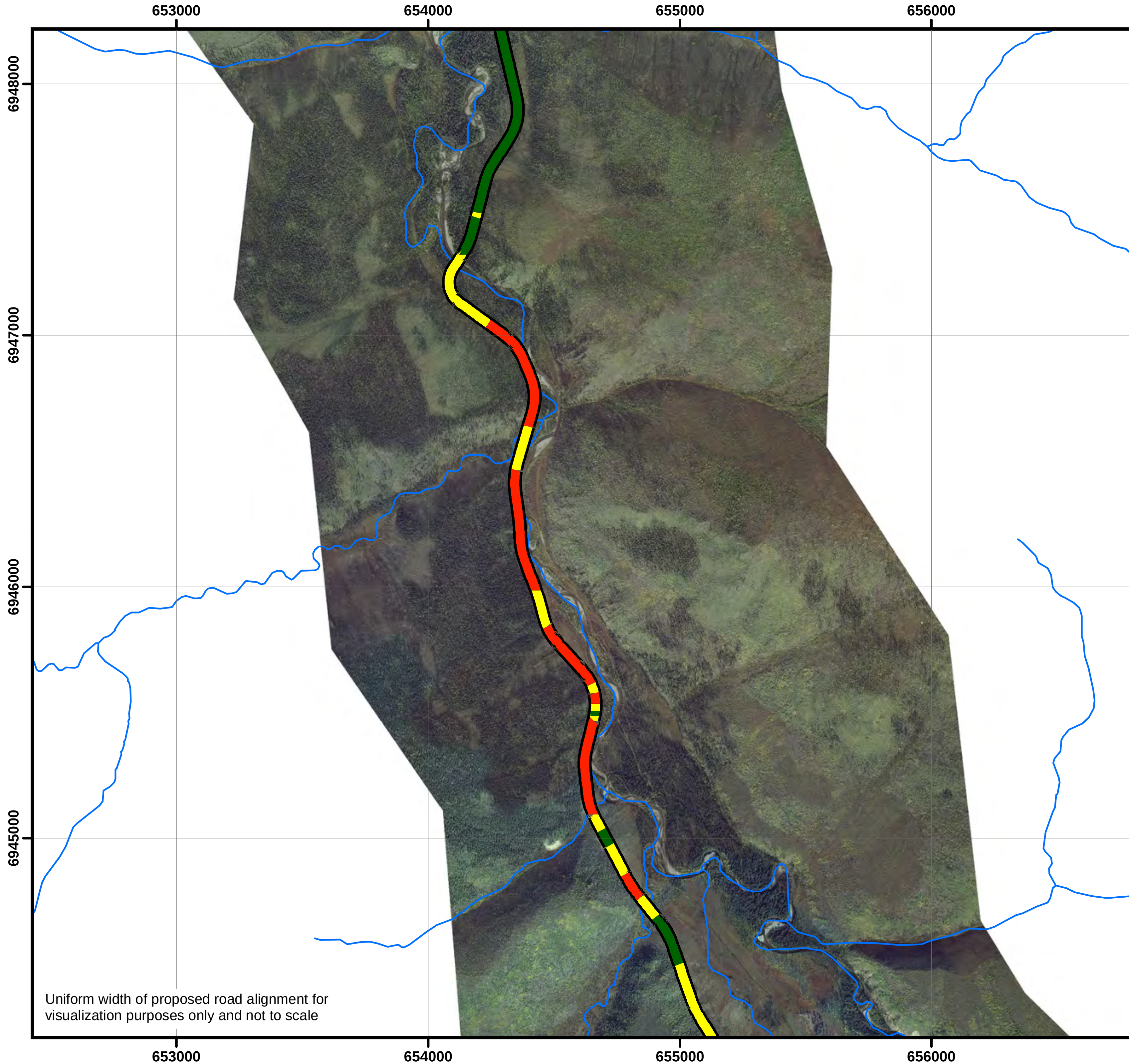
Freegold Road Extension

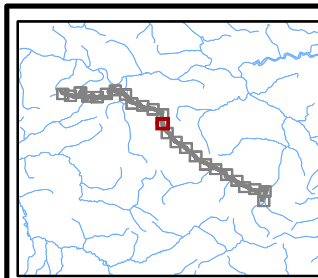
Map 3

Overall Erosion and Sedimentation Risk

CASINO COPPER AND GOLD

PALMER ENVIRONMENTAL CONSULTING GROUP INC.





Legend

Overall Erosion and Sedimentation Risk

High

Moderate

Low

Streams

Non-Permanent

Permanet Water

Contours (5m)

0 125 250 500 750 m

1:20,000

Grid: UTM Zone 7N

Casino Mining Corporation

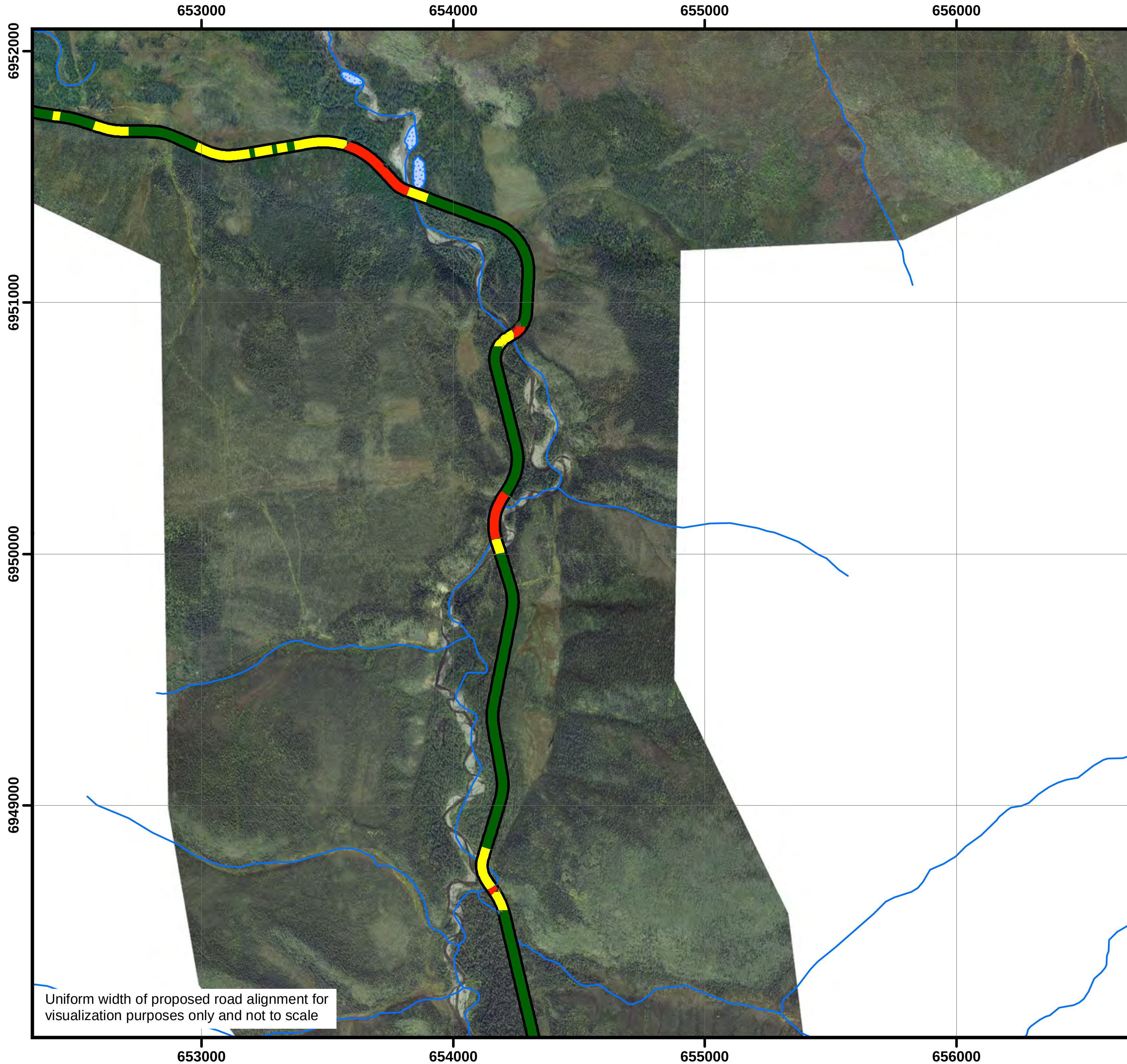
Freegold Road Extension

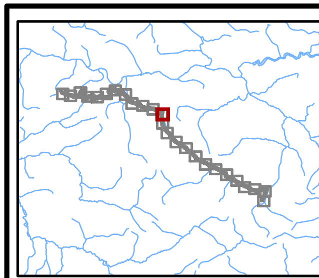
Map 3

Overall Erosion and Sedimentation Risk

CASINO COPPER AND GOLD

PALMER ENVIRONMENTAL CONSULTING GROUP INC.





Legend

Overall Erosion and Sedimentation Risk

High
Moderate
Low
Streams
Non-Permanent
Permanet Water
Contours (5m)

0 125 250 500 750 m

1:20,000

Grid: UTM Zone 7N

Casino Mining Corporation

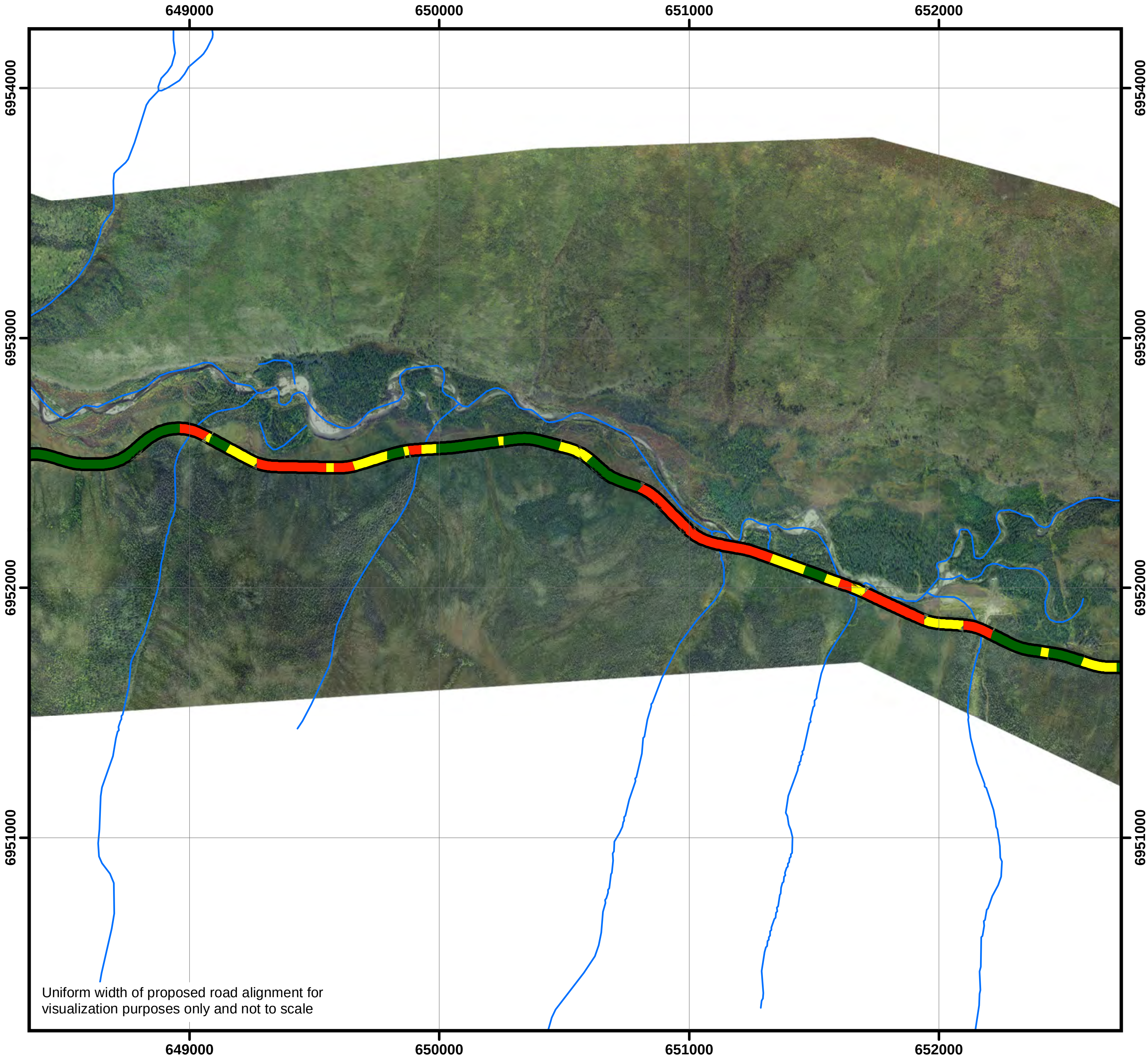
Freegold Road Extension

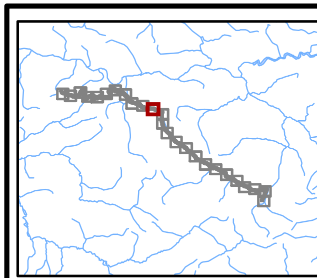
Map 3

Overall Erosion and Sedimentation Risk

CASINO COPPER AND GOLD

PALMER ENVIRONMENTAL CONSULTING GROUP INC.





Legend

Overall Erosion and Sedimentation Risk

High
Moderate
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Streams
Non-Permanent
Permanet Water
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Casino Mining Corporation

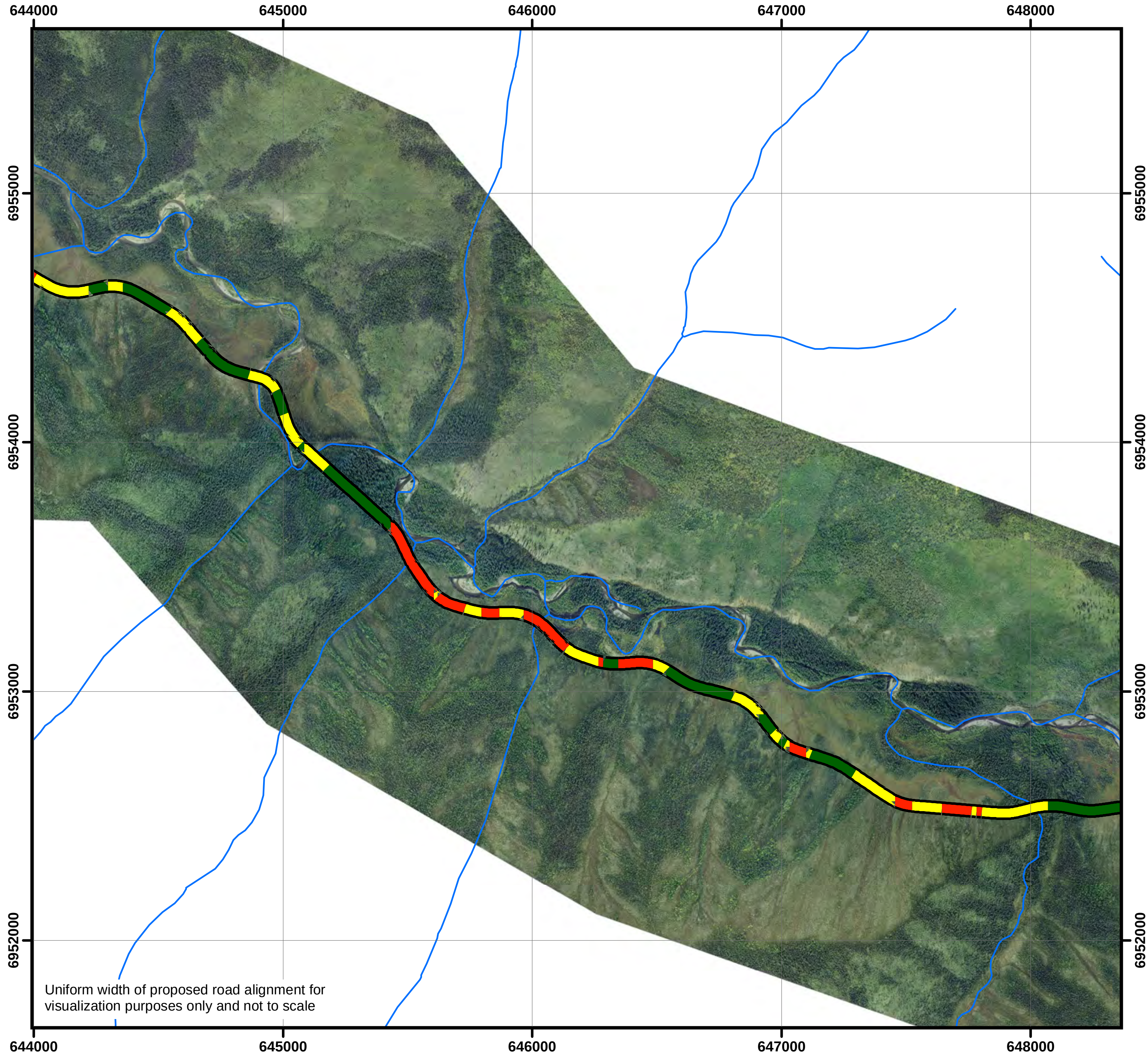
Freegold Road Extension

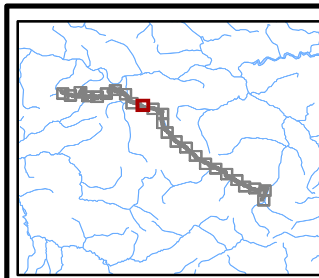
Map 3

Overall Erosion and Sedimentation Risk

CASINO COPPER AND GOLD

PALMER ENVIRONMENTAL CONSULTING GROUP INC.





Legend

Overall Erosion and Sedimentation Risk

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- Streams
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Casino Mining Corporation

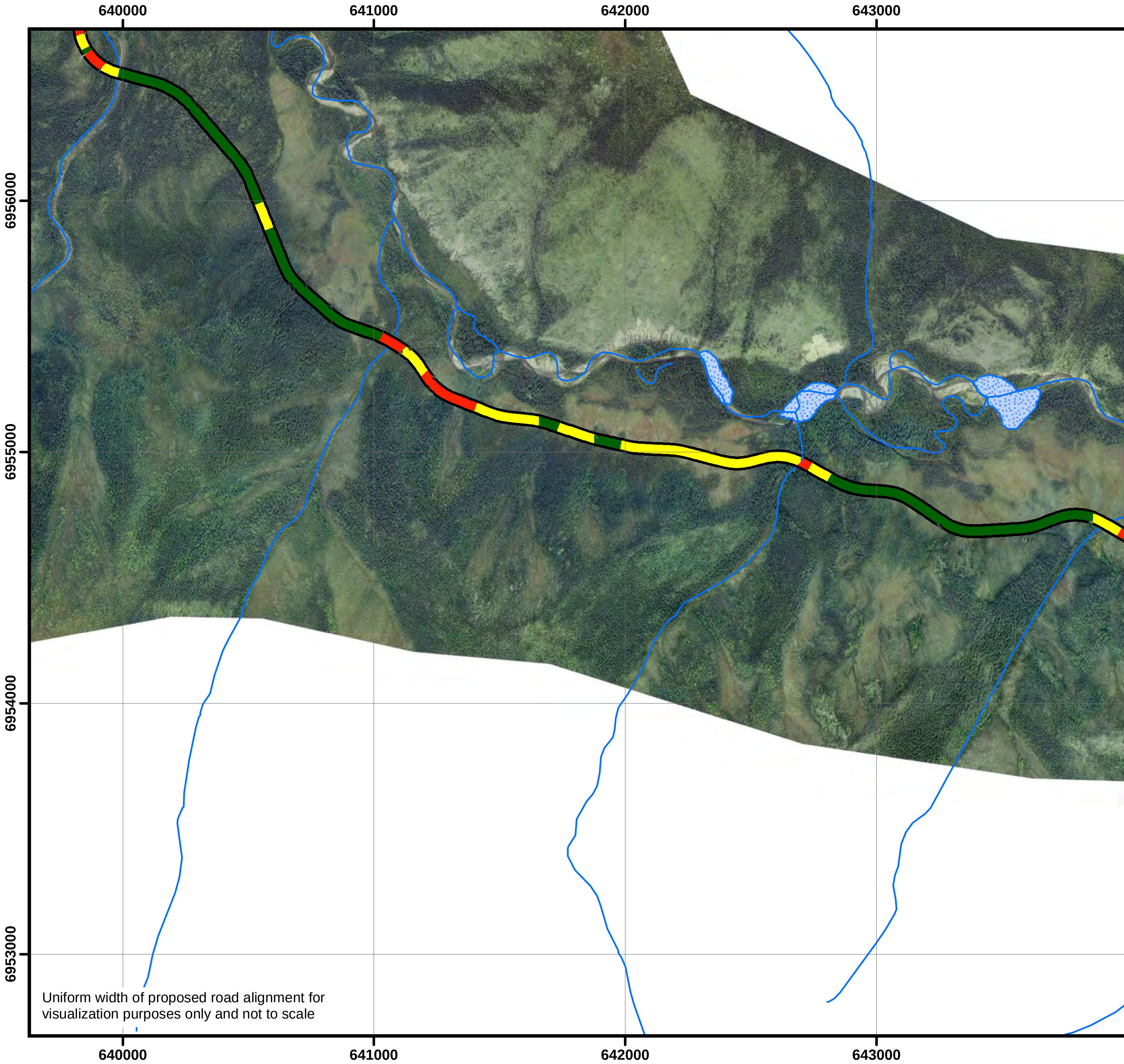
Freegold Road Extension

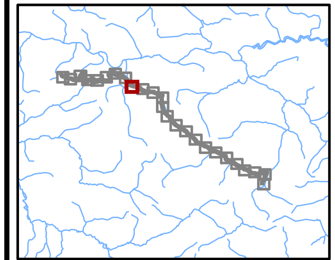
Map 3

Overall Erosion and Sedimentation Risk

CASINO COPPER AND GOLD

PALMER ENVIRONMENTAL CONSULTING GROUP INC.





Legend

Overall Erosion and Sedimentation Risk

High
Moderate
Low
Streams
Non-Permanent
Permanent Water
Contours (5m)

0 125 250 500 750 m

1:20,000

Grid: UTM Zone 7N

Casino Mining Corporation

Freegold Road Extension

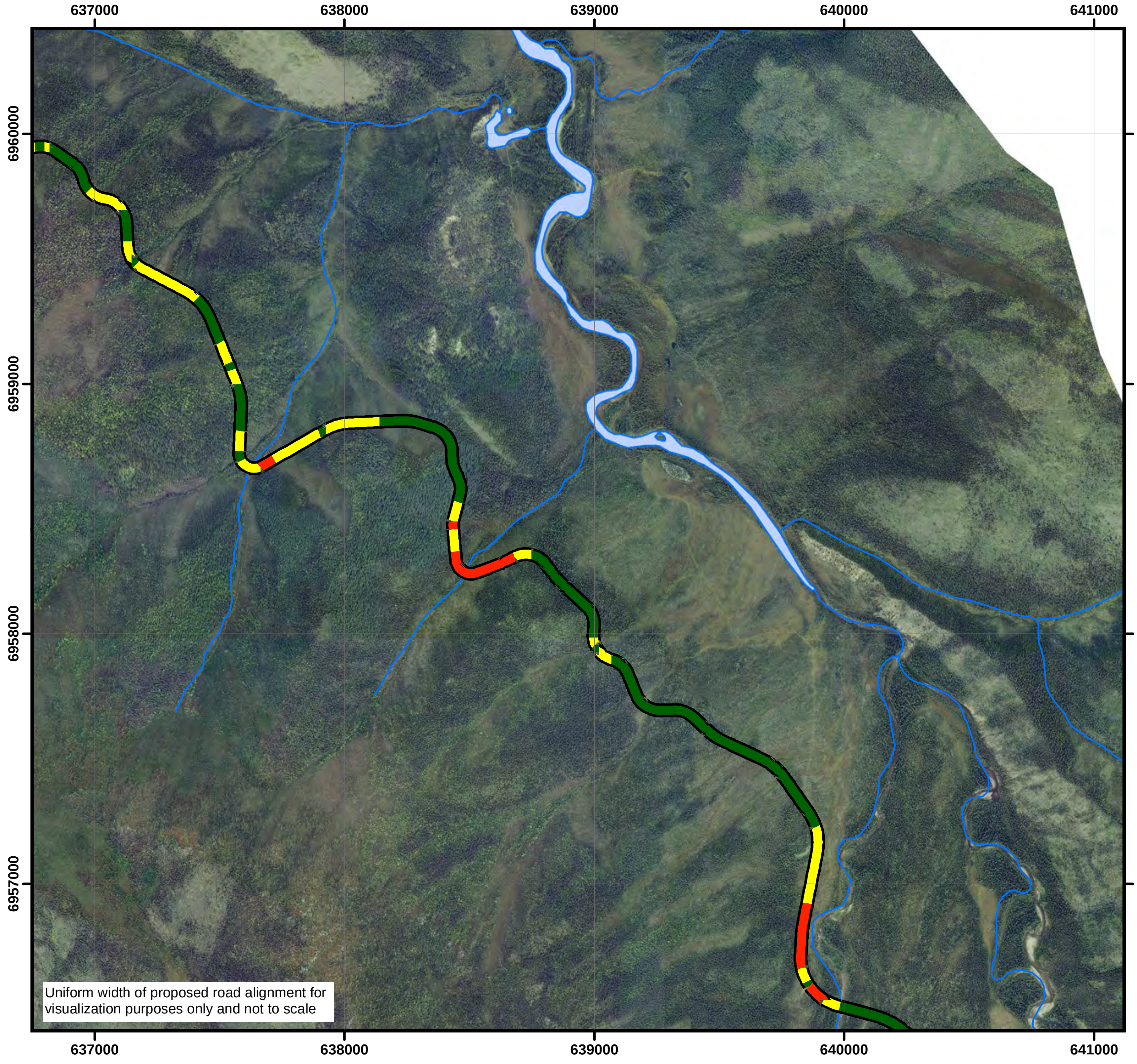
Map 3

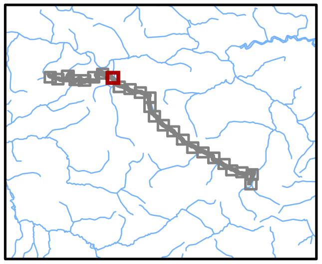
Overall Erosion and Sedimentation Risk

CASINO COPPER AND GOLD

PALMER ENVIRONMENTAL CONSULTING GROUP INC.

Sheet 17 of 25





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Casino Mining Corporation

Freegold Road Extension

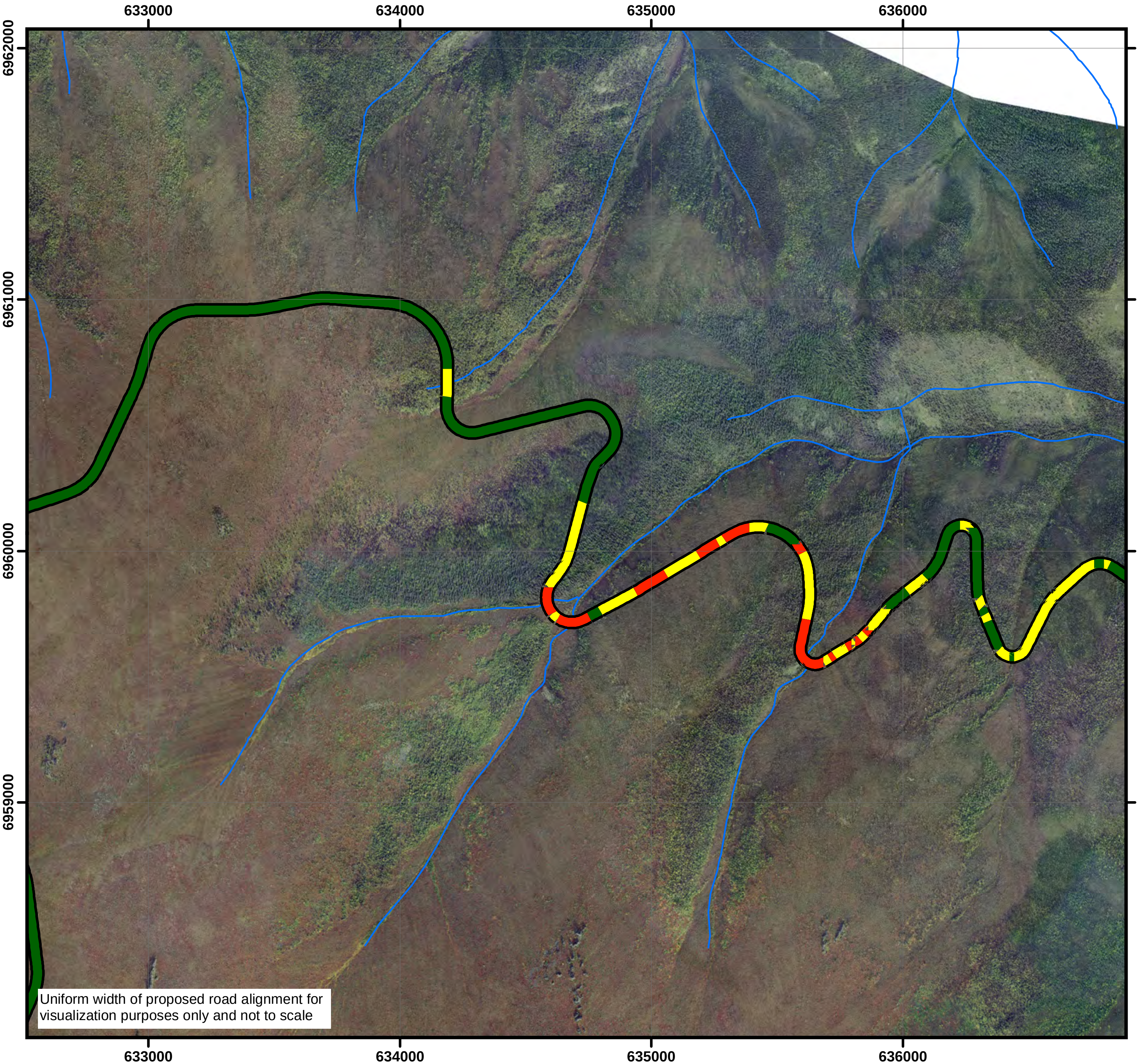
Map 3

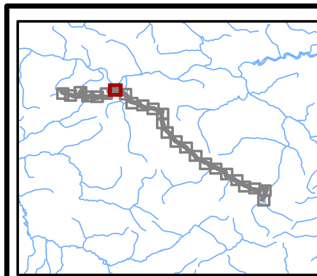
Overall Erosion and Sedimentation Risk

CASINO COPPER AND GOLD

PALMER ENVIRONMENTAL CONSULTING GROUP INC.

Sheet 18 of 25





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Casino Mining Corporation

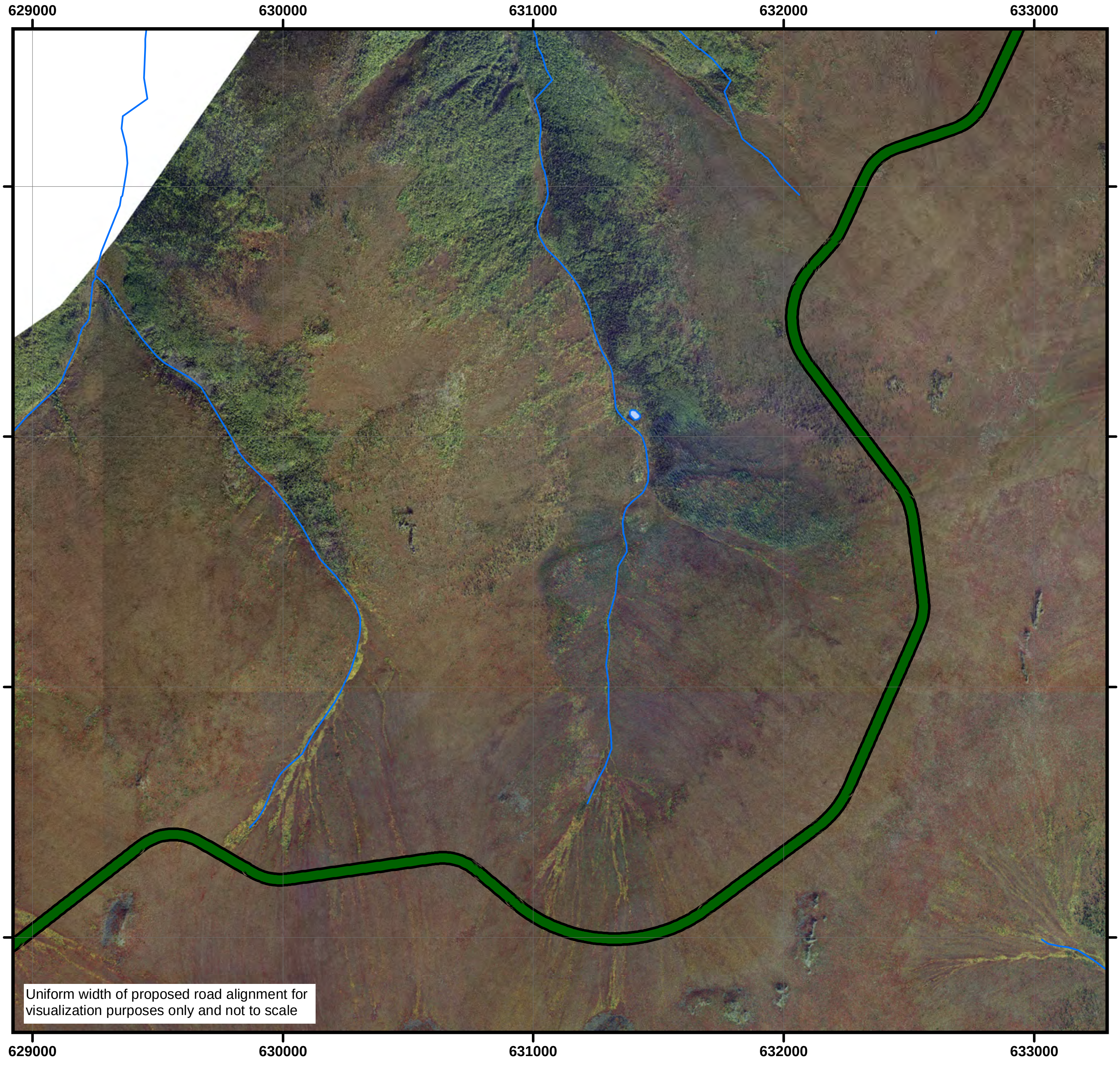
Freegold Road Extension

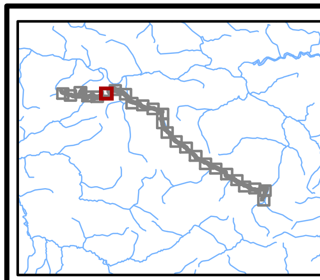
Map 3

Overall Erosion and Sedimentation Risk

CASINO COPPER AND GOLD

PALMER ENVIRONMENTAL CONSULTING GROUP INC.





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Casino Mining Corporation

Freegold Road Extension

Map 3

Overall Erosion and Sedimentation Risk

CASINO COPPER AND GOLD

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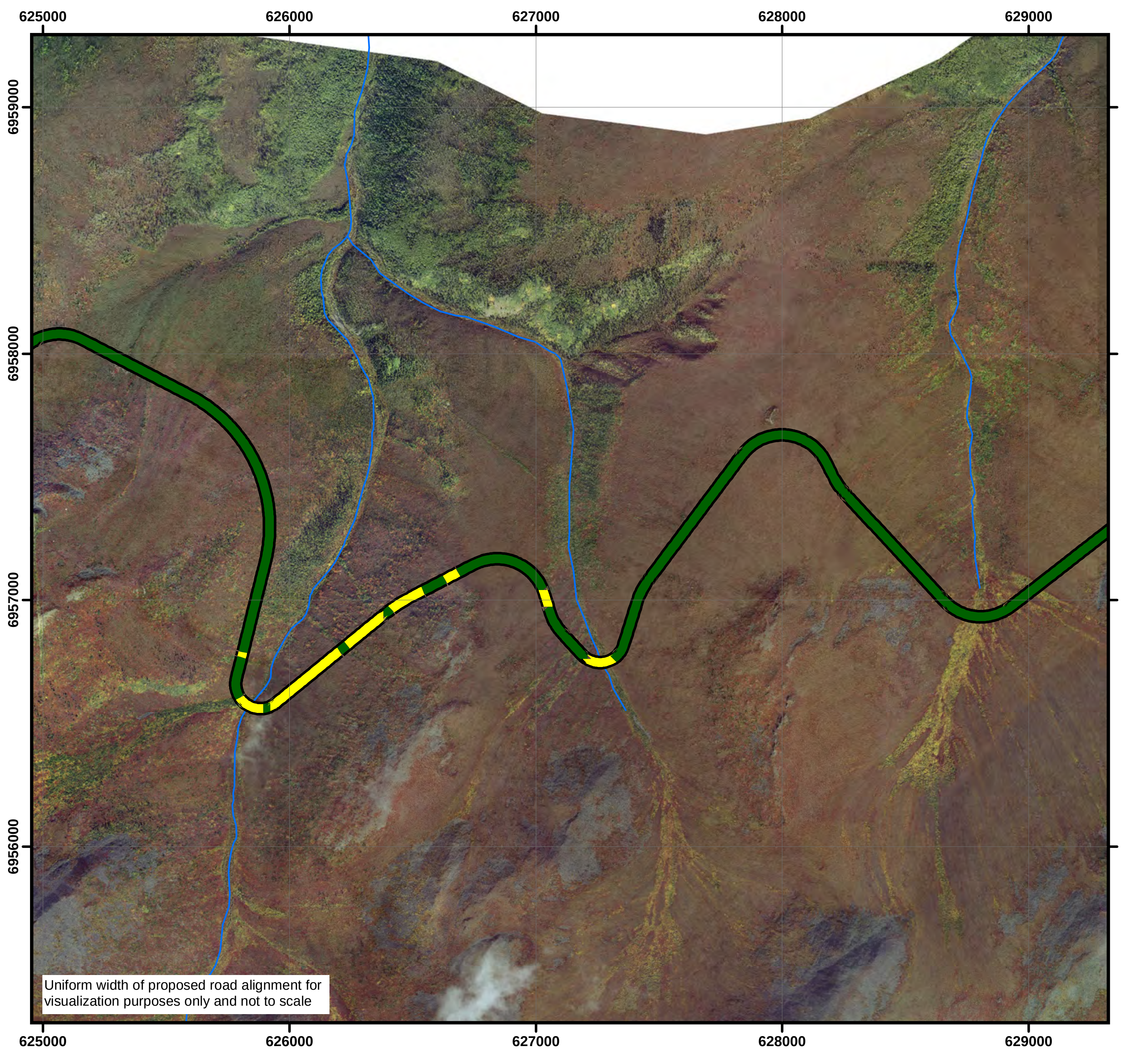

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Casino Mining Corporation

Freegold Road Extension

Map 3

Overall Erosion and Sedimentation Risk

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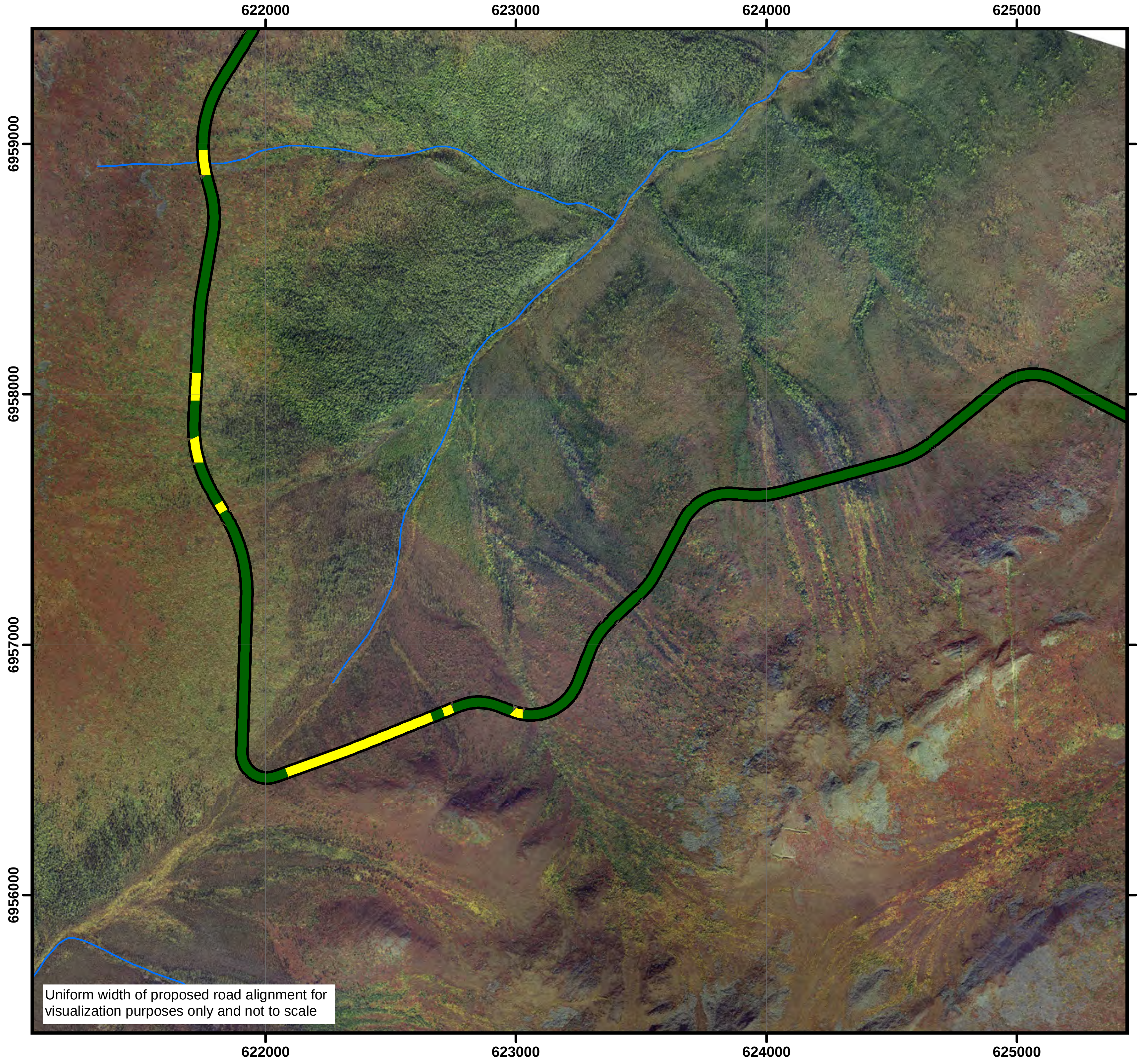

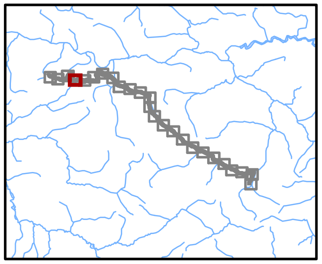

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Casino Mining Corporation

Freegold Road Extension

Map 3

Overall Erosion and Sedimentation Risk

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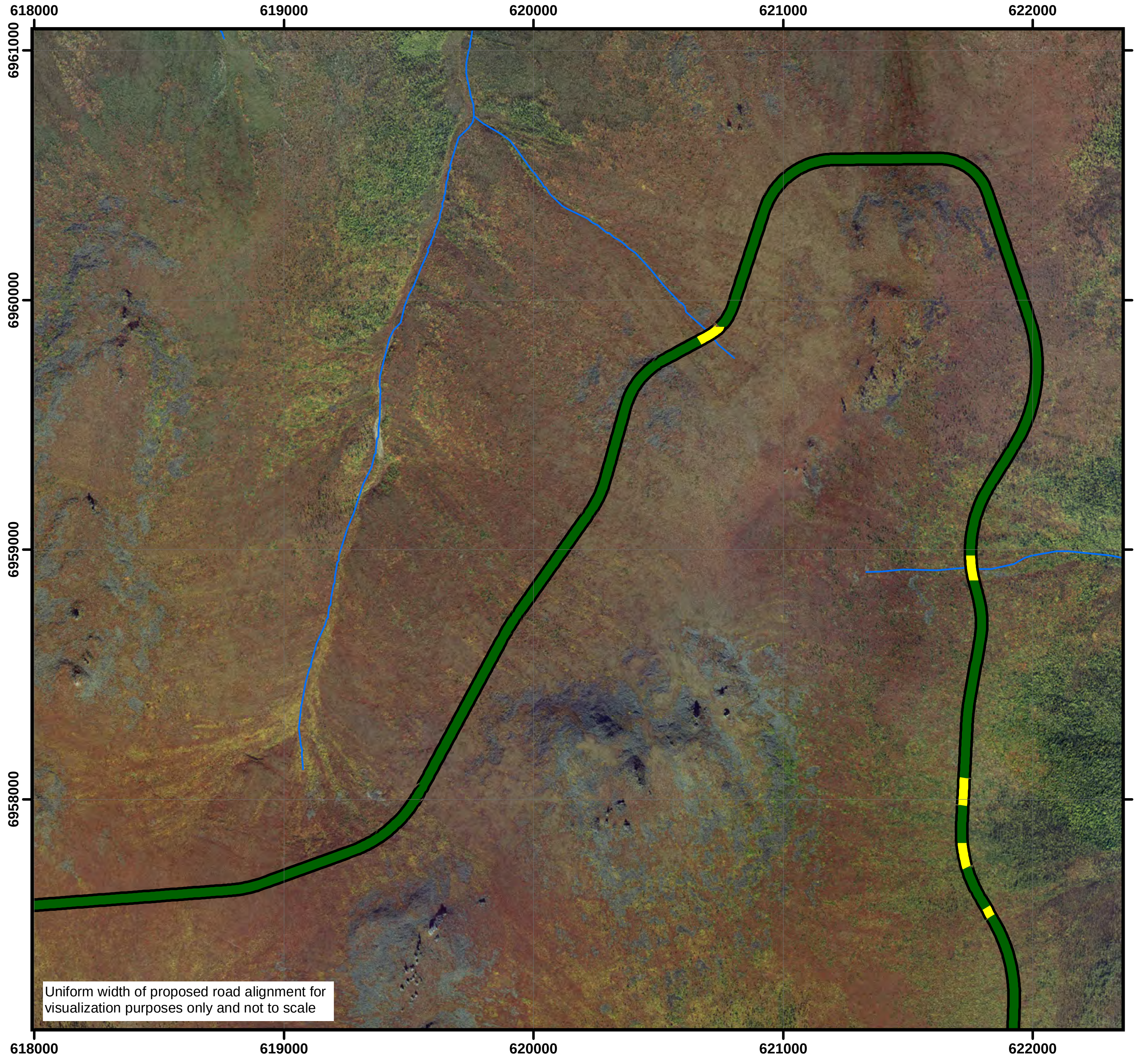

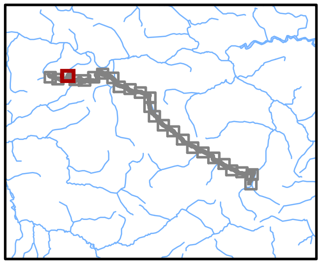

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Casino Mining Corporation

Freegold Road Extension

Map 3

Overall Erosion and Sedimentation Risk

CASINO COPPER AND GOLD

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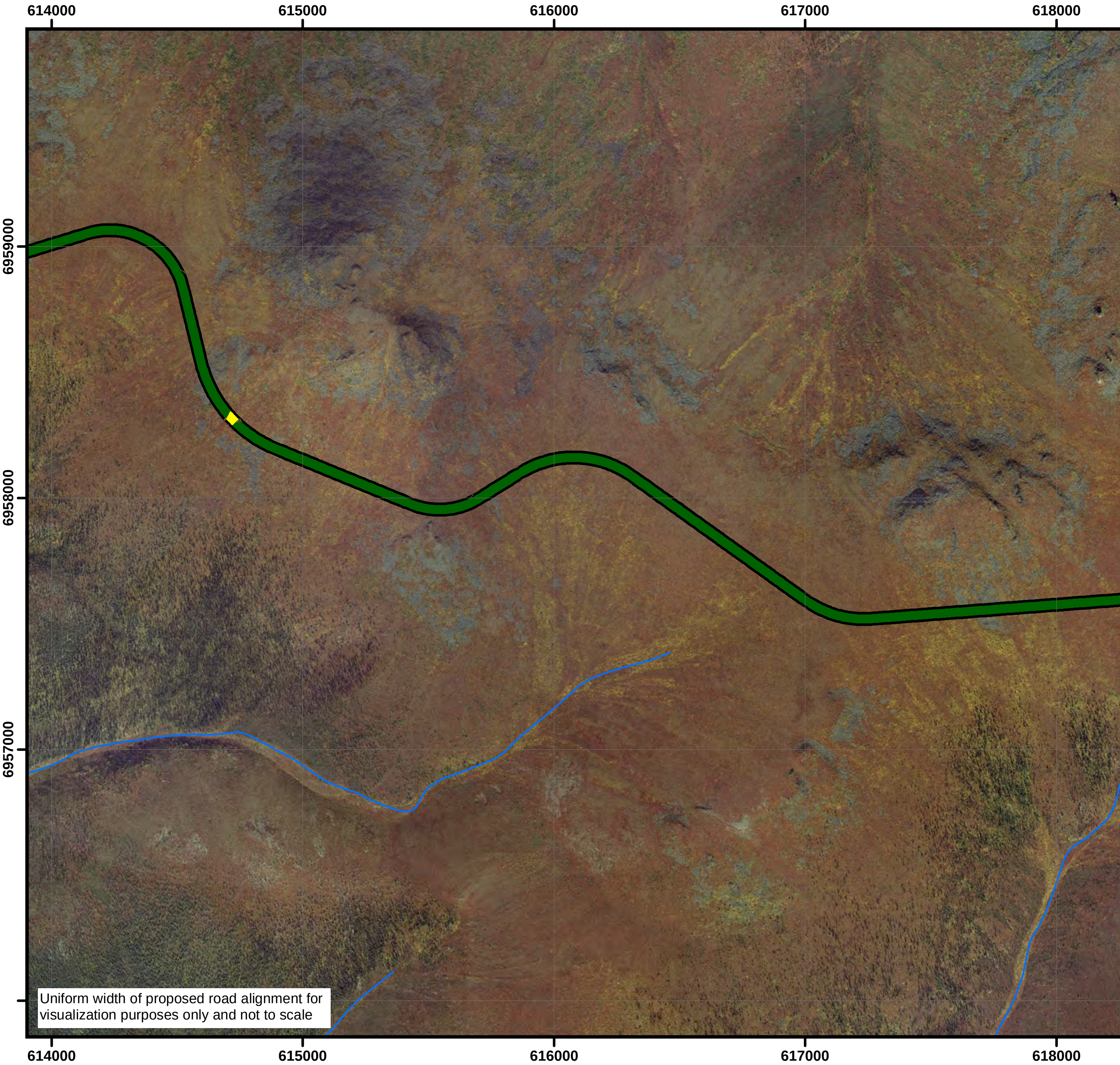

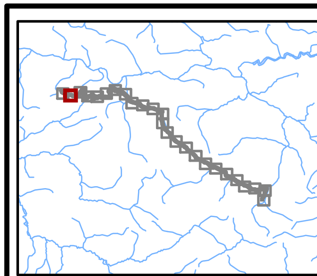

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Map 3

Overall Erosion and Sedimentation Risk

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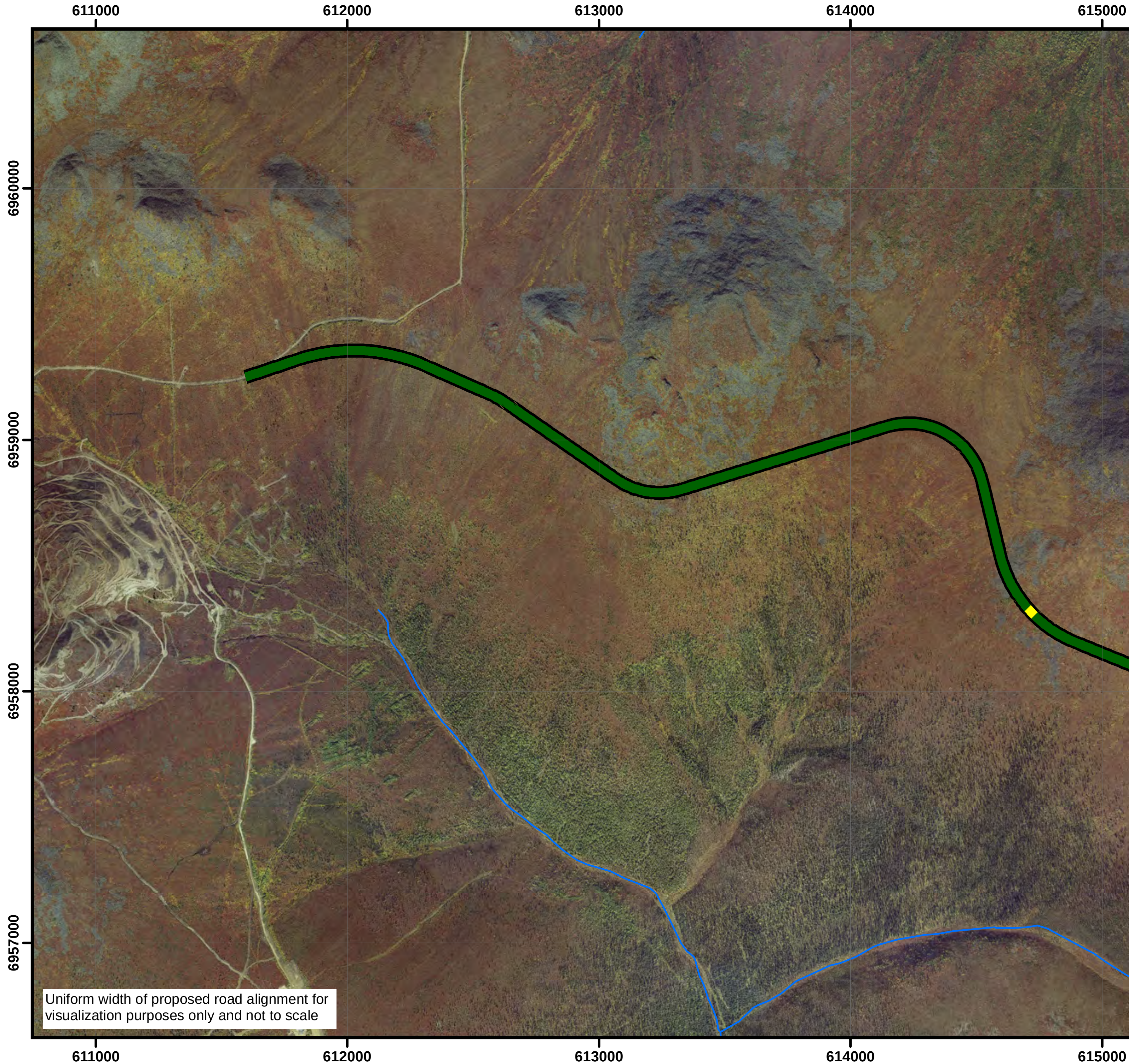

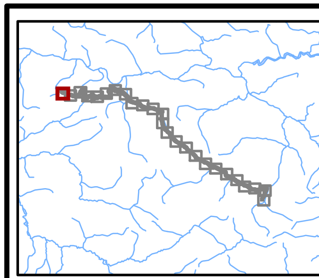

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Casino Mining Corporation

Freegold Road Extension

Map 3

Overall Erosion and Sedimentation Risk

CASINO COPPER AND GOLD

PALMER ENVIRONMENTAL CONSULTING GROUP INC.

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