

City of Coquitlam Erosion and Sediment Control Best Management Practices



New best practices for real-time monitoring of water discharge.

This guide is supplementary to the Stream and Drainage System Protection Bylaw No. 4403, 2013 (hereafter referred to as “the Bylaw”).

This guide is provided to summarize industry standard Best Management Practices (BMPs) that may be expected to be implemented in support of development activities. Suitable erosion and sediment control (ESC) BMPs for a given development project will be dictated based on the scope of development activities and site conditions.

The list of applicable BMPs or measures is not to be considered exhaustive, but a summary of potentially applicable practices to support the water quality objectives as defined by the Bylaw. It is anticipated that the list of BMPs applicable to development activities within the City of Coquitlam will be expanded over time.

Impact of Sediment on Fish and Fish Habitat

Sediment suspended in water settles on the bottom of our creeks and can smother fish eggs. Suspended sediment can also suffocate fish, reduce visibility and affect the productivity of plants and bugs in the creek reducing the amount of food available to aquatic life overall. All surface drainage that enters into the municipal storm system, including all storm drains, catch basins and ditches lead directly into local streams and fish-bearing waterways.

Development Under a Single Family/Duplex Building Permit versus All Other Developments

The full suite of ESC BMPs as described herein may not be applicable to single family or duplex residential development as defined under Section 4.1 of the Bylaw. However, the responsibility to implement proactive measures to mitigate the risk of erosion or sediment transfers and to maintain compliance with the Bylaw is the responsibility of the Developer.

Developments Other than a Single Family/Duplex Building Permit

Development projects other than Single Family/Duplex require the submission of a formal ESC Plan in accordance with Section 4 of the Bylaw and will require formal drawings and plan submissions to the City of Coquitlam. These plans shall define the applicable ESC Facilities, measures, or work procedures which will be implemented to provide both proactive and reactive measures to mitigate the risks and severity of ESC concerns.

The BMPs outlined herein are intended to provide a basis for the selection of measures to be illustrated by the ESC Facilities designer in support of the development of the ESC Plans for a given development project.

It is the responsibility of the ESC Plan designer to prescribe the locations, specifications, and maintenance requirements for all ESC BMPs prescribed in the ESC Plans submitted for review by the City of Coquitlam.

Mandatory and Additional ESC BMPs

Mandatory ESC BMPs are the minimum standard for **ALL** developments (including Single Family/Duplex residential development) to demonstrate due diligence under the Bylaw.

Additional BMPs must be considered for inclusion in the ESC Plan for developments other than Single Family/Duplex. The following table provides a summary of mandatory and additional BMPs.

Table 1. ESC BMPs

Mandatory BMPs	Additional BMPs
1. Gutter down-spout connection. See section 1, "Clean Water Management".	8. Project Planning/Phasing. e.g., vegetation retention, project phasing, scheduling, wet weather operating procedures. See section 8.
2. Formal access pad/parking restriction. See section 2, "Access/Egress Controls".	9. Temporary Sediment Control Detention Facilities. e.g., sediment control pond, portable tanks, active filtration systems, temporary sediment traps, Single Family/Duplex sediment traps. See section 9.
3. Formal perimeter control. BMPs installed along the downslope perimeters, i.e., site boundaries with the potential to generate surface runoff which may cross property boundaries and/or enter existing drainage infrastructure. See section 3, "Perimeter Control Measures".	10. Sediment Barriers. e.g., silt fencing, straw wattles, wood mulch berms, rock mulch berms, straw bale barriers. See section 10.
4. Temporary drainage swale and sump. See section 4, "Onsite Water Management".	11. Incidental Water Management. e.g., infiltration to vegetated surfaces or contained areas, dewatering bag. See section 11.
5. Storm sewer inlet protection. e.g., catch basin or lawn basin inlets. See section 5, "Storm Inlet Protection".	12. Polymer/Flocculent Additives. e.g., passive/active flow-through treatments, batch treatment. See section 12.
6. Disturbed surfaces/stockpile protection. See section 6, "Disturbed Surfaces Protection (Erosion Control)".	13. pH Mitigation. e.g., compressed CO2 gas diffusion. See section 13.
7. Road Surface Sweeping. See section 7, "Paved Road Surfaces Sweeping/Maintenance".	A detailed summary of ESC BMPs including objectives and general specifications is provided.

1. Clean Water Management

Objective: To intercept surface runoff from adjacent undisturbed sites or impervious surfaces to mitigate the risk of saturation of onsite materials and substantially reduce the risk of initiation of channelized erosion due to flowing water during periods of heavy rainfall or high pre-existing soil moisture conditions.

Measures:

1. **Clean Water Interceptor Ditch** – Interceptor ditches should be constructed so that they intercept both surface runoff and shallow subsurface flows (i.e., interflows). Clean water may be diverted around the site to existing storm infrastructure or the receiving environment via temporary surface mounted pipes so that flow contributions do not tax the onsite stormwater management/detention facilities (note: temporary connections to natural streams or existing stormwater infrastructure will require the review and approval by City of Coquitlam drainage department).



Interceptor ditches or swales must include design elements to minimize flow velocity or measures to mitigate channel invert and bank scour potential (see discussion re: Interceptor Ditches/Swales in section 4).

2. **Clean Water Interceptor Berm** – A compacted earthen berm may be constructed to intercept and divert surface runoff around or away from an active development area. The berm must be constructed to a height to preclude overtopping, and exposed materials must be suitably compacted and protected to mitigate scour resulting from channelized flows along the berm.
3. **Temporary Downspout/Gutter Connection** – Applicable to the building construction stage, rooftop runoff may pose a significant risk of erosion and surface runoff generation during rain events. Gutter systems and either permanent or temporary down-spouts should be constructed as soon as possible to divert rooftop runoff from erodible materials within the immediate project area.

2. Access/Egress Controls

Objective: To define formal vehicle use restrictions and defined access/egress points to mitigate the risk of tracking sediment from equipment or truck use offsite and impacting offsite road

surfaces and posing a risk of sediment introduction to offsite stormwater infrastructure.

Measures:

1. **Wheel Wash Facilities** – Mechanical or passive wheel wash systems may be employed to clean trucks and equipment tires of accumulated sediment prior to exiting the development boundaries. Wheel wash facilities require consideration of maintenance and dewatering requirements to remove accumulated sediments and to ensure that the ESC mitigation objectives are being met. Typically wheel wash facilities should ensure that wheels in contact with the wash facility should achieve at least four full rotations.
2. **Rock Mulch Access/Egress Pads** – A formal access/egress point shall define all trucking/hauling routes to mitigate sediment tracking. The rock mulch access pad shall consist of a minimum 3” clear fractured rock, installed at a minimum thickness of 200mm, and placed on a layer of non-woven geofabric. The geofabric mitigates the potential for the entrainment of fines from native materials below the access pad, and mitigates the potential for the access pad materials to compact into the underlying substrate.



Rock mulch pads require frequent inspection and repair/replacement to maintain their function and preclude offsite tracking.

3. **Mud Mats** – Proprietary products exist which utilize geotextile fabric supported by flexible supports or ribs which may be rolled out onto erodible surfaces to define a temporary access/egress location and mitigate potential tracking concerns.
4. **Parking/Access Pad** – For smaller projects such as Single Family/Duplex building permitted sites, formal site access restrictions should be implemented to mitigate tracking and disturbance of onsite materials. A formal parking pad with a minimum length of 6m or extension to the garage is recommended. 3” (~75mm) clear fractured rock installed at a minimum depth of 200mm is recommended. The rock access/parking pad must be installed before onsite construction activities begin. The access pad shall not be utilized for the temporary storage of construction materials to preclude contamination and tracking concerns.

3. Perimeter Control Measures

Objective: To define formal site perimeter protection along downslope boundaries which may be subject to erosion and sediment transfers beyond the site margins and pose a risk of sediment introduction affecting the drainage system or natural areas.

Perimeter control BMPs are considered sediment control measures insofar as providing formal measures to detain site runoff and facilitate the deposition and retention of suspended materials while allowing for the slow release/filtration of runoff waters.

Where perimeter control measures will result in a defined boundary condition which may result in the interception and diversion of surface runoff along the perimeter control measures, the modification of the perimeter control to define segments extending parallel to slope contours to arrest diverted/channelized runoff along the base of the perimeter control must be implemented. These periodic contour extensions are often referred to as “J-hooks”. The use of “J-hooks” is considered applicable to each of the perimeter control BMPs summarized below.

Measures:

- 1. Standard Silt Fencing** – Silt fencing is a pre-fabricated geotextile fabric with supporting stakes installed to intercept and detain transported sediment via the impoundment of flowing water behind the fence fabric, creating a depositional environment. Silt fencing is not a filtration device and should never be installed in situations where concentrated or channelized flows will develop.



Critical to the function of silt fencing is the proper installation and “key in” of the lower flap of the geotextile fabric. The fabric flap must be oriented upslope and keyed in, backfilled, and compacted as per manufacturer’s specifications to preclude potential bypass or undermining during runoff events.

Silt fencing must be staked at a spacing per the manufacturer’s specifications which shall not exceed 2m. Silt fencing interfaces must be installed per the manufacturer’s specifications which typically require overlapping and rotation in a direction clockwise relative to the direction of surface runoff to provide an impermeable seam.



Silt fencing should not be installed on steep slopes (e.g. $\geq 2H:1V$), rather fencing should be installed approximately 1m below or beyond the toe of slope inflection to provide appropriate sediment retention capacity. Sediment accumulations exceeding 1/3 of the fabric height must be removed.

- 2. Wire Backed Silt Fencing** – Similar to standard silt fencing, wire backed silt fencing includes a geotextile fabric and support stakes; however, the geotextile is further supported by a wire mesh to provide additional support and integrity for locations anticipated to receive significant sediment loads between maintenance events.
- 3. Wood Mulch Berm** – On sites with limited topographic relief, wood grindings generated during site clearing activities may provide a beneficial erosion control product, subject to their use in areas without prolonged exposure to standing water or seepage zones. The use of wood mulch may include the construction of temporary berms along site perimeters to detain site runoff and promote settling of suspended sediments. Wood mulch berms should be a minimum of 1m wide at the base and 300-500mm in height, depending on site conditions/grades.
- 4. Fiber Log Barriers** – Sediment logs may include manufactured straw wattles (e.g. Stenlogs), composted wood mulch berms (e.g. Filtrex logs), or wood fiber logs (e.g. Curlex sediment logs). Sediment logs require installation as per manufacturer’s specifications which typically include specifications for ground preparation and installation below grade, overlapping at wattle/log interfaces, and staking at defined intervals to ensure “intimate contact” with substrate to preclude surface runoff breaching or bypassing the BMP. Typically, fiber log barriers are most suitable for perimeter control measures on small lots or low gradient surfaces.

4. Onsite Water Management

Objective: To define formal onsite water management measures to collect and convey site runoff to detention facilities in a manner that mitigates the risk of potential channel erosion or sediment entrainment within the drainage features, and to provide adaptive water management measures to mitigate the risk of channelized erosion onsite.

Appropriate onsite water management can provide sediment control benefits in addition to providing for the safe conveyance of site runoff in stable, non-erosive channels. The use of appropriately spaced and sized check-dams should provide a step-pool profile channel with low energy backwater pools which can evolve into depositional environments to achieve sediment control objectives in addition to mitigating erosion concerns.

Measures:

1. Interceptor Ditch/Swales – Interceptor ditches or swales should be constructed with slopes constructed at a maximum grade of 2H:1V and stabilized with the use of temporary disturbed surface protection BMPs (see section 6) to mitigate rill erosion of the ditch banks themselves. Ditch or swale slopes are considered slopes which require consideration of erosive processes, particularly when constructed across slopes where surface runoff may initiate retrogressive erosion at the slope inflection and yield rills or gullies.

Ditch inverts should be constructed with a flat bottom and include rock mulch check dams installed at spacing dictated by the gradient of the channel. Check dams shall be installed such that the top of the downstream check dam is equivalent to the base of the next upstream check dam to create a stepped channel profile with 0% gradient between the check dams to reduce flow velocities and mitigate channelized scour.

Where ditch gradients exceed 5%, the invert of the ditch and lower 1/3 of the banks should be armoured with clear fractured rock mulch sized to the dimensions and flow capacity of the temporary ditch.

2. Slope Drains – The management of surface runoff frequently requires the collection of ponded water or drainage from interim ditches/swales across a slope segment in a manner that will preclude significant channelization. Temporary slope drains may include the construction of a polyethylene-lined flume, a rock-armoured channel, or the temporary installation of a flexible “Big-O” pipe to convey flows down a slope. Flows should be captured at least 1m back from the slope inflection point and carried over the slope break in a manner that precludes the initiation of retrogressive scour. The base of the slope drains must be constructed/stabilized to mitigate scour from potentially high energy flows at the point of confluence with downstream drainage facilities.



3. Adaptive Water Management – The use of adaptive water management measures is critical on hillslope developments typical of the City of Coquitlam and in response to excavation activities yielding cut-slopes. Temporary interceptor ditches along the base of cut-slopes require management of intercepted surface runoff and interflow contributions to divert flowing water from active construction areas. Adaptive water management measures may include the construction of temporary sumps and hard piping, or construction of temporary drainage ditches or swales as discussed above. Opportunities for the construction of infiltration trenches to manage minor seepages and convey drainage via permeable media (e.g. coarse sand or rock) may also provide suitable adaptive water management.

Adaptive water management also encompasses measures aimed at intercepting and diverting surface runoff around temporary stockpiles or construction materials which may be placed on paved surfaces. The establishment of temporary sandbag berms located on the upslope margin of stockpiled materials is an effective measure to divert surface runoff around the base of potentially erodible materials to preclude entrainment and transport to stormwater inlet structures.

5. Storm Inlet Protection

Objective: Structural BMPs installed to define a barrier at existing stormwater inlet structures. Barriers are provided to induce a local backwater effect to promote settling of coarse sediments prior to introduction to storm sewer inlets. Inlet protection measures require frequent inspection and maintenance to maintain capacity.

Measures:

1. **Filter Sock Inserts** – Filter sock inserts refer to pre-fabricated geotextile fabric bags which are inserted into catch basin or lawn basin inlets to capture and filter coarse sediments to facilitate regular maintenance removal of captured materials following individual storm events.



2. **Sediment Barrier Berms/Check Dams** – Berms or check dams in the context of inlet protection refer to the installation of temporary barriers installed in conjunction with filter sock inserts to augment the intended function of the inlet protection measures. Berms may consist of rock mulch, fiber rolls, or straw wattles installed along the rear openings of storm inlets to preclude the bypass of sediment laden runoff past filter sock inserts.

Check dams refer to the implementation of a rock mulch filled geotextile tube or equivalent at a sufficient distance upstream from a storm drain inlet to promote a localized backwater effect such that suspended sediments are deposited prior to the catch basin or lawn basin inlet to limit the accumulation of sediments requiring clean-out within the inlet structure directly.

Check dams must not be located immediately upstream of the storm sewer inlets to prevent deflection of runoff under high flow events past the storm inlets, which may pose a significant downstream flooding risk. Check dams should be set at a sufficient distance upslope that flows bypassing the outer edge of the check dam will return to the roadside gutter and enter the storm inlet as per design. To mitigate downstream flooding concerns, additional rock check dams may be installed immediately below catch basin or lawn basin inlets to ensure that flows are directed into the formal drainage inlets.

6. Disturbed Surfaces Protection (Erosion Control)

Objective: To provide temporary or permanent cover to disturbed or erodible surfaces, both during and upon completion of a development project, to mitigate the risk of erosion by water (e.g. rainsplash and runoff) and the generation of sediment.

The treatment of disturbed surfaces reduces the potential for erosion by affecting the cover factor (C) in the revised universal soil loss equation (RUSLE). When implemented in conjunction with appropriate site water management, implementation of erosion control measures are extremely effective at limiting erosion potential and concomitant water quality concerns.

Measures:

1. **Temporary Stockpile Protection** – All temporary stockpiled materials should be covered with 6mm polyethylene tarps in advance of any forecasted rain events exceeding 25mm in 24 hours. Over and above stockpile protection in advance of significant rain events, any stockpile which will remain in place for a period greater than or equal to two weeks should be covered as a preventative measure.



The placement of polyethylene tarps must be completed such that the overlapping margins of the tarps is folded and secured to prevent disturbance by wind. An effective measure to secure tarps is the anchoring of overlapping seams with a length of plastic snow fencing anchored with landscape staples installed at 0.5m centers along the plastic seam.

Polyethylene tarps must extend to the base of the stockpiled materials and extend a minimum of 0.5m beyond the toe to mitigate scour from runoff generated during significant rain events.

Due to the potentially significant runoff generated from large polyethylene covered stockpiles, it is strongly recommended that the downslope perimeter of stockpiles receive the installation of wire-backed silt fencing installed at a minimum 1m offset from the toe of the stockpile.

2. **Temporary Slope Protection** – Temporary cut slopes greater than 2H:1V should be treated with either 6mm polyethylene tarps or rolled erosion control products (RECPs). Typically, polyethylene will be employed for temporary slope protection while RECPs would be applied to the finished grade of a cut-slope.

3. **Straw Mulch** – Lower gradient disturbed surfaces should be stabilized via the application of hand spread or mechanically blown straw mulch, applied at a minimum rate of 3.36 tonnes per hectare to achieve a 93% soil loss reduction.



It is strongly recommended that any slopes or disturbed surfaces which will remain inactive for a period of two months or greater receive seeding during the growing season to further mitigate the risk of erosion.

4. **Rolled Erosion Control Products** – RECPs are considered temporary surface protection and are intended for application to surfaces to mitigate rainsplash and rill-erosion generation. RECPs are considered temporary in that they typically consist of biodegradable straw or coir materials, and are intended for use in conjunction with ground cover seeding to establish vegetative cover. RECPs may be utilized as temporary slope protection without seeding in some instances; however, this approach is usually cost-prohibitive.

RECPs must be installed as per manufacturer's specifications which typically require that the upper portion of the RECP extends beyond the slope inflection point and is properly keyed into a shallow trench to preclude surface runoff from flowing overland underneath the product. Similarly, the overlapping seams of RECPs must be overlapped and stapled as per manufacturer's specifications.



RECPs must be installed to achieve "intimate contact" with the underlying substrate to provide the intended erosion control functions. Typically, intimate contact is achieved through the

careful placement and stapling at the manufacturer's staple spacing specifications for a given slope.

It is strongly recommended that any slopes or disturbed surfaces which will remain inactive for a period of two months or greater receive seeding during the growing season to further mitigate the risk of erosion.

5. **Hydraulic Mulches** – Hydraulically applied mulch products are applied as a pumped and aerated slurry and typically consist of small pieces of cellulose fiber applied to stabilize soil from wind and water erosion, and provide temporary protection for seeds to promote germination. Hydraulic mulches are typically applied in conjunction with seeding and include the use of a tackifier to stabilize the mulch application.

Hydraulically applied mulches include a range of proprietary products which may include wood fibre mulches, straw mulches, or paper based mulches.

Hydraulic mulches should be applied to slopes following slope preparation to yield a surface textured or roughened surface. Track walking with heavy machinery to provide surface depressions perpendicular to the flow paths may be employed to prepare surfaces prior to hydraulic mulching.

Hydraulic mulches should be applied under optimal site conditions, and should be applied at least 24 hours prior to forecasted rain events to prevent "tear outs" on slopes, or development of rill erosion. Application prior to forecasted rain events allow the mulches and tackifiers to "set up" on slopes.

Hydraulic mulch specifications will vary depending on slopes requiring treatment. The continuum of hydraulic mulches begins with a standard hydraulic mulch and progresses through to a stabilized mulch matrix (SMM: Flat to ~2H:1V), a Bonded Fiber Matrix (BFM: ≤3H:1V to 1H:1V), and a Flexible Growth Matrix (FGM: ≤3H:1V to >1H:1V). Application rates of all hydraulic mulches require consideration of slope gradients, slope lengths, and adherence to manufacturer's specifications.

6. **Permanent Slope Protection** – Upon completion of slope grading, the establishment of vegetative cover is critical in mitigating long-term erosion potential. Vegetation establishment may be achieved via seeding (broadcast seeding or hydraulic seeding – see below). Upon completion of final slope treatment (e.g. surface scarification and application of growing medium), seeding combined with RECPs or hydraulically applied mulches should be applied at the earliest opportunity. Application of seed outside the growing season may require re-seeding in the following year to address seed losses due to frost impacts.

7. **Broadcast Seeding** – Broadcast seeding is the mechanical or manual application of seed directly onto prepared surfaces. Seed applications should be applied at the rate specified by the seed supplier and include fertilizer amendments as per manufacturer's recommendations or results of soil fertility testing.

- 8. Hydraulic Seeding** – Hydraulically applied seeding typically is completed in conjunction with the application of a hydraulically applied mulch.



7. Paved Road Surfaces Sweeping/Maintenance

Objective: To proactively clear tracked materials from both onsite and offsite roads in advance of rain events to mitigate the entrainment and transport of “first flush” sediment loads to existing stormwater infrastructure.

Measures:

- 1. Hand Sweeping** – Regular hand sweeping of incidental tracking in advance of any forecasted rain events should be completed to mitigate the risk of “first flush” sediment transport of road surface sediments to storm sewer inlets. Hand sweeping is typically completed in response to minor or localized tracking issues (e.g. single family lots).
- 2. Mechanical Sweeping/Vacuum Truck** – Mechanical sweeping involves the use of a vacuum sweeper truck which provides repeated passes over paved road surfaces to address significant tracking concerns, typically associated with major hauling activities. Mechanical sweeping may also involve the use of a bobcat mounted sweeper attachment to scrape and sweep tracked materials associated with more localized activities.

Vacuum sweeping may include the use of water to facilitate the sweeping efforts; however, flushing of road surfaces to remove tracked materials is not recommended.

8. Project Planning/Phasing

Objective: Mitigate the risk of erosion by phasing clearing/grubbing or earthworks to limit the areal extent of disturbed surfaces at risk of erosion.

Measures:

- 1. Vegetation Retention** – The retention of vegetation will significantly reduce erosion potential. Retention of ground cover vegetation and root structures even following clearing will retain undisturbed soil profiles which will maintain infiltration capacity and are far less prone to erosion than disturbed soils (e.g. cleared and grubbed).

- 2. Project Phasing** – ESC Plans shall clearly prescribe project phasing or staging of works to retain, wherever possible, vegetation cover or relatively undisturbed soil profiles. Project phasing remains applicable even following completion of clearing and grubbing where disturbed surfaces treatments utilizing a thin veneer of wood mulch, seeding, or straw mulch application has been undertaken to mitigate rain-splash erosion potential.

ESC plans should clearly define cut/fill limits and stockpile locations such that inactive areas which may be retained as undisturbed or stabilized areas remain protected until development activities within the designated areas is required to commence.

- 3. Scheduling** – Scheduling refers to the provision of a prescribed construction sequence for specific development activities to guide the contractor on what works can be done before other works are initiated to mitigate potentially serious ESC concerns.
- 4. Wet Weather Operating Procedures** – Wet weather operating procedures refers to the prescription of conditions governing both proactive and reactive wet weather operating shut-downs to mitigate ESC concerns.

Proactive wet weather shut downs should include specifications for the suspension of major earthworks or hauling activities utilizing unpaved road surfaces in advance of forecasted rain events exceeding 25mm in 24 hours.

Reactive wet weather operating shut-downs should be implemented when the intensity or duration of precipitation is sufficient to yield saturation of the surface materials and result in significant ponding or visible surface runoff.

9. Temporary Sediment Control Detention Facilities

Objective: To provide hydraulic controls, collect site runoff to modify the storm runoff hydrograph and provide suitable detention to slow water velocities and afford residence times to facilitate the settling of suspended particles prior to discharge to the drainage system.

Measures:

- 1. Sediment Control Pond** – Sediment control facilities are typically detention ponds constructed to detain a given design storm event to provide a depositional environment to facilitate the settling by gravity of suspended sediment particles prior to discharge. Detention ponds are not intended to function as “filtration” ponds; rather, they should be designed to provide the maximum flow path length, and thus, residence time to allow for the settling of suspended sediments under the forces of gravity.



Sediment control ponds should include a pre-treatment sump to facilitate the deposition of the largest sediments in transport. The pre-treatment sump should be a minimum 0.5m deeper than the remaining pond invert, and be separated by 3" fractured rock berm set a minimum of 0.5m above the normal pond invert. The pre-treatment fore-bay should include measures to facilitate clean-out of deposited materials as required.

The provision of the maximum possible flow-path length through the detention pond is recommended to afford opportunities for settling of suspended particles by gravity. Extended flow-path lengths may be achieved through the use of offset impermeable baffles or central barriers depending on detention pond configuration.

Sediment control ponds must include a formal outlet structure which is designed to drain only the upper layer of water within the pond. Proprietary products such as the Faircloth Skimmer® or their equivalent are recommended to dewater the cleanest upper layer of water between storm events.

Ponds may be designed with a typical riser pipe outlet structure which consists of slotted vertical pipes to provide for pond dewatering. Slotted riser pipes must not include slotted pipes extending to the base of the riser pipe to preclude entrainment of turbid water or fine sediments at the base of the pond.

Ponds may be designed as detention ponds wherein discharge is constant and defined by the outlet orifice structure, or modified to provide a variable detention/retention function. Retention ponds are designed such that a valve may be manually operated to close the slow release via the outlet structure/skimmer in advance of a forecast rain event to restore the detention/retention capacity of the pond.

A sediment control pond's design capacity (i.e. design storm) shall be defined by current City of Coquitlam policy or specifications set by the ESC Plan designer. The pond must include a failsafe overflow designed to an appropriate factor of safety to manage potential upset events and mitigate risks to downstream life and property.

- 2. Portable Tanks** – Portable tanks may be utilized to provide additional detention capacity. Typically portable tanks would be utilized in conjunction with a passive flocculant treatment approach wherein the tanks provide additional residence time to facilitate settling under the forces of gravity.



Portable tanks may also provide suitable detention in support of localized dewatering requirements where discharge to the municipal storm system or watercourses would be prohibited due to turbidity levels.

- 3. Active Filtration Systems** – Active filtration systems refer to facilities installed in conjunction with the use of a polymer or flocculant (see section 12) to provide for the settling of larger colloids followed by the filtration of water, typically via sand filter media, prior to discharge to the drainage system.
- 4. Real-time monitoring systems** – A valuable tool in monitoring discharge for turbidity and pH and allow for recirculation of non-compliant discharge. As of 2023, these systems are a requirement for development in areas outlined in Schedule "D" of the Bylaw. Real-time monitoring systems help keep watercourses clean and assists developers in ensuring their site is compliant with City discharge requirements in the Bylaw to avoid costly fines and stop work orders.
- 5. Temporary Sediment Traps** – Sediment traps may include in-line sumps constructed within onsite drainage ditches or swales to provide functions similar to a "fore-bay" in sediment control ponds. Traps will provide deeper low energy environments to facilitate the settling of larger sediment particles within the development site, prior to flows entering the formal sediment pond facilities or filtration systems. Sediment traps will provide negligible value in the treatment of fine sediments (e.g. silts and clays) in the absence of pre-treatment with flocculants.

Development site sediment traps will typically dewater based on a rock mulch berm dictating the local base-level control at the outlet of the sump; however, opportunities to drain sumps via temporary riser pipe connections to catch basin or lawn basin leads may prove beneficial depending on site conditions. Siting temporary sumps at locations of future lawn basin inlets is recommended. Temporary sediment traps/sumps should include side slope protection with polyethylene tarps keyed in a minimum of 0.5m above the slope inflection points.

- 6. Single Family/Duplex Sediment Trap** – A temporary sediment trap/sump should be included at Single Family / Duplex development projects where civil services have been previously installed to preclude the discharge of sediment laden site runoff directly to the storm sewers. A sediment trap should consist of a minimum 0.75m deep excavated pit with polyethylene lined 2:1 side slopes drained via vertical riser pipe connected to storm services at or near the inspection chamber connections. The riser pipe should be slotted or perforated and surrounded with $\frac{3}{4}$ " clear crushed gravel. The riser pipe perforations shall not include perforations within the lower $\frac{1}{3}$ of the sumps depth to preclude entrainment of the most sediment laden runoff.

10. Sediment Barriers

Objective: Sediment barriers include small sediment containment systems which when implemented onsite serve to “minimize” the discharge of sediment by providing localized onsite detention of suspended sediment. In the absence of “erosion control” measures, the use of sediment barriers onsite will yield negligible performance gains during significant runoff events.

Sediment barriers can be critical elements in addressing the potential sediment yield for a given development project insofar as reducing the effective slope length which is a key variable in influencing total sediment yield (Slope Length (L) is a key variable in the revised universal soil loss equation – RUSLE).

Measures:

- 1. Contour Silt Fencing** – Silt fencing installed parallel to site contours can provide an effective sediment trap and effectively reduce slope length (L) factors. Based on the typical height of silt fencing materials, the risk of overtopping under typical rain events is lower than other potential sediment barrier options.
- 2. Straw Wattles** – Straw wattles may be utilized to reduce the effective slope length distances on low gradient sites. Straw wattles must be installed as per manufacturer’s specifications and spacing requirements to preclude frequent breaching during rain events, which, may be prohibitive to their use as effective slope breaks.



- 3. Wood Mulch Berms** – Wood mulch, particularly when generated onsite during tree clearing activities may provide a suitable temporary sediment barrier for use on disturbed surfaces. The height of wood mulch berms may be modified based on availability of wood mulch making it an effective option for slope length management. Wood mulch products should not be used as sediment barriers in the immediate vicinity of drainage inlets or where exposed to channelized flows due to water quality concerns related to wood waste leachate. Wood mulch berms are best suited to barriers to address sheet flow runoff.
- 4. Rock Mulch Berms** - Rock mulch berms may be installed as linear obstructions to sheet flows or channelized flows to induce a local backwater effect in support of sediment control, and to channelize unconfined flows in support of temporary water management objectives.



- 5. Straw Bale Barriers** – Straw bales are increasingly not recognized as an appropriate or effective ESC BMP; however, site conditions may exist where a temporary straw bale barrier may provide an effective temporary sediment barrier and therefore, they are included herein as a potential BMP option. Caution must be exercised with the use of a straw bale barrier to acknowledge the potential risks associated with impoundment and overtopping, or deflection of surface runoff. Straw bales must not be utilized as barriers implemented where channelized flows will be expected.

Straw bale barriers intended for application as temporary barriers on disturbed surfaces must be installed in a minimum 100mm deep trench excavated into native soils to preclude bypass by subsurface flows, and bales must be staked with 1" x 2" wood stakes or re-bar installed at 2 stakes per bale.

The upslope face of the straw bale barrier must be backfilled with compacted soils to prevent piping below the installed barrier. Where conditions that may result in overflow/ overtopping of the barrier, the downslope margin should be stabilized within polyethylene, geotextile fabric or RECPs to mitigate scour potential.

11. Incidental Water Management

Objective: Provide for the safe dewatering of incidental accumulations of turbid water within building site or civil services excavations in a manner that does not contravene the water quality criteria of the Bylaw.

Measures:

- 1. Infiltration to Vegetated Surfaces or Contained Areas**
– Incidental dewatering may be discharged to adjacent vegetated surfaces to promote infiltration into the ground and filtration of potentially turbid water. Dewatering to disturbed surfaces within the active site may also afford capacity for infiltration; however, disturbed and un-vegetated surfaces are extremely prone to erosion, and opportunities for infiltration following topsoil removal is likely negligible.
- 2. Dewatering Bag** – Dewatering bags are pre-fabricated geotextile bags which are typically used in conjunction with a polymer or flocculant to filter turbid incidental water prior to draining via existing surface flow paths or storm sewers. Compliance with Bylaw requirements will typically require active management of the dewatering process and include in-situ monitoring to ensure that the resulting discharge following filtration meets Bylaw criteria.

12. Polymer/Flocculant Additives

Objective: To introduce a polymer/flocculant additive to development site runoff to promote the flocculation of colloids to form larger particles which may be more effectively filtered through onsite management techniques, or settled under the forces of gravity prior to discharge to achieve the water quality criteria of the Bylaw.

When dealing with soils with >20% of particle sizes less than 0.02mm, it may be impractical to achieve Bylaw compliance without the use of flocculants even within 72 hours following a significant rain event. It is essential to confirm that site stormwater is conducive to treatment with flocculent via a simple bench test for runoff or soil conditions from different project areas or soil layers which will be exposed during the project duration.

The use of flocculants requires the explicit consideration of appropriate dose rates and the provision of measures to appropriately mix the flocculant and runoff mixture to ensure appropriate activation and treatment. The lack of mixing and activation of flocculants, particularly in passive systems is frequently the major limiting factor in the effectiveness of flocculant use. Following mixing, at least 33m of pipe or lay-flat hose should be utilized to allow enough travel time for reaction before the water is discharged for filtration or settling.

Any ESC plans that propose to utilize flocculants should include the provision of materials safety data sheets (MSDS) and toxicity reports in support of the ESC Plan review.

Measures:

- 1. Flow Through Treatment (Passive)** – Flow through treatments imply the pre-treatment of influent turbid runoff with a flocculant to treat the water to promote the formation of larger sediment colloids which may be removed through the forces of gravity within onsite detention facilities or filtration systems.

Passive flow-through systems must include some level of detention or filtration to ensure that coagulated and flocculated materials are removed prior to discharge to the receiving environment.
- 2. Flow Through Treatment (Active)** – Active flow through treatments imply that the application of flocculant is treated via active filtration through some form of filter media prior to discharge from the site. Active filtration is typically addressed through the implementation of proprietary third party products or services which include sand media filtration.
- 3. Batch Treatment** – Batch treatment systems refer to measures which may be implemented to collect and treat site runoff from a designated facility (e.g. sediment detention/retention pond). Turbid inflow may be intercepted at the inlet to a facility and treated with a flocculant and recirculated into the containment system to promote settling prior to discharge.

13. pH Mitigation

Objective: Concrete works and resulting concrete wash water, or leachate generated from the generation or re-use of recycled concrete aggregate (RCA) can yield extremely alkaline runoff. Water quality criteria of the Bylaw require compliance with pH in the range of 6.5 – 8.0. Treatment of alkaline runoff must be undertaken to neutralize alkaline runoff associated with cement, concrete, or substances yielding alkaline runoff.

Measures:

- 1. Compressed CO₂ Gas Diffusion** – Aeration of compressed CO₂ gas through a body of alkaline runoff is an effective means to mitigate alkaline runoff concerns. The use of a diffusion hose with a high number of small diffuser holes connected to a supply of compressed CO₂ gas and submerged in a sample is an effective approach. Simple diffusion from the end of a hose is not considered to be effective or an efficient use of CO₂ gas. Suppliers of suitable diffuser hose include 4 Point Systems which supply a proprietary diffuser hose originally intended for use in aquaculture systems. Deployment of the CO₂ diffuser system should be placed in a sump prior to the point of discharge from the development site or at strategic locations within the stormwater network.



Please Note

This bulletin is provided as a reference guide only. It is the responsibility of the applicant to ensure compliance with all applicable by-laws and legislation. For more information, please refer to the City of Coquitlam Bylaw 4403, 2013 and the Department of Fisheries and Oceans Land Development Guidelines for the Protection of Aquatic Habitat.

Where Can I Call If I Have Other Concerns or Need More Information?

For further information, contact Engineering Customer Services at 604-927-3500.

City of Coquitlam
3000 Guildford Way
Coquitlam, British Columbia
V3B 7N2