SITE SPECIFIC ENVIRONMENTAL MANAGEMENT AND PROTECTION PLAN (SSEMPP)

Site C – Talbot Earth Dams

Trent-Severn Waterway Infrastructure
Talbot Dams Rehabilitation – Kirkfield Bundle
Public Works and Government Services Canada

November 17, 2017
Rev. 04

PREPARED FOR:
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DOCUMENT CONTROL TABLE – RECORD OF UPDATES

TOR	TOC	SPEC SECTION	DATE ISSUED	Rev. No	COMMENTS
RS 3.8.2	-	-	21/07/2017	0	SSEMPP SUBMITTED FOR REVIEW
RS 3.8.2	-	-	10/08/2017	1	See Amendment Sheet
RS 3.8.2	-	-	17/08/2017	2	See Amendment Sheet
RS 3.8.2	-	-	28/08/17	3	See Amendment Sheet
RS 3.8.2	-	-	17/11/17	4	See Amendment Sheet

TOR – Terms of Reference number

TOC – Table of Contents reference number

SPEC SECTION – TDKB Project Specification reference

Table of Contents

Amendment Sheet

REVISION	PAGE #	SUBJECT OF THE AMENDMENT	AMENDED BY	DATE
0	15	Added Bentonite Cement Mix Deployment and Disposal section	Jordan Feijoo	25/07/2017
0	15	Added Surface and Ground Water section	Jordan Feijoo	31/07/2017
1	All	Corrections and clarifications of workings to describe proper communication channels and procedures, corrected the naming of the Plan to match TOR	Jordan Feijoo	10/08/2017
2	All	Corrections to the record of updates and amendment sheet to reflect proper document control procedures, changes due to comments from PWSGC and PCA	Jordan Feijoo	17/08/2017
3	All	Corrections and changes due to comments from PWSGC and PCA	Jordan Feijoo	23/08/2017
4	5 21	Included Ted Chant as Project Manager as approved by PWGSC Additions based on feedback from PWGSC and PCA	Jordan Feijoo	17/11/2017

1.0 Vision Statement

The EllisDon-Chant Joint Venture (herein referred to as EDCJV) will establish, implement, maintain, and continually seek to strengthen a culture premised on a respect for the environment in which we work and the sustainable use of our natural resources. EDCJV's corporate policies, procedures, processes, documents, opportunity selection, work planning, execution and close-out shall reflect this respect for the natural environment around us and the need for sustainable development. In keeping with this philosophy, we have adopted an Environmental Management Policy that affirms our commitment to this premise.

The Environmental Management Policy is intended to establish the basis for:

a) Determination of the processes and procedures required to successfully implement the EDCJV Environmental Management and Protection Plan.

b) Determination of the means and methods needed to ensure that the development, implementation, operation and control of these processes and procedures are effective.

c) Ensuring the availability of knowledge, information and trained resources to support the effectiveness of the processes, procedures, means and methods.

d) Monitoring, measuring, and analyzing related outcomes.

e) The continual improvement of outcomes through the enhancement of the processes and procedures.

EDCJV has reviewed all environmental requirements in the Basic Impact Assessment (BIA) prepared by PCA and will ensure work is completed in compliance with these specifications. The project staff that will be responsible for site management of the Environmental Management and Protection Plan and Site Specific Environmental Management and Protection Plan are found in Table A below.

Table A - Environmental Plan Management Responsibilities

Role	*Name*
EDCJV Project Manager	Ted Chant
EDCJV Contract Manager	James Hook
EDCJV Construction Manager	Wayne Brooks
EDCJV Project Coordinator	Jordan Feijoo
EDCJV Environmental Manager	Sophia Sestito

The EDCJV Environmental Protection effort during construction shall:

- Comply with the commitments and conditions of environmental approvals, permits, exemptions, agreements, reports and clearances provided by PWGSC.

- Comply with any other formal environmental approvals (such as the BIA), permits, exemptions, agreements, reports and clearances that must be procured by EDCJV in order to perform the work.
- Be integrated with the environmental and other requirements specified in the contract documents.
- Incorporate Best Management Practices for project site dewatering, vegetation removal and rehabilitation, environmental practices and mitigation measures, and other standards and guidelines set forth in the contract documents.
- Mitigation or guidelines provided within the BMP documents, which are not referred to within the SSEMPP, shall still be implemented and adhered to throughout the duration of the project, as required. The SSEMPP will remain a living document throughout the lifecycle of the project.

The key objectives of the SSEMPP are to:

- Clearly establish the positions and names of the persons responsible within the subcontractor's hierarchy for ensuring adherence to the SSEMPP.
- Establish clear and specific obligations on the part of the subcontractor to report, inform, consult and otherwise communicate on environmental matters with EDCJV. EDCJV shall inform, seek the approval of or otherwise engage PCA and PWGSC as required by the understandings between these three (3) parties as described in the PCA/PWGSC approved EDCJV EMPP.
- Detail site access (site roads, access embankments and access ramps) and staging area plans.
- Detail the Erosion and Sedimentation Control Plan, including provisions for maintaining the sites during construction and providing erosion control on all exposed earth surfaces and temporary fills.
- Provide drawings which illustrate the proposed SSEMPP means and methods and to detail key features and facilities of the SSEMPP.
- Detail the Spill Control Plan.

The proposed season of work will be from August 15, 2017 through early May, 2019. The working hours for this project will be on a 12 hour a day basis, seven days a week, with some of the night shift and weekend work being conducted with a limited crew (TBD).

The following equipment list does not include tools of the trade used as part of general construction processes. Exact quantities of equipment and personnel are at the discretion of the subcontractor and will be determined so as to ensure that schedule objectives are attained.

The following is a list of equipment to be used for the permanent works, temporary roads, access embankments and ramp construction:

- Excavators
- Bulldozers
- Backhoes
- Tandem and tri-axle dump trucks
- Tree Chipper
- Feller Buncher
- Cement Bentonite Batch Plant
- Smooth drum compacting roller
- Various Piping and Hoses
- Vibratory sheet pile installation equipment

For concrete removals:

- Pneumatic jack hammers
- Excavators equipped with a hydraulic breakers (Hoe Ram)
- Air compressors
- Generators
- Hand held cutting equipment

The following is a list of materials to be used. The list is not exhaustive:

- Washed 19mm clear stone
- Well graded Rip Rap washed
- Washed Armor stone
- 300 mm rock with minimal fines.
- 2”- crushed stone
- Well graded granular “B”
- Select Subgrade Material (SSM)
- Geotextile
- Geotextile Sediment Fence – In accordance with Table 3 OPSS 1860, 04/2012
- Grass Seed (Various application techniques)
- Bentonite/Concrete mix

2.0 Environmental Protection Measures

2.1. **Soil Movement Mitigation Measures (Erosion and Sediment Control)**

The soil movement mitigation measures will be carried out as indicated in the Scope of Work and applicable sections of the SSEMPP and the Erosion and Sediment Control Plan located in Appendix D. The following measures will serve as a guideline for the Erosion and Sediment Control Plan and are not all-inclusive:

2.1.1. The subcontractor shall provide temporary erosion and sediment control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties, walkways, and the waterway itself according to the approved Erosion and Sediment Control Plan and requirements of authorities having jurisdiction.

2.1.2. The subcontractor shall inspect, repair, and maintain erosion and sediment control measures daily and post rainfall during construction until permanent vegetation has been established. If sediment and erosion control measures are not functioning properly, no further work shall occur until the sediment and/or erosion problem is addressed.

2.1.3. The subcontractor will remove erosion and sedimentation controls as well as restore and stabilize areas disturbed during the removal when work is complete.

2.1.4. The subcontractor will confine work, including temporary structures, plant, equipment, materials and operations of employees, to areas defined by the contract documents. Drawings showing the project footprint including the fencing and gate locations can be found in Appendix B.

2.1.5. The subcontractor will stockpile fill materials in areas approved by the EDCJV Project Manager in consultation with PCA/PSA. To prevent erosion of fill material, stockpiles will be protected if said material is expected to be unused for a long period of time. Geotextile sediment fence is to be placed around the stockpile as per the Sediment and Erosion Control plan. Any stockpiled materials, or concrete debris shall be stored and stabilized a safe distance away from any watercourse, drainage course or swales to prevent erosion and subsequent entry into the TS Waterway OR removed from the site, in accordance with all federal, municipal and provincial regulations.

2.1.6. All disturbed areas of the work site shall be re-instated immediately following work and re-vegetated as soon as conditions allow. Then the backfill will be placed along with erosion sediment control blankets overtop to stabilize the slope. All exposed areas will be covered with erosion control blankets to keep the soil in place and prevent erosion until vegetated.

2.1.7. Erosion control blankets will be fibre-based and biodegradable.

2.1.8. Sediment and erosion control measures shall be left in place by the subcontractor until all areas of the work site have been stabilized.

2.2. **Temporary Access Ramps, Roads and Yards Construction and Maintenance**

Access road and staging areas as required by the Scope of Work will be carried out as outlined in the Access Roads Construction and Maintenance Plan (See Appendix E).

2.2.1. A properly contained staging area set back at the maximum available on-site distance from the water or embankment edge shall be established for the storage of materials, liquid products (in a secure area on impermeable pads) and equipment.

2.2.2. Vehicle and equipment (e.g. pumps, chainsaws, etc.) re-fuelling and/or maintenance shall be conducted off of slopes and away from the water on impermeable pads to allow for full containment of spills, at a recommended minimum distance of 20 m from water. All stationary equipment and/or small power tools containing deleterious liquids shall be kept in a watertight containment that will have the bottom lined with absorbent pads. The containment unit shall be capable of holding 125% of the total volume of liquid of the equipment housed in it.

2.2.3. Earth dam crest improvement/temporary repairs should be constructed using gravel or larger stone laid on top of geotextile fabric rather than leveling or excavating soils on the embankments so that potential archaeological resources are not impacted by construction, and runoff into the canal channels is limited. See Appendix B for typical cross section drawings.

2.2.4. Any excavation of the dam crests must be approved by EDCJV.

2.2.5. The subcontractor will inspect and maintain temporary access roads and staging areas for safe travel within the project area, and ensure that mud and dirt are not tracked onto local roads or onto river bed areas where practical. The subcontractor will monitor and take necessary cleaning measures (i.e. water sweeping truck) when mud and/or dirt are tracked onto local roads.

2.2.6. The subcontractor will de-compact/scarify soils as required to restore existing surface conditions and grades to the satisfaction of both EDCJV and PCA. Grassed areas to be re-vegetated for surface restoration shall be planted by sodding as indicated on the drawings and as specified.

2.2.7. Staging areas and access roads shall not encroach on municipal roads right-of-way, except at existing entrances. Municipal approval shall be obtained for temporary entrances for site access roads.

2.2.8. Clearing of isolated trees and grubbing of isolated tree stumps outside prescribed clearing limits may be permitted to establish staging areas and temporary access with prior approval from EDCJV in consultation with PCA. Soil stabilization of such hilly grubbed areas may be required if there is insufficient growing time remaining in the growing season, as per the BMP for Vegetation Removal.

2.2.9. Construction of the access road and staging areas to be constructed in as described in the Scope of Work and as designated by the drawings once determined (See Appendix B).

2.3. **Clearing & Grubbing**

Clearing and grubbing operations will be carried out as indicated in the Scope of Work and the SSEMPP.

2.3.1. Prior to the clearing & grubbing operations, the subcontractor and EDCJV will meet with PCA to identify and approve the areas of work. The subcontractor will notify utility authorities before starting clearing and grubbing and utility locates will be conducted.

2.3.2. There will be no formal Vegetation Management Plan, but a replantation/revegetation outline shall be provided by the subcontractor prior to revegetation and replantation, it will be reviewed and approved by EDCJV.

2.3.3. Prior to clearing & grubbing operations, the subcontractor will install erosion and sediment control barriers as per OPSD 219.110 in Appendix F. Additional sediment fencing may be required as directed by EDCJV.

2.3.4. The subcontractor will remove cleared and grubbed materials off site for disposal in accordance with the Waste Management Section 2.12 below. Removal of diseased trees identified by EDCJV and shall be disposed of in a manner approved by the EDCJV Project Manager.

2.3.5. The subcontractor will clear vegetation from unstable or erodible banks by hand, where possible, and avoid the use of heavy machinery.

2.3.6. Should any vegetation require chipping/mulching, the after product will be used onsite for the duration of the project to supplement erosion and sediment control methods where appropriate. Should chippings/mulch not be immediately required at site they will be transported to an approved landfill.

2.3.7. The subcontractor will minimize clearing as much as practical to maintain riparian vegetation cover, tree screens and windbreaks. Where possible, the subcontractor will maintain vegetated buffer at shorelines and minimize clearing near water bodies. If buffers cannot be maintained, grubbing of vegetation root mass in close proximity to shorelines and stream banks is to be avoided.

2.3.8. When practical, alter riparian vegetation in the right-of-way by hand. If machinery must be used, the subcontractor will operate machinery on land and in a manner that minimizes disturbance to the banks of the water body.

2.3.9. The subcontractor will make every effort to retain as much of the natural vegetation as reasonably possible to help ensure bank stability, control erosion and expedite re-colonization of vegetative cover.

2.3.10. All disturbed surfaces and shorelines shall be stabilized and revegetated as soon as possible after completion of the work in the immediate area. If there is insufficient time remaining in the growing season, the site should be stabilized (e.g. cover exposed areas, where machinery will not be operating, with erosion control blankets to keep soil in place and prevent erosion) and vegetate in the following spring.

2.3.11. Where disturbance occurs outside approved clearing limits the subcontractor will restore these areas to original conditions or as directed by the EDCJV Project Manager.

2.3.12. Only equipment designed for vegetation removal will be used during clearing and grubbing activities.

2.3.13. When practical, large trees will be pruned rather than removed. Pruned limbs will be cut close to the trunk. Pruning will consist of a shallow undercut followed by a full top cut. This method will prevent bark from being peeled from the tree when the limb falls. Axes will not be used for pruning.

2.3.14. Trees that would require pruning on more than 50% of the limbs will be removed.

2.3.15. When removing trees the stumps will be cut to ground level and chipped so no pointed stumps remain.

2.4. **Tree and shrub protection**

Preservation of trees and shrubs within the limits of construction that are not removed by construction operations will be carried out as indicated in the Scope of Work and SSEMPP.

2.4.1. The subcontractor will protect trees and shrubs adjacent to construction work, storage areas and trucking lanes, and encase with protective wood framework and snow fencing from grade level to height of 1.2 m minimum.

2.4.2. The subcontractor will protect roots of designated trees to dripline during excavation and site grading to prevent disturbance or damage, avoid unnecessary traffic, dumping and storage of materials over root zones and minimize stripping of topsoil and vegetation. Barriers for tree protection to be placed as per OPSS 220.010.

2.4.3. The subcontractor will identify, by tagging, trees required for removal and those required for pruning, for review by EDCJV and acceptance by PCA. Restrict tree removal and pruning to areas indicated or designated by the EDCJV.

2.4.4. The subcontractor will protect trees, plants and foliage on adjacent properties.

2.5. **Wildlife Protection**

All construction equipment and vehicles shall give right of way to wildlife, allowing wildlife to pass and proceed at a safe distance prior to construction equipment/vehicles commencing construction activities. In the event wildlife is injured during construction activities, the subcontractor will notify the EDCJV Project Manager immediately and provide details of the incident. PWGSC/PCA will be notified by EDCJV immediately.

2.5.1. Areas of non-disturbance ("no-go zones") as identified by a PCA approved personnel will be avoided by all EDCJV and subcontractor employees, vehicles and machinery.

2.5.2. Pre-stressing activities may be performed by PCA approved personnel prior to the start of work at site in order to encourage wildlife to relocate. The requirement of this procedure will be dependent on site conditions.

2.5.3. As part of daily site inspection, a visual sweep of the work site will be completed to ensure no wildlife is present. This includes the discovery of tracks or trails within the work site.

2.5.4. Evidence of wildlife activity or encounters with wildlife within site limits will be reported to the EDCJV Project Coordinator – Environmental. The Project Coordinator will inform the EDCJV Project Manager who will inform PCA as required.

- Wildlife encounters on site will be recorded including: Location, date and time of encounter, wildlife species (if possible), any photographs taken of the species and condition of the animal. These records will be supplied to EDCJV within 24 hours of the encounter.
- Injured or dead wildlife found on site will be immediately reported to EDCJV who will inform PCA.
- Tracks or trails found within the site area will be reported to PCA.

2.5.5. Objects and material that could entangle (wire, tubing, plastic, etc.) or be consumed by wildlife will be properly stored or disposed of as appropriate.

2.5.6. Feeding of wildlife is prohibited.

2.5.7. The subcontractor will carry out construction operations to minimize impact on fish habitat from both disturbed sediments and fill materials.

2.5.8. The subcontractor will abide by the mitigation measures and best management practices outlined within DFO's online guidance materials: Measures to Avoid Causing Harm to Fish and Fish Habitat

2.5.9. If dewatering is required, fish shall be removed from the work area prior to complete dewatering and released alive in the nearest appropriate water course.

2.5.10. Captured invasive species will be removed from site and disposed of as directed by EDCJV in consultation with PCA.

2.5.11. Fish shall be relocated safely during dewatering operations:

- EDCJV staff must be on hand with appropriate equipment to remove any stranded fish in the dewatered area. As water levels drop in the work area the subcontractor shall monitor the deeper pool areas where fish are congregating. If safe to do so, Seine nets or Dip nets can be operated by EDCJV staff to remove the fish. A qualified consultant may be required to remove fish with specialized equipment where conditions dictate.
- Fish shall be immediately transported to the closest open water source (fish from upstream are returned upstream, fish from downstream are returned downstream) and released. The length of time fish are out of the water shall be minimized.
- Any invasive species (such as the Round Goby) will be euthanized in ethanol and disposed of as per Waste Management and Disposal (Section 2.12)
- Contact the EDCJV Project Manager should there be any issues with fish removal. EDCJV will coordinate with PWGSC staff.

2.6. **Nesting and Migratory Bird Protection**

The subcontractor shall not destroy nests of protected migratory birds. When these are encountered, the EDCJV Project Manager will be notified. The subcontractor shall take all necessary measures to seal all structural work platforms and closures against entry of birds protected under the provision of the Migratory Birds Convention Act in order to prevent their nesting within the work area.

2.7. **Protection of Species at Risk**

The subcontractor shall comply with the Species at Risk Act, 2002, which provides for the protection of Species at Risk in Canada, if any Species at Risk is encountered during the Work.

2.7.1. No vegetation shall be removed without consent of EDCJV to protect nesting birds.

2.7.2. Should conditions at the work site indicate that there are unforeseen negative effects on wildlife or their habitat, all work shall cease until the problem has been corrected and PWGSC immediately notified. Should work-related activities have potential to negatively impact Species at Risk, contact the EDCJV Project Manager, who will consult with the PCA Environmental Manager for guidelines on how to proceed.

2.7.3. If a turtle is found within the limits of the project, it should be left alone to leave the area if possible, or the animal should be gently placed outside the construction site. Typically, animals should not be released more than 250 m from the capture site. Release sites should be near water with vegetative cover for shelter. Turtle/reptile exclusion fencing will be implemented for works extending into May as per the BIA.

2.7.4. If any other Species at Risk are observed on or near the worksite, the species must not be harmed or harassed. If the species does not leave, or cannot leave the site, the subcontractor must immediately stop the works and contact the EDCJV Project Manager who will contact the Canadian Wildlife Service and PCA.

2.7.5. Fish stranded behind turbidity curtains shall be captured and released in safe area. Fish trapped in area to be dewatered must be captured alive and relocated outside areas to be dewatered before commencement of pumping.

2.7.6. Geotextile sediment fence surrounding stockpiles will be implemented in accordance with *Species at Risk Branch Best Practice Technical Note: Reptile and Amphibian Exclusion Fencing* as included in Appendix G.

2.8. **Habitat Protection (Aquatic and Terrestrial)**

The subcontractor shall make every effort to protect the aquatic/fish habitat adjacent to and contained within the work area. These efforts include but are not limited to:

2.8.1. Should conditions at the work site indicate that there are unforeseen negative impacts to fish or their habitat, all work shall cease until the problem has been corrected and/or EDCJV and PCA consulted.

2.8.2. Prior to commencement of work, access points and work areas are to be inspected for any nests or dens and the subcontractor is to avoid disturbing any that may be found

2.8.3. The subcontractor will conduct an orientation session with the workers and subsubcontractors to advise of invasive species potentially present within the work site areas including, but not limited to the following:

- Dog-strangling Vine: https://www.ontario.ca/document/dogstrangling-vine
- Giant Hogweed: https://www.ontario.ca/document/gianthogweed
- Purple Loosestrife: https://www.ontario.ca/document/purpleloosestrife-0
- Round Goby: https://www.ontario.ca/document/round-goby
- Rusty Crayfish: https://www.ontario.ca/document/rustycrayfish
- Spiny Water flea: https://www.ontario.ca/document/spiny-andfishhook-water-flea

2.8.4. The subcontractor will conduct a site assessment for invasive species plant infestations prior to carrying out field activities. Any equipment or vehicles which are to be used in water should be thoroughly cleaned, before and after use, of any visible mud, vegetation, mussels, etc. Should an invasive species be encountered (or at least suspected), a photo and report of the specimen should be sent to EDCJV who will contact PCA and the Invading Species Hotline at 1-800-563- 7711 or online at EDDMapS Ontario, https://www.eddmaps.org/ontario/

2.8.5. The subcontractor will follow *Ontario Clean Equipment Protocol for Industry – Inspecting and Cleaning Equipment for the Purposes of Invasive Species Prevention* when dealing with invasive species as included in Appendix G. Ontario Best Management Practises for the species identified in Section 2.8.3 will be available as required.

2.8.6. The subcontractor will use weed-free material (i.e. sand, gravel, etc.) for erosion control and stabilization. Use weed free seed and confirm that seed mix to be used for re-vegetation purposes does not (potentially) contain invasive plants. Native grasses, shrubs, etc., should be planted to match existing species on site.

2.8.7. The subcontractor will move only weed/contaminant-free materials into non-infested areas. Moving materials from one infested location to another within a particular zone may not cause contamination, but moving materials from infested to non-infested areas could lead to the introduction and spread of invasive plants.

2.8.8. The subcontractor will line ditch slopes using seeds from species native to the area and similar to pre-existing vegetation.

2.9. **Prevention of Wildlife Harassment**

The subcontractor shall not harass or otherwise any wildlife encountered during construction. The subcontractor shall not block or prohibit wildlife access or other points of natural access and egress without the approval of EDCJV.

2.10. **Winter Protection**

No snow will be stockpiled on temporary access roads. No chemical de-icing agents shall be used. Screened sand or road surface scarification will be used to provide traction as required.

2.10.1. For cold weather protection, heating, and hording of concrete refer to the EDCJV Environmental Management and Protection Plan.

2.11. **Areas of Archaeological Concerns and Archaeological Finds/Heritage Resources**

If buried archaeological material is encountered, the subcontractor shall stop all construction activities in the area and inform EDCJV requesting direction.

2.11.1. Impacts to known or potential Archeological Resources shall be managed and mitigated. Should any artifact be found that could be of historical significance work shall stop until the object can be assessed; contact Trent-Severn Waterway, Peterborough Office at 705- 750-4900.

2.11.2. Should any archaeological or cultural resource be discovered while excavating, stop work. Contact the EDCJV Project Manager, who will contact PWGSC/PCA for direction prior to continuing work.

2.12. **Waste Management and Disposal**

Waste Management and disposal will be carried out as indicated the EDCJV Environmental Management and Protection Plan. The subcontractor and its subcontractors will abide by the following guidelines:

2.12.1. Waste and Recycling Facilities to be utilized: TBD (list)

2.12.2. Do not bury rubbish and waste materials on site.

2.12.3. Do not dispose of waste or volatile materials, such as mineral spirits, oil or thinner, into waterways, sewers or drains.

2.12.4. All waste materials should be disposed of in a legal manner at a site approved by Local Authorities.

2.12.5. Do not allow deleterious substance to enter the waterway.

2.12.6. Remove from site and dispose of all packaging materials at appropriate recycling facilities.

2.12.7. Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with the Waste Management Plan.

2.12.8. Divert unused metal materials from landfill to metal recycling facilities as approved by the EDCJV Project Manager.

2.12.9. Fold up metal banding, flatten and place in designated area for recycling.

2.12.10. Divert unused concrete materials from landfill to a local quarry approved by the EDCJV Project Manager.

2.12.11. Divert unused admixtures and additive materials from landfill to official hazardous material collections site as approved by the EDCJV Project Manager.

2.12.12. Unused admixtures and additive materials must not be disposed of into sewer systems, into lakes, streams, onto ground or in other location where it will pose a health or environmental hazard.

2.12.13. Prevent admixtures and additive materials from entering drinking water supplies or streams. Using appropriate safety precautions, collect liquid or solidify liquid with inert, non-combustible material and remove for disposal. Dispose of waste in accordance with applicable local, Provincial/Territorial and National regulations.

2.12.14. Remove recycling containers to appropriate facilities.

2.12.15. Provide appropriate areas on the site where concrete trucks can be safely washed.

2.13. **Bentonite Cement Mix Deployment and Disposal**

The bentonite cement mix used to raise the sheet piling impermeable cutoff within the embankments is known to be an alkaline substance and requires care when being handled, poured or disposed of.

2.13.1. Avoid seepage and spills while pouring, taking care to avoid accidental discharge into foliage or the waterway.

2.13.2. To avoid seepage and ensure the proper mix is maintained pouring work will be delayed after rain events at site for a period of to be established by EDCJV.

2.13.3. The batch plant, if site based, will be contained within a double walled container to catch any overflow or spills.

2.13.4. Spills exterior to the batch plant facility will follow the Spill Response Plan (as outlined in Appendix C).

2.13.5. In the event that concrete or grout is released into the water course the Spill Response Plan is to be followed and the EDCJV Project Manager alerted to the spill. The EDCJV Project Manager will contact PCA.

2.14. **Surface and Ground Water**

The primary objective of the dewatering and water management effort is for the subcontractor to isolate all work from the waterbodies and effectively manage any water that enters or reenters the watercourse. All water released or reintroduced to a waterbody during the work shall be monitored and controlled, released water will meet the standards included in the Erosion and Sediment Control Plan (Appendix D).

2.14.1. In the event that a cofferdam is required to complete the Scope of Work, only clean material free of fine particulate matter shall be placed directly in water.

2.14.2. Dirty water will be filtered by means of an appropriately designed sediment removal devices that will be constantly reviewed for their effectiveness. Discharge of pumped water shall be performed in a manner that does not cause additional erosion at the point of discharge. Sediment settling devices shall be adequately designed to compensate for excess flows during weather events or spring snow melts.

2.14.3. The subcontractor will ensure edges of turbidity curtains are tight to the shorelines to reduce the risk of turbid water and sediment escaping and install the curtain beginning at the shoreline or cofferdam and move it into the desired location in such a manner as to ensure fish are not trapped behind the curtain. The subcontractor will also monitor and maintain the turbidity curtain both during and outside normal working shifts daily and identify if any fishes are trapped behind the curtain. The coordination of the removal of any fish so trapped is the responsibility of EDCJV.

2.14.4. During freezing conditions, an excavator shall be used to break ice in and around the turbidity curtain area if required.

2.14.5. Typically, submersible pumps (2” - 6”) utilizing a fish screen on each piece of equipment will be used for maintenance dewatering and they will be placed in the low point of a given work site and installed above the invert of the waterway with the use of sand bags. If there is high turbidity, pre-filtering of inflow water may involve a perforated drum or culvert with clear stone around the outside of the pump (or other similarly effective approach) to restrict the volume of sediment being pumped.

2.14.6. The subcontractor shall carry out its construction operations so as to minimize impact on fish habitat and fish from both dewatering activities, fill placements and sedimentation. The subcontractor will abide by mitigation measures and best management practices outlined within DFO's online guidance materials entitled Measures to Avoid Causing Harm to Fish and Fish Habitat. Fish endangered by dewatering activities shall be relocated safely as described in Section 2.14.7.

2.14.7. As water levels drop in the work area the contractor shall monitor the deeper pool areas where fish are congregating and advise EDCJV. The subcontractor shall contact EDCJV should there be any issues with fish or if fish removal is required. EDCJV is to contact and inform PCA but EDCJV shall coordinate any and all fish rescue activities.

2.14.8. All in water work must be completed before March 15 to protect fish populations during their spawning and nursery periods. Should emergency work be required beyond this date, additional mitigation measures may be required based on site specific characteristics. In water work will not proceed beyond March 15 unless approval from EDCJV and PCA has been received well in advance of March 15.

2.14.9. Upon completion of work and prior to watering up dewatered areas, all debris shall be completely removed and the area shall be restored to its original state or better to the satisfaction of EDCJV.

2.14.10. Watering up of the worksite will follow an EDCJV prepared checklist of activities which will reflect the following considerations, among others:

- All construction material/debris is removed from are to be watered up
- Any excess sediment deposits have been removed and capped with clean washed rock if appropriate
- Fish timing windows for in-water work still apply
- Sediment control measures and exclusion fencing has been removed and in a manner that has prevented the escape or re-suspension of sediments

3.0 Equipment Refueling, Maintenance and Washing

All equipment will be cleaned of any excess surface oil, grease and dirt prior to their arrival on site. Equipment will kept in good working order. Equipment with any leaks will stop work until they are repaired. Each piece of equipment will have an emergency spill kit; in addition a spill kit capable of containing large spills (minimum 45 gallons) will be located at the access point (s) on the shore in a secured visible location. The spill kit shall be replenished as required. If items in the spill kit have been used, the "incidence" shall be reported to the EDCJV Project Manager regardless if it is reportable to the Spill Action Line.

The subcontractor will provide a list of equipment and fuel storages to be used on site to be examined by EDCJV to access that the quantity and capability of spill kits on site is satisfactory.

Designated areas will be established to allow concrete trucks to wash out after unloading and discharge their contents no closer than 20 meters from watercourse or wetland areas. The concrete sediments will also be disposed of at an approved waste handling facility.

Refueling of mobile equipment and trucks will be done no closer than 20 meters from a watercourse or wetland area. The operator of the equipment will be in a position to see that it is not overfilled. The fuel truck will have an emergency spill kit as well. Location of the refueling stations will be in four (4) designated areas, as determined by EDCJV.

No hazardous or deleterious substances shall be deposited in any watercourse or wetland area.

4.0 Environmental Spill Response

See Appendix C for the Environmental Spill Response Plan.

5.0 Fire Protection Contingency

There will be no burning of materials on the site. Construction debris will be picked up and placed in designated maintained dump boxes.

In the event of a fire, the subcontractor will notify the fire department immediately. The subcontractor will have fire extinguishers on site and will attempt to put out any fires that may break out as best possible. Fire extinguishers will be located in site pickup trucks, tool cribs, on equipment and in all office trailers. These fire extinguishers will be of type ABC 20-P5 or equivalent.

6.0 Education and Training

Prior to the start of the project, each worker will review the Environmental Management and Protection Plan as well as the Site Specific Environmental Management and Protection Plan with the subcontractor's site superintendent and/or foreman, during this review employees will be trained on their requirements for Species at Risk on site, spills and the Spill Response Plan as well as site specific environmental objectives and work impacts. During the initial Health & Safety weekly meeting for the project the EMPP and SSEMPP will be reviewed with all the subcontractor staff specific to that site. This Health & Safety weekly meeting will be held prior to the commencement of construction in the work site. All field staff joining the project once underway will review this plan as part of their site orientation.

Each subcontractor will be asked by EDCJV to acknowledge and sign off that they understand and will adhere to the contents of the SSEMPP prior to engaging in any work activities at the site.

Continuous training will be carried out in conjunction with the Health & Safety weekly meetings. The subcontractor's superintendent and foreman are responsible for this training.

A hard copy of the most recent revision of current Site Specific Environmental Management and Protection Plan must be available in the subcontractor's site construction trailer.

7.0 Inspection and Monitoring

As part of the Site Specific Environmental Management and Protection Plan, the subcontractor will assign qualified personnel (Site Superintendent, Foremen & Lead Hands) to the daily inspection of environment related items.

The Project Superintendent and/or Foremen will carefully monitor the adherence to this plan and advise management if any worker is working outside of this plan, or may cause damage to the environment as a result of his/her actions.

The site will be reviewed on a continuing basis for conformance with the SSEMPP. Additional reviews as required will be done prior to and after storm events to assess the suitability of the erosion control measures and to make adjustments to improve the effectiveness of the SSEMPP means, methods and infrastructure as installed.

The environmental management and protection plans contained in this document shall be continuously monitored by the CM during the execution of the works. PWGSC/PCA will be notified of any changes or additional activities that were not covered in the BIA dated 8/28/2017.

If during the execution of the works if the size and layout of the environmental controls provided in Appendix B appears to be inadequate, adjustments will be done on site to achieve the expected water quality outcomes. PWGSC/PCA will be notified of any required changes.

APPENDICIES

APPENDIX A NOISE AND AIR QUALITY MANAGAMENT PLAN

APPENDIX B SITE DRAWINGS

APPENDIX C SPILL RESPONSE PLAN

APPENDIX D EROSION AND SEDIMENT CONTROL PLAN

APPENDIX E ACCESS ROADS CONSTRUCTION AND MAINTENANCE

APPENDIX F TYPICAL DRAWINGS

APPENDIX G BEST MANAGEMENT PRACTICES FOR INVASIVE SPECIES AND SPECIES AT RISK

APPENDIX A
NOISE AND AIR QUALITY MANAGEMENT PLAN

Noise and Air Quality Management Plan

The subcontractor will require that all employees and subcontractors adhere to the following air quality principles:

- All equipment using internal combustion engines shall be maintained in such as manner as to minimize exhaust fumes (visible emission)
- Idling of equipment and vehicles is to be avoided
- Dust material being transported is to contained in covered haulage vehicles
- Release of dust generated by work being completed shall be minimized via vacuum equipment or wetting, any run-off caused by wetting will be captured by sediment control ditches and treated as stated in the Erosion and Sediment Control Plan
- Dust generated by travel on site roads shall be minimized using water or alternate approved means
- The disposal of combustible waste materials by burning is not permitted

The subcontractor will also ensure that all equipment and vehicles adhere to the following noise pollution reduction principles:

- All equipment must be in good operating condition, well maintained and look well maintained. Equipment shall meet EDCJV's high expectations with respect to serviceability, fluid tightness and exhaust emissions
- Exhaust systems shall function in a manner to control noise to within acceptable levels
- Avoid causing operating loud equipment when not required (compressors and related equipment, batch plants, etc.)
- Use equipment with sound shielding or dampening when possible
- Deploy or install sound barriers if required

APPENDIX B
SITE DRAWINGS

EDCJV
Building things that matter

No.	Description	By	Date
2	Issued for Comments	JF	10/08/17
1	Issued for Comments	JF	31/07/17
0	Issued for Comments	JF	18/07/17

Project:

Trent Severn Waterway:
Kirkfeild Bundle

Drawing:

Site C - Embankments:
Proposed Site Layout
Part 1

Scale:

Drawn By:
Jordan Feijoo

Project Number:
Chant: 161001
EllisDon: ED70236
PWSGC: EQ754-162678/001/PWL

- Access Gate
- Access Ramp
- Work Area Limits
- Reinforced Embankment Road
- Temporary Construction Road
- Clearing/Grubbing (except marked trees and certain delineated areas, exact limits will be as directed by EDCJV)
- MS Monitoring Station

Notes
1. Access Ramps and Gates
- Exact Access Ramps and Gate locations will be dependent on site conditions

2. Water Control
- Check dams will be installed in farm drainage trenches to control inflows from outside of Work Area Limits

3. Sediment Controls
- Sediment Fence will be installed on both sides of embankment roads and on the edge of the property line according to site conditions
- Chippings from grubbing will be used as erosion protection on stripped slopes (geotextile fabric will be available as a contingency plan should chipping be sparse)
- Flow Management Ditches will be strategically grubbed to allow for 6-10m of vegetation plug every 300m of ditch (distances between and size of vegetation plugs will be subject to site conditions, best fit locations will be dependent on vegetation cover/type)
- Sediment controls will be tested in small sections and assessed for effectiveness prior to full deployment
- All Access Ramps within the canal will be installed in the dry and removed prior to March 15 2018

Turbidity Curtains/Fences to create sediment control sections (Exact locations and type of barrier dependent on site conditions)

Sediment Treatment Facility (Site B & C)

N

Fencing

Durham Regional Road 50

No tree movement required

71.0 m

Thorah Side Rd

Concession Road 11

Potential leased area for laydown area, stockpile, etc.

Temporary local widening of dyke crest road

Erosion and sediment control measures at existing Site C culvert inlet/outlet (TBD)

Notes
4. Tree Protection
- Once trees to be retained have been identified they will be noted on site maps
- All tree protection to be installed past the drip line where trees do not overhang hard surfaces prior to the start of activities that could affect trees with no heavy machinery navigation through the tree protection zone permitted
- Small equipment will be permitted to navigate through open areas

5. Land Reclamation
- Seed mix will conform to specifications once determined
- Excavated areas will be re-graded to original profile or as determined by PCA
- Ditches will be re-instated using native species seeds

EDCJV
Building things that matter

No.	Description	By	Date
2	Issued for Comments	JF	10/08/17
1	Issued for Comments	JF	31/07/17
0	Issued for Comments	JF	18/07/17

Project:

Trent Severn Waterway:
Kirkfeild Bundle

Drawing:

Site C - Embankments:
Proposed Site Layout
Part 2

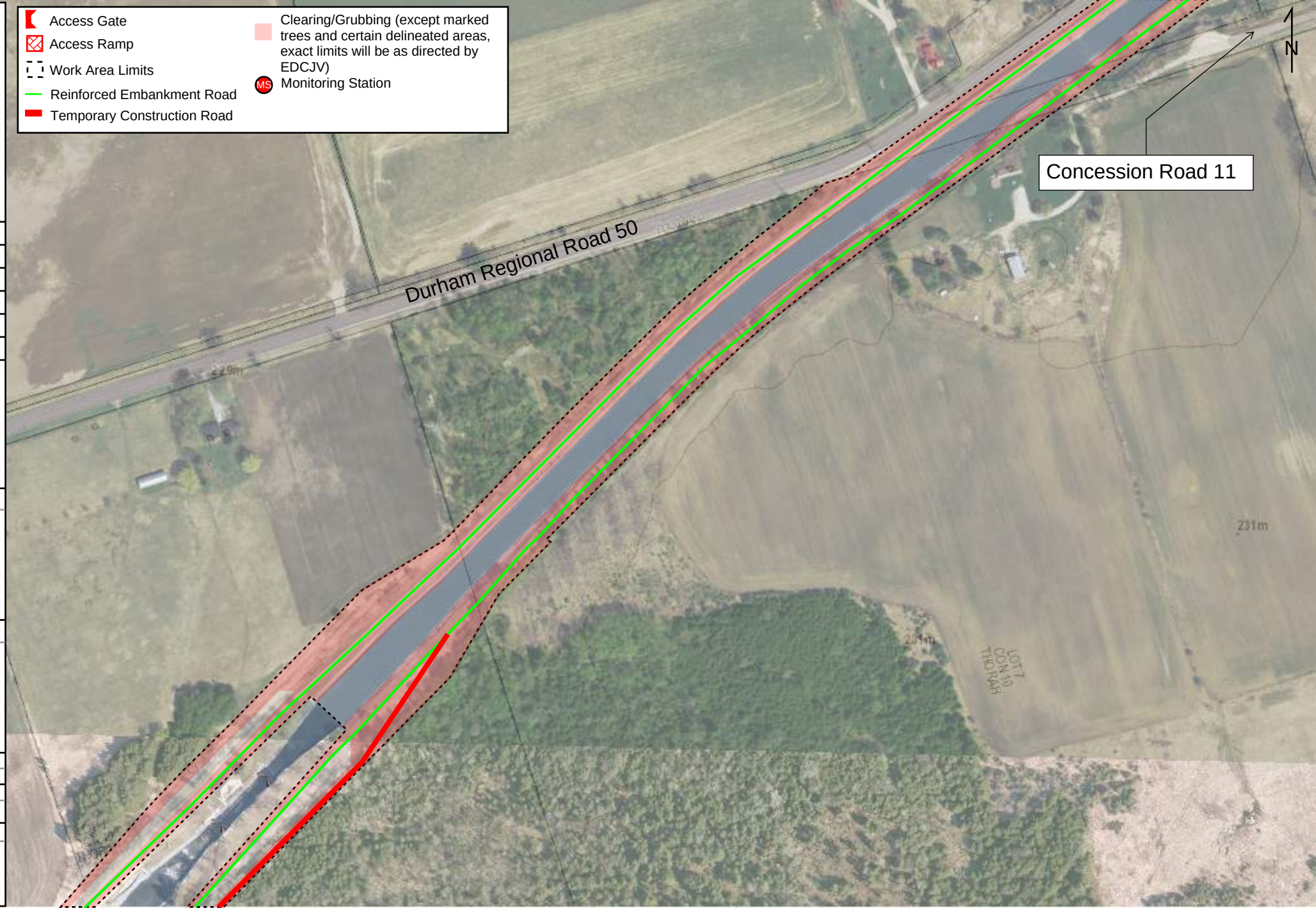
Scale:

Drawn By:

Jordan Feijoo

Project Number:

Chant: 161001
EllisDon: ED70236
PWSGC: EQ754-162678/001/PWL



EDCJV
Building things that matter

No.	Description	By	Date
2	Issued for Comments	JF	10/08/17
1	Issued for Comments	JF	31/07/17
0	Issued for Comments	JF	18/07/17

Project:

Trent Severn Waterway:
Kirkfeild Bundle

Drawing:

Site C - Embankments:
Proposed Site Layout
Part 3

Scale:

Drawn By:

Jordan Feijoo

Project Number:

Chant: 161001
EllisDon: ED70236
PWSGC: EQ754-162678/001/PWL

- Access Gate
- Access Ramp
- Work Area Limits
- Reinforced Embankment Road
- Temporary Construction Road
- Clearing/Grubbing (except marked trees and certain delineated areas, exact limits will be as directed by EDCJV)
- MS Monitoring Station

Notes:
- The Area between Locks 39 and 40 on the South side has been identified as Provincially Significant Wetland
- Additional Sediment Fences will be installed between the ditch and property

N

EDCJV
Building things that matter

No.	Description	By	Date
2	Issued for Comments	JF	10/08/17
1	Issued for Comments	JF	31/07/17
0	Issued for Comments	JF	18/07/17

Project:

Trent Severn Waterway:
Kirkfeild Bundle

Drawing:

Site C - Embankments:
Proposed Site Layout
Part 4

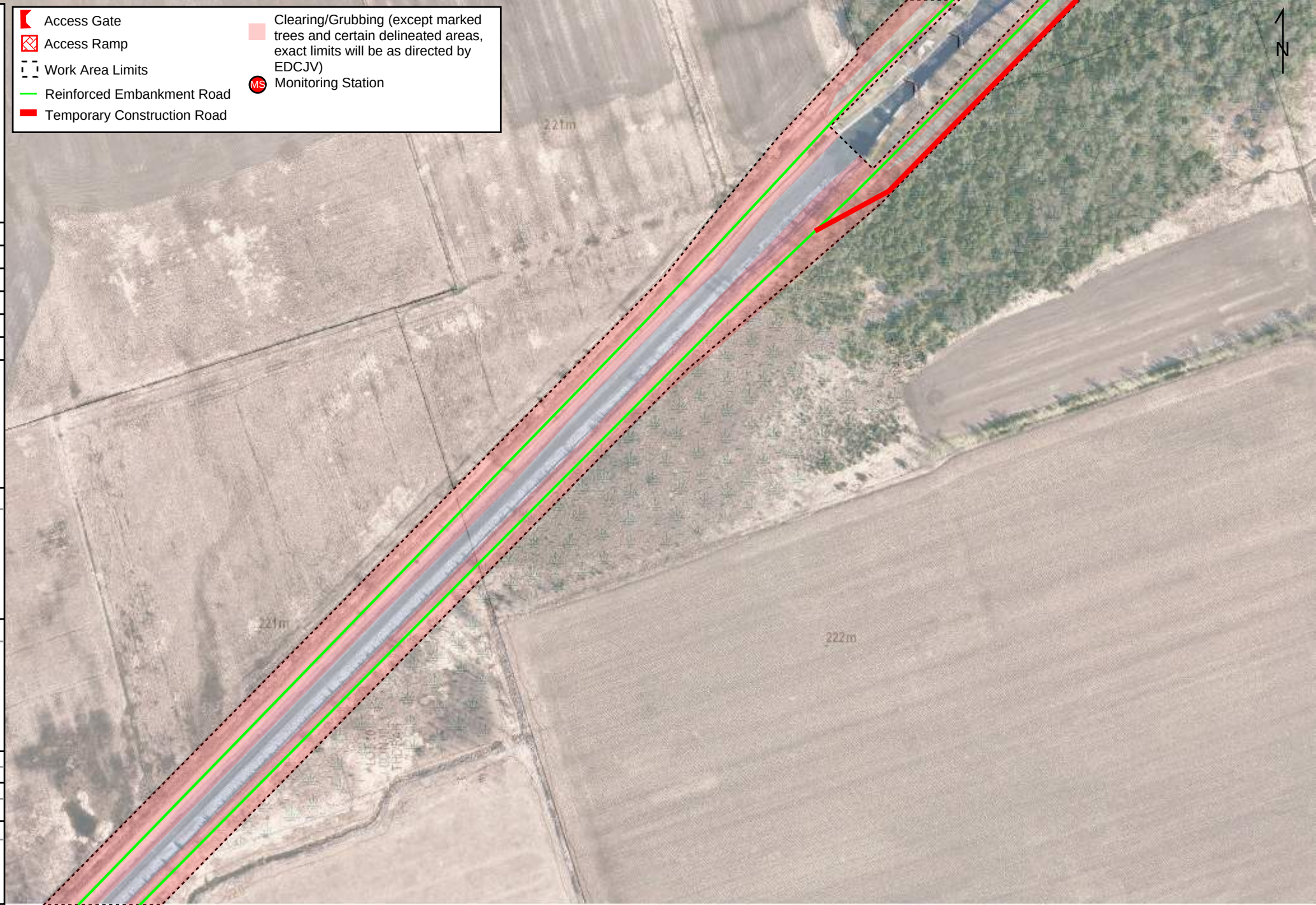
Scale:

Drawn By:

Jordan Feijoo

Project Number:

Chant: 161001
EllisDon: ED70236
PWSGC: EQ754-162678/001/PWL



EDCJV
Building things that matter

No.	Description	By	Date
3	Issued for Comments	JF	11/02/17
2	Issued for Comments	JF	10/08/17
1	Issued for Comments	JF	31/07/17
0	Issued for Comments	JF	18/07/17

Project:

Trent Severn Waterway:
Kirkfeild Bundle

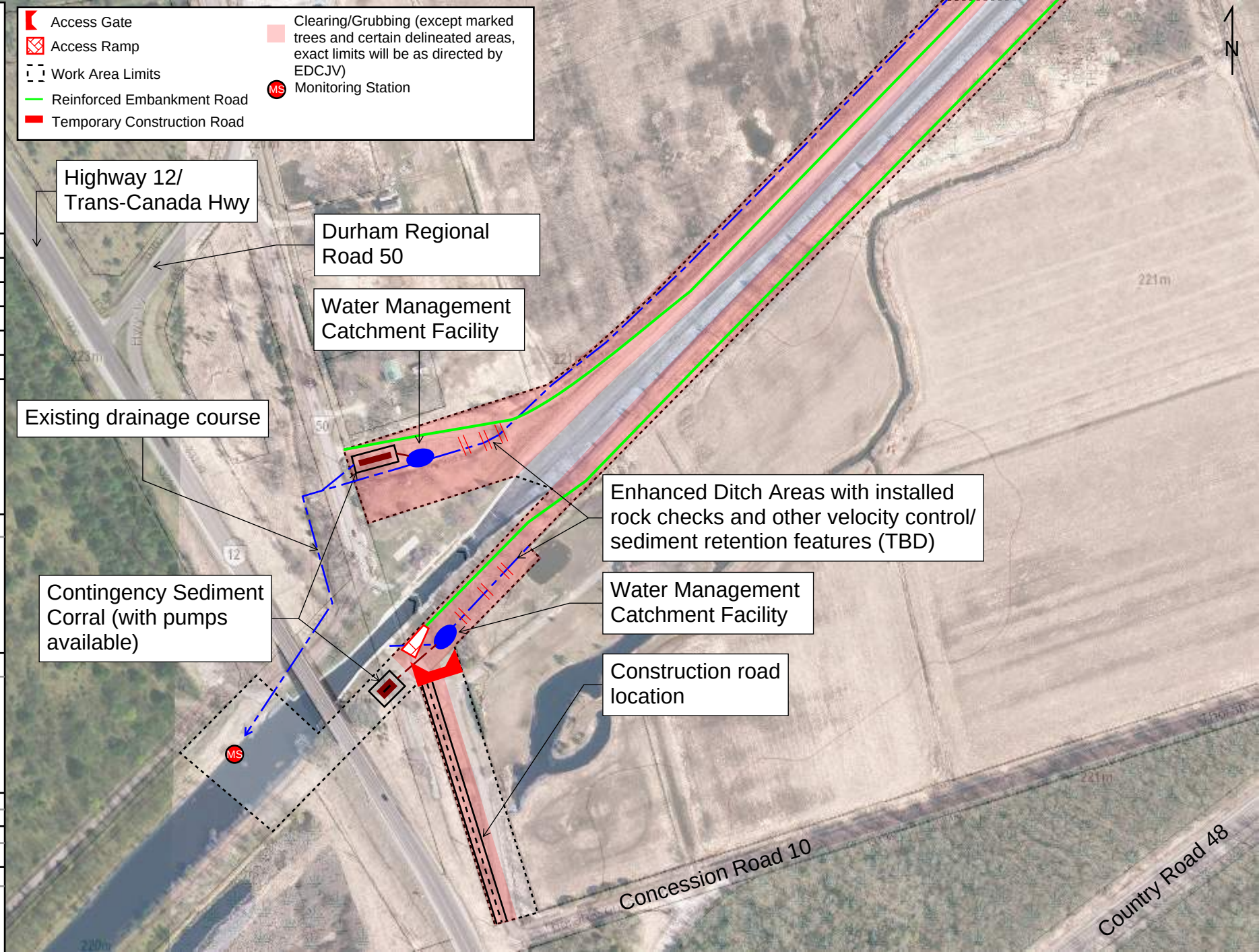
Drawing:

Site C - Embankments:
Proposed Site Layout
Part 5

Scale:

Drawn By:
Jordan Feijoo

Project Number:
Chant: 161001
EllisDon: ED70236
PWSGC: EQ754-162678/001/PWL



EDCJV
Building things that matter

No.	Description	By	Date
2	Issued for Comments	JF	10/08/17
1	Issued for Comments	JF	31/07/17
0	Issued for Comments	JF	18/07/17

Project:

Trent Severn Waterway:
Kirkfeild Bundle

Drawing:

Site C - Embankments:
Proposed Site Layout
Talbot Earthdams

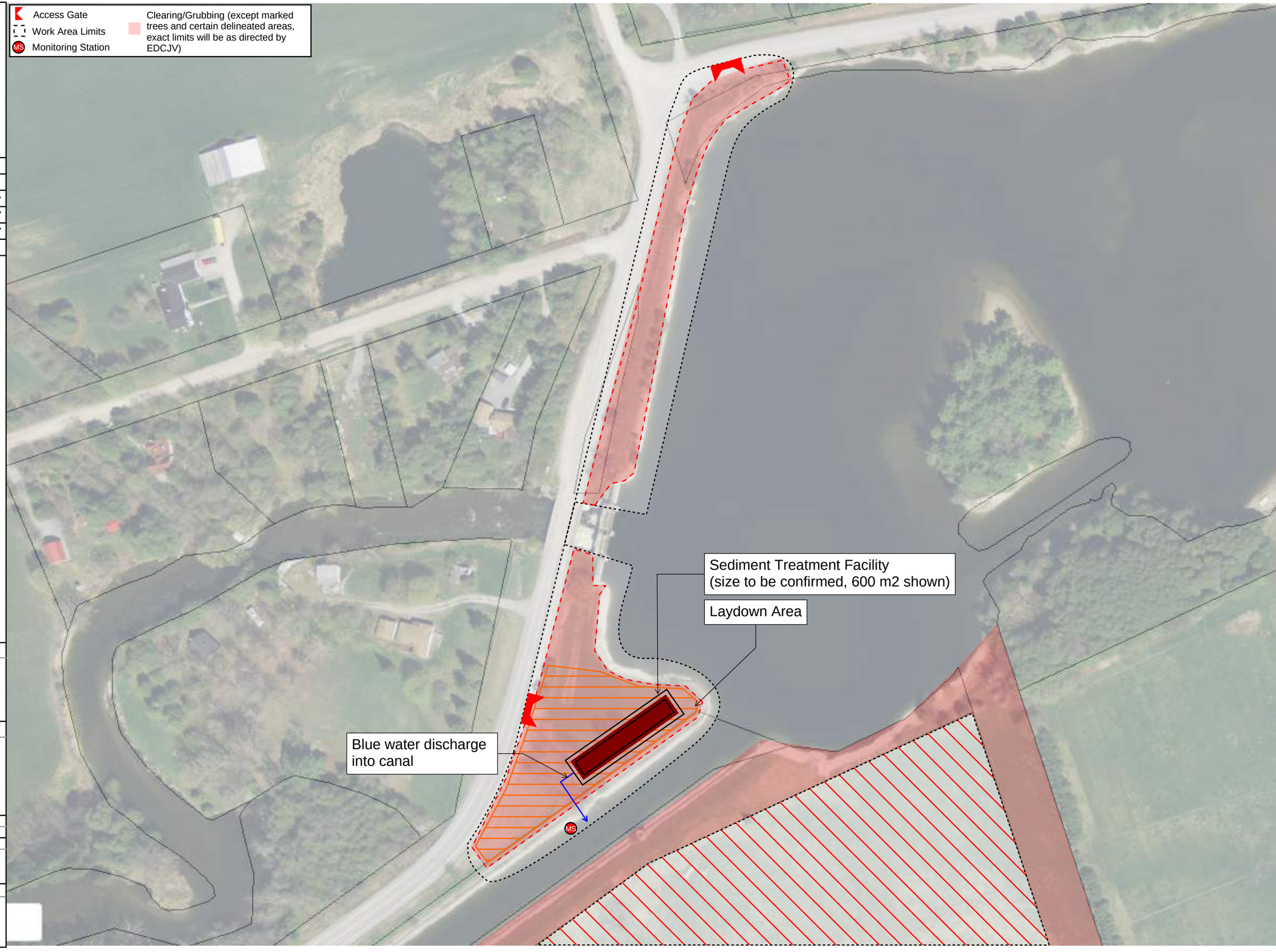
Scale:

Drawn By:

Jordan Feijoo

Project Number:

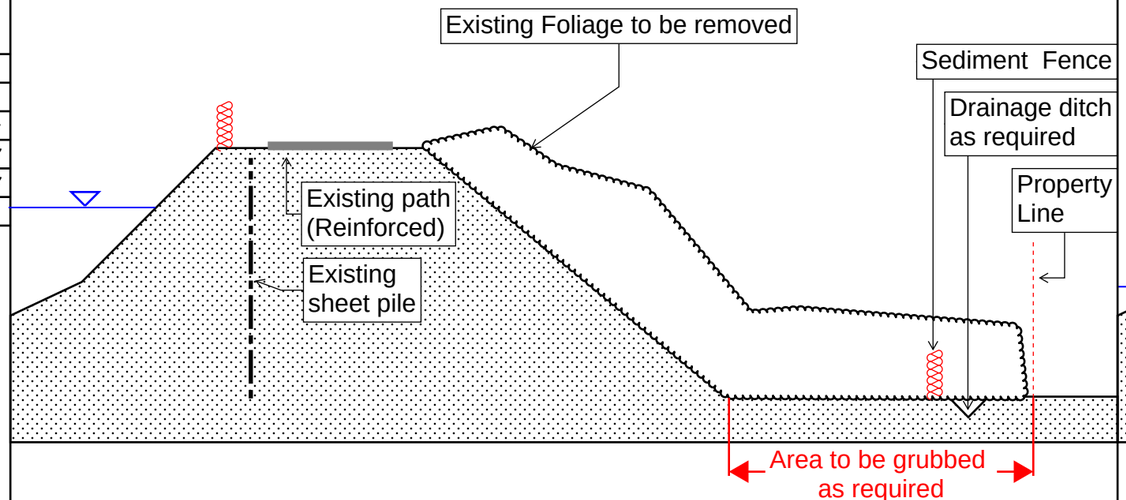
Chant: 161001
EllisDon: ED70236
PWSGC: EQ754-162678/001/PWL



EDCJV
Building things that matter

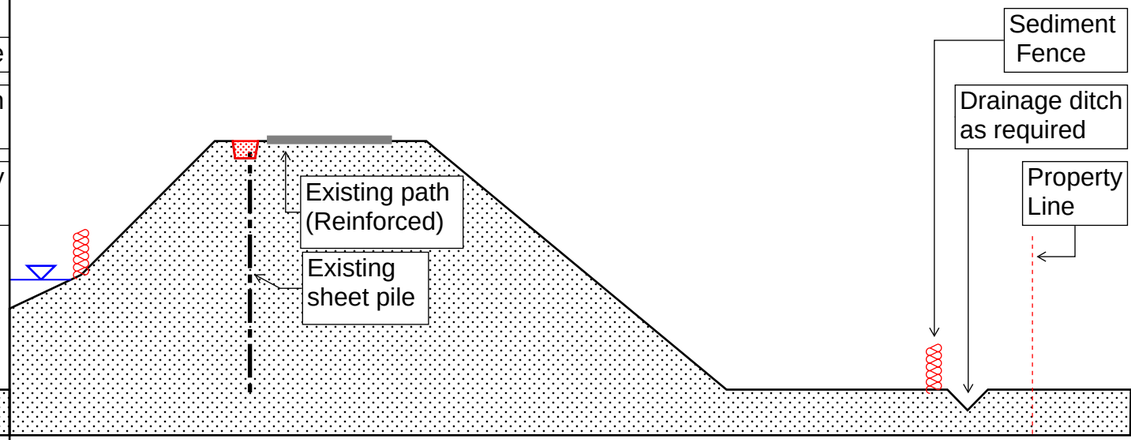
No.	Description	By	Date
2	Issued for Comments	JF	10/08/17
1	Issued for Comments	JF	31/07/17
0	Issued for Comments	JF	18/07/17

Typical Cross Section Phase 1 (between Locks)



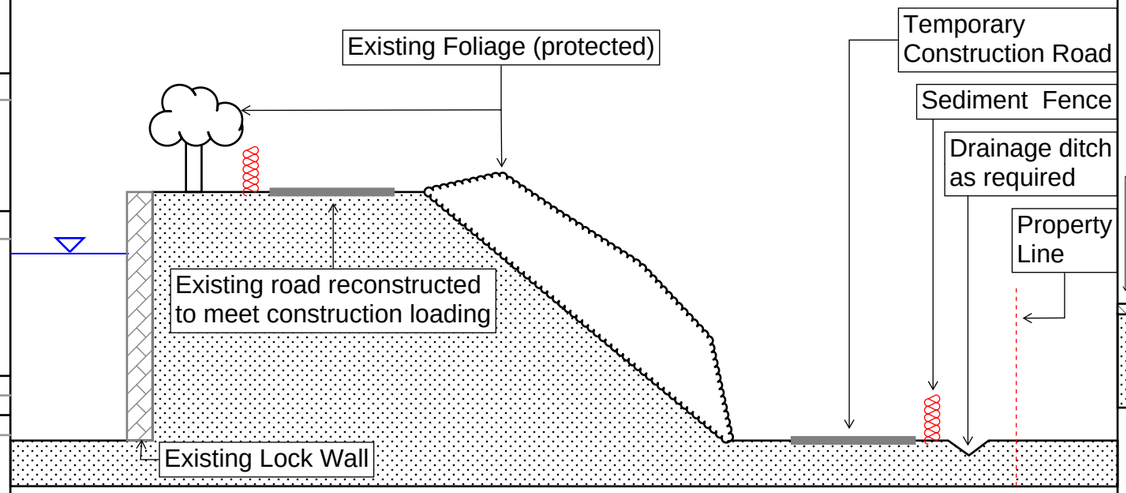
Note: Sediment Fence placement will be subject to field conditions

Typical Cross Section Phase 2 (between Locks)



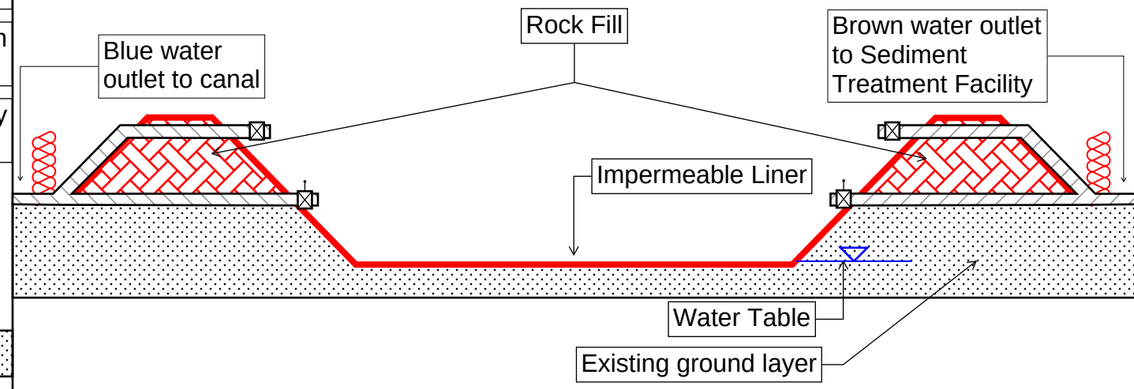
Note: Sediment Fence placement will be subject to field conditions

Typical Cross Section Phase 1 & 2 (Lock areas)



Note: Sediment Fence placement will be subject to field conditions

Typical Cross Section Water Management Catchment Facility



☒ Valve
☒ Valve with extended operator

Note: Sediment Fence placement will be subject to field conditions

Project:
Trent Severn Waterway: Kirkfeild Bundle

Drawing:
Site C - Embankments: Typical Cross sections Part 1

Scale:

Drawn By:
Jordan Feijoo

Project Number:
Chant: 161001
EllisDon: ED70236
PWSGC: EQ754-162678/001/PWL

EDCJV
Building things that matter

No.	Description	By	Date
2	Issued for Comments	JF	10/08/17
1	Issued for Comments	JF	31/07/17
0	Issued for Comments	JF	18/07/17

Project:

Trent Severn Waterway:
Kirkfeild Bundle

Drawing:

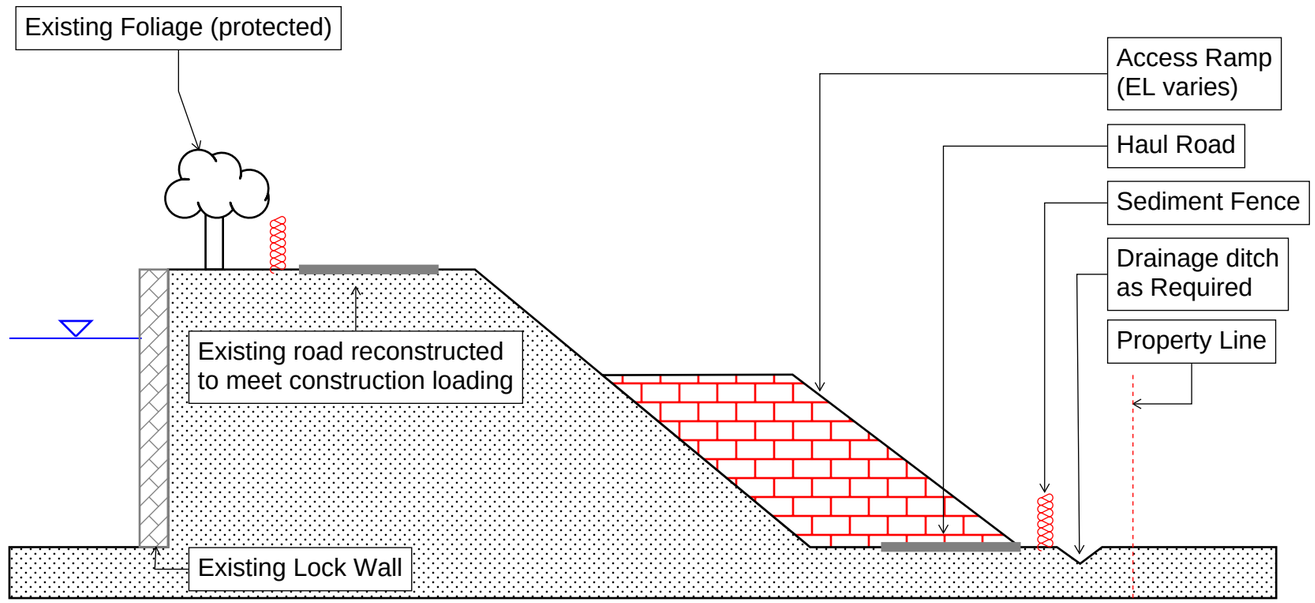
Site C - Embankments:
Typical Cross sections
Part 2

Scale:

Drawn By:
Jordan Feijoo

Project Number:
Chant: 161001
EllisDon: ED70236
PWSGC: EQ754-162678/001/PWL

Typical Access Ramp Cross Section (Lock areas)

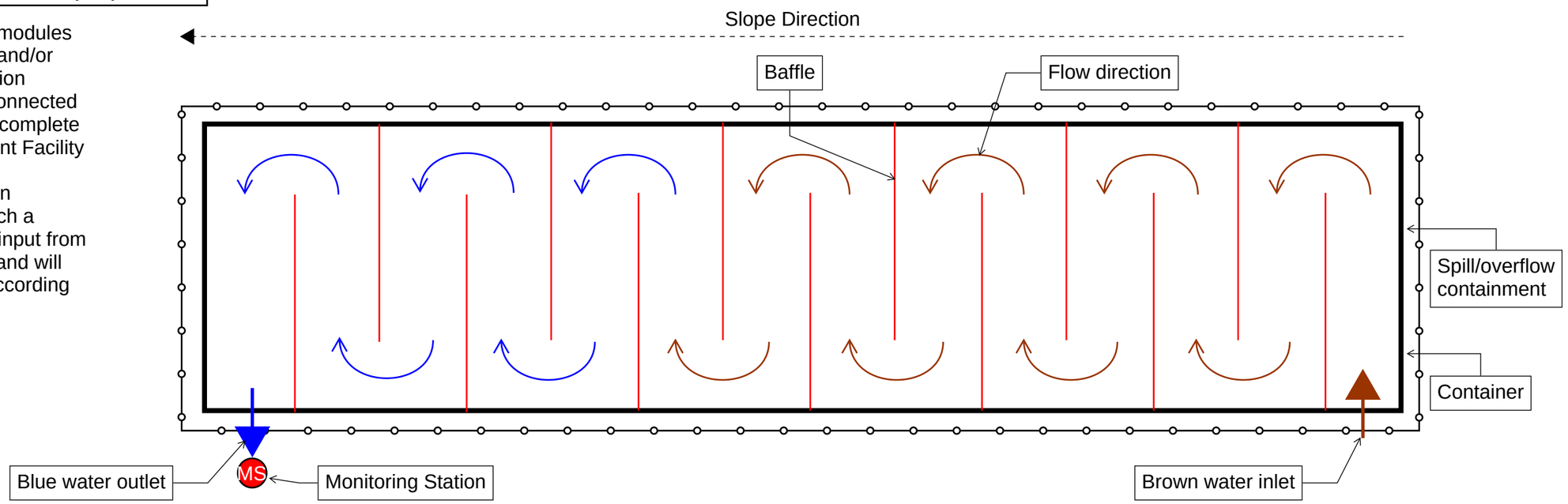


Note: Sediment Fence placement will be subject to field conditions

Typical Sediment Treatment Facility Sketch (requires design and subcontractor input)

NOTE: Additional modules containing baffles and/or other settling/filtration systems may be connected together to form a complete Sediment Treatment Facility

The final orientation /composition of such a facility will require input from the subcontractor and will be implemented according to site conditions



APPENDIX C
SPILL RESPONSE PLAN

SPILL RESPONSE PLAN

Spill response kits will be kept and maintained on site. The subcontractor will ensure that all personnel on-site will be trained in the use of the spill control and response procedures, including spill source and receptor recognition, spill prevention techniques and spill reporting protocols. Spill response will be specifically identified in the Emergency Response Plan which will be posted in the subcontractor site office and all temporary offices. The subcontractor will ensure that adequate additional response resources (labor, equipment and materials) are available in case of a spill.

The Ontario Ministry of Environment and Climate Change Spills Action Center, (1-800-268-6060) shall be immediately notified of any spills occurring on site.

Spill kits will be located at the site tool storage container for each individual site in addition to the spill kits within site equipment. All workers will be made aware of the location of the spill kits. Spill kits will be immediately replenished when required by the subcontractor. In the event any of the contents of a spill kit are required to be used, the incident will be immediately reported to EDCJV. Any and all incidents or spill "close calls" must also be reported to EDCJV. It is the responsibility of EDCJV to immediately report any such incidents to PCA.

The following is the procedure and steps to be taken by any the subcontractor in the event of a spill of a regulated substance on the Project:

- Use absorbent material to soak up the spill
- Place containment material in an approved containment device or structure
- Call a supervisor immediately. The subcontractor Supervisor will contact the Spill Action Centre (1-800-268-6060) and notify the EDCJV Project Manager who will contact PCA.
- Try to contain the spill from spreading by banking with earth, sand or other such materials. Avoid excavating surrounding materials for this purpose.
- Plug or stop the cause of the spill if this can be done safely.
- If the spill cannot be stopped contact the subcontractor Supervisor or EDCJV directly. Employees may also contact the Spill Action Centre directly. Be prepared to tell the location, the amount and type of material spilled. Alert the subcontractor Project Manager.
- Spills of any size shall be reported to EDCJV who will inform PCA.

Information on regulated or hazardous materials in use on the Project including all MSDS are located in the subcontractor site office trailer. If any new regulated or hazardous substances are introduced during the Project time line they will be added to the MSDS Binder.

APPENDIX D
EROSION AND SEDIMENT CONTROL PLAN

Erosion and Sediment Control Plan

The subcontractor will manage the existing stream flows and other water inflows within the construction zone and control all construction work activities so as there is no release of sediment or other deleterious material into waterbodies. Onsite existing drainage patterns will be maintained during construction whenever possible and only altered when absolutely required.

The primary tools to accomplish the Project's erosion and sediment control objectives are geotextile sediment fence barriers, turbidity curtains and other effective proven erosion and sediment control measures. Prior to the commencement of work all planned erosion and sediment control measures will be installed and commissioned. See Appendix B for the locations of planned erosion and sediment control features.

Erosion and sediment measures will be inspected and maintained by the subcontractor on a daily basis and immediately after rainfall, snow fall and other significant weather events to ensure they are functioning properly. Should erosion and sediment control measures not be functioning adequately work shall cease until the identified problem(s) is addressed to the satisfaction of EDCJV. Any breaches or other failures of the erosion and sediment control features will be repaired immediately. An extra supply of sediment barrier will be kept on site for use in emergency situations.

Turbidity and pH shall be monitored and tested daily at each of the identified (see Appendix B) Monitoring Stations. Daily Readings will be recorded by the subcontractor and provided to EDCJV on a next day basis. EDCJV Staff will conduct additional monitoring as a performance check and log the results of the tests.

Control facilities shall be designed and implemented in adequate numbers and size as required to ensure that **released water quality** is consistent with the following:

- The maximum increase in turbidity shall not exceed 8 Nephelometric Turbidity Units (NTU) over background levels for short term exposure (24 hour). Maximum average increase in turbidity shall not exceed 2 NTU over background levels for longer term exposures (30 day period). This NTU criteria is the primary compliance standard relied upon by PCA.

- The maximum increase of suspended solids shall not exceed 25 mg/L over background levels during any short-term exposure period (24 hours). For longer term exposure (30 days or more) average suspended sediment concentrations shall not be increased by more than 5 mg/L over background levels. This compliance standard shall be implemented at the discretion of EDCJV should NTU testing exceed the limits described above. Testing for suspended solids requires the use of a certified laboratory. EDCJV will be responsible for taking the water samples in an approved manner, delivering them to the designated laboratory and communicating test results to PCA.

- pH levels shall be between 6.5 and 7.5 pH units. pH adjustment measures shall be taken if pH levels change more than 1.0 pH unit measured to an accuracy of 0.2 pH units from the background level or is recorded to be below 6.0 or above 9.0 pH units.

The location and frequency of monitoring may be altered based on final water management configurations.

A Daily Diary dedicated to erosion and sediment control facilities and readings will be maintained by the subcontractor during the construction project and will be submitted daily for review by the EDCJV Project Manager. A weekly report will be provided by EDCJV to PCA. PCA will have access to monitoring records anytime upon request.

All disturbed areas of the work site shall be stabilized immediately following work and revegetated as soon as conditions allow. Exposed areas should be covered with erosion control blankets (jute mat) or other protective measures (wood chips/chippings/mulch, etc.) to keep the soil in place and prevent erosion until successfully vegetated. Erosion and sediment control features shall not be removed until after vegetation (or other permanent erosion and sediment control features or devices) has been established to the satisfaction of EDCJV.

Wood chippings/mulch will be locally generated and applied evenly in a 50 mm – 75 mm layer (equivalent to 13,500 kg/ha). The effectiveness of the chipping/mulch layer will be monitored.

Staging areas and access roads shall be kept in good condition with positive drainage to prevent the pooling of water and the development of mudded areas.

A Turbidity Curtain will be installed if required (to be determined in the field based on conditions and final constructability means and methods). The functionality of the turbidity curtain will be monitored daily and should they become dislodged or submerged they will be repaired by the subcontractor accordingly.

Sites will have a designated stockpiling area for native and/or imported fills, permanent or waste materials. Once these areas have been determined they will be shown in Appendix B. The onsite stockpiling locations have been assigned to areas furthest from waterbody to prevent the possibility of stockpile runoff entering the waterbody.

Geotextile sediment fence will be installed around any stockpiled materials. The locations of stockpiling and staging areas on the drawings are approximate.

The embankment leaks upstream of Lock 40 will be monitored for void development, slope failure and erosion development. The area will be evaluated for mitigation measures, either to plug the flow if possible or divert the water and manage the resulting flow.

Sediment and erosion measures will be implemented around culvert outlet upstream of Lock 39, the nature of these measures will be determined by site conditions in the area.

Flow management ditches will be used to control surface water flows when wet and sediment dispersion when dry. The bed of these management ditches will be protected by retaining existing organic material along the surface of the ditch supplemented with geotextile material as required where native material is limited and/or sparse.

Flow management ditches will be grubbed strategically to retain portions of vegetation in place to act as sediment check dams hereafter referred to as vegetation plugs. The final arrangement and length of vegetation plugs along the ditch will depend on site conditions, positioning and plug length will be adapted to flow conditions. Should vegetation plugs not be adequate to achieve the desired results additional approved check dams will be installed.

Rock baffles or check dams may be installed in flow management ditches if currents within the ditch are assessed to be too fast and/or are causing damage to the ditches.

A storm water management catchments will be installed on the North and South bank downstream of Lock 41 to be used to avoid ditch overtopping or as an additional sediment settling pond. A contingency sediment treatment facility will be available in the same locations to be used if ditch turbidity or sediment load is excessive.

Water levels and ditch water content (turbidity, suspended solids/sediment load and pH) on the northern side of the canal will be monitored as fluctuation is expected based on nearby farm drainage patterns and historical evidence. Sediment fence will be placed on both sides of the northern embankment road in order to reduce sediment entering the ditches.

The effectiveness of the vegetation plugs and rock check dams will be assessed in a small section (between 500 – 1000 m) and confirmed effective prior to complete deployment along the ditches.

A sediment treatment facility will be installed on the northern embankment adjacent to the Talbot Dam, this facility will be used by the works at Sites B & C. Size and exact location of the sediment treatment facility will be dependent on site conditions. If required an additional sediment facility may be installed on the southern side of the canal adjacent to the access ramp.

The configuration and function of the sediment treatment facilities will be dependent on the makeup of the sediment present, the exact configuration will be determined based on site conditions:

- Large particles such as sand or gravel will be treated using sediment traps, bags or settling ponds
- Fine particles such as clays or silts will be treated using advanced methods such as flocculation-filtration or filtration press

If multiple sizes of particles require treatment, facilities will be configured in series to settle out large particles prior to treating the water for fine particles.

Disturbance/sedimentation of clays present in the work area will be avoided to minimize suspension of clays within the water at site.

Water containing sand used during winter works for road maintenance will be captured and treated. Methods for capture include geotextile sediment fencing, earthen berms to direct water to the sediment control ditches, pre-melt snow removal or other techniques as determined by EDCJV in consultation with PCA.

APPENDIX E
ACCESS ROADS CONSTRUCTION AND MAINTENANCE PLAN

Access Roads Construction and Maintenance Plan

The location of security fencing is shown in Appendix B. The temporary fence will be 1.8 m high steel welded wire fabric on a rigid steel frame.

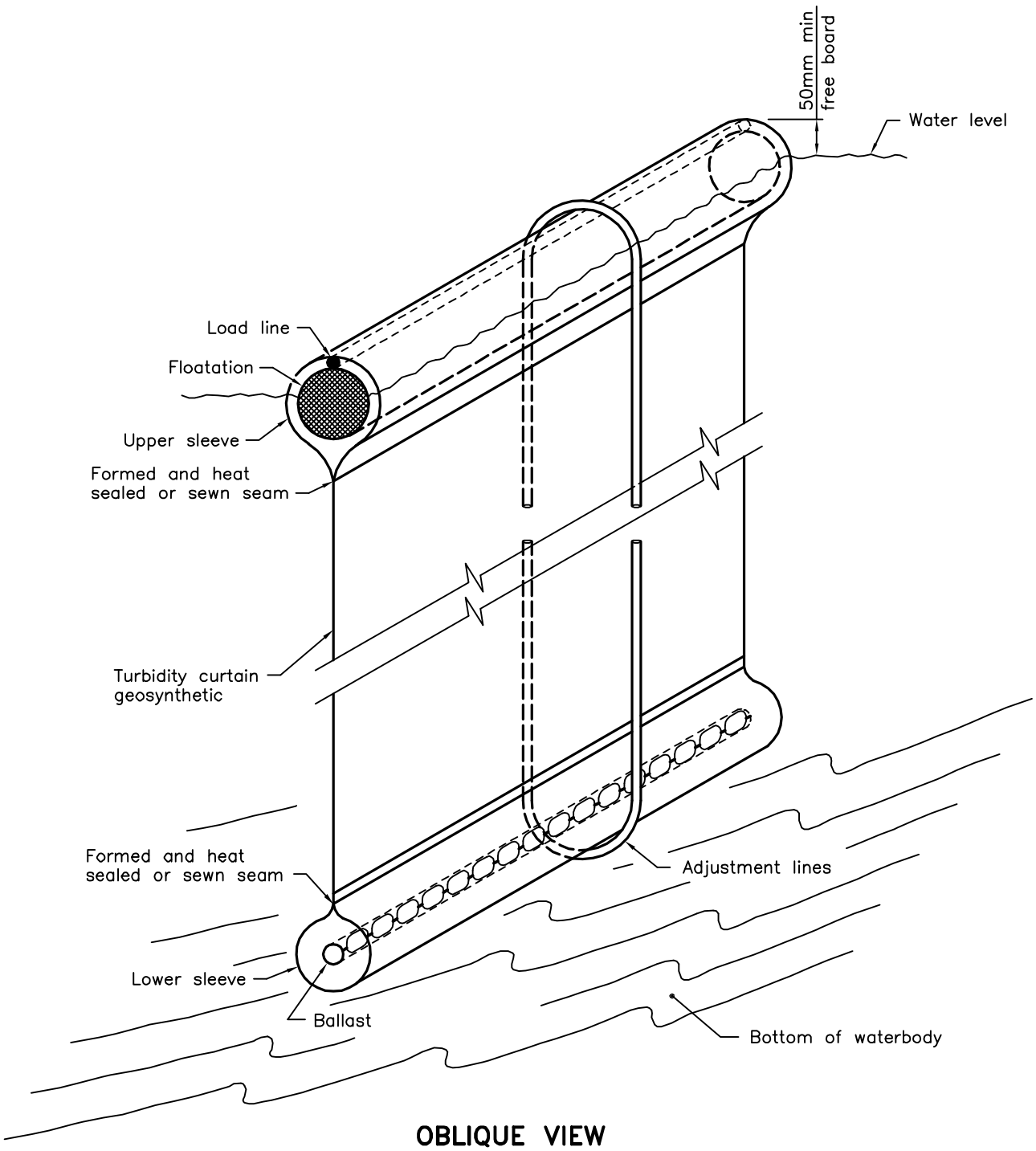
Points of access are also shown in Appendix B. Upon completion of the Work and the removal of any temporary surface protection required for site access, areas damaged by construction processes will be repaired to an equal to or better than as-found condition with topsoil and sod by the subcontractor as per the Subcontract Documents. Damaged hard surfaces shall be repaired to a similar equal to or better standard.

During winter time operations snow accumulation will be managed onsite by subcontractor personnel. Local Roads will be monitored by subcontractor personnel and cleaned of any mud tracked onto the running surfaces to the satisfaction of EDCJV.

PCA roads and all internal site access roads will be cleared of snow by the subcontractor through the use of appropriate equipment and if required by hand. De-icing salts will not be used on the project site and instead sand will be spread or the road surface scarified on all access roads and work areas as required. Snow containing salt or sand shall never be dumped in, or allowed to melt and run off into a waterbody. Water containing sands will be captured and treated as stated in the Erosion and Sediment Control Plan.

For completeness, certain areas may be hoarded with the use of insulated tarps over timber or steel framed structures and/or rental equipment and will be heated with diesel powered frost-fighter heaters or equivalent. Non-hoarded work areas will be kept free from snow accumulation by use of equipment or by hand.

APPENDIX F
TYPICAL DRAWINGS



OBLIQUE VIEW

NOTES:

A All dimensions are in millimeters.

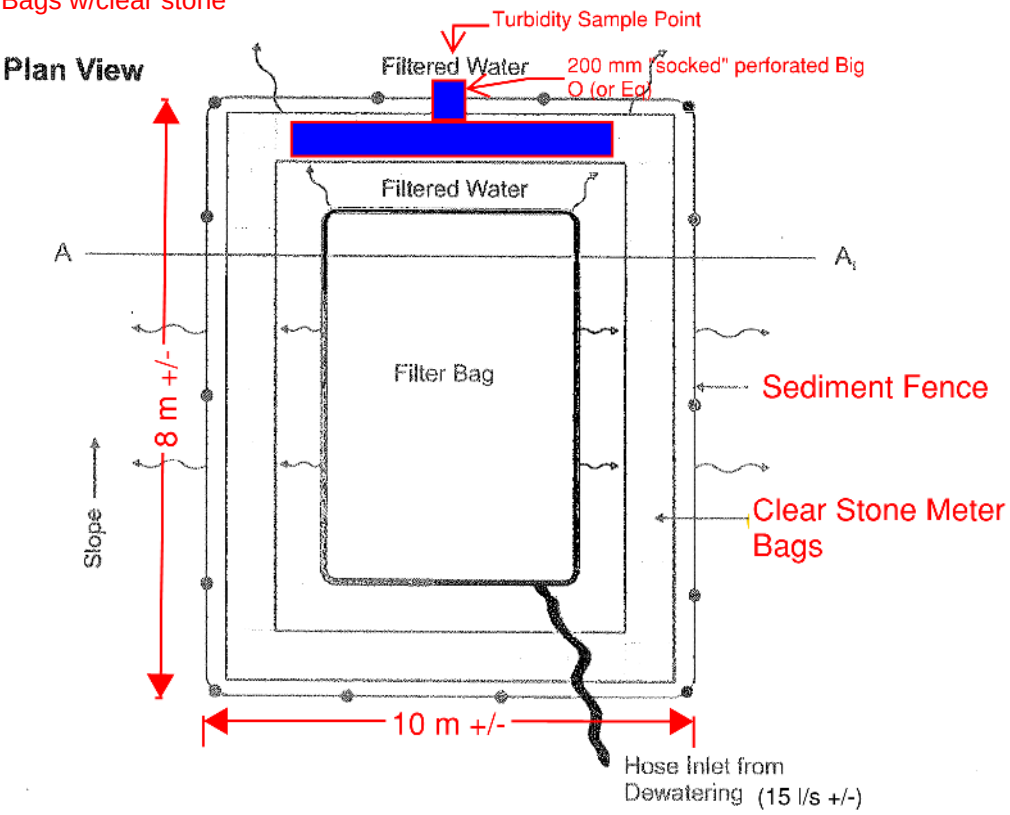
ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2015	Rev	2
TURBIDITY CURTAIN SEAM DETAIL			
	OPSD 219.261		

De-watering Corral

*To be used only if field conditions dictate that it's required

Cross Section

Plan View



terrafix®
geosynthetics inc.

Product Description Sheet
Terrafix 360R
NONWOVEN ENVIROBAG

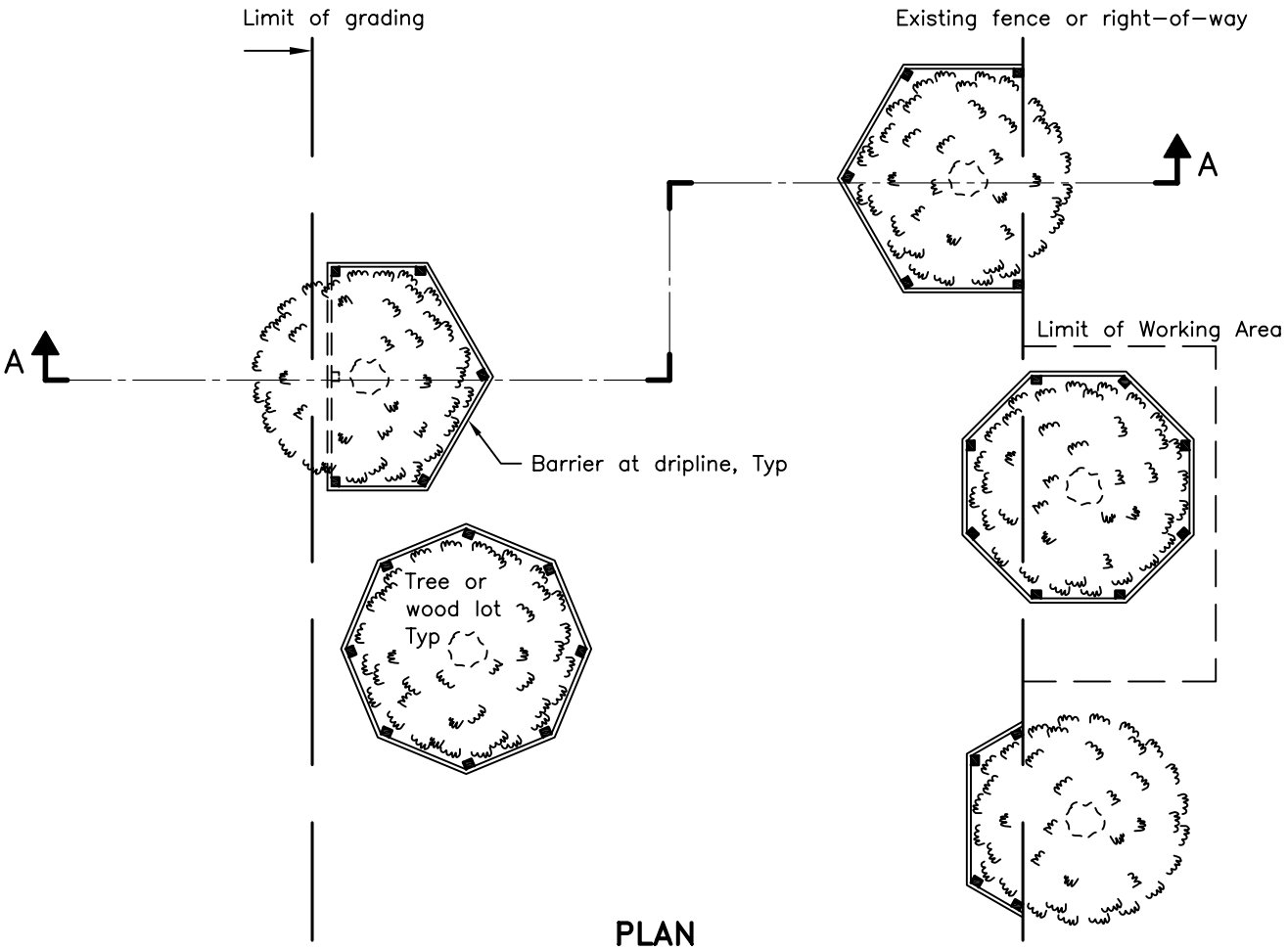
Terrafix 360R ENVIROBAGS are composed of a needle-punched nonwoven geotextile made of 100% polypropylene staple fibers, which are formed into a random network for dimensional stability. Terrafix 360R ENVIROBAGS resists ultraviolet deterioration, rotting, biological degradation, naturally encountered basics and acids. Polypropylene is stable within a pH range of 2 to 13. Terrafix 360
R) ENVIROBAGS conforms to the physical property values listed below:

PROPERTY	TEST METHOD	UNIT	M.A.R.V. (Minimum Average Roll Value)
Weight (Typical)	ASTM D 5261	oz./yd.^{2} (g/m^2)	6.0 (203)
Grab Tensile	ASTM D 4632	lbs. (kN)	160 (0.711)
Grab Elongation	ASTM D 4632	%	50
Trapezoid Tear Strength	ASTM D 4533	lbs. (kN)	60 (0.267)
CBR Puncture Resistance	ASTM D 6241	lbs. (kN)	410 (1.82)
Permittivity*	ASTM D 4491	sec^{-1}	1.5
Water Flow*	ASTM D 4491	gpm/ft.^{2} (l/min/m^2)	110 (4480)
AOS*	ASTM D 4751	US Sieve (mm)	70 (0.212)
U.V. Resistance	ASTM D 4355	%/hrs.	70/500

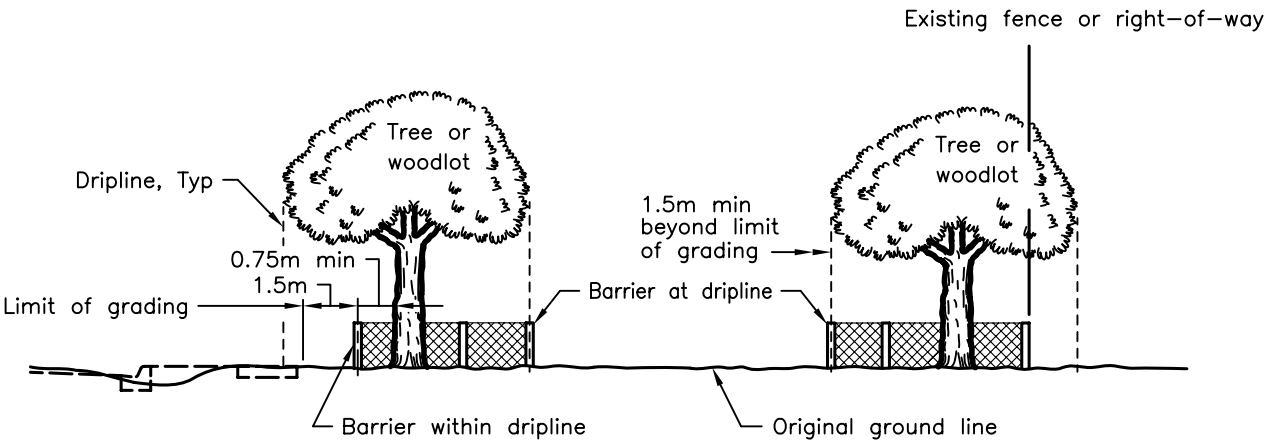
* At the time of manufacturing. Handling may change these properties.

Terrafix Geosynthetics Inc
455 Horner Avenue
Toronto, ON
M8w 4W9,

www.terrafixgeo.com

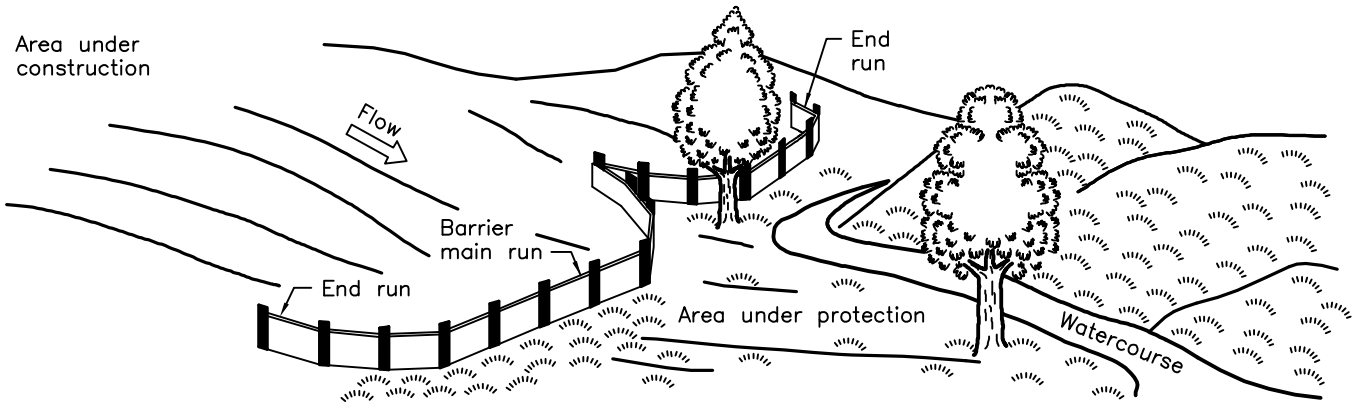


PLAN

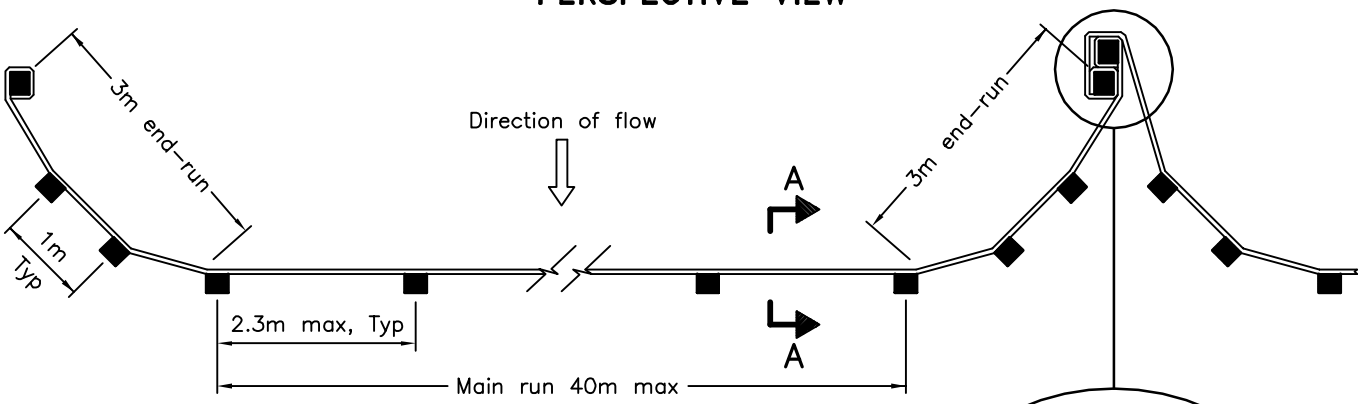


SECTION A–A

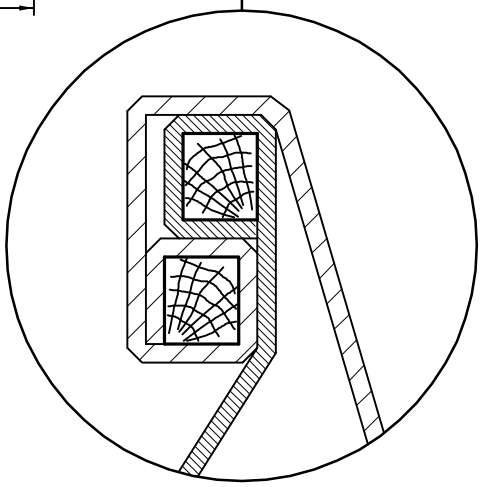
ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2007	Rev	0
BARRIER FOR TREE PROTECTION			
	OPSD 220.010		



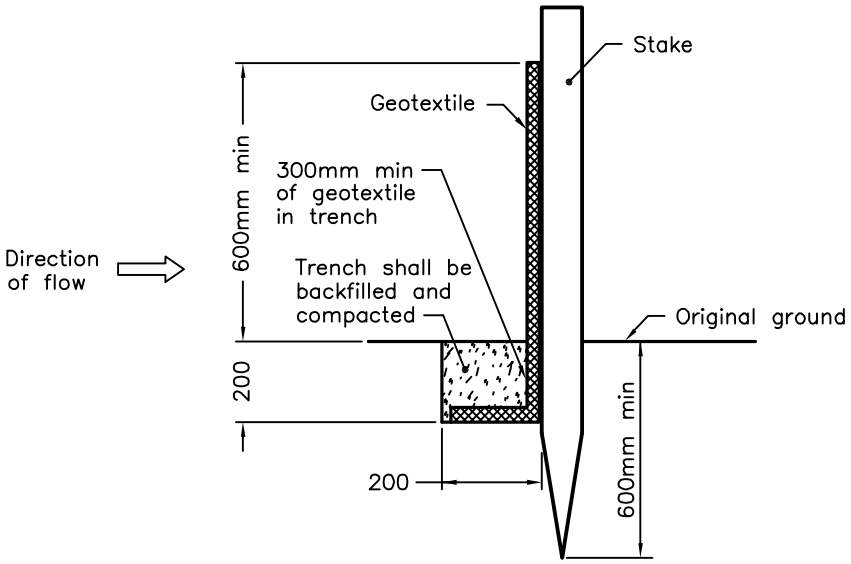
PERSPECTIVE VIEW



PLAN



JOINT DETAIL

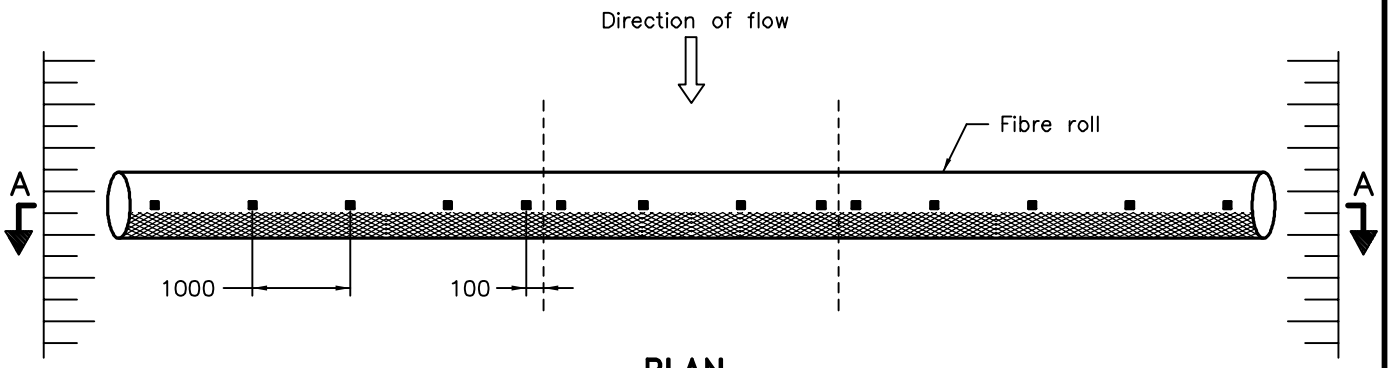


SECTION A–A

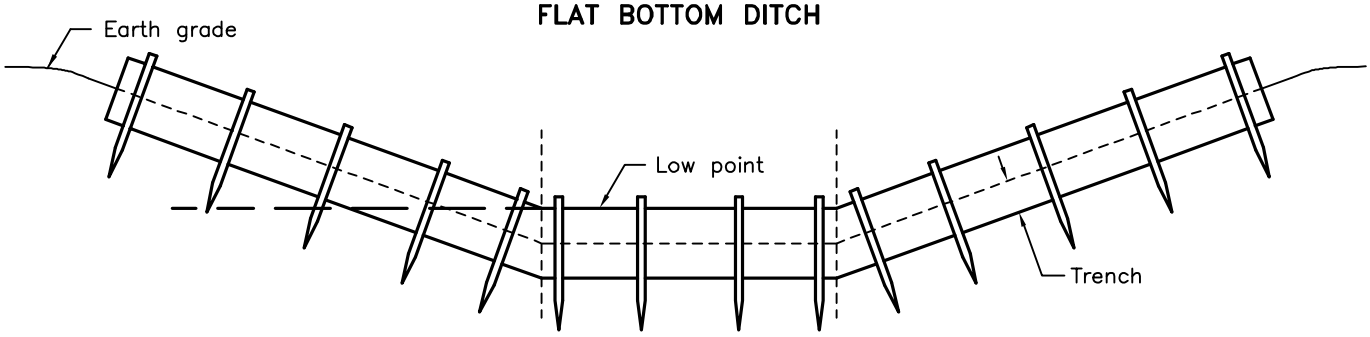
NOTE:

A All dimensions are in millimetres unless otherwise shown.

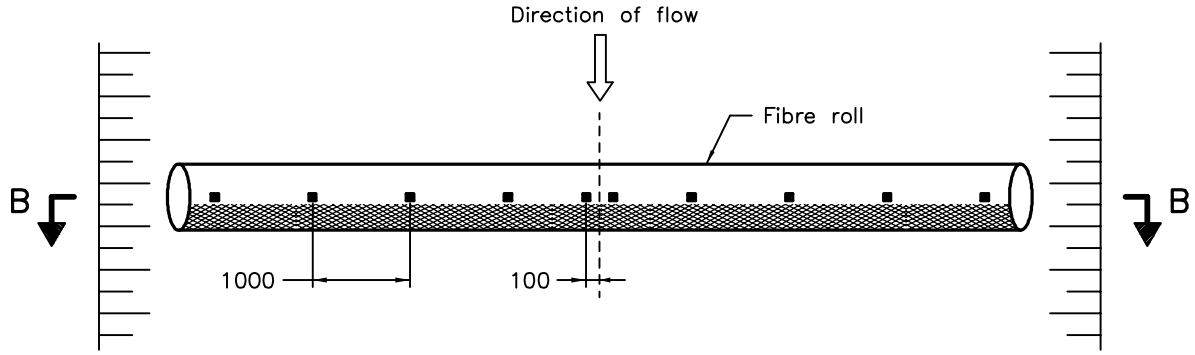
ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2015	Rev	2
LIGHT-DUTY SEDIMENT FENCE BARRIER			
	OPSD 219.110		



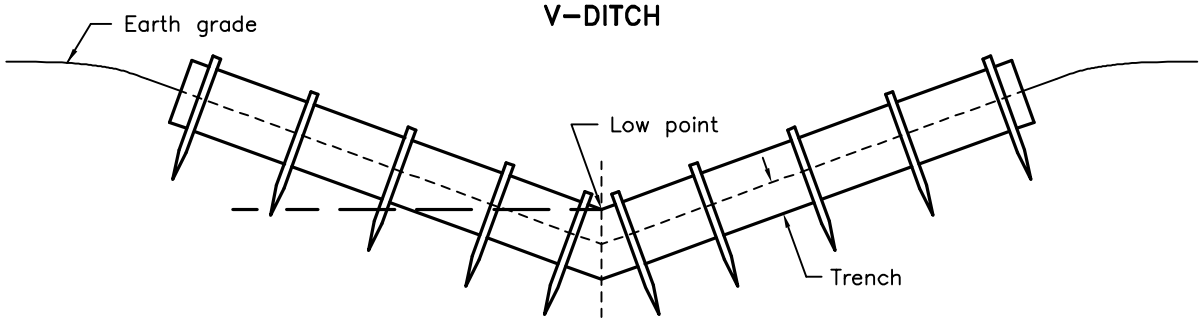
PLAN
FLAT BOTTOM DITCH



SECTION A–A



PLAN
V–DITCH



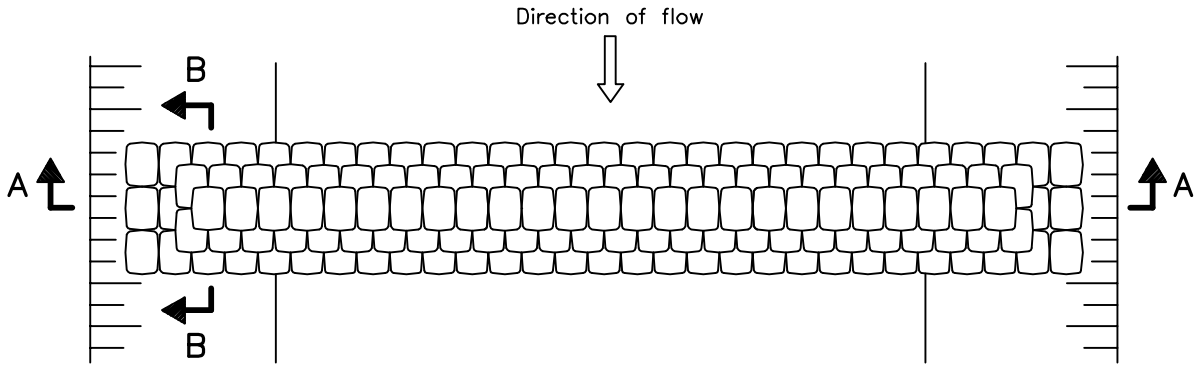
SECTION B–B

NOTES:

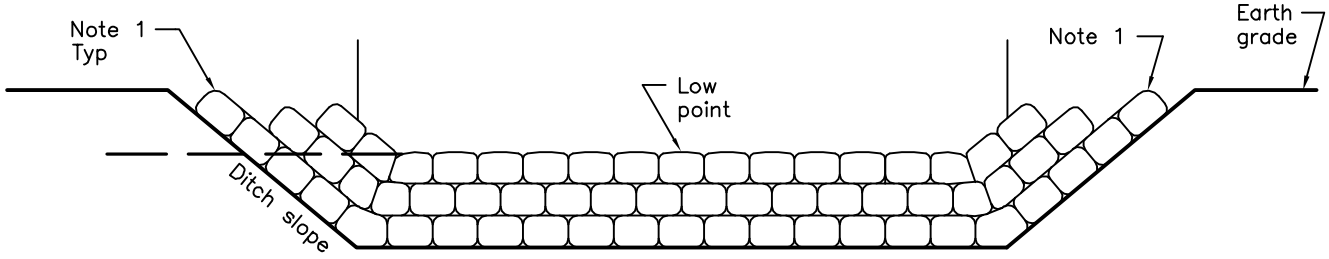
A Refer to OPSD 219.120 Section A–A installation detail.

B All dimensions are in millimetres unless otherwise shown.

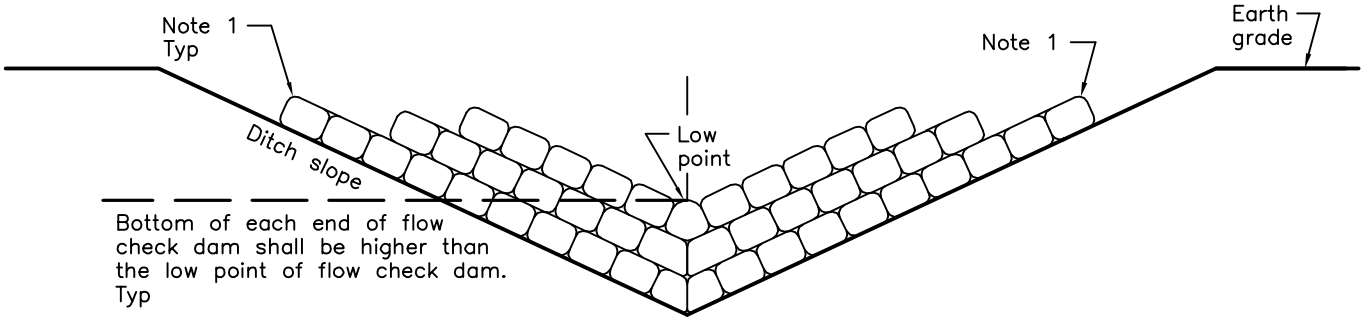
ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2015	Rev	0
FIBRE ROLL FLOW CHECK DAMS			
	OPSD 219.191		



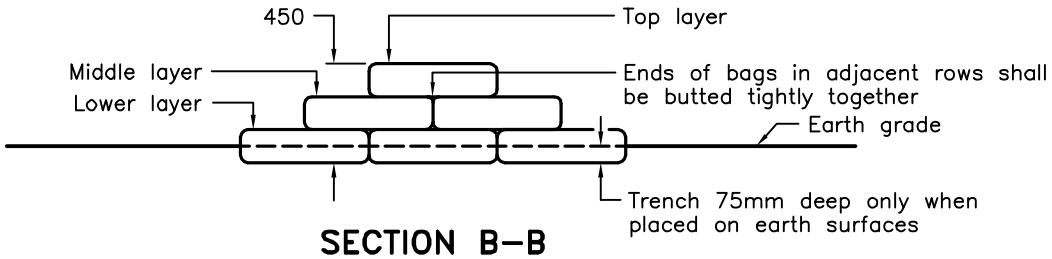
PLAN



SECTION A–A
FLAT BOTTOM DITCH



SECTION A–A
V–DITCH



SECTION B–B

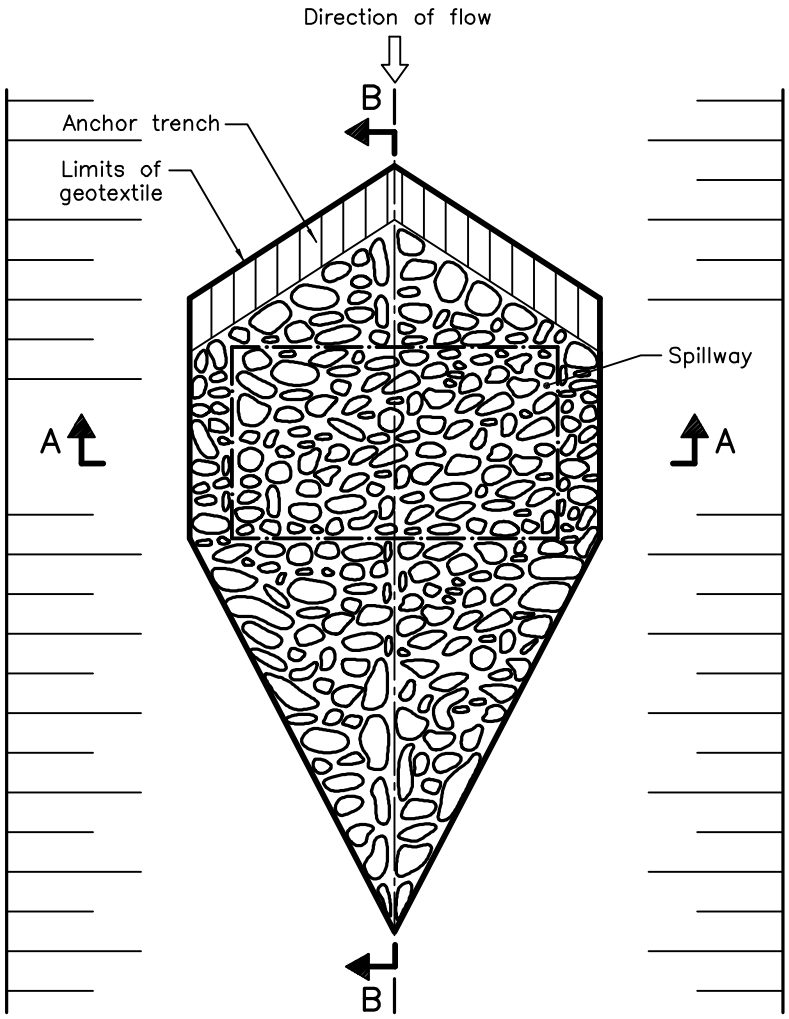
NOTES:

1 Sufficient sandbags shall be placed to prevent end scouring.

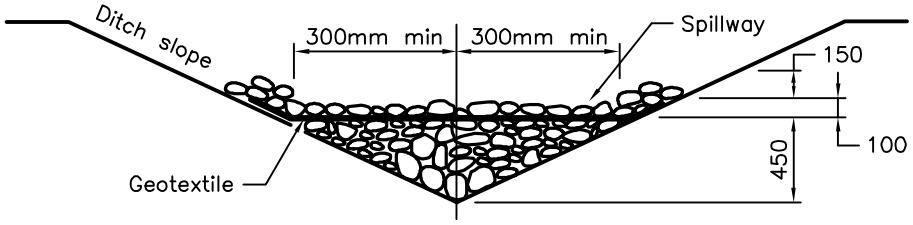
2 For sandbag dimensions see OPSD 219.150.

A All dimensions are in millimetres unless otherwise shown.

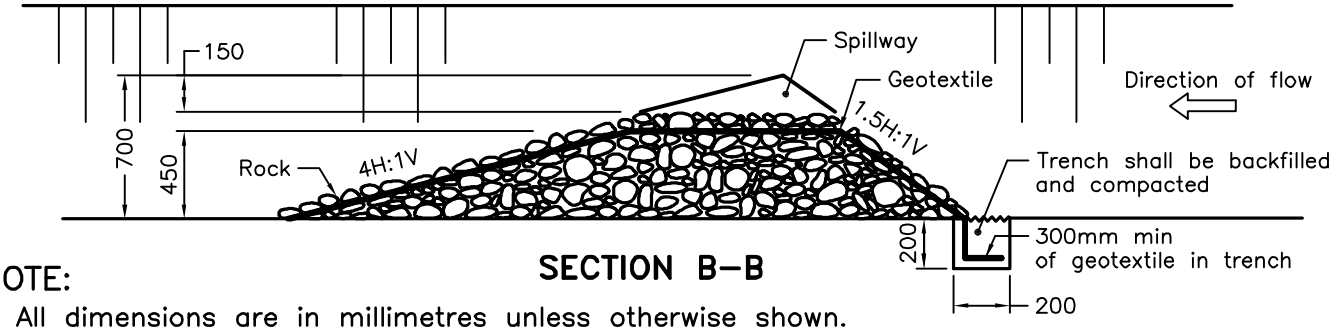
ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2015	Rev	2
SANDBAG FLOW CHECK DAM			
	OPSD 219.200		



PLAN
SPILLWAY



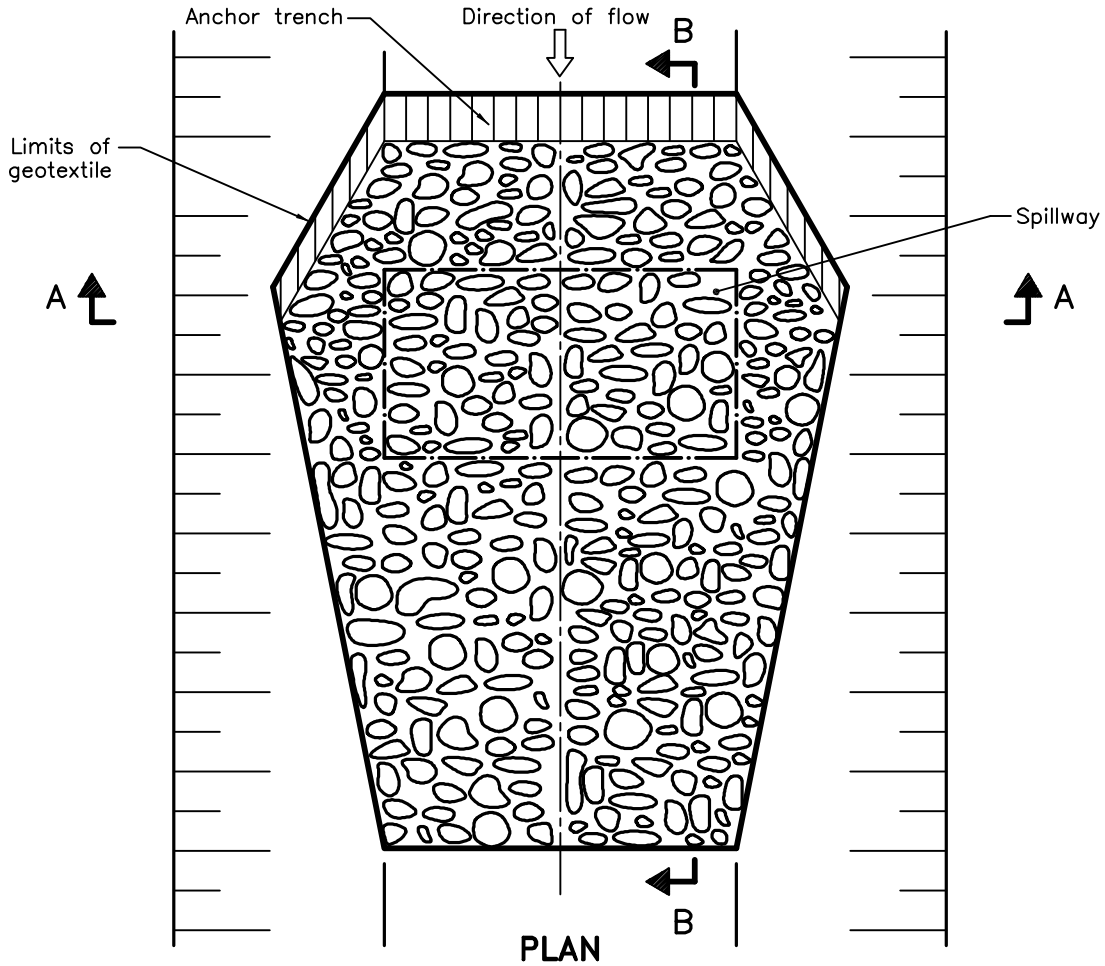
SECTION A–A



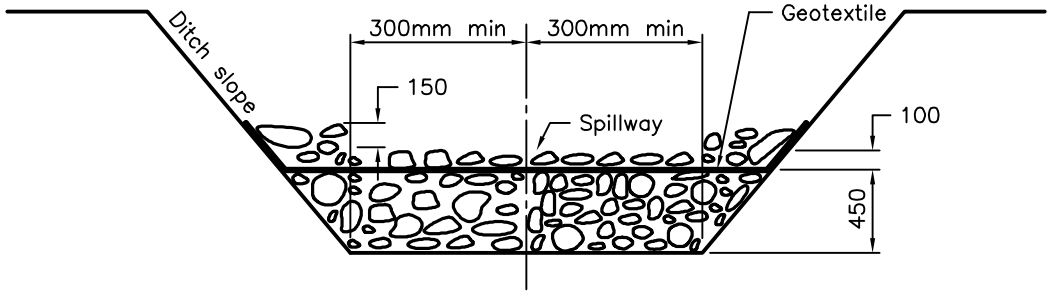
SECTION B–B

NOTE:
A All dimensions are in millimetres unless otherwise shown.

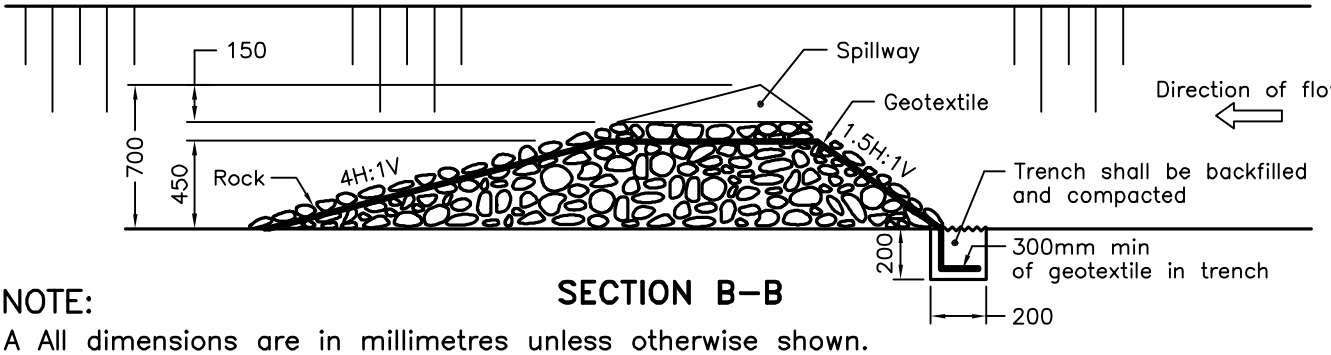
ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2015	Rev	2
TEMPORARY ROCK FLOW CHECK DAM V–DITCH			
			OPSD 219.210



PLAN
SPILLWAY



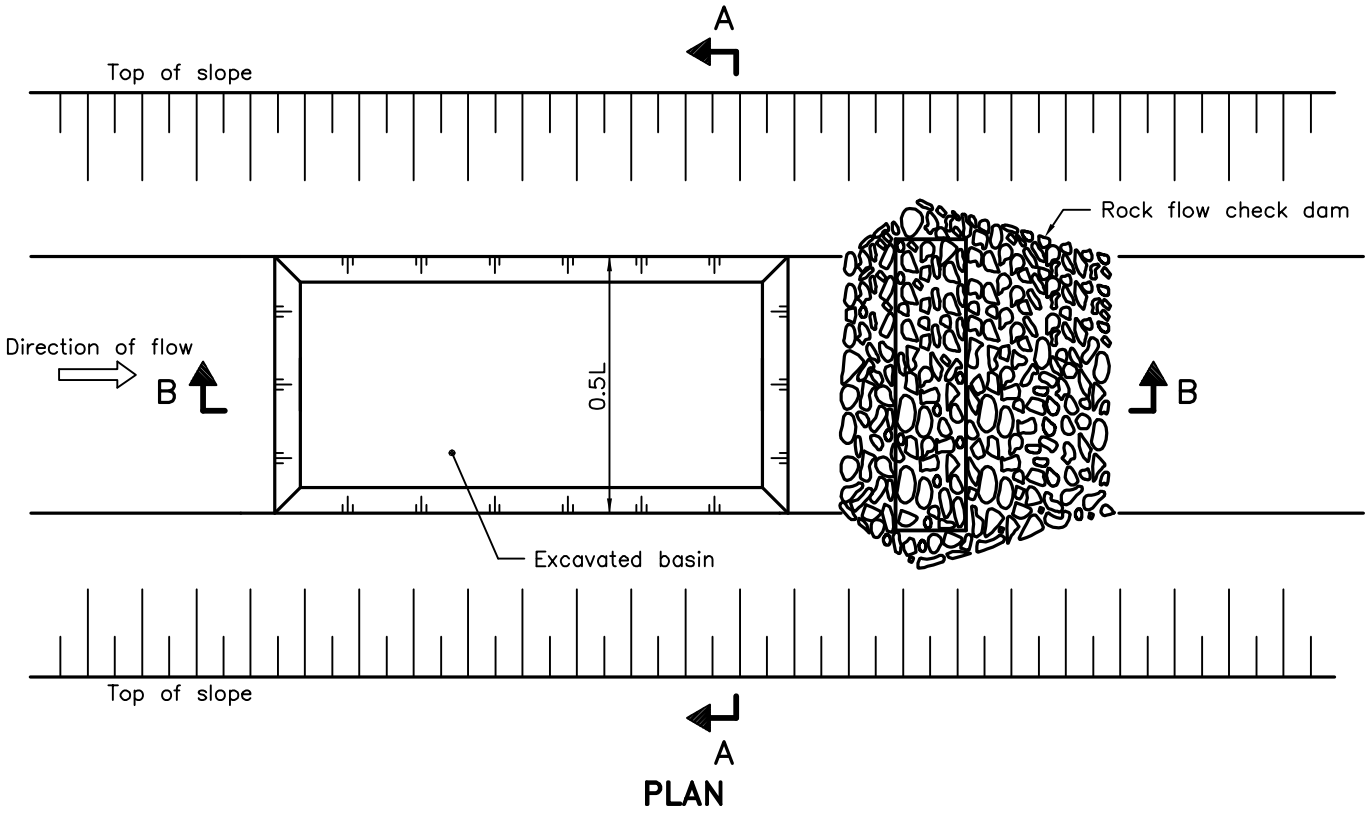
SECTION A–A



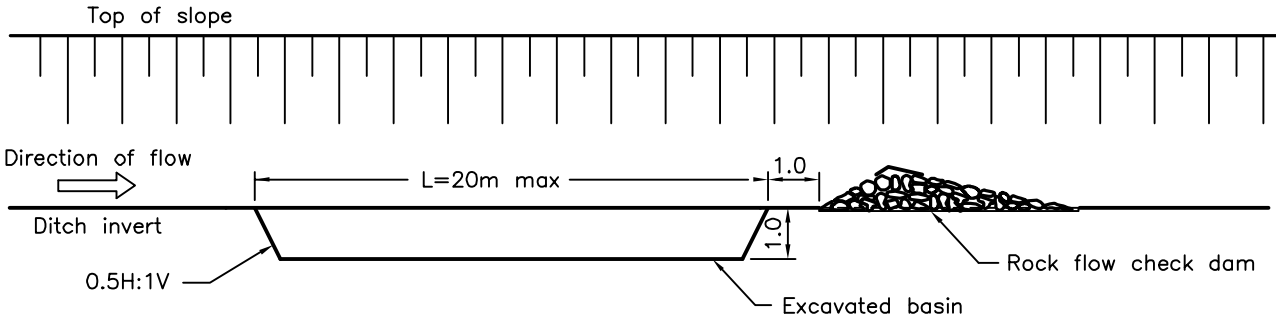
SECTION B–B

NOTE:
A All dimensions are in millimetres unless otherwise shown.

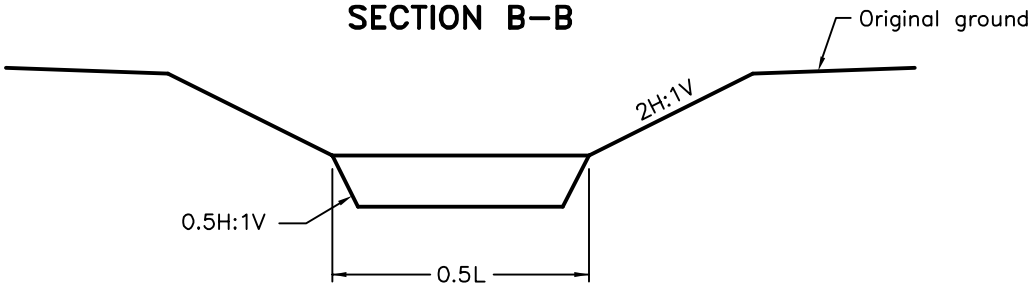
ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2015	Rev	2
TEMPORARY ROCK FLOW CHECK DAM FLAT BOTTOM DITCH			
			OPSD 219.211



PLAN



SECTION B–B



SECTION A–A

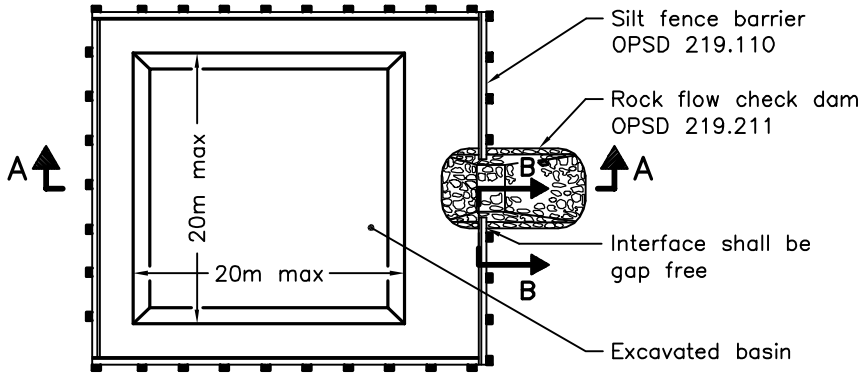
NOTES:

A Ditch cross–section upstream or downstream of sediment trap may be flat bottom or V–shaped. Flat bottom shown.

B This OPSD shall be read in conjuction with OPSD 219.210 or 219.211.

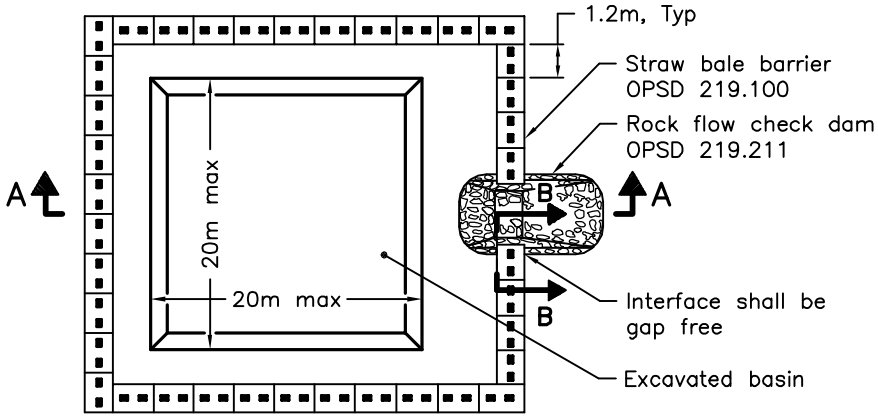
C All dimensions are in metres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2015	Rev	2
SEDIMENT TRAP IN DITCH			
	OPSD 219.220		



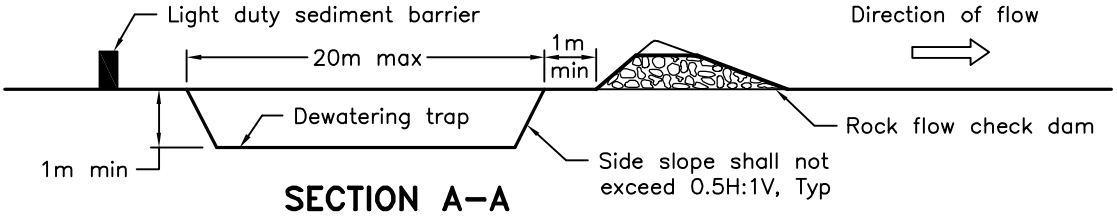
PLAN

DEWATERING TRAP WITH SILT FENCE

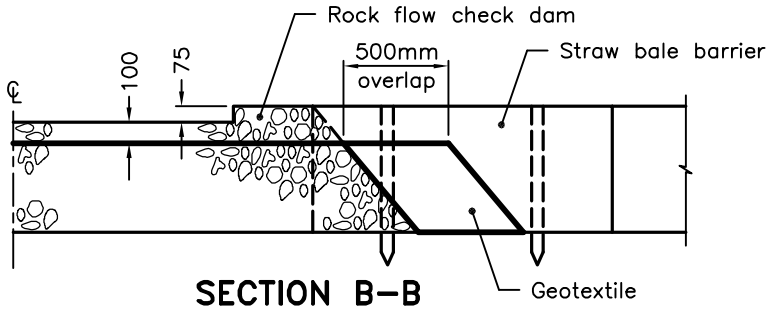


PLAN

DEWATERING TRAP WITH STRAW BALES



SECTION A–A



SECTION B–B

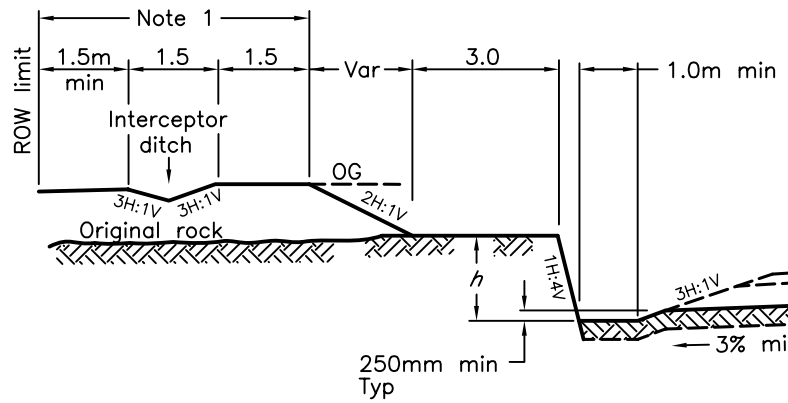
STRAW BALE BARRIER SHOWN

NOTE:

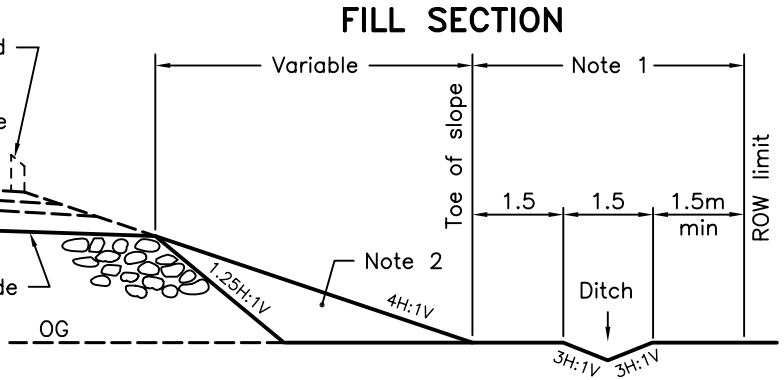
A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2015	Rev	2
SEDIMENT TRAP FOR DEWATERING			
	OPSD 219.240		

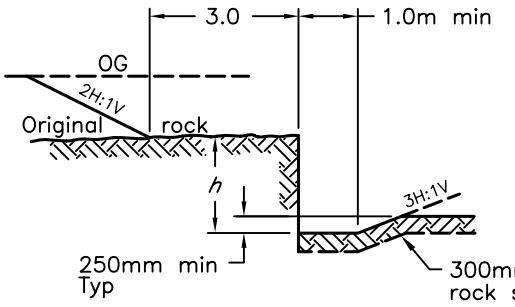
CUT SECTION



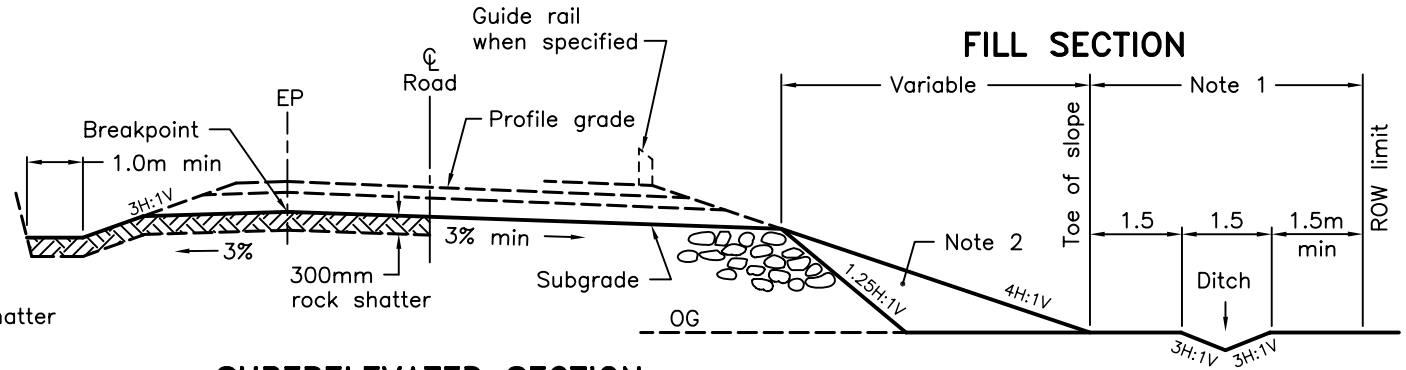
FILL SECTION



TANGENT SECTION



SUPERELEVATED SECTION



ALTERNATIVE DETAIL
WHERE SPECIFIED

NOTES:

1 Distance shall be 1.5m minimum when ditch is not required.

2 Where top of rock fill embankment is less than 2.0m above original ground, flatten slope with surplus excavated material.

A Shale shall be treated according to earth grading standards.

B This OPSD to be read in conjunction with OPSD 202.010 and OPSD 202.020.

C All dimensions are in metres unless otherwise shown.

LEGEND:

h – Height of rock face

ONTARIO PROVINCIAL STANDARD DRAWING

ROCK GRADING

UNDIVIDED RURAL

Nov 2009 | Rev 2

OPSD 201.010

APPENDIX G
BEST MANAGEMENT PRACTICES FOR INVASIVE SPECIES AND SPECIES AT RISK

Clean Equipment Protocol for Industry

Inspecting and cleaning equipment for the purposes of invasive species prevention

Invasive Species Centre

Catalyst for research and response

Ontario

Peterborough County Stewardship

ONTARIO INVASIVE PLANT COUNCIL

Publication Information

Halloran, Joe, Anderson, Hayley and Tassie, Danielle. 2013. Clean Equipment Protocol for Industry. Peterborough Stewardship Council and Ontario Invasive Plant Council. Peterborough, ON.

Printed April 2013
Updated May 2016.
Peterborough, Ontario

ISBN: (to be confirmed)

This document was prepared for the Canada-Ontario Invasive Species Centre and the Ontario Ministry of Natural Resources by the Peterborough Stewardship Council and the Ontario Invasive Plant Council.

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Phone: (705) 748-6324
Email: info@ontarioinvasiveplants.ca

For more information on invasive plants in Ontario, visit www.ontario.ca/invasivespecies, www.ontarioinvasiveplants.ca, www.invadingspecies.com, or www.invasivespeciescentre.ca.

Table Of Contents

Introduction

Why Invasive Plants are a Problem

Invasive alien species are "a growing environmental and economic threat to Ontario. Alien species are plants, animals and microorganisms that have been accidentally or deliberately introduced into areas beyond their normal range. Invasive species are defined as harmful alien species whose introduction or spread threatens the environment, the economy, or society, including human health (Government of Canada 2004)." (Ontario Invasive Species Strategic Plan, 2012). The great majority of plant invasions occur in habitats that have been disturbed either naturally or by humans (Rejma´nek 1989; Hobbs and Huenneke 1992; Hobbs 2000).

The ecological effects of invasive species are often irreversible and, once established, they are extremely difficult and costly to control or eradicate. According to Pimental et al. (1999), invasive species in the U.S. cause economic and environmental damages totalling over $138 billion per year, with agricultural weed control and crop losses totalling approximately $34 billion per year. Exact figures for the total economic and environmental damages are not available for Canada. In Ontario however, the costs of dealing with just one invasive species is astonishing; Zebra Mussels cost Ontario power producers who draw water from the lake $6.4 million per year in increased control/operating costs and about $1 million per year in research costs (Colautti et al. 2006).

Invasive species can spread to new areas when contaminated mud, gravel, water, soil and plant material are unknowingly moved by equipment used on different sites. This method of spread is called an unintentional introduction, and is one of the four major pathways for invasive species introduction into a new area of Ontario (Ontario Invasive Species Strategic Plan, 2012).

Buckthorn removal, Lynde Shores Conservation Area.
Photo by: Central Lake Ontario Conservation Authority

Invasive plant seed and other propagules (plant material, i.e. rhizomes) have the ability to travel sight unseen in mud attached to or lodged in various parts and spaces between parts of vehicles, machinery and other mechanical equipment. A recent study at Montana State University found that most seeds (99% on paved roads and 96% on unpaved roads) stayed attached to the vehicle after traveling 160 miles (257 km) under dry conditions.

Invasive plant species are commonly transported on or in vehicles and construction equipment when they are moved to new locations. Those vehicles include four-wheel drives, excavators, tractors, loaders, water trucks and all-terrain vehicles. Failure to properly clean vehicles and machinery of soils, mud, and contaminated water that may contain invasive species seed and propagules can result in permanent, irreversible environmental impacts. These impacts can mean substantial cost to the landowner, land manager and/or the user. Businesses may also face liability issues for activities and operations that result in the introduction of invasive species.

Some of the invasive species in Ontario which have been known to spread through equipment transfer include:

- **Common Buckthorn** *(Rhamnus cathartica)*
- **Dog-strangling Vine** *(Cynanchum rossicum)*
- **Garlic Mustard** *(Alliaria petiolata)*
- **Giant Hogweed** *(Heracleum mantegazzianum)*
- **Glossy Buckthorn** *(Frangula alnus)*
- **Japanese Knotweed** *(Polygonum cuspidatum)*
- **Miscanthus or Chinese Silver Grass** *(Miscanthus sinensis)*
- **Invasive Phragmites or Common Reed** *(Phragmites australis subsp. australis)*
- **Reed Canary Grass** *(Phalaris arundinacea)*
- **Wild Parsnip** *(Pastinaca sativa)*
- **Wild Chervil** *(Anthriscus sylvestri)*

Dog-strangling Vine
(Cynachum rossicum)
Photo by: Hayley Anderson

Garlic Mustard
(Alliaria petiolata)
Photo by: Ken Towle

Invasive Phragmites
(Phragmites australis subsp. australis)
Photo by: Michael Irvine

These plants impact biodiversity by out-competing native species for space, sunlight, and nutrients. They can also have impacts on road and driver safety by physically blocking intersection sightlines, and in the case of invasive *Phragmites* and *Miscanthus*, may fuel intense grass fires if ignited, which can damage utility stations and hydro lines.

The harmful effects of invasive species include:

- Physical and structural damage to infrastructure
- Human health hazards (i.e. giant hogweed and wild parsnip exposure)
- Delays and increased cost in construction activities
- Environmental damage (i.e. erosion)
- Aesthetic degradation
- Loss of biodiversity
- Reduced property values
- Loss of productivity in woodlots and agriculture

Why Cleaning Vehicles and Equipment is Important

Passenger and recreational vehicles as well as heavy machinery are major vectors for spreading terrestrial invasive species into new areas.

Preventing the spread of invasive species has proven to be considerably more cost effective than controlling established populations. The spread of invasive species through unintentional introduction can be minimized significantly by the diligent cleaning of vehicles and equipment when leaving one site and moving to the next. In the case of large properties, cleaning before moving to a new site is recommended, even if it is within the same property.

This guide has been developed for the construction, agriculture, forestry, and other land management industries, to provide equipment operators and practitioners with tools and techniques to identify and prevent the unintentional introduction of invasive species. It establishes a standard for cleaning vehicles and equipment and provides a guide where current codes of practice, industry standards or other environmental management plans are not already in place.

Passenger and recreational vehicles include:

- 2WD and 4WD cars
- 2WD and 4WD trucks
- All Terrain Vehicles (ATV's)
- Motorbikes
- Snowmobiles

Heavy machinery includes:

- Trucks
- Tractors
- Mowers
- Slashers
- Trailers
- Backhoes
- Graders
- Dozers
- Excavators
- Skidders
- Loaders
- Water Tankers and Trucks

Dog-strangling Vine plants attached to ATV.
Photo by: Francine Macdonald

Plant material attached to bobcat.
Photo by: TH9 Outdoor Services

Impacts of Invasive Species on Industry

Construction

In the UK, Japanese Knotweed (*Polygonum cuspidatum* or *Fallopia japonica*) is classified as a hazardous material. When construction occurs in established Japanese Knotweed stands workers sift the soil to remove root fragments and institute treatment plans to ensure that the Knotweed does not re-sprout, as it can damage housing foundations by growing through concrete and asphalt. The contractors must also thoroughly clean their equipment, and dispose of the contaminated soil at biohazard waste sites. While we do not have these requirements in Ontario, Japanese Knotweed is present here.

Invasive plant species can also increase site preparation and weed control costs, and reduce property values. For example, in Vermont the presence of the aquatic invasive plant Eurasian Watermilfoil (*Myriophyllum spicatum*) depressed shoreline residence property value by as much as 16.4% (Zhang and Boyle, 2010).

Forestry/Agriculture

Invasive plant species which become established in forests will out-compete native species and prevent forest re-generation after logging or natural disturbance. Dog-strangling Vine (*Cynanchum rossicum*) is of particular concern in conifer plantations. This species thrives in the filtered light and open soils of mature plantations, and suppresses seedling establishment of native hardwoods. If its invasion continues, very few juvenile trees will survive to fill the shrinking canopy of over-mature pines. Reforestation sites are also susceptible; the thick mats of vegetation and aggressive competition from Dog-strangling Vine decrease available planting space and increase costs as more mature vegetation needs to be planted in order to ensure the new vegetation can outcompete the invasive plant. As a result, expensive control programs are often required.

Land Management (Trail Use/Maintenance)

Recreational trail use and the maintenance of trails can facilitate the transport of invasive plant material and seeds, and create open and disturbed sites that are prime locations for the establishment of invasive species. Studies have proven that trails act as corridors which assist in the spread of invasive plant species. Humans, their pets, and vehicles such as ATV's can be vectors of invasion along trails because seeds and plant pieces can be carried on equipment and clothing. In addition, frequent trampling along trails alters soil properties, limits the growth of some native species, and creates conditions that may favour the growth of non-native species (Kuss et al. 1985; Marion et al. 1985; Yorks et al. 1997).

Roadsides/Utilities

Invasive species can increase the cost of roadside and utility maintenance by requiring additional maintenance and control efforts. The presence of invasive species can also provide a safety hazard. In the case of Phragmites and Miscanthus (invasive grass species), along with interrupting sight lines, the dead stalks which remain standing each autumn also provide combustible material. Fires in these stands burn intensely, and can damage utilities and hydro lines. Phragmites along roadsides is generally assumed to be spread through the transport and burial of rhizome fragments through ditching, ploughing, and other human activities that transport rhizomes on machinery. Studies have shown that vehicles and road-fill operations can transport invasive plant seeds into uninfested areas, and road construction and maintenance operations provide optimal disturbed sites for seed germination and seedling establishment (Schmidt 1989; Lonsdale & Lane 1994; Greenberg et al. 1997; Trombulak & Frissell 2000).

Steps to Prevent the Unintentional Introduction of Invasive Species from Equipment

Inspection and cleaning of all machinery and equipment should be performed in accordance with the procedures, checklists and diagrams provided in this protocol.

When visiting more than one site, always schedule work in the sites that are the least disturbed and free of known invasive species first, and visit sites with known invasive species infestations last. This will greatly reduce the risk of transferring plants to new locations.

When to Inspect

Inspection should be done before:

- Moving vehicles out of a local area of operation
- Moving machinery between properties or sites within the same property where invasive species may be present in one area, and not in another
- Using machinery along roadsides, in ditches, and along watercourses
- Vehicles using unformed dirt roads, trails or off road conditions
- Using machinery to transport soil and quarry materials
- Visiting remote areas where access by vehicles is limited

Inspection should be done after:

- Operating in areas known to have terrestrial invasive plants or are in high risk areas (i.e. recently disturbed areas near known invaded areas)
- Transporting material (i.e. soil) that is known to contain, or has the potential to contain, invasive species
- Operating in an area or transporting material that you are uncertain contain invasive species
- In the event of rain. If mud contains seeds, they can travel indefinitely until it rains or the road surface is wet, allowing for long distance transport. This may result in transporting seeds to areas where those species did not previously exist

How to Inspect

- Inspect the vehicle thoroughly inside and out for where dirt, plant material and seeds may be lodged or adhering to interior and exterior surfaces.
- Remove any guards, covers or plates that are easy to remove.
- Attention should be paid to the underside of the vehicle, radiators, spare tires, foot wells and bumper bars.

If clods of dirt, seed or other plant material are found, removal should take place immediately, using the techniques outlined below.

When to Clean

Vehicles and heavy equipment that stay on formed and sealed roads have a low risk of spreading invasive species. Cleaning is only required when inspection identifies visible dirt clods and plant material or when moving from one area to another.

Depending on the invasive species present, vehicles may need to be cleaned even when deep snow is present. Invasive *Phragmites*, for example, can still be spread, even in packed snow because the seed heads are usually above the surface of the snow. Other plants, such as dog-strangling vine, will be contained beneath deep snow.

**Regular inspection of vehicles and machinery will identify if any soil or plant material has been collected on or in vehicles and machinery.*

Where to Clean

Clean the vehicle/equipment in an area where contamination and seed spread is not possible (or limited). The site should be:

- Ideally, mud free, gravel covered or a hard surface. If this option is not available, choose a well maintained (i.e. regularly mowed) grassy area.
- Gently sloping to assist in draining water and material away from the vehicle or equipment. Care should be taken to ensure that localized erosion will not be created, and that water runs back into the area where contamination occurred.
- At least 30m away from any watercourse, water body and natural vegetation.
- Large enough to allow for adequate movement of larger vehicles and equipment.

**Safely locate the vehicle and equipment away from any hazards. If mechanized, ensure engine is off and the vehicle or equipment is immobilized.*

How to Clean Inside

Clean the interior of the vehicle by sweeping, vacuuming or using a compressed air device. Particular attention should be paid to the floor, foot wells, pedals, seats, and under the seats.

How to Clean Outside

Knock off all large clods of dirt. Use a pry bar or other device if necessary.

Identify areas that may require cleaning with compressed air rather than water such as radiators and grills. Clean these areas first prior to using water.

Clean the vehicle with a high pressure hose in combination with a stiff brush and/or pry bar to further assist the removal of dirt clods.

Start cleaning from the top of the vehicle and work down to the bottom.

Emphasis should be placed on the undersides, wheels, wheel arches, guards, chassis, engine bays, radiator, grills, and other attachments.

When the cleaning is finished avoid driving through the waste water when removing the vehicle or equipment from the cleaning site.

For equipment such as water trucks that may be exposed to aquatic invasive species, trucks should be disinfected with bleach solution before conducting work in a new area. For further information please refer to the Invading Species Awareness Program's Technical Guidelines listed under Contacts and Resources.

Hosing down a vehicle in Queensland, Australia
Photo by: TH9 Outdoor Services

Final Inspection Checklist

Conduct a final inspection to ensure the following general clean standard has been achieved:

- No clods of dirt should be visible after wash down.
- Radiators, grills, and the interiors of vehicles should be free of accumulations of seed, soil, mud and plant material parts including seeds, roots, flowers, fruit, and or stems.

Diagrams have been provided to assist in quickly identifying key areas to inspect and clean on a variety of vehicles associated with the targeted industries. These can be used in combination with vehicle checklists to ensure all areas of the vehicles have been inspected and cleaned.

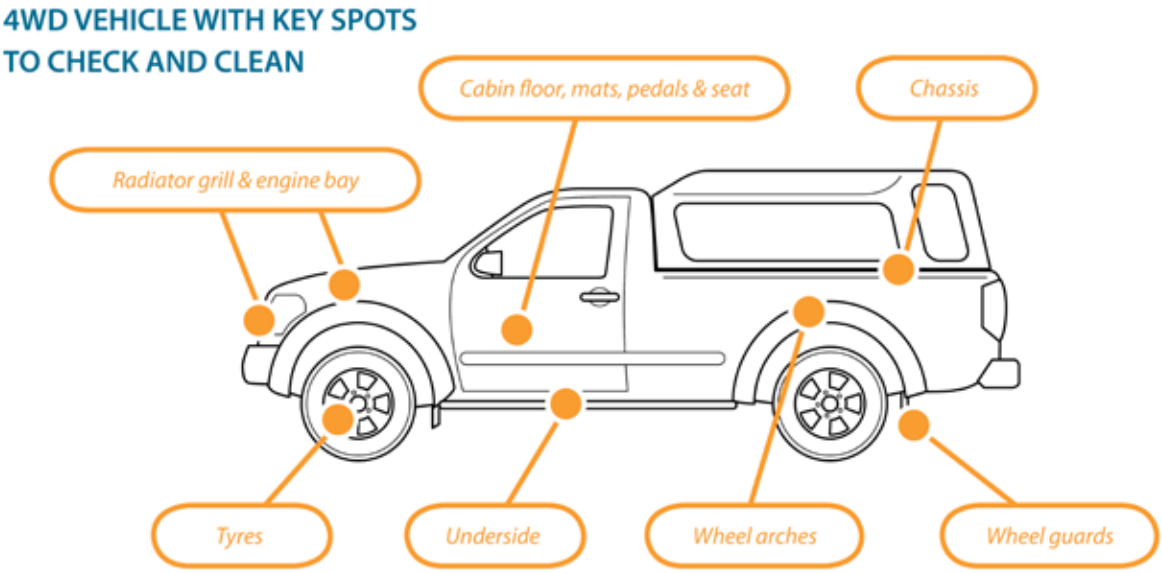
Equipment Required

- A pump and high pressure hose OR high pressure water unit
- Minimum water pressure for vehicle cleaning should be at least 90 pounds per square inch. Water can be supplied as high volume/low pressure or low volume/high pressure (NOAA Fisheries Service).
- Air compressor and blower OR vacuum
- Shovel
- Pry bar
- Stiff brush or broom

Cleaning station at construction site.
Photo by: Mark Heaton, OMNR

Inspection and Cleaning Diagrams and Checklists

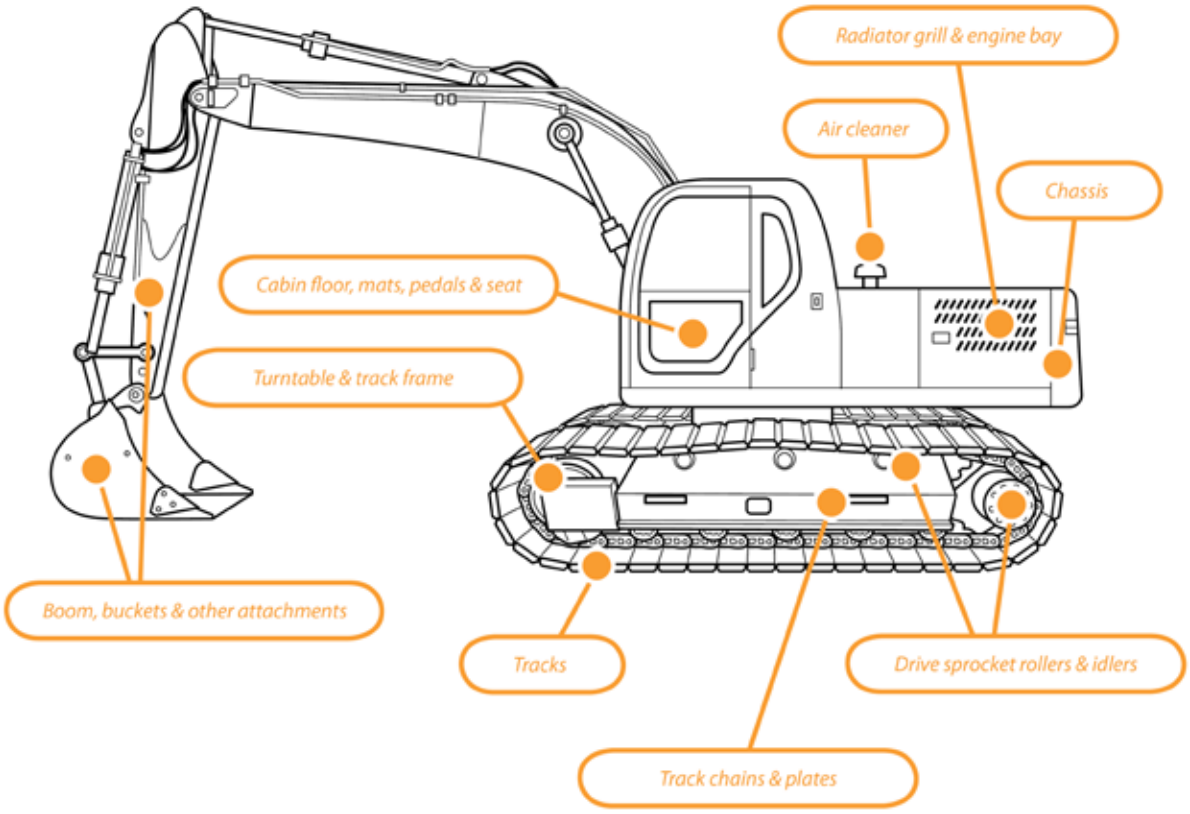
2WD and 4WD Vehicles



		✓
Cabin	Floor, mats, pedals, seats	
Engine	Radiators, engine bay, grill	
Body	Underside, chassis, crevices, ledges, bumper bars	
Wheels	All wheels (including spare), wheel arches, guards	
Tray	Floor, canopy (if included)	

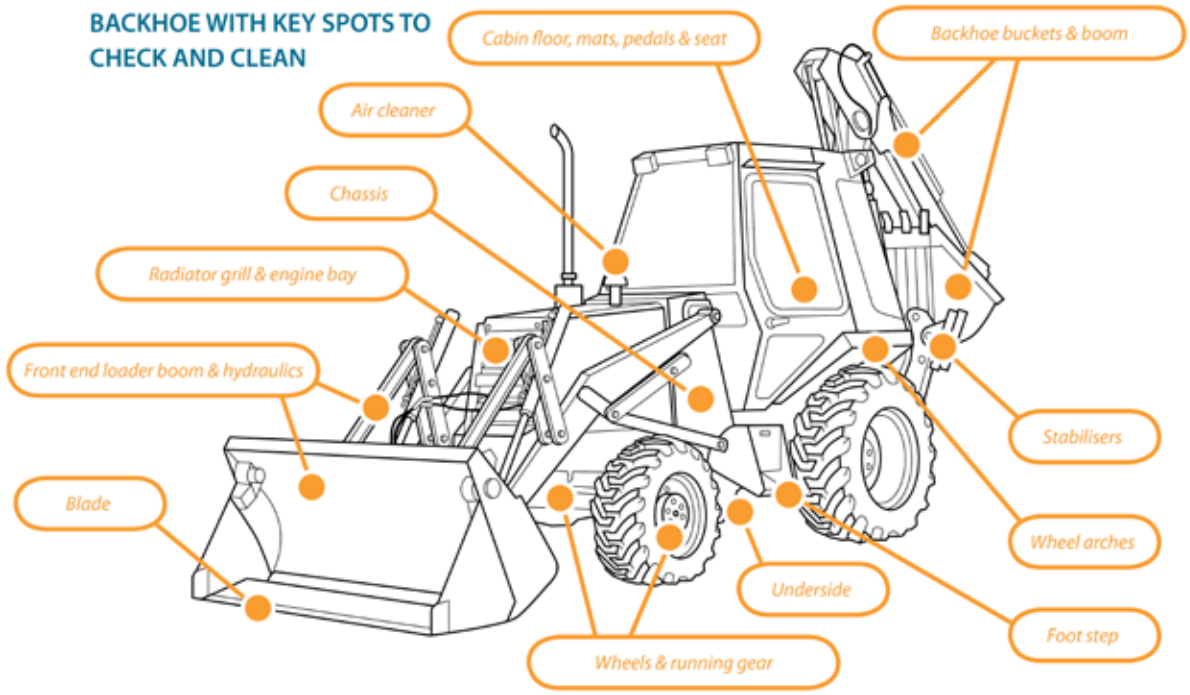
Excavator

EXCAVATOR WITH KEY SPOTS TO CHECK AND CLEAN



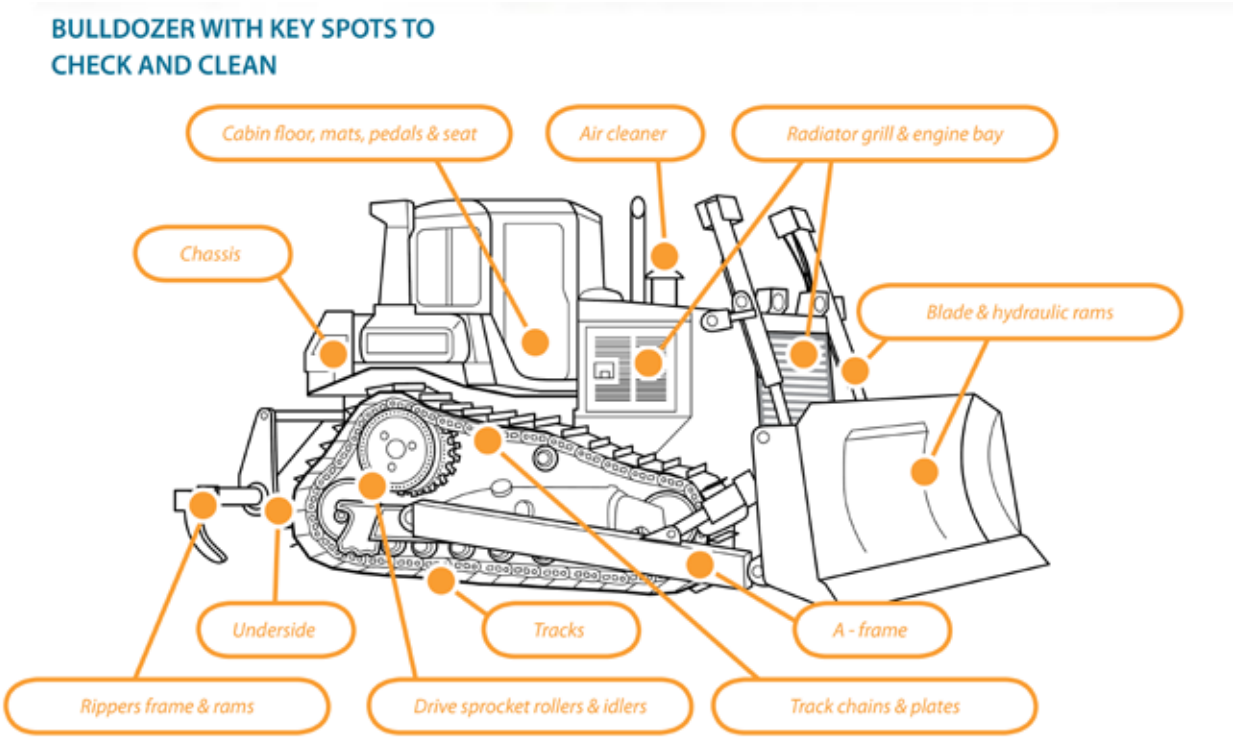
		✓
Cabin	Floor, mats, pedals, seats	
Engine	Radiators, engine bay, grill, air cleaner	
Tracks	Tracks, track frame, drive sprocket rollers, idlers	
Body Plates	Plates of cabin	
Body	Ledges, channels	
Bucket		
Booms		
Turret Pivot		

Backhoe



		✓
Cabin	Floor, mats, pedals, seats, foot step	
Engine	Radiators, engine bay, grill, air cleaner	
Wheels	All wheels (including spare), wheel arches, guards	
Front end loader	Blade, hydraulics, booms	
Backhoe	Buckets, boom, hydraulics, stabilisers	

Bulldozer



		✓
Cabin	Floor, mats, pedals, seats	
Engine	Radiators, engine bay, grill, air cleaner	
Tracks	Tracks, track frame, drive sprocket rollers, idlers	
Body Plates	Belly plates, rear plates	
Body	Ledges, channels	
Blade	Pivot points, hydraulic rams, a-frame	
Ripper	Ripper frame, ripper points	

Contacts and Resources

Ontario Invasive Species Strategic Plan 2012. Government of Ontario. Online, accessed May 8, 2012.
http://www.mnr.gov.on.ca/stdprodconsume/groups/lr/@mnr/@biodiversity/documents/document/stdprod_097634.pdf

Invasive Species Management for Infrastructure Managers and the Construction Industry 2008. Wade, M. Booy, O. and White, V. Online, accessed April 27, 2012.
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T.I.P.S (Targeted Invasive Plant Solutions) Highway Operations. British Columbia Invasive Species Council. Online, accessed May 8, 2012.
http://www.bcinvasiveplants.com/iscbc/publications/TIPS/Highways_Operations_TIPS.pdf

Invading Species Awareness Program Workshop Manual: Aquatic Invasive Species: An Introduction to Identification, Collection and Reporting of Aquatic Invasive Species in Ontario Waters (includes information on decontaminating equipment).
http://www.invadingspecies.com/download/publications/manuals/WorkshopManual.pdf

Reporting Invasive Species

To report invasive species, or view maps of existing records, visit the Invading Species Awareness Program website www.invadingspecies.com/report/ or www.eddmaps.org/Ontario.

Or call the OFAH/MNR Invading Species Awareness Program Hotline at **1-800-563-7711.**

Acknowledgements

We gratefully acknowledge NRM South (Tasmania, Australia) for allowing the use of their artwork and text from their "Keeping it Clean – A Tasmanian Field Hygiene Manual to Prevent the Spread of Freshwater Pests and Pathogens".

We also sincerely thank the Clean Equipment Protocol Working Group and the Ontario Invasive Plant Council Committees and Board of Directors for their ongoing support and valuable input into this document, and the Canada-Ontario Invasive Species Centre and Ontario Ministry of Natural Resources for the support in creating this protocol.

Clean Equipment Protocol Working Group:

Diana Shermet, Central Lake Ontario Conservation Authority; Paula Berketo, Ontario Ministry of Transportation; Travis Cameron, Ontario Ministry of Natural Resources; Jennifer Hoare, Ontario Parks; Michael Irvine, Ontario Ministry of Natural Resources; Alison Kirkpatrick, OFAH/MNR Invading Species Awareness Program; Erika Weisz, Ontario Ministry of Natural Resources; Amanda Chad, Ontario Power Generation; Nancy Vidler, Lambton Shores Phragmites Community Group; Nigel Buffone, Du Pont Canada Company; Ewa Bednarczuk, Lower Trent Conservation Authority

We also gratefully acknowledge the input and direction from Francine MacDonald, James Rockwood, Anne-Marie Roussy, Stephen Smith, Caroline Mach, Patricia Lowe, John Bowen, Karen Hartley, and the Southern Ontario Community Forest Managers group.

More Information:

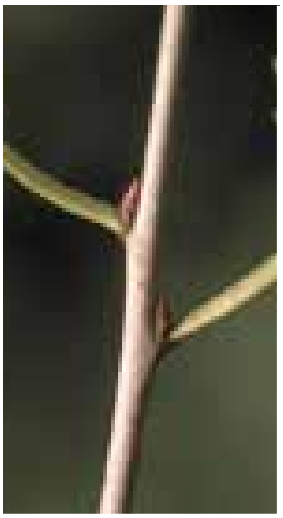
Ontario Invasive Plant Council: www.ontarioinvasiveplants.ca

Appendix A: Identification of Invasive Plants Found in Ontario

- **Common Buckthorn** (*Rhamnus cathartica*) and **Glossy Buckthorn** (*Frangula alnus*)
- **Dog-strangling Vine** (*Cynanchum rossicum*)
- **Garlic Mustard** (*Alliaria petiolata*)
- **Japanese Knotweed** (*Polygonum cuspidatum*)
- **Phragmites or Common Reed** (*Phragmites australis subsp. australis*)
- **Giant Hogweed** (*Heracleum mantegazzianum*)

common & glossy buckthorn

(Rhamnus cathartica & R. frangula)



Plant type: Shrub/small tree

Arrangement: Common buckthorn are sub-opposite (almost opposite). Glossy buckthorn are alternate.

Leaf: The common buckthorn leaf is egg shaped, edge of the leaf is "pebbled" (small rounded teeth). Veins converging toward leaf top. The glossy buckthorn leaf is more slender (tear drop shaped) and smooth margined.

Bark: Smooth, young bark with prominent raised patches or lenticels; rough texture and peeling bark when mature.

Seed/Flowers: Flowers are green-yellowish, small and inconspicuous. Green berries becoming purplish/black in late summer, berry > 1 cm in diameter.

Buds/Twigs: Common buckthorn has thorn-like tip on many twigs. Glossy buckthorn buds have no bud scales and lack thorny tips to twigs.

Habitat: Various - forest, thickets, meadows, dry to moist soils.

Similar native species: Native dogwoods, which lack the thorny "tip". Native dogwoods are truly opposite in arrangement of twigs; only alternate leaved (pagoda) dogwood has alternate branching.

dog-strangling vine
(Cynanchum rossicum & C. nigrum)



Plant type: Herb, twining vine

Arrangement: Opposite

Leaf: Lance shaped, smooth margin (edge)

Bark: n/a

Seed/Flowers: Bean shaped seed pod with seeds attached to downy 'umbrellas'. Flowers - pink (C. rossicum) or purple (C. nigrum) with five petals.

Buds/Twigs: n/a

Habitat: Dry to moist soils; more dominant in meadows and woodland edges.

Similar native species: Swamp milkweed (Asclepias incarnata spp.), is an upright plant, typically found in wetland habitats.

garlic mustard
(Alliaria petiolata)



Plant type: Herb

Arrangement: Alternate

Leaf: Saw tooth like edge, elongated heart shape. Garlic/onion smell when crushed. Leaves are kidney shaped with prominent veins.

Bark: n/a

Seed/Flowers: Cluster of small white flowers with four petals. Small black < 1 mm rounded seed found in elongated 'tube-like' seed pods (similar to a bean pod).

Buds/Twigs: n/a

Habitat: Various – dry to moist soils, in all habitat types, less often in meadows.

Similar native species: n/a

japanese knotweed
(Polygonum cuspidatum)

Plant type: Herb, 2 - 4 m in height.

Arrangement: Alternate

Leaf: Tear drop shaped, sharp pointed, dark green, flattened at base.

Bark: n/a

Seed/Flowers: Flowering stalk of many small greenish-white flowers.

Buds/Twigs: Large plant with a 'bamboo-like' stem. Stem light green maturing to tan colour.

Habitat: Moist to wet soils found in wetlands, water-courses and roadside ditches.

Similar native species: None.

common reed
(Phragmites australis)

Plant type: Grass

Arrangement: Alternate

Leaf: Broad leaf > 1 cm wide.

Bark: n/a

Seed/Flowers: Dense cascading 'broom-like' flower head. 'Cottony' in appearance when mature.

Buds/Twigs: Stems rough and ridged, ligule a densely hairy band. Mature plants > 3 m tall.

Habitat: Moist to wet soils. Found in wetlands, water- courses and road side ditches.

Similar native species: Species of mannagrass (Glyceria sp) including tall northern, eastern and rattlesnake grass. A native common reed exists but has a smooth stem and the ligule is not hairy. It is also quite rare.

giant hogweed
(Heracleum mantegazzianum)

Plant type: Herb. Mature plants can be over 3m tall.

Arrangement: Alternate

Leaf: Lobed leaf 1-2 m wide, lobes sharp-pointed.

Bark: n/a

Seed/Flowers: Small, white flowers in a large umbrella-shaped cluster, .75 m wide.

Buds/Twigs: Hairy stem with purple spots.

Habitat: Fresh to wet soils in forests, swamps, meadows, marshes.

Similar native species: Cow parsnip *(Heracleum maximum)* – has smaller flowers, no purple spots on stems.Angelica (Angelica atropurpurea) has a rounded-topped flower cluster and leaves divided into many leaflets.

Do not touch this plant because it is poisonous. If you do, wash your skin immediately in cool soapy water and do not expose the area to sunlight.

Seek professional advice before removing.

Identification of Invasive Plants found in Ontario Photos by:

Credit Valley Conservation, Greg Bales, Ken Towle, Patrick Hodge,
Ontario Federation of Anglers and Hunters, Francine Macdonald, Matt Smith

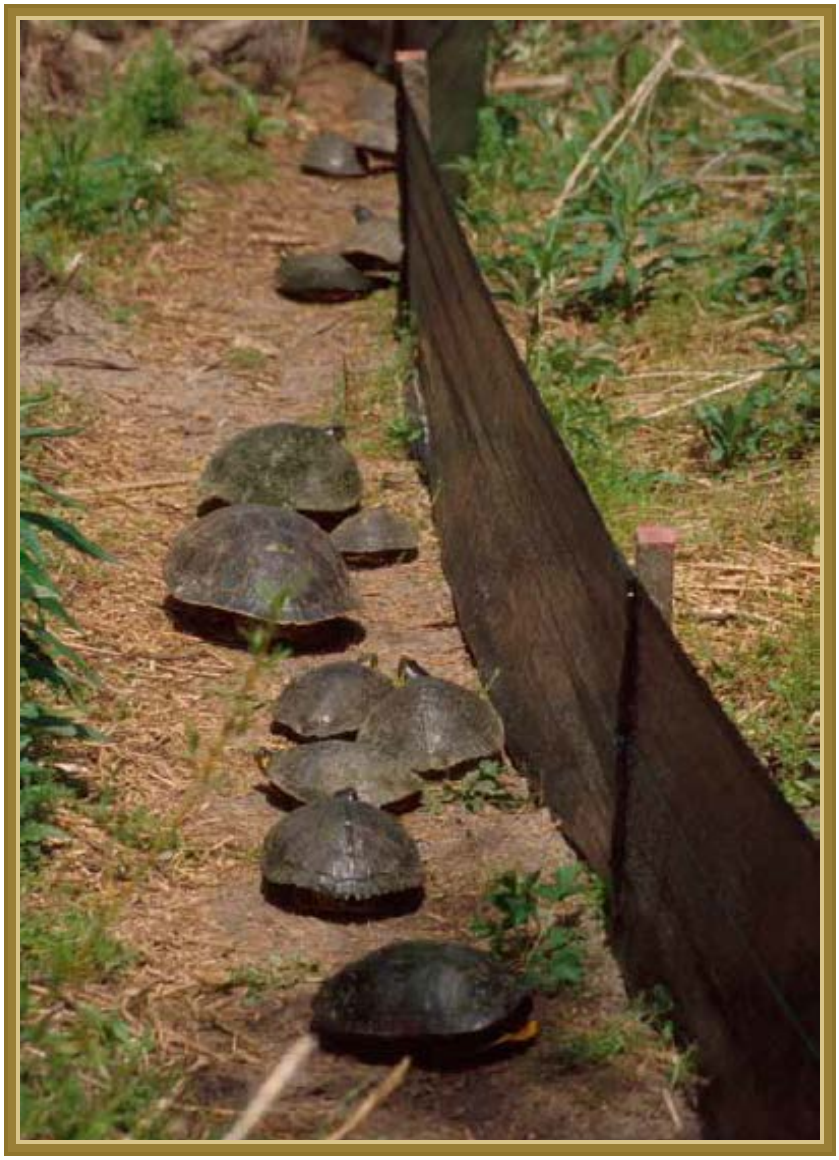
ONTARIO
INVASIVE PLANT
COUNCIL

SPECIES AT RISK BRANCH
BEST PRACTICES TECHNICAL NOTE

REPTILE AND AMPHIBIAN EXCLUSION FENCING

Version 1.1

July 2013



Ministry of Natural Resources

Ontario

July 2013

Ontario Ministry of Natural Resources
Species at Risk Branch

Recommended Citation:
OMNR. 2013. Reptile and Amphibian Exclusion Fencing: Best Practices, Version 1.0. Species at Risk Branch Technical Note. Prepared for the Ontario Ministry of Natural Resources, Peterborough, Ontario. 11 pp.

Cover illustration: Photograph by Matthew J. Aresco, Conservation Director, Nokuse Plantation

Before an activity can be initiated, permissions, approvals or authorizations may be required from MNR (e.g. Endangered Species Act authorization, Wildlife Scientific Collector's Authorization) or other agencies, levels of government (e.g. a conservation authority, municipality, federal or provincial government), or landowners. It is your responsibility to ensure that all necessary permissions, approvals and authorizations are acquired prior to proceeding with your activity.

This document presents information as of the point in time of publication and is meant to be updated through time as improved information becomes available.

Cette publication hautement spécialisée, Reptile and Amphibian Exclusion Fencing Best Practices n'est disponible qu'en anglais en vertu du Règlement 671/92 qui en exempte l'application de la Loi sur les services en français. Pour obtenir de l'aide en français, veuillez communiquer avec le ministère des Richesses naturelles au Pamela Wesley,705-755-5217.

Document History

Revision Number	Revision Date	Summary of Changes	Originated	Reviewed	Authorized
1.1	**June, 2013**	**Pre-publishing edits**	**June, 2013**	**June, 2013**	**June, 2013**

REPTILE AND AMPHIBIAN EXCLUSION FENCING - BEST PRACTICES -

The purpose of this guidance document is to provide an overview of proven design and installation techniques for reptile and amphibian exclusion fencing. Though this document points to site and species-specific design requirements, it is important to recognize that every situation is different. This guidance is not meant to replace site-specific advice obtained from local MNR staff or experienced exclusion fencing contractors. Moreover, exclusion fences are only effective when well planned, properly constructed, and maintained.

Exclusion fencing seeks to eliminate access to specific areas where activities that could harm animals are occurring (e.g. active aggregate operations, construction sites, and roads). The selection and installation of exclusion fencing can present some challenges, particularly if multiple species are being excluded. For example, some reptiles and amphibians are able to dig under fencing while others can climb over. Some may also take advantage of burrows dug by other animals. To maintain effectiveness, the bottom of the fence should be buried or secured firmly to the ground and minimum height recommendations (Table 1) are considered.

Exclusion fence design should consider the target species as well as those that might be unintentionally impacted. Fencing material should not pose a risk of entanglement or permit individuals to pass underneath or between openings. Landscape features such as topography and substrate need to be considered as they may constrain fencing design.

Including plans for fencing in advance of a project can increase efficiency and fence effectiveness. For example, long-term road projects that will include a permanent sound barrier could design the sound barrier such that it also meets the specifications of the required exclusion fence.

EFFECTIVE FENCE CHARACTERISTICS

The fence burial and height recommendations listed in Table 1 below have been compiled from scientific literature, established management practices, and practitioner best advice. These are general recommendations and at times other specifications may be more appropriate. For instance, in areas where the substrate does not permit fence burial, weighing down the fence with heavy items (e.g. sand bags) or backfilling may be acceptable. Where needed, speak with your local MNR staff or experienced exclusion fencing contractor to develop site-specific plans.

If multiple species are being excluded from the same area, and the species-specific fencing specifications differ, the uppermost minimum height and greatest depth recommendation should be used (Table 1). If you are excluding both Blanding's Turtle and Gray Ratsnake, for example, the exclusion fence should be a minimum of 2 m tall (see Gray Ratsnake section below for additional details).

Exclusion fences should be installed prior to emergence from hibernation. A survey of the enclosed/secluded area should be conducted immediately following fence installation to ensure that no individuals have been trapped on the wrong side of the fence.

Table 1. Recommended burial depth and height requirements of exclusion fencing for reptiles and amphibians. Recommended height is the height of the fence after it has been installed including the buried components and any installed overhangs or extended lips.

SPECIES	RECOMMENDED DEPTH OF FENCE BURIED (cm) *	RECOMMENDED HEIGHT OF FENCE (cm) **
Turtles – general	10 – 20	60
Eastern Musk Turtle, Wood Turtle	10 – 20	50
Massasauga, Eastern Hog-nosed Snake, Butler's Gartersnake, Queensnake	10 – 20	60
Gray Ratsnake & Eastern Foxsnake	10 – 20	200
Fowler's Toad	10 – 20	50
Snakes - general	10 – 20	100
Common Five-lined Skink	10 – 20	unknown
Salamanders	10 – 20	30

*** does not include the 10 cm horizontal lip that should extend outward an additional 10 – 20 cm (see Figure 2)**
**** the height of fencing has been provided as an approximate. Fencing materials may in fact not be available in proportions that would allow for these precise measurements. It is most effective, if the height and burial depth recommendations are met.**

DURATION OF ACTIVITIES & DEGREE OF ANTICIPATED DISTURBANCE

The type of disturbance, the proximity to disturbance, and the planned fence longevity are factors that influence which type of exclusion fence is most effective. For short-term activities (i.e. 1 to 6 months) such as minor road repairs, a light-duty geotextile fence is appropriate. Longer term or permanent fencing projects, however, require more durable materials such as – heavy-duty geotextile, wood, concrete, woven-wire, sheet metal, vinyl panels, or galvanized mesh.

GEOTEXTILE FENCES

Geotextile fences (e.g. silt fences) come in many types and qualities. They can be very effective for the temporary exclusion of reptiles and amphibians. For the purposes of this document, temporary use ranges from a few months up to 2-3 years. Winter weather is generally damaging to geotextile materials and the cost of maintenance over the long-term should be considered during the planning phase. Depending upon the quality, geotextile can be resistant to UV degradation and the bio-chemical soil environment.

Light-duty Geotextile Fencing:

Light-duty geotextile fencing is made of nylon material and is typically purchased with wooden stakes pre-attached at 2 m to 3 m intervals (Plate 1). It can also come without pre-attached stakes. Light-duty geotextiles are largely intended for projects with shorter durations of only a few months in duration and up to one season.

Geotextile fencing with nylon mesh lining should be avoided due to the risk of entanglement by snakes.

To use light-duty geotextile fencing:

- Fencing fabric is effective if attached to wooden, heavy plastic or metal stakes using heavy-duty wire staples or tie-wire (Figure 2).
- Secure the fence on posts that are placed at 2 m to 3 m apart. If using the greater recommended distance between posts, additional maintenance may be required to maintain effectiveness.
- Securely drive the stakes into the ground to a recommended depth of 30 cm. The fencing fabric should be buried to the recommended specifications in Table 1 and back-filled with soil.
- For snakes, supporting posts should be staked on the activity side (e.g. on the side facing the aggregate stock pile or the road - Figure 2).
- Light-duty geotextile fences are not effective where rocks or other hard surfaces prevent proper anchoring of fence posts and burial of the fence fabric.
- Light-duty geotextile fences are not effective where a large amount of concentrated run-off is likely or to cross streams, ditches or waterways without specific modifications.
- Contact your local MNR staff or experienced exclusion fencing contractor for advice and recommendations.
- See general best practices section below for additional details.

Generally, light-duty geotextile fences are not effective if they exceed 1 metre in height unless purposely manufactured for greater height (e.g. stakes placed at closer intervals or cross braces). If greater height is required consider using heavy duty geotextile, hardware cloth or other fencing materials.

Plate 1. Light-duty geotextile fencing with pre-attached wooden stakes used to exclude turtles from a road as seen on a regular maintenance check (photo credit: Brad Steinberg).

Heavy-duty Geotextile Fencing:

Heavy-duty geotextile fencing is typically constructed of a thick felt-like fabric. It may also be called ‘double row’ or ‘trenched’ fencing. For support, this fencing uses a woven wire fence (e.g. chain link) or some other structure (Plate 2). It is recommended that a minimum density of 270R or equivalent woven geotextile fabric is used.

Heavy-duty geotextile material can be effective for up to 2 or 3 years with proper maintenance. This type of fencing can be damaged by small mammals chewing through or torn by heavy debris (e.g. tree branches). Therefore, it may be best suited to turtles, which are less likely to take advantage of holes or tears in the fabric. If

used to exclude snakes or other animals, more maintenance may be required.

Heavy-duty geotextile fencing:

- The wire fence should be installed on the activity side to prevent animals from leveraging and climbing into the exclusion area while allowing the animal to escape if they find themselves on the wrong side (Figure 2).
- Geotextile fences across streams, ditches or waterways should have case-specific modifications.
- Contact your local MNR staff or experienced exclusion fencing contractor for advice.
- See light-duty geotextile section above and general best practices below for additional details.

Plate 2. Example of a heavy-duty geotextile fencing used to exclude snake species (photo credit: Jeremy Rouse).

HARDWARE CLOTH FENCES

Hardware cloth (also known as galvanized mesh or Birdscreen) is durable, cost effective and useful for excluding reptiles and amphibians. The fence should be made of heavy galvanized hardware cloth with a ¼ inch mesh. For fences intended to exclude small snakes, a ⅛ inch mesh may be more effective. In contrast, fencing intended to exclude turtle species can have a larger mesh size (e.g. ½ inch). Larger mesh may have a longer lifespan as it is constructed from a thicker material compared to smaller mesh sizes.

To use hardware cloth fencing:

- Secure the fence on posts placed a recommended 2.5 m apart with the stakes on the activity side (Figure 2).
- Pull the mesh taught and staple or secure with screws and a metal stripping to prevent the mesh from being ripped when pressure is applied.
- Installing a top rail or folding the mesh over a taut smooth wire reduces tearing (Plates 3 and 4).
- An outward facing lip installed on the species side ensures that snakes and amphibians are unable to climb or jump over the fence (Figure 2; Plate 4)
- Tears can be mended with 18-gauge galvanized wire.
- See general best practices section below for additional details.

Plate 3. Example of a galvanized mesh fencing used for the long-term exclusion of snakes and turtles from the adjacent highway (photo credit: Megan Bonenfant).

Plate 4. Long-term to permanent exclusion fencing using galvanized mesh with over-hanging lip to prevent animals from climbing or jumping over (photo credit: Megan Bonenfant).

WOOD LATH SNOW FENCING

In certain circumstances, wood lath snow fencing can be effective at excluding turtles. This fencing is typically constructed from soft wood slats that have been woven together with 13-gauge wire and is then attached to steel fence posts which have been driven into the ground.

Wood lath fencing is cost effective and can easily be laid down during the winter to prevent damage. The durability of the material, however, is not meant for very long-term use (e.g. more than 3 years), unless regular maintenance occurs.

To use wood lath snow fencing:

- The fencing should be attached to heavy plastic or metal stakes using heavy-duty wire staples or tie-wire.
- The stakes are recommended to be placed at 2 to 3 m intervals and securely driven into the ground 30 cm or more.
- Wood lath snow fencing across streams, ditches or waterways should have case-specific modifications.
- Wood lath snow fencing lends itself well to being combined with other types of material to ensure complete exclusion.
- See general best practices section below for additional details.

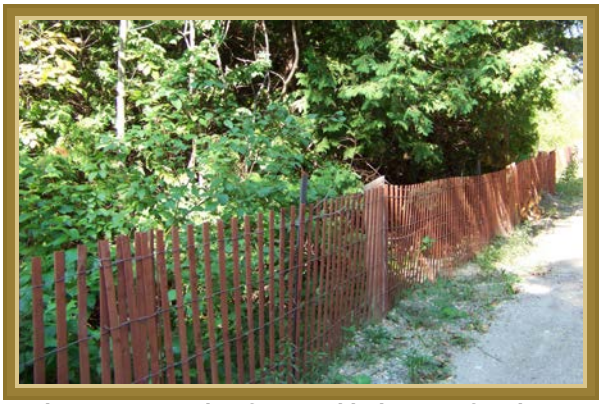


Plate 5. Example of a wood lath snow fencing used to exclude turtles (photo credit: Karine Beriault).

EXCLUSION FENCING FOR GRAY RATSNAKE AND EASTERN FOXSNAKE

Gray Ratsnake and Eastern Foxsnake are the largest snakes in Ontario - reaching nearly 2 m in length. They are also excellent climbers. For this reason, fencing intended to exclude either of these species has additional recommended design specifications.

- The fence should be at least 2 m high.
- The material on the species side (Figure 2) should be smooth to prevent the snakes from climbing into the excluded area.
- Stakes should be on the activity side of the fence (Figure 2).
- Due to the increase in fence height, it is valuable to decrease the distance between posts or install diagonal braces.
- See general best practices section below for additional details.

CONCRETE, SHEET METAL & VINYL WALLS

Concrete, metal or vinyl walls can stand alone or be combined with woven wire or chain link fences. They are durable, require minimal maintenance and are effective in excluding target species from high risk areas and guiding them to crossing structures or other desired locations (Plates 6 and 7). This fence type is comprised of a continuous vertical face of concrete, metal or vinyl sheeting with no gaps. Concrete walls can be installed as either pre-cast sections or pour directly in place.

Plate 6. Stand-alone continuous concrete wall used to exclude salamander species installed as pre-cast forms (photo credit: Steven Roorda).

Plate 7. Pre-formed vinyl sheeting fence intended to exclude salamanders for a construction site (photo credit: Herpetosure Ltd.)

The wall height depends upon the target species, but they are usually between 45 and 60 cm tall and buried 25 cm. Concrete, metal or vinyl exclusion fencing is most appropriate for salamanders, skinks, small snakes, and small turtles. For large turtle species, a chain link fence can be installed directly on top of the concrete wall for complete exclusion.

HABITAT CONNECTIVITY

Habitat connectivity is the connectedness between patches of suitable habitat or the degree to which the landscape facilitates animal movement. Exclusion fencing installed along roads or other large projects can effectively reduce or eliminate habitat connectivity for animals. In these scenarios, exclusion fencing should be considered with eco-passages in order to maintain connectivity. Fencing in isolation should be viewed as a temporary method to reduce mortality until species movement can be restored. Where eco-passages are not feasible they should be identified for consideration with any future road work or development to improve connectivity.

During the installation of fencing with an eco-passage, it is important that the fencing sits flush with the passage to ensure that

there are no gaps where animals can squeeze through.

Plate 7. A wood turtle travelling through a dry eco-passage. Ecopassages such as this help to ensure the long-term connectivity of seasonal habitat for this and other reptile and amphibian species (photo credit: Amy Mui).

GENERAL BEST PRACTICES:

- To deter digging, bury the fence 10 cm down with an additional 10 cm horizontal lip (Figure 2).
- Backfill and compact soil along the entire length on both sides of the fence (Figure 2).
- Once the fence is installed, a survey should be done to ensure that no individuals have been trapped inside (speak with MNR for survey advice).
- Exclusion fencing intended to exclude snakes should have the stakes installed on the activity side (opposite the normal requirement for sediment control fencing) to prevent snakes from using the stakes to maneuver over the fencing.
- For snakes and toads, the fence should have an overhanging lip on the species side (Figure 2).
- Fences should be inspected after spring thaw and at regular intervals throughout the active season, especially following heavy rain events. This is particularly important for geotextile fences. Any damage that affects the integrity of the fence (e.g. tears, loose edges, collapses, etc.) should be fixed promptly.
- Tall or woody vegetation on the species side of the fence should be managed if there is a risk that it may enable the animals to climb over. This is most important during spring and fall. Proceed cautiously to not harm animals protected plant species during vegetation removal.
- When installing an eco-passage, fencing or exclusion walls should be used as a guiding system to direct animals to passage openings.
- Natural screens such as trees or shrubs can help to reduce road access and can be combined with fencing to provide protection of individuals from predation.
- Install fences with a turn-around at the ends furthest from the wetland habitat and at any access areas to assist in redirecting animals away from any fence openings (Figure 1).
- Curving the ends of the fencing inward (i.e. away from the road or construction site) may help to reduce access to these locations. The ends may also be tied off to natural features on the landscape such as trees or rock cuts.

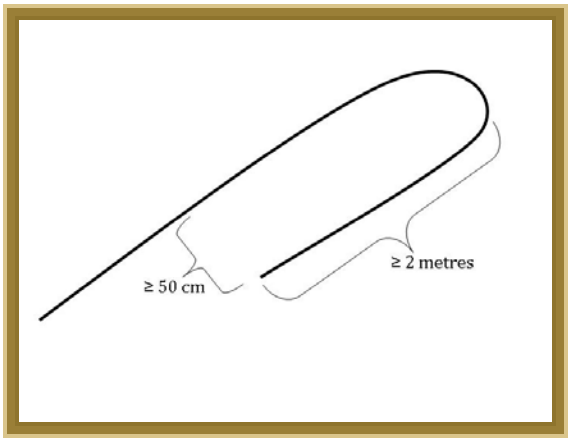


Figure 1. Diagram of the ends of the fence designed to curve inward in order to direct animals away from the area of exclusion.

WATER MOVEMENT & DRAINAGE

- In areas where surface water run-off may erode a soil-based backfill, consider using rocks or sand bags. Ensure these materials cannot be used by animals to climb over the fence.
- Where possible, minimize the number of water crossings: when necessary, it should occur where flow is minimal.
- Fence posts in waterways or areas prone to seasonal flooding should be driven rather than dug – unless following established best practices.
- Fencing should be placed above the high water mark anticipated for high water events such as spring freshet or periods of heavy or continuous rainfall.

TOPOGRAPHY:

- Fence posts should be closer together in undulating topography.
- Fences installed on slopes have a different effective height depending upon whether the animal will be approaching from the up or down slope. The fence height can be adjusted accordingly.

Improvements or questions regarding exclusion fencing can be brought to the local MNR Species at Risk Biologist or other MNR staff.

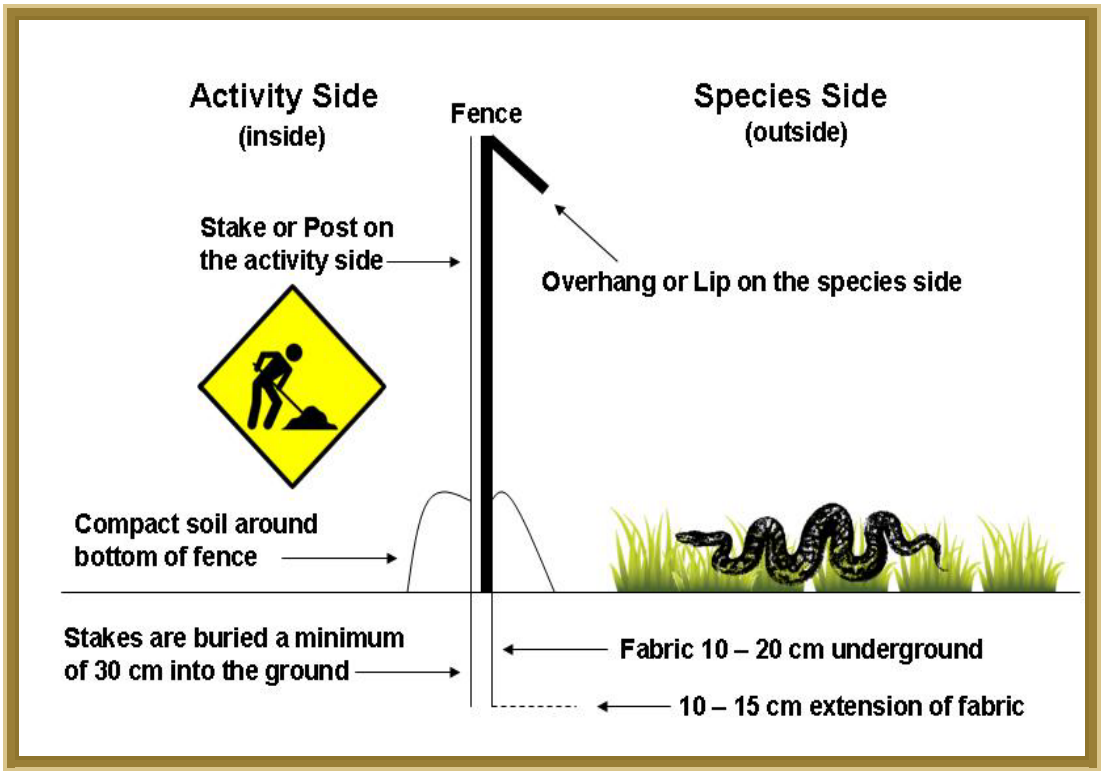


Figure 1. A side view of a basic exclusion fence including an overhang or flexible lip to deter animals from climbing or jumping over the fence. Placement of the stake on the Activity Side or on the inside of excluded area is also illustrated. This is particularly important for snake species which may use the stakes to maneuver over the fence.

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For additional information:

Visit the species at risk website at
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