Temporary Erosion and Sediment Control Plan (TESCP) – Construction Phase 1

Alberta Transportation TND 0022477

Springbank Dam Project

Prepared for: Vinci Infrastructure Canada

Date: April 17, 2022

CPP ENVIRONMENTAL | Charette Pell Poscente

This page was intentionally left blank.

PROFESSIONAL SIGNOFF

This report was prepared exclusively for the client by CPP Environmental. The quality of the information, conclusions, and any estimates are based on information available at the time of the preparation of the report. This includes any data supplied by 3rd party sources.

This report is to be used by the client for its identified intention, subject to any terms or agreements with CPP Environmental. Any other use of this report is at the user's own risk.

Prepared by: Greg Henderson, P.Ag., CPESC
Théo Charette, M.Sc., P.Biol., QAES

<original signed by>

To the best of my knowledge and the best of my professional ability, recognizing reasonable standard of care expected of a professional doing this work, it is my professional opinion that all the information contained in this report is accurate and complete, and contains all the relevant information for the purposes of this project or application.

This report, including all attachments, data and supplemental information, were prepared by me or under my direct supervision and has been reviewed and accepted by me.

All the information submitted is, to the best of my knowledge, true, accurate, and complete.

CONTENTS

List of Appendices

1 Erosion and Sediment Control Process Overview

This report is a temporary erosion and sediment control plan (TESCP) that focusses on providing measures at the Springbank off-storage dam project (Springbank) for selected stripping and stockpile locations (see **Figure 1**) proposed for April 2022. Measures are also provided for the general protection of environmentally sensitive sites prior to the start of construction.

This TESCP is provided to facilitate the start of the project, to allow for continued progress, and to help integrate erosion and water management with project scheduling and staging. The TESCP provides temporary measures that may be removed or altered as the project transitions into subsequent phases.

In general, erosion and sediment control (ESC) measures are designed to protect exposed soil surfaces and to reduce the release of sediment into environmentally sensitive areas, such as water bodies and watercourses. Sedimentation is considered a deleterious substance under the *Fisheries Act*, as it may cause degradation to fish habitat and water quality. Standard procedures and best management practices are detailed in *Alberta Transportation's Erosion and Sediment Control Manual* (2011). The purpose of the erosion and sediment control measures is to minimize erosion and sediment transport.

The difference between erosion and sediment control processes is defined as follows:

- Erosion control is the process whereby the potential for the physical removal or detachment of soil particles is minimized.
- Sediment control is the process whereby the potential for eroded soil being transported and deposited beyond the limits of the site is minimized.

Erosion control is the primary focus, as it is very effective in preventing erosion and when applied correctly mitigates the need for sediment control. Best Management Practices (BMPs) for erosion control listed in Alberta Transportation (2011) are well known and commonly applied at construction sites in Alberta.

The main goals of ESC plans are to provide measures for three project phases of the Springbank project:

1. Prior to the start of construction
2. During construction, and
3. After construction.

Measures will change from temporary to permanent through the project phases. At phase 1, integrating scheduling and staging of construction activities within a TESCP is the most important planning strategy for soil conservation. This includes:

- Minimizing exposed soil,
- Directing run-on surface water around the work area,
- Soil stockpile management,
- Installing BMPs early, and
- Inspections to assess the effectiveness of BMPs.

Throughout all stages of construction, it is critical that disturbance to existing vegetation and soils be minimized to the greatest degree possible. Construction will be strictly limited to those areas requiring disturbance to complete the works. Before beginning construction activities, project limits, including any areas requiring clearing, will be identified to ensure no work takes place beyond the proposed disturbance area.

Redirecting runoff water away from any exposed soils will help minimize the amount of erosion and sediment generation.

ESC measures will follow best management practices (BMPs) by AT (2011). ESC measures to control soil erosion will be assessed, in part, using the 2002 Revised Universal Soil Loss Equation for Application in Canada (RUSLEFAC, Wall et al. 2002), especially during the construction phase. The RUSLE model is meant

as a guideline only and does not quantify actual soil loss or estimate soil loss from mass wasting. However, it is recognized by Alberta Transportation for estimating surface erosion and used to help select controls and measures. RUSLEFAC is expressed as:

A= R*K*LS*C*P, where

- A= annual soil loss due to erosion (t/ha)
- R= erosivity index interpolated from isoerodent map for Calgary area= 320
- K= Index for soil erodibility, based on soil texture and organic matter content
- LS = topographic factor, with slope lengths and % gradient from topographic maps
- C= cover factor, ranges from 0.001 (fully vegetated) to 1.0 (bare soil, no cover), and
- P= support factor, varies by measure selected to 1 (no practice).

At stripping areas (**Figures 2, 5 and 6**), texture for the 'lower subsoil' layer was obtained from the nearest soil sampling location to each slope segment. K values ranged from 0.029 to 0.040. At stockpiled areas, the K value corresponding to topsoil texture was applied to the RUSLE equation. A publicly available LS calculator provided by the City (2022) was employed to derive LS. Proposed RUSLE target for soil loss is <11 t/ha/y, which is a 'low' soil loss category (Wall et al. 2002). C and P values for measures to bring estimated soil loss to target levels were available from manufacturers. Installation guidelines for measures are provided in AT's (2017) Best Management Practices (BMPs), while measure-specific details are from individual manufacturers.

Soil management for erosion at stockpiles is based on generally accepted guidelines (e.g., City 2022) such as downslope protection to contain runoff and temporal stablization.

2 Project Information

Vinci Infrastructure Canada ("Vinci" or "Contractor") was retained by Alberta Transportation to complete construction of the Springbank Dam Off-Stream Reservior (Springbank). Major works include infrastructure to divert and retain a portion of Elbow River flows within an off-stream reservoir during flood conditions and release of water in a controlled manner after the threat of flood has subsided. The reservoir will work in tandem with the Glenmore Reservoir in Calgary to accommodate water volumes equal to the 2013 Calgary flood. The Site is located in the vicinity of the Highway 22 and Highway 8 intersection, approximately 15 km west of Calgary, Alberta in Rocky View County.

The project is scheduled to commence on April 18, 2022, and be fully complete by October 1, 2025. Refer to the Environmental Construction Operations (ECO) Plan (CPP 2022) for a schedule of activities and component details. For ease of management, this TESCP will focus on 2022 activities listed in Appendix 2 of the ECO Plan starting in April. ESC plan updates will be provided as the project transitions into subsequent phases. Actvivities scheduled to start in the immediate future include:

1. Elow River: Diversion Structure: River Diversion, Service Spillway, Diversion Inlet
2. Elbow River: Diversion Channel: Stage 1- Excavation, and
3. Unnamed Creek: Off-stream Storage Dam: Low Level Outlet Works and Embankment

2.1 Objectives

The main objective of this TESCP is to protect areas planned to be stripped, and critically sensitive areas. The critically sensitive areas for this project are protection of the:

- Elbow River,
- Unnamed Creek, and
- Wetlands which occur within and adjacent to the proposed work area.

The intent of this TESCP is to provide site-specific, temporary erosion and sediment control measures for environmentally sensitive locations of the project under current conditions for the start of the Project. This TESCP does not encompass project shutdown details and the TESCP may require updates as site conditions change and unforeseen issues arise.

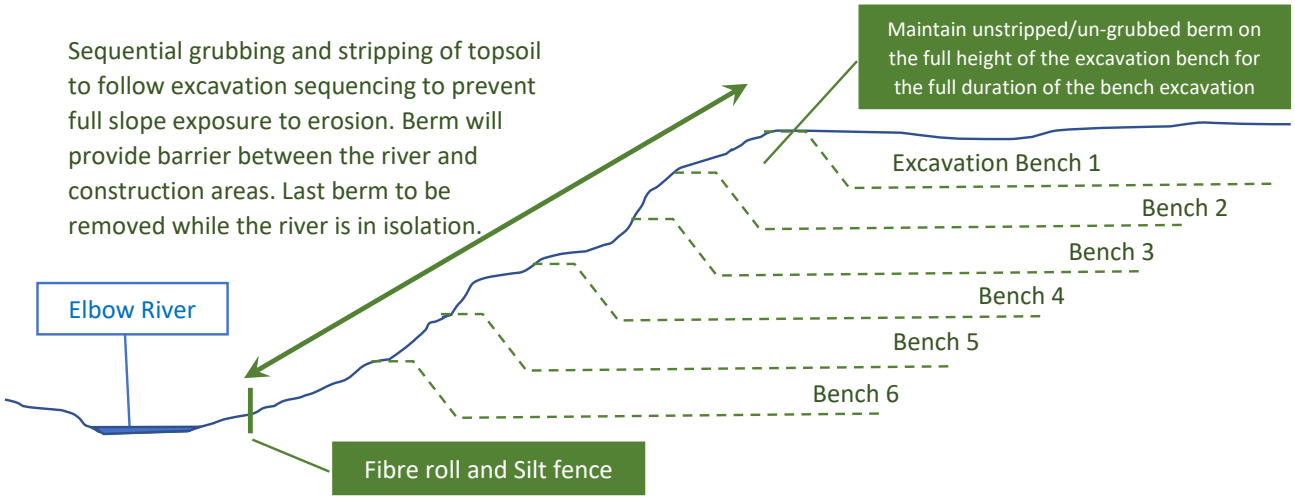
3 Proposed (Temporary) ESC Measures for Environmental Sensitivities

Figure 1 identifies locations of site specific measures discussed in the following sections.

3.1 Stripping Area North of the Elbow River

Figure 2 encompasses the north slope of the Elbow River with steep (20 to >40%) slopes, but the risk to topsoil erosion when maintaining existing ground cover is low except for a narrow band of severe soil erosion close to the water (Stantec 2018). The plan is to strip soils and excavate down to lowest designed diversion channel elevation to allow future access to the river by July 16, 2022, which is when the Restricted Activities Period ends and instream construction activities can begin. Further soil stripping and excavation of the diversion channel on the side slopes will occur sequentially until the design elevations and slopes are achieved. I.e., this will be an active construction site, thus no ESC measures are proposed within the excavation. The excavation area will never have overland connection to the Elbow River, since a pillar of land (i.e., a berm) will be left in place between the river and the construction area until river isolation is complete. This berm will maintain unstripped and ungrubbed surface conditions on the outside, to retain natural processes in place.

Due to the sensitivity of the river and to steep terrain including the identified band of severe soil erosion, Vinci will retain the double perimeter protection near the toe of the slope, at least 2 metres above the high water mark of the Elbow River. The first protection measure is a fibre roll, followed by a silt fence. The following is a conceptual illustration of the sequence described above.



Note that high flows in the Elbow River are typically expected in June but may also occur earlier in May. Flow data for Elbow River at Sarcee Trail (Water Survey of Canada Station 05BJ010) from 1979 to 2019 indicates that the annual average peak flow is in June. However, flow higher than the annual average has been recorded in both May and July. Maximum flow observed over the period of record occurred in June 2013. Therefore, it is important to install toe-of-slope measures above the typical high water mark and remove when no longer needed.

3.2 Stockpile area near Elbow River

Figure 3 illustrates the proposed stockpile. Measures here are:

- A silt fence at the west border to prevent run-on and protect the wetland outside of the Project area,
- A silt fence at the base of the stockpile area at the north-east, east and south-east borders, and
- Silt fences at the toe/downslope of the side of any temporary stockpile within the stockpile area, parallel to the contours along the slope.

3.3 Stockpile area east of Pirmez Creek

This proposed stockpile area is shown in **Figure 4.** This area is nearly flat (<1%) and no RUSLE calculation was conducted. Regardless, ESC measures that will be applied are to:

- Install a silt fence downslope of the stockpile area at the west, south north and east borders as shown in the figure. This will also serve to protect the wetland area outside of the Project area, and
- Install silt fences at the toe/downslope of the side of any temporary stockpile within the stockpile area, parallel to the contours along the slope.

3.4 Adjacent to Highway 22

This is an area immediately adjacent to Highway 22 (**Figure 5**) where works will begin on soil salvage and excavation of the diversion channel as per the design in preparation for crossing construction. Slopes are gentle (2%) and estimated soil loss using RUSLE is low, which is not a concern by itself. However, to prevent off-site delivery of sediment downgradient, Vinci will retain the silt fence downgradient at the southern border of the excavation area. Also, the silt fence on the west side will remain to create a barrier from the Highway ditch will remain in place until no longer needed.

3.5 Stripping area west of Unnamed Creek (future Low Level Outlet area)

This area will be stripped and excavated to allow work on the Low Level Outlet. Although there are some steep slopes along the Unnamed Creek, in the proposed stripping/excavation area, topography is relatively flat (**Figure 6**). The risk to topsoil erosion with existing cover is low (Stantec 2018). Before construction or clearing, and to prevent sediment laden water from entering the creek, the existing fibre rolls will be retained above the high water mark on the west side of the creek. Since the area will consist of an active excavation area, there is no need for further ESC measures at this stage of the project, other than those measures shown to protect adjacent wetlands.

3.6 Wetlands

There are pockets of wetlands mapped in **Figures 3 to 6**. Before the start of construction, Vinci will complete the following actions prior to the start of construction:

1. Install silt fence to separate remaining wetland areas from active construction areas (as shown in the figures), and
2. Install a high visibility fence to clearly delineate the extent of the wetlands.

3.7 Additional Information

- This first phase of construction has been planned to minimize the extent of exposed ground.
- If construction activities are delayed for extended periods of time after work has commenced, temporary measures will be maintained until work resumes. Extended periods of time will be defined as any time work is not active.
- To protect soils, silt fences will be installed at the toe/downslope of the side of any temporary stockpile, parallel to the contours along the slope.
- Very high local winds recorded at over 70 km/h (Stantec 2018) can generate dust from both roads and stockpiles, and transport sediment long distances into waterbodies. Dust suppressants will be applied to roads, as necessary. Tackifier will be applied to stockpiles. Stockpile measures are for the short term only. Additional coverage measures will be applied to stabilize stockpiles if stockpiles are in place longer than 30 days (e.g., for dust) and permanent measures if in place for up to one year.
- Stabilizing work entrances to prevent mud tracking onto roads will be practiced.
- Surfacing (e.g., rig mats, gravel) on temporary roads over fields to access sites will be practices to reduce surface erosion at this phase.
- Sediment captured by silt fences will be removed and disposed of before it reaches 1/3 the height of the device.
- Retain all temporary measures in place (unless noted otherwise) until transition (e.g., before to during- construction) or permanent measures can be implemented.
- Keep spare sediment fence and straw wattles on hand in case they are needed.
- Vinci will be responsible for the removal of temporary ESC measures once Project activities are completed.

4 BMPs

Refer to **Appendix 2** for further details of the two BMPs discussed below.

4.1 Silt Fence (BMP #1)

Silt fences collect sediment laden sheet flow runoff and causes water to pond allowing for sediment to settle out as water filters through the fabric. Silt fencing can be useful as perimeter protection at the toe of slopes. moving downslope towards flowing water. Silt fence should not be installed in areas of concentrated flow (e.g., channels, ditches). Silt fences should be installed per AT BMP #1, importantly with maximum lengths of 40 m, along the contour, and in a J-hook configuration.

4.2 Fibre Rolls (BMP #38)

Fibre rolls can be installed on the soil along slope contours as a grade break to reduce erosion potential, and along streambanks to capture sediment and organic matter carried by the runoff. It can also be a solution for sheet flow and rill erosion on slopes, flow retarder and silt trap, and can be used on slopes too steep for silt fences. Fibre rolls are to be trenched into the ground with a minimum of at least 150 mm deep by 150 mm wide. Secure fibre rolls to soil using a wooden stake or other appropriate anchor (metal rebar, large nails) to a minimum depth of 0.3 m.

5 Inspections and Reporting

All ESC measures will be inspected weekly to ensure they are properly installed, functioning effectively, and are maintained, cleaned and/or upgraded as required until revegetation of disturbed areas is achieved. At any time, if Vinci or CPP determines a location within the project area that requires ESC mitigation due to a new development of erosional concerns, it is to be documented and rectified. Construction activities often reveal site conditions that were not anticipated in the TESCP.

6 Exceedance Reporting

In the event of an accidental occurrence or a visually conspicuous plume in the Elbow River or Unnamed Creek is observed during monitoring or normal construction activities, Vinci will temporarily stop all works that have the potential to transport sediment within the watercourse and investigate the origin of the incident and contact CPP. The exceedance, if reportable, will be reported to Vinci and to the Alberta Energy and Environment Response line at 1-800-222-6514 as soon as possible and followed up with a written report, if required. The following information will be provided to AEP as it would be documented at the time of event:

- Location and the time of release
- Description of circumstances leading to release
- Type and quantity of substance released
- Details of any action proposed or taken
- Description of immediate surrounding

7 Limitations and Emergency Measures

Measures provided in this document are designed for control of surface erosion, whereas mass wasting is within the scope of geotechnical engineers. Unexpected events including but not limited to intense or prolonged rain represent an uncertainty on erosion control objectives (per ISO 31000 risk definition). ESC risk is controlled through the design and implementation of ESC plans, coupled with effective and diligent monitoring.

This TESCP does not encompass project shutdown details and the plan may require updates as site conditions change and unforeseen issues arise.

The main emergency measure is response to unusual high intensity rainfall (e.g., >2-yr, 24 h) events which can result in failure of ESC measures. Vinci may need to adopt emergency measures to stop movement of

excessive sediment laden flows to waterbodies and sensitive sites. For example, overland flow may require redirection to emergency storage ponds or sediment traps.

8 References

Alberta Transportation (AT). 2011. Erosion and Sediment Control Manual. June, 2011

City of Calgary (City) 2022. 2022 Standard Specifications Erosion and Sediment Control.

CPP Environmental. 2022. Environmental Construction Operations (ECO) Plan. Alberta Transportation TND 0022477. Sprinbank Dam Project. March, 2022. 223 pp.

Stantec. 2018. Springbank off-stream reservoir project environmental impact assessment. Volume 3a: effects assessment (construction and dry operations).

Wall, G.J., D.R. Coote, E.A. Pringle and I.J. Shelton (editors). 2002. RUSLEFAC- Revised Universal Equation for Application in Canada: A Handbook for Estimating Soil Loss from Water Erosion in Canada. Research Branch, Agriculture and Agri-Food Canada. Ottawa. Contribution No. 02-92. 117 pp.

APPENDICES

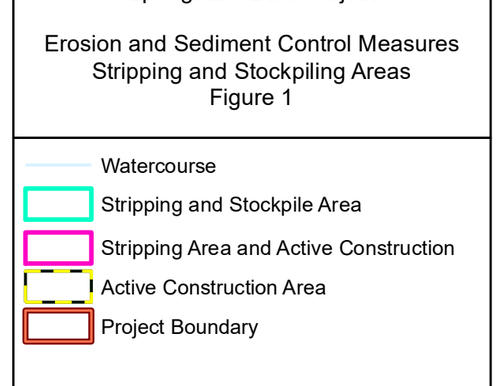
Appendix 1 – Figures

Vinci Construction

Springbank Dam Project

Erosion and Sediment Control Measures
Stripping and Stockpiling Areas
Figure 1

- Watercourse
- Stripping and Stockpile Area
- Stripping Area and Active Construction
- Project Boundary



Source: Contains information licensed under the Open Government Licences – Canada, Alberta and Maxar
Imagery Acquisition Date: 2015
Coordinate System: NAD 1983 3TM 114

N
W E
S

1:32,000

0 500 1,000 1,500 Meters

Date: April 17, 2022

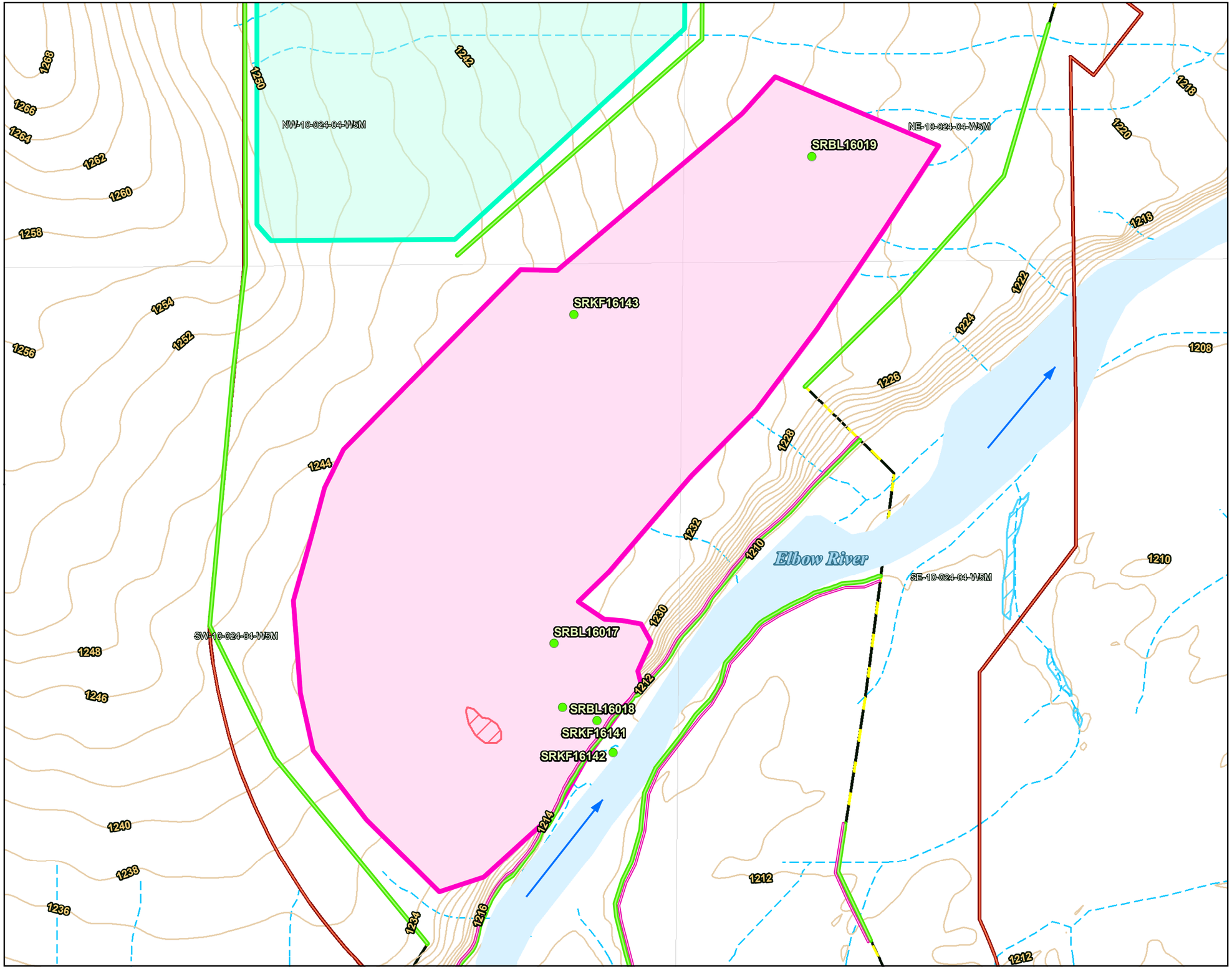
Prepared by: T. Kjorlien

CPP ENVIRONMENTAL

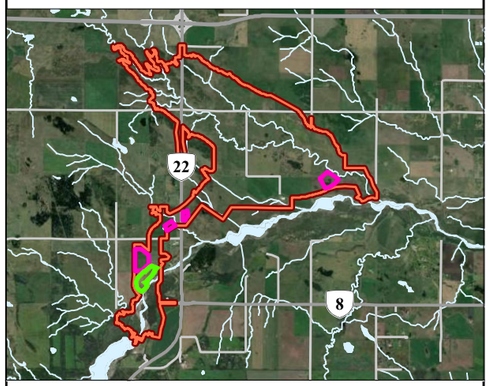
Vinci Construction

Springbank Dam Project

Erosion and Sediment Control Measures
Stripping and Stockpiling Areas
Figure 2



- Stripping and Stockpile Area
- Stripping Area and Active Construction
- Soil Sampling Point
- Silt Fencing
- Fibre Roll (Straw Wattle)
- Natural Drainage Pathway
- Watercourse
- Natural Contour (2 m)
- Approved Wetland Disturbance
- Wetland
- Active Construction Area
- Project Boundary



Source: Contains information licensed under the Open Government Licences – Canada, Alberta and Maxar
Imagery Acquisition Date: 2015
Coordinate System: NAD 1983 3TM 114

N
W E
S

1:3,000

0 50 100 150 Meters

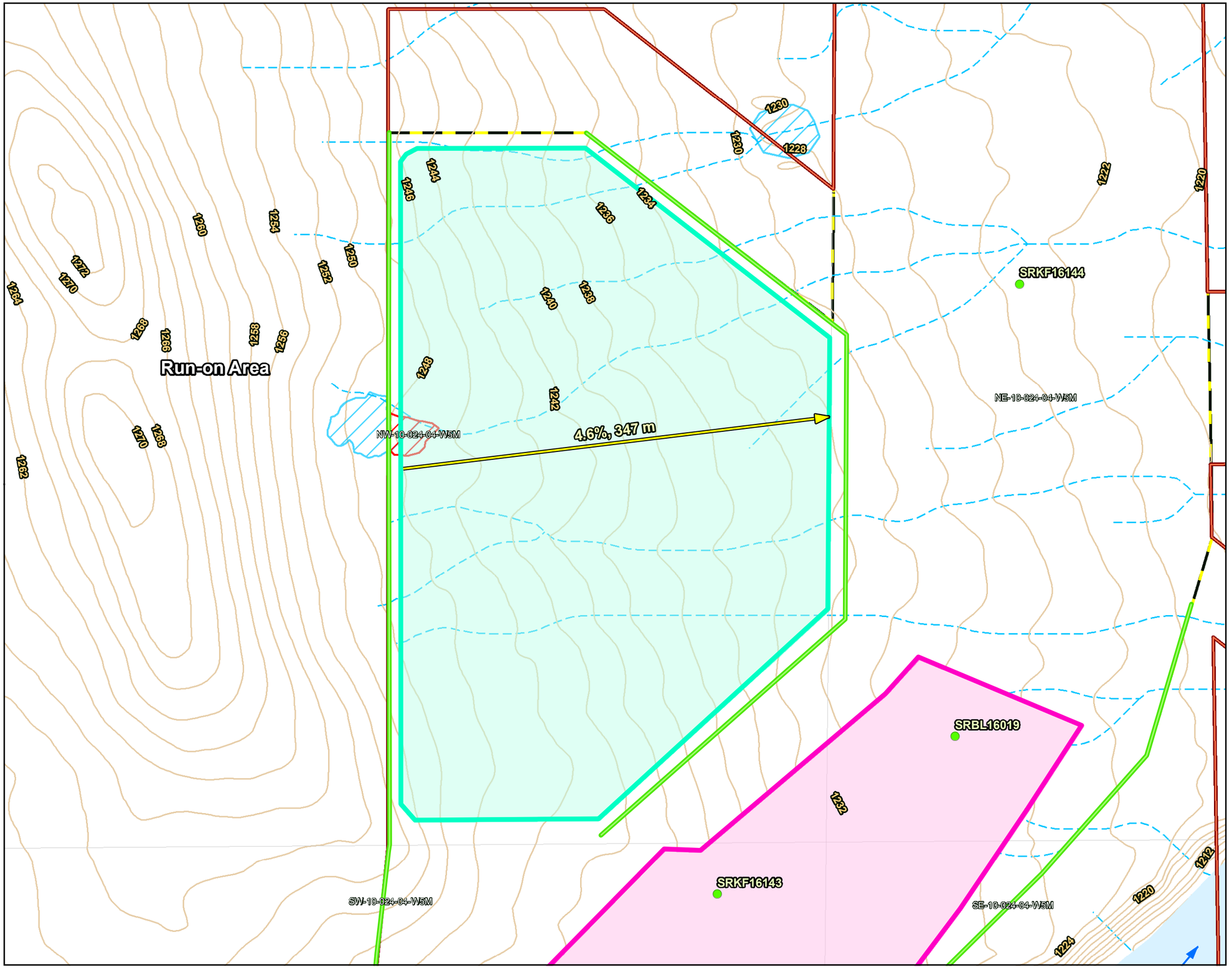
Date: April 17, 2022

Prepared by: T. Kjorlien

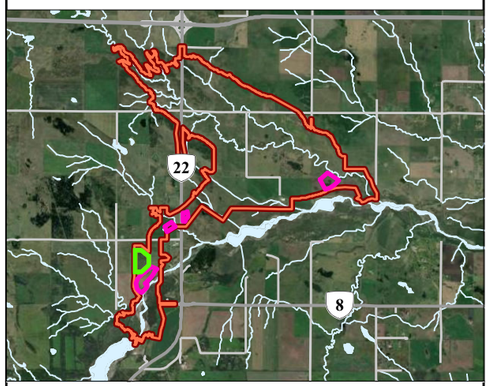
CPP ENVIRONMENTAL

Vinci Construction
Springbank Dam Project

Erosion and Sediment Control Measures
Stripping and Stockpiling Areas
Figure 3



- Stripping and Stockpile Area
- Stripping Area and Active Construction
- Soil Sampling Point
- Silt Fencing
- Natural Drainage Pathway
- Watercourse
- Natural Contour (2 m)
- Slope for RUSLE Equation
- Approved Wetland Disturbance
- Wetland
- Active Construction Area
- Project Boundary



Source: Contains information licensed under the Open Government Licences – Canada, Alberta and Maxar
Imagery Acquisition Date: 2015
Coordinate System: NAD 1983 3TM 114

N
W E
S

1:3,000

0 50 100 150 Meters

Date: April 17, 2022

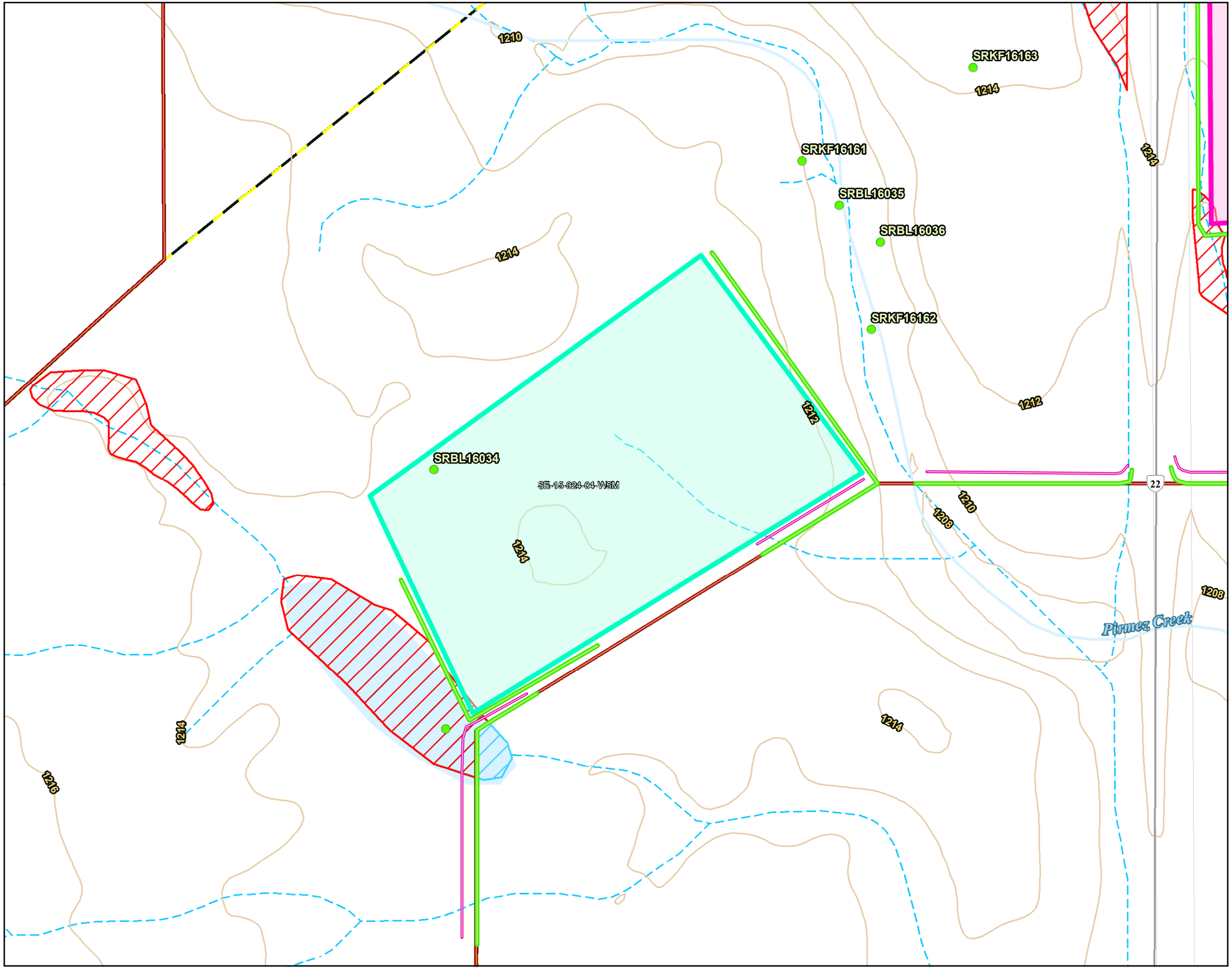
Prepared by: T. Kjorlien

CPP ENVIRONMENTAL

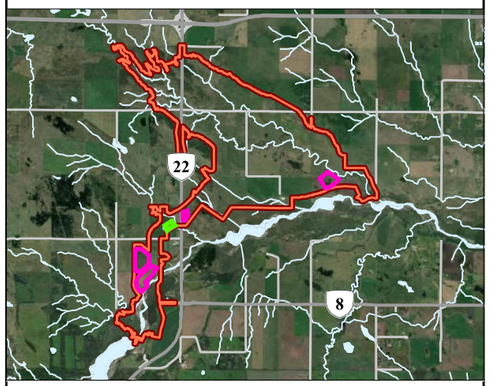
Vinci Construction

Springbank Dam Project

Erosion and Sediment Control Measures
Stripping and Stockpiling Areas
Figure 4



- Stripping and Stockpile Area
- Stripping Area and Active Construction
- Soil Sampling Point
- Silt Fencing
- Fibre Roll (Straw Wattle)
- Natural Drainage Pathway
- Watercourse
- Natural Contour (2 m)
- Approved Wetland Disturbance
- Wetland
- Active Construction Area
- Project Boundary



Source: Contains information licensed under the Open Government Licences – Canada, Alberta and Maxar
Imagery Acquisition Date: 2015
Coordinate System: NAD 1983 3TM 114

N
W E
S

1:2,000

0 30 60 90 Meters

Date: April 17, 2022

Prepared by: T. Kjorlien

CPP ENVIRONMENTAL

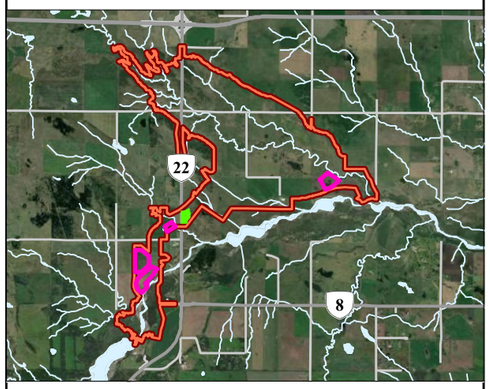
Vinci Construction

Springbank Dam Project

Erosion and Sediment Control Measures
Stripping and Stockpiling Areas
Figure 5

NE-15-024-04-W5M
NW-14-024-04-W5M
SE-15-024-04-W5M
SW-14-024-04-W5M
1220
1218
1216
1214
1212
1210
1208
22
Pirmez Creek
SRKF16001
SRBL16037
SRKF16002
SRKF16003
SRKF16163
SRKF16161
SRBL16035
SRBL16036
SRKF16162

- Stripping and Stockpile Area
- Stripping Area and Active Construction
- Soil Sampling Point
- Silt Fencing
- Fibre Roll (Straw Wattle)
- Natural Drainage Pathway
- Watercourse
- Natural Contour (2 m)
- Approved Wetland Disturbance
- Wetland
- Active Construction Area
- Project Boundary



Source: Contains information licensed under the Open Government Licences – Canada, Alberta and Maxar
Imagery Acquisition Date: 2015
Coordinate System: NAD 1983 3TM 114

N
W E
S

1:2,000

0 30 60 90
Meters

Date: April 17, 2022

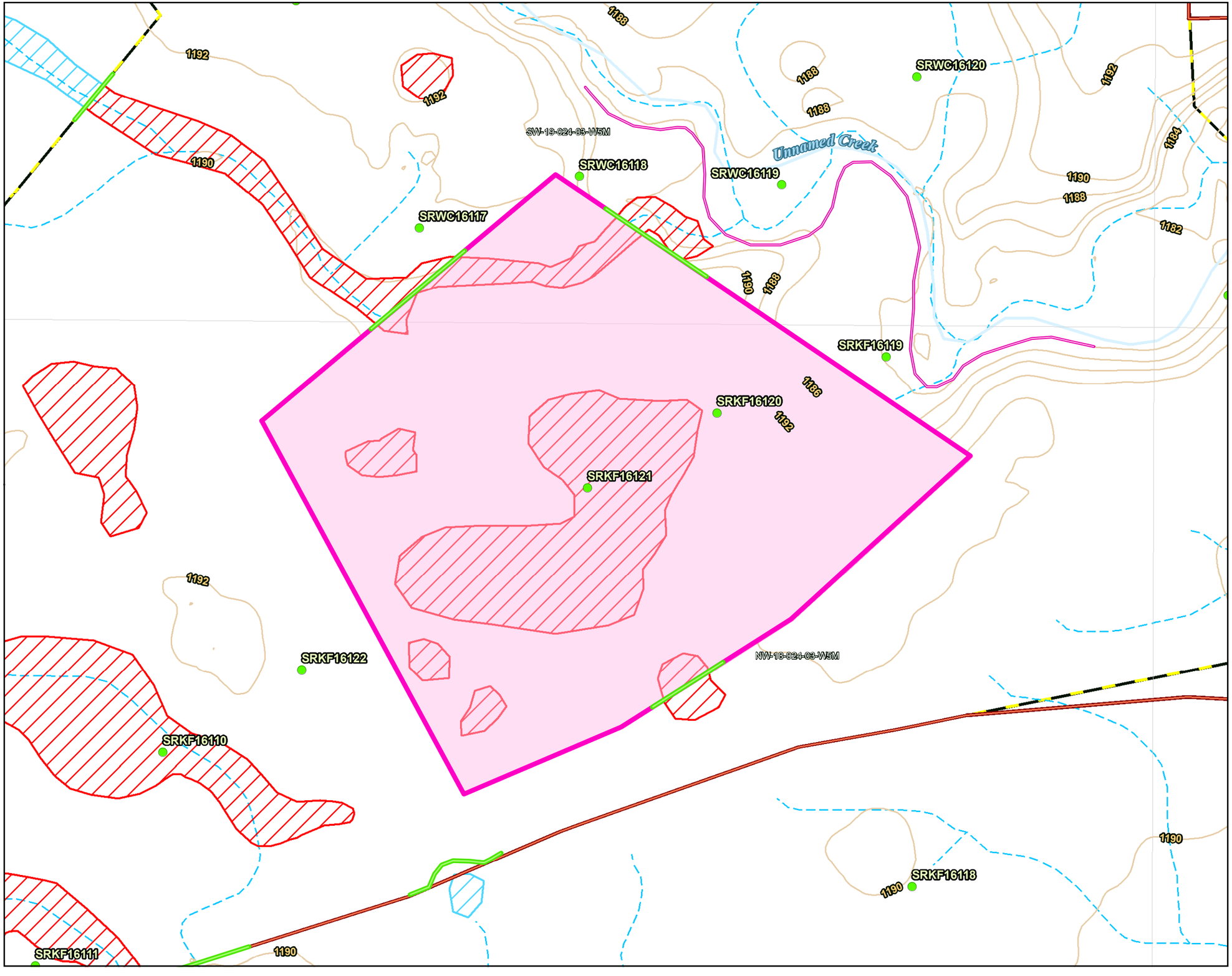
Prepared by: T. Kjorlien

CPP ENVIRONMENTAL

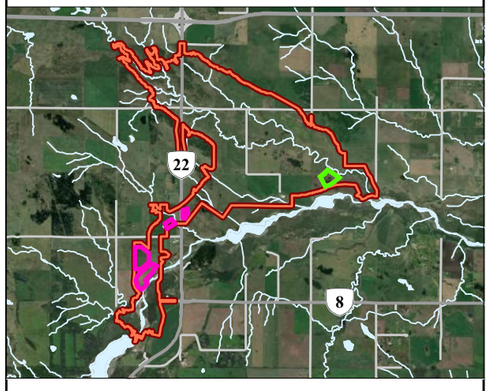
Vinci Construction

Springbank Dam Project

Erosion and Sediment Control Measures
Stripping and Stockpiling Areas
Figure 6



- Stripping Area and Active Construction
- Soil Sampling Point
- Silt Fencing
- Fibre Roll (Straw Wattle)
- Natural Drainage Pathway
- Watercourse
- Natural Contour (2 m)
- Approved Wetland Disturbance
- Wetland
- Active Construction Area
- Project Boundary



Source: Contains information licensed under the Open Government Licences – Canada, Alberta and Maxar
Imagery Acquisition Date: 2015
Coordinate System: NAD 1983 3TM 114

N
W E
S

1:2,500

0 40 80 120 Meters

Date: April 17, 2022

Prepared by: T. Kjorlien

CPP ENVIRONMENTAL

Appendix 2 – Alberta Transportation BMPs #1, and 38

Silt Fence Sediment Control	B.M.P. #1

Description and Purpose

- Permeable fabric barriers installed vertically on support posts along contours to collect sediment laden sheet flow runoff
- Causes water to pond allowing sediment to settle out as water filters through fabric
- Entraps and minimizes coarse sediment from sheet flow or overland flow from entering waterbodies
- Perimeter control for sediment transport and deposition

Applications

- Temporary measure
- Used at bottom of cut or fill slopes to collect sediment laden runoff
- Used along streams (or channels) banks
- Used around stockpiles
- Midslope grade-break (using "J-hook" or "smile" pattern to effect ponding, filtering and sedimentation)

Advantages

- Low permeability silt fences have high filtering capabilities for fine sand to coarse silt
- Filter fence more effective than straw bales at filtering out sediment

Limitations

- Applicable for sheet flow, cannot handle concentrated channel flow volumes
- May fail under high runoff events
- Limit to locations suitable for temporary ponding of sediment laden runoff
- Low permeability silt fences may not be strong enough to support weight of water retained behind it and may require reinforcement (i.e., wire mesh and stronger support)
- Sediment build up needs to be removed on a regular basis
- Damage to fence may occur during sediment removal
- Useable life of approximately one year dependent on regular maintenance

Silt Fence Sediment Control	B.M.P. #1

Construction

- Two methods of installation are commonly used
  - Trench method
  - Mechanical (slicing) installation method (e.g. Tommy Silt Fence Machine or equivalent)
- Trench Method
  - Select location of silt fence (usually along contours)
  - Drive support posts a minimum of 0.3 m into ground, spaced a maximum of 2 m apart
  - Excavate trench approximately 0.15 m deep by 0.15 m wide for entire length of fence along upstream side of posts
  - Attach the wire mesh or snow fencing, if used as reinforcement, to upstream side of posts with staples
  - Extend filter fabric to base of trench and attach over wire mesh or snow fence, if used, on upstream side of posts
  - Backfill and compact soil in trench, being careful not to damage fence
- Mechanical Installation Method
  - Select location of silt fence (usually along contours)
  - Use mechanical installation machine to embed the fabric a minimum of 0.15 m into the ground. One mechanical installation method is by slicing (with special equipment) the geotextile fabric embeds into the ground without excavation and backfill. There is only minor disturbance of the ground. Tamping of ground is required for compaction.
  - Drive support posts a minimum of 0.3 m into ground, spaced a maximum of 2 m apart
  - Attach the wire mesh or snow fencing, if used as reinforcement to silt fence fabric, to upstream side of posts with staples
  - Extend filter fabric to base of trench and attach over wire mesh or snow fence, if used, on upstream side of posts

Construction Considerations

- Site Selection

  - Size of drainage area should be no greater than 0.1 ha per 30 m length of silt fence
  - Maximum flow path length above silt fence should be no greater than 30 m
  - Maximum slope gradient above the silt fence should be no greater than 2H:1V
- Fence should be placed on contour to produce proper ponding
- Fence should be placed far enough away from toe of slope to provide adequate ponding area (minimum of 1.8 m away from toe of slope is recommended)
- Ends of fence should be angled upslope to collect runoff
- Fence should not extend more than 0.6 m above grade
- Posts can be wood or metal material dependent on design and ground conditions
- Posts should be placed on downstream side of fence
- Posts should not be spaced greater than 2 m apart
- Wire mesh or standard snow fencing may be placed between the posts and fabric barrier to provide additional strength and support reinforcement
- Geotextile should be cut from a continuous roll to avoid joints (if joints are necessary, the wrapping of fabric around the fence post and a minimum overlap of 0.2 m with staples should be used to attach the fabric to the post)
- Fence (and wire mesh or snow fence, if used) should be attached to posts with heavy duty staples, tie wires, or hog rings
- Fence (and wire mesh or snow fence, if used) should be dug into a trench at least 0.15 m deep to prevent undercutting of fence by runoff
- Trench backfill should be compacted
- Long runs of silt fence are more prone to failure than short runs
  - Maximum length of each section of silt fence should be 40 m
  - Silt fence should be installed in 'J' hook or 'smile' configuration, with maximum length of 40 m, along contours allowing an escape path for ponded water (minimizes overtopping of silt fence structure)

Inspection and Maintenance

- Inspection frequency should be in accordance with the PESC and TESC Plans
- Repair undercut fences and repair or replace split, torn, slumping or weathered fabric immediately

Silt Fence Sediment Control	B.M.P. #1

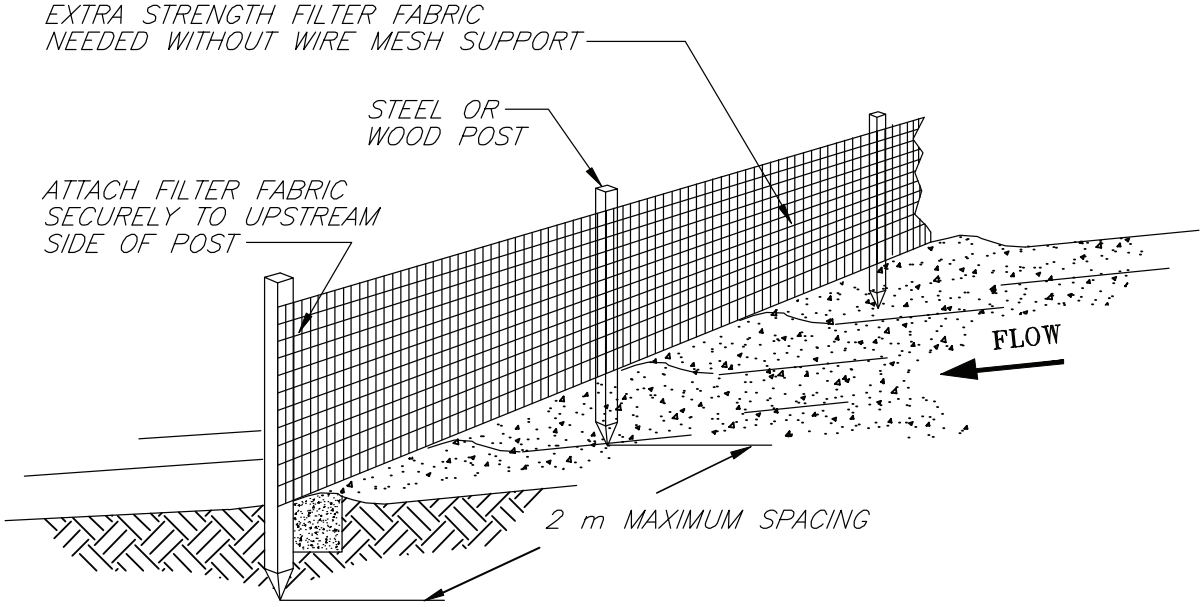
- Sediment build up should be removed once it accumulates to a depth of 0.2 m
- Remove fence after vegetation is established
- Deactivate fabric by cutting-off top portion of fabric above ground; bottom trenched-in portion of fence fabric can be left in-ground thus minimizing ground disturbance

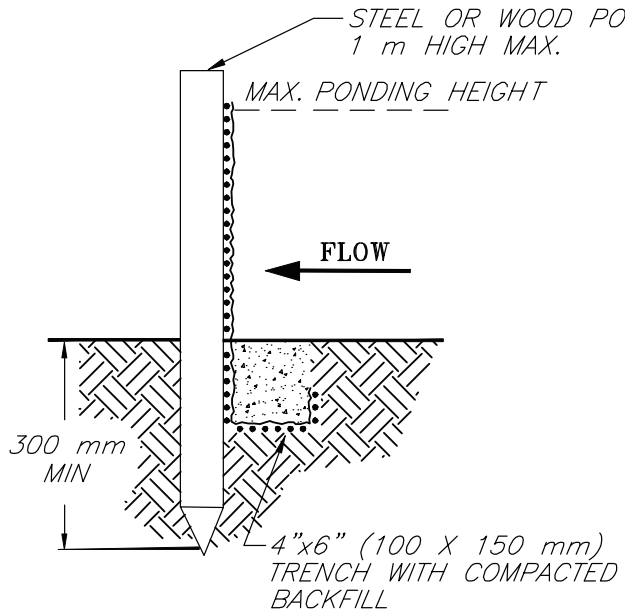
Similar Measures

- Straw Bales
- Rock Barrier
- Permeable/Synthetic Barriers

Design Considerations

- For a silt fence system to work as a system, the following factors should be considered:
  a) quantity – adequate number and frequency of fence for efficient ponding and sedimentation
  b) installation – workmanship
  c) compaction – backfill and trenching of fabric
  d) support – posts adequately embedded, appropriate selection of post material and spacing
  e) attachment – secure fabric to post
- Install silt fences in a 'J' hook or 'smile' configuration





TRENCH METHOD DETAIL

NOTES:

1. SILT FENCE SHALL BE PLACED ON SLOPE CONTOURS TO MAXIMIZE PONDING EFFICIENCY.
2. INSPECT AND REPAIR FENCE DAILY AND AFTER EACH STORM EVENT AND REMOVE SEDIMENT WHEN ACCUMULATED SILT REACHES 200 mm.
3. REMOVED SEDIMENT SHALL BE DEPOSITED TO AN AREA WILL NOT CONTRIBUTE SEDIMENT OFF-SITE.
4. THIS FIGURE IS PROVIDED FOR GUIDANCE ONLY AND DOES NOT CONSTITUTE A DESIGN. A SITE SPECIFIC DESIGN IS REQUIRED FROM DESIGNER/ENGINEER.

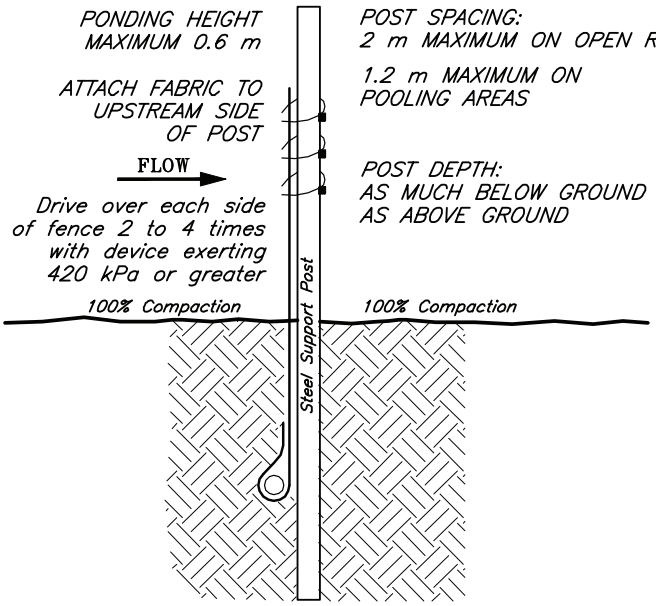
NOT TO SCALE

SILT FENCE

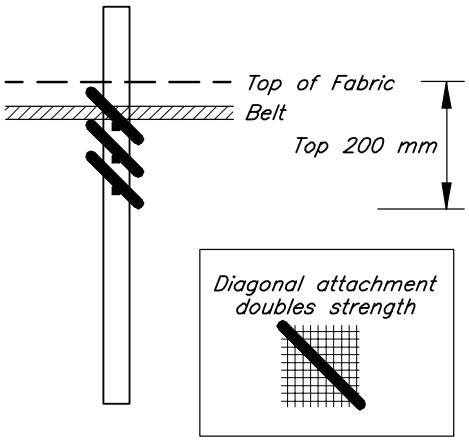
(TRENCH METHOD)

FILE: SILTFENC

Government of Alberta ■
Transportation



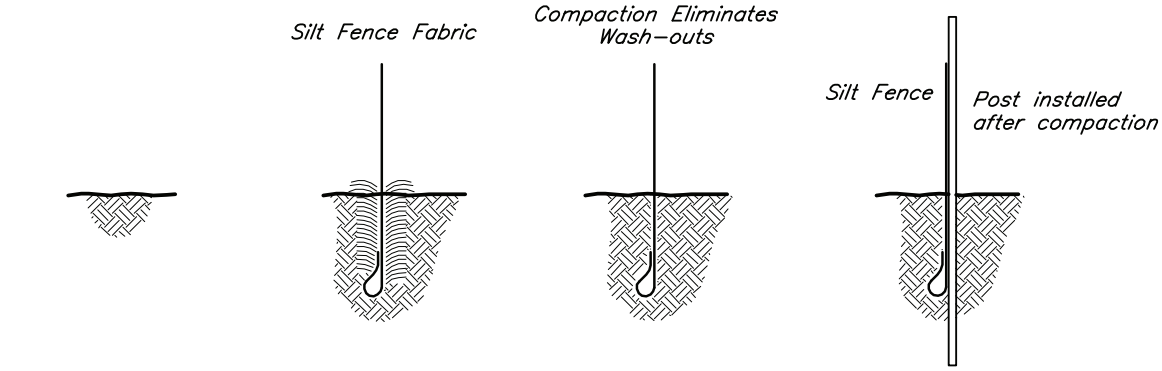
NO MORE THAN 0.6 m OF A 0.9 m FABRIC
IS ALLOWED ABOVE GROUND



ATTACHMENT DETAILS:

- Gather fabric at posts, if needed.
- Utilize three ties per post, all within top 200 mm of fabric.
- Position each tie diagonally, puncturing holes vertically a minimum of 25 mm apart.
- Hang each tie on a post nipple and tighten securely.
- Use cable ties (50 lbs) or soft wire.

MECHANICAL (SLICING) METHOD



a) Before Installation

b) During fabric insertion. Disrupted soil.

c) After Compaction. Greater stability.

d) Completed Installation

MECHANICAL (SLICING) METHOD INSTALLATION SEQUENCE

NOTES:

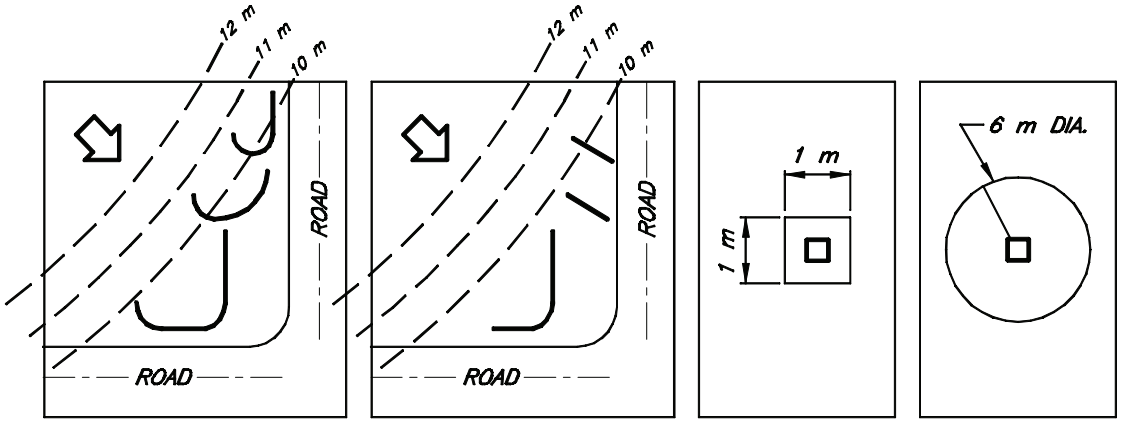
1. INSTALLATION MACHINE MUST ALLOW CONTINUOUS SLICING AND EMBEDMENT OF GEOTEXTILE INTO GROUND WITH MINOR GROUND DISTURBANCE.
2. INSTALLATION MACHINE TYPES WILL VARY WITH MANUFACTURER.
3. THIS FIGURE IS PROVIDED FOR GUIDANCE ONLY AND DOES NOT CONSTITUTE A DESIGN. A SITE SPECIFIC DESIGN IS REQUIRED FROM DESIGNER/ENGINEER.

NOT TO SCALE

SILT FENCE

(MECHANICAL METHOD)

SOURCE: CARPENTER T. 2000

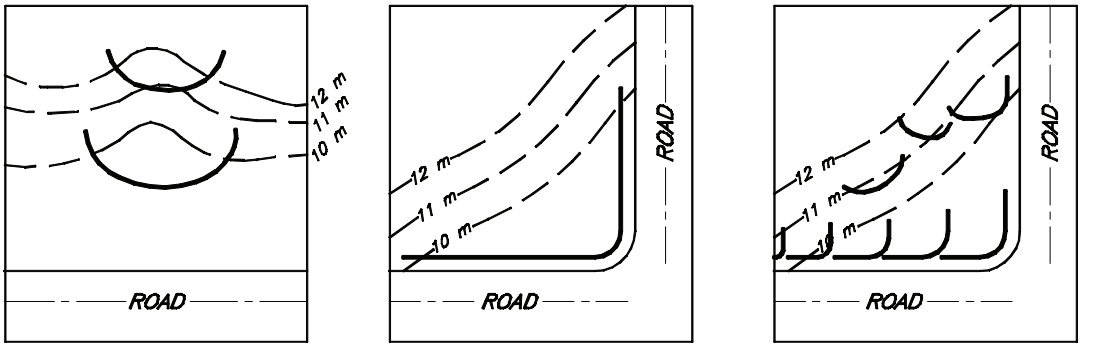


CORRECT

INCORRECT

"J" CONFIGURATION

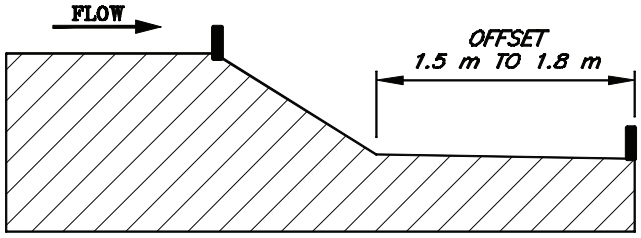
SILT FENCE BARRIER AT STORM INLET



"SMILE" CONFIGURATION

AVOID LONG INSTALLATION

COMBINATION OF "SMILE" AND "J" CONFIGURATIONS



LOCATION AT TOP AND BOTTOM OF SLOPE

NOT TO SCALE

NOTE:

1. THIS FIGURE IS PROVIDED FOR GUIDANCE ONLY AND DOES NOT CONSTITUTE A DESIGN. A SITE SPECIFIC DESIGN IS REQUIRED FROM DESIGNER/ENGINEER.

SOURCE: CARPENTER T. 2000

SILT FENCE (CONFIGURATION PLAN)

Rolls
a) Coir Roll
b) Fibre Roll
Streambank Stabilization Techniques and Erosion Control

B.M.P. #38

Description and Purpose

- Coir Rolls are long cylindrical tubes that are composed of interwoven coconut fibres which are bound together with durable coir netting. Coir rolls are particularly applicable for wetland, streambank, and shoreline projects. Coir rolls are most commonly available in 300mm diameters and 6m lengths. These rolls can be linked together to form longer tubes, and are often used in combination with other biotechnical techniques, such as brush layering or live siltation. Coir logs encourage siltation and wetland/floodplain creation
- Fibre rolls are installed across slope contours as a grade break to reduce erosion potential by reducing overland flow velocities
- Straw roll consists of bundled straw (or natural fibre) wrapped in photo-degradable open-weave plastic netting staked into the soil along slope contours as a grade break to reduce erosion potential
- Normally live staking can be installed to anchor the Fibre Rolls to provide deep root vegetation with potential favourable moisture retention provided by fibre roll
- Fibre Rolls also capture sediment, organic matter, and seeds carried by runoff

Applications

- The tough, long-lasting coconut fibres make coir rolls appropriate for wetland, streambank, and shoreline applications. Coir rolls work well when immediate erosion control is needed. Brushlayers work well with coir roll applications, adding further stabilization with a live root system, while also providing excellent habitat features. The coir roll provides a base for the brushlayer cuttings to be laid upon at an appropriate angle which benefits the growth of cuttings. The cuttings provide further protection from breaking waves and high flows
- Fibre Rolls may be used on slopes stable enough to support vegetation (steep, confined, slopes and channel banks with gradients greater than 1H:1V may have low success potential)
- Fibre Rolls may be used along long slopes as a grade break to shorten slope length between line of fibre rolls at different contour elevations
- Fibre Rolls may be used as grade breaks, where slopes transition from flatter to steep gradients

Advantages

- The coir material is natural and long lasting (5 to 7 years), and has high tensile strength

- The fibre rolls and mats accumulate sediment while the plants grow and the plant roots develop. Eventually the coir material biodegrades and the cohesive strength of the root systems and flexible nature of the plants become the primary stabilizing element
- The coir roll/brushlayering combination provides immediate shoreline and streambank protection, with additional benefits of riparian enhancement when the cuttings become established
- Coir Rolls address ecological concerns by encouraging vegetation and wildlife habitat, and are an alternative to stone revetments or other structural measures
- The high tensile strength coconut fibres, fibre netting and the wooden stakes used to anchor the material make up the initial structural components of the system, while plant root and top growth increase the strength and baffle effects of the structure
- Fibre Rolls can be used on slopes too steep for silt fences or straw bales sediment barriers
- In time, plastic netting will degrade due to the sunlight and straw will degrade and be incorporated into the soil
- Fibre Rolls primary purpose is erosion control, however fibre rolls do provide some sediment control

Limitations

- This technique should be implemented during the dormancy period of the cuttings used for brushlayering and staking
- Coir Rolls are relatively expensive
- Fibre Rolls are designed for low sheet flow velocities
- Fibre Rolls are designed for short slopes with a maximum gradient of 1H:1V
- Fibre Rolls may be labour intensive to install
- Straw rolls have short life span due to natural degradation
  - Usually only functional for two seasons
- Susceptible to undermining and failure if not properly keyed into the soil
- Labour intensive maintenance may be required to ensure rolls are in continuous contact with the soil, especially when used on steep slopes or sandy soils

Rolls a) Coir Roll b) Fibre Roll Streambank Stabilization Techniques and Erosion Control	B.M.P. #38

Construction

- Determine annual water elevation
- Mark the annual water level on a stake driven into the substrate, 0.3 or 0.6 m offshore. Installing the materials and plants at the correct elevation is the most important aspect to assure success of the installation. Determine, on site, where the installation will begin and end
- Determine soil level by laying a straight cutting on the coir roll with approximately 20% of the cutting sticking out past the roll, and with the basal ends dipping down into the soil
- Begin installation at the downstream end (if using in a streambank project)
- Prepare the site for installation of coir roll and coir mats by removing any large rocks, obstructions or material that may prevent the coir from making direct and firm contact with the soil. Coir rolls must be level, installed along a horizontal contour. Place coir rolls parallel to the stream bank or shoreline. It is very important to key the ends of the coir rolls firmly into the shoreline or stream bank, so waves and flows will not scour behind the rolls and compromise the integrity of the structure
- Install the coir roll such that 50 mm of the roll extends above the annual water elevation
- Adjacent rolls shall be laced together, end-to-end, tightly and securely
- If using brushlayer cuttings prepare soil bed behind installed coir rolls for laying. It is important that the bud ends of the live cuttings angle up to some degree from the basal ends. Lay cuttings in this fashion, slightly crisscrossed for additional strength
- Next, backfill over cuttings with soil, covering the lower 80% of the branches. At this time, soil can be levelled and prepared for a soil wrap for additional height and soil stability
- If simply covering the cuttings with soil, compact slightly and grade slope to appropriate angle. Use water to wash soil in between branch layers
- If using plant materials, such as container-grown, pre-rooted plant plugs or willow stakes, they should be planted into the coir rolls and through the coir mats and netting
- To install plant plugs and willow stakes into the coir roll, use a planting iron or pilot bar into the roll and wedge it back and forth to create a hole for the plant. It is extremely important that the root system of the plant be placed below the water

level for certain species. All plants shall be checked to ensure that they have been firmly installed in the fibre material

- Mulch and seed exposed areas with native species
- Prepare slope face and remove large rocks or other deleterious materials
- Excavate small trenches a minimum of 0.15 m deep and 0.15 m wide across the width of the slope, perpendicular to slope direction, starting at the toe of the slope and working upwards towards crest of slope
- Space trenches a maximum of 3 to 8 m apart along the slope incline, with steeper slopes having trenches spaced closer together
- Place fibre rolls into trench ensuring continuous contact between fibre roll and soil surface
- Butt-joint adjacent fibre roll segments tightly against one another
- Use a metal bar to make pilot hole through middle of the fibre roll a minimum depth of 0.3 m into underlying soil
- Pilot holes should be spaced a maximum of 1 m apart
- Secure fibre roll to soil using wooden stake or other appropriate anchor; live stake may be used as alternate anchor
- Place soil excavated from trench on upslope side of fibre roll and compact to minimize undermining of fibre roll by runoff
- Seed the soil along the upslope and downslope sides of the fibre roll to promote vegetation growth

Construction Considerations

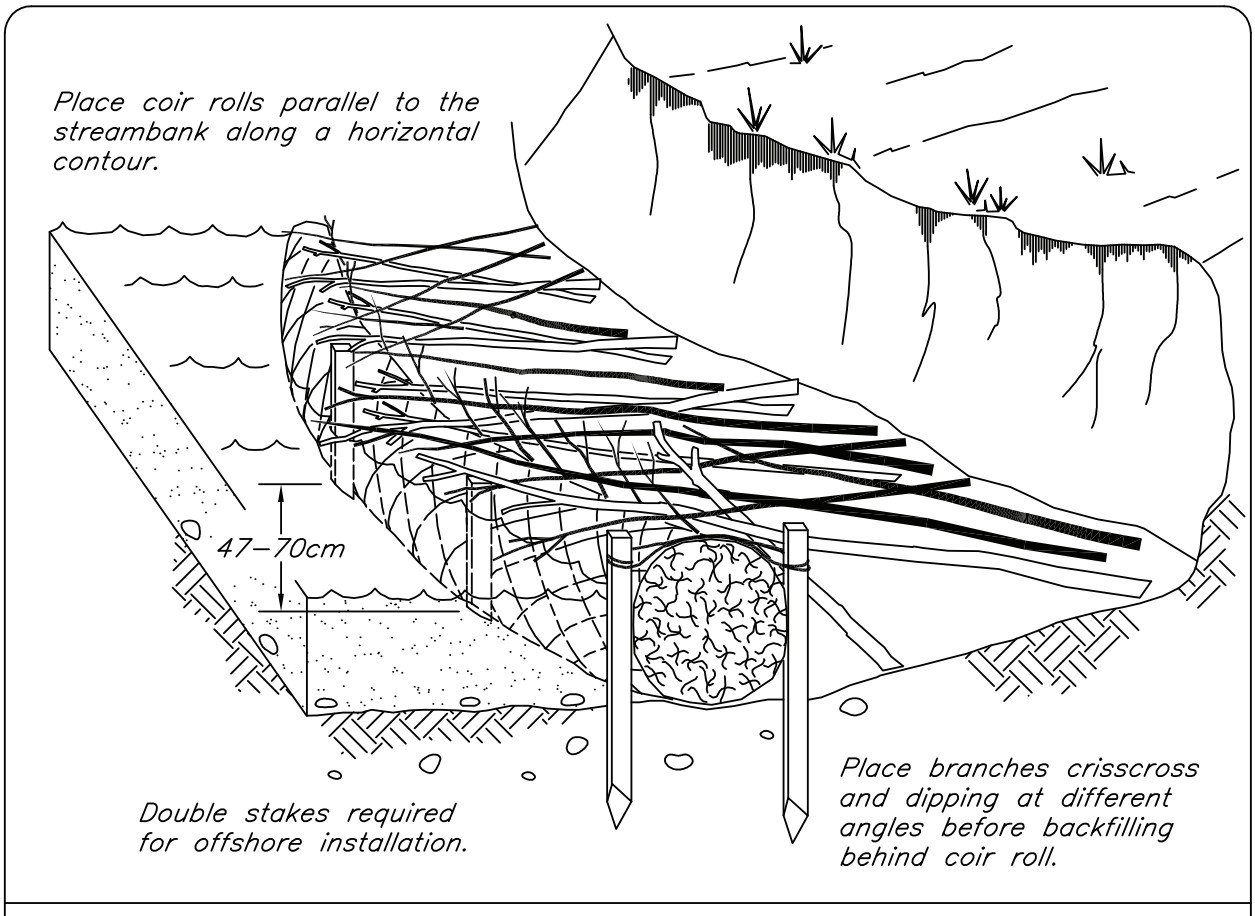
- All work site disturbance should be minimized. Protect any existing plant, when possible, and avoid additional disturbance that can lead to erosion and sedimentation
- Install additional erosion and sediment control measures such as temporary diversion dikes, silt fences and continuous berms, as needed, before beginning work
- Coir rolls can be used in the stream as a sediment barrier, silt curtain, and/or coffer dam to control sediment while work is being done in the water
- Topsoil should be saved, if possible, and replaced once the subsoil has been removed or regraded. Soil shall be stored away from the water's edge and it shall be moved to its final location and stabilized as quickly as possible

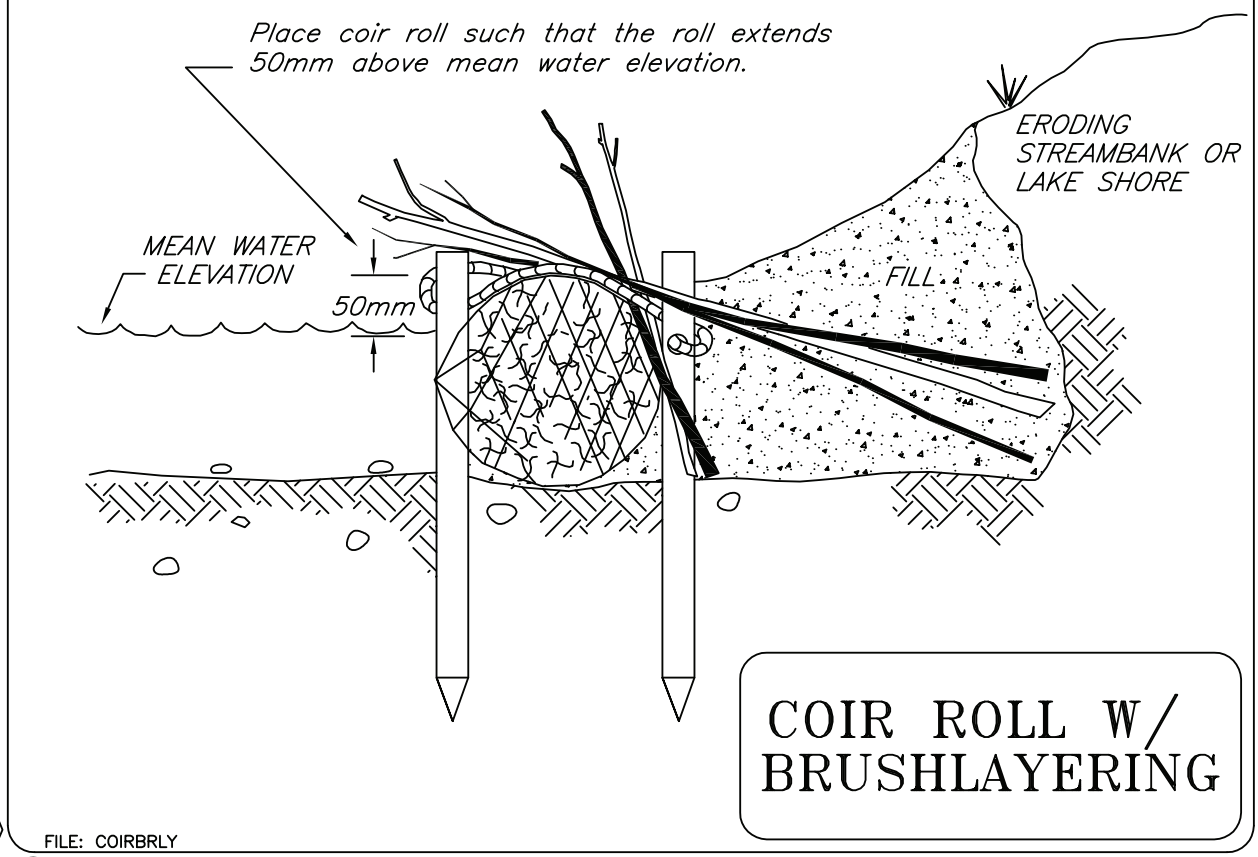
Rolls a) Coir Roll b) Fibre Roll Streambank Stabilization Techniques and Erosion Control	B.M.P. #38

- For typical applications at the water's edge, coir rolls are held in place with a single row of stakes, 300 mm on center. Stakes may be driven through the netting on the outer edge of the roll. It is very difficult to drive stakes through the high-density rolls, however, a stake can be driven with the help of a pilot hole through the low density coir rolls
- Lacing among the stakes is recommended for coir mats exposed to extreme conditions such as ice, waves, or flooding
- Coir rolls shall be placed along streambanks or shorelines at a height sufficient to protect the bank from flows or waves. Additional coir rolls may be placed above the lower rolls, in a tile-like fashion, to protect the upper shore or stream bank
- Use live stakes in place of wooden stakes
- If the slope soil is loose and uncompacted, excavate trench to a minimum depth of 2/3 of the diameter of the fibre roll
- For steep slopes, additional anchors placed on the downslope side of the fibre roll may be required

Inspection and Maintenance

- Inspection frequency should be in accordance with the PESC and TESC Plans
- Check plants to ensure that they have been firmly installed in the fibre material
- Water plants, if necessary, during the establishment phase
- Check all materials periodically or after storms to ensure they remain properly secured. Make necessary repairs promptly
- All temporary and permanent erosion control practices shall be maintained and repaired as needed to ensure continued performance of their intended use
- Areas damaged by washout or rutting should be repaired immediately
- Additional stormwater control measures should be considered for rilling areas damaged by runoff



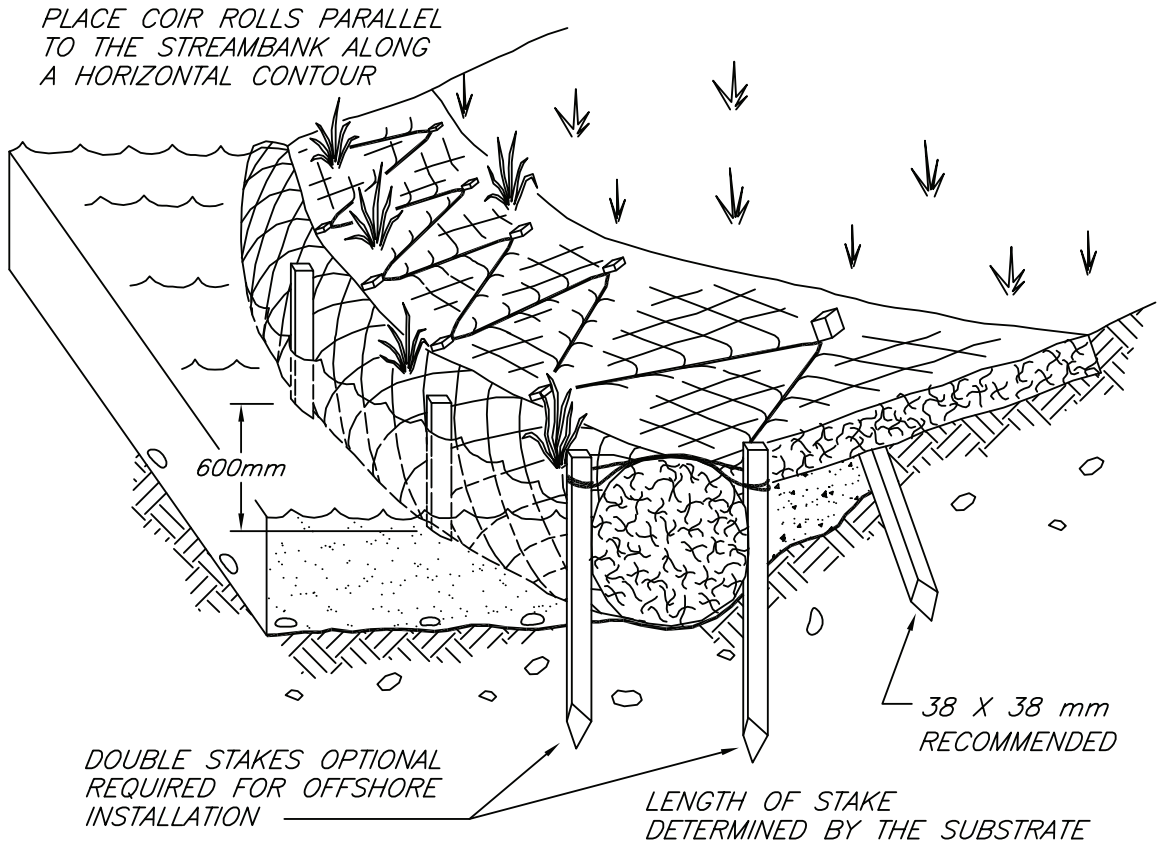


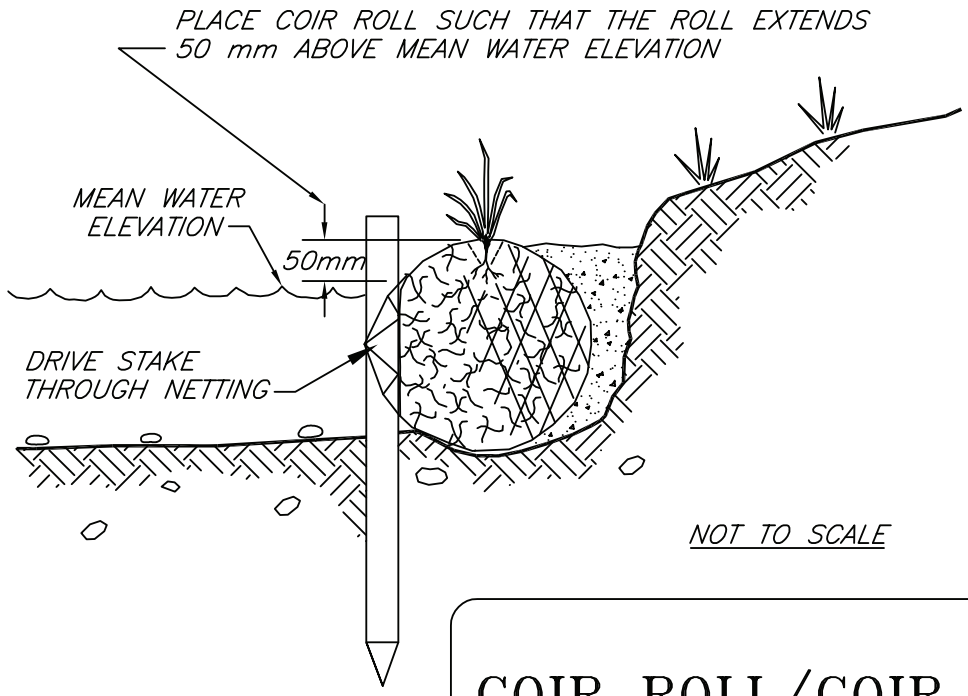
COIR ROLL W/ BRUSHLAYERING

FILE: COIRBRLY

Government of Alberta ■
Transportation

B.M.P. #38a
Typical Section





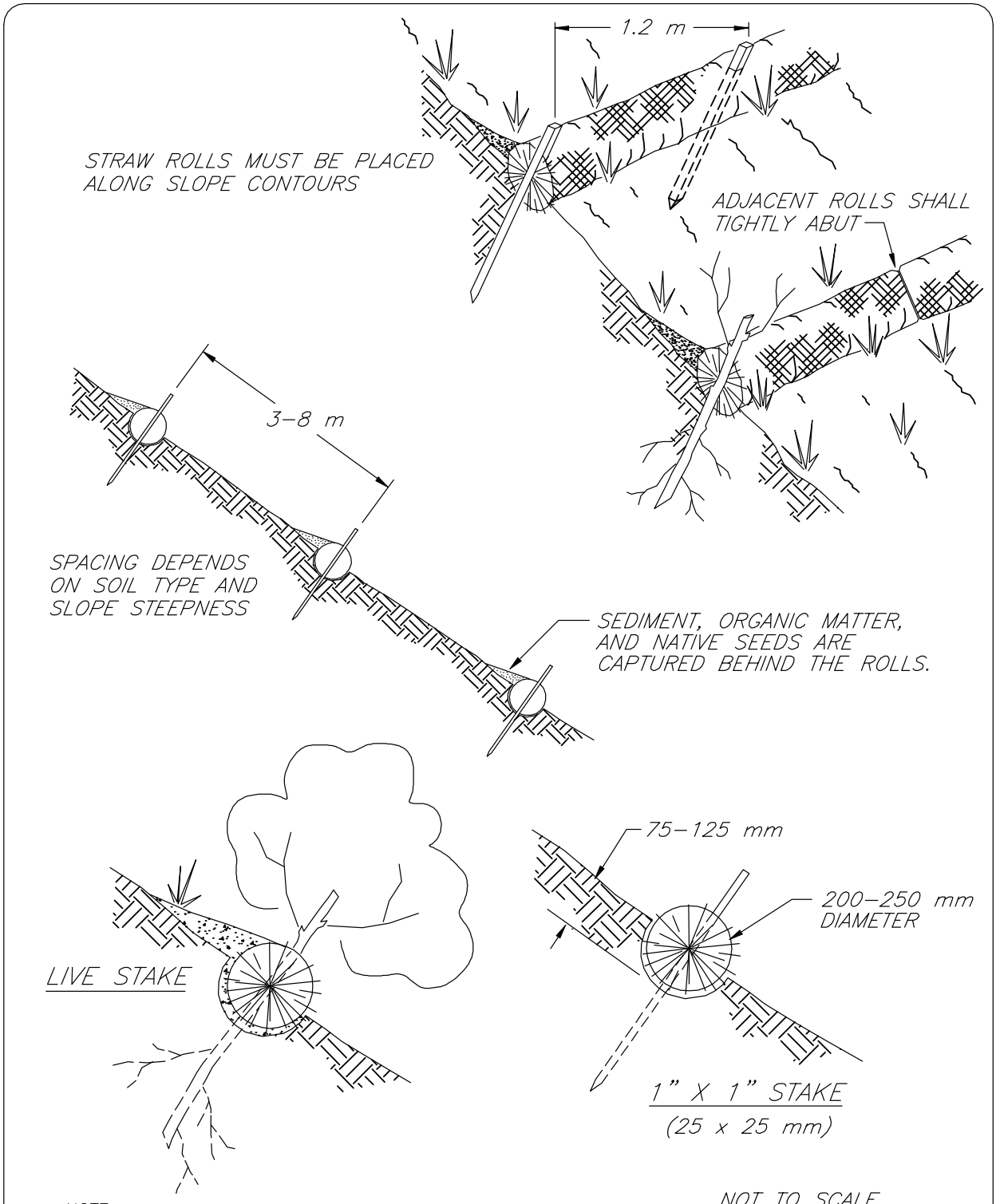
NOT TO SCALE

COIR ROLL/COIR MATS

FILE: COIRRM

Government of Alberta ■
Transportation

B.M.P. #38b
Typical Section



NOT TO SCALE

NOTE:

1. STRAW ROLL INSTALLATION REQUIRES THE PLACEMENT AND SECURE STAKING OF THE ROLL IN A TRENCH, 75–125 mm DEEP, DUG ON CONTOUR. RUNOFF MUST NOT BE ALLOWED TO RUN UNDER OR AROUND ROLL.
2. THIS FIGURE IS PROVIDED FOR GUIDANCE ONLY AND DOES NOT CONSTITUTE A DESIGN. A SITE SPECIFIC DESIGN IS REQUIRED FROM DESIGNER/ENGINEER.

STRAW ROLLS

FILE: STRWROLL

Government of Alberta ■
Transportation

B.M.P. #38c
Typical Section