

PART 1 GENERAL**1.1 Summary**

- .1 Unless otherwise indicated, follow the standards below when specifying green roofs for landscape use. These standards are not intended to restrict or replace professional judgment.

1.2 References

- .1 Régie du bâtiment du Québec (RBQ)
 - .1 Critères techniques visant la construction de toits végétalisés¹.

1.3 Insurance and warranty

- .1 To ensure the warranty of the system in case of failure, the green roof components should be sourced by one supplier only.

1.4 Design Requirements

- .1 The following recommendations should be considered before starting a green roof project. These should be read in conjunction with the Flow Chart found at the end of this section
 - .1 McGill Support
 - .1 It is important that stakeholders approve and support a given green roof project, including administratively and financially.
 - .2 To ensure long-term success, this approval and support must include commitments for the maintenance requirements, either within the project scope and budget (recommended), or with follow-up funds and responsibilities. See Part 3 below.
 - .2 Slope of roof
 - .1 Green roofs should only be installed on roofs with a slope less than 5%.
 - .3 Sun and wind exposure
 - .1 Where possible, the installation of a green roof on a south-facing roof with protection from the wind should take precedence over other roof areas.
 - .4 Accessibility and safety
 - .1 To be considered for a retrofit, the roof must be easily accessible. Types of access may be an elevator, interior or exterior stairs, or a stairwell with a door leading directly to the roof.
 - .2 If the roof is to be accessible to the public, the number of people on the roof at one time will be limited to 60 by the Quebec Building Code, unless a second exit stairwell is provided.
 - .5 Wood construction buildings

¹ <https://www.rbq.gouv.qc.ca/fileadmin/medias/pdf/Publications/francais/guide-criteres-techniques-construction-toits-vegetalises.pdf>

- .1 The Régie du Bâtiment du Québec (RBQ) has published a technical guide, entitled Technical criteria for green roofs construction
 - .1 If the building being considered is of wood construction, i.e., of combustible construction, it cannot benefit from pre-authorized approval by the RBQ for the installation of a green roof. In such a case, the design team will need to submit a proposal for approval to the RBQ that meets or exceeds the requirement of the technical guide. An alternative solution can be to install vegetated planting boxes on a roof deck instead of a green roof.
- .6 Structural load capacity of existing building
 - .1 The Quebec Building Code (2015) requires that a roof terrace be capable of supporting a live load of 100 pounds per square foot for the installation of a green roof. If the green roof retrofit is accessible to the public, the structural load capacity of the building must be verified, and reinforced if need be.
 - .2 During construction, temporary placement of heavy components need to be carefully planned and calculated.
- .7 Mechanical equipment on the roof
 - .1 If more than 50% of the roof surface is occupied by mechanical equipment, ducts, and chimneys, the green roof's social and ecological benefits may not offset the effort and cost of construction. In such a case, it would not be recommended.
- .8 Visibility from other buildings
 - .1 The roof should be visible from other buildings.

PART 2 PRODUCTS

2.1 Waterproof membrane

- .1 The following membranes are appropriate for green roof design at McGill:
 - .1 Rubberized asphalt (completely adhered to the deck)
 - .1 Shall be hot applied rubberized asphalt membrane MM6125 by Hydrotech or approved equivalent.
 - .2 Thermoplastic olefin (TPO) (sheets with seams)
 - .3 Elastomeric membranes: Ethylene propylene diene membrane (EPDM) (sheets with seams)
- .2 The membrane needs to be installed by a professional experienced in green roof applications. After membrane installation and prior to installation of all additional green roof system layers, a membrane leak detection test should be conducted.
- .3 The membrane must be guaranteed when submerged in water.

2.2 Root barrier

- .1 Shall be *Root Stop – Standard*, as provided by Hydrotech or approved equivalent, for use in extensive assemblies with herbaceous plants only (no woody plant varieties), lawn applications with no woody plants, and planters with herbaceous plants only

- .2 Shall be *Root Stop – HD*, as provided by Hydrotech or approved equivalent, for use settings with perennials, woody plants, tree wells, planters with woody plants, and foundation wall applications to control roots.
- .3 Sheeting shall be held together with *Root Stop Tape*, as provided by Hydrotech or approved equivalent,

2.3 Protection Board

- .1 A 1/8 to 1/4 inch thick protection board, made of a durable material that does not deteriorate in water, shall be used until all components are installed on top of the root barrier.

2.4 Insulation

- .1 Insulation material shall be expanded or extruded polystyrene, and shall be installed above the membrane.
- .2 This material can also be used to create lightweight landforms if applicable.
- .3 Acceptable products: STYROFOAM™, ROOFMATE™, HiLoad 40, HiLoad 60 and HiLoad 100, or approved equivalents.

2.5 Drainage system

- .1 All components of the drainage system must be kept free of debris and plant material in order to properly convey drainage.
- .2 Drainage components include:
 - .1 Granular media (crushed stone, pea gravel or river rock) installed at the perimeter of the green roof and around drains and other openings in the membrane (chimney stacks, posts etc.)
 - .2 Rigid drain board or granular fill underneath the water retention layer
 - .3 Water retention layer (plastic sheeting with depression cups or moisture retention mat) to capture water and retain moisture underneath the growing medium
 - .1 Shall be Gardendrain GR25 or GR30 by Hydrotech or approved equivalent
 - .4 Roof drains
 - .1 Inspection chamber for roof drain: shall be GardenHatch® by Hydrotech, or approved equivalent.

2.6 Filter fabric

- .1 Shall be FABROC® 400 by Hydrotech, or approved equivalent.

2.7 Flashing

- .1 Flashing shall be made from corrosive resistant materials such as stainless steel. The root barrier shall also be carried into the flashings.

2.8 Erosion control

- .1 An erosion protection layer shall be installed during vegetation establishment where applicable.
- .2 Shall be:

- .1 Biodegradable erosion control matting composed of straw and coconut fiber such as GardMat LT or GardMat N by Hydrotech or approved equivalent
- .2 Wood fibre and polymer-based hydro-mulch, 100% biodegradable and having nutritive properties promoting rooting for securing seedlings on roof.

2.9 Growing medium

- .1 A lightweight growing medium shall be used, which must:
 - .1 Retain necessary amounts of air and water for plant roots
 - .2 Allow water to permeate through planting media
 - .3 Provide root stability and plant support
 - .4 Resist compaction and maintain integrity
 - .5 Drain well enough so that roots are not consistently saturated.
 - .6 Be able to resist and stay in place during wind gusts.
- .2 Shall be LiteTop growing media by Hydrotech or approved equivalent.

2.10 Vegetation

- .1 The stability of larger shrubs and trees should be considered given the use of shallow and lightweight growing medium.
- .2 When selecting plants, consider the presence of adjacent walls that are highly reflective, such as window or metal, as they will cause extremes in temperature or solar reflection.
- .3 Ensure the plant selection is coordinated with type of root barrier used (see article 2.2. above)
- .4 The use of annuals may be needed for aesthetics during the initial establishment phase.
- .5 Vegetation-free zones
 - .1 The RBQ's technical guide for green roofs design (see article 1.2 above) requires a 300mm vegetation-free zone around the perimeter of the green roof, and a 500mm vegetation-free zones around other penetrations to the roof membrane

2.11 Irrigation and water faucets

- .1 An irrigation system must be installed as part of the establishment stage for green roof systems.
- .2 Installing a main line hose spigot is also required for additional hand watering.

PART 3 MAINTENANCE

3.1 General

- .1 At the end of the project, a maintenance manual must be submitted by the landscape architect or other competent design professional to the maintenance team responsible for the green roof's upkeep. The maintenance program must include at the very least instructions regarding articles 3.2 to 3.5 below.

- .1 It is recommended that the project fund maintenance works, performed by an external organisation, for at least the first three years after green roof completion.

3.2 Waterproof membrane

- .1 Regular inspections of joints, borders or other features penetrating the roof, such as all abutting vertical walls, roof vent pipes, outlets, air conditioning units and perimeter areas are advised at least three times per year.

3.3 Drain inspection

- .1 All drains must remain free of vegetation and foreign objects. To allow for regular inspections and maintenance, every drain on a green roof must remain permanently accessible.
- .2 Roof outlets, drains, interior gutters, and emergency overflows must be kept free from obstruction by either providing a drainage barrier (e.g., a gravel barrier between the green roof and the emergency overflows) or they should be equipped with an inspection shaft.

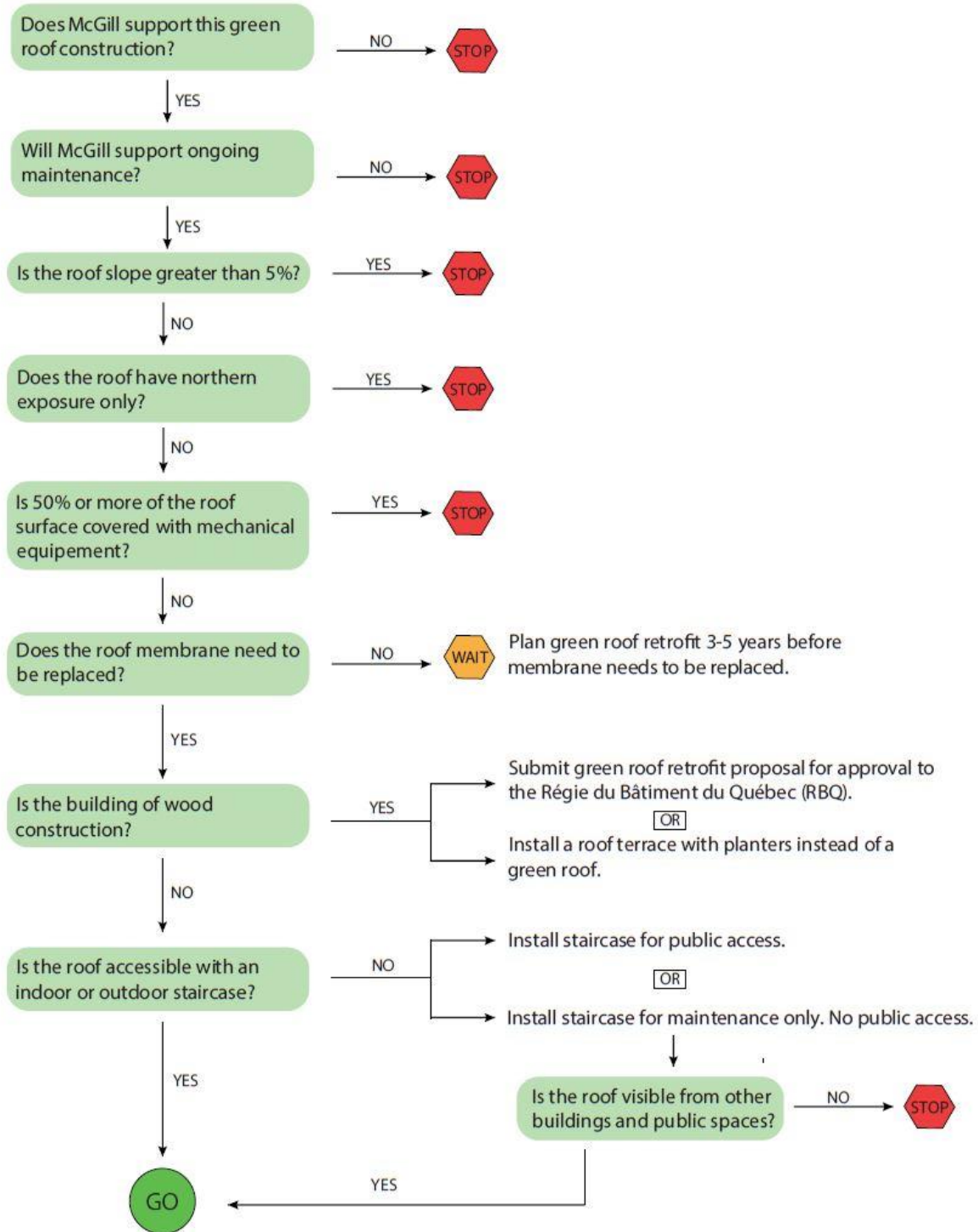
3.4 Plant and growing medium

- .1 Care of the plants on the green roof will require the most attention during the critical establishment phase (first 18-24 months), unless the green roof is a modular system comprised of pre-grown vegetative carpet that is and close to being established upon installation.
- .2 The maintenance will include the following. A manual shall be provided at the end of each project.
 - .1 Hand weeding and replacing planting is necessary throughout life of the roof
 - .2 Watering is necessary especially during establishment phase and might be necessary throughout the life of the roof and/or especially during droughts
 - .3 Thinning & pruning is necessary after the establishment phase to promote plant health
 - .4 Fertilizing using organic products may be used during establishment phase to promote plant health

3.5 Irrigation system

- .1 The irrigation system needs to be flushed out completely before the first winter freeze
- .2 Check emitters and spray heads at spring start-up and throughout the season
- .3 If a drip irrigation system is used, hand watering is recommended during the plant establishment phase.
- .4 Installing or adding a main line hose spigot is required for additional hand watering during establishment periods, during dry seasons and during fall and spring, while irrigation is off and for cleaning.

FLOW CHART



END OF SECTION