



**CONSTRUCTION SEDIMENT &  
EROSION CONTROL AND WATER  
MANAGEMENT PLAN**

***VERSION 2013-01***

**EAGLE GOLD PROJECT**

**Prepared by:  
StrataGold Corporation & Knight Piésold Ltd.  
September 2013**

**TABLE OF CONTENTS**

**1 Introduction ..... 1**

    1.1 Project Summary..... 1

    1.2 Scope of Plan..... 5

**2 Site Conditions..... 6**

    2.1 Hydrometeorology..... 6

        2.1.1 Intensity-Duration-Frequency Data ..... 6

    2.2 Soils..... 6

**3 Construction Water Management Approach..... 8**

    3.1 Objectives ..... 8

    3.2 Strategies ..... 8

    3.3 Design ..... 8

        3.3.1 Storm Water Design Criteria ..... 8

    3.4 Sediment and Erosion Control ..... 11

        3.4.1 Sediment and Erosion Sources..... 11

        3.4.2 Best Management Practices ..... 12

        3.4.3 Monitoring Strategies ..... 18

**4 Water Management Plan Implementation ..... 23**

    4.1 Water Management Ponds ..... 23

        4.1.1 Lower Dublin South Pond..... 24

        4.1.2 Lower Dublin North Pond ..... 24

        4.1.3 Eagle Pup Pond..... 25

        4.1.4 Platinum Gulch Pond..... 25

    4.2 Ditches ..... 25

**5 Erosion and Sediment Control Plan Implementation..... 27**

    5.1 General..... 27

    5.2 Stage 1 Construction..... 27

        5.2.1 Southern Portion of the Project Area ..... 29

        5.2.2 Central Portion of the Project Area..... 31

        5.2.3 Eagle Pup and Lower Dublin South Areas ..... 32

        5.2.4 Northern Portion of the Project Area ..... 33

    5.3 Stage 2 Construction..... 36

        5.3.1 Southern Portion of the Project Area ..... 37

        5.3.2 Central Portion of the Project Area..... 37

        5.3.3 Northern Portion of the Project Area ..... 37

**6 References..... 39**

## List of Tables

Table 2.1-1:	Intensity-Duration-Frequency Values
Table 3.3-1:	Design Criteria
Table 3.4-1:	Temporary Sediment Basin Design Specifications
Table 4.1-1:	Water Management Pond Design Specifications

## List of Figures

Figure 1.1-1:	Project Location Map
Figure 1.1-2:	Mine Site – General Arrangement
Figure 3.3-1:	Overview Plan Catchment Areas Year 9
Figure 3.4-1:	Erosion Control BMP – Sections and Details – Sheet 1 of 3
Figure 3.4-2:	Erosion Control BMP – Sections and Details – Sheet 2 of 3
Figure 3.2-3:	Erosion Control BMP – Sections and Details – Sheet 3 of 3
Figure 5.2-1:	Stage 1 Construction Overview Plan
Figure 5.3-1:	Stage 2 Construction Overview Plan

## Abbreviations

the Plan .....	the Erosion and Sediment Control Plan
the Project .....	the Eagle Gold Project
ADR .....	adsorption, desorption and recovery
AMC .....	antecedent moisture condition
BMP .....	best management practice
DGDC .....	Dublin Gulch diversion channel
EP Pond .....	Eagle Pup pond
FNNND .....	First Nation of Na-Cho Nyäk Dun
g/t .....	grams per tonne
HKP .....	Hallam Knight Piésold
HLF .....	heap leach facility
IDF .....	Intensity-Duration-Frequency
KPL .....	Knight Piésold Ltd.
LOM .....	life of mine
Lorax .....	Lorax Environmental Services Ltd.
masl .....	meters above sea level
MAP .....	mean annual precipitation
MIW .....	mine influenced water
m <sup>3</sup> .....	cubic metres
mm .....	millimetre
mm/y .....	millimetre per year
Mt .....	megatonnes (million tonnes)
Mt/y .....	megatonnes per year
MWTP .....	mine water treatment plant
PMF .....	probable maximum flood
PMP .....	probable maximum precipitation
RECP .....	rolled erosion control products
SECP .....	sediment and erosion control plan
SCP .....	sediment collection pond



TSS ..... total suspended solids  
SGC.....StrataGold Corporation  
WMP..... water management plan  
WRSA..... waste rock storage area



# 1 INTRODUCTION

## 1.1 PROJECT SUMMARY

StrataGold Corporation (SGC), a directly held wholly owned subsidiary of Victoria Gold Corporation has proposed to construct, operate, close and reclaim a gold mine in central Yukon. The Eagle Gold Project (the Project) is located 85 km from Mayo, Yukon using existing highway and access roads. The Project will involve open pit mining at a production rate of approximately 10 million tonnes per year (Mt/y) ore, at an average strip ratio (amount of waste: amount of ore) of 1.45:1.0. Gold will be extracted using a three stage crushing process, heap leaching, and a carbon adsorption, desorption, and recovery system over a 10 year mine life.

Access to the Project site is from the Silver Trail (Highway 11) onto the existing South McQuesten Road and Haggart Creek Road. Together, they comprise a 45 km road divided by the South McQuesten River. The majority of the Project site lies within the Dublin Gulch and Eagle Creek watersheds. Dublin Gulch and Eagle Creek are second order streams that are tributary to Haggart Creek, which flows to the South McQuesten River. Figure 1-1.1 provides a map of the Project location.

The Project will utilize conventional open pit mining techniques to extract ore. The open pit will be located on the south side of Dublin Gulch/Eagle Creek in an area that includes portions of three tributary gulches, namely Eagle Pup, Suttles Gulch and Platinum Gulch. Mined rock that does not contain economic ore or cannot be used for construction will be placed in one of two areas – Platinum Gulch or Eagle Pup waste rock storage areas.

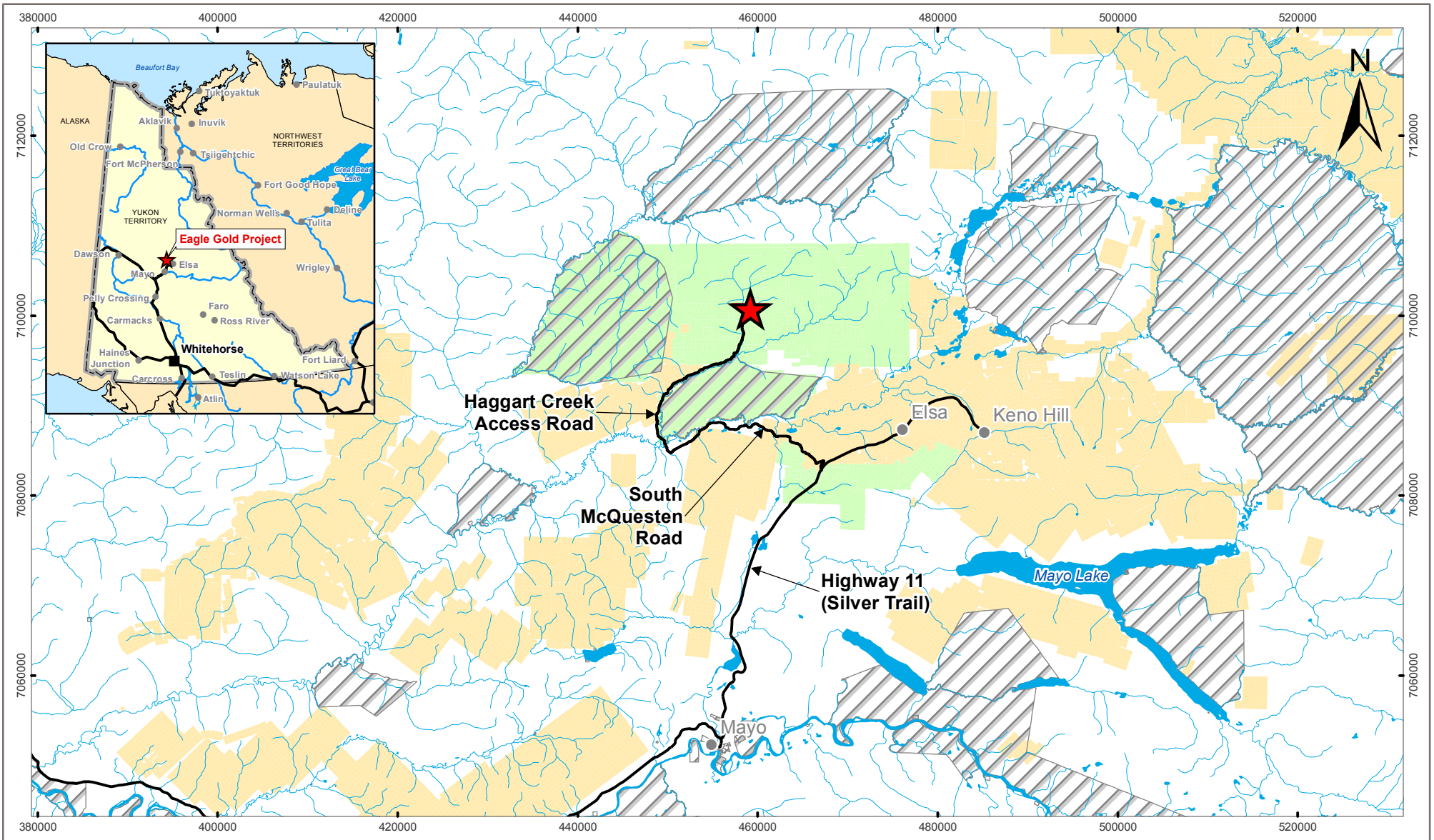
Historically, the Project site has been impacted by extensive placer mining in the Haggart Creek and Dublin Gulch watersheds. The valley floor has been significantly re-worked in the lower Dublin Gulch catchment, which has resulted in the re-routing of smaller streams within the system.

Planned infrastructure includes an open pit, three stage crushing facilities, Platinum Gulch waste rock storage area (WRSA), Eagle Pup WRSA, Ann Gulch Heap Leach Facility (HLF), Dublin Gulch diversion channel (DGDC), an ADR plant, a mine water treatment plant (MWTP), a truck shop and maintenance area, a camp, temporary (or 100-day) ore stockpile, and water management ponds. The proposed general layout of the mine and infrastructure components of the Project are presented on Figure 1.1-2 (Mine Site General Arrangement).

During operations the MWTP will be constructed downstream of the HLF to treat excess process water and other collected mine influenced water (MIW). The MWTP will discharge treated water into Haggart Creek. During the construction phase, water management ponds will be constructed for use as sediment collection ponds (SCPs) and exfiltration areas. Non-contact water will be diverted, as feasible, around disturbed areas before discharging into Haggart Creek or Dublin Gulch.

The term “contact water” is used in this Plan to describe water that has come into contact with either the WRSAs, open pit, or HLF during operations. This type of water will need to be treated at the MWTP during operations prior to discharge to the environment. Conversely, “non-contact water” is used to describe water that has not come into contact with any Project facilities. “Sediment-laden water” is used to describe water that originates from disturbed areas (e.g., roads, foundation pads, etc.) and only needs treatment for sedimentation, which is done through the management practices described in this Plan without the use of the MWTP.

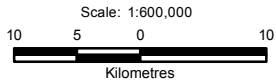
Construction activities will produce sediment-laden water only. While the ditches and culverts described in this Plan are also capable of conveying contact-water during operations, since this is a construction-specific sediment and erosion control plan, it will describe the function of best management practices (BMPs) with respect to sediment-laden and non-contact water. A comprehensive water management plan that includes a description of contact, non-contact and sediment laden water during all phases of the Project will be submitted as part of the application for a Water Use License.



**LEGEND**

- Eagle Gold Project Site
- Victoria Gold Claims
- Other Mineral Claims
- Nacho Nyak Dun Settlement Land
- Town / Village
- Road
- Watercourse
- Waterbody

**NOTES**  
 1. Data Sources: Government of Canada, Victoria Gold Corp, Yukon Geomatics.



<b>PROJECTION</b> UTM Zone 8	<b>DATUM</b> NAD83
<b>FILE NO.</b> V23201707	
<b>CLIENT</b> 	

**EAGLE GOLD PROJECT  
YUKON TERRITORY**

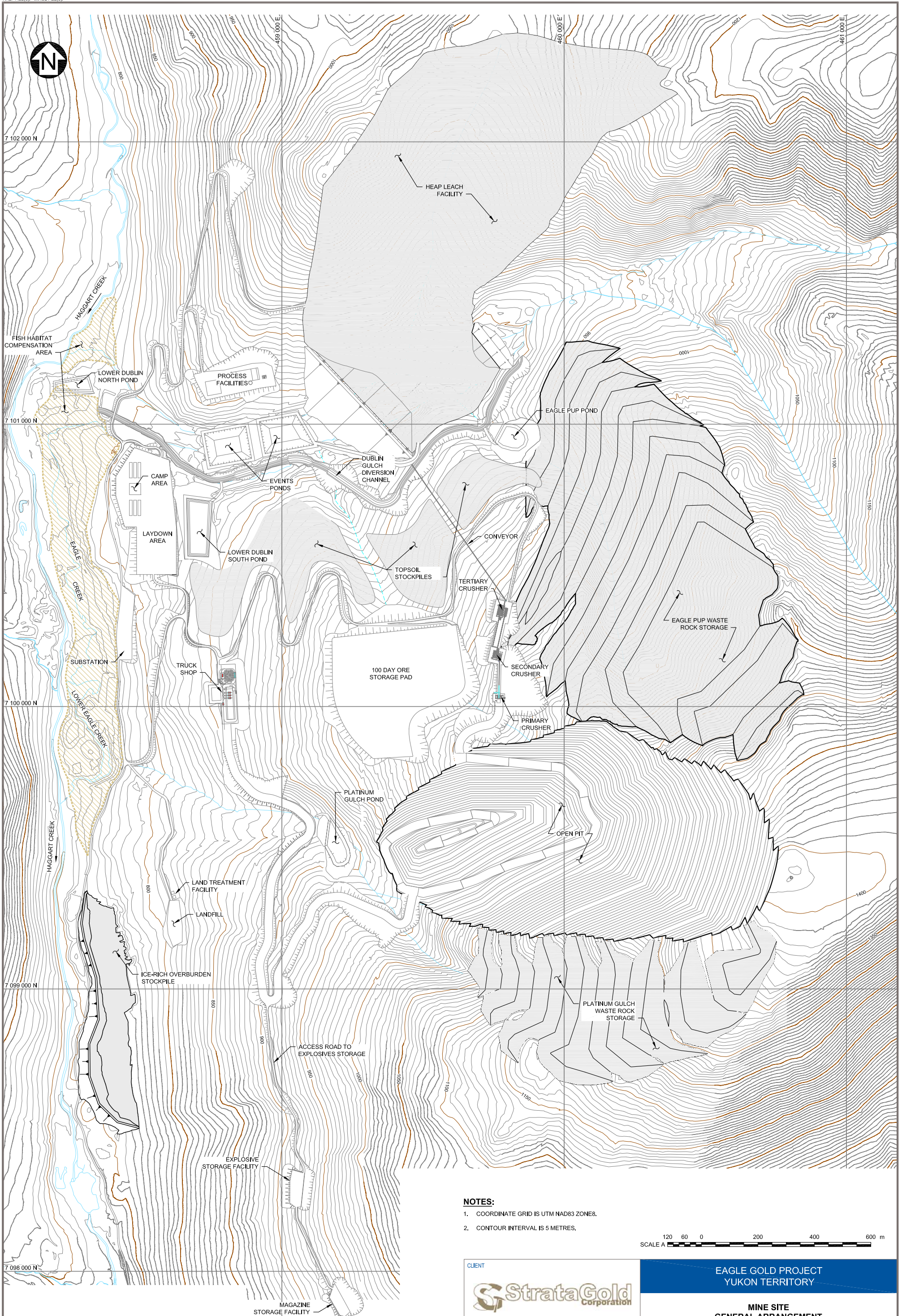
**Property Location Map**

<b>PROJECT</b> Eagle Gold	<b>DWN</b> SL	<b>CKD</b> IS	<b>APVD</b> IS	<b>REV</b> 0
<b>OFFICE</b> EBA_VANC	<b>DATE</b> March 25, 2013			

**Figure 1.1-1**

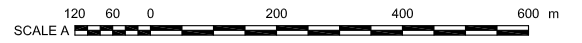
**STATUS**  
ISSUED FOR REVIEW





**NOTES:**

1. COORDINATE GRID IS UTM NAD83 ZONE8.
2. CONTOUR INTERVAL IS 5 METRES.



CLIENT 	EAGLE GOLD PROJECT YUKON TERRITORY			
	MINE SITE GENERAL ARRANGEMENT			
	FILE NO. VA101-290/6	DWN JT/WAL	CKD BB	REV 0
	OFFICE KPL-VANC	DATE July 18, 2013		
				<b>Figure 1.1-2</b>



## 1.2 SCOPE OF PLAN

This construction sediment and erosion control and water management plan (the Plan) has been developed to proactively manage water, erosion and sedimentation throughout the construction of the Project. Construction of the mine is planned to occur over two years pending issuance of required licenses and permits. The construction phase has been divided into two stages to accommodate permitting assumptions and seasonal constraints. Stage 1 Construction includes site preparation allowable prior to receipt of a Water Use License. Stage 2 Construction includes facility construction after receipt of a Water Use License. These stages are defined in Sections 5.2 and 5.3 – Stage 1 Construction and Stage 2 Construction, respectively. The scope of this Plan includes sediment and erosion control for both construction stages.

The Plan has two functional components:

- A water management plan (WMP)
- A sediment and erosion control plan (SECP)

The WMP describes the capability of the site water management infrastructure to contain, control and convey short duration extreme rainfall events (i.e., 1 in 10 year rainfall, 1 in 100 year rainfall, or the Probable Maximum Precipitation). Water management facilities are designed with two specific operating modes: 1) service conditions, which include day-to-day operations and 2) ultimate limit conditions, which include provisions for safely handling extreme peak runoff events.

The SECP provides the best management practices (BMPs) that will be implemented on site and detailed site-specific plans that address the construction objectives of the Project.

The contents of the Plan are as follows:

- Site Conditions
- Construction Water Management Approach
- Water Management Plan Implementation
- Sediment and Erosion Control Plan Implementation

The primary emphasis of the Plan corresponds to the construction phases of the Project.

This Plan provides strategies and design objectives with appropriate flexibility to allow the design elements to be field-fit to suit the conditions encountered during construction (i.e., adaptive management approach).

## 2 SITE CONDITIONS

Baseline conditions have been addressed in the *Eagle Gold Project Proposal* (Stantec 2011a), subsequent updates to environmental baseline data reports (Stantec 2012a, 2012b, 2012c and 2012d), and the *Eagle Gold Project Hydrometeorology Report* (Knight Piésold 2013a). Baseline data reports and analysis contain background data that are integral to the design and implementation of the Plan. Parameters such as precipitation, runoff coefficients, soil types, and physiography are used to develop techniques and design of the sediment and erosion control and water management plan.

### 2.1 HYDROMETEOROLOGY

Updated and detailed hydrometeorology baseline data for the Eagle Gold site are presented in the *Eagle Gold Project Hydrometeorology Report* (Knight Piésold 2013a). The key findings of the study have been summarized in the following sections.

#### 2.1.1 Intensity-Duration-Frequency Data

Knight Piésold (2013a) developed annual extreme rainfall values in the form of Intensity-Duration-Frequency (IDF) data. The estimated 2-year and 10-year 24-hour rainfalls are 31.0 mm and 49.1 mm, as presented in Table 2.1-1. Comparison with the measured site rainfall data suggests that the 24-hr rainfall estimates are reasonably conservative.

**Table 2.1-1: Intensity-Duration-Frequency Values**

Return Period (years)	24-Hour Rainfall (mm)
2	31.0
10	49.1
100	71.6
200	78.3
1000	93.7

### 2.2 SOILS

The most recent soil samples were collected in October 2012 at the Project site by Lorax Environmental Services Ltd. (Lorax) and submitted for grain size analysis. Four samples were collected – three from the Eagle Creek bluffs and one from a temporary sediment pond in the Suttles Gulch area. The particle size distributions for the samples from the Eagle Creek bluffs indicate that 11-16% of the particles are smaller than 0.005 mm, which is the smallest suspended sediment particle that practically can be removed by standard sedimentation practices. If the pond's surface area is big enough, 0.005 mm particles can be settled out as per the *Guidelines for Assessing the Design, Size and Operation of Sedimentation Ponds Used in Mining* (BC MOELP 1996). Comparatively, 4% of the Suttles Gulch sample contained particles smaller than 0.005 mm. The median grain size for the three samples from the Eagle Creek bluffs was 0.1 mm, 0.3 mm, and 0.02 mm. The median grain size for the sample from Suttles Gulch was 0.03 mm.



Frozen ground, when observed, is generally encountered immediately below the organic cover. Ground temperatures were measured in thermistors installed on site by Knight Piésold (Knight Piésold 1996). The measured ground temperatures showed the frozen ground to be relatively warm when observed, typically between 0°C and -1°C.

The term “ice-rich” is used to describe a soil where ice occupies a larger pore space in the soil than water in an unfrozen state. When this ice thaws, the water content exceeds the water holding capacity of the soil and excess water will be present. Frozen ground with excess ice, hereafter called ice-rich, may become unstable upon thawing, and will therefore generally need to be excavated to prescribed depths within the footprint of planned facilities. These materials, which could potentially be useful in closure activities (e.g. as cover for reclamation) once thawed and drained, require management during construction and operation of the mine. Ice-rich soils can be problematic as they begin to thaw. The exposed soils become wet, muddy, and unable to support loading as the frost melts. Additionally, disposal of ice-rich soils requires gentle slopes and low stockpile heights or confining berms for containment.

Throughout the construction stages, it has been estimated that approximately 620,000 m<sup>3</sup> of ice-rich overburden will need to be managed. Using the current construction plan, the majority of this ice-rich material, up to approximately 489,000 m<sup>3</sup>, will be encountered within the first year of construction. Where these zones are relatively thin (e.g., less than 0.5 m thick), the area will be exposed and allowed to thaw and drain to temporary sediment basins (see Table 3.4-1). Where thicker zones are encountered, the ice-rich materials will be excavated, transported and placed in an existing containment area. The containment area will be designed to allow the thawing ice to drain. Ice-rich materials will be hauled from their source areas to the management area by haul truck and placed while still frozen to the extent possible. Accessible stored materials, where feasible once thawed and drained, will be used in reclamation activities elsewhere on site at mine closure, and in closure of the ice-rich overburden storage area. The site selected for the ice-rich material storage area is in existing depressions within placer tailings along Haggart Creek. A detailed description of ice-rich material management including preliminary design of the storage area is provided in the *Ice-Rich Materials Management Plan* (BGC 2013).

## **3 CONSTRUCTION WATER MANAGEMENT APPROACH**

### **3.1 OBJECTIVES**

The water management objective during construction is to safely convey and/or detain the respective design storm event at each facility, while maintaining water quality at background levels or meeting water quality standards in the receiving environment. The primary means of achieving this objective will require the diversion of non-contact runoff, and erosion source control (i.e., minimizing total suspended sediment levels in runoff from construction areas).

Water will be controlled in a manner that minimizes erosion in areas disturbed by construction activities and prevents the release of construction water which could adversely affect the quality of receiving waters (e.g., Dublin Gulch, Haggart Creek, and Eagle Creek).

### **3.2 STRATEGIES**

Water management during construction will include diversion of non-contact water to reduce the total volume of sediment laden water to manage via ditches, construction of sediment control ponds, construction of an exfiltration pond, stabilization of disturbed land surfaces, and re-establishing vegetative cover. Where final slopes are created, native vegetation will be planted as per the *Decommissioning and Reclamation Plan* (Knight Piésold 2013b). Sediment laden water during construction will be collected in exfiltration areas or sediment basins and then released to the ground surface or watercourses after suspended solids have settled.

### **3.3 DESIGN**

For the purpose of the WMP, the Project area has been subdivided into a number of hydrologic catchments, as shown on Figure 3.3-1. The catchment boundaries are based on end of mine footprint. However, the SCPs are designed to contain the maximum volume of runoff from catchment areas, which, depending on the catchment, may not necessarily correspond to the end of mine footprint. During construction and particularly prior to installation of diversion ditches, some of the catchment areas reporting to the SCPs are larger than the areas shown on Figure 3.3-1. Therefore, to ensure that the SCPs are capable of storing runoff during the entire life of the Project, they were sized to store the 1 in 10 year 24-hour return period storm from their largest respective contributing area.

The implementation of water management infrastructure is described in Section 4.0.

#### **3.3.1 Storm Water Design Criteria**

A risk-based approach is used to select appropriate design storm events for water management facilities. This approach weighs the likelihood of failure, versus the consequence of failure, on a

## Section 3: Construction and Water Management Approach

case-specific basis. Design storm events are developed by assessing the annual recurrence of precipitation events of a given magnitude, as described in Section 2.1.1.

Design storm events are used as input parameters in most rainfall-runoff type storm water models (e.g., HEC-HMS, HydroCAD, TR-55). This is the approach followed in Knight Piésold (2013c), and the design criteria from that report for various design elements are listed in Table 3.3-1 below.

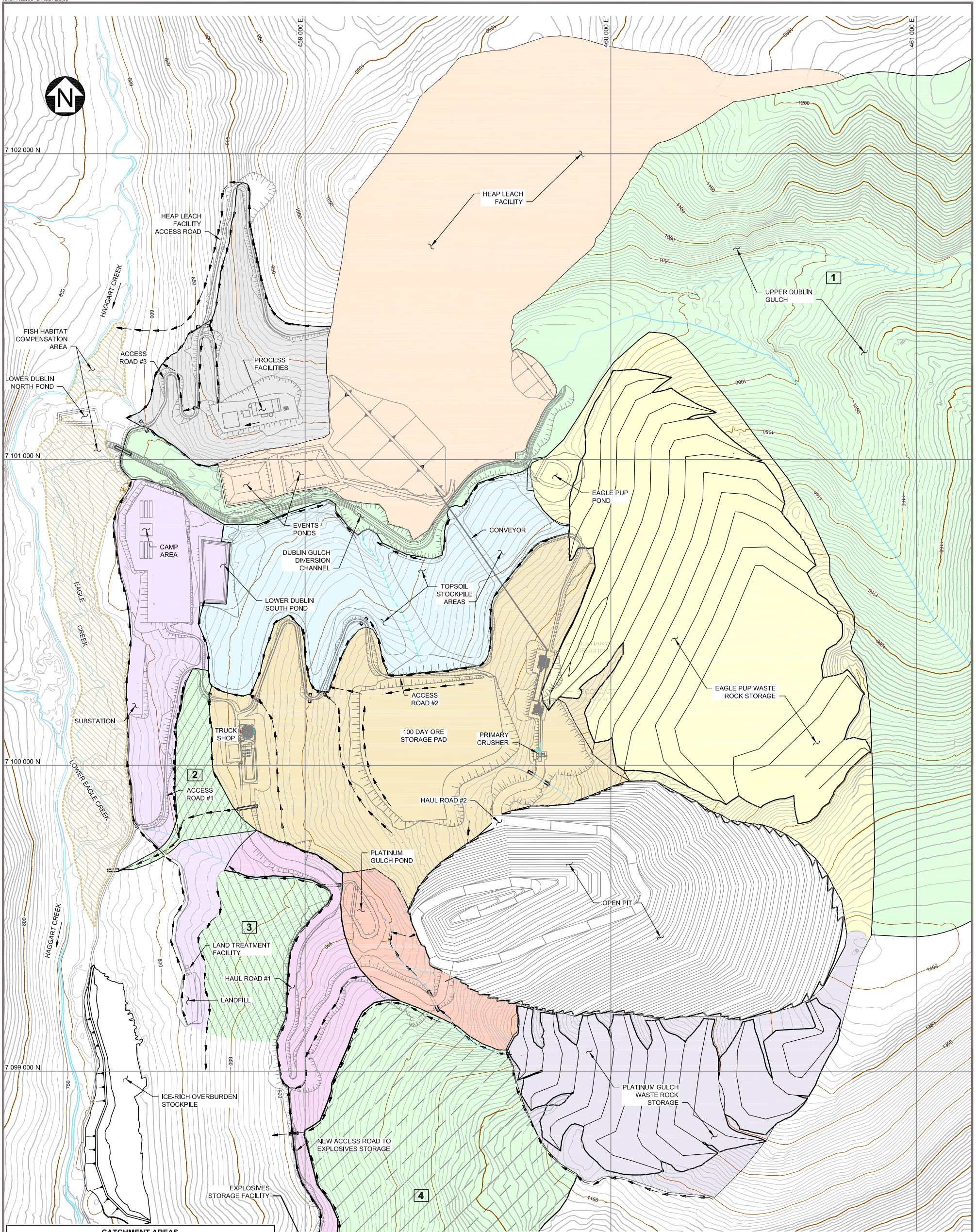
**Table 3.3-1: Design Criteria**

<b>Design Element</b>	<b>Design Criteria</b>	<b>Anticipated Exposure Time</b>
Diversion Ditches Upslope of Key Mine Infrastructure	1 in 100 year return period 24-hour storm with a >0.2 m freeboard	Life of Mine
Collection Ditches Upslope of Key Mine Infrastructure	1 in 100 year return period 24-hour storm with a >0.2 m freeboard	Life of Mine
General Diversion Ditches	1 in 10 year return period 24-hour storm with a >0.2 m freeboard	Life of Mine
General Collection Ditches	1 in 10 year return period 24-hour storm with a >0.2 m freeboard	Life of Mine
Corrugated Metal Half-Pipe	1 in 10 year return period 24-hour storm with a >0.2 m freeboard	Life of Mine
Sediment Control Ponds (storage)	1 in 10 year return period 24-hour storm with a 0.5 m freeboard	Construction
Sediment Control Pond Spillways	1 in 200 year return period 24-hour storm with a >0.5 m freeboard	Construction
Exfiltration Areas	1 in 10 year return period 24-hour storm with a > 0.5 m freeboard	Construction
Culverts	1 in 100 year return period 24-hour storm	Life of Mine

**NOTES:**

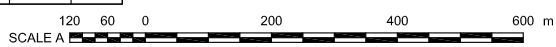
1. A diversion ditch is used to intercept and divert clean water prior to contact with disturbed areas.
2. A collection ditch is used to convey sediment-laden water to treatment facilities (i.e. sediment basins, sediment ponds).





**CATCHMENT AREAS**

DESCRIPTION	ha	CN
OPEN PIT	83.9	90
PROCESS FACILITIES	27.8	90
HEAP LEACH & EVENTS PONDS	121.1	-
TOPSOIL STOCKPILES	46.7	-
TRUCK STOP, ORE STORAGE	81.7	90
EAGLE PUP WRSA	123.9	85
LOWER PLATINUM GULCH & PGP	13.2	85
PLATINUM GULCH WRSA	51.2	85
LAYDOWN AND LANDFILL AREA	33.2	-
DISTURBED EXPLOSIVES AREA	24.1	90
UNDISTURBED DGDC AREA	853.3	85
UNDISTURBED CENTRAL DIVERTED AREA	8.0	90
UNDISTURBED LANDFILL	15.6	-
UNDISTURBED EXPLOSIVES	76.7	85
<b>TOTAL</b>	<b>1560.4</b>	<b>-</b>



**NOTES:**

- COORDINATE GRID IS UTM NAD83 ZONE8.
- CONTOUR INTERVAL IS 5 METRES.
- THE DUBLIN GULCH DIVERSION CHANNEL (DGDC) AREA EXTENDS BEYOND THE BOUNDARIES OF THE FIGURE. THE AREA IN THE TABLE (838.4 ha) REPRESENTS THE FULL CATCHMENT AREA.
- THE UNDISTURBED EXPLOSIVES AREA IS APPROXIMATE, CONTOURS ARE NOT AVAILABLE IN THE SOUTH EXTENT OF PROJECT.
- THE CURVE NUMBER VALUES WERE USED FOR STORM RUNOFF MODELLING.

CLIENT



EAGLE GOLD PROJECT  
YUKON TERRITORY

**OVERVIEW PLAN  
CATCHMENT AREAS YEAR 9**

**Knight Piesold  
CONSULTING**

FILE NO. VA101-290/6	DWN JT/WAL	CKD BB	REV 0
OFFICE KPL-VANC	DATE July 18, 2013		

**Figure 3.3-1**



## 3.4 SEDIMENT AND EROSION CONTROL

Sediment and erosion control measures will be implemented and maintained to prevent the discharge of sediment laden water to the receiving environment. The BMPs described below are shown on Figures 3.4-1 to 3.4-3 and will be required during construction. Implementation of BMPs is described in Section 5.0.

### 3.4.1 Sediment and Erosion Sources

Construction activities that have the potential to result in erosion and sedimentation include:

- Vegetation clearing and topsoil stripping,
- Excavation, grading and filling,
- Stockpiling of topsoil,
- Management of ice-rich material, and
- Construction of roads and infrastructure.

Potential effects from the above activities in the absence of planned mitigation measures include:

- Increased surface erosion from disturbed and rehabilitated areas,
- Increased sediment load entering the natural water system, and
- Siltation or erosion of ditches and watercourses.

The Plan addresses the above potential hazards to ensure effective management of surface water and sediment laden runoff during both Construction Stages 1 and 2. Sediment mobilization and erosion will be minimized by:

- Limiting the extent of land disturbance to the practical minimum
- Reducing water velocities across the ground using soil bioengineering, surface roughening, and re-contouring, particularly on exposed surfaces and in areas where water concentrates
- Progressively rehabilitating disturbed land and constructing drainage controls to improve the stability of rehabilitated land
- Protecting natural drainages and watercourses by constructing appropriate sediment control devices such as collection and diversion ditches, sediment traps, in-channel rock energy dissipaters, and sediment basins
- Installing rock riprap, channel lining, sediment filters or other suitable measures in ditches on steep gradients, as required
- Restricting access to rehabilitated areas
- Constructing collection and diversion ditches to intercept surface runoff

- Directing all sediment-laden runoff to the appropriate sediment basin
- Constructing appropriate temporary BMP measures (e.g., silt fences, hay bales) downslope of disturbed sites (where more permanent sediment control measures are not appropriate, or in combination with more permanent measures)
- Implementing soil bioengineering techniques to contain sediment and enable disturbed surfaces to recover

Installation of temporary erosion and sediment control features or “Best Management Practices” (BMPs) will be the first step towards controlling erosion and sedimentation during construction. All temporary sediment and erosion control features will require regular maintenance and inspection after each significant rainfall. These temporary features will be reclaimed after achieving soil and sediment stabilization. Typical sediment and erosion design elements and BMPs are described in Section 3.4.2 below.

### **3.4.2 Best Management Practices**

Erosion control Best Management Practices (BMPs) reduce erosion by stabilizing exposed soil or reducing surface runoff flow velocity. There are generally two types of erosion control BMPs:

- Source control BMPs for protection of exposed surfaces, and
- Conveyance BMPs for control of runoff.

Erosion control BMPs will be implemented prior to and during construction to minimize erosion and sediment discharge into surrounding areas

Descriptions of the planned BMPs are provided below:

#### **Vegetation Management and Re-vegetation**

Natural vegetation is one of the best and most cost effective methods of reducing the potential for erosion and sedimentation. Vegetation keeps soil secure and leaves and ground cover reduce raindrop velocities. In order to preserve vegetation, it is recommended to maintain “no-entry” vegetation buffers to prevent excess clearing, particularly around water bodies, prior to clearing vegetation from surrounding areas. If preserving natural vegetation is not a viable option, cleared areas that will not include infrastructure will be re-vegetated as soon as practical after construction activities have ended in the area accounting for seasonal constraints.

#### **Soil Bioengineering**

Soil bioengineering is the use of plant materials to perform engineering functions such as bank protection, erosion protection, drainage, and slope stabilization (Polster 2002). Some typical techniques include:

- Wattle fences
- Live bank protection

- Live palisades

Wattle fences are used on over-steepened slopes where the incline prevents successful growth of vegetation. Live cuttings are placed in the slopes to create terraces, which hold soil in place and encourage the cuttings to grow.

Live bank protection is generally used in streams for habitat restoration, but the technique can be transferred to constructed ditches. Wattle fences using cut plugs and live cuttings are installed on the banks of the ditch, which become stabilized once the live cuttings sprout and grow.

The live palisades technique involves installing large cottonwood (poplar) posts in trenches adjacent to eroding stream beds where the natural vegetation has been compromised. The cottonwood will root along its entire buried length producing a dense cylinder of roots.

These techniques prevent the creation of smooth, hard surfaces, which tend to encourage increased velocities and thus increased erosion potential. The USDA *Engineering Field Handbook Chapter 18 – Soil Bioengineering for Upland Slope Protection and Erosion Reduction* provides useful application and construction guidelines for various bioengineering techniques.

### **Mulching**

Mulching is the application of a uniform protective layer of straw, wood fiber, wood chips, or other acceptable material on, or incorporated into, the soil surface of a seeded area to allow for the immediate protection of the seed bed. The purpose of mulching is to protect the soil surface from the forces of raindrop impact and overland flow, foster the growth of vegetation, increase infiltration, reduce evaporation, insulate the soil, and suppress weed growth. Mulching also helps hold fertilizer, seed, and topsoil in place in the presence of wind, rain, and runoff, while reducing the need for watering.

Mulching may be utilized in areas that have been seeded either for temporary or permanent covers. There are two basic types of mulches: organic mulches and chemical mulches. Organic mulches may include straw, hay, wood fiber, wood chips and bark chips. This type of mulch is usually spread by hand or by machine (mulch blower) after seed, water, and fertilizer have been applied. Chemical mulches, also known as soil binders or tackifiers, are composed of a variety of synthetic materials, including emulsions or dispersions of vinyl compounds, rubber, asphalt, or plastics mixed with water. Chemical mulches are usually mixed with organic mulches as a tacking agent to aid in the stabilization process, and are not used as stand-alone mulch, except in cases where temporary dust and/or erosion control is required.

Hydroseeding, sometimes referred to as hydromulching, consists of mixing a tackifier, specified organic mulch, seed, water, and fertilizer together in a hydroslurry and spraying a layer of the mixture onto a surface or slope with hydraulic application equipment. The choice of materials for mulching will be based on soil conditions, season, type of vegetation, and the size of the area.

### **Rolled Erosion Control Products**

Rolled erosion control products (RECP) are geosynthetic or organic materials composed of two layers of coarse mesh that contain a central layer of permeable fibres in between. These products take the form of flexible sheet materials that are often composed of organic materials that decompose over time. When intended for long-term use, RECPs are made from UV-stable synthetics such as polypropylene. RECPs are used to cover un-vegetated cut or fill slopes in order to provide erosion control when seeding or mulching alone is unsuccessful. RECP sheets must be anchored with special stakes or rocks and must be in direct, tight contact with the soil surface in order to perform effectively.

### **Surface Roughening**

Cut and fill slopes will be roughened with tracked machinery or by other means, to reduce runoff velocity, increase infiltration, reduce erosion, and to aid in the establishment of vegetative cover with seed. Roughening will typically be carried out by a tracked machine moving up and down the slope, creating undulations on the soil surface. This procedure is simple, inexpensive and provides immediate short-term erosion control for bare soil, where vegetative cover is not yet established. Compared to hard, compacted smooth surfaces a rough soil surface provides more favorable moisture conditions, which will aid in seed germination. Surface roughening works best on flat and moderately sloped areas.

### **Re-contouring**

Re-contouring the soil surface can also reduce the effect of erosion by shortening the length of the accumulation and movement of water as well as decreasing its slope. Creating undulations or troughs will also reduce overland water movement velocity. These types of improvements are beneficial as they are easily planned and constructed on site. However, both surface roughening and re-contouring are only semi-permanent erosion control methods and more permanent structures are needed over time.

### **Silt Fencing**

Silt fencing is a perimeter control used to intercept sheet flow runoff and used in conjunction with other BMPs. Typical silt fencing comprises a geotextile fabric anchored to posts driven into the ground. Silt fencing promotes sediment control by filtering water that passes through the fabric and increases short term detention time, allowing suspended sediments to settle. A typical silt fence installation is shown on Figure 3.4-2.

Silt fences will be placed parallel to slope contours in order to maximize ponding efficiency. Barrier locations are informally chosen based on site features and conditions (e.g., soil types, terrain features, sensitive areas, etc.), design plans, existing and anticipated drainage courses, and other available erosion and sediment controls. Typical barrier sites are catch points beyond the toe of fill or on side slopes above waterways or drainage channels. Silt fences are not recommended for wide low-flow, low-velocity drainage ways, for concentrated flows, in continuous flow streams, for flow



diversion, or as check dams. Silt fencing will be installed in backfilled trenches to ensure that it is properly anchored.

All silt fences should be inspected and maintained following major rainfall events. Proper installation and frequent maintenance is required for effective sediment control.

### Temporary Sediment Traps and Sediment Basins

A sediment trap/basin is a temporary structure that is used to detain runoff from small drainage areas (generally less than 2 ha) to allow sediment to settle out. Sediment traps/basins are generally used for relatively small drainage areas and will be located in areas where access can be maintained for sediment removal and proper disposal. A sediment trap/basin can be created by excavating a basin, utilizing an existing depression, or constructing a dam on a slight slope downward from the work area. Sediment-laden runoff from the disturbed site is conveyed to the trap/basin via ditches, slope drains, or diversion dikes. The trap/basin is a temporary measure, with a nominal design life of approximately six months, and is to be maintained until the site is permanently protected against erosion by vegetation and/or structures.

Temporary sediment traps and sediment basins will be constructed at the end of collection ditches to detain sediment-laden runoff long enough to allow the majority of the sediment to settle out. The size of the temporary sediment trap/basin is dependent on the ditch design flows. The exact locations and final geometry of each trap will be field fitted to integrate with the terrain to minimize disturbance. The engineer of record or construction manager shall review and approve the sizing and location of these basins prior to construction. The sediment traps/basins will be checked regularly for sediment cleanout; if the sediment trap/basin has accumulated sediment and/or debris, the trap will be removed and cleaned, or replaced.

Two sizes of sediment basins designated SB1 and SB2 have been developed for the site and will be used for different size drainage areas. The sizing and dimensions of the two sediment basins are summarized as follows:

**Table 3.4-1: Temporary Sediment Basin Design Specifications**

	Sediment Basin size 1	Sediment Basin size 2
Drainage Area (hectares)	<1	1 - 2
Width (m)	10	12
Length (m)	20	25
Depth of Wet Storage (m)	1	1
Minimum Spillway Weir Length (m)	2	4

The width and length dimensions correspond to the top of the wet storage area, at the base of the outlet structure. Typical details are shown on Figure 3.4-3. These designs are based on techniques outlined in the *Alaska Storm Water Pollution Prevention Plan* (ADTPF 2011).

### **Filter Bags and Geotubes**

Filter bags, shown on Figure 3.4-3, are generally constructed from a sturdy non-woven geotextile capable of filtering particles larger than 150 microns. Filter bags are typically installed at the discharge end of pumped diversions, via fabric flange fittings, to remove fine grained materials before discharging to the environment.

If necessary for fine grained materials, filter bags shall be installed on flat, stable, non-erodible foundations, or in well vegetated areas. The pumping rate shall be no greater than specified by the manufacturer. Discharge from filter bags will be routed to lined areas (i.e. rock aprons, rip rap, etc.) to reduce water velocity and minimize erosion.

A smaller variety of filter bags, referred to as filter socks, can be installed on the discharge ends of gravity flow pipes, such as slope drains, to filter silt particles before discharging to the environment.

Filter bags shall be maintained in the following manner:

- Inspected daily for defects, rips, tears, sediment accumulation, and erosion of the surrounding area.
- When sediment fills one half of the volume of the filter bag, the filter bag shall be removed from service and replaced.

Spare bags shall be kept nearby to minimize time required to recommence pumping activities. Once the used bag is fully drained, the bag and its contents can be deposited in reclamation material storage areas for use as cover materials during mine closure, or disposed of in the on-site landfill.

Geotubes can be used as part of a dewatering system to separate and contain solids in sediment-laden water. The system is composed of a geosynthetic tube, which is available in various sizes, and an injection port. The sediment-laden water is pumped or directed via gravity into the geotube until full. Clean water drains through the pores of the engineered textile, which allows the solids to consolidate inside the geotube. The apparatus can be filled multiple times and once it is full of solids, it can be disposed of at a landfill or the solids can be removed and used on site.

### **Flocculants**

The term flocculation is used to describe the aggregation of small particles clumping together and settling out of suspension. In sediment and erosion control applications, flocculation achieved with the use of chemical or natural additives (e.g. corn starch, chitosan, guar gum, etc.). A flocculent dosing system is typically installed at the inlet to a sedimentation pond, which allows the flocculation process to begin immediately upon discharge to the pond. The flocculants accelerate the natural settling process as the sediment-laden water flows through the pond, and therefore the required pond detention time is reduced. Additionally, flocculants can be added at specific points along collection ditches to initiate the settling process prior to arrival at the water management pond. This system may be required in steep topographic areas where:

- The calculated surface area for the design particle size is not practical; and
- Where the clay component is high, as clay soil types have a lower settling velocity than other particles.

Although a common best management practice, flocculants are not currently planned for sediment control. However, flocculants will be considered if other measures are not successful to meet water quality guidelines as described by the *Yukon Waters Act and Regulations*. Prior to the use of flocculants, the type and timing of flocculant use will be discussed with the Yukon Water Board Secretariat and Energy Mines and Resources Client Services and Inspections to determine if a water use license under the *Yukon Waters Act* will be required.

### **Ditches**

Strategically placed ditches and runoff collection structures can help direct water movement, which in turn limits erosion. Cut and fill slopes created during construction leave long runs of exposed soils that are prone to erosion. A ditch placed above the cut slope will intercept water and direct it to less erosion prone areas. Coarse rock and equipment to build ditches and dams are easily obtained on site, and require little further maintenance, making them effective improvements. Typical collection and diversion ditches (two types) are shown on Figure 3.4-1. A corrugated metal half-pipe (CMH) will be used in terrain that is steeper than 15%, as the velocities at such slopes are too high for practical riprap channel protection. An appropriate diameter of CMH is 1.0 m, as shown on Figure 3.4-3

### **Collection Ditches**

A collection ditch intercepts sediment-laden water runoff from disturbed areas and diverts it to a stabilized area where it can be effectively managed. Collection ditches are used within construction areas to collect runoff and convey it to the appropriate sediment control measures. General locations and conditions may include:

- Below disturbed existing slopes to divert sediment-laden water to control facilities
- At or near the perimeter of a construction area to prevent sediment-laden runoff from leaving the site
- Below disturbed areas before stabilization to prevent erosion

Collection ditches may be either temporary or permanent structures and will be sized to convey the runoff from a 1 in 10 year 24-hour return period storm event assuming that the entire footprint area has been disturbed and contributes sediment-laden runoff to the seepage collection and recycle ponds. Ditches located upslope of key mine infrastructure (i.e. HLF, WRSAs, events ponds) will be sized to convey the runoff from a 1 in 100 year 24-hour return period storm event, as per the *YESAB Screening Report and Recommendation* (YESAB 2013).

The ditch designs will be based on steady, uniform flow analysis.

### **Diversion Ditches**

Diversion ditches will be constructed up-gradient of disturbed areas to intercept clean surface water runoff. A diversion ditch is a channel lined with vegetation, riprap, or other flexible, erosion resistant material. The main design considerations are the design flow and velocity of the water expected in

the channel. All diversion ditches have been designed to carry the appropriate peak flow. All diversion ditches will discharge through a stabilized outlet designed to handle the expected runoff velocities and flows from the ditch without scouring. The selection of a type of lining has been based upon the design flow velocities.

The ditches will be sized to convey the 1 in 10 year 24-hour peak storm for the estimated catchment size. As with collection ditches, diversion ditches located upslope of key mine infrastructure will be sized to convey the runoff from a 1 in 100 year 24-hour return period storm event. Where fine grain soils have been exposed, appropriate erosion protection materials will be installed based on the estimated magnitude of flow and the flow velocity.

### **Culverts**

Culverts may be either temporary or permanent structures and will be sized to convey the 1 in 100 year 24-hour peak storm event for small catchments and the 1 in 200 year 24-hour peak storm event for stream crossings.

In general, while variations may occur due to site-specific conditions, it is assumed that culverts will be installed at a slope of 2% with an inflow along a smooth headwall. A small stilling basin will be constructed at the upstream end of each culvert to reduce sedimentation. The culvert will consist of corrugated metal pipe or corrugated polyethylene tubing bedded in sandy material and the backfill material will be carefully compacted around the pipe to support the pipe haunches to prevent crushing.

### **Exfiltration Areas**

An exfiltration area is used to treat sediment laden water by detention in an area that is not lined, and which allows the sediment laden water to filter through the natural ground surface providing the terrain meets the objectives for sediment filtration. This process provides treatment for sedimentation as it filters the water only and does not allow for any additional outflows such as riser pipes and/or spillways, which are commonly used in sediment ponds/basins.

Where feasible, exfiltration areas have been designed to detain the 1 in 10 year 24-hour storm event. The hydraulic conductivity of surficial material on site ranges from  $10^{-3}$  to  $10^{-7}$  m/s. A value of  $10^{-7}$  m/s is used for the design of the exfiltration areas.

### **3.4.3 Monitoring Strategies**

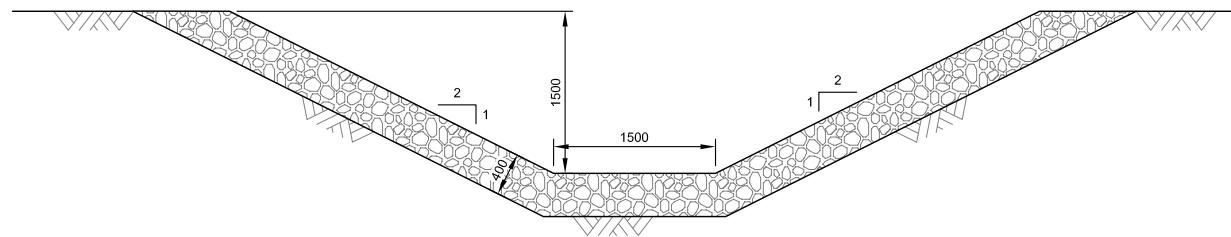
Regular monitoring of implemented BMPs will ensure success of the Plan. The contractor shall inspect all erosion control measures periodically and after each runoff-producing rainfall event. Frequent and proper maintenance will allow for prolonged use instead of allowing the measures to be destroyed and in need of full replacement.

Silt fences, sediment traps/basins, ditches, culverts, exfiltration areas, and water management ponds will be visually inspected for the following:

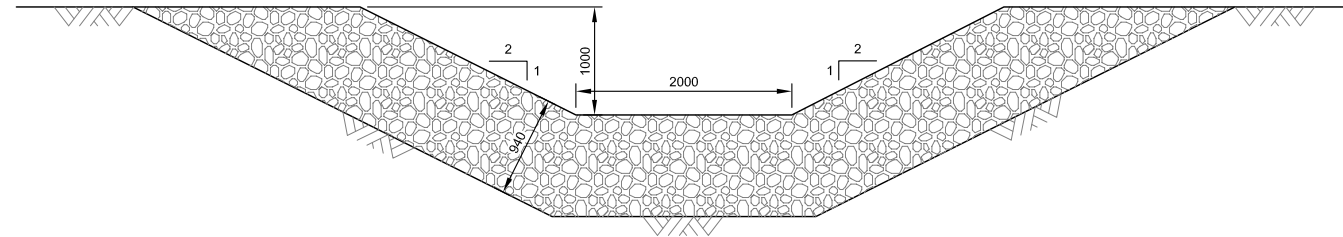
- Excess sediment build-up,

- Structural/physical integrity, and
- Anticipated wear and tear.

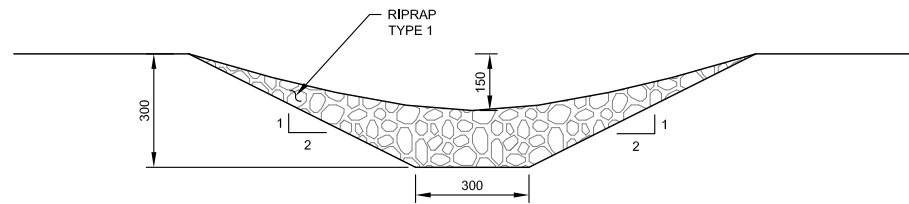
Sediment removal and proper disposal shall be done as required.



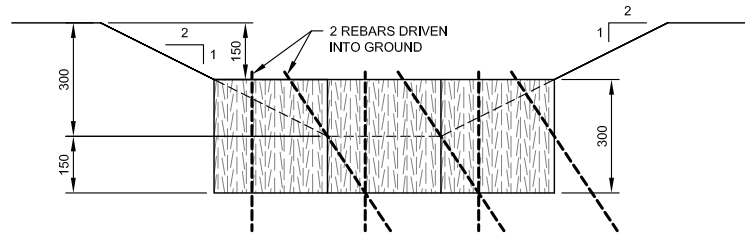
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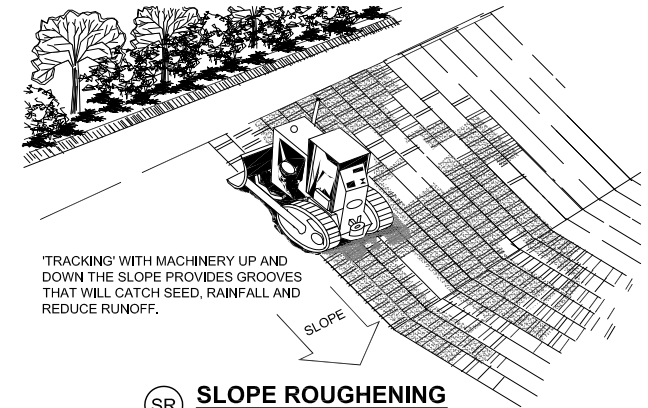
CD DD COLLECTION AND DIVERSION DITCH WITH TYPE 2 RIPRAP  
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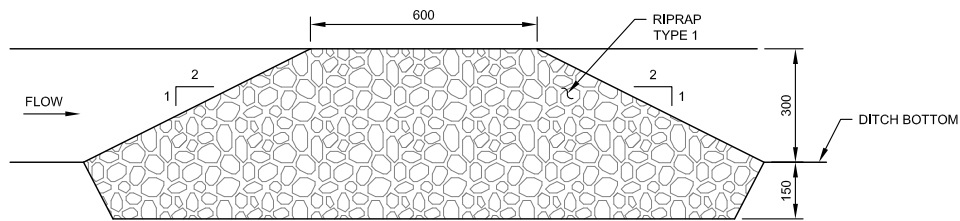
ST ROCK DAM CROSSING SECTION  
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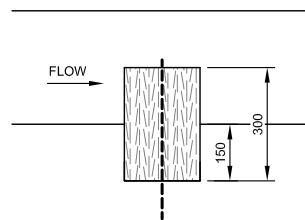
ST STRAW BALE CROSSING SECTION  
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SR SLOPE ROUGHENING  
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ST ROCK DAM PROFILE  
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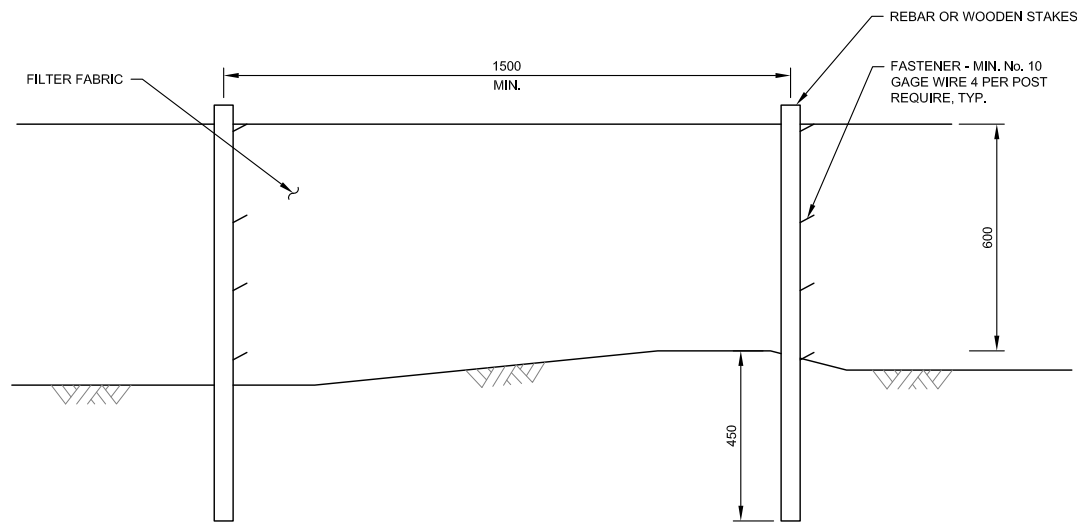
ST STRAW BALE PROFILE  
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**NOTES:**

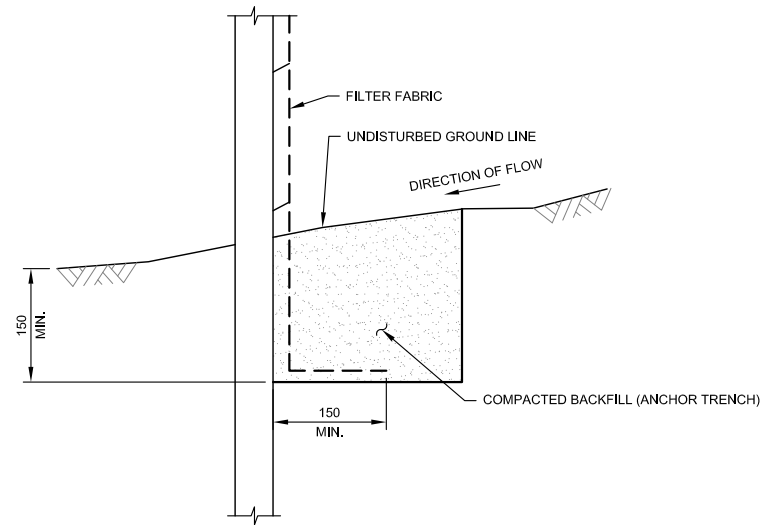
1. ALL SEDIMENT AND EROSION CONTROL MEASURES MUST BE CONSTRUCTED, STABILIZED AND FUNCTIONAL BEFORE SITE DISTURBANCE BEGINS.
2. SITE GRADING SURFACE WATER RUNOFF TO BE DIRECTED TO THE SEDIMENT TRAPS AT ALL TIMES DURING SITE DISTURBANCE ACTIVITIES UNTIL FINAL STABILIZATION IS ACHIEVED.
3. THE CONTRACTOR SHALL INSPECT ALL EROSION CONTROL MEASURES PERIODICALLY AND AFTER EACH RUNOFF-PRODUCING RAINFALL EVENT, ANY NECESSARY REPAIRS OR CLEANUP TO MAINTAIN THE EFFECTIVENESS OF THE EROSION CONTROL DEVICES SHALL BE MADE IMMEDIATELY.
4. AN AREA IS CONSIDERED TO HAVE ACHIEVED FINAL STABILIZATION WHEN IT HAS A MINIMUM UNIFORM 70% VEGETATIVE COVER OR OTHER PERMANENT NON-VEGETATIVE COVER TO RESIST ACCELERATED SURFACE EROSION.
5. THE SLOPE ROUGHENING DIAGRAM IS FROM THE ALASKA STORM WATER POLLUTION PREVENTION PLAN, ALASKA DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES, FEBRUARY 2011.

SAVED: M:\10100290\06\AAcad\FIGS\B49\_r0 (SGC) - 7/17/2013 4:19:27 PM - WLAHODA PRINTED: 7/17/2013 4:20:28 PM, Figure 3.4-1, WLAHODA XREF FILES: IMAGE FILES:

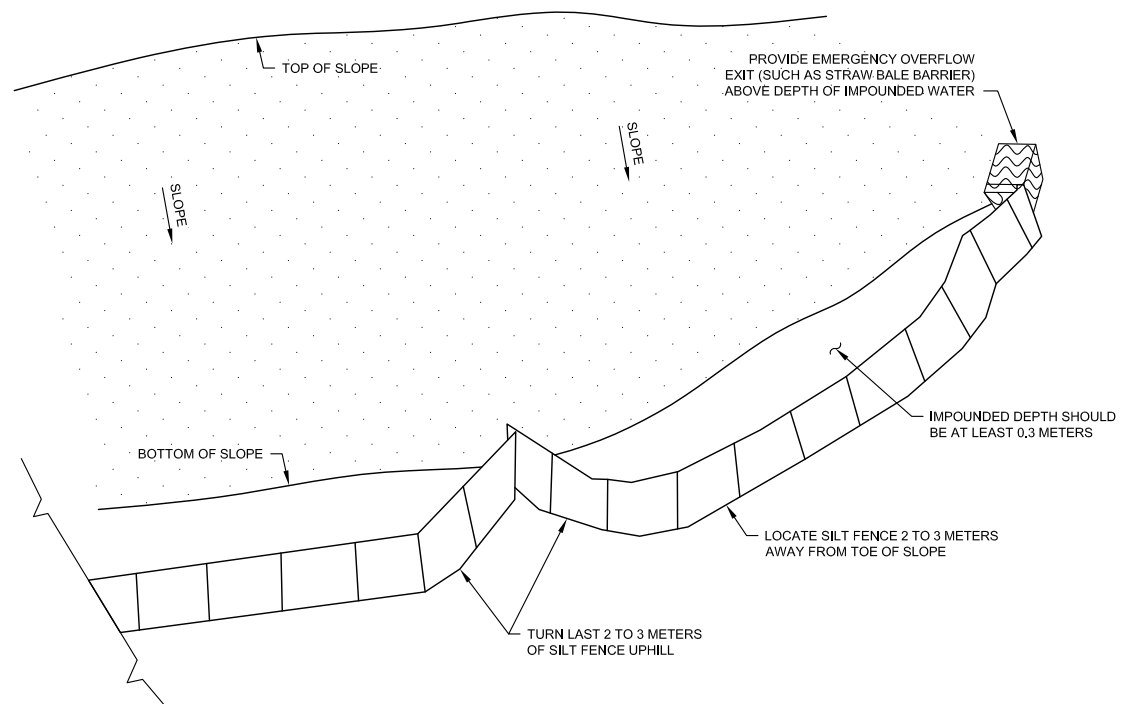
	<b>EAGLE GOLD PROJECT YUKON TERRITORY</b>			
	<b>EROSION CONTROL BMP SECTIONS AND DETAILS SHEET 1 OF 3</b>			
	FILE NO. VA101-290/6	DWN NSD/DP	CKD BB	REV 0
	OFFICE KPVAN	DATE July 18, 2013		<b>Figure 3.4-1</b>



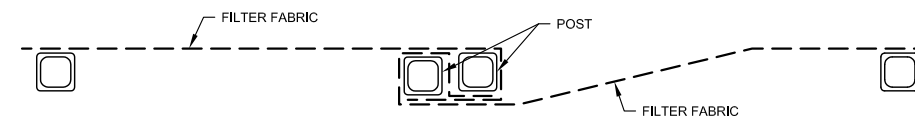
**SF SILT FENCING PROFILE**  
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**SF SILT FENCING CROSSING SECTION**  
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**SILT FENCE BELOW A STEEP OR LONG GRADE**  
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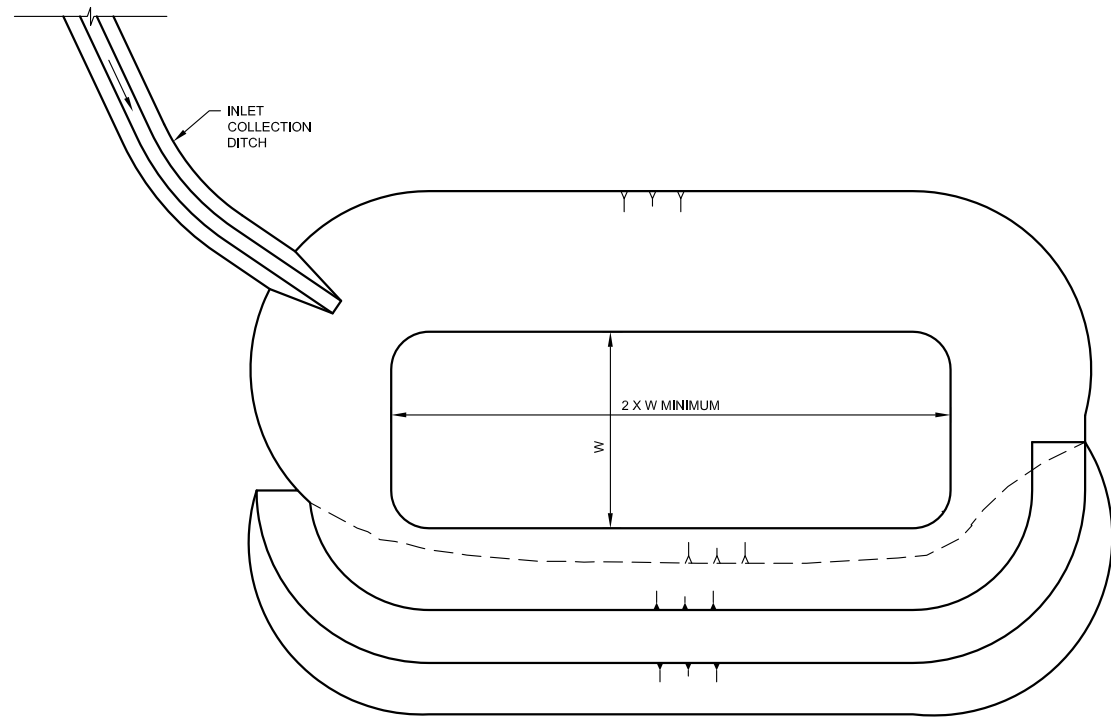
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**NOTES:**

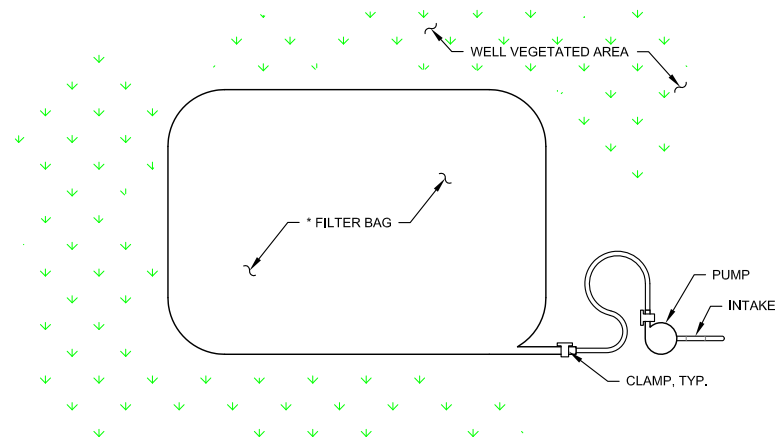
1. ALL SEDIMENT AND EROSION CONTROL MEASURES MUST BE CONSTRUCTED, STABILIZED AND FUNCTIONAL BEFORE SITE DISTURBANCE BEGINS.
2. SITE GRADING SURFACE WATER RUNOFF TO BE DIRECTED TO THE SEDIMENT TRAPS AT ALL TIMES DURING SITE DISTURBANCE ACTIVITIES UNTIL FINAL STABILIZATION IS ACHIEVED.
3. THE CONTRACTOR SHALL INSPECT ALL EROSION CONTROL MEASURES PERIODICALLY AND AFTER EACH RUNOFF-PRODUCING RAINFALL EVENT. ANY NECESSARY REPAIRS OR CLEANUP TO MAINTAIN THE EFFECTIVENESS OF THE EROSION CONTROL DEVICES SHALL BE MADE IMMEDIATELY.
4. AN AREA IS CONSIDERED TO HAVE ACHIEVED FINAL STABILIZATION WHEN IT HAS A MINIMUM UNIFORM 70% VEGETATIVE COVER OR OTHER PERMANENT NON-VEGETATIVE COVER TO RESIST ACCELERATED SURFACE EROSION.

SAVED: M:\10100290\06\AAcad\FIGS\B50\_r0 (SGC) - 7/19/2013 1:46:38 PM - WLAHODA PRINTED: 7/19/2013 1:46:50 PM, Figure 3.4-2, WLAHODA XREF FILES: IMAGE FILES:

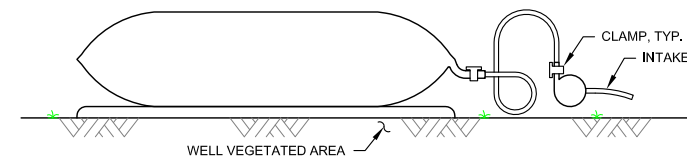
CLIENT 	<b>EAGLE GOLD PROJECT</b> <b>YUKON TERRITORY</b>				<b>Figure 3.4-2</b>
	<b>EROSION CONTROL BMP</b> <b>SECTIONS AND DETAILS</b> <b>SHEET 2 OF 3</b>				
	FILE NO. VA101-290/6	DWN NSD/DP	CKD BB	REV 0	
	OFFICE KPVAN	DATE July 18, 2013			



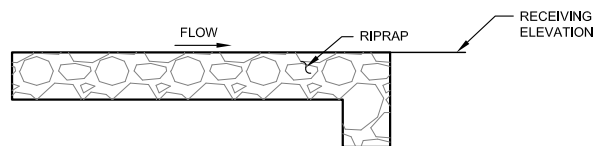
**SB SEDIMENT BASIN PLAN**  
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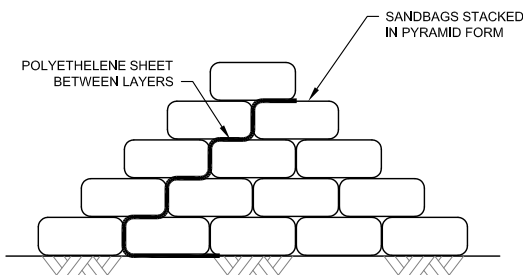
**FB FILTER BAG PLAN**  
NTS



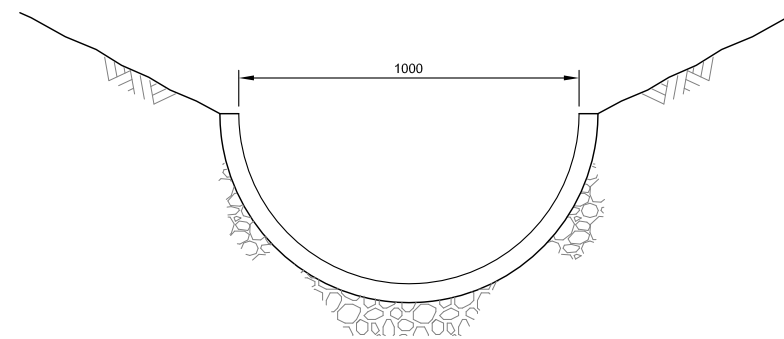
**FB FILTER BAG ELEVATION**  
NTS



**RD ROCK ENERGY DISSIPATER**  
NTS



**DS TEMPORARY STREAM DIVERSION STRUCTURE**  
NTS



**CMP CORRUGATED METAL HALF-PIPE**  
NTS

**SEDIMENT BASIN GENERAL NOTES**

1. SEDIMENT BASINS DETAIN STORMWATER RUNOFF FROM A DISTURBED AREA FOR AN EXTENDED TIME, ALLOWING SEDIMENT TO SETTLE.
2. SEDIMENT BASINS MAY REMAIN IN PLACE AS DURING OPERATIONS, AS INDICATED IN THE PLANS OR AS DIRECTED BY THE ENGINEER.
3. SEDIMENT BASIN MAY HAVE PUMP OR OUTLET CHANNEL TO COLLECTION DITCH.
4. RELEASES FROM SEDIMENT BASINS MAY REQUIRE FURTHER WATER MANAGEMENT/BMPS (EX. PUMPBACK, DISCHARGE TO COLLECTION DITCHES, FILTER BAGS, AND VEGETATED BUFFER STRIPS).

SAVED: M:\10100290\06\AA\acad\FIGS\B5\_1\_e (SGC) - 7/19/2013 1:44:30 PM - WLAHODA PRINTED: 7/19/2013 1:50:09 PM, Figure 3.4-3, WLAHODA XREF FILES: IMAGE FILES:

CLIENT 	<b>EAGLE GOLD PROJECT</b> <b>YUKON TERRITORY</b>			<b>Figure 3.4-3</b>
	<b>EROSION CONTROL BMP</b> <b>SECTIONS AND DETAILS</b> <b>SHEET 3 OF 3</b>			
	FILE NO. VA101-290/6	DWN NSD/WAL	CKD BB	REV 0
	OFFICE KPVAN	DATE July 18, 2013		



## 4 WATER MANAGEMENT PLAN IMPLEMENTATION

### 4.1 WATER MANAGEMENT PONDS

Prior to any proposed potential discharge to surface watercourses, the initial measures that will be implemented are the construction of the four permanent ponds: Lower Dublin North, Lower Dublin South, Eagle Pup, and Platinum Gulch ponds.

These four ponds have been designed as per the *Guidelines for Assessing the Design, Size and Operation of Sedimentation Ponds Used in Mining* (BC MOELP 1996), and their locations are shown on Figure 1.1-2. The ponds were designed to settle out sediment particles sized 0.005 mm (and larger), while providing a detention time of at least 10 hours.

The SCPs were designed to accommodate 0.5 m of dead storage (e.g., sediment), plus a live storage equal to the 1 in 10 year 24-hour storm event with a half meter of headboard. Design storms are detailed in Table 2.1-1 of this report. According to the sedimentation pond design manual (BC MOELP 1996), all structures within the ponds must be designed to withstand at least a 1 in 200 year 24-hour storm event.

Additionally, the ponds are classified as small dams since the embankment heights are greater than 2.5 m and some of the ponds are capable of storing more than 30,000 m<sup>3</sup> of water. As such, they were designed in accordance with the *Dam Safety Guidelines* (CDA 2007), and classified as Significant Level Dam class. The suggested inflow design flood for dam structures (i.e., the spillway) is between the 1 in 100 and 1 in 1,000 year flood. The spillways were designed to pass a 1 in 200 year 24-hour storm. The design criteria are further discussed in the *Draft Water Management Report* (Knight Piésold 2013c).

Table 4.1-1 summarizes the specifications of the ponds.

**Table 4.1-1: Water Management Pond Design Specifications**

Pond	Surface Area at Spillway Invert (m <sup>2</sup> )	Height of Embankment (m)	Storage Capacity (m <sup>3</sup> )	Primary Outflow		Secondary Outflow	
				Type	Depth Below Embankment Crest (m)	Type	Specifications
Lower Dublin North	5,200	9	-	300 mm Riser Pipe	1.5	Spillway	3.0 m width 0.3 m breadth
Lower Dublin South	15,400	17	30,000	600 mm Riser Pipe	1.5	Spillway	5.0 m width 0.5 m breadth
Eagle Pup	8,300	15	-	300 mm Riser Pipe	2.0	Spillway	7.0 m width 0.5 m breadth
Platinum Gulch	8,700	12	-	600 mm Riser Pipe	2.0	Spillway	4.0 m width 0.5 m breadth

**NOTES:**

1. The Platinum Gulch Pond will use exfiltration as the sole outflow during the construction phases.
2. The ponds do not have operational storage capacity, except for the Lower Dublin South pond. The storage capacity in the ponds shall be reserved for the 1 in 10 year storm event.

**4.1.1 Lower Dublin South Pond**

The Lower Dublin South pond will be constructed during Stage 1 of construction, and will be used to treat sediment-laden water in the central portion of the Project throughout construction. The treated water will be released to the DGDC, which will convey the water to Eagle Creek. With the commencement of mine operations, the Lower Dublin South pond will collect contact water from the Eagle Pup WRSA via a collection ditch which will connect the Eagle Pup pond and Lower Dublin South pond. This water will be treated in the MWTP for removal of metals prior to release to the environment.

The design of the Lower Dublin South pond is based on the largest area expected to report directly to the pond using the design criteria described in Section 4.1. No alterations to the layout and design of the pond are necessary during the change from construction to operations.

**4.1.2 Lower Dublin North Pond**

The Lower Dublin North pond will serve as a sedimentation pond during the entire life of mine, including the construction stages. The pond will be constructed during Stage 1 of construction, and will be used to treat sediment-laden water in the northern portion of the Project. The treated water will be released to Haggart Creek upon receipt of a Water Use License (WUL) authorizing discharge within standards.

The design of the Lower Dublin North pond is based on the largest area expected to report directly to the pond using the design criteria described in Section 4.1. No alterations to the layout and design of the pond are necessary during the change from construction to operations.

### 4.1.3 Eagle Pup Pond

The Eagle Pup pond will be constructed during Stage 2 of construction, and will be used to treat sediment-laden water from the Eagle Pup WRSA strip. Upon receipt of the WUL to support Stage 2 Construction, treated water will be released to the DGDC, which will convey the water to Eagle Creek. With the commencement of mine operations and loading of the WRSA with waste rock, the contact water from the Eagle Pup WRSA will be temporarily stored in the Eagle Pup pond and conveyed to the MWTP for removal of metals via the Lower Dublin South pond.

The design of the Eagle Pup pond is based on the largest area expected to report directly to the pond using the design criteria described in Section 4.1. No alterations to the layout and design of the pond are necessary during the change from construction to operations.

### 4.1.4 Platinum Gulch Pond

The Platinum Gulch pond will be used as an exfiltration area during both Stage 1 and Stage 2 construction in order to prevent discharge to watercourses in the southern extent of the Project. The pond will be used to treat sediment-laden water from the open pit strip and Platinum Gulch WRSA strip. The exfiltration area will be built with a riser pipe, as described in the *Draft Water Management Report* (Knight Piésold, 2013c), but the riser pipe will be blocked during construction stages to prevent water from discharging through it. The exfiltration area will need to be converted to a water management pond at the start of operations, which involves the design criteria outlined in Section 4.1, and therefore the governing design of the facility will be the water management pond criteria. Prior to commencement of operations, the Platinum Gulch pond will be converted to a water management pond by:

- Dredging the sediment build-up from the construction activities;
- Lining the basin to prevent exfiltration;
- Unblocking the riser pipe and constructing the overflow spillway as described in the *Draft Water Management Report* (Knight Piésold, 2013c).

During operations, contact water from the open pit and Platinum Gulch WRSA will be temporarily stored in the Platinum Gulch pond and conveyed to the Lower Dublin South pond via gravity fed collection ditches. This water will be treated in the MWTP for removal of metals prior to discharge to the environment.

## 4.2 DITCHES

Non-contact and sediment-laden water will be conveyed via trapezoidal ditches lined with riprap and corrugated metal half-pipes (CMH) during the construction stages. The same ditches and corrugated metal half-pipes will be used during operations to convey contact water, as necessary.

The ditches will be one of two types based on the gradient. For slopes of 5% or less, a Type 1 ditch will be constructed that includes riprap lining with a  $D_{50}$  of 200 mm, and a riprap thickness of

400 mm. For slopes between 6% and 15% a Type 2 ditch will be constructed, with 940 mm thickness of material with a  $D_{50}$  of 470 mm. The median grain size,  $D_{50}$ , refers to the grain diameter for which 50% of the sample is smaller than and 50% is larger than the specified diameter (i.e.,  $D_{50}$  of 200 mm means that 50% of the sample has a diameter greater than 200 mm and 50% has a diameter less than 200 mm). Cross section configurations of collection and diversion ditches with Type 1 and Type 2 riprap are shown on Figure 3.4-1.

Corrugated metal half-pipes will be used in terrain that is steeper than 15%, as the velocities at such slopes are too high for practical riprap channel protection. An appropriate diameter of corrugated metal half-pipes is 1.0 m, as shown on Figure 3.4-3.

Ditches located upslope of key mine infrastructure will be sized to convey the 1 in 100 year 24-hour return period storm event. Due to the relatively small area contributing to these specific ditches, the Type 1 and Type 2 ditches described above will be sufficient to convey the larger storms as well.

## **5 EROSION AND SEDIMENT CONTROL PLAN IMPLEMENTATION**

### **5.1 GENERAL**

This section provides an overview of the construction activities for each year during the construction phase of the project.

The overall construction sequencing is described in the following sections.

### **5.2 STAGE 1 CONSTRUCTION**

The scope of the Stage 1 Construction Plan includes:

- Upgrades to the Haggart Creek Road that includes minor realignments, construction of pull outs, grading, resurfacing and drainage improvements.
- Camp expansion.
- Upgrade of existing site access roads by widening and grading to provide access to construction areas.
- Construction of new site access roads to provide access to construction areas.
- Clearing, grubbing and grading for roads, infrastructure and facilities including the following:
  - Camp expansion
  - Laydown area
  - Sub-stations
  - Landfill
  - Transmission Line Right-of-Way
  - Open pit initial pre-stripping
  - Permanent crushing and screening Plant
  - Overland conveying system
  - Dublin Gulch Diversion Channel
  - Heap Leach Facility Phase I
  - Heap Leach Facility embankment and spillway
  - Adsorption, desorption and recovery plant, metallurgical laboratories, administration office and reagent storage buildings

- Mine water treatment and cyanide detoxification plant
- Lower Dublin South pond
- Lower Dublin North pond
- Platinum Gulch pond/exfiltration area
- Diversion and collection ditches and sediment and erosion control facilities
- Truck shop, mine offices and fuel storage
- Explosives storage
- Magazine storage
- Excavation and bulk earthworks for the following facilities:
  - Ice-rich overburden storage facility
  - Dublin Gulch Diversion Channel
  - Sub-stations
  - Laydown area
  - Landfill
  - Heap Leach Facility Phase I
  - Heap Leach Facility Embankment and Spillway
  - Permanent crushing and screening Plant
  - Temporary (for construction purposes) crushing and screening plant(s)
  - Overland conveying system
  - Adsorption, desorption and recovery plant, refinery, security/administration office and reagent storage buildings
  - Assay and metallurgical lab
  - Mine water treatment and cyanide detoxification plant
  - Open pit initial pre-stripping
  - Lower Dublin South pond
  - Lower Dublin North pond
  - Platinum Gulch pond/exfiltration area
  - Truck shop, mine offices and fuel storage
- Concrete foundations for the following infrastructure and facilities:
  - Sub-stations

- Laydown area
- Landfill
- Crushing and screening plant
- Overland conveyor support footings
- Adsorption, desorption and recovery plant, refinery, security/administration office and reagent storage buildings
- Assay and metallurgical lab
- Mine water treatment and cyanide detoxification plant
- Truck shop, mine offices and fuel storage

The following sections describe erosion and sediment control measures to be implemented during Stage 1 Construction, as shown on Figure 5.2-1. For the purposes of this Plan, the Project site has been subdivided by geographical and functional areas.

### **5.2.1 Southern Portion of the Project Area**

For the purposes of this Plan, the southern portion of the site is defined as the area of disturbance south of the truck shop and crushing plant and includes the open pit, explosives storage and magazine storage facilities, and site access roads for these facilities. Sediment and erosion control in the southern portion of the site is focused around the Platinum Gulch pond/exfiltration area. Sediment-laden runoff from cleared areas will be directed to the Platinum Gulch Pond/exfiltration area where possible. Downstream of this facility, sediment-laden water will be controlled in supplemental sediment basins or exfiltration ponds, as necessary. No discharge of sediment laden runoff to watercourses will occur. The implementation of the Plan is depicted on Figure 5.2-1.

In order to stabilize the southern portion of the Project, the following sequence of measures will be implemented:

- Construct the Platinum Gulch Pond/exfiltration area.
- Construct sediment basins in the low points downslope of the following facilities/areas:
  - South of Access Road #1
  - Two sediment basins downslope of the ice-rich overburden stockpile
  - One south of the ice-rich overburden stockpile
- Construct the exfiltration area south of Access Road #1.
- Construct the diversion ditch (Type 1) south of Haul Road #1 to divert all clean water upslope of the road.
- Construct the diversion ditch (Type 1) upslope of the Access Road to Explosives Storage, running south to north, and tie it in to the diversion ditch upslope of Haul Road #1.

- Construct the diversion ditch (Type 1) east of the ice-rich overburden stockpile running north to south to the sediment basin.
- Construct the diversion ditch (Type 1) upslope of the Land Treatment Facility and Landfill area.
- Install rock energy dissipater structures at the end of the diversion ditches where the ditches tie into the natural drainage. This protects the natural drainage from higher velocity flows released from the diversion ditch. Vegetation management will be implemented downslope of the diversion ditch to ensure the flow does not erode natural ground.
- Install silt fences downstream of proposed collection ditches prior to construction of collection ditches.
- Construct collection ditches:
  - One ditch (Type 1) around the perimeter of Haul Road #1.
  - One ditch (Type 1) alongside the Access Road to Explosives Storage that joins the collection ditch along Haul Road #1.
  - One ditch (Type 1) on the south side of the open pit initial strip perimeter, leading to the Platinum Gulch Pond/ exfiltration area.
  - One ditch (Type 1) alongside the landfill area and landfill access road.
  - One ditch (Type 1) downslope of the ice-rich overburden stockpile leading to the first sediment basin (north SB2)
  - Two ditches (Type 1) downslope of the ice-rich overburden stockpile leading to the second sediment basin (south SB2)
- Install a corrugated metal half-pipe on the north side of the open pit initial strip perimeter leading to the Platinum Gulch Pond/exfiltration area.
- Install culverts as necessary under Haul Road #1, Temporary Access Road #1, and Access Road to explosives and magazine storage facilities.
- Install sediment traps in the collection ditch along Haul Road #1, as necessary.
- Install sediment traps in the collection ditch and diversion ditch along Access Road to Explosives Storage, as necessary.
- Apply slope roughening and temporary seeding to all cut and fill slopes once the silt fences, sediment basins and collection or diversion ditches have been installed.
- Apply BMPs for slope stabilization and channel protection as necessary in the sediment basins, ditches, and on unstable and/or disturbed slopes and surfaces.
- Clear timber and brush from the open pit, explosive storage and magazine storage facilities areas.
- Strip the topsoil from the facilities footprints and begin earthworks in area.



### 5.2.2 Central Portion of the Project Area

For the purposes of this Plan, the central portion of the site is defined as the area of disturbance for the laydown area, sub-station, truck shop, and crushing plant. Most of the sediment and erosion control measures implemented in this area focus on collecting sediment-laden water and treating it in temporary sediment basins.

In order to stabilize the central portion of the Project, the following sequence of measures will be implemented:

- Construct a sediment basin (type SB2) immediately southwest of the Dublin Gulch Diversion Channel as shown on Figure 5.2-1.
- Construct a rock energy dissipater structure downstream of the sediment basin to protect the natural drainage.
- Construct sediment basin (SB2) in the southwest corner of the sub-station area and grade the area to allow runoff to flow into the basin.
- Construct sediment basin (SB2) in the southwest corner of the laydown area and grade the area to allow runoff to flow into the basin.
- Construct sediment basin (SB2) southeast of the first bend in Access Road #1.
- Install silt fences:
  - Downslope of the proposed collection ditch adjacent to Eagle Creek
  - Downslope of the truck shop area
  - Downslope of the crushers area
- Install a culvert under Haul Road #2 to allow Suttles Gulch to flow through when flowing as the watercourse is ephemeral and intermittent.
- Construct non-contact surface water diversion ditches to Eagle Creek:
  - One (Type 1) running north to south on the east side of Access Road #1
  - One (Type 2) running east to west on the south of Access Road #2, and then north to south upslope of the truck shop area
- Install a corrugated metal half-pipe to join the two diversion ditches named above, and convey the flow to the SB2 southeast of the first bend in Access Road #1.
- Install a diversion structure on Suttles Gulch immediately south of Access Road #2 and divert the flow to Eagle Creek via the diversion ditch.
- Construct collection ditches (Type 1):
  - Downslope of the laydown area and sub-station, running south to north to the sediment basin

- Downslope of the truck shop, running south to north towards the Lower Dublin South pond
- Conduct slope roughening and apply temporary seeding to all cut and fill slopes once the silt fences, sediment basins and collection or diversion ditches have been installed.
- Apply BMPs for slope stabilization and channel protection as necessary in the sediment basins, ditches, and on unstable and/or disturbed slopes and surfaces.
- Strip the topsoil from the facilities footprints and begin earthworks in area.
- Maintain all the mitigating measures listed above during Stage 1 and 2 construction.

### 5.2.3 Eagle Pup and Lower Dublin South Areas

For the purposes of this Plan, the Eagle Pup and Lower Dublin South areas are defined as the area of disturbance for the Eagle Pup pond, the Lower Dublin South pond, the topsoil stockpiles, and Access Road #2. The primary focus of this part of the Plan is to collect sediment-laden water and convey it to the Lower Dublin South pond and to divert clean water where possible.

In order to stabilize the Eagle Pup and Lower Dublin South areas of the Project, the following sequence of measures will be implemented:

- Construct the Lower Dublin South pond as shown on Figure 5.2-1.
- Construct three sediment basins (SB2) at the low points on the north side of the topsoil stockpiles. These sediment basins will discharge to the DGDC after treating the runoff for sedimentation.
- Install a silt fence upslope of Eagle Pup.
- Install corrugated metal half-pipes upslope of Eagle Pup leading to the DGDC.
- Install a rock energy dissipater structure at the end of the corrugated metal half-pipe diversion ditch where the ditch ties into the DGDC. This protects the DGDC from the higher velocity flows from the corrugated metal half-pipe.
- Construct collection ditches:
  - The main collector ditch (Type 2) along the north side of Access Road #2 leading to the Lower Dublin South pond
  - Numerous ditches (Type 1) along the switch-backs of Access Road #2 that flow into the main collector ditch on the north side of this access road
  - The perimeter ditches (Type 1) on the north side of the topsoil stockpiles leading to the sediment basins
- Install culverts as necessary under Access Road #2.
- Conduct slope roughening and apply seeding to all cut and fill slopes once the silt fences, sediment basins and collection or diversion ditches have been installed.

- Apply BMPs for slope stabilization and channel protection as necessary in the sediment basins, ditches, and on unstable and/or disturbed slopes and surfaces.

#### **5.2.4 Northern Portion of the Project Area**

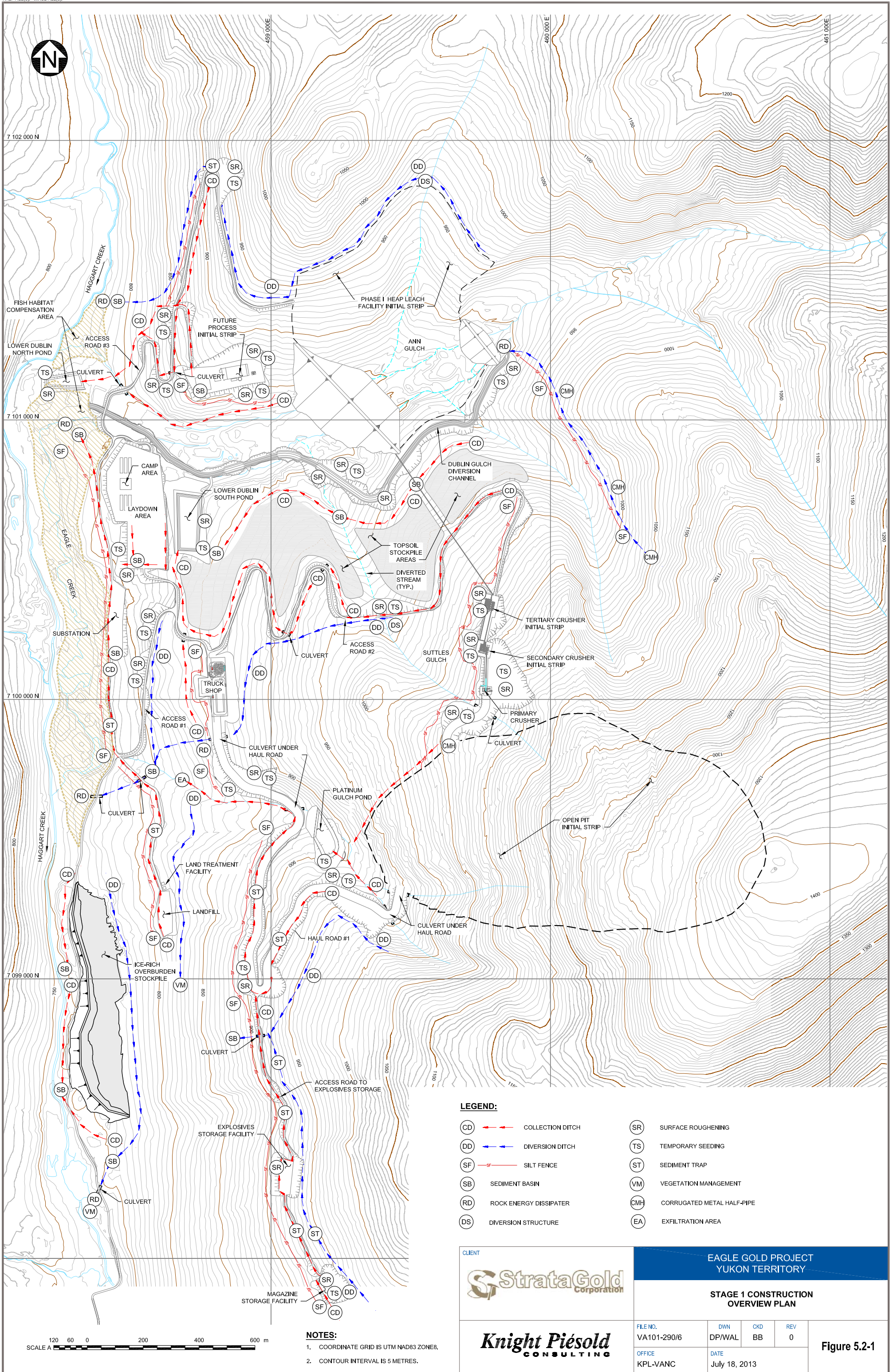
For the purposes of this Plan, the northern part of the Project area is defined as the area of disturbance for the heap leach facility, Dublin Gulch diversion channel, events ponds, process area and Lower Dublin North pond. The Plan focuses on collecting sediment-laden water and directing it to either temporary sediment basins or to the Lower Dublin North pond.

In order to stabilize the northern area of the Project, the following sequence of BMPs will be executed:

- Construct the Lower Dublin North pond, as shown on Figure 5.2-1.
- Construct a sediment basin (SB2) in the southwest corner of the future process facilities area and grade the area to allow runoff to flow into the basin.
- Construct the diversion ditch (Type 1) around the future HLF running east to west.
- Install a sediment trap in the diversion ditch downslope of the cut slope to trap any sediment that may come off of the disturbed slope.
- Construct a sediment basin (SB2) at the end of the diversion ditch running along the Heap Leach Access Road to treat water prior to release to Haggart Creek.
- Install a rock energy dissipater structure downstream of the sediment basin.
- Install a collection ditch (Type 1) upslope of the switch-back of the Heap Leach Access Road.
- Install a diversion structure on the north tributary to Ann Gulch and divert flow to Haggart Creek via the diversion ditch.
- Construct collection ditches (Type 1) along the switch-backs of Access Road #3 leading to the Lower Dublin North pond.
- Construct a collection ditch (Type 2) upslope of the events ponds leading to the Lower Dublin North pond.
- Install culverts as necessary under Access Road #3.
- Install silt fences:
  - Downslope of the future process facilities area
  - Downslope of the Heap Leach Facility Access Road
- Apply slope roughening and temporary seeding to all cut and fill slopes once the silt fences, sediment basins and collection or diversion ditches have been installed.

- Apply bioengineering techniques for slope stabilization and channel protection as necessary in the sediment basins, ditches, and on unstable and/or disturbed slopes and surfaces.
- Strip the topsoil from the facilities footprints and begin earthworks.





**LEGEND:**

(CD)	→	COLLECTION DITCH	(SR)	SURFACE ROUGHENING
(DD)	→	DIVERSION DITCH	(TS)	TEMPORARY SEEDING
(SF)	→	SILT FENCE	(ST)	SEDIMENT TRAP
(SB)	→	SEDIMENT BASIN	(VM)	VEGETATION MANAGEMENT
(RD)	→	ROCK ENERGY DISSIPATER	(CMH)	CORRUGATED METAL HALF-PIPE
(DS)	→	DIVERSION STRUCTURE	(EA)	EXFILTRATION AREA

**NOTES:**  
 1. COORDINATE GRID IS UTM NAD83 ZONES.  
 2. CONTOUR INTERVAL IS 5 METRES.

	<b>EAGLE GOLD PROJECT          YUKON TERRITORY</b>			
	<b>STAGE 1 CONSTRUCTION          OVERVIEW PLAN</b>			
<b>Knights Piésold          CONSULTING</b>	FILE NO. VA101-290/6	DWN DP/WAL	CKD BB	REV 0
	OFFICE KPL-VANC	DATE July 18, 2013		

**Figure 5.2-1**



### 5.3 STAGE 2 CONSTRUCTION

As the Project progresses into Stage 2 construction, some of the temporary sediment and erosion control measures can be decommissioned and reclaimed.

Construction during Stage 2 will be sequenced as follows:

- Site preparation for the following areas:
  - Eagle Pup WRSA
  - Eagle Pup Pond
  - Platinum Gulch WRSA
  - 100-day ore storage area
  - Events ponds
- Completion of construction started in Stage 1:
  - Overland conveying system
  - Crushing and screening plant
  - Adsorption, desorption and recovery plant, metallurgical laboratories, administration office and reagent storage buildings
  - Mine water treatment and cyanide detoxification plant
  - Dublin Gulch Diversion Channel
  - Phase I Heap Leach Facility
  - Events ponds
  - Eagle Pup pond
  - Sub-stations
  - Truck shop, mine offices and fuel storage

The following sections detail the implementation of the BMPs in Stage 2 construction, as shown on Figure 5.3-1.

### **5.3.1 Southern Portion of the Project Area**

Sediment and erosion control in the southern portion of the Project area will tie into the existing measures implemented in Stage 1, as described in Section 5.2.1.

In order to stabilize the southern portion of the Project, the following sequence of BMPs are planned:

- Place a corrugated metal half-pipe around the perimeter of the Platinum Gulch WRSA initial strip.
- Place a corrugated metal half-pipe at the toe of the Platinum Gulch WRSA initial strip connecting the perimeter corrugated metal half-pipe to the Platinum Gulch pond/exfiltration area.
- Commence site preparation for the Platinum Gulch WRSA.

### **5.3.2 Central Portion of the Project Area**

Sediment and erosion control in the central portion of the Project area will tie into the existing measures implemented in Stage 1, as described in Section 5.2.2.

In order to stabilize the central portion of the Project, the following sequence of BMPs are planned:

- Construct a collection ditch (Type 1) downslope of the proposed 100-day ore storage pad initial strip area.
- Commence site preparation for the 100-day ore storage pad.

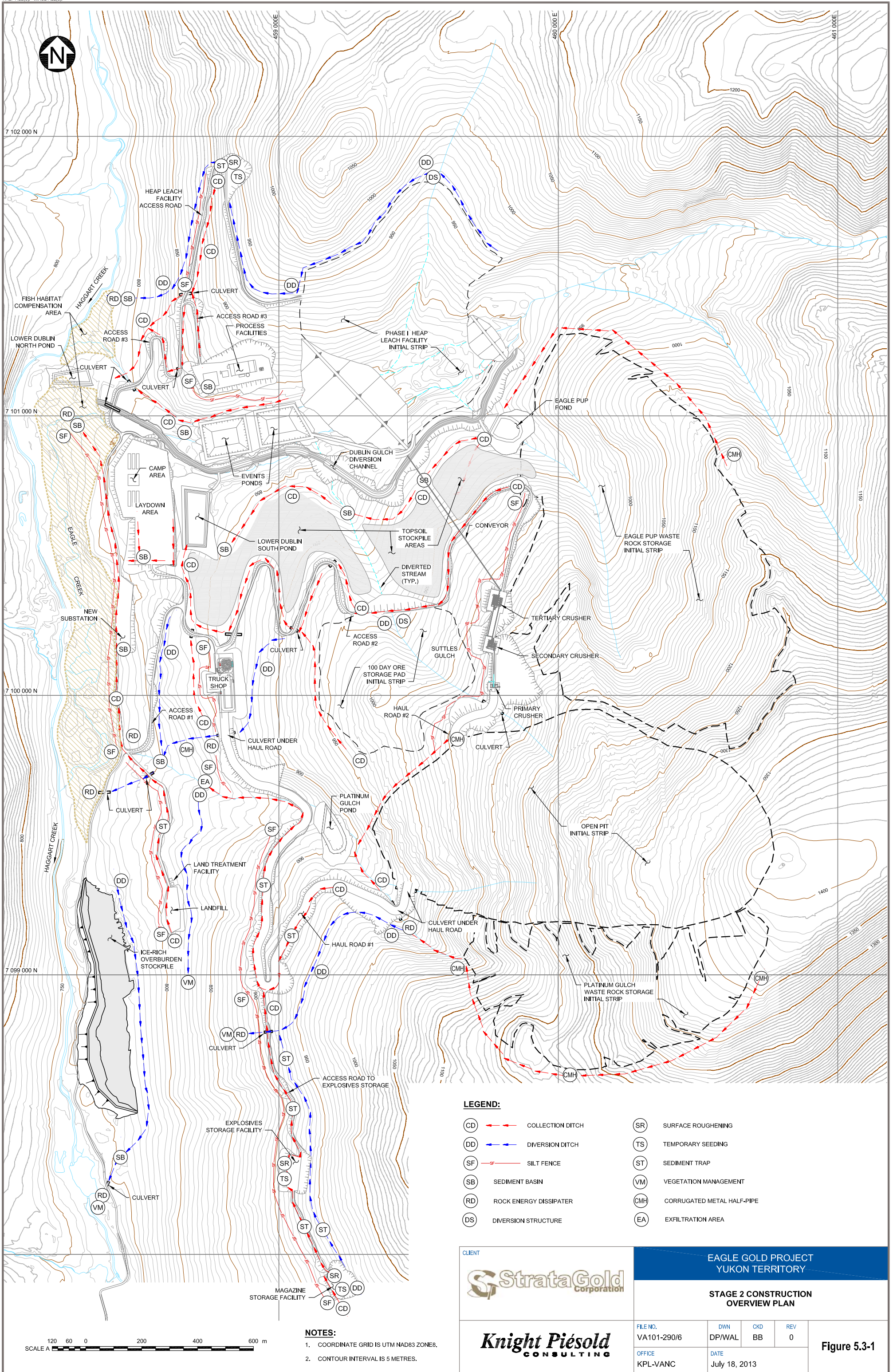
### **5.3.3 Northern Portion of the Project Area**

Sediment and erosion control in the northern portion of the project area will tie into the existing measures implemented in Stage 1, as described in Section 5.2.4.

In order to stabilize the northern portion of the Project, the following sequence of BMPs are planned:

- Construct the Eagle Pup pond.
- Construct a sediment basin (SB2) downstream of the events ponds in Dublin Gulch.
- Install a corrugated metal half-pipe around the eastern perimeter of the Eagle Pup WRSA initial strip to convey flow to the Eagle Pup pond.
- Commence site preparation for the Eagle Pup WRSA.





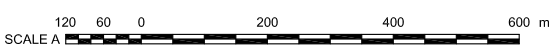
**LEGEND:**

- |      |                        |       |                            |
|------|------------------------|-------|----------------------------|
| (CD) | COLLECTION DITCH       | (SR)  | SURFACE ROUGHENING         |
| (DD) | DIVERSION DITCH        | (TS)  | TEMPORARY SEEDING          |
| (SF) | SILT FENCE             | (ST)  | SEDIMENT TRAP              |
| (SB) | SEDIMENT BASIN         | (VM)  | VEGETATION MANAGEMENT      |
| (RD) | ROCK ENERGY DISSIPATER | (CMH) | CORRUGATED METAL HALF-PIPE |
| (DS) | DIVERSION STRUCTURE    | (EA)  | EXFILTRATION AREA          |

**NOTES:**

- COORDINATE GRID IS UTM NAD83 ZONE8.
- CONTOUR INTERVAL IS 5 METRES.

	<b>EAGLE GOLD PROJECT          YUKON TERRITORY</b>			
	<b>STAGE 2 CONSTRUCTION          OVERVIEW PLAN</b>			
<b>Client</b> 	<b>FILE NO.</b> VA101-290/6	<b>DWN</b> DP/WAL	<b>CKD</b> BB	<b>REV</b> 0
<b>Office</b> KPL-VANC	<b>DATE</b> July 18, 2013	<b>Figure 5.3-1</b>		





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