

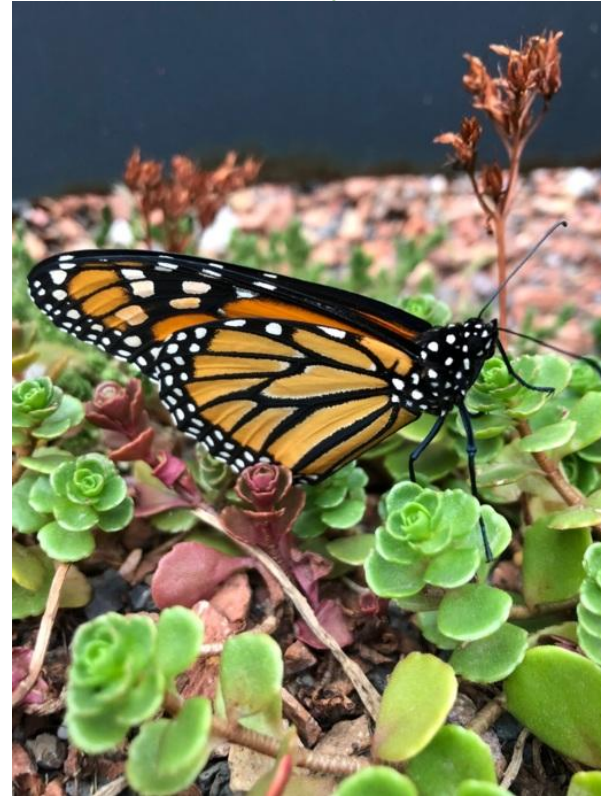
ALL ABOUT GREEN ROOFS



ginkgosustainability

Agenda

1. Intro
2. What is a green roof
3. Benefits
4. Common misconceptions & myths
5. Performance
6. Green Roofs & Solar
7. Policy tools and frameworks
8. Options & tools
9. Funding
10. Resources
11. Q&A



Introduction

Connecting the Living and Built Environments

- Founded in 2010
- Design, Build, Maintain
- Support of Industry via GRHC
 - Walls Committee
 - Maintenance Committee
 - Treasurer
- BC added in 2021
- 50 plus FT and FT seasonal staff (union and non-union)
- Close to 4 million SF of green roofs under maintenance



What is a green roof?

Specialized roofing system that supports vegetation growth on rooftops

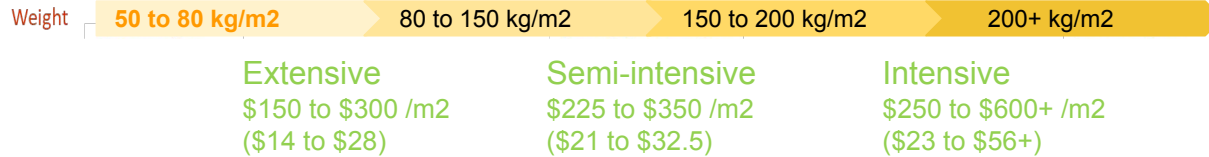
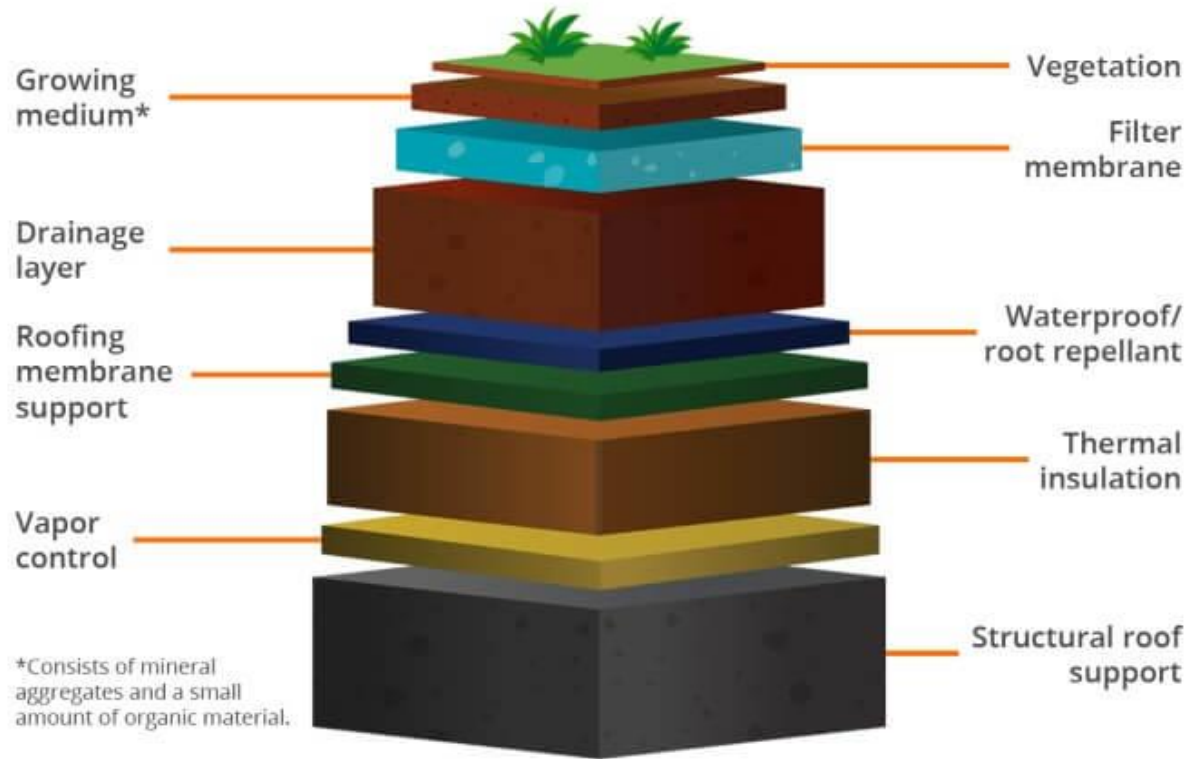


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What is a green roof?: Components



Benefits

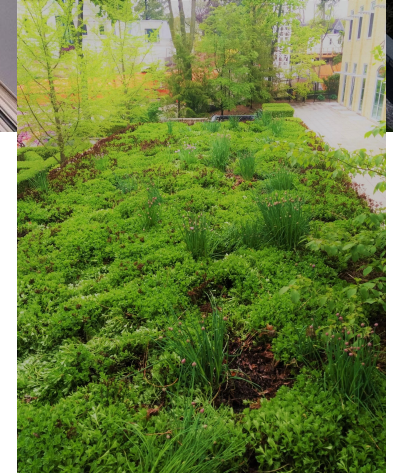
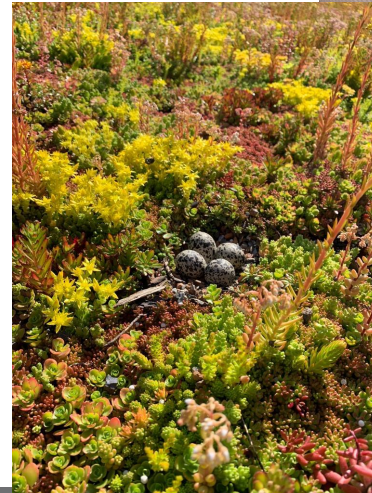
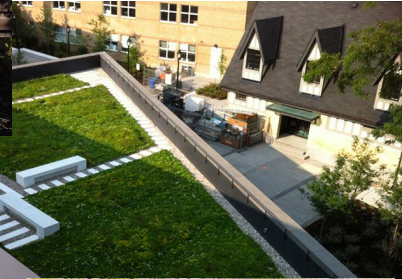
Public & Private

1. Public

1. Air quality
2. Biodiversity
3. Urban Heat Island Mitigation
4. Reduced Stormwater Runoff
5. Enhanced Aesthetics / Spaces

2. Private

1. Stormwater management
2. Energy savings
3. Lifecycle returns
4. Solar performance
5. Enhanced Aesthetics / Spaces
6. Noise Dampening



Common Myths

- **Maintenance Free - NO!**
 - Low yes! But none is not feasible. Assets need maintenance
- **Cause leaks - NO!**
 - They shield the membrane
 - For example: Hail damage or bird droppings
- **Fire Hazard - NO!**
 - Vegetation has much lower embodied energy than asphalt or synthetic based products
 - Design to reduce risk using green roofs (ANSI/SPRI & FLL)



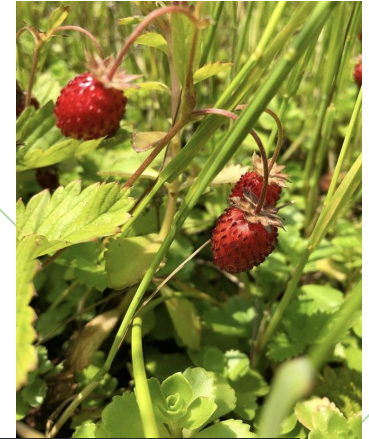
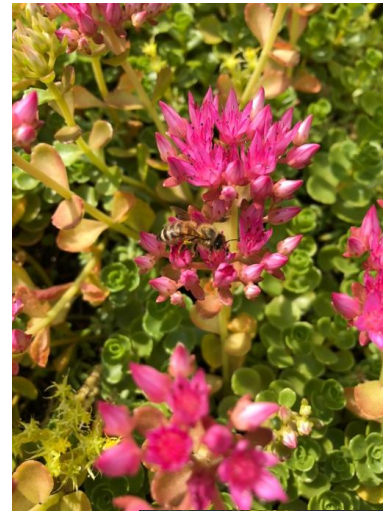
Performance

Design Goals

1. SWM Retention & Detention
2. Energy savings (modelling)
3. Biodiversity
4. Maximize coverage
5. ...

Solutions for multiple disciplines:

1. Civil - Water Balance, Quality & Quantity
2. Landscape Architect - Amenity Space, Biodiversity
3. Architect - Sustainable Development
4. Urban Planner - Infrastructure and Development ie: TGS, Biodiversity corridors, etc



Performance: SWM Retention



Water Balance - Evapotranspiration (Drying Cycle)

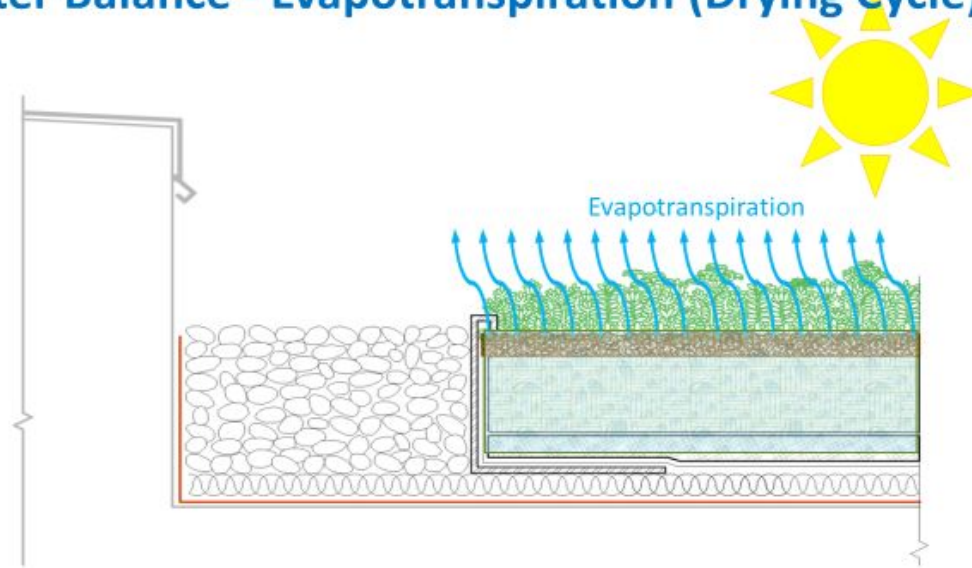
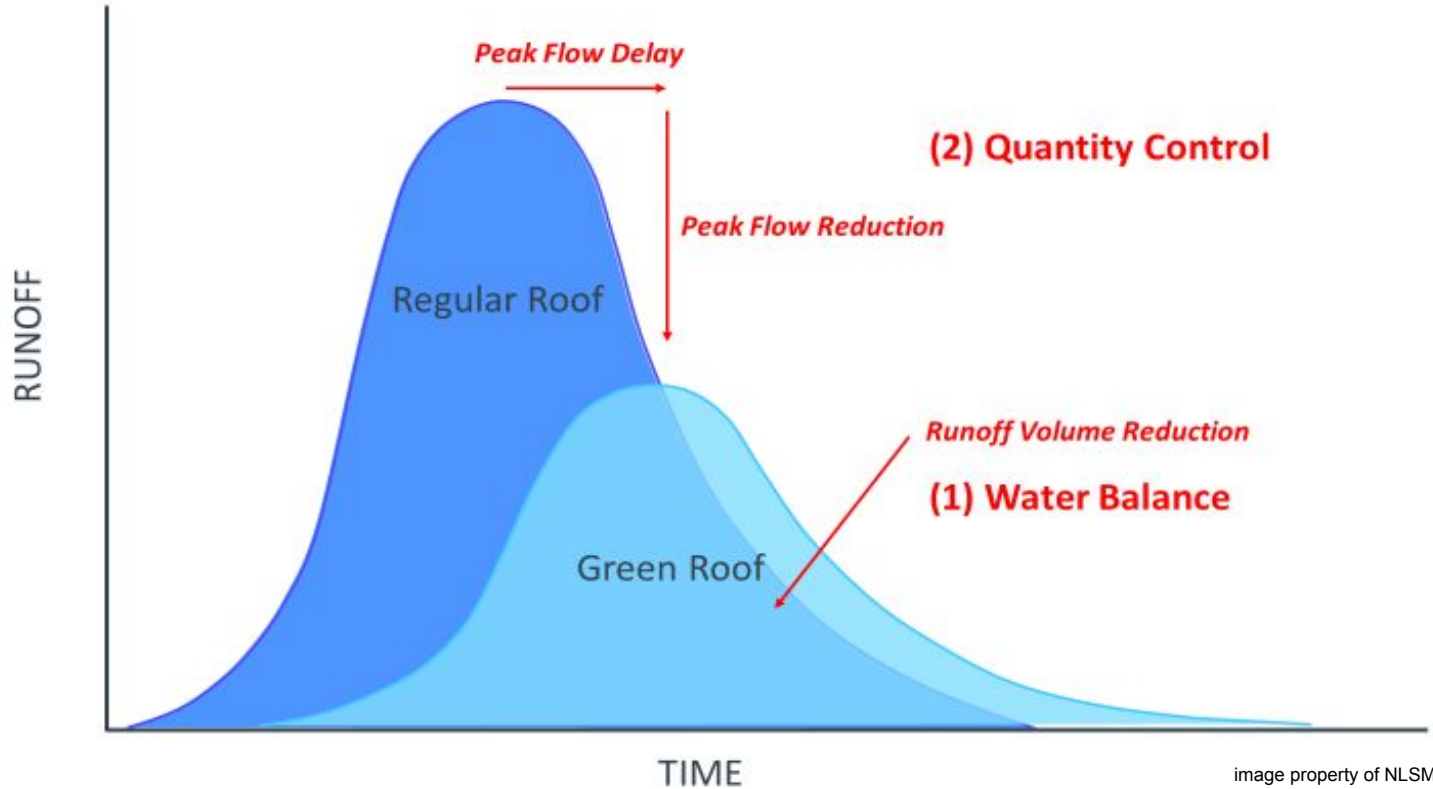


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Performance: SWM Detention



Green Roofs & Solar

- Also known as BioSolar
- I'm aware of a pilot project done in 2012
- Green roofs reduce ROI of Solar
 - Solar has a Private ROI greater than that of a Green roof so joint ROI is driven downwards
 - Toronto Green Roof bylaw excludes Solar Roof area from Green Roof Area calculation
 - This is being impacted by new water balance calculations so will likely see more of in future



Policy Tools & Frameworks

Successful Green Roof Policy

1. Objective - single/multiple, clear & concise
2. Requirements - prescriptive vs performance
3. Achievable - realistic, resource availability
4. Local Context - opportunities and limitations



Policy Tools & Frameworks: Objectives



| City | Policy / Program | Objectives |
|---------------|-----------------------------------------------------------------------------------|---------------------------------------------------------------------|
| Toronto ON | Toronto Green Roof By-law, Ecoroof Incentive Program, Toronto Green Standard | Sustainable development, stormwater management, biodiversity |
| Washington DC | Stormwater Retention Credit Trading Program, RiverSmart Rewards, Green Area Ratio | Stormwater Management |
| Chicago IL | Sustainable Development Policy, Green Elements Permit Process | Sustainable development Green infrastructure |
| Denver CO | Better Buildings Ordinance | Sustainable development, green space, energy, stormwater management |
| Portland OR | Ecoroof Requirement | Sustainable Development |
| New York NY | Green Roofs for New Construction | Sustainable Development, energy |



Policy Tools & Frameworks: Requirements

Prescriptive vs Performance

Prescriptive based

- Specific requirement to achieve the goal
- Easier to implement and check

Performance based

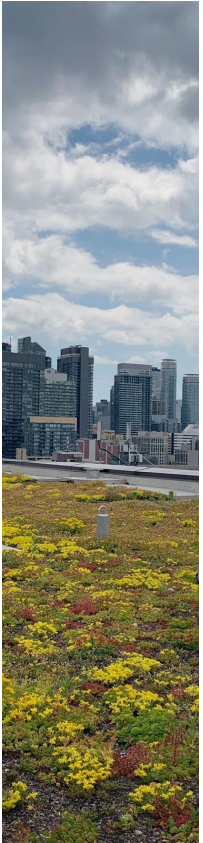
- Specific goals that the policy aims to achieve without stating how
- Adds flexibility and allows for innovation

City of Toronto By-law No.583-2009 § 492-9 K.

K. Vegetation Performance

In order to support plant survivability:

- (1) When structurally possible, the growing media shall be at a minimum 100 mm, or
- (2) the Applicant shall provide a report confirming that the engineered system as designed provides plant survivability comparable to that of an un-irrigated system with growing media at minimum 100 mm.



Policy Tools & Frameworks: Achievable / Realistic

Prescriptive vs Performance

Minimal cost and resource requirements allow systems to be more widely used and so maximize environmental benefits “Less is more”

- Light system weight
- Easy installation
- Low maintenance
- Economical

Prescriptive vs Performance

Performance helps future proof policy by allowing various ways of fulfilling a requirement to evolve

Prescriptive requirements great for setting boundary conditions such as:

- Need for Leak testing prior to installation
- Structural sign-off required.
- ...



Options & Tools for Policy Implementation

1. Green Area Ratio - environmental zoning regulation
2. Construction Standards - ie the Toronto Green Roof Bylaw
3. Biodiversity
4. Green Standards - ie the Toronto Green Standard (TGS)
5. Options for meeting water balance
 1. GR irrigation vs water reuse for toilets



Funding

1. Raise funds to drive adoption to ideal sites/projects from less ideal cases - Whats is the transfer mechanism
 1. For example take an expensive site - say high-rise or hard to maintain and shift to low rise - easy to maintain location
 2. Or shift from locations with low impact on infrastructure to high impact on infrastructure
2. Creating incentive programs
 1. [Eco-roof Incentive Program](#)
 2. [Stormwater Retention Credit Trading Program](#)



RESOURCES



- [Green Roofs for Healthy Cities](#)
 - Coming soon Q2/Q3- 2023 Policy Document
- GIF - [The Green Infrastructure Foundation](#)
 - the [Living Architecture Performance Tool](#)
- [Living Architecture Monitor](#) & [Journal for Living Architecture](#)
- Ginkgo Sustainability Inc - [Resources](#) (Various downloads)
- [City of Toronto - Green Roofs](#)
 - 492-2 Toronto Municipal Code Green Roofs (By-Law and Construction Standard)
 - Eco-Roof Incentive Program
 - The Guideline for Biodiverse Green Roofs
- [ANSI/SPRI](#)
 - VF-1 External Fires Standard for Vegetative Roofs
 - RP-14 Wind Design Standard
- [Canadian Standards Association \(CSA\) A123.24-15](#) (Wind Uplift)
- Forschungsgesellschaft Landschaftsentwicklung Landschaftsbau e.V. (FLL) ([Guidelines for the Planning, Construction and Maintenance of Green Roofing](#))





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