



Standard
Specifications
Erosion and Sediment Control

2017

UTILITY AND PIPELINE LOCATION NUMBERS

Prior to commencement of any work, the contractor is responsible for contacting the appropriate authorities to locate existing underground utilities and pipelines in or adjacent to the construction work site. The utility or pipeline agencies must be contacted a minimum of 2 working days in advance prior to commencement of work.

UTILITY LOCATES:

ALBERTA ONE-CALL FIELD LOCATION SERVICE CALLS

Phone 1-800-242-3447, Cellular: *3447, Web: www.albertaonecall.com

Alberta One-Call covers utilities owned by:

<u>Utility</u>	<u>Utility Locates</u>	<u>Emergencies</u>
ATCO	1-800-242-3447	403-245-7222
ENMAX	1-800-242-3447	403-514-6100
Telus	1-800-242-3447	611
City of Calgary Water Resources	1-800-242-3447	311
PETROGAS Systems Limited	1-800-242-3447	403-226-0022
Devon Energy (Home Oil)	1-800-242-3447	403-264-9994
Trans-Northern Pipelines Inc. (Alberta Products Pipeline)	1-800-242-3447	1-800-361-0608

OTHER UTILITIES (NOT PART OF THE ALBERTA ONE-CALL SERVICE):

Shaw (cable television): 1-866-DIGSHAW (1-866-344-7429) (Utility Locates and Emergency Calls)

EMERGENCY SERVICE

If you accidentally damage the coating of, or scrape, sever, or rupture any underground line, please call the appropriate emergency number immediately.

Watch for aboveground structures, such as pedestals, power lines, and hydrants that are located in roadways, lanes, and private property. If they are damaged, please report the incident immediately.

Failure to report a damaged buried or aboveground utility, even if it has not been severed, can lead to it failing at some time in the future with catastrophic results.

EROSION AND SEDIMENT CONTROL CONTACT INFORMATION

CONTACTING THE CITY OF CALGARY:

General ESC Questions: 3-1-1

Drainage Permits: Contact 3-1-1. Information on Drainage Permits is also available at www.calgary.ca/esc

Key phrases to ensure that you are promptly connected with the ESC staff are:

- Erosion and Sediment Control
- Erosion and Sediment Control Inspection
- Erosion and Sediment Control Approval
- Drainage Permit
- Drainage Permit Self-Assessment

EMERGENCIES:

Immediate response required from Police, Fire and/or Emergency Medical Services: **9-1-1**

RELEASE REPORTING:

Reports of releases (including sediment) must be made to:

- 3-1-1 (The City of Calgary)
- 1-800-222-6514 (Alberta Environment and Parks) 24-hour release reporting line

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Commonly Used Acronyms:

AEP	Alberta Environment and Parks
ASTM	American Society for Testing and Materials International
CAS	Chemical Abstracts Service
CCME	Canadian Council of Ministers of the Environment
cm ²	square centimetre
CPESC	Certified Professional in Erosion and Sediment Control
ESC	erosion and sediment control
H:V	horizontal to vertical
ha	hectare
kg/ha	kilogram per hectare
kg/m	kilogram per metre
LID	low-impact development
m	metre
m/s	metre per second
m ²	square metre
m ³ /ha	cubic metre per hectare
mm	millimetre
MSDS	material safety data sheet
NPK	nitrogen, phosphorus, and potassium
P.Ag.	Professional Agrologist
P.Eng.	Professional Engineer
P.L.Eng.	Professional Licensee
RECP	rolled erosion control product
ROW	right-of-way
RUSLE	Revised Universal Soil Loss Equation

RUSLE-FAC Revised Universal Soil Loss Equation for Application in Canada

t/ha tonne/ha

t/ha/y tonne/hectare/year

The City The City of Calgary

TRM turf reinforcement mat

How to Use These Specifications

These *Standard Specifications Erosion and Sediment Control (Specifications)* set out requirements for construction site erosion and sediment control in Calgary. The *Specifications* form part of all approved Erosion and Sediment Control (ESC) Plans and must be followed when developing ESC Plans and during all stages of construction. Failure to follow these specifications as they apply to the ESC Plan is a contravention of the ESC Approval and subsequently The City of Calgary (The City) *Drainage Bylaw*.

ESC Plan Development: Use these *Specifications* as a reference document when creating ESC Plans. The Plan must align with the general requirements section and any standard control or practice you are using must follow the implementation, maintenance, inspection and removal requirements outlined in the Standard Specification section.

The *Specifications* are split into the three following categories:

- 100, General Requirements
- 200, Specifications
- 300, Drawings

ESC Plan Implementation: A copy of these *Specifications* must be available on all construction sites. Staff responsible for the implementation, inspection, maintenance and removal of erosion and sediment controls and practices must comply with all 100, General Requirements laid out in the *Specifications*. Additionally, they are required to follow all 200, Specifications and 300, Drawings that have been noted in their ESC Plan.

100 General Requirements

Proper management of soil erosion and sediment control begins with careful planning and execution of an approved ESC Plan. The *General Requirements* section contains requirements related to all construction sites.

200 Standard Specifications

Standard Specifications include general design, installation, maintenance and removal requirements for common erosion and sediment controls used in Calgary.

Customers may use practices that are not listed in the standard specifications. These practices are referred to as non-standard specifications; they must be identified in the ESC Plan submission and must include all appropriate supporting information. **At a minimum, supporting information for non standard specifications must include: the following:**

- Manufacturer's Specification Sheet (which may include the information noted below)
- C or P-value
- Design Requirements
- Installation Requirements
- Inspection Requirements
- Maintenance Requirements
- Removal Requirements

For the most current supporting information requirements for non-standard specifications please visit www.calgary.ca/esc

200.1. Erosion Control

Providing rapid protective cover on all exposed soil surfaces is the single most important practice for minimizing erosion. Cover may include topsoil application used in conjunction with seeding, mulching, hydroseeding, or erosion control blankets. The ESC designer has many options to select the proper erosion control practices for their site.

200.2 Sediment Control

Sediment controls can generally be classed as filtering and entrapment methods or impounding and gravity-settling methods that are used to prevent sediment-laden water from leaving a site.

200.3 Support Practices

Gravel pads, inlet protection, perimeter protection – those practices with no C or P-value.

300 Standard Drawings

Standard installation drawings are provided at the end of this document for clarity on how the proposed ESC practices are required to be installed. Drawings related to non-standard practices must be included in the ESC Plan.

100 General Requirements

100.1 Scope

These *Standard Specifications Erosion and Sediment Control (Specifications)* form part of all Erosion and Sediment Control (ESC) Plans approved for construction under Section 16 of the *Drainage Bylaw (37M2005)*.

All work must be carried out in accordance with the documents outlined below. In case of inconsistency or conflict between these documents, documents govern in the following order:

- 1) *Drainage Bylaw 37M2005*
- 2) *Standard Specifications Erosion and Sediment Control*
- 3) Manufacturer's specifications
- 4) The City of Calgary Standard General Conditions (applicable for City projects only)
- 5) Other City of Calgary specifications (e.g. Landscape, Roads)

All deviations from these *Specifications* or the approved ESC Plan require disclosure and written approval from The City of Calgary Water Resources (The City).

100.2 Release Reporting

A "person," as defined under the *Drainage Bylaw*, involved in carrying out a construction activity, must report any releases of sediment-laden water or other contaminants to a storm drainage system.

Release reporting information by calling:

- a) 3-1-1 (City of Calgary staff and contractors follow the Corporate Substance Release Reporting Procedure);
- b) 1-800-222-6514 (Alberta Environment and Parks) 24-hour release reporting line.

If requested, a person must provide the release reporting number provided by Alberta Environment and Parks (AEP).

100.3 Requirement to Comply

100.3.1 Sites Equal to or Greater than 0.4 ha

No person may commence or continue earth-moving activities on a site larger than or equal to 0.4 hectare (ha) unless the work is done pursuant to an ESC Approval issued under Section 16 of the *Drainage Bylaw*.

Approval of the ESC Plan is granted by Water Resources. Practices implemented onsite must comply with the approved ESC Plan.

The site must comply with the current ESC Approval that was provided under the previous Development Permit (DP) or Development Agreement (DA) until a new ESC Approval is issued for the site. The ESC Approval is tied to the land outlined in the DP or DA.

100.3.2 Sites less than 0.4 ha

Sites with disturbed areas less than 0.4 ha, and where there are no site characteristics that indicate greater than normal ESC concerns must adhere to the *Specifications* as outlined in the Development Permit. These sites do not generally require submission of an ESC Plan. The City reserves the right to request an ESC Plan on any site that is less than 0.4 ha if they believe there is potential of an adverse effect to property, infrastructure, health and safety, or the environment.

100.3.3 Construction Site Dewatering

No person may dewater a site (pumping or directing impounded surface water and/or groundwater into a storm drainage system) unless the activity complies with the *Drainage Bylaw*.

To obtain permission to dewater a site, contact 3-1-1.

Information on Drainage Permits is available at www.calgary.ca/esc

100.4 Erosion and Sediment Control Plans

ESC Plans must outline how any potential releases from the parcel will not cause an adverse effect (as defined by the *Drainage Bylaw*) during a construction activity.

The ESC Plan must ensure that:

- All construction and land-disturbing activities and associated erosion controls, sediment practices, and storm water management practices have been identified.
- Contractors and other impacted onsite staff are aware of all control practices to be implemented prior to and during each stage of construction.

The ESC Plan consists of:

- The ESC Approval letter;
- Application form;
- City of Calgary Specifications for Erosion and Sediment Control;
- All applicable drawings;
- Attachments (including nomograph and sieve analysis data).

100.5 Qualified Designer

ESC Plans must be created, stamped, and signed by a professional designer with experience in the design and implementation of erosion and sediment controls who holds a valid designation as either a:

- Certified Professional in Erosion and Sediment Control (CPESC), or
- Professional Engineer (P.Eng.), or
- Professional Licensee (P.L.Eng.), or

- Professional Agrologist (P.Ag.) with experience in ESC.

The ESC Plan must comply with and reference these *Specifications* at the time of the ESC Plan submittal.

100.6 Revised Universal Soil Loss Equation For Application in Canada (RUSLE-FAC)

Soil loss, for all areas and slopes on the proposed construction site, must remain less than 2 tonnes/hectare/year (t/ha/y) using the Revised Universal Soil Loss Equation for Application in Canada (RUSLE-FAC).

Construction adjacent to a water body, such as a wetland or a river, may be subject to additional provincial and federal requirements.

100.7 Amendments to the Approved ESC Plan

An amendment to the ESC Approval must be obtained for any deviations from the approved ESC Plan. An amendment request must contain the:

- a) Project name;
- b) Project reference number (Development Permit, Development Agreement, Development Liaison, Circulation Drawing number);
- c) Municipal site address;
- d) Notification that it is an amendment for a previous ESC Approval;
- e) A detailed description of what is being amended;
- f) Applicable amended drawing and details portions of the ESC Plan.

Amendments must be submitted to the City ESC Inspector following the process outlined at the following link calgary.ca/esc.

100.8 Documentation Accessibility

The following information must be available upon request, and retained for a minimum of 2 years following final site stabilization:

- a) ESC Plan, including all amendments
- b) Specifications for Erosion and Sediment Control
- c) Documentation (including photos and up-to-date written records) detailing implementation, inspection, and maintenance of ESC practices
- d) Drainage Permit (if applicable)

100.9 Trench Excavations

Soil windrowed during utility excavations should be placed up-gradient of the trench.

100.10 Authority to Access Site

The City must have free and uninterrupted access to work areas to carry out ESC inspections. The owner, site developer, contractor, their authorized agents, or a combination of these, must provide access for The City ESC Inspector to conduct a complete inspection of all ESC practices.

100.11 Winterization Plan

All ESC Plans must include a Winterization Plan.

Winter is defined as the dates between November 15th and April 15th of each year.

Implementation of Winterization Plans must be considered beginning September 15th and no later than November 14th of each year.

A pre-winter inspection is required to note any deficiencies that do not comply with the Winterization Plan. This winter shutdown inspection must be documented and available upon request.

Inspection and maintenance of the site will be required throughout winter at the frequency defined in Section 100.13, regardless of whether a project site is subject to winter shutdown or if construction is continuing. Any change to inspection frequency during winter must be pre-approved via an amendment (see section 100.7).

100.12 Pre-construction Meeting

A pre-construction meeting to discuss ESC implementation will be scheduled with The City ESC Inspector for all sites 0.4 hectares and greater. This meeting should be held after controls have been put in place but prior to the commencement of construction. Meeting time and date will be provided in the ESC Acceptance letter for your ESC Plan. Provide at least five business days notice if you need to reschedule your meeting by calling The City ESC Inspector.

100.13 Inspections

Inspection of all ESC practices must be completed and documented at least every 7 days and at critical times when erosion or sediment releases could occur, including:

- Windy weather;
- Significant precipitation events; and/or
- Melt events.

At a minimum, significant precipitation events are defined as greater than 12 millimetres (mm) of precipitation within any 24-hour period, or precipitation or snowmelt on wet or thawing soils. Shorter duration, but more intense events may also be deemed "significant".

Deficiencies documented during inspection of erosion controls and sediment practices must be corrected promptly, and the maintenance documented. Corrective actions, identified by the Qualified Inspector, must be taken as soon as possible and not longer than 72 hours after the identification of the deficiency, as long as the corrective timelines do not risk public health or safety.

100.14 Qualified Inspector

Inspections must be conducted by a Qualified Inspector.

A Qualified Inspector is a person who has training in ESC inspections or someone who is directly under the supervision of a person who has ESC inspection training and provides assistance in understanding the purpose and requirements of ESC inspections.

100.15 Stripping and Grading

Where the site owner transfers ownership of a piece of property, it must be properly stabilized and all slopes on the parcel must have annual soil losses of 2 t/ha/yr or less, using only erosion and sediment controls contained within the boundary of the property.

The stripping and grading ESC Plan is tied to the land and must be followed for the property, or any piece of the property, until a subsequent ESC Plan is approved by The City.

100.16 Low-Impact Development

Low-impact developments (LIDs) are critical areas that must be clearly identified in ESC Plans.

The ESC Plan must outline how the critical area will be protected for the duration of the project and until final stabilization.

LIDs must be installed after the upstream catchment area is stabilized wherever possible. If the LID cannot be installed after stabilization, it must be isolated from the construction site, or sacrificial measures, such as sod, must be applied.

100.17 Sediment Removal

The owner, site developer, contractor, and authorized agents are responsible to remove all sediment, mud, construction debris, and any other substance that may accumulate in any part of the storm drainage system, whether on private property or within public rights-of-way (ROWS).

The owner, site developer, contractor, and authorized agents will obtain all necessary permissions, permits, authorizations and approvals to access all property and infrastructure when cleaning sediment, mud, construction debris, and any other substance discharged into the storm drainage system.

100.18 Site Stabilization

A maximum of 65 ha of land may be exposed to erosion at any given time during construction, unless otherwise authorized through an ESC Approval Letter.

Sites with ESC Approval to expose greater than 65 ha require:

- An ESC Plan;
- a Phasing Plan Drawing (ESC10) which clearly shows how the soil disturbance area is to be limited to 65 ha at any one time during development of the site; and
- an ESC Large Site Safety Plan that is available to staff working on the construction site.

Stabilization is required, in the form of cover, when the site is left inactive as per the Site Stabilization Requirements table at the end of this section.

Short Term Cover: Is defined as a control that has a defined life span and must be reapplied; examples include blankets, mulches, and tackifiers.

Long Term Cover: Is defined as a control that, once installed, will continue to provide cover with limited or no reapplication; examples include vegetated cover such as sod or established seedlings.

The following conditions must be met if all or part of the site is left in a state where active construction is not occurring:

- a) The inspection frequency listed in Section 100.13 must be maintained, unless written approval has been obtained via an amendment (see section 100.7);
- b) Documentation associated with the site must be maintained, but may be kept at an alternate specified location; and
- c) Stabilization that reduces the annual soil loss of all slopes on site to 2 t/ha/y is required in the form of cover as outlined in the table below:

Site Stabilization Requirements	
Trigger	Control
30 Days Inactivity	Cover – short or long-term
One Calendar Year Inactivity (365 Days)	Cover – long-term

100.19 Stockpiles

Stockpiles must be properly placed and protected onsite so material will not be eroded to offsite areas, including the storm drainage system. Placement of materials on a City street or where wind or water could transport material offsite is prohibited under The City *Street Bylaw (20M88)*.

A stockpile is deemed in place after the first placement of soil.

Stockpiles in place for less than 30 days must have, at a minimum, functional sediment control practices on the down-gradient side of the pile that will contain sediment. A 2-metre (m) buffer must be in place between the toe of the stockpile and the sediment or silt fence.

Long-term stockpiles (in place more than 30 days) must be stabilized with an appropriate erosion control measure (cover).

When soil is being added to or removed from a stockpile, any face that has been undisturbed for more than 30 days must be stabilized with an appropriate erosion control measure.

Stockpiles in place for more than 1 year must be stabilized with an appropriate long-term cover as defined in Section 100.18.

100.20 Mud Tracking

Mud tracking must be controlled by means of installing, maintaining, and using stabilized construction entrances and exits at all access locations. Traffic entering and leaving the site must be minimized when soils are wet.

All sediment transported onto City streets must be removed immediately.

100.21 Haul Routes

When soil or subsoil is to be moved to or from the construction site, a detailed haul route map showing the location where soil is to be stored and the haul routes that are to be used must be supplied as part of the Approved ESC Plan. If this information is not known at the time of the application, it must be supplied as an amendment (see section 100.7) prior to any soil leaving the site.

100.22 Pollution Prevention

Practices must be implemented on all sites to prevent the release of prohibited substances to the storm drainage system and water bodies as a result of construction dewatering, surface washing, sand blasting, saw cutting, washing vehicles, washing out of concrete mixers and concrete trucks (including chutes and tools), and any other activities that could result in a prohibited discharge.

Water exposed to fresh concrete or saw cutting slurry must not be allowed to enter the wastewater system, storm drainage system or any watercourse. The water and slurry must be disposed of in accordance with all applicable regulations and at approved locations.

100.23 Development

During development, the owner is responsible for ensuring the protection of the storm drainage system until the completion of infrastructure installation and receipt of all Final Acceptance Certificates from The City.

Owners responsibilities during development include:

- is ultimately responsible for ESC on their land and for confirming compliance with regulations.
- confirming that the site is stabilized and approving the timely removal of temporary ESC measures.

100.24 Landowner

Upon purchase of a property, which has been developed under an Approved ESC Plan, the new landowner must comply with the Approved ESC Plan until such time that all Final Acceptance Certificates for the piece of property are acknowledged.

100.25 Obstruction of Storm Drainage System

No one may install inlet protection on any part of the storm drainage system, public or private, without prior written approval.

All inlet protection installed under a catch basin grate or manhole must be equipped with an overflow system.

All inlet protection approved on the ESC Plan must be removed at Final Acceptance Certificate. Any inlet protection to remain after this point must obtain a separate authorization under the *Drainage Bylaw*.

100.26 Good Housekeeping Practices for Utility Right-of-Way work

Good housekeeping practices must be followed at all times during soil disturbance related to Utility right of way work that do not trigger ESC Plan submissions under Section 100.3 of this document. Please refer to the general requirements listed below.

1. Proper placement and protection of stockpile soils and materials. Placement of materials on a City Street or where wind/water could transport material off-site is prohibited under the City of Calgary Street Bylaw. Stockpiles are to be properly placed and protected on site so material will not be eroded to off-site areas, including storm inlets.
2. Control of mud track out during construction, usually by means of a well-maintained construction entrance/exit on all access locations, supplemented with periodic street sweeping if required.
3. Dust control must be implemented on site, when required.
4. Down-gradient perimeter protection (such as silt fence, compost socks or fiber rolls) to protect off-site areas from stormwater runoff and sedimentation during construction.
5. Soil windrowed during utility excavations should be placed up-gradient of the trench.
6. Inspections are required every 7 days and after rainfall or snowmelt events.
7. Temporary sediment control at any storm inlets requires prior written approval. For most sites, the only location where inlet protection would be approved is directly adjacent to a gravel pad or stockpile. Failure to obtain approval can lead to fines under the Drainage Bylaw. Please contact our office for more information if you wish to use inlet protection on or near your good housekeeping site.
8. All disturbed areas must be stabilized within 30 days of construction completion (e.g. Asphalt, concrete, sod, mulch tackifier and seed)

200 Specifications

200.1 Erosion Control

200.1.1 SEEDING

C-Value	1.0 * *When completely established, C-value will be dependent on ground cover.
Drawing	None
Manufacturer's Specification	Follow supplier's installation criteria.

200.1.1.1 General

Seeding involves placing an approved seed mix onto prepared ground so that in the future the exposed soil will be covered with vegetation.

200.1.1.2 Design Requirements

An ESC designer who is familiar with the area's soils, climate, and seeding requirements must be consulted before proposing a seed mix for site, or applying seed to a site.

The seed must be specified and installed in accordance with Chapter 5 of the *City's Development Guidelines and Standard Specifications for Landscape Construction* (current edition).

Seed rates for temporary and permanent seeding should be based on a Pure Live Seed (PLS) of 80%. This rate is calculated by multiplying the minimum seed purity (%) and the minimum germination rates (%) from the seed tag. Divide by 100% to get the % PLS.

Use certified Canada No. 1 seed, free of diseases, weed seeds or foreign materials that meet the requirements of the *Seed Act*.

If seeding occurs after the 50% frost probability date for the site, a dormant seeding method must be used. In this case, the seed should be applied late in the season when there is no chance of germination and applied with a seed drill so cold temperatures do not damage the seed.

200.1.1.3 Implementation

1) Site Preparation

Concentrated runoff must be diverted away from all exposed slopes and areas to be seeded.

For soil that is compacted, crusted or hardened, the soil must be loosened (with discing, raking or harrowing) and surface roughened.

2) Application of Seed

Seed must be applied immediately after seedbed preparation while the soil is loose and moist. If the seedbed has been idle long enough for the soil to become compact, the soil must be harrowed or loosened.

Seed must be uniformly applied at the rates specified in the ESC Plan.

Broadcast seed must be incorporated into the soil by raking or chain dragging, and then lightly compacted to provide good seed-soil contact.

Temporary irrigation must be implemented until self-sustaining vegetation cover is established.

Seed may be installed via hydroseeding, see Specification 200.1.4.

200.1.1.4 Inspection and Maintenance

All seed, fertilizer, mulch, and other materials must be clearly marked and made available for inspection (contents, weight, analysis, supplier, and manufacturer).

Keep records of materials used and all certification tags for inspection and records.

Verify that seed and hydroseed applications meet specifications.

- Seed germination and seedling density must be evaluated.
- Re-application or additional soil amendments must be applied to maintain specified thickness of the cover.

Where seeds fail to achieve long-term germination, the area must be reseeded, fertilized, and mulched within the planting season using not less than half the original application rates.

Noxious weeds must be removed.

200.1.2 SODDING

C-Value	0.01
Drawing	1
Manufacturer's Specification	Follow supplier's installation criteria.

200.1.2.1 General

Sodding is the use of grass sod to cover and immediately stabilize disturbed areas of bare soil.

200.1.2.2 Design Requirements

The sod must be specified and installed in accordance with Chapter 5 of The City's *Development Guidelines and Standard Specifications for Landscape Construction* (current edition).

Lay sod strips on slopes with the long length parallel to the slope contours and perpendicular to the direction of the slope.

When used in open channels, lay sod strips perpendicular to the anticipated direction of the flow.

Sod must not be:

- Applied during unfavourable weather conditions;
- Placed on frozen ground surfaces; and
- Used on slopes greater than 3H:1V without staking.

200.1.2.3 Implementation

1) Prior to laying sod:

Sod must be kept moist during storage and transportation.

During dry, hot weather, cool the ground surface using irrigation before laying sod.

Apply slow release fertilizer on prepared surface (smooth surface free of rocks, weeds, and debris over 50 mm in diameter).

2) During sod laying:

The joint ends of adjacent sod strips must be butted tightly together. There must be no open joints or overlap adjacent pieces of sod.

Each sod strip must be rolled or tamped firmly to provide continuous contact between topsoil and underside of sod strip.

On slopes steeper than 3H:1V, each strip of sod must be secured with an anchor embedded a minimum of 150 mm into underlying soil. Space anchors a maximum distance of 600 mm apart.

Finished sod surfaces must be flush with adjoining areas, pavement, or top surface structures.

Irrigate freshly installed sod to moisten the topsoil to minimum depth of 100 mm.

200.1.2.4 Inspection and Maintenance

Sodded areas must be inspected at least every 7 days for the first 2 months after placement and after significant storm events or snowmelt likely to cause erosion.

If damaged by washout or rilling, the sod must be immediately re-graded and damaged areas re-sodded.

Re-sod bare spots larger than 15 square centimetres (cm²).

200.1.3 ROLLED EROSION CONTROL PRODUCTS (RECP's)

C-Value	C-Value = 0.3* *C-value varies depending on product type chosen. A manufacture's specification showing a C-value derived from ASTM testing must be provided if a C-value lower than 0.3 is to be assigned.
Drawing	2, 3
Manufacturer's Specification	Attach: Manufacturer's Specification to <i>Erosion and Sediment Control Plan Application Form</i> . Design and install as per Manufacturer's Specifications. If there is a discrepancy between these Specifications and the Manufacturer's Specifications the more stringent of the two will apply.

200.1.3.1 General

RECP's consist of prefabricated blankets or netting which are formed from both natural and synthetic materials.

RECP's may be used in conjunction with seeding to accelerate the establishment of vegetation, especially on slopes.

RECP's approved for use by The City fall into the following two categories:

- **Erosion Control Blanket (ECB):** A temporary degradable rolled erosion control product composed of processed natural or polymer fibers.
- **Turf Reinforcement Mat (TRM):** A RECP composed of non-degradable synthetic fibers, filaments, nets, wire mesh and/or other elements. TRM is often selected for lining high flow channels.

200.1.3.2 Design Requirements

RECP's used for disturbed slopes adjacent to water bodies or environmentally sensitive areas must be a net-free wildlife-friendly product.

Upstream flows must be managed to prevent flowing under the RECP.

RECP's may not be used in excessively rocky locations.

Netted RECP's may not be used in areas where final vegetation will be mowed.

The longevity of the RECP must match the expected time period that the blanket will be in place.

200.1.3.3 Implementation

The slope must be properly prepared before installing the blanket, as follows:

- Slope must be fine-graded to a smooth profile free of weeds, rills, and crusting;

- Large rocks, debris, and other materials greater than 50 mm in diameter must be removed; and
- Voids must be filled and the slope lightly compacted.

If seeding is planned, then prior to installing the RECP, the area must be seeded in accordance with Specification 200.1.1.

1) Installation of ECB

Anchor trench must be dug at 300 mm deep by 300 mm wide and set back at least 1 m from the crest of the slope. Install the end of the blanket in the trench, providing 750 mm of excess blanket extended upslope of the trench. Staples must be installed at 300 mm centres along the width of the trench and 1000 mm centers along the length of the trench.

Anchor trench must be backfilled and compacted. If seeding, seed must be placed over the compacted soil at this point. Compacted soil must be covered with at least 300 mm of the terminal end of the blanket. The terminal end downslope of the anchor trench must be stapled in at 300 mm centres.

One of the following must be used to anchor the blanket into the ground:

- U-shaped wire staples;
- metal geotextile stake pins;
- biodegradable stakes; or
- triangular wooden stakes.

Staples must be a minimum of 150 mm in length. Staples must be driven into the ground so they are flush with the surface of the ground. Slope must be fine-graded to a smooth profile free of weeds, rills, and crusting;

Large rocks, debris, and other materials greater than 50 mm in diameter must be removed prior to laying of blanket(s).

Blankets must be unrolled down the slope, in a controlled manner, starting at the anchor trench. Excess slack must be removed from the blanket every 6 meters.

The staple pattern to secure the blankets must be as per the manufacture's specifications.

A minimum 100 mm overlap must be used when rolling adjacent sections of blanket, unless specified otherwise by the manufactures specifications.

If the blanket needs to be spliced in the middle of a slope, the blankets must be 'shingled' with the upslope blanket overlapping the downslope blanket by a minimum of 100 mm.

2) Installation of Turf Reinforcement Mats (TRMs) in Channels

Longitudinal anchor trenches and terminal slope and channel anchor trenches must be dug to measure 300mm deep by 150 mm wide.

Longitudinal anchor trenches must be installed perpendicular to the flow line.

Terminal slope and channel anchor trenches must be installed parallel to the flow line.

Longitudinal, terminal and channel anchor trenches must be installed into the trench allowing for 300 mm of excess mat extending upstream of the trench. The mat must be stapled at 300-mm centres along the width of the trench.

All anchor trenches must be backfilled and compacted. Compacted soil must be covered with at least 300 mm of the terminal end of the blanket. The anchor trench must be stapled in at 300-mm centres perpendicular to flow line.

The mat must be unrolled, in a controlled manner, in the direction of water flow, starting with the mat in the channel bottom. Adjoining mats must be installed away from the centre of the channel bottom and must be overlapped as recommended by the manufacturer. Overlap seams must be stapled at 300 mm centres or as noted in manufacturer specifications.

The staple pattern to secure the TRM must be as per the manufacturer specifications.

Check slots must be installed as per manufacturer specifications.

The mat must be installed from the channel bottom up the channel sides in a shingle-type installation (with the upslope mat overlapping the lower mat 100 mm, or as specified by the manufacturer).

Edges of the matting must be buried in 300 mm deep by 150 mm wide longitudinal anchor trenches, extending the mat at least 300 mm above the crest of the channel side slopes.

200.1.3.4 Inspection and Maintenance

Verify that check slots, anchors, and joints are secure; if they are not, repair.

Ensure staples are flush with the ground; if they are not, repair.

Check for areas where hydraulic uplift of the RECP may have occurred. Repair any damage immediately, and install additional staples as necessary.

Verify RECPs have good contact with the soil, and look for erosion, undermining, or blanket separation.

If weeds have caused 'tenting' where intimate contact with the soil has been lost, remove noxious weeds and reengage contact between the blanket and the soil.

If undermining has occurred, identify cause and resolve; re-install lost soil and, if applicable, seed.

200.1.3.5 Removal

If the blanket is removed, fill in any trench channels to prevent channeling of water.

All staples, that will not biodegrade, must be removed.

200.1.4 HYDROMULCH & TACKIFIER

C-Value	Varies depending on Manufacturer’s Specifications
Drawing	N/A
Manufacturer’s Specification	<p>Attach: Manufacturer’s Specification to <i>Erosion and Sediment Control Plan Application Form</i>.</p> <p>Design and install as per Manufacturer’s Specifications.</p> <p>If there is a discrepancy between these Specifications, the <i>Development Guidelines and Standard Specifications for Landscape Construction</i> (current edition) and the Manufacturer’s Specifications, the more stringent of the three will apply.</p>

200.1.4.1 General

Hydromulch is a temporary erosion cover that uses a hydraulically applied slurry to cover soil and protect it from erosion. At application, hydromulch consists of a water, fibre mulch and a tackifier. It may or may not include a non-toxic tracer (e.g. indicator dye) if required for visibility.

Tackifier is a temporary erosion cover that consists of an organic polymer agent that covers soil and protects it from erosion. At application, tackifier consists of water and tackifier. It must include a non-toxic tracer (e.g. indicator dye).

200.1.4.2 Design Requirements

An ESC designer who is familiar with the area’s soil, climate, and seeding requirements must be consulted before proposing hydromulch or tackifier on a site.

If seed is to be added to the hydromulch it must be specified according to Specification 200.1.1.

The hydromulch and tackifier used must have a Material Safety Data Sheet available on site.

The hydromulch and tackifier used must have a Chemical Abstract Service number.

Hydromulch and tackifiers must be non-toxic and have documented confirmation that they can pass a Lethal Dose 50 (LD50) for aquatic organisms.

Hydromulch and tackifiers must be made of products that will biodegrade in Calgary’s climate.

Hydromulch and tackifier products must have a minimum ground cover, in all areas, of 80-100%.

200.1.4.3 Implementation

1) Site Preparation

Concentrated runoff must be diverted away from all exposed slopes and areas to be hydromulched or tackified.

Hydromulch requires 24 hours curing time after application. Hydromulch must not be applied if precipitation is forecast within the next 24-hour period.

2) Application

Do not over-spray hydromulch or tackifier onto roads, sidewalks, water courses and existing vegetation.

Hydromulch and/or tackifiers must be clearly visible when applied and may require the addition of a non-toxic tracer to support this.

If installing with seed, hydromulch must be applied immediately after seedbed preparation while the soil is loose and moist. If the seedbed has been idle long enough for the soil to become compact, the soil must be harrowed or loosened.

Hydromulch must be uniformly applied at the rates specified in the ESC Plan.

Records must be kept of materials used and all certification tags for inspection.

Hydromulch and/or tackifiers must be applied from more than one direction to prevent shadowing.

200.1.4.4 Inspection and Maintenance

The effectiveness of the hydromulch and/or tackifier cover must be maintained until permanent cover is established. Any areas where hydromulch and/or tackifier has been damaged or removed must be promptly repaired and replaced.

Records of materials used and all certification tags for inspection and records must be kept on site and available for inspection.

The hydromulch and/or tackifier applications rates must meet those approved in the ESC Plan. If they do not, reapplication is required.

Ground coverage must be clearly discernible and the hydromulch and/or tackifier application must provide a minimum of 80% coverage in all areas. Coverage is determined on square meter transects.

Exercise care to minimize damage to protected areas while making repairs. For temporary applications, maintain an unbroken ground cover throughout the period of construction when the soils are not being reworked.

Remove noxious weeds.

Where hydromulch and/or tackifier is being replaced by the growth of vegetation from seed, ensure the effectiveness of the hydromulch and/or tackifier is maintained until vegetation is established.

200.1.5 COMPOST BLANKETS

C-Value	0.05 (based on application and slope information below)	
	Compost Blanket Depth	Slope Limitations
	50 mm	Slopes less than 25%
	100 mm	Slopes between 25-50%
	Not applicable	Slopes greater than 50%
Varies depending on product type and depth. A manufacturer's specification showing a C-value derived from ASTM testing must be provided if a C-value lower than 0.05 is to be assigned or if the application depths provided in the table above are not adhered to.		
Drawing	N/A	
Manufacturer's Specification	<p>Attach: Manufacturer's Specification to <i>Erosion and Sediment Control Plan Application Form</i>.</p> <p>Design and install as per Manufacturer's Specifications.</p> <p>If there is a discrepancy between these Specifications, the <i>Development Guidelines and Standard Specifications for Landscape Construction</i> (current edition) and the Manufacturer's Specifications the more stringent of the three will apply.</p>	

200.1.5.1 General

Compost is produced by controlled biological decomposition of organic materials from agriculture, forestry, commercial and residential activities. A compost blanket is a layer of loosely applied composted material placed on the soil in disturbed areas to reduce storm water runoff and erosion.

200.1.5.2 Design Requirements

Compost blankets must not be applied in areas subject to concentrated runoff.

Use a compost blanket with a well-graded mixture of coarse and fine particles as this provides desirable erosion protection.

Upstream runoff must be diverted away from exposed slopes.

To prevent water from sheeting between the compost blanket material and the soil surface on a slope, a minimum 1 m wide band of blanket material should be installed on the shoulder of the slope. Alternatively, a compost berm may be placed at the top of the slope.

If seed is to be added to the compost blanket it must be specified according to Specification 200.1.1.

Compost used in compost blankets must meet the criteria for Category A quality in accordance with the *Canadian Council of Ministers of the Environment (CCME) Guidelines for Compost Quality*, and also meet local municipal and provincial requirements.

200.1.5.3 Implementation

Compost must be free of Noxious and Prohibited noxious weeds as defined in the *Weed Control Act 125/2016*, pesticide residues, and garbage.

Compost blankets must be installed by a specialized, certified supplier using a pneumatic blower truck or pre-approved alternative.

Prepare the slopes by removing loose rocks, roots, clods, stumps, and debris over 50 mm in diameter.

Machine track-walk up and down slopes before application according to Specification 200.2.5.

Extend compost blankets 1.0 m over the crest of the treated slope.

200.1.5.4 Inspection and Maintenance

Confirm compost application depth meets requirements for the slope; if not, apply additional compost.

Re-apply compost to bare or eroded areas as required.

If compost is eroding from an area, install additional upstream controls.

For steep slopes, greater than 25%, wattles, logs or barriers should be installed (See Specification 200.2.1).

200.1.6 AGGREGATE COVER

C-Value & K-Value Adjustments	<table border="1"> <thead> <tr> <th rowspan="2">Type</th> <th colspan="2">Application Rate</th> <th rowspan="2">Slope %</th> <th rowspan="2">C-Factor</th> <th colspan="2">Length limit</th> </tr> <tr> <th>tons/acre</th> <th>Kg/ha</th> <th>feet</th> <th>meters</th> </tr> </thead> <tbody> <tr> <td rowspan="7">Crushed Stone 6.35 mm (1/4") – 38.1 mm (1 1/2")</td> <td>135</td> <td>302,630</td> <td><16</td> <td>0.05</td> <td>200</td> <td>61</td> </tr> <tr> <td>135</td> <td>302,630</td> <td>16-20</td> <td>0.05</td> <td>150</td> <td>46</td> </tr> <tr> <td>135</td> <td>302,630</td> <td>21-33</td> <td>0.05</td> <td>100</td> <td>30</td> </tr> <tr> <td>135</td> <td>302,630</td> <td>34-50</td> <td>0.05</td> <td>75</td> <td>23</td> </tr> <tr> <td>240</td> <td>538,009</td> <td><21</td> <td>0.02</td> <td>300</td> <td>91</td> </tr> <tr> <td>240</td> <td>538,009</td> <td>21-33</td> <td>0.02</td> <td>200</td> <td>61</td> </tr> <tr> <td>240</td> <td>538,009</td> <td>34-50</td> <td>0.02</td> <td>150</td> <td>46</td> </tr> </tbody> </table>						Type	Application Rate		Slope %	C-Factor	Length limit		tons/acre	Kg/ha	feet	meters	Crushed Stone 6.35 mm (1/4") – 38.1 mm (1 1/2")	135	302,630	<16	0.05	200	61	135	302,630	16-20	0.05	150	46	135	302,630	21-33	0.05	100	30	135	302,630	34-50	0.05	75	23	240	538,009	<21	0.02	300	91	240	538,009	21-33	0.02	200	61	240	538,009	34-50	0.02	150	46
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K-value Adjustments	K-Value Adjustment Factor (St)*		% Stones > 2 mm																																																									
	0.740		Stones may be present in the onsite soil or they may be imported, such as a 150 mm blanket of pit run																																																									
	0.332		Equal to or greater than 10% but less than 25%																																																									
	0.074		Equal to or greater than 25% but less than 50%																																																									
<p>* K-value adjustment formula: $K_{st} = K * St$</p> <p>K_{st} = Adjusted K-value</p> <p>K = K-value for site (calculated using nomograph)</p> <p>St = K-value Adjustment Factor (from table above)</p>																																																												
Drawing	N/A																																																											

200.1.6.1 General

Aggregate cover is the application of clean washed gravel following the application rates in the table above or the presence of stone or gravel at a rate of 10% or more.

200.1.6.2 Design Requirements

Concentrated upstream runoff must be diverted away from areas of aggregate cover.

1) Critical Areas:

- On slopes with highly erosive soils (silt and sand), the granular blanket must be thick enough to prevent erosion of the soils underneath.
- For areas of high groundwater seepage, aggregate cover with a non-woven geotextile fabric underlay must be used to eliminate migration of clay fines into the blanket.

2) Aggregate Quality:

- Aggregates must not contain recycled concrete, mine waste, iron blast furnace slag, or blended nickel slag or clinkers due to the potential of groundwater contamination from materials contained in the aggregate.
- Aggregate fines must be less than 5% material passing the 2.5-mm sieve.

200.1.6.3 Implementation

Apply after the sites have received their initial grading for quick stabilization.

200.1.6.4 Inspection and Maintenance

In areas with frequent traffic, inspect for loss of cover due to gravel and stones punching into the soil. If loss of gravel occurs, apply a top-dress.

Check slopes for washouts during and after significant weather events (rainfall, runoff, and snow melt).

Immediately repair any damage discovered.

200.2 Sediment Control

200.2.1 WATTLES/LOGS/BARRIERS

P-Value	Varies depending on Manufacturer's Specifications
Drawing	N/A
Manufacturer's Specification	Attach: Manufacturer's Specification to <i>Erosion and Sediment Control Plan Application Form</i> . Design and install as per Manufacturer's Specifications. If there is a discrepancy between these Specifications and the Manufacturer's Specifications the more stringent of the two will apply.

200.2.1.1 General

Wattles, logs and barriers look similar in that they are cylindrical and are placed upon contours across slopes. Wattles, such as straw wattles, are used to slow down the velocity of silt laden runoff while logs, such as aspen curl logs, and barriers, such as compost berms, slow down water and filter it through the log or barrier.

200.2.1.2 Design Requirements

Wattles, logs and barriers must all be installed as per the Manufacturer's Specifications.

Concentrated upstream runoff must be captured and diverted away from exposed slopes or conveyed down the slope in a suitable channel.

200.2.1.3 Implementation

Any rills and gullies on the slope must be repaired prior to the installation of wattles, logs and barriers.

Spacing of wattles, logs and barriers must comply with the Manufacturer's Specification for the product size and type.

200.2.1.4 Inspection and Maintenance

All sections of the wattle, log or barrier must be inspected to ensure they are in good contact with the soil.

Any rills or undermining must be repaired promptly; add additional runoff or erosion control for areas subject to rilling.

For wattles, remove sediment retained behind the wattle when it reaches one-third of the exposed height of the structure.

For logs and barriers that filter runoff, remove and replace the log or barrier when sediment reaches half the height of the product.

200.2.1.5 Removal

Removal or retrieval of the wattle, log or barrier is not required as long as the entire product (netting included) is organic, will decompose, and the product is not installed in an area where final vegetation will be mowed.

Barriers such as compost socks (with the mesh split and removed) may be left onsite if spread out and vegetated or if it is spread out and used as a soil amendment.

200.2.2 SEDIMENT CONTAINMENT SYSTEMS

P-Value	The P-value for sediment containment systems is based on the storage volume/hectare as outlined in the table below.	
	The higher P-value must be selected when a proposed sediment containment system falls between the storage volumes listed.	
	No interpolation is allowed.	
	Storage Volume	P-value
	150 m ³ /ha	0.7
	200 m ³ /ha	0.6
	300 m ³ /ha	0.5
	500 m ³ /ha	0.4
	750 m ³ /ha	0.3
1200 m ³ /ha	0.2	
1750 m ³ /ha	0.1	
Drawing	4, 5	

200.2.2.1 General

The function of a sediment containment system is to provide storage capacity for storm water runoff from site and to slow the flow velocity of runoff to allow for the sedimentation of suspended soil particles to occur.

Sediment containment systems include:

- sediment traps;
- sediment ponds; and
- storage ditches.

200.2.2.2 Design Requirements

Clean run-on from stabilized areas must be diverted away from sediment containment systems.

Sediment containment systems must be:

- constructed below grade; the use of berms to increase the volume of sediment containment is prohibited;
- used in conjunction with other upstream ESC measures;

- located to maximize storage benefit from the terrain and for ease of clean-out and disposal of trapped sediment;
- a minimum of 0.5 m deep and a maximum of 1 m deep;
- have side wall slopes no steeper than 3H:1V; and
- flat bottomed.

Sediment containment systems must **not**:

- be perched on slopes where they may impact the stability of the slope; and
- have access to underground infrastructure. This restriction includes direct access to storm infrastructure and indirect access such as seepage through gravel bedding and pipe joints into infrastructure.

200.2.2.2.1 Storage Ditches

Storage ditches must **not** have a grade along the ditch line that exceeds 2%.

Storage ditches must include compacted soil cross check structures at the spacing outlined in the table:

Table 200.2.2.2.1 Storage and diversion ditch cross check structure spacing

Cross Check Structure Spacing (m)			
	Ditch Depth		
% Slope	0.5 m	0.75 m	1.0 m
1.0	50	75	100
1.5	33	50	67
2.0	25	37	50

Cross check structures installed in storage ditches must:

- Be installed 0.1 m below surface grade;
- Have 1:1 side slopes; and
- Have a 1.5 m flat top.

Storage ditch volume, serving area, serving volume must be provided in the ESC Plan and P-values must be selected given the Sediment Containment Systems P-value/volume noted in Section 200.2.2.

200.2.2.3 Implementation

All vegetation, roots, and debris must be cleared from the footprint area of the sediment containment system and embankments, and disposed of properly.

Sediment containment systems must be constructed by excavating a volume of soil in the ground per the ESC Plan, and the sidewalls, bottoms and cross check structures must be well compacted.

A stake must be set in the basin or trap, and a mark added to indicate one-third design depth.

Storage ditch cross check structures must be spaced as per Table 200.2.2.2.1.

200.2.2.4 Inspection and Maintenance

The sediment containment system must be inspected for areas of standing water during every inspection and after precipitation events.

If the containment systems do not dewater within three days, they must be manually dewatered to maintain adequate storage volume for the next runoff event.

Inspect for rilling, gullying and slumping; repairs must be made immediately.

Sediment must be removed when it reaches one-third the design depth of the sediment containment system.

Removed sediment must be disposed of either by spreading onsite and stabilizing, or removed and disposed at a suitable location.

200.2.2.5 Removal

The sediment containment system must be backfilled once construction is complete and the drainage area is stabilized.

200.2.3 DIVERSION CHANNELS

P-Value	1.0
Drawing	5, 6

200.2.3.1 General

Diversion channels are used to direct water into an appropriate ESC measure.

200.2.3.2 Design Requirements

Channels intended for diversion do not have a P-value. If the channel is intended for runoff storage, refer to the section on Sediment Containment Systems for P-values based on storage volume.

Channels must be designed to manage the volume and flow velocity of a 2-year, 24-hour storm event and the final channel must have the proper grade and shape of the cross-section to discharge the design flow and provide positive drainage.

Channels must be stabilized with an erosion control measure (e.g. riprap, RECP's, vegetation), capable of withstanding the run-off velocity that the ditch is designed for.

The slope along the channel ditch line must be a minimum of 2% and a maximum of 5% to maintain positive drainage and avoid water ponding and breaching of channel flow.

Cross check structures are required in diversion channels that are moving on-site storm water.

Cross check structures are not required if only moving clean run-on off-site.

Cross check structures must be composed of 75 mm to 300 mm clean wash gravel and must adhere to all specification detail in drawing 9. Spacing of check structures within the channel must be so that the bottom of the upstream check structure is level with the top of the downstream check structure.

Channels must be constructed:

- A minimum of 0.5 m deep and a maximum of 1 m deep;
- With any overburden placed upstream from the ditch and leveled out or compacted;
- With parabolic or trapezoidal cross-sections, with side slopes of 2H:1V or flatter;
- So that runoff is directed to an appropriately stabilized outlet when discharging to a sediment containment system; and
- With an erosion control designed to withstand water velocity and shear.

200.2.3.3 Implementation

Excavate channel to the percent slope specified in the ESC Plan.

Place overburden on the upstream side of the ditch and compact it.

Channels must be stabilized with an appropriate erosion control practice immediately after construction.

200.2.3.4 **Inspection and Maintenance**

Inspect channel for sediment deposition and remove if present.

Ensure the erosion control installed is adequate to withstand flows encountered; repair any damage to the erosion controls when required.

Repair any damage to the channel before the end of each working day.

Prior to freeze-up, stabilize all temporary channels adequately to handle snowmelt.

200.2.3.5 **Removal**

The diversion channel must be backfilled once construction is complete and the drainage area is stabilized. If required, remove the erosion control that was being used to stabilize the ditch.

The backfilled area must be graded to match the surrounding grade.

200.2.4 DIVERSION BERMS

P-Value	1.0
Drawing	7

200.2.4.1 General

Diversion berms are linear piles of compacted earth that are used to direct storm water into an appropriate ESC measure.

200.2.4.2 Design Requirements

Diversion berms do not have a P-value.

No ponding of water behind the berm is authorized.

Diversion berms must be designed to manage the volume and flow velocity of a 2-year, 24-hour storm event and the final berm must have the proper grade and shape, discharge the design flow, and provide positive drainage.

The entire berm must be compacted and stabilized with an appropriate erosion control cover to withstand flow velocity and shear stress.

The catchment area must not exceed 2 hectares.

Typical berm design details are:

- Cross sectional dimensions:
 - Minimum 0.5 m high and maximum 1 m high;
 - Minimum width of 0.5 m and a maximum height of 1 m.
- Berms must be trapezoidal in cross-section with side slopes of 2H:1V or flatter.

Berms greater than 1 m in height must be designed by a geotechnical engineer.

200.2.4.3 Implementation

Apply soil lifts at an appropriate depth to achieve compaction to a minimum of 97% of Standard Proctor Density.

Construct berm to achieve percent slope and trapezoidal cross-sections as specified in the ESC Plan.

Berm must be stabilized with an appropriate erosion control practice as approved in the site ESC Plan immediately after construction.

200.2.4.4 Inspection and Maintenance

Inspect berm for sediment deposition and remove if present.

Ensure the erosion control installed is adequate to withstand flows encountered; repair any damage to the erosion controls when required.

Repair any damage to the berm and re-compact as soon as function is compromised.

Prior to freeze-up, stabilize all berms adequately to handle snowmelt.

200.2.4.5 **Removal**

The diversion berms must be removed or flattened to meet surrounding grade once construction is complete and the drainage area is stabilized. If required, remove the erosion control that was being used to stabilize the berm.

200.2.5 SURFACE TEXTURING

P-Value	Varies depending on texturing practices:		
	Surface Roughening		
	P-value	0.9	
	Contour Furrowing		
	P-Value	% Slope	Max Length
	0.6	1 to 2	120
	0.5	3 to 5	90
	0.5	6 to 8	60
	0.6	9 to 12	40
	0.7	13 to 16	25
0.8	17 to 20	20	
0.9	21 to 25	15	
Drawings	Terracing		
	P-Value	% Slope	
	0.12	1 to 2	
	0.10	3 to 8	
	0.12	9 to 12	
	0.14	13 to 16	
	0.16	17 to 20	
	0.18	>20	
	(Source: Designing for Effective Sediment and Erosion Control on Construction Sites, Fifield, 2001)		
	Surface Roughening	8	
Contour Furrowing	9		

200.2.5.1 General

Surface texturing involves modifying the soil surface to reduce run-off velocity and, in many cases, increase infiltration. There are three common types of slope texturing practices used in Calgary:

- **Surface roughening:** involves running tracked machinery on exposed soil in a pattern that is perpendicular to the slope.
- **Contour furrowing:** involves using mechanical equipment to deep-rip furrows into the exposed soil perpendicular to the flow of water down a slope. The furrows slow down the water and allow it to accumulate in the furrow trenches.
- **Terracing/benching:** terracing and benching is used to reduce the effective length of long slopes (break up slopes) by providing large benches running along the slope contours.

200.2.5.2 Design Requirements

All slope texturing must be maintained through construction activities, or the P-value reverts to 1.0.

1) Surface roughening

Machine-tracking must be limited to one or two passes to prevent excessive compaction.

Machine-tracking must be installed perpendicular to the slope direction.

Excessively wet or clayey soils must not be track packed.

2) Contour furrowing

Contour furrows must follow the contour lines of the slope.

Furrows must be installed at a depth between 100-200 mm with a maximum spacing between contours of 500 mm.

3) Terracing/benching

Must have sufficient volume to contain within the terrace a 2-year, 24-hour storm event (380 cubic metres per hectare [m^3/ha]) without overflowing.

All benches and terraces must be designed and stamped by a qualified geotechnical engineer for slope stability.

200.2.5.3 Implementation

1) Surface roughening

Use tracked construction equipment to move up and down the slope, leaving depressions.

Tracks must be perpendicular to slope.

2) Contour furrowing

Furrows must be ripped across the width of and perpendicular to the slope.

3) Terracing/benching

A diversion channel or other appropriate measure must be installed at the top and bottom of the slope to be terraced (see Specification for Diversion Channels). Water from the diversion channels must flow into a sediment containment system or an area approved within the ESC Plan.

Narrow, flatter sections of terrain on the slope must be constructed perpendicular to slope direction.

Benches and terraces must be graded back towards the slope and drained with a gentle gradient to a stabilized outlet.

200.2.5.4 Inspection and Maintenance

Inspect for rills and gullies; surface texturing must be reinstalled when impacted by wind, water and onsite construction activities.

Ensure there have been no concentrated sediment releases from terracing and benching; if required, repair and resolve upstream concerns.

200.2.5.5 Removal

If required, level slopes to design grade.

200.2.6 SILT FENCE

P-Value	0.6
Drawing	10, 11, 12, 13

200.2.6.1 General

Silt fence is a semi-porous geotextile material attached to wooden or metal posts and is primarily used to promote sedimentation through ponding sediment-laden runoff.

200.2.6.2 Design Requirements

Maximum area draining to the silt fence must not exceed 0.1 ha per 30 m run of silt fence.

The runoff path length above a fence must not exceed 30 m.

Silt fence must be installed in J-hook or Smile.

Silt fence must be installed a minimum of 2 m away from the toe of the slope.

Maximum slope gradient upstream of a fence must not exceed 2H:1V.

Silt fence must be proposed/installed on ground contours with ends of the fence pointed upslope.

Silt fence must not:

- Be constructed in areas where flow velocity is to exceed 0.03 m/s;
- Be installed around the perimeter of construction site in a long linear fashion;
- Be installed on existing fence, such as chain link or temporary construction fence;
- Be installed in locations where concentrated runoff occurs;
- Be used in drainage swales where there are grades that exceed 2% and/or the contributing area exceeds 0.8 ha;
- Be designed to impound sediment or water more than 0.45 m high; and
- Use wire backing for fence reinforcement, unless previously approved in the ESC Plan.

200.2.6.3 Implementation

Silt fence must be trenched into the ground at a minimum of 0.2 m deep.

Silt fence must be installed at a minimum height of 0.6 m and a maximum height of 0.9 m (from grade to top of silt fence fabric).

Silt fence trench must be backfilled and compacted to grade so as to hold the base of the silt fence firmly in place.

Silt fence posts must be driven 600 mm into the ground, and spaced at a maximum distance of 2 m apart.

Silt fence must be secured on the upstream side by either:

- Steel posts (minimum 2 kilograms per metre [kg/m] with projections for fastening fence); or
- Wood posts (100 mm in diameter, with a minimum length of 1.35 m).

Silt fence must be firmly secured to the upstream side of posts using staples, wire or plastic tie-straps.

Where joints are required, construct at minimum 0.4-m overlap between silt fence ends and wrap the end-posts together with a ½ turn at minimum.

200.2.6.4 Inspection and Maintenance

Ponded water behind silt fence must be removed within 24 hours after each storm event.

Sediment must not be allowed to exceed 50% of the height of the silt fence.

Silt fence must be firmly entrenched and anchored in the soil.

Replace damaged fabric and address flow around and/or undermining problems immediately.

200.2.6.5 Removal

Silt fence fabric and posts must be removed both above grade and below once the upstream catchment area has been permanently stabilized.

Any excavations required to remove silt fence and post must be backfilled, compacted and covered with an appropriate erosion control and stabilized.

200.3 Support Practices

200.3.1 STABILIZED GRAVEL ACCESS

P-Value	1.0
Drawing	14

200.3.1.1 General

Stabilized gravel access pads consist of a layer of gravel over a geotextile base used to reduce mud tracking in areas where vehicles enter and exit a construction site.

200.3.1.2 Design Requirements

Install stabilized construction access points at all locations where vehicles are directed to enter or exit a construction site.

Stabilized access must not be located on steep grades or entrances to curves in public roadways.

Avoid the installation of entrances which are located over grated-top manholes and catch basins.

Use clean wash rock that is hard, durable, angular and 40-80 mm in diameter.

The thickness of the pad must be a minimum of 150 mm in depth.

Access must be a minimum width of 3.6 m and a minimum length of 15 m.

Install a sediment trap on the downstream side of the stabilized construction entrance.

Install a diversion ridge that will direct water to a downstream sediment trap when the stabilized construction entrance is angled towards the roadway with a slope of 2% or greater.

200.3.1.3 Implementation

Level ground at stabilized construction entrance and install diversion ridge, if required.

Install geotextile fabric and place 40-80 mm diameter rock on top.

Install the downstream sediment trap.

200.3.1.4 Inspection and Maintenance

Ensure all traffic is using stabilized construction access points.

Inspect the entrance daily during active construction for effectiveness.

Excessively muddy vehicle wheels and tires must be washed to remove sediment prior to entrance onto City streets. When washing is required, wash on an area stabilized with crushed stone that drains into an approved sediment trap or basin.

Maintain the entrance in a condition that will prevent tracking or flowing of sediment onto public ROWs. This maintenance may require top dressing, repair, clean-out, or some combination of these activities for any measures used to trap sediment.

Immediately remove all sediment spilled, dropped, washed, or tracked onto City streets.

200.3.1.5 Removal

Remove the stabilized construction access when permanent stabilization has been established on site roadways or when access at the location is no longer required.

200.3.2 STORM INLET CONTROLS

P-Value	1.0
Drawing	15, 16
Manufacturer's Specification	<p>For manufactured inlet protection, attach the Manufacturer's Specification to <i>Erosion and Sediment Control Plan Application Form</i>.</p> <p>Design and install as per Manufacturer's Specifications.</p> <p>If there is a discrepancy between these Specifications and the Manufacturer's Specifications the more stringent of the two will apply.</p>

200.3.2.1 General

Inlet controls are temporary devices that only work when temperatures are above 0 °C. They must be removed before winter sets in (November 15th) and reinstalled before significant spring runoff events (April 15th).

Three standard types of inlet protection in Calgary are:

- **Block and gravel inlet sediment barrier:** cinder blocks surrounded by filter fabric and gravel.
- **Silt fence sediment barrier:** silt fence installed around an inlet.
- **Manufactured inlet protection:** protection designed to attach to a catch basin or be placed directly over a catch basin.

200.3.2.2 Design Requirements

Prior approval (via an ESC Plan) must be received before installing inlet protection on any part of the public or private storm drainage system. Failure to obtain approval can lead to fines under the *Drainage Bylaw (37M2005)*.

Storm inlet controls may only be installed on an impermeable surface, such as pavement, when the control is located on a catch basin less than 5 m downstream of a construction access.

Inlet control must be removed after the first lift of impermeable surface has been installed.

Inlet control must not be the only practice proposed on site at any time during construction and must be paired with an upstream erosion control.

Inlet controls must be installed with overflow devices to accommodate high flows.

Inlet controls must be removed during periods of time when icing could occur. This time period is defined as November 15th to April 15th.

200.3.2.3 Implementation

1) Block and gravel

Block and gravel systems must be chosen when low ponding (less than 0.2 m) is expected.

Concrete blocks must be placed one to two blocks high around the inlet such that block cavities face the direction of flow.

Filter fabric and wire mesh must be placed on the outside face of the blocks.

A minimum of 20 mm diameter clean wash gravel must be placed around the entire inlet (0.6 – 1.0 m wide) and the gravel must be sloped away from the top of the concrete blocks to form a gravel donut.

Gravel must be placed to the full depth of the concrete block.

The slope to the block and the gravel inlet protection must be less than 5%.

2) Silt fence barrier

4 wooden stakes (100 mm x 50 mm x 1000 mm deep) must be driven to a depth of 500 mm, at each corner of the catch basin.

The top elevation of the stakes must be:

- A maximum of 0.5 m above the ground; and
- Graded to the silt fence barrier at a maximum of 5%.

Stakes must be secured with a top wooden frame connected between each stake.

Filter fabric must be secured around the 100 x 50 mm frame and firmly anchored to the wooden frame.

Filter fabric must be embedded into the soil at least 300 mm deep and backfilled.

3) Manufactured inlet protection

Refer to the manufacturer's information for more details on implementation.

200.3.2.4 Inspection and Maintenance

Remove accumulated sediment after each runoff event and deposit it at a location where it cannot be re-entrained or transported.

Repair or replace damaged materials as soon as function is compromised.

200.3.2.5 Removal

Inlet sediment control systems must be removed:

- When the contributing area is stabilized;
- When the first lift of pavement is installed around the catch basin;

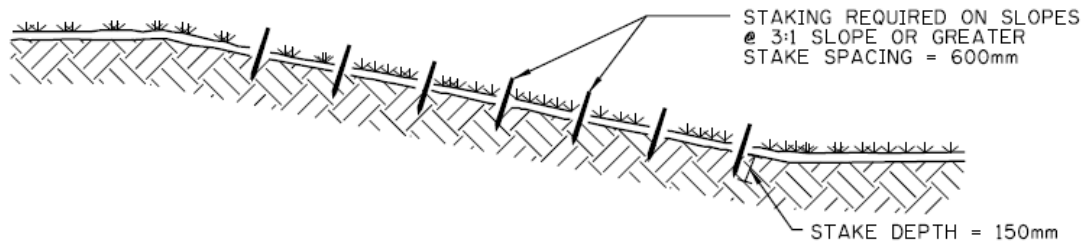
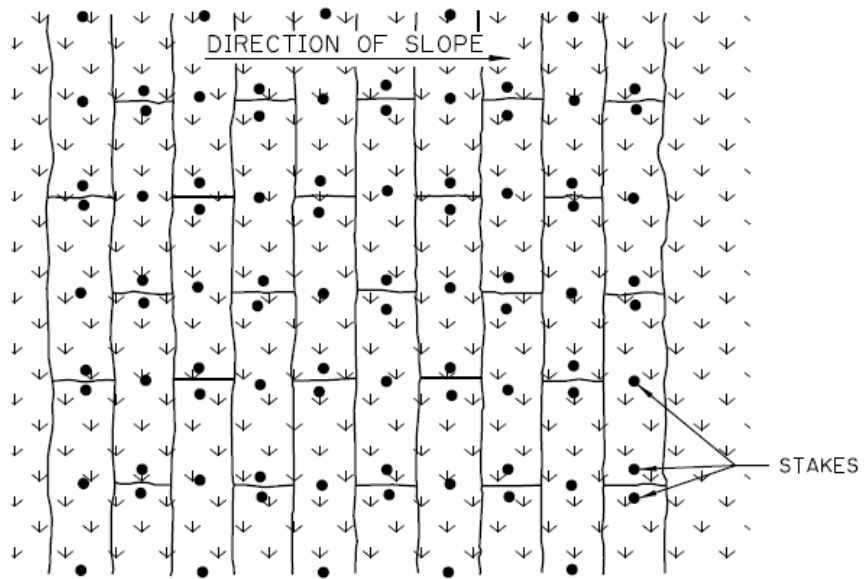
- During winter (November 15th to April 15th); and
- When they are no longer called for in the ESC Plan.

Any inlet protection that remains in place after it is no longer required as part of the approved ESC Plan must have a separate authorization under the *Drainage Bylaw (37M2005)*.

300 Standard Drawings


1	Sodding
2	Rolled Erosion Control Product: Slope Installation
3	Rolled Erosion Control Product: Channel Installation
4	Typical Sediment Containment System
5	Cross Check Structures
6	Diversion Channel
7	Diversion Berm
8	Surface Roughening
9	Contour Furrowing
10	Silt Fence
11	Silt Fence
12	Silt Fence: Slope Installation
13	Silt Fence: Perimeter Installation

14	Stabilized Gravel Access
15	Block and Gravel Inlet Sediment Barrier
16	Silt Fence Sediment Barrier




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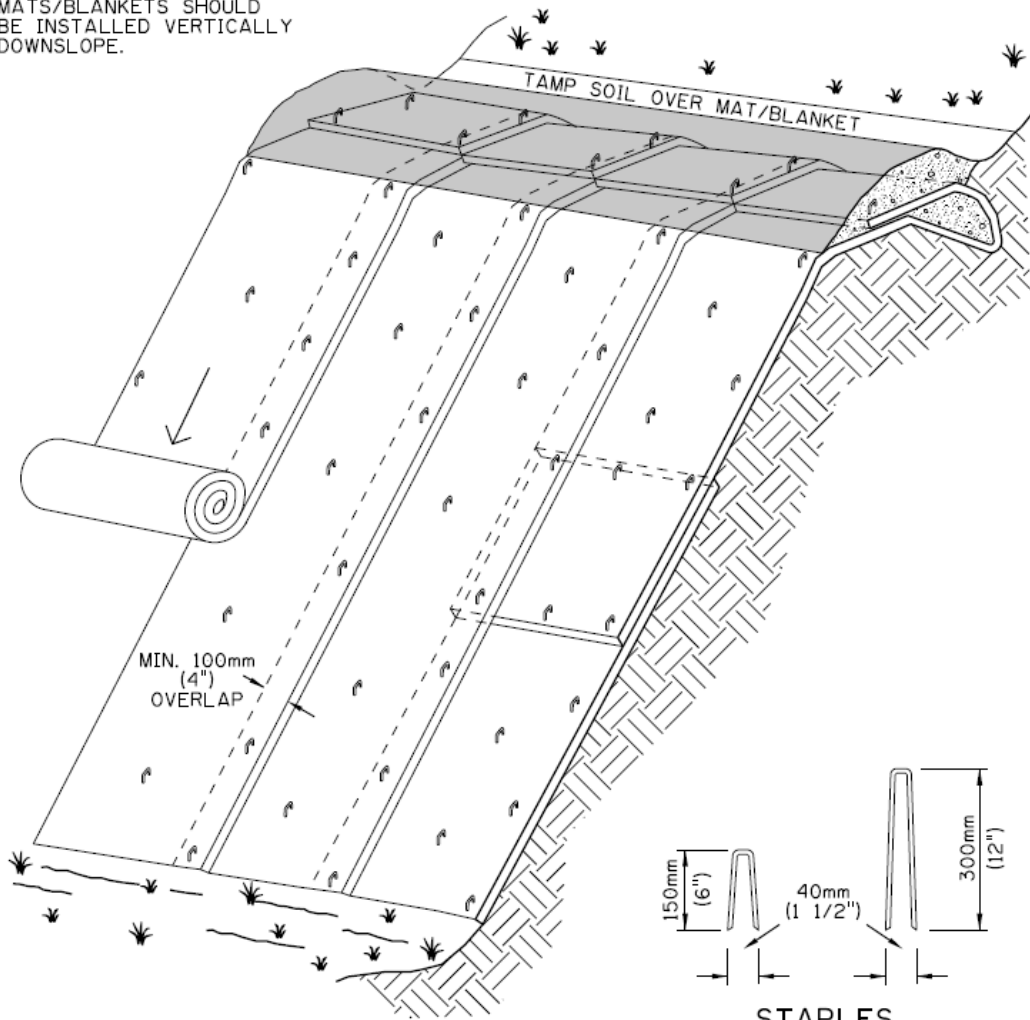
EROSION CONTROL
SODDING

Sheet	1 
File Number	

Source: Salix Applied Earthcare - Erosion Draw 5.0 - © 1994 John McCullah

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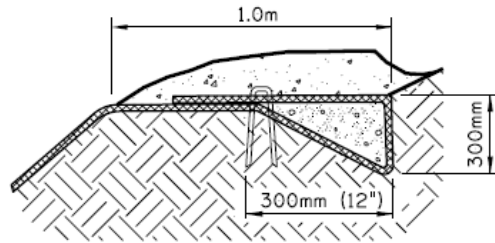
MATS/BLANKETS SHOULD BE INSTALLED VERTICALLY DOWNSLOPE.



**TYPICAL SLOPE
SOIL STABILIZATION**

NOTES:

1. SLOPE SURFACE SHALL BE FREE OF ROCKS, CLODS, STICKS AND GRASS. MATS/BLANKETS SHALL HAVE GOOD SOIL CONTACT.
2. APPLY PERMANENT SEEDING BEFORE PLACING BLANKETS.
3. LAY BLANKETS LOOSELY AND STAKE OR STAPLE TO MAINTAIN DIRECT CONTACT WITH THE SOIL. DO NOT STRETCH.
4. STAPLE PATTERN AND DIMENSIONS MUST MEET MANUFACTURER'S SPECIFICATIONS



BERM

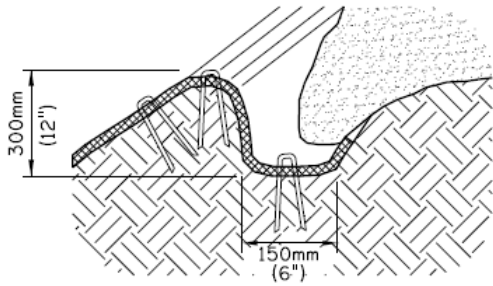
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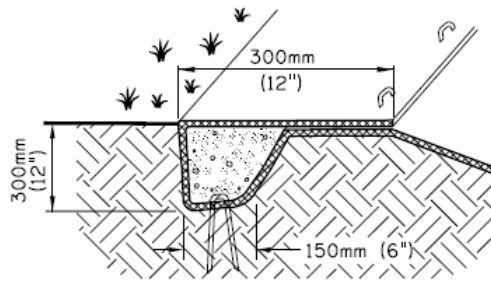
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Scale	N.T.S.
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EROSION CONTROL
ROLLED EROSION CONTROL PRODUCT SLOPE INSTALLATION

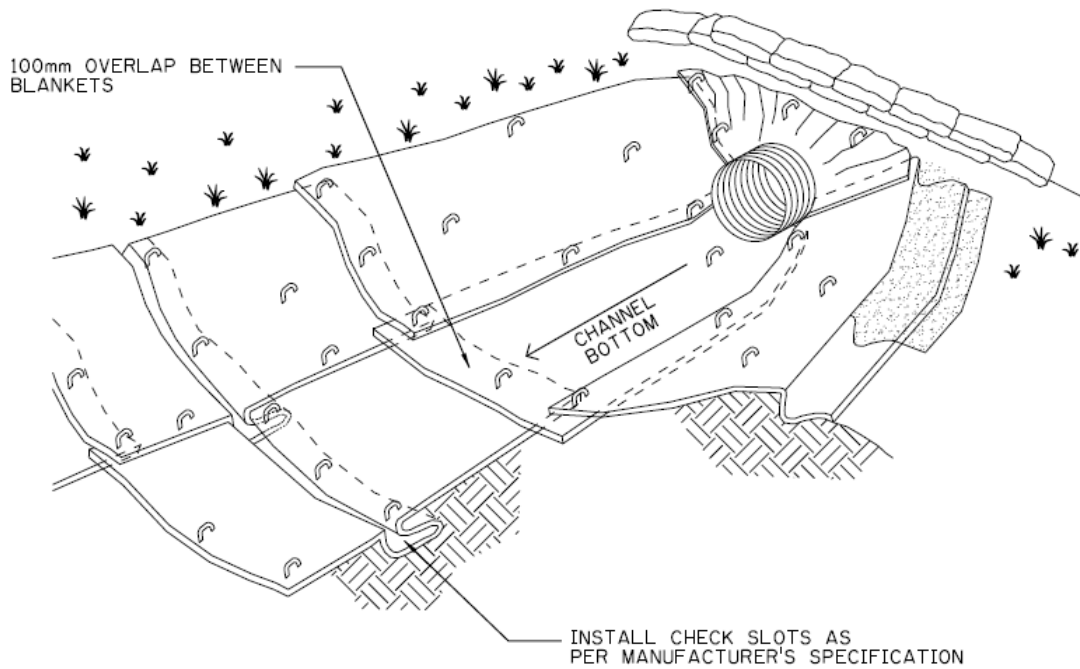
Sheet	2
File Number	



LONGITUDINAL ANCHOR TRENCH



TERMINAL SLOPE AND CHANNEL ANCHOR TRENCH



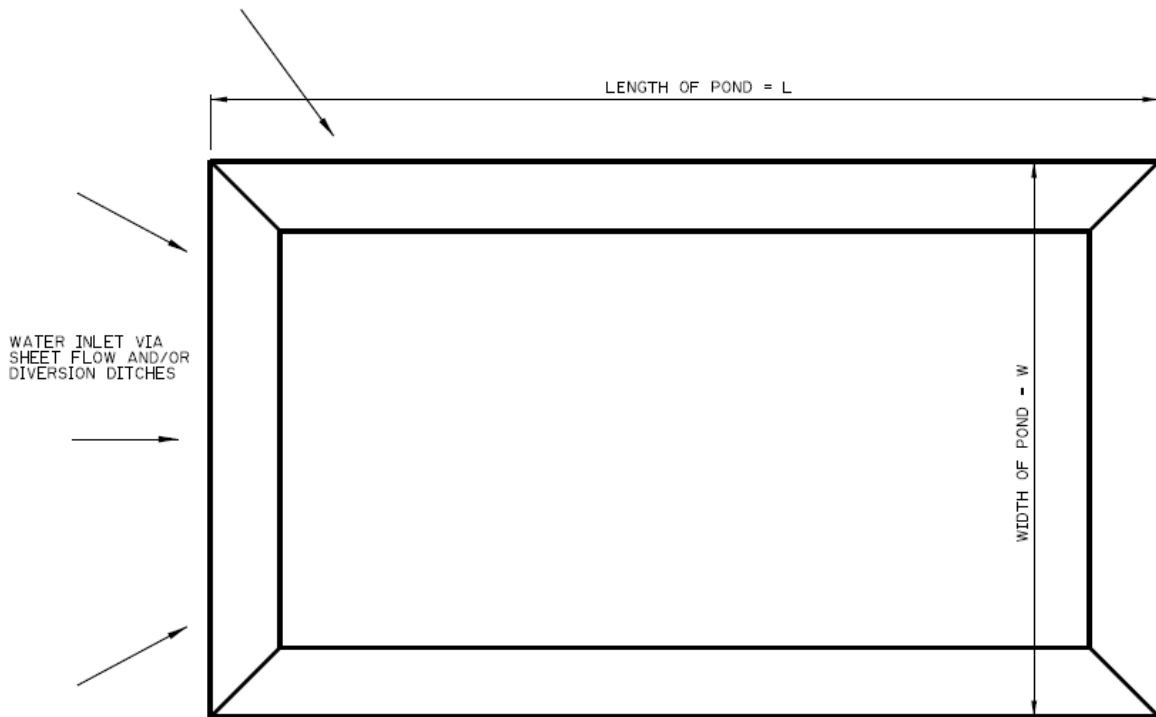
NOTE:
STAKING OR STAPLING LAYOUT MUST FOLLOW MANUFACTURER'S SPECIFICATIONS.

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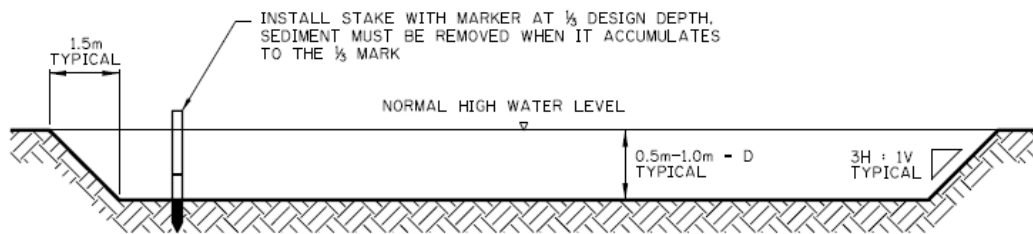
			Date 2017/11/20		EROSION CONTROL		Sheet 3
			Scale N.T.S.		ROLLED EROSION CONTROL PRODUCT CHANNEL INSTALLATION		File Number
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PLAN



SECTION

NOTES:

L x W x D MUST BE EQUAL TO VOLUME REQUIRED TO MEET SELECTED P-VALUE
 BOTTOM OF THE POND MUST BE FLAT.

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EROSION CONTROL

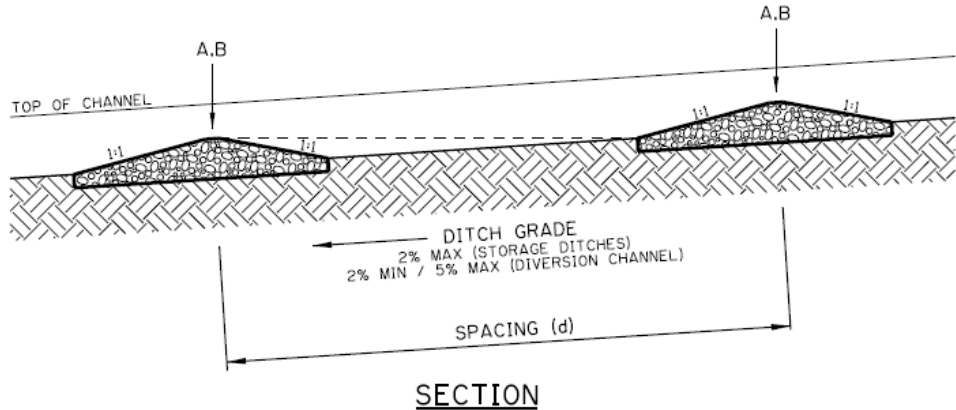
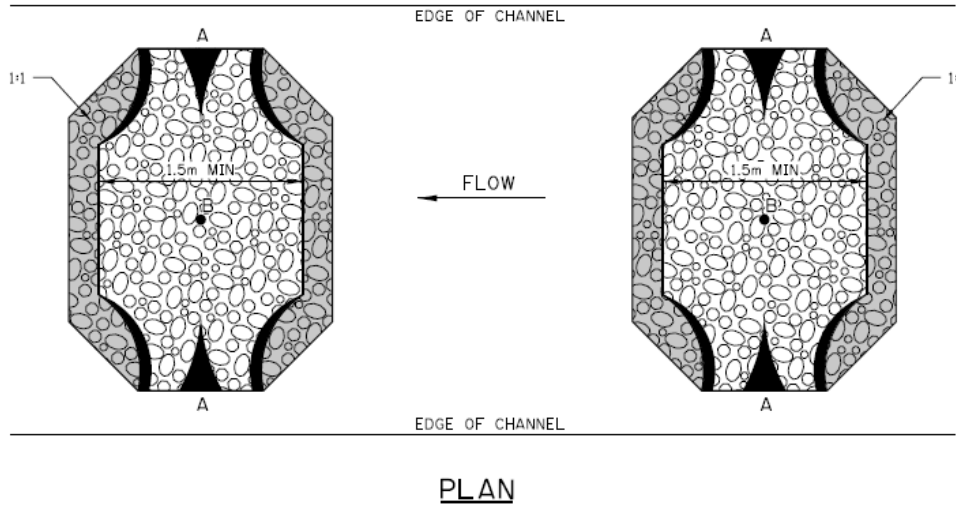
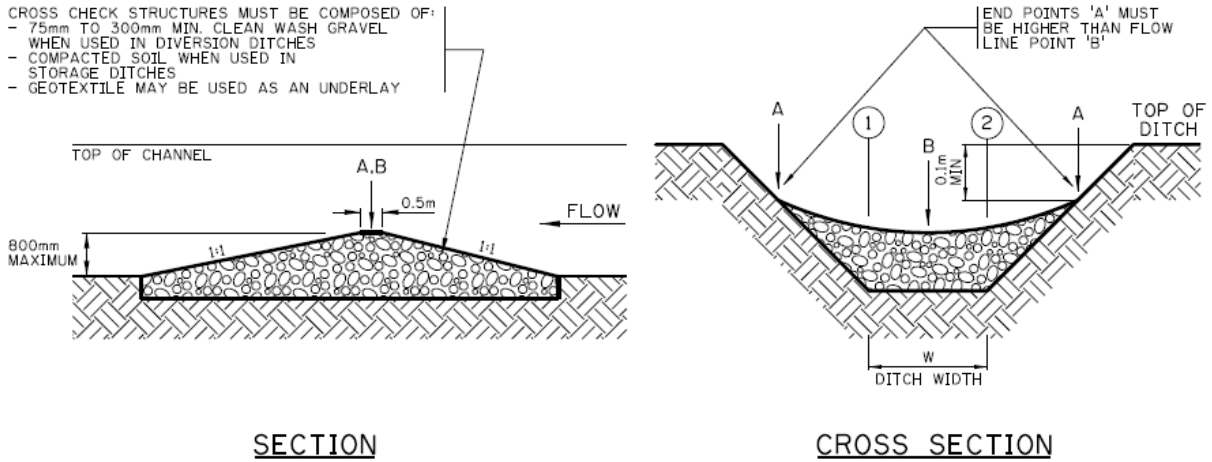
TYPICAL SEDIMENT CONTAINMENT SYSTEM

Sheet
4

File Number

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- CROSS CHECK STRUCTURES MUST BE COMPOSED OF:
- 75mm TO 300mm MIN. CLEAN WASH GRAVEL
 - WHEN USED IN DIVERSION DITCHES
 - COMPACTED SOIL WHEN USED IN STORAGE DITCHES
 - GEOTEXTILE MAY BE USED AS AN UNDERLAY



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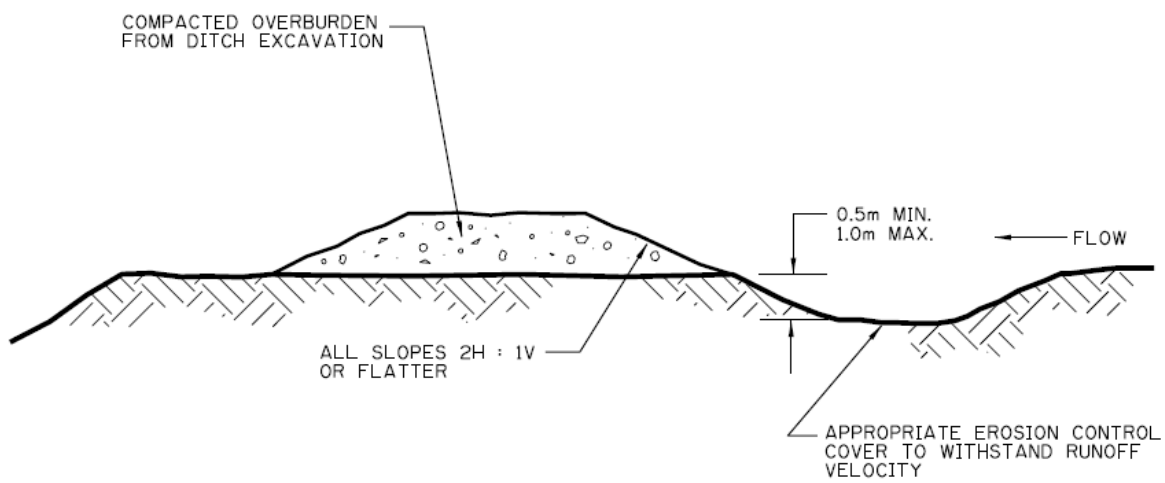
EROSION CONTROL
CROSS CHECK STRUCTURES

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Sheet	5
File Number	

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TYPICAL DIVERSION CHANNEL

NOTES:


1. THE CHANNEL BEHIND THE DIKE SHALL HAVE POSITIVE GRADE TO A STABILIZED OUTLET.
2. DITCH LINE OF DIVERSION CHANNEL MUST BE A MINIMUM OF 2% AND A MAXIMUM OF 5% GRADE.

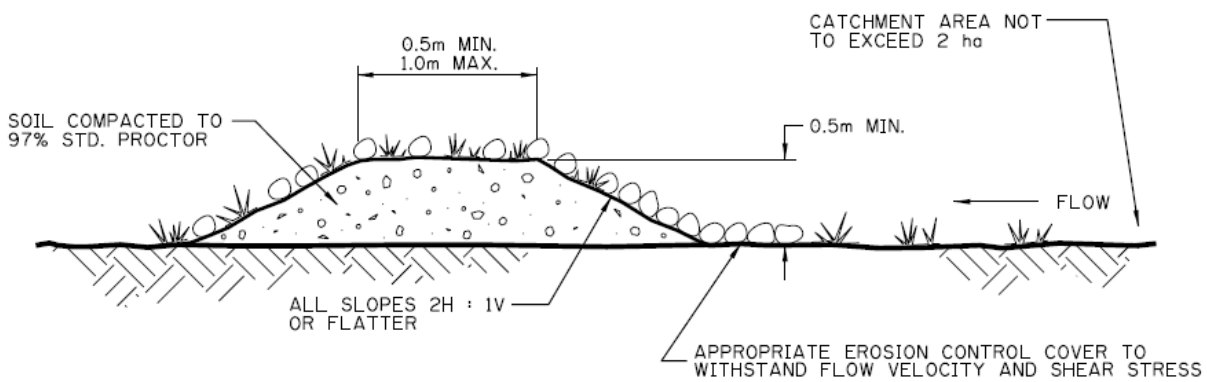
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EROSION CONTROL
DIVERSION CHANNEL

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Sheet	6 
File Number	



TYPICAL DIVERSION BERM

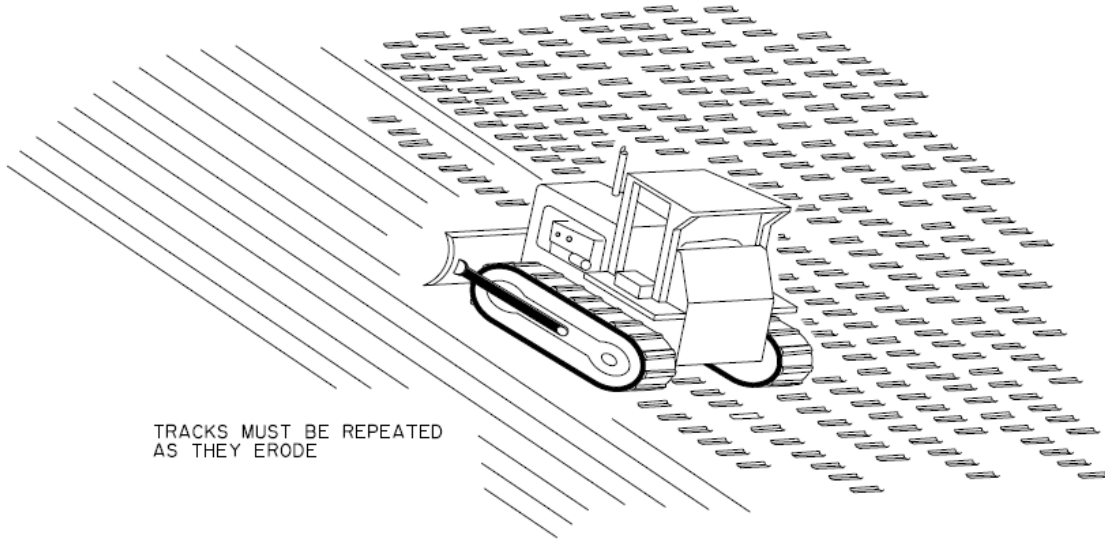
NOTES:

1. THE BERM SHALL BE STABILIZED IMMEDIATELY WITH APPROPRIATE EROSION CONTROL.

				DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE NOTED	
				Date 2017/08/29	Scale N.T.S.
				Approved by 	EROSION CONTROL
				for The City of Calgary	DIVERSION BERM
1	2017/08/29	DESIGN DETAILS MODIFIED BY COC	AP		Sheet 7
No.	Date	Revision	App'd		File Number

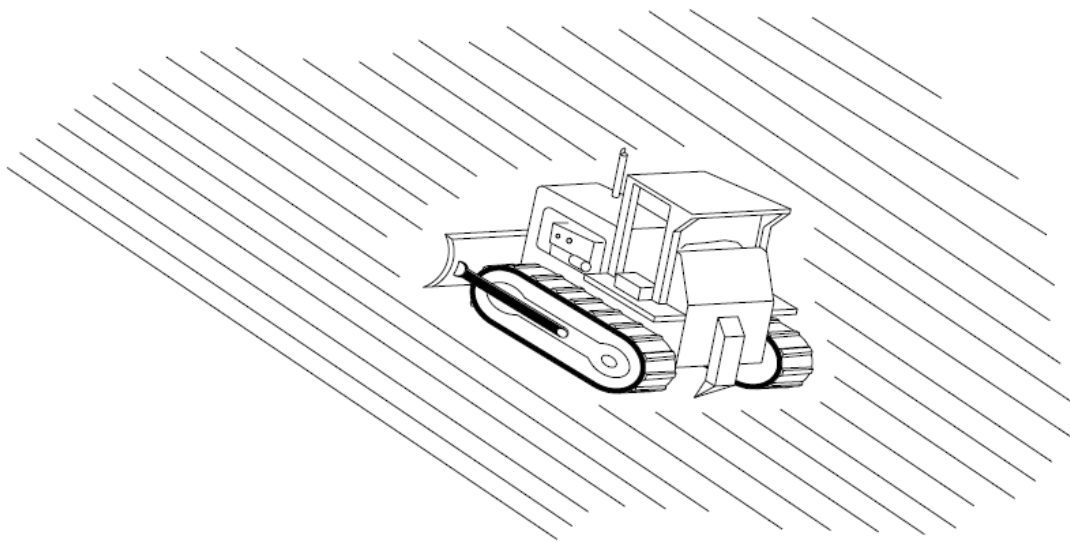
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TRACKS MUST BE REPEATED
AS THEY ERODE

SURFACE TRACKING



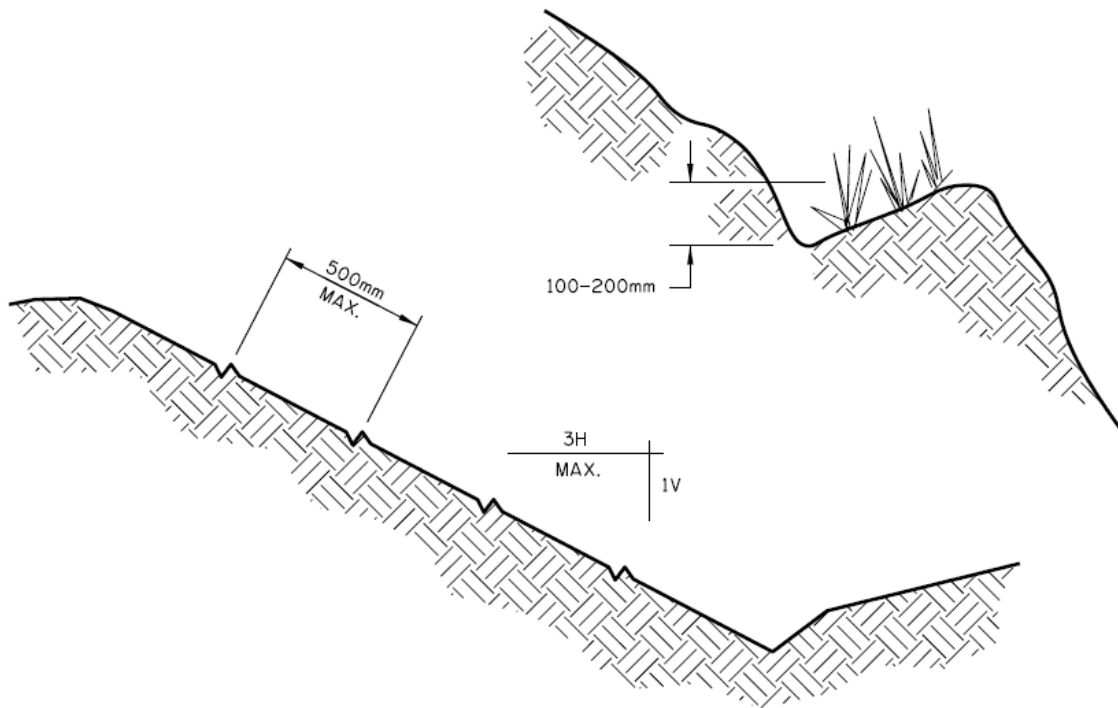
SURFACE RIPPING

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		Date 2017/11/28		EROSION CONTROL		Sheet 8 
		Scale N.T.S.		SURFACE ROUGHENING		File Number
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CONTOUR FURROWS


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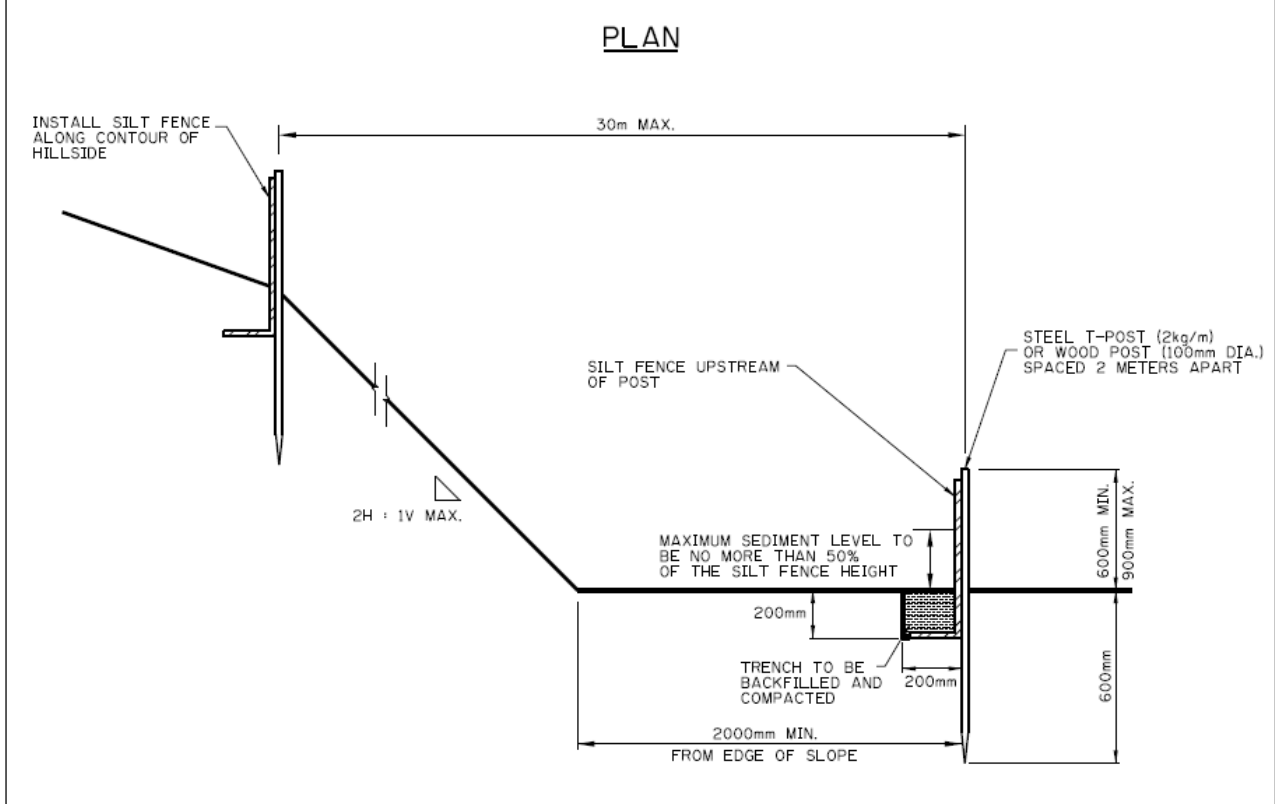
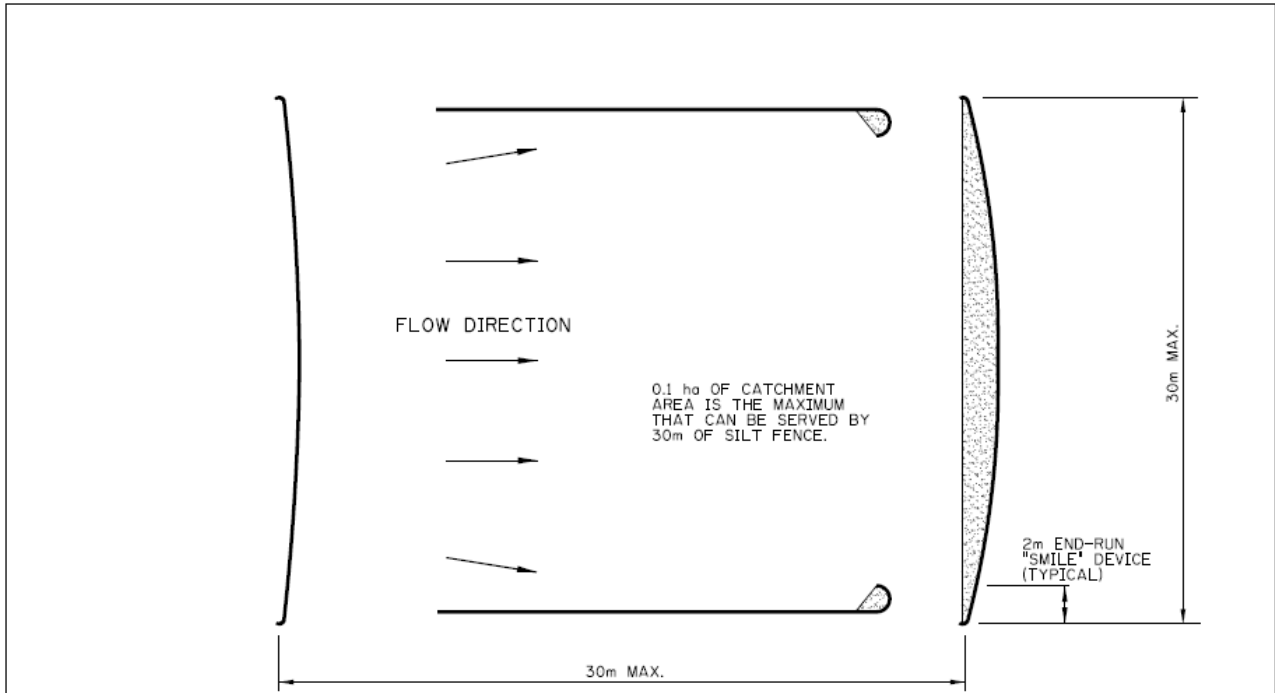
CONTOUR FURROWING

Sheet
9

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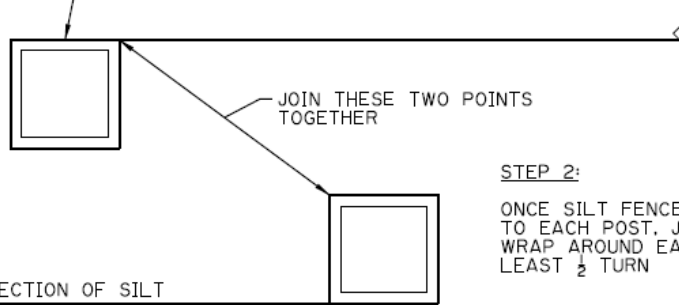
				Date 2017/08/29			EROSION CONTROL		DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE NOTED	
				Scale N.T.S.			SILT FENCE		Sheet 10	
				Approved by				File Number		ISC: Unrestricted
No.	Date	Revision	App'd	for The City of Calgary						
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STEP 1:

JOIN SILT FENCE FABRIC ON TO THE POST

SECURELY JOIN SILT FENCE AND WRAP COMPLETELY AROUND POST WITH A 0.4m OVERLAP

NEW SECTION OF SILT FENCE

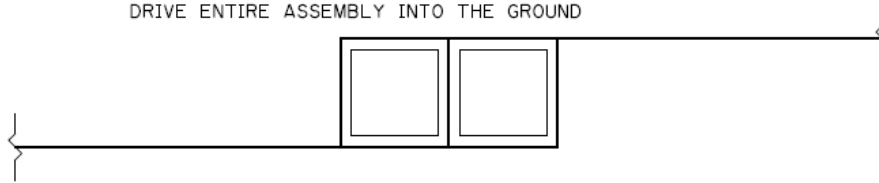


STEP 2:

ONCE SILT FENCE IS SECURED TO EACH POST, JOIN POSTS AND WRAP AROUND EACH OTHER, AT LEAST 1/2 TURN

STEP 3:

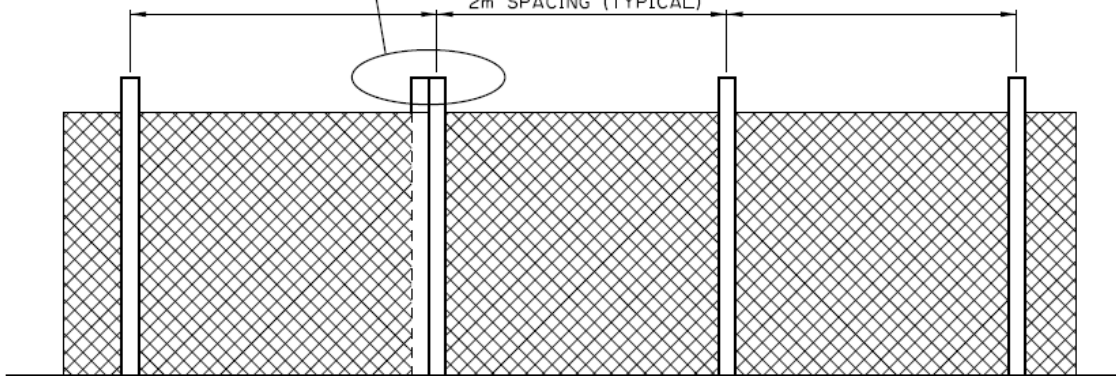
DRIVE ENTIRE ASSEMBLY INTO THE GROUND



**SILT FENCE JOINING - PLAN
DETAIL**

SEE SILT FENCE JOINING DETAIL

2m SPACING (TYPICAL)



SILT FENCE - FRONT

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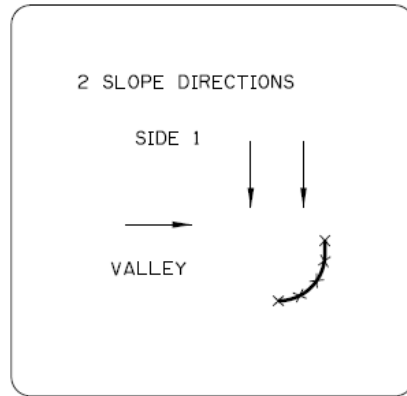
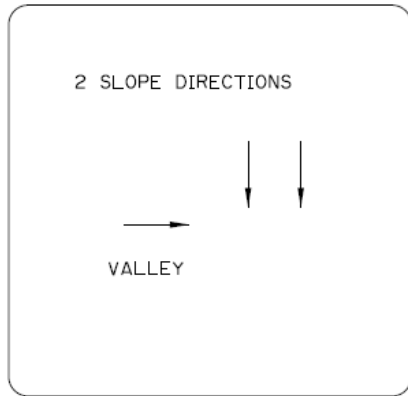
EROSION CONTROL

SILT FENCE

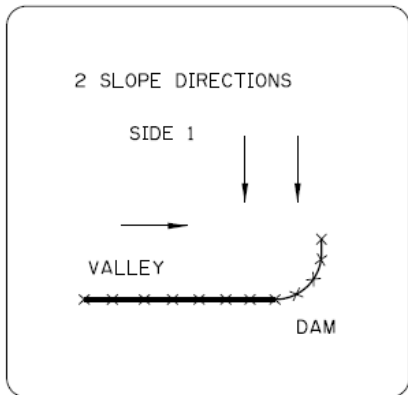
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11

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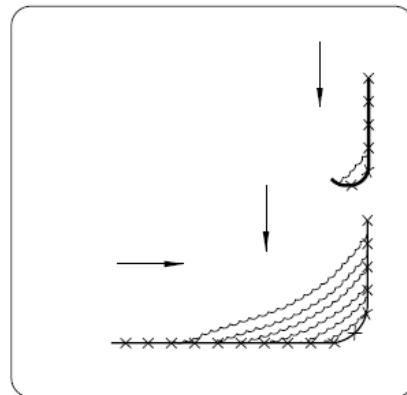
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STEP 1 - CONSTRUCT A DAM



STEP 2 - CONSTRUCT SIDE 2



**STEP 3 - CONSTRUCT J-HOOKS
AS NEEDED**

INSTALLATION WITH J-HOOKS WILL INCREASE SILT FENCE EFFICIENCY AND REDUCE EROSION-CAUSING FAILURES.

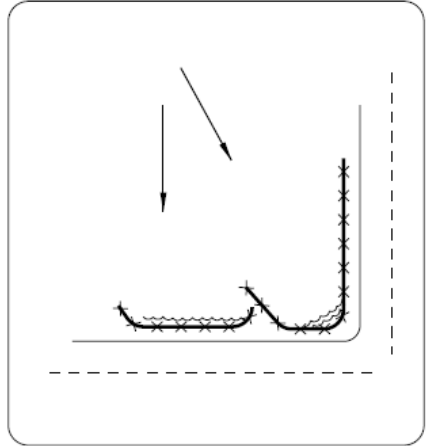
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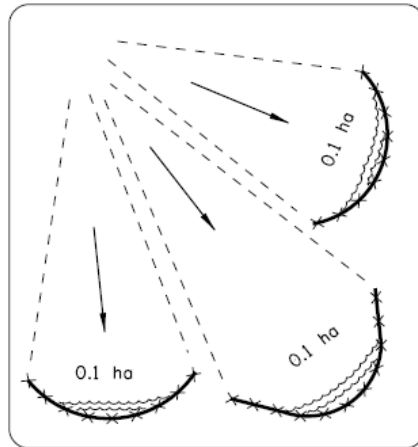
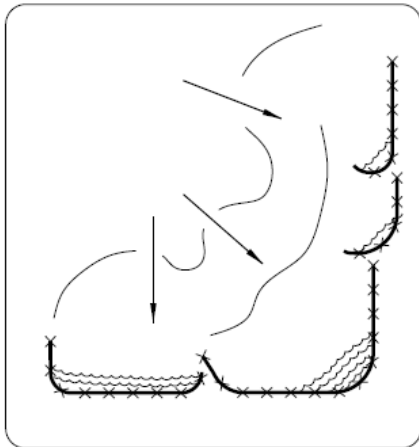
EROSION CONTROL
SILT FENCE SLOPE INSTALL

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Sheet	12
File Number	



INSTALL J-HOOKS



DISCREET SEGMENTS OF SILT FENCE, INSTALLED WITH J-HOOKS OR 'SMILES' WILL BE MUCH MORE EFFECTIVE.

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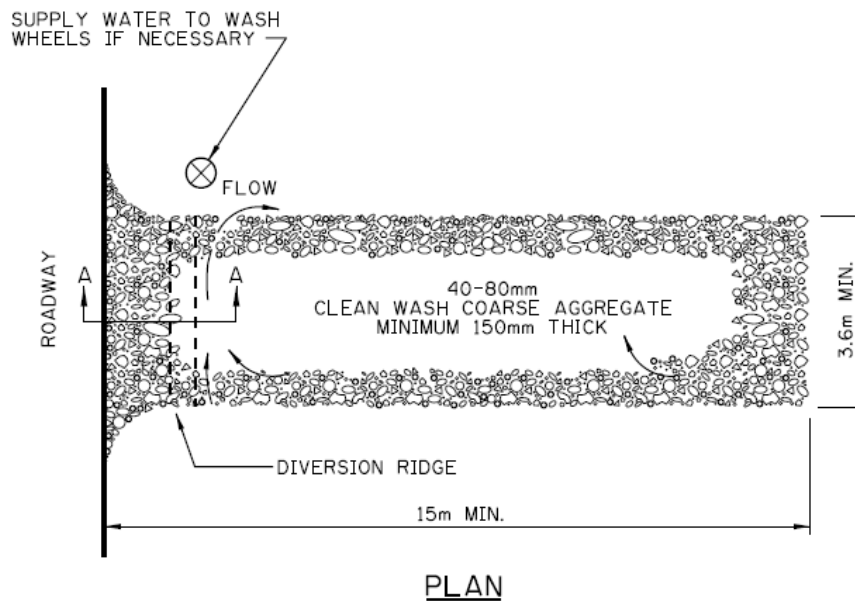
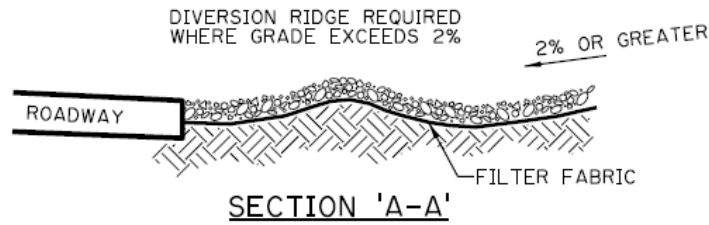
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EROSION CONTROL
SILT FENCE PERIMETER INSTALL

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Sheet	13
File Number	

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NOTES:

1. THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION THAT WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHT-OF-WAYS. THIS MAY REQUIRE TOP DRESSING, REPAIR AND/OR CLEAN OUT OF ANY MEASURES USED TO TRAP SEDIMENT.
2. WHEN NECESSARY, WHEELS SHALL BE CLEANED PRIOR TO ENTRANCE ONTO PUBLIC RIGHT-OF-WAY.
3. WHEN WASHING IS REQUIRED, IT SHALL BE DONE ON STABILIZED AREA THAT DRAINS INTO AN APPROVED SEDIMENT CONTAINMENT SYSTEM.


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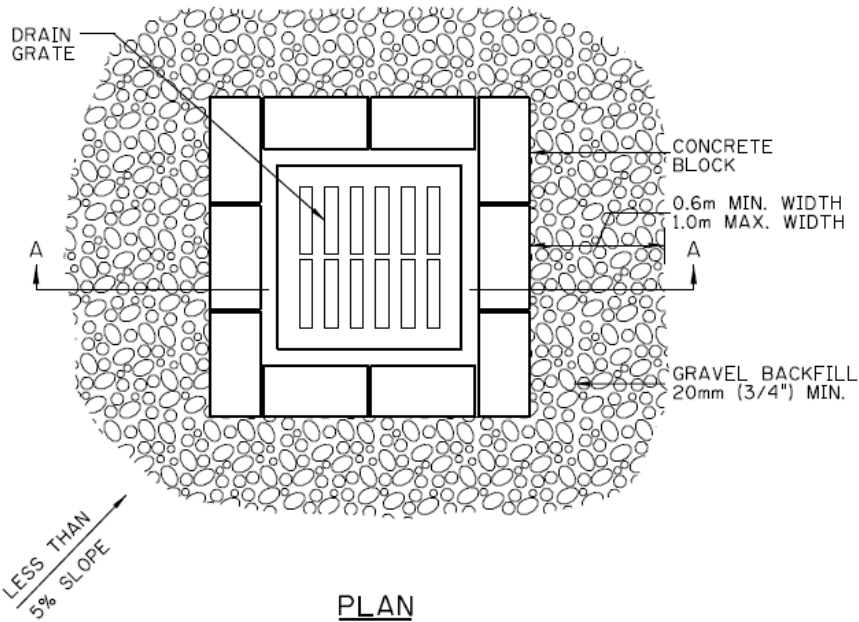
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EROSION CONTROL

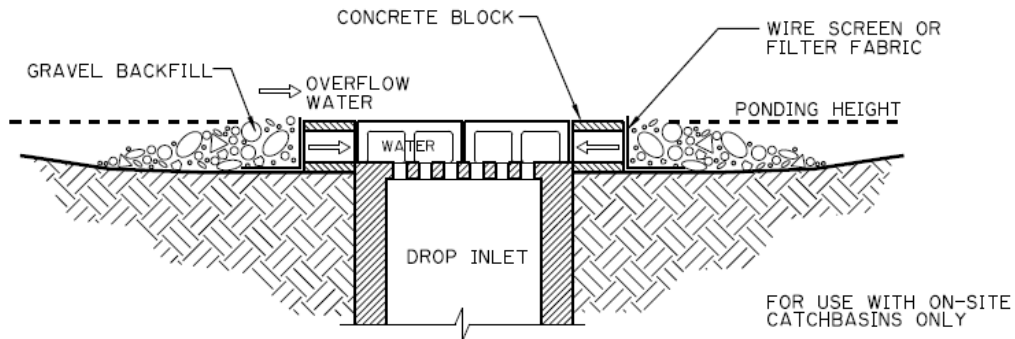
**STABILIZED
GRAVEL ACCESS**

Sheet
14

File Number



PLAN



SECTION 'A-A'

NOTES:

1. ONLY SUITABLE ON CONSTRUCTION SITES (NOT PUBLIC ROADS) PRIOR TO FINAL GRADING AND PAVING
2. DROP INLET SEDIMENT BARRIERS ARE TO BE USED FOR SMALL, NEARLY LEVEL DRAINAGE AREAS. (LESS THAN 5%)
3. EXCAVATE A BASIN OF SUFFICIENT SIZE ADJACENT TO THE DROP INLET.
4. THE TOP OF THE STRUCTURE (PONDING HEIGHT) MUST BE WELL BELOW THE GROUND ELEVATION DOWNSLOPE TO PREVENT RUNOFF FROM BYPASSING THE INLET. A TEMPORARY DIKE MAY BE NECESSARY ON THE DOWNSLOPE SIDE OF THE STRUCTURE.

DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE NOTED

No.	Date	Revision	App'd
1	2017/08/29	DESIGN DETAILS MODIFIED BY COC	AP

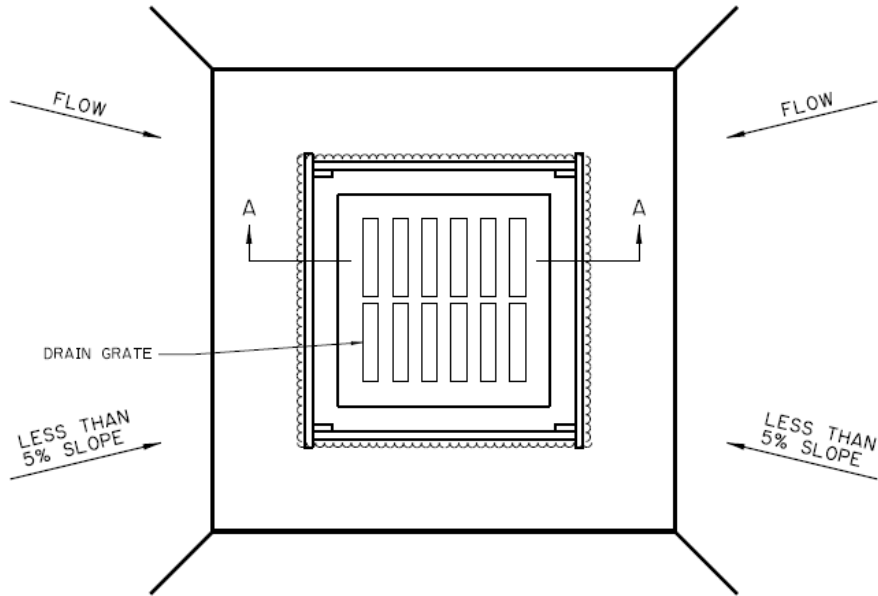
Date	2017/08/29
Scale	N.T.S
Approved by	
for The City of Calgary	

EROSION CONTROL
BLOCK AND GRAVEL INLET SEDIMENT BARRIER

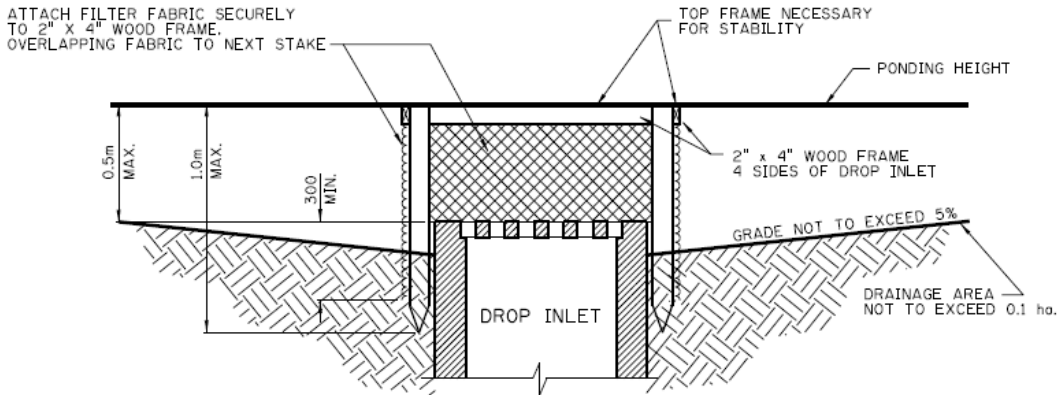
Sheet	15
File Number	

Source: Salix Applied Earthcare - Erosion Draw 5.0 - © 1994 John McCulloch

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PLAN



SECTION 'A-A'

NOTE:

FOR USE WITH ON-SITE CATCHBASINS ONLY

No.	Date	Revision	App'd
1	2017/08/29	DESIGN DETAILS MODIFIED BY COC	AP

Date	2017/08/29
Scale	N.T.S.
Approved by	
	for The City of Calgary

EROSION CONTROL
SILT FENCE SEDIMENT BARRIER

DIMENSIONS ARE IN MILLIMETRES
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File Number	

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