metrovancouver

LOWER SEYMOUR CONSERVATION RESERVE

Trail Standards

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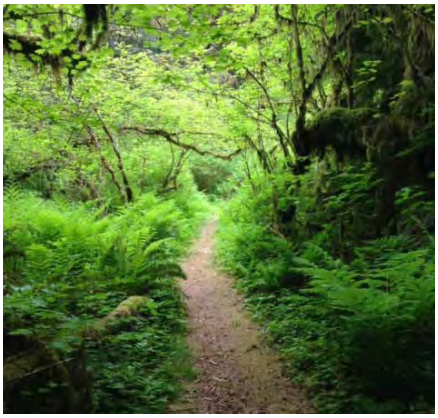

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1 INTRODUCTION

1.1 CONTEXT

The 5,668 hectare Lower Seymour Conservation Reserve (LSCR) is home to spectacular temperate rainforest ecosystems, and features rugged mountain peaks, rocky slopes and pristine waters. Balancing recreation, education, and environmental conservation with its capacity to be a future water reservoir, the LSCR offers an abundance of outdoor recreational opportunities, including hiking, horseback riding and cycling (on and off road), fishing, kayaking, water education programs and more.

The LSCR's trail network includes over 100 km of trail, and is home to some of the Lower Mainland's most iconic trails, contributing to the region's reputation as a premiere destination for hiking and mountain biking.

With population growth and increased trail use, pressure on the LSCR trail network is expected to increase. This document was developed as a means to standardize development and management of the trail system as a recreational asset for the region. It will also be used to inform development of a comprehensive long-term management strategy for the trail network, which will support recreational activities that depend on the unique landscapes and features of the LSCR.

The methods and technical information used in this document are sourced from various documents and Best Management Practices, listed at the end of this document (Section 7- References).

1.2 PURPOSE

These standards have been developed to guide trail development and maintenance within the LSCR. All new trails will be built to these Standards, and existing trails will be upgraded and maintained, as time and resources permit. The Standards provide the foundation for sustainable trail design and construction, allowing for safe, sustainable and enjoyable trail experiences.

As physical environments and trail usage may change with time, periodic reviews of these standards and guidelines should be completed in order to keep them effective and relevant. These standards are aimed at the multiple interest groups and uses of the area including those of water quality, ecological and recreational significance.

1.3 OBJECTIVES:

Specific objectives of these Trail Standards include:

- Protecting the natural landscape and areas of environmental significance;
- Creating a sustainable trail network;
- Creating a safe network and lessening user conflict;
- Protecting cultural heritage resources; and
- Enhancing user experience.

Photo Credit:
Metro Vancouver

2 INVENTORY + CLASSIFICATION

Type Class 3 – Multi-Use Trail before surface material (Bridle Trail)

Class 1 - Urban Paved Trail (Seymour Valley Trailway)

Class 7 - Mountain Bike Primary Trail (High School League down-track)

2.1 NETWORK

The LSCR trail network consists of over 100 km of trails, comprised of gentle paved pathways, wide and narrow multi-use trials, assessable trails and technical mountain bike trails that range in difficulty and experience.

2.2 TRAIL INVENTORY

The majority of trails are situated in the frontcountry with some providing important connections, linking trails in neighbouring jurisdictions and communities. The LSCR provides a range of trails that contribute to varying user experiences and difficulties, some of which provide educational experiences through interpretive signage, and others that link users to view unique landscapes and infrastructure while supporting health and wellness.

2.3 CLASSIFICATION

The LSCR recognizes the need for a well-balanced safe trail network that includes a variety of standardized trail classes, and meets the needs and wants from a range of user groups and stakeholders.

These Standards establish seven trail classifications that reflect the existing network, as well as the trail categories contained in the Metro Vancouver's Park Design Standards. Each classification category comes with a set of standards allowing for consistent management decisions and displays the classes of trails throughout the LSCR for planning purposes.

Summarized in Table 1 Trail Classifications, and shown on cross sections, the seven trail types include:

CLASS 1 | Urban Paved Trail Wide paved trail that accommodates low-speed activities, and is suitable for strollers and mobility impaired individuals.

CLASS 2 | Access/Connector Trail Wide trail for pedestrians and cyclists that allows for limited vehicle access for MV operations and maintenance.

CLASS 3 | Multi-Use Trail Wide graveled surfaced trail suitable for a range of low-intensity recreational pursuits, including walking, jogging, cycling.

CLASS 4 | Frontcountry Hiking Primary Trail Easy to access trail designed for moderate short day hikes and trail running.

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Middle: '91684349 ' www.panaramio/photo, photo by Jeff Hitchcock
Bottom: 'High School League Trail Project'http://nsmba.ca/content/2013-07_high-school-league-trail-project-phase-2-starting-mid-july

CLASS 5 | Frontcountry Multi-Use Trail Easy to access trail designed for short day hikes, trail running and mountain biking.

CLASS 6 | Backcountry Hiking Only Trail provides a wilderness experience for hikers in the backcountry, and is designed for longer hikes by one user type.

CLASS 7 | Mountain Bike Primary Trail designed primarily for mountain biking. For safety reasons, trails could be separated for uphill or downhill traffic or single use. All mountain bike trail users must yield to pedestrians.

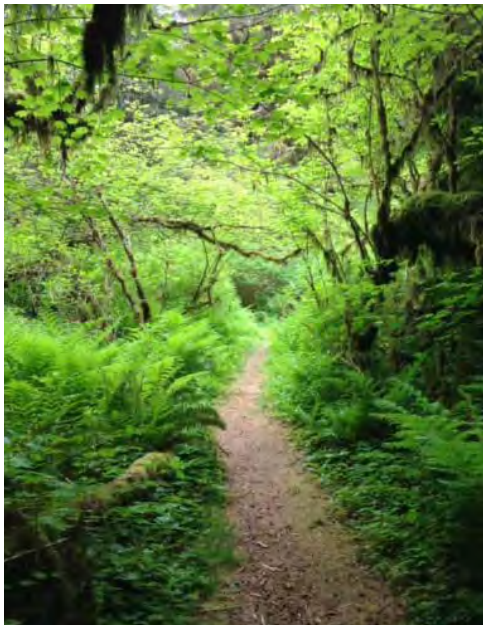
This Class 7 Trail, routed over roots and rocks, would be rated Black Diamond/Difficult

2.4 TRAIL DIFFICULTY RATING

Trails within the LSCR are rated for level of difficulty, based on the grading system popularized in the ski industry and adopted by the International Mountain Bicycling Association (IMBA). Difficulty ratings for the LSCR are as follows:

- ○ WHITE CIRCLE | Easiest: fairly flat, wide and paved or smooth surfaced, suited to beginner and recreational users.
- ● GREEN CIRCLE | Easy: gentle terrain with easily avoidable obstacles suited to beginner and recreational users.
- ■ BLUE SQUARE | More Difficult: challenging terrain with steep slopes and/or obstacles, possibly on narrower trails, suited to intermediate users.
- ◆ BLACK DIAMOND | Very Difficult: a mix of long steep climbs, loose trail surfaces and numerous difficult obstacles, suited to advanced/expert users.
- ◆◆ DOUBLE BLACK DIAMOND | Extremely Difficult: a mix of long steep climbs, loose trail surfaces and numerous difficult obstacles, average trail grade 20% or more with possibly some unavoidable obstacles. Suited to advanced/expert users only.

  *The LSCR will not permit the development of new double black diamond trails.



Class 5 - BCM Connector Trail

Trails in each trail class could be assigned different difficulty ratings, but because of the correlation between difficulty, width and grade, the following difficulty ratings are likely within each trail class.

Class 1 | Urban Paved Trail : WHITE/GREEN

Class 2 | Access/Connector Trail: WHITE/GREEN

Class 3 | Multi-Use Trail: WHITE/GREEN/BLUE

Class 4 | Frontcountry Hiking Primary Trail : GREEN/BLUE

Class 5 | Froncountry Multi-Use Trail: GREEN/BLACK

Class 6 | Backcountry Hiking Only Trail : BLUE/BLACK

Class 7 | Mountain Bike Primary Trail: GREEN/BLUE/BLACK/DOUBLE BLACK

For more detail, refer to Table 2 | Summary of Trail Ratings.

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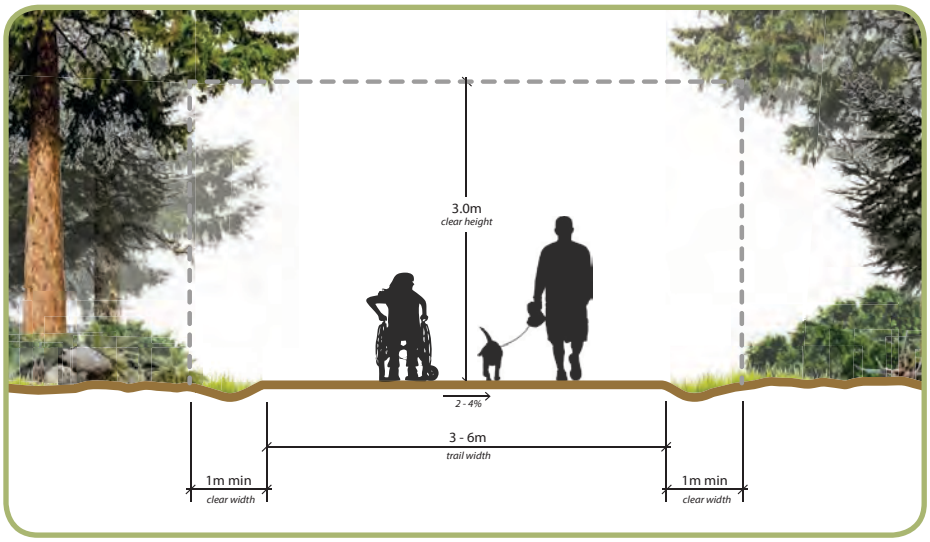
Bottom: 'Lost Lake Trail', Metro Vancouver

TRAIL CROSS SECTIONS*



CLASS 1 | URBAN PAVED TRAIL

PRIMARY USE: walking/biking/wheelchair

SURFACE: pavement

WIDTH: 3- 6m

CLEARANCE: 1m each side

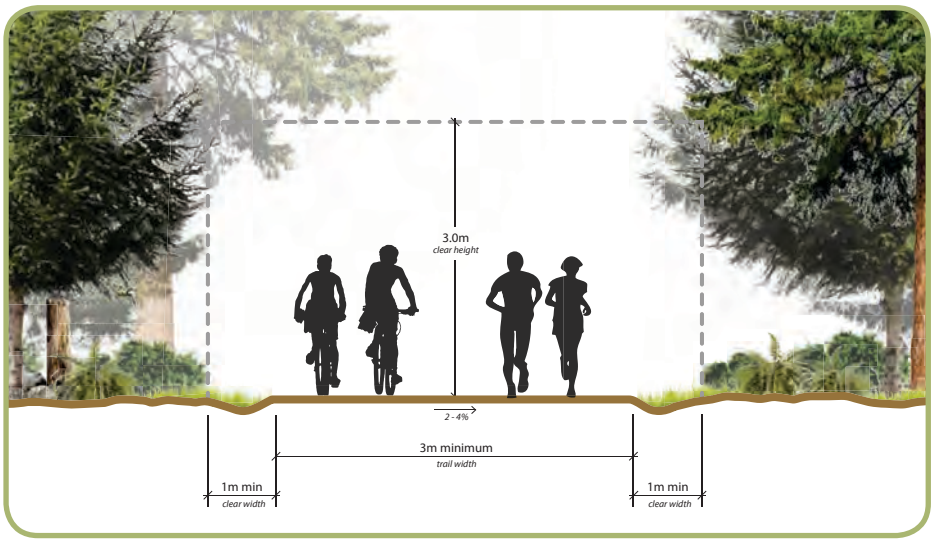
CLASS 2 | ACCESS/CONNECTOR

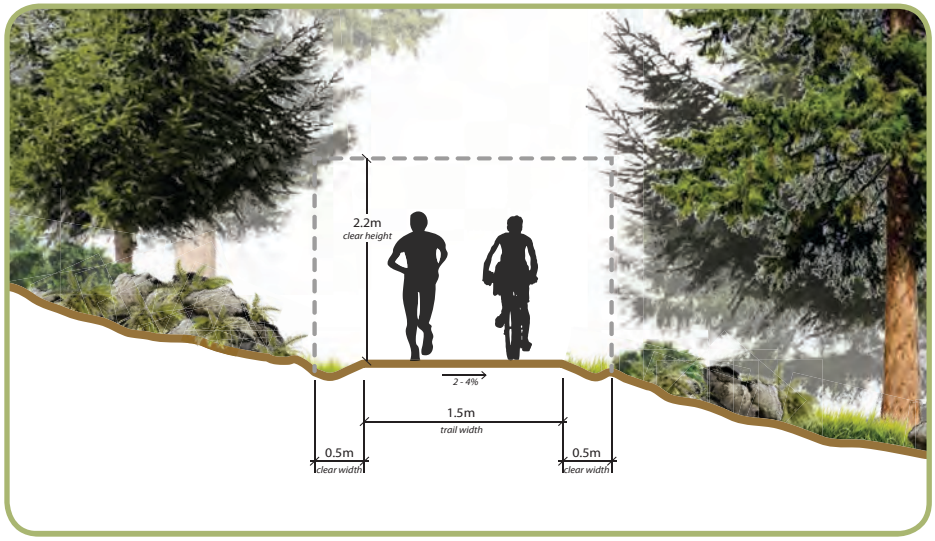
PRIMARY USE: walking/biking, MV vehicle access

SURFACE: gravel (3/4” minus road base)

WIDTH: 3m minimum

CLEARANCE: 1m each side





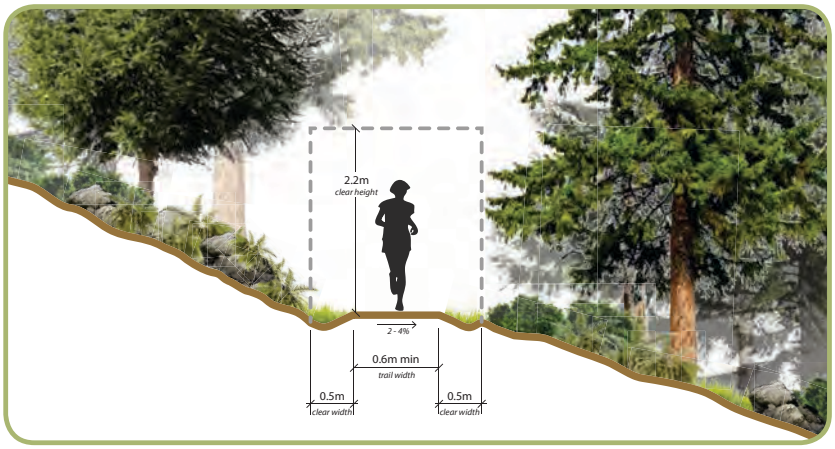
CLASS 3 | MULTI-USE TRAIL

PRIMARY USE: walking/biking

SURFACE: gravel (3/4” minus road base)

WIDTH: 1.5m minimum

CLEARANCE: 50cm each side



CLASS 4 | FRONTCOUNTRY HIKING PRIMARY

PRIMANY USE: walking/running

SURFACE: native soils

WIDTH: 60cm minimum

CLEARANCE: 50cm each side

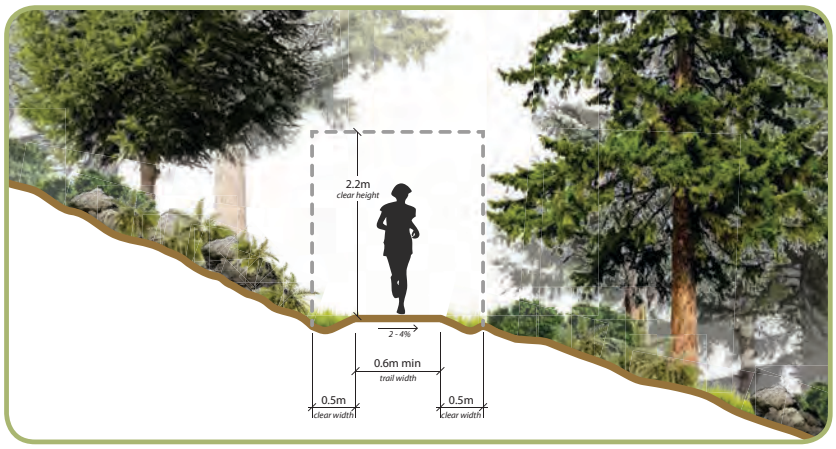
CLASS 5 | FRONTCOUNTRY MULTI-USE

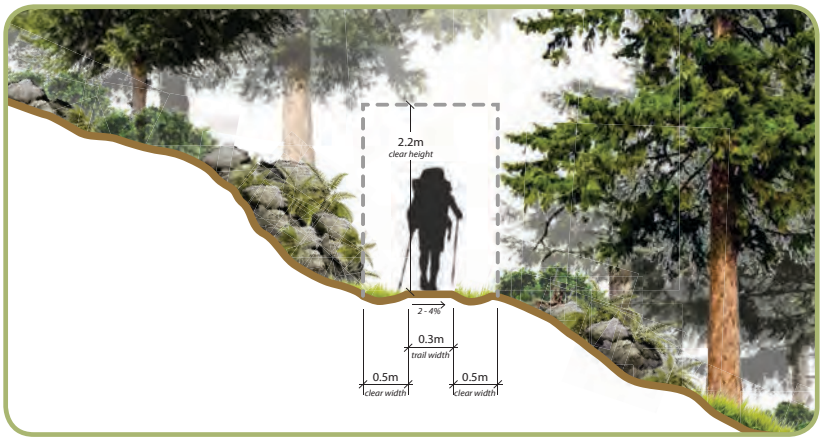
PRIMARY USE: hiking/biking/running

SURFACE: native soils

WIDTH: 30cm minimum

CLEARANCE: 50cm each side





CLASS 6 | BACKCOUNTRY HIKING ONLY

PRIMARY USE: walking/running

SURFACE: native soils

WIDTH: 30cm minimum

CLEARANCE: 50cm each side

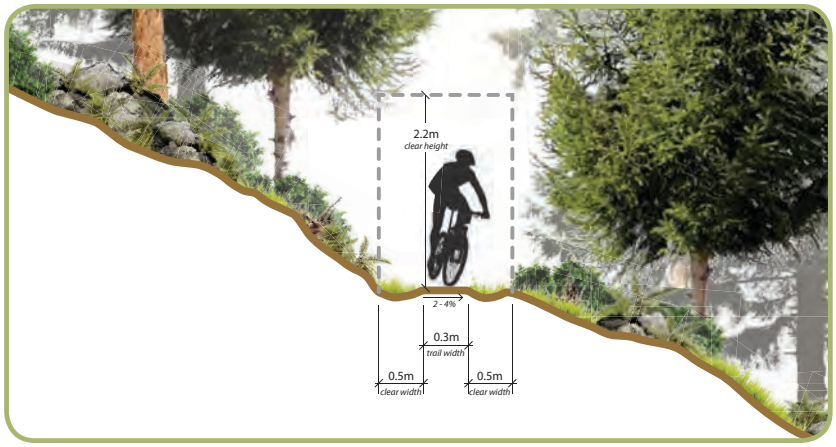
CLASS 7 | MOUNTAIN BIKE PRIMARY

PRIMARY USE: hiking/biking/running

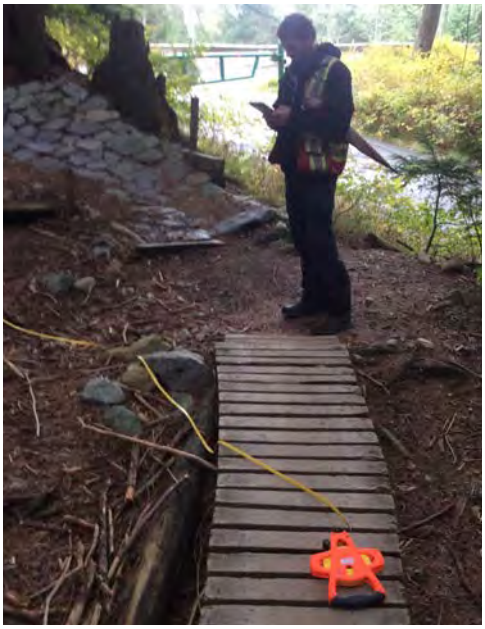
SURFACE: native soils

WIDTH: 30cm minimum

CLEARANCE: 50cm each side



*complete cross sections are provided in the Appendix



Biologist assessing a TTF on CBC Trail

Trail feature that fails from a safety perspective

3 TRAIL ASSESSMENT

3.1 ASSESSMENT METHODS

Assessing trail condition is an important step in categorizing trail types, and in determining priorities for maintenance and future planning of the overall network. The following methods have been developed to assist Metro Vancouver to methodically assess the conditions of all trail types and reach our overall goal of 80% or greater for the network.

Trails constructed or proposed to be constructed in environmentally sensitive areas, or trails on steep and challenging terrain may require further assessments by a Qualified Environmental Professional.

Methods for assessing trail condition include the following steps:

1. Establish trail evaluation plots every 50m (using measuring tape).
2. Evaluate sections of trail using the following evaluation criteria:
   - trail surface, width and slope;
   - surface water flow;
   - tread wear; and
   - tree impacts.
3. Evaluate trail features throughout the length of the trail, regardless of location or plot:
   - wetland and stream crossings;
   - technical trail features (TTFs);
   - culverts;
   - off trail water impacts;
   - borrow pits; and
   - environmentally sensitive features.
4. Use GPS based field computers to collect and record georeferenced data.
5. Take photos of inventoried trail features and plots to illustrate findings within the trail assessment report.
6. Consider engaging a qualified professional to assess:
   - ecological classification;
   - habitat for species at risk;
   - stand density and age;
   - ground vegetation cover; and
   - hydrogical conditions.

A short report or spreadsheet should be completed to summarize the condition of each trail based on the criteria listed above, and should also include an assessment of overall trail condition (unsafe, poor, average, good or excellent, as described on the following page).

Photo Credits:
Top: Diamond Head Consulting
Middle: 'Fashionable detritus on Boogieman' http://steedcycles.com/blog/blog-mountain-bikes/the-shore-lives-on/#!prettyPhoto

Frequency of Assessment

To ensure a sustainable, well-functioning trail network that provides a high quality user experience, trail condition should be assessed on an annual basis in the spring of each year. Once the preliminary condition rating has been determined, follow up assessments should be completed as follows:

- Trails rated 'unsafe' should be dealt with as soon as possible or considered for trail closures. These trails should be re-assessed every year until trail conditions are improved (i.e. structures are removed or re-built, crossings are upgraded to reduce impact on sensitive riparian areas etc).

- Trails rated 'poor' should be reassessed and put on a priority list until conditions are improved (i.e. structures are removed or re-built, crossings are upgraded to reduce impact on sensitive riparian areas, etc.).

- Trails rated 'average' or better should be re-assessed every spring until trail condition rating is improved.

- Trails rated 'excellent' should be assessed every spring or every two years; discretion is up to the assessor.

3.2 TRAIL CONDITION RATING

Based on the assessment methods listed above, overall condition of each trail can be rated as unsafe, poor, average, good or excellent. Trail condition rating will help to determine priorities. However, if a trail or section of trail scores a 0 in safety and/or stream and wetland crossing, it will be made priority.

The following pages outlines a three step process for evaluating and scoring trail condition.

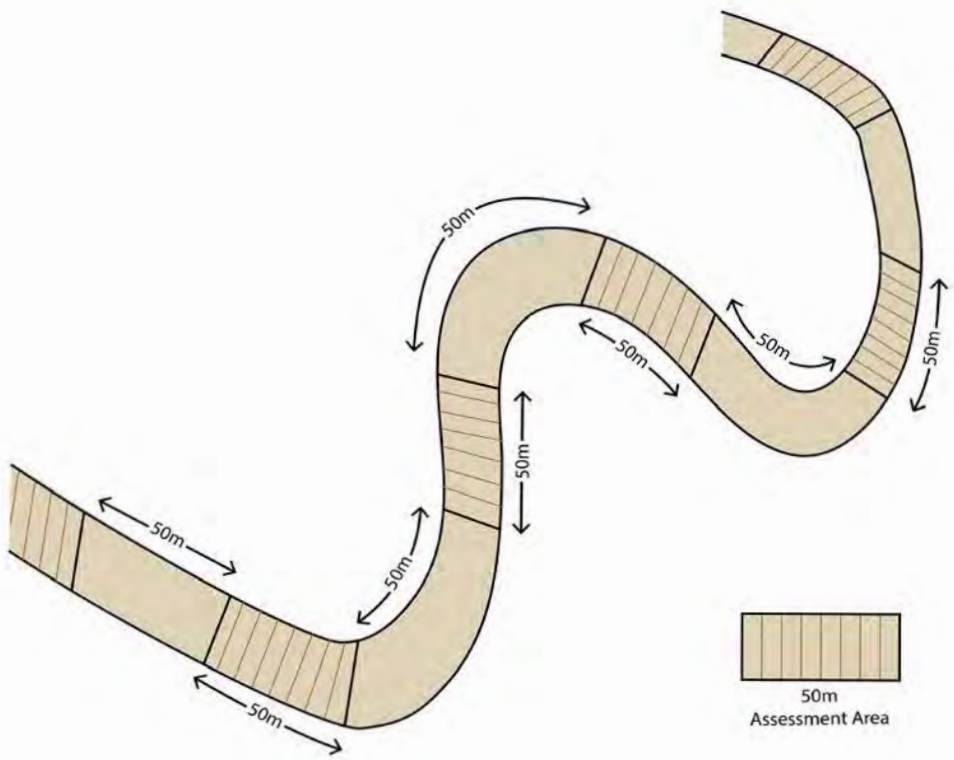


Figure 1. Trail evaluation plots for trail assessments

1. Plot Assessments - *Using a measuring tape, assess criteria and use a new Scorecard 1 for each trail plot (every 50 m). Each assessed trail will have multiple completed copies of Scorecard 1, depending on trail length. Total the average score across all plots.*

Scorecard 1

	CRITERIA	TARGET	RESPONSE			TOTAL
			NO (0 points)	SOMEWHAT (1 points)	YES (2 points)	
1	Trail width and slope	Trail dimensions and grade are consistent with trail class (Refer to Table 1)				
2	Surface condition	Surface is consistent with Trail Standards (Table 1), shows little sign of tread wear and is in good repair				
3	Surface water flow	Trail is properly drained with no sign of mud holes, soil erosion or puddles				
4	Tree impacts	There are no visible signs of impact to trees or structural roots on or near the trail				
5	Ground vegetation	Ground vegetation adjacent to the trail is healthy, and adequate horizontal clearance is provided (refer to Table 1). There is no evidence of unrestored borrow pits.				
6	Off-trail water impacts	Runoff from the trail is not causing mud holes, puddles or erosion off the trail				
7	Safety	There are no obvious safety hazards and the trail is consistent with trail class and difficulty rating (see Table 1 and Table 2)				
		SUB-TOTAL				
		AVERAGE SCORE: ALL PLOTS				

2. TTF Assessments - *Assess criteria in Scorecard 2 individually at every occurrence - i.e. every time a Technical Trail Feature is encountered it should be assessed. Total the average score for each criteria in a given trail.*

Scorecard 2

	CRITERIA	TARGET	RESPONSE			TOTAL
			NO (0 points)	SOMEWHAT (1 points)	YES (2 points)	
9	Technical Trail Features (TTFs)	TTFs are in good repair, structurally sound/safe, and are appropriate to the trail level / rating (see Table 4 - Specifications for Mountain Bike Technical Trail Features)				
		AVERAGE SCORE: ALL TTFs				

3. Crossing Assessments - *Assess criteria in Scorecard 3 individually at every occurrence - i.e. every time a stream or wetland crossing is encountered it should be assessed. Total the average score for each criterion in a given trail.*

Scorecard 3

	CRITERIA	TARGET	RESPONSE			TOTAL
			NO (0 points)	SOMEWHAT (1 points)	YES (2 points)	
10	Stream or Wetland Crossings	Crossings are in good repair, structurally sound / safe, and are appropriate to the trail level / rating, and they adequately protect riparian areas per Section 4.3 of these Standards				
11	Culverts	Culverts are in good working order with little to no debris blocking inflow/outflow. Water if flowing freely.				
		AVERAGE SCORE: ALL CROSSINGS				

4. Final Overall Trail Condition Rating - *This is determined by averaging scores across all scorecards (average total scorecard 1 + average total scorecard 2 + average total scorecard 3. Where criteria do not apply (i.e. there are no TTFs or stream crossings), assign 1 point (neutral). Trail condition corresponds to the average number of points calculated, where:*

FINAL Scorecard

AVERAGE SCORE: ALL PLOTS	
AVERAGE SCORE: ALL TTFs	
AVERAGE SCORE: ALL CROSSINGS	
FINAL SCORE	

Aging trail showing signs of erosion and lacking proper drainage

Off-trail impacts from water runoff

Trail Condition Ratings

UNSAFE : where the trail achieves less than 1 point (average) for any of the following criteria: 7-Safety; 9-Technical Trail Features or 10-Wetlands and Stream Crossings, the trail is given an unsafe designation, as well as a final condition rating (below).

1 - 7 points or <50% | POOR : the trail fails to meet the basic standards listed in this document, is in poor condition and/or the built features are incompatible with the desired trail difficulty rating. Use of the trail may be causing undue environmental impacts to vegetation or riparian areas, and may be unsafe for trail users. Trails rated as 'poor' should be considered a priority for restoration, closure, or decommissioning as resources permit.

8 - 11 points | AVERAGE : the trail generally meets the standards, but in certain areas may be damaged or show signs of degradation. Some environmental impacts, such as erosion, tread wear or tree impacts, may be visible. While trail restoration is required to ensure long term sustainability of the trail, it is generally in fair condition and is safe to use. Specific areas of the trail may be identified as priorities for restoration.

11 - 12 points or >80% | GOOD : the trail is in good condition, is safe to use, and environmental impacts are minimized. On-going maintenance is needed to ensure the trail continues to function at a high level and provides a positive user experience.

13- 14 points | EXCELLENT : the trail is in excellent condition: the latest Best Management Practices have been employed in trail construction. Future maintenance is minimized as a result of sustainable trail planning and construction methods.

In some cases, sections of a trail may be rated differently from each other; where this type of pattern emerges it is possible for a trail to have one or more condition ratings. This pattern likely exists on trails where some sections have been re-aligned or re-built, or where terrain changes dramatically.

Photo Credits:
All photos by Diamond Head Consulting

4 ENVIRONMENTAL STANDARDS + GUIDELINES

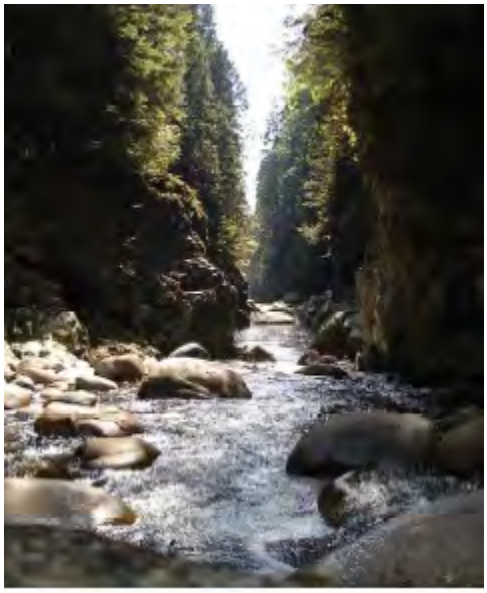
Second growth forest on the North Shore

Providing access to natural areas will inevitably cause some level of impact to the environment. Trail management and use causes direct impacts on environmental features and functions, as well as indirect impacts from human presence. In general, the magnitude of impacts increases with volume frequency of trail use, and effects of use. The Limits of Acceptable Change (LAC) methodology aims to keep the character and rate of change due to human factors within acceptable levels. It uses an analysis of existing conditions and those judged as acceptable and identifies management actions and an evaluating system to mitigate changes.

Sustainable trail building and maintenance aims to reduce environmental impact, and focuses on creating the most sustainable network possible. Trail siting is at the foundation of a sustainable trail network, where concentrating trails in areas of lower environmental vulnerability lessens overall impacts. Beyond siting, specific trail building techniques and Best Management Practices will reduce environmental impacts throughout the trail network.

This section of the Trail Standards is intended to guide decisions on building and maintaining a sustainable trail network that minimizes levels of impact, and reduces risk to sensitive ecosystems and species; recommendations in this section should be applied throughout the network.

Although addressed in 5 broad categories, below, all environmental impacts of the trail network are interrelated and should be managed holistically.



Seymour River

4.1 WATER

The greatest environmental risk from the trail network results from changes to natural water flow patterns. The North Shore mountains receive high amounts of rainfall which feeds and sustains biodiversity in its many creeks and wetlands. When surface hydrology is altered, rainfall can negatively impact ecology as a result of its high volume and flow intensity. Trails that are close to streams or ponds require special design and management consideration to prevent the introduction of sediments and to minimize impacts to water quality and habitat.

The most common impacts on surface hydrology, streams and wetlands include:

1. **Sedimentation and pollution** from runoff into streams and wetlands. During rainfall events, water can channelize and run down steep trail sections, eroding mineral soil and exposing roots and rocks. Water carries sediment and non-organic pollutants into drainages, impacting the health of the water system. Erosion from water flowing off the trail can also lead to water scour and sediment deposits that impact vegetation. Tread wear from bicycle tires exacerbates erosion by creating ruts, further channelizing and concentrating water runoff.
2. **Direct impacts to watercourses and riparian vegetation** as a result of improper creek crossings. Trail users and dogs can trample sensitive vegetation and contaminate water with additives such as sediment and inorganic pollution.
3. **Diversion of surface and ground water flows** changing hydrology of creeks and wetland.

Photo Credits:
Top: photo by Diamond Head Consulting
Bottom: 'Seymour River', http://www.panoramio.com/user/468927?with_photo_id=3770041, by mrplant

Bridge crossings should extend back from top-of-bank

Stream near CBC Trail

Creek crossings should be designed to prevent people from straying off trail and into the riparian area

Recommendations

Streams, Wetlands and Riparian areas

- Wherever possible, align new trails more than 15 m from all streams that are greater than 15 m wide, and keep the total number of stream crossings to a minimum. Where crossings are necessary, design for the following:
    - all streams > 30 cm wide at high water level should be protected with a boardwalk or bridge. The structure footings should be well anchored to an area at least 1m back from the stream's top of bank at high water level.
    - for streams that are 30 cm to 1 m wide, the entrance and exit to the bridge should extend back at least 3 m from the top of bank.
    - for creeks that are >1 m wide, the entrance and exit of the bridge should extend back at least 5 m from the top of bank, and should include railings to prevent access to the creek.
    - creeks <30 cm wide can be managed with culvert crossings as long as the inlet and outlet are well protected from trail impacts.
- Minimize grades for trails extending down to stream crossings or align trails in flatter areas in order to prevent erosion and concentrated runoff. Where steep grades to watercourse crossings cannot be avoided, consider armouring trails with rock to minimize soil erosion.
- Take care to minimize disturbance to all vegetation within 30 m of a stream or wetland.
- Prioritize the upgrading of trail sections within 30 m of any streams.
- Protect wetlands with boardwalks. Such structures require riding surfaces no less than 60cm wide. Surface with a width of less than 60cm create a greater risk of riders falling off the structure and compromising the integrity of the sensitive or wet area, negating the intent of the boardwalk.

Drainage

- Design trail drainage to allow water to run slowly down hillsides, prioritizing water disbursement and infiltration instead of direct flow into water courses. Design trails with frequent grade reversals, regularly maintained outslopes and/or drainage features to divert water.

Photo Credits:
Top and Middle: by Diamond Head Consulting
Bottom: 'Mountain Biking Paparazzi', https://anotherheader.wordpress.com/2010/08/19/squamish-chesire-cat-chesire-kittens-white-rabbit-and-wonderland/

4.2 VEGETATION

Trails and their users can cause irreversible damage to trees and vegetation, both on and off trail. Common impacts include:

1. **Permanent loss of vegetation and productive growing sites** from the trail surface itself. The most detrimental impacts to vegetation occur when the trail is first built and vegetation, including trees and understory, is permanently removed from the trail surface.
2. **Damage to trees**: Forests in the LSCR are mature and dense, and tree roots extend far out and interconnect with one another. It is difficult to construct trails through these types of forested areas without causing some level of impact to trees. Significant impacts include the cutting of roots during construction and damage to exposed roots. Soil displacement and erosion caused by trail use and surface water flow can expose roots to wear and tear. New trail alignments should avoid building corners and switch backs around western red cedar, and Douglas-fir and avoid mature tree stands. Existing trail alignment should consider armouring or re-routing where such trees are seeing impacts.
3. **Potential for the establishment of invasive species** is increased when native vegetation is removed, offering new areas for growth. Moreover, seeds of invasive species can be transported into the area by trail users.
4. **Off-trail impacts to vegetation** occur when trail users and their pets stray off of the designated corridor, trampling vegetation. Mining mineral soils through off-trail 'borrow pits' also impacts vegetation, and should be carefully restored once pit is depleted or trail construction is completed.

Native groundcover in the LSCR

Second growth cedars growing near Rice Lake

Photo Credits:
All photos by Diamond Head Consulting

Permission can be given to use downed trees and woody debris in the trail design

A narrow mountain bike TTF elevates the trail and protects sensitive vegetation

Logs on the side of Baden Powell help to prevent people from straying off trail

Photo Credits:
Top and Middle: by NSMBA
Bottom: http://static.panoramio.com/photos/medium/91636868.jpg

Recommendations

Structural Diversity

- In dense second growth conifer stands, consider creating small stand openings to enhance structural diversity. This should be completed under the direction of a biologist or forester.
- Protect all high value wildlife trees that are not rated as high risk to trails and the public. Trails can be re-routed if the tree is rated as a hazard tree.

Undergrowth Vegetation

- Construct trail and clear zone corridors only as wide as necessary in order to limit impact to vegetation and to reduce the area of disturbance. Also consider designating 'waiting areas' on trail to prevent trail users from gathering at the edges of trails and expanding the area of disturbance.
- Rehabilitate off-trail impacts, including unsanctioned trails, braiding and borrow pits. Do not permit borrow pits in areas of sensitive vegetation, and consider establishing standards for borrow pits, including location, size and restoration requirements.
- Save and redistribute topsoil and plants excavated during trail building for rehabilitation work.
- Use signage to educate users on off-trail impacts caused by straying off trail. Reduce the likelihood that users stray off-trail by designing the experience they seek: incorporate ridgelines, high points, and other areas of significance (large boulders, old growth trees, water features) into the trail alignment.
- Locate trails away from rare plants and animals, and away from sensitive habitats. This may require an environmental assessment prior to establishing the trail. Use the LSCR Management Plan to guide trail development. Where fragile plant communities are next to the trail, delineate trail edges using rocks or logs, or construct boardwalks.
- Favour hand building over machine building as it is less disruptive to vegetation outside of the trail corridor. Where machine building is employed, ensure operators are skilled.

Old Growth Trees and Trees of Significance

- Route all trails within 6 m of old growth trees or trees of significance (size and rarity) over boardwalks.
- Old growth trees should not be cut or pruned, even for the purpose of hazard mitigation.
- Prevent any new trail building in old growth forest areas.
- Decommission all unsanctioned trails through old growth areas and mature forest stands.
- Do not permit the cutting of live old growth, mature trees or heritage stumps for trail construction materials.
- Minimize cut slopes and use native soils and rocks to build up over existing grades to protect tree roots.
- Only remove hazard trees that pose risk to the public; post signs on trails that should not be used during high wind events. Tree removal must be assessed and approved by the LSCR.

Invasive Species

- Educate visitors about high risk invasive species and their ability to carry non-native plant seeds on their shoes, clothes or bikes.

4.3 SOILS

Soil disturbance occurs immediately after the initial trail construction and initial use of the trail. During trail construction, surface organic materials (twigs, leaves, needles) and organic soils are removed from the trail alignment; trails built on sideslopes require even more extensive excavation. Once complete, trail use and the influences of water flow can impact surface soils over time. Soils cannot be easily replaced on trails; once trails have been eroded or become muddy, it is very difficult to reverse their conditions.

Common forms of soil degradation from trails include:

1. **Soil erosion** caused by poor drainage is one of the most common issues caused by trail building and trail use. Soil erosion exposes rocks and plant roots, creating a rutted, uneven tread surface. Erosion is accelerated when treads erode below the surrounding soil level, diverting water away from the natural drainage and causing muddiness, or concentrated water runoff which further channelizes or ruts the trail surface. Concentrated runoff carries soil particles and other materials downhill, and can be carried directly into watercourses, impacting water quality. The impact potential is closely related to trail grade as water travels faster and becomes more erosive with increasing grade.

   Erosion can also be caused or exacerbated by forces of gravity, wind, and user impacts. The erosion of surface soils is largely preventable with sustainable trail design building, an annual maintenance plan, and use of natural erosion and sediment control methods.

2. **Removal of native soils:** trail construction impacts native soils during construction and through trail use. During construction, surface organic materials and organic topsoils are removed; the extent of this impact depends on the width of the trail and the grade of the slope.

3. **Water pooling and muddiness:** water will pool in low lying areas with insufficient drainage, and is exacerbated by soil compaction, displacement, and erosion. As a result, muddiness can occur even where there is sufficient drainage, especially in areas of high rainfall (like the LSCR). Muddiness can have the further damaging effect of drawing trail users around the trail widening the trail area and encroaching on adjacent vegetation.

4. **Soil displacemen**t as trail use pushes soils outwards. Displacement can cause development of ruts, berms, and cupped treads that results in pooling on flat trails or runoff channels on steeper trails.

Mineral soil from a borrow pit

Signs of erosion off-trail of CBC Trail

Impact to exposed roots can threaten tree health

Photo Credits:
Top: photo from NSMBA
Middle and bottom: photos by Diamond Head Consulting

Water pooling on trails creates mud holes

Old growth cedar on the CBC Trail

Rock armouring on CBC Trail

Recommendations

Trail Alignment

- Locate trails across slopes or on ridgelines to minimize erosion and water runoff, and avoid fall line trails. Any sections of trail with grades over 20% should be rerouted and constructed to meet design standards.
- Avoid flat terrain, wet soils and drainage bottom locations, which have greater susceptibility to collect water.
- Seek dry areas with a high amount of natural rock or coarse material for trail alignments.

Drainage

- Incorporate trail building techniques that encourage proper drainage:
    - avoid deep cut slopes that intercept ground water;
    - design periodic grade reversals to prevent pooling and concentrated runoff; and
    - use outsloped treads to direct water flow across trails and downslope, while preventing concentrated runoff.
- Where flat terrain cannot be avoided, 'crown' trails with mineral soil, gravel or rock to direct water off the trail or incorporate knicks and ditches. Regular maintenance is required to avoid soil compaction along the line of travel, which can cause water pooling in the centre of the trail.
- Design trail drainage to disperse surface water and sediment towards adjacent vegetation and organic litter off trail that can filter out sediments.
- Mine mineral from off site pits, called 'borrow pits', to provide surface materials for trail construction. Ensure surface is compacted to create a durable tread resistant to erosion.
- If it is not possible to install proper drainage on a trail, consider rerouting problematic sections or hardening the trail surface with rock armouring.
- Clean out culverts and grade reversals.

Off-Trail Impacts

- Discourage or prohibit off-trail travel and restore unsanctioned trails. Improperly built informal trails frequently have insufficient drainage, and have steep grades that can quickly lead to soil erosion, especially without the benefit of regular maintenance.
- Ensure restoration of all borrow pits to a natural state by filling them in with organic materials and replanting native vegetation.

Tread Wear

- On mountain bike primary trails, consider mountain bike specific design techniques to reduce tread wear impacts, such as banked corners, reverse grades and compact mineral soil surface treatment. Minimize fall line descents and ensure proper drainage.
- Provide a higher level of maintenance for trails that experience high wear and tear to prevent degradation from soil displacement, erosion and muddiness that reduces the utility of the trail and diminishes the user experience.

Photo Credits:
Top: 'Mud Pit Hiking', http://www.johnharveyphoto.com/cgi-bin/search.pl?Search=trail, photo by John Harvey
Middle: by Metro Vancouver
Bottom: by Diamond Head Consulting

4.4 WILDLIFE

The even aged second growth forest that dominates most of the LSCR provides low habitat value and supports a relatively lower level of wildlife species diversity compared to old forest and open shrub communities. Important habitat features for wildlife include patches of dense understory vegetation, large woody debris, large mature trees, large dead standing trees, streams, wetlands and their riparian areas.

The trail network and increased presence of humans (and their pets) has a negative impact on wildlife. Major impacts on wildlife varies by species, depending on the sensitivity of a given species, and may include:

1. **Removal, alteration and fragmentation of habitat** including removal of large trees, ground cover features and forage. Wildlife trees and snags, for example, are often removed to limit risk to trail users, despite providing critical habitat for many species. In addition to removal of critical habitat features, bisecting trails can cause fragmentation of wildlife habitat or territories. Removal of hazard trees must be assessed by a certified danger/wildlife tree assessor and must follow Metro Vancouver's Songbird Nest Protection Guidelines. All vegetation removal needs approval by Metro Vancouver.
2. **Disturbance and behavioural stress to wildlife**, especially in less travelled back country areas. The level of impact depends on the species' tolerance to human presence and the type of activity. In general, the impact increases with the number of interactions and the intensity of the activity.

   Mountain biking in particular, and to a lesser degree trail running, can cause disturbance to wildlife related to potential relative speed and sound level of the activity. For example, wildlife may not have sufficient time to detect and react to a quiet, fast moving mountain biker.

   Some animals can become habituated to humans, and may modify their behaviour based on begging and other easy sources of food. Where wild animals and birds come to associate people with food, they lose their fear of humans and even change their typical territory in exchange for areas likely to offer easy food sources.

   Although injury or death through wildlife collisions are rare, smaller species are more susceptible to conflict with fast moving trail users, or their pets.
3. **Impacts to fish and amphibian habitat** can be caused by degradation to water quality, often a result of soil erosion from trails, or from dogs and people accessing water where trails cross.

All new trail development must be 15 m away from any water body and/or stream. Existing trails within 15 m should be considered for a re-route.

Pacific Tree Frog

Northern Aligator Lizard

American robin eggs

Photo Credits:
All photos by Diamond Head Consulting

LSCR's understory vegetation provides habitat for a range of species

Waterbody within the LSCR

Recommendations

Habitat

- Align trails to limit impact to sensitive wildlife habitat; wherever possible, trails should be aligned outside of riparian corridors.
- Retain wildlife trees, heritage stumps and large woody debris whenever possible.
- Where dogs are permitted off-leash, educate trail users to ensure dogs do not disturb wildlife, or wildlife habitat. This should be especially enforced on backcountry trails where the potential to impact wildlife is greater. Educational signage should be used to explain the risks, and patrolling by staff may be required to enforce on-leash trails.
- Avoid removing trees and vegetation for any purposes during the bird nesting season (March- September).
- Educate trail users on the importance of not feeding animals and to leave no trace: food should be stored safely and nothing should be left behind.

Species at Risk

- Engage a qualified Professional Biologist to review all new and modified trail building activities to ensure ESAs and habitat for species-at-risk are not impacted.
- Pursue a long term wildlife behaviour impact assessment for keystone indicator species throughout the year.

Photo Credits:
Photo by Diamond Head Consulting

5 SUPPORTING GUIDELINES + STANDARDS

Dale's Trail - Black Diamond, Class 7

5.1 PLANNING TRAILS

All new trails, trail realignments, and upgrades to construction of structures must be approved by the LSCR. Permits will only be issued when planning meets the current standards within each trail classification and trail difficulty rating, and must reflect the users of the trail; for example, equestrian use on the Richard Juryn Trail. This process includes a written summary and illustrations; with rationale and purpose of the work, design specifications consistent with these standards, material and construction specifications for any structures, and schedule for trail building. Applications must specify the source of all materials, including soil and wood for structures, and include a maintenance plan.

Routes for new trails or trail re-alignments must be flagged and inspected by LSCR prior to final approval or development. All safety and security considerations must be addressed in the application, including construction details for any proposed TTFs. Where trails are realigned or features are re-built, closed sections must be rehabilitated to natural conditions and all safety issues addressed, and include a maintenance plan.

Once approval has been granted and the trail is constructed, the trail will be re-inspected for compliance. Outstanding issues will need to be addressed before opening the trail; the new trail will be named, classified, given a trail difficulty rating, GPS mapped and added to the LSCR trail inventory.

5.2 SUSTAINABLE TRAIL DEVELOPMENT

Sustainable trails incorporate many design features to improve trail lifespan, minimize impacts on the environment, and improve the user experience. When designing a new trail, consider the following Best Practices for trail siting and design.

Siting

Many factors influence the specific siting and placement of trails, including the type of trail and experience desired; connections to other trails and parks; biophysical site conditions including soil type, vegetation and environmental sensitivity; hillside slopes and drainage/water table. Once building in the field, new trails and trail alignments may need to shift from proposed trail alignments in order to enable sustainable construction. Trail siting should consider the following:

- Trails should be sited to complement and respect the natural environment: natural features such as rocks and logs, should be incorporated into the design to denote edges and trail direction and to provide visual interest. The resulting trail will appear to be directed by the landscape. Trail tread with constantly reversing grade should incorporate natural features.
- To limit environmental impact and reduce cost, trails should utilize existing routes if at a suitable grade. However, where unofficial trails intrude into environmentally sensitive areas, preferred routes will be designated and unofficial trails should be closed and restored to natural conditions.
- Steep or erosion prone slopes should be avoided. Rock retaining may be used to prevent slumping, but should be avoided wherever possible by working with the terrain. Trail steepness has the strongest effect on trail sustainability.
- Avoid the fall line at all costs on steep or moderate slopes as this directs water directly down the trail surface as the path of least resistance, causing erosion, removing surface materials, and potentially causing deep ruts or channels that are difficult to mitigate.
- Conversely, avoid flat ground or going up a hill along a fall line, as these are prone to becoming basins for water collection.
- Trails should incorporate areas of special interest or significant natural features, adding interest to the trail and preventing new informal trails from forming when users stray off-trail to view these features.

Photo Credits:
by Metro Vancouver

Integrated into the trail alignment, a rock slab provides a hard packed trail surface

Class 4- Rice Lake Loop Trail

- Trails should not be sited too closely together where trail users may create informal shortcuts to travel between trails.
- Trails should be built on bedrock or hardpacked soil, wherever possible.
- The closer the trail grade is to zero, the more sustainable it is.
- Trails must be maintained and constructed within their trail classification and difficulty rating.
- No contouring trail steeper than 50% of the cross slope grade (h rule)

Trail Turns

To ensure visibility, safety and adequate sight lines, especially on Urban Paved, Access/Connector and Multi-Use trails (Classes 1- 3, respectively), turns will be minimized. For Frontcountry, Backcountry and Mountain Bike Primary trails (Classes 4- 7), turns add interest and challenge to the user experience. Switchbacks will be commonly used on terrain over 10% slope to ensure sustainable trail construction despite challenging terrain.

5.3 TRAIL DESIGN

Sustainable trail design reflects techniques to minimize environmental impacts and water damage, including erosion, to ensure trails continue to meet user needs well into the future. In all cases, trail design can limit environmental impacts by implementing recommendations outlined in Section 4 of these Standards.

A favoured technique for sustainable trail design is to build rolling contour trails that gently traverse hillsides at roughly half the slope grade - rather than cutting up or down at extreme grades. Bench cuts are used to cut the full width of the trail into the hillside, wherever possible. Rolling contour trails include grade reversals to capture water and disperse runoff downslope in a non-erosive manner. Treads should be built to outslope gently (~5%), tilting runoff off the trail, rather than down the trail.

Placing obstacles strategically along the trail can slow riders down and prevent them from skidding just before a steep slope, TTF or sharp turn. This reduces concentrated areas of tread wear.

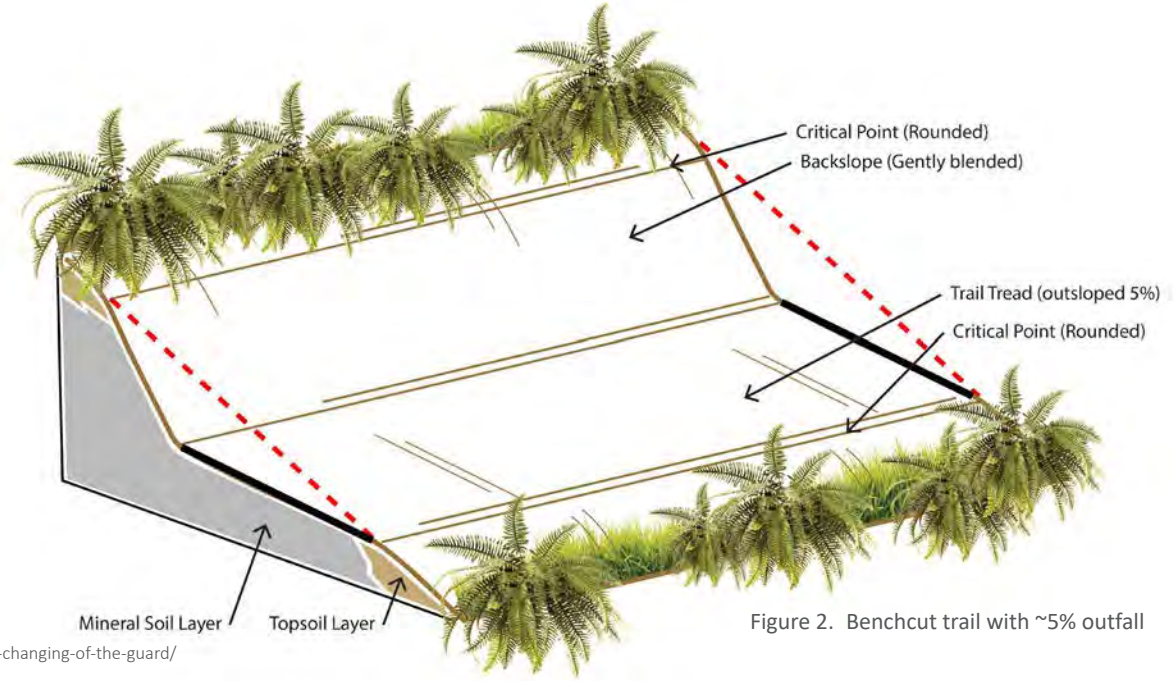
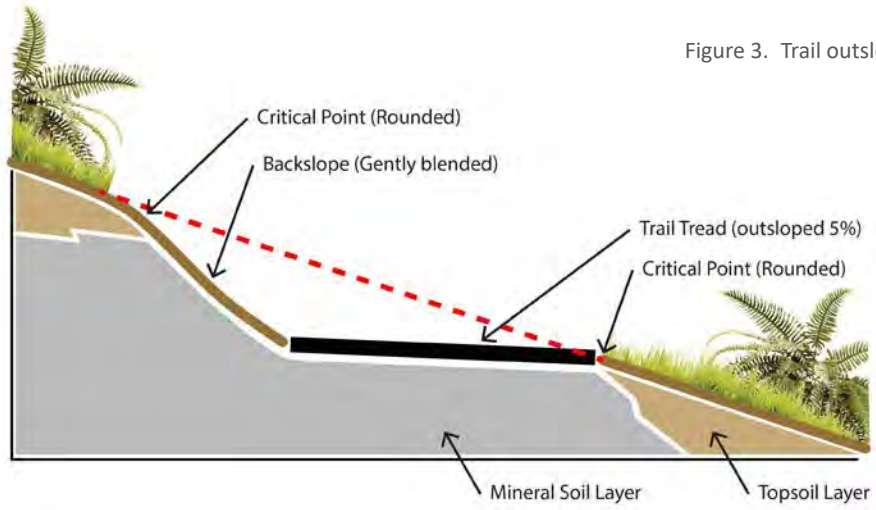


Figure 2. Benchcut trail with ~5% outfall

Photo Credits:
Top: http://nsmb.com/4770-the-changing-of-the-guard/
Bottom: Metro Vancouver

Figure 3. Trail outslope



Fall Zones

Recommended for Class 7-Mountain Bike Primary trails, Fall Zones are those areas beside challenging trail sections, such as Technical Trail Features (TTFs), bottoms of descents or technical sections, or sharp corners where mountain bike riders are more likely to fall. To reduce the frequency and severity of injuries, fall zones should be designed as part of the trail. Ensure that hazards are removed from the fall zone (1.5 m of each side of a trail):

- Remove (cut or dig out) any sharp objects, such as jagged rocks or sticks.
- Trim live tree branches back from the trail.
- Where removal is not possible, cover hazards with dirt or organic material, and dull exposed rocks or other sharp points.

The fall zone should not be cleared of all vegetation and organic material, only those materials likely to increase chances of injury.

Drainage

Drainage is a critical component of any trail design, and if executed properly, impacts to the environment lessen and improve 's a trails life span. Poor drainage can cause more damage to a trail than any user, causing erosion and creating concentrated runoff that can impact watercourses and vegetation. Drainage and erosion control methods depend on the location of the trail and soil type, but should generally rely on trail construction techniques. Proper trail grade and site preparation is key to ensuring proper drainage; this allows water to flow across the trail rather than pooling in the middle of the trail or down the trail.

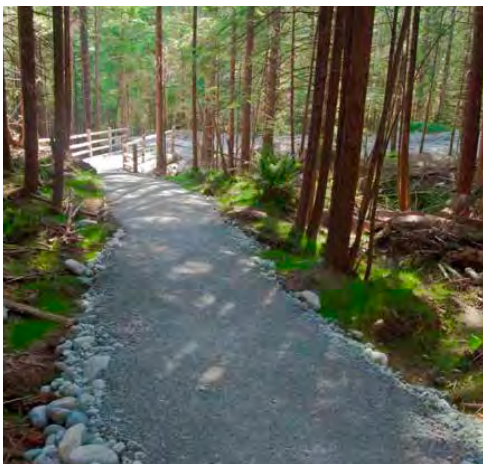
High School League minimizes erosion through use of rolling contours with grade reversals and outfall slopes

Specific techniques for sustainable trail building are:

- Proper grading and site preparation is key to ensuring proper drainage by allowing water to flow across the trail rather than pooling in the middle or down the trail. Specific techniques for sustainable trail building are:
- Avoiding the fall line, while also avoiding flat areas (See Siting, on page 19).
- Shaping outslopes where the trail tread tilts gently downslope (~5%), allowing water to sheet off the trail rather than pooling or accumulating.
- Integrating grade reversals, where a climbing trail levels out and dips briefly (for ~ 3- 15m) before climbing again. The grade change catches water and forces it to drain off the trail before gaining too much volume. Grade reversals should be used frequently.
- Creating nicks: a semi-circular, shaved down section of trail that slope downwards ~15% to the outside edge of the trail, allowing water to escape off the trail. Knicks are particularly effective on low-grade trails where water tends to pool.
- Use culverts where applicable or when grade reversals aren't feasible. Culverts should be used in line with the natural drainage feature (e.g. gully, creek, stream) to avoid diversion of natural watercourses keeping the water in line with the natural flow.

Photo Credits:
'High School League Trail Project', http://nsmba.ca/content/2013-07_high-school-league-trail-project-phase-2-starting-mid-july, from NSMBA'

Circuit 8, a Class 5 Frontcountry Trail, is surfaced with native soils



Bear Island Trail, a Class 3 Trail, is surfaced with road base gravel

Surface Materials

The materials used for trail surfacing varies according to the proposed use and traffic volume, as listed by trail class in Table 1- Trail Classifications.

Trail surfacing materials include pavement, road base gravel and native soil surfacing. Natural surfacing materials are emphasized in order to ensure permeability, reduce costs and complement the natural landscape. All imported materials must follow the current Watershed Environmental Management Importation Guidelines. The following applies (by class):

CLASS 1 | Urban Paved Trail: Pavement with 75 mm compacted recycled road base

CLASS 2 | Access/Connector Trail: 6.5 mm gravel with 75 mm compacted recycled road base, compacted to 150 mm depth

CLASS 3 | Multi-Use Trail: 6.5mm gravel with 75 mm compacted recycled road base, compacted to 150 mm depth

CLASS 4 | Frontcountry Hiking Primary Trail: natural surface with native soils; in some instances road based surface is used.

CLASS 5 | Frontcountry Multi-Use Trail: natural surface with native soils

CLASS 6 | Backcountry Hiking Only Trail: natural surface with native soils

CLASS 7 | Mountain Bike Primary Trail: natural surface with native soils

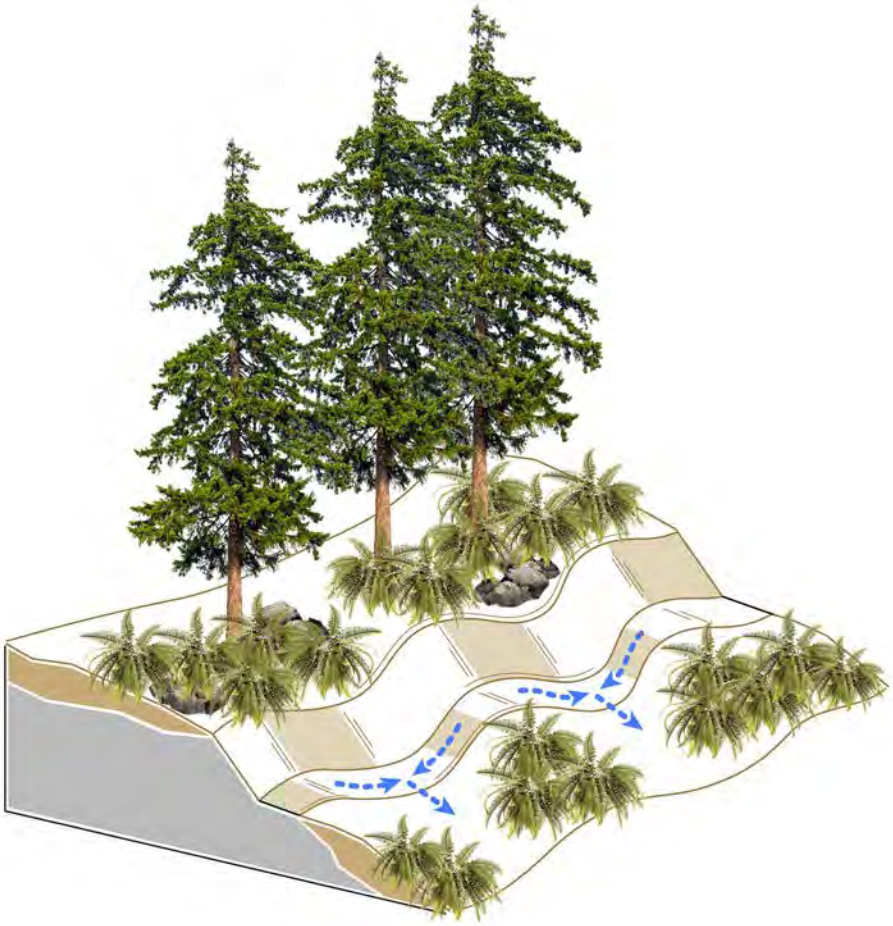


Figure 4. Rolling contour trail with grade reversals

Photo Credits:
Top: by Sebastien Launay
Bottom: by Metro Vancouver

Figure 5. Trail boardwalks structures

5.4 TRAIL STRUCTURES

Bridges and Boardwalks

Bridges and boardwalks are used throughout the LSCR network in order to protect streams, wetlands and other sensitive environments, such as old growth stands. The design of these structures will depend on trail type and difficulty, as well as terrain and size of the area to be protected. They must meet the current LSCR Standards to ensure proper engineering is met, and possible building codes are followed.

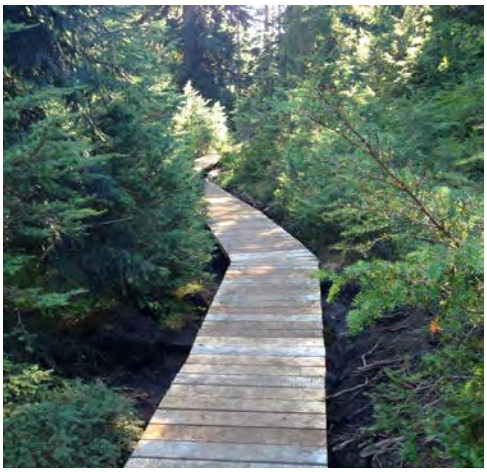
Boardwalks are used where trails cross smaller watercourses, wetlands and sensitive vegetation or habitat. They are generally low in height but should include a raised edge or railing where they are over 60 cm above ground, except on mountain bike primary trails where boardwalks can be used as Technical Trail Features (TTFs).

Similar to bridges, widths for boardwalks vary based on class type, difficulty, and feature being protected. Boardwalks range from 30 cm on mountain bike primary trails to at least 90 cm wide on multi-use and frontcountry trails. For further direction, refer to Table 2- Summary of Trail Ratings and Table 4 - Specifications for Mountain Bike Technical Trail Features.

In general, bridges and boardwalks should be aligned in the same direction as the trail so that users do not have to make sharp turns to access them and are less likely to go off trail to follow an easier or drier route. Design should include user type considerations, for example equestrian users.

Prior to building in or around a stream, all work must be reviewed by a Qualified Environmental Professional, during the planning phase, to ensure environmental permits and requirements are met. Boardwalks and bridges must be approved by LSCR Staff.

Wooden stairs can be used where sections of trail exceed 30%



Boardwalk standard: Dog Mountain Trail

Trail building technique over tree roots, wetlands or low lying areas

Stairs

Steps and staircases may be built for steep sections of trail (15% or greater) where switchbacks are not feasible and if the primary user type allows. Step construction depends on the site's drainage, soil and rock substrate. Typically constructed of wood, the following standards apply:

- Where feasible (based on terrain), steps should have a step to tread ratio of 2:1 with optimal 15 cm rise and 30 cm run.
- To prevent tripping, rise is very important and should be consistent unless separated by landings.
- Landings should be provided on longer flights.
- Handrails should be provided on at least one side either if the flight is long and steep, or if stairs are raised over 2 feet above ground.
- If wood is imported, material must be raw cedar.

Technical Trail Features (TTFs)

Typically built to enhance the mountain bike experience, Technical Trail Features (TTFs) are on-trail obstacles that require skill and negotiation. TTFs can be natural, such as a rock, or man-made, such as an elevated bridge or ramp. This section is specific to man-made TTFs within the LSCR.

**Due to safety and maintenance considerations associated with wood structures, TTFs should only be constructed where dictated by terrain: either where crossings for environmentally sensitive areas are necessary, where a trail must respond to rapid changes in elevation, or where major natural features, such as boulders, logs or trees, cannot be avoided in the trail alignment.

Permitted TTFs include:

A-Frame: ladder bridge or planking going up one side of an obstacle and down the other with little or no platform in between.

Ramps: an inclined structure, typically used to enter or exit a bridge, boardwalk, skinny or drop.

Drop: Vertical drop-off or step down in trail surface.

Ladder bridge: a type of bridge usually constructed with log stringers and small cedar rungs creating the riding surface.

Skinny: a narrow ladder bridge, plank or log with a riding surface that is usually around 30 cm wide.

Where TTFs are permitted, the trailbuilder must ensure the following:

- Man-made structures must be authorized and inspected by Metro Vancouver to ensure compliance with construction and safety standards, including the standards listed in this document.
- All built structures that are in poor condition should be removed as soon as possible. If possible, features should be rebuilt on ground surface if no water is present.

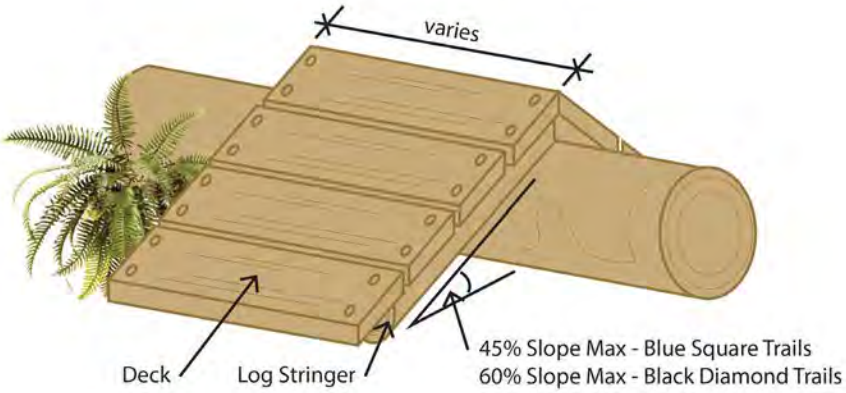
Photo Credits:
Top: 'Baden Powell Trail by Seymour RIver', https://www.flickr.com/photos/chaerea/8470818609, by Chaerea
Middle: Megan Kobitzsch
Bottom: Metro Vancouver

Difficulty Rating

Where TTFs are used, ensure the following for improving user safety:

- TTFs must be consistent with the level of difficulty of the trail (refer to Table 2 - Summary of Trail Ratings and Table 4 - Specifications for Mountain Bike Technical Trail Features).
- Every TTF must have an obvious ride-around, unless it is used as a stream crossing in which case the feature must be a minimum of 60 cm wide (i.e. for Black Diamond, Class 6 | Mountain Bike Primary trails).
- Create 'gateways' to more challenging TTFs by placing a narrow section or difficult turn early while the structure is still close to the ground. Inexperienced trail users may back up or fall before consequences are high, limiting the potential for injury. For example, a 10 cm wide section 20 cm off the ground as a gateway to a section 30 cm wide and 1.2m off the ground.
- Make the highest point or most difficult section of the feature visible from the entrance; by making the difficult section visible, the rider can make an informed decision before entering the feature.
- Signage must be placed showing all users of easier route.

Elevated wood structure on CBC Trail with a clear ride around.



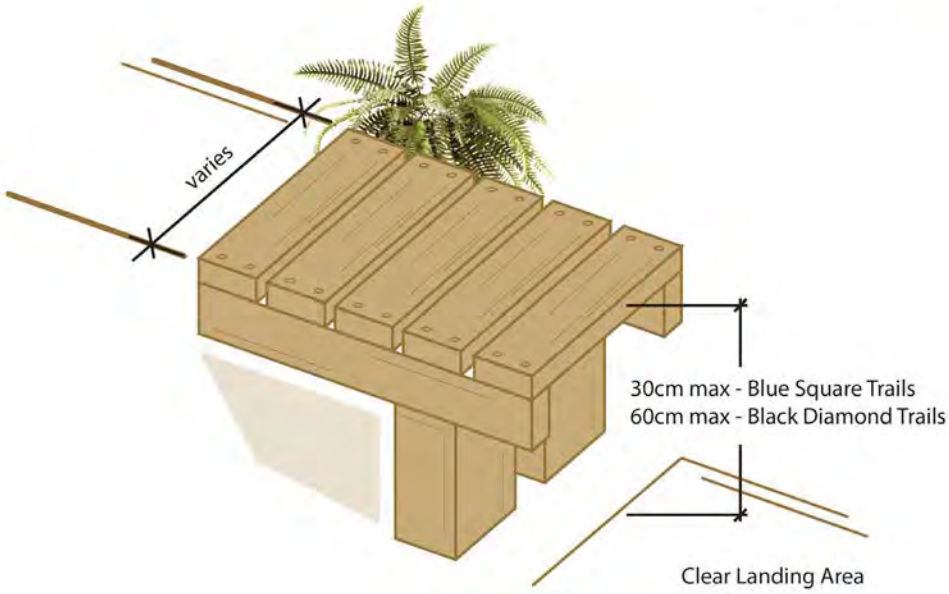


Figure 6. Technical trail features (TTFs)

Photo Credits:
by Diamond Head Consulting

Baden Powell Trail, Class 3

Mushroom Lot Access Trail minimizes erosion through use of rolling contours with grade reversals and outfall slopes

Bridge with expanded metal grate adds traction on the LSCR Old Growth Trail.

Materials for Structures

The following guidelines should be followed for construction of all structures and TTFs within the LSCR, accounting for local conditions and materials:

Structural or Surface Materials

- To prevent damage to trees and for the integrity of built features, no structures may be mounted to living trees.
- No live trees or heritage stumps in the LSCR should be used to source building materials. Deadfall may only be used with approval from the LSCR (See Section 5.1 for more information on approval).
- Due to its abundance and durability, locally sourced cedar is the preferred building material for structures and TTFs. Rough sawn/split cedar should be used for most applications; milled cedar can be used but does not offer the same durability or performance (i.e. grip in wet conditions).
- In certain cases, fir may be used, as available, but should not be used structurally.
- To avoid leaching toxic preservatives, chemically treated wood is not permitted: in particular, structures in direct contact with water should be inert (untreated cedar, precast concrete or steel) to prevent water quality impacts associated with chemical leaching from treated wood.
- Whole logs should be peeled to slow the onset of rot, and increase joint strength and must be pre-approved.
- It is recommended that wood surfaces, particularly those with a grade or having a smooth surface finish (not rough sawn wood), have an anti-slip surface, such as expanded metal grates (not for class 7). Chicken wire and rolled roof material are not durable, and roofing material traps moisture, promoting premature rot and creates waste in the forest. Where used, anti-slip surface should be fastened every 15 cm. Note: TTFs must be reinforced to withstand the additional loading of anti-slip surfaces against the direction of breaking forces.

Fasteners

Use fasteners designed for outdoor use; fasteners must be strong, secure and corrosion resistant. In order of structural integrity:

- Galvanized carriage bolts and nuts with galvanized washers
- Galvanized lag screws and washers
- Galvanized ardox spikes and nails (spiral spikes for their superior holding strength).

When using fasteners:

- Lag screws and nails should be of adequate length to allow for 2/3 penetration of the member being screwed or nailed.
- Fasten rungs securely with a minimum of two or more (preferably four, if practical) large bolts, lag screws or Ardox nails (see above).

Photo Credits:
Top: http://nsmb.com/4770-the-changing-of-the-guard/, by NSMBA
Middle: 'High School League Trail Project', http://nsmba.ca/content/2013-07_high-school-league-trail-project-phase-2-starting-mid-july, by NSMBA
Bottom: Metro Vancouver

Construction of Structures and TTFs

The following standards follow Best Practices for construction of structures or features, accounting for the particularly wet climate and local materials available:

Specifications

- Bridges, boardwalks, stairs and TTFs should be designed and built using conventional carpentry techniques, and must be built to withstand a centered vertical load of at least 225 kg (495 lbs): 2 times the heaviest trail user (i.e. a mountain bike rider with bike and gear.) Every single rung of a bridge or feature must be able to withstand this weight.
- Use cross and diagonal bracing; the strength of TTFs shouldn't rely on the shear strength of fasteners.
- The finished surface shouldn't have any protrusions or sharp edges that might pose a safety hazard.
- Decking planks should be spaced to allow drainage while providing a safe travel surface, but not wide enough to allow small arms and legs to get caught: ~1-3 cm spacing is ideal.
- Pay special attention to the supports and abutments where structures touch the ground; because of its propensity to rot when wet, wood should generally not touch the ground. For foundation materials, use instead rock or pre-fabricated concrete footings.
- Bridge crossings or stairs may require engineer drawings.

Railings

For stream crossings more than 60 cm high, railings should be set to code heights according to BC Building Code. All stairs should have railings between 0.8 m and 0.9 m high, and platforms should have both bottom and mid rails. For universally accessible stairs, refer to Section 5.4.

Circuit 8 – Adding rocks to Crown Trail's trail bed

Stringers for a TTF, laid on peeled log supports

5.5 FURNITURE STANDARDS

Furniture used throughout the LSCR should continue to follow a consistent "look" and standard when it comes to picnic tables, benches, bike racks, outhouses and tanks, and other furniture.

Picnic Tables

Mackay Precast- "Federal Parks Style Picnic Table"

Product Number: PCI-0040

Precast Concrete Top, Cedar Seats, Exposed Aggregate Concrete Legs

72"L x 70"W x 30"H

Weight: 2200 Lbs

Federal Parks Style Picnic Table

Photo Credits:
Top: by Mountain Madness
Middle: by NSMBA
Bottom: Metro Vancouver

Top: Waterfront Bench series 35
Right: Frances Andrew Site Furnishings installation detail for W35- 62 Bench

Benches

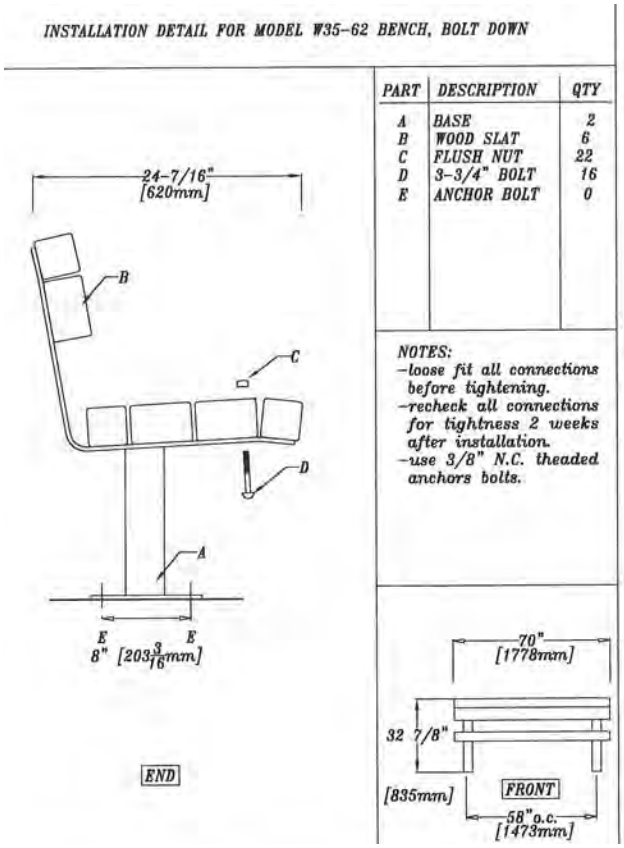
Frances Andrew- “Waterfront Bench series 35”

Product Number: W35-62 “Bolt Down”

Clear Select Cedar Seat and Back. Mild Steel Legs and Back Braces in “Hunter Green” Colour

70”L x 24.5”W x 33”H

Weight: 170 Lbs



Rice Lake Outhouse

Outhouses

Wishbone Site Furnishings – The ‘John’ Pit Toilet Building

Product number: PTR-6 (Regular) PTR-6H (Handicap)

Re-Plast Recycled Plastic Tongue and Groove Slats, powder coated aluminium frame,

Colour: Frame – Cold Textured Brown. Plastic – Walnut

PTR-6:

- Height: 92 inches / 2337 mm
- Depth: 55 inches / 1397 mm
- Width: 48 inches / 1219 mm
- Weight: 800 lbs / 363 kg

PTR-6H:

- Height: 95.5 inches / 2426 mm
- Depth: 68 inches / 1727 mm
- Width: 68 inches / 1727 mm
- Weight: 1100 lbs / 499 kg

Photo Credits:
Top: Frances Andrew Site Furnishings
Middle: Frances Andrew Site Furnishings
Bottom: Metro Vancouver

Wide, even surfaced trails provide access for the whole family

Railings set at different heights

5.6 ACCESSIBILITY

Universal Access

For trails where universal access is appropriate (including all Urban Paved | Class 1 trails), the following standards must be applied in the design, construction, and maintenance of trails to allow physical accessibility:

Design

- Maintain average grades of 0-3%; do not exceed a maximum sustained grade of 5%. Avoid grades greater than 8% for more than 4 m.
- Slopes exceeding 5% are considered ramps; handrails should be provided.
- When handrails are provided, maximum grade can be increased to 15% as long as two handrails are provided on either side of the trail to help control speed.
- Surfacing should be uniform with no obstructions or depressions.
- Trail heads and parking should provide universally accessible stalls.
- Signs, kiosks, benches and railings can obstruct the flow of a wheelchair or stroller; installation should limit physical and visual impacts.

Rest Areas and Landings

- Level landings or rest areas should be provided if the slopes exceed sustained grades of 5% or more than 8% for 4 m. These should be roughly 2 m long at the end of each length of slope.
- Benches with back rests and high arms rest should be placed at 45-60 m intervals.
- Level areas should be provided at all turning points on a slope.

Handrails

- Handrails should be provided on slopes exceeding 5%, as much for people using crutches or canes, or for people unsteady on their feet, as for people in wheelchairs.
- Two handrails should be provided: 90 cm from the ground for people walking, and 75 cm from the ground for children and people in wheelchairs. Extend rails 45 cm beyond the top and bottom of the slope or 60 cm beyond the top and bottom of a staircase, and make rails strong enough to support the weight of 2 or 3 people.
- Rails should be smooth to prevent injuries (no projecting bolts) and wheelstops/low curbs should be used along the edges of treads.
- Provide handrails on both sides so that people can use left or right handed. In heavy use areas, provide a double set of handrails so that separate rails may be used for climbing and descending.

Clearing and Tread

- On moderately used trails, provide a width of at least 1.2 m for one-way traffic and 2 m for two-way traffic (suitable to Class 1- 3 trails). For minor foot paths, such as Class 5 Frontcountry Multi-use Trails, widths can be reduced to 60-150 cm.
- Surfaces suitable for wheelchair use include asphalt, crushed stone sealed with stone dust or asphalt emulsion, compacted cinders, some types of crushed shale, hard packed road base, or boardwalk.

Universally Accessible Structures

- Ensure bridges, boardwalks and steps are wide enough to allow easy passing, and have secure footing when wet.
- Where steps are necessary, provide ramps wherever possible, per specifications above. To facilitate movement for users with crutches or canes, use rough skid materials, such as rough sawn cedar, laid parallel to the direction of the trail.
- Where steps are constructed, ensure a smooth transition from stairs to bridge decking or trails. Where handrails are not used for bridge decking, installed edge railings that extend beyond the ends of the bridge.

Photo Credits:
Top: 'Canada 2013 213', http://leemhuisfamilyblog.blogspot.ca/2013_07_01_archive.html
Bottom: by Diamond Head Consulting

Vehicle Access

Intentionally wide and uniform in surface, Access/Connector Trails (Class 2) provide vehicle access for the supervision and maintenance of the water reservoir and its infrastructure, and emergency access, along with other maintenance works for the LSCR.

Spur 4 trail allows access for maintenance vehicles while also allowing recreational use

Photo Credits:
'Spur 4 Bridge', http://www.panoramio.com/user/7087818/tags/Lower%20Seymour%20Conservation%20Reserve, by Jeff Hitchcock

6 TRAILS NETWORK

7 REFERENCES

The methods and technical information used in this document are sourced by Metro Vancouver and Diamond Head Consulting from various documents and Best Management Practices, including:

- *Trail Solutions: IMBA's Guide to Building Sweet Single Track*
- R*egional Parks Design Standards* by Metro Vancouver
- *District of Squamish's Trail Standards*
- *Resort Municipality of Whistler's Trail Standards*
- *Fromme Mountain Trails Environmental Impact Assessment Report,* by Diamond Head Consulting for District of North Vancouver
- *Environmental Assessment of CBC Trail*, by Diamond Head Consulting for Metro Vancouver
- *A Review of the Ecological Effects*, by the Miistakis Institute

APPENDIX

TABLE 1 | SUMMARY OF CLASSIFICATIONS

	URBAN PAVED TRAIL Class 1	ACCESS CONNECTOR Class 2	MULTI-USE TRAIL Class 3	FRONTCOUNTRY HIKING PRIMARY Class 4	FRONTCOUNTRY MULTI-USE Class 5	BACKCOUNTRY HIKING ONLY Class 6	MOUNTAIN BIKE PRIMARY Class 7
DESCRIPTION	A wide paved trail that accommodates low-speed activities, and is suitable for strollers and mobility impaired individuals	A wide trail for pedestrians and cyclists, while allowing limited vehicle access	A wide surfaced trail suitable for a range of low-intensity recreational pursuits (walking, trail running, cycling, equestrian)	Easy to access, and designed for moderate intensity short day hikes and trail running	Easy to access, and designed for moderate intensity short day hikes, trail running or mountain biking	Provides a wilderness experience for hikers in the backcountry, designed for single or multi-day hikes	Primarily mountain biking, for safety reasons often separated uphill and downhill traffic. All users must yield to pedestrians
TRAIL CATEGORY	Multi-use	Multi-use	Multi-use	Hiking Primary	Multi-use	Hiking Only	Bike Primary
PRIMARY USE	Walking/Biking/Wheelchair	Walking/Biking	Walking/Biking/Equestrian	Hiking/Equestrian	Hiking/Running/Biking/Equestrian	Hiking	Biking
UNIVERSAL/ BARRIER FREE?	Yes	Yes	Yes	No	No	No	No
VISITATION LEVEL	High	High	High	Medium	Medium	Low	Medium
SUB-BASE MATERIAL	3” minus compacted road base (must meet WEM importation guidelines) min. 6” compacted depth	3” minus compacted road base (must meet WEM importation guidelines) min. 6” compacted depth	3” minus compacted road base (must meet WEM importation guidelines) min. 6” compacted depth	Native soils	Native soils	Native soils	Native soils, rock armouring
TREAD MATERIAL	Pavement	Gravel (3/4” minus road base)	Gravel (3/4” minus road base)	Native soils (surfaced with natural materials, using BMPs*)	Native soils (surfaced with natural materials, using BMPs*)	Native soils (surfaced with natural materials, using BMPs*)	Native soils (surfaced with natural materials, using BMPs*)
TREAD WIDTH	3 - 6m	3m minimum	1.5m minimum	60cm minimum	60cm minimum	30cm minimum	30cm minimum
TRAIL GRADE	1 - 4% (maximum 10% for short sections)	1 - 4% (maximum 15% for short sections)	1 - 4% (maximum 15% for short sections)	10 - 20 % (maximum 20% for short sections)	10 - 20 % (maximum 20% for short sections)	15 - 20 % (maximum 25% for short sections)	15 - 25 % (maximum 30% for short armoured sections)
CROSS SLOPES	1% where longitudinal slope >2% then 2% max.	1% where longitudinal slope >2% then 2% max.	2% max.	2% minimum / 4% max.	2% minimum / 4% max.	2% minimum / 4% max.	2% minimum / 15% max.
LAYOUT	Increase sight lines with sloped curves	Increase sight lines with sloped curves	Increase sight lines with sloped curves	Trail layout allows for more turns to create interest	Trail layout allows for more turns to create interest	Trail layout allows for more turns to create interest	Trail layout allows for more turns to create interest
DRAINAGE	Below surface or off-trail	Below surface or off-trail	As needed	As needed	As needed	Design with reverse grades	Design with reverse grades
TRAIL STRUCTURES	• Ramps with handrails, as needed • Entry control structures and bike racks • Speed restricting gates	• Bridges where necessary • Speed restricting gates	• Boardwalks, steps, ladders, or railings, as needed • Speed restricting gate	• Boardwalks, steps, ladders, or railings, as needed	• Boardwalks, steps, ladders, or railings, as needed • Speed restricting gate	• Boardwalks, steps, ladders, or railings, as needed	• Technical Trail Features (see Table 3) • Speed restricting gates
VEGETATION CLEARANCE	2m max. each side from edge of trail	2m max. each side from edge of trail	50cm each side from edge of trail	50cm each side from edge of trail	50cm each side from edge of trail	50cm each side from edge of trail	50cm each side from edge of trail
OVERHEAD CLEARANCE	3m minimum	3m minimum	2.2m minimum	2.2m minimum	2.2m minimum	2.2m minimum	2.2m minimum
RIPARIAN AREA	30m setback or per BMPs*	30m setback or per BMPs*	30m setback or per BMPs*	30m setback or per BMPs*	30m setback or per BMPs*	30m setback or per BMPs*	30m setback or per BMPs*
DIFFICULTY RATING	White/Green	White/Green	White/Green/Blue	Green/Blue	Green/Blue	Blue/Black	Green/Blue/Black/ Double Black
SPECIAL SITE CONDITIONS	• Accessible design: if requirements are not met, trail is not considered universal access • Deviations in trail width are permissible to meet site conditions; room for passing is required at regular intervals • Use root barrier next to trees • All riparian areas, wetlands and ESAs should be protected by boardwalks	• Accessible design: if requirements are not met, trail is not considered universal access • Deviations in trail width are permissible to meet site conditions; room for passing is required at regular intervals • All riparian areas, wetlands and ESAs should be protected by boardwalks	• Accessible design: if requirements are not met, trail is not considered universal access • Deviations in trail width are permissible to meet site conditions; room for passing is required at regular intervals • All riparian areas, wetlands and ESAs should be protected by boardwalks	• Main site condition is to mitigate potential user conflicts in high use trails • Trails in this class are more suitable for hiking • May need to consider rock surfaces • All riparian areas, wetlands and environmentally sensitive areas should be protected by boardwalks • In some instances, 3/4” minus road base can be used (e.g. Rice Lake Loop Trail)	• Trail design may need to consider rock surfacing • All riparian areas, wetlands and environmentally sensitive areas should be protected by boardwalks	• Trail design may need to consider rock surfaces • All riparian areas, wetlands and environmentally sensitive areas should be protected by boardwalks	• Trail design may need to consider rock surfaces • TTFs may be designed specifically for single direction mountain biking; as such, features will be passable for pedestrians but may not be built according to BC Building code • All riparian areas, wetlands and environmentally sensitive areas should be protected by boardwalks

*Best Management Practices

TABLE 2 | SUMMARY OF TRAIL RATINGS

	EASIEST White Circle	EASY Green Circle	DIFFICULT Blue Square	VERY DIFFICULT Black Diamond	EXTREMELY DIFFICULT Double Black Diamond
DESCRIPTION	• Fairly flat, wide and paved or smooth surfaced • Suited to beginner and recreational users • Low speed trail that may accommodate families,strollers, cyclists and physically impaired individuals. 	• Gentle terrain and easily avoidable obstacles • Suited to beginner and recreational users • Proper equipment recommended (hiking shoes/ mountain bikes) • Safety equipment recommended 	• Challenging terrain with steep slopes and/or obstacles, possibly narrow trails • Suited to intermediate users • Proper equipment required (hiking boots or mountain bikes) • Full safety equipment required for mountain biking 	• A mix of long steep climbs, loose trail surfaces and numerous difficult obstacles • Suited to advanced/expert users • Full safety equipment required • High level of fitness required 	• A mix of long, steep climbs, loose trail surfaces • Numerous difficult obstacles, some unavoidable • Suited to advanced/expert users only 
EXAMPLE TRAIL	Seymour Valley Trailway	Hyannis Trail	High School League Trail	Dale's Trail	CBC Trail
MINIMUM TRAIL WIDTH	1.8m	90cm	60cm	30cm	30cm or less
TREAD SURFACE	Hardened or surfaced	Firm and stable	Mostly stable, some variability	Widely variable	Widely variable
AVERAGE TRAIL GRADE	< 5%	< 5%	< 10%	< 15%	> 20%
MAXIMUM TRAIL GRADE	10%	15%	20%	25%	30%
NATURAL OBSTACLES + MOUNTAIN BIKING TTFS*	• To the greatest extent possible, obstacles should not be present except where creek crossings are necessary. • Bridges should be the same width as the trail	• Unavoidable obstacles: 10cm • Avoidable obstacles may be present • Unavoidable bridges 90cm or greater • Expected features and TTFs include small logs and roots perpendicular to direction of travel, wide bridges, and embedded rocks to avoid (Table 4)	• Unavoidable obstacles: 20cm or less • Avoidable obstacles may be present • Expected features and TTFs include small bridges, rollable drops, small jumps and medium sized logs (Table 4) • Ride-arounds should be provided for all TTFs on mountain bike trails	• Unavoidable obstacles: 38cm or less • Avoidable obstacles may be present • May include loose rocks • Unavoidable bridges 60cm wide or greater • Expected features and TTFs include elevated bridges and connected bridges, mandatory air, larger jumps and steep descents (Table 4) • Short sections may exceed criteria	• Unavoidable obstacles: 38cm or less • Avoidable obstacles may be present • May include loose rocks • Unavoidable bridges 60cm wide or greater • Expected features and TTFs include elevated bridges and connected bridges, mandatory air, larger jumps and steep descents (Table 4) • Many sections may exceed criteria

*Technical Trail Features (TTFs) are designed specifically for mountain biking, however, while not built according to BC Building Code can also be travelled by foot. TTFs are generally defined as obstacles requiring concentrated negotiation. These can be natural or man-made. Many are constructed of wood, but do not include boardwalks and creek crossings. Most TTFs are found on trails that are designed to be rated Difficult/Blue Square, Very Difficult/Black Diamond or Extremely Difficult/Double Black Diamond. New trails may have fewer TTFs and were built to include easily accessible ride-arounds. Where no alternate route is provided, off trail impacts are likely to occur.

TABLE 3 | TRAIL INVENTORY

TRAIL	CLASS (1 - 7)	DIFFICULTY RATING
Baden Powell Tr. (Bridle to Grind)	4	Blue Square
Baden Powell Tr. (Lillooet Rd. to Riverside)	3	Blue Square
BC Hydro Access Road	2	Blue Square
Bear Island Bridge Trail	3	Green Circle
Berm Trail	3	Green Circle
BMC Connector	5	Green Circle
Bottletop Trail	5	Blue Square
Bridle Trail	3	Blue Square
Butterfly Garden Loop	2	White Circle
Cabin Trail	7	Single Black
Camp Brick By-pass	3	Blue Square
CBC Trail	7	Double Black
Circuit 8/ Fisherman's Connector Trail	5	Single Black
Circuit 8 Trail	5	Blue Square
Clearwells Trail	3	Green Circle
Coho Trail	3	Green Circle
Connector Road from RLG to Outpost	2	White Circle
Corkscrew Trail	7	Single Black
Dale's Trail	7	Single Black
Dinkey Peak Look-Out	6	Blue Square
Dog Mountain Trail (Winter Route)	6	Green Circle
Dog Mountain Trail	6	Green Circle
Dromedary Look-Out	6	Blue Square
Elbow Trail	5	Green Circle
Enquist Trail	2	Blue Square
Fisherman's Trail North	2	Green Circle
Fisherman's Trail South	2	Green Circle
First Lake Trail	6	Blue Square
Footbridge Trail	2	Green Circle
Forever After Trail	7	Blue Square
Greenland Trail	5	Blue Square
Greenway Trail	1	White Circle
High School League Trail (Down-track)	5	Blue Square
High School League Trail (up-track)	5	Blue Square
Homestead Trail	2	Blue Square
Hyannis Access Trail (at Greenland/Ned's intersection)	5	Blue Square
Hyannis Connector Trail	3	Blue Square
John Thompson Trail	5	Blue Square

TRAIL	CLASS (1 - 7)	DIFFICULTY RATING
Incline Trail	4	Blue Square
IRM Trail	3	Green Circle
Lillooet Trail	3	Green Circle
Lost Lake North Branch Trail	2	Green Circle
Lost Lake South Branch Trail	2	Green Circle
Lynn Connector Trail	2	Green Circle
Lynn Loop	4	Blue Square
Lynn Peak (includes viewpoint 1 and 2	4	Single Black
Mid-Valley Connector Trail	5	Blue Square
Mid-Valley Enhancement Loop Trail	3	White Circle
Mount Seymour Main Trail	6	Blue Square
Mushroom Lot Access Trail	5	Blue Square
Mystery Creek Trail	4	Blue Square
Ned's Atomic Dustbin Trail	7	Single Black
Parking Lot Trail	3	White Circle
Powerline Access Road Trail (from mount seymour road)	2	Green Circle
Powerlines Trail (from Old Buck intersection down to Hyannis)	2	Green Circle
Rice Creek Connector Trail	4	Green Circle
Rice Lake Loop Trail, Wharf and all Connectors	4	Green Circle
Richard Juryn Trail (Eastside)	2	Blue Square
Richard Juryn Trail (Westside)	5	Blue Square
Ridgerunner Trail	5	Blue Square
Richard Juryn Access Trail (from Berm Trail)	5	Blue Square
Salvation Trail	7	Single Black
See More Stumps Trail	3	Green Circle
Seymour Valley Trailway	1	White Circle
Spruce Loop Trail	4	Green Circle
Spur 4 Trail	2	Green Circle
Spur 7 North	2	White Circle
Suicide Branch Trail	2	White Circle
Trail to Seymour River (at Spur 7 and SVT intersection)	2	White Circle
Twin Bridges Trail	2	Green Circle
Will's Way Trail	4	Blue Square

UNSANCTIONED TRAIL	
Boulder Creek Trail	Loamer (CBC Braid)
Cambodia Trail	Lumpy Gravy
Coliseum Mountain Route	Lumpy Gravy (Secondary Fork)
Dirty Diapers Trail	Magic Kingdom
Gnomer Trail	Run Lola Run Trail
Gnomer/Asian Adonis Connector	Greenland Braid

TABLE 4 | SPECIFICATIONS FOR MOUNTAIN BIKE TECHNICAL TRAIL FEATURES

	EASIEST White Circle	EASY Green Circle	DIFFICULT Blue Square	VERY DIFFICULT Black Diamond	EXTREMELY DIFFICULT Double Black Diamond
EXPECTED TTFs	• *TTFs are not appropriate for this trail level*	• Small roots and logs perpendicular to trail • Embedded rocks • Wide bridge, often with rails	• Small bridges: wide, flat, rollable from section to section • Rollable drops • Small jumps • Medium sized logs	• Elevated bridges, often narrow with connected sections • Larger mandatory jumps • Drops require limited front wheel • Steep descents with sharp transitions	• Elevated bridges, narrow with connected sections • Larger mandatory jumps • Drops require limited front wheel • Steep descents with sharp transitions • High risk level
OBSTACLES		• Easily avoidable rocks, roots and pot-holes • Embedded obstacles up to 10cm	• Steep descents and/or rocks, roots and pot-holes • Embedded obstacles up to 20cm	• Numerous difficult unavoidable obstacles and jumps • Drops and sharp corners	• Numerous difficult unavoidable obstacles and jumps • Drops and sharp corners
FEATURE DIMENSIONS (BOARDWALKS, BRIDGES, A-FRAMES, RAMPS, SKINNIES, ETC		• Min, 90cm wide, handrail required if bridge height exceeds 60cm	• Max. width to height ratio: 1:2 • Max. deck height: 1.8m • Min. width of flat decking is 1/2 the height above surface • Connecting sections must be large enough to allow transitions without wheel lifting techniques	• Max. width to height ratio: 1:4 • Max. deck height: 3m	• Max. width to height ratio: 1:4 • Max. deck height: 3m
DESCENT ANGLE (ROCK FACES, RAMPS, ETC)		Not exceeding 25%	Not exceeding 45%	Not exceeding 60%	May exceed 60%
DROPS		No	Not exceeding 30cm	Not exceeding 60cm high	No maximum height
CURVE RADIUS		Min. 2.4m	Min. 1.8m	May be very sharp (no limit)	May be very sharp (no limit)
JUMPS		No	• No jumps with consequences for lack of speed • Max. height of 45cm • Table top max. height 60cm	• Larger jumps • Mandatory air less than 1m vertical • Table tops, no max. height • No gap jumps or rhythm sections	• Larger jumps • Mandatory air less than 1m vertical • Table tops, no max. height • Gap jumps and rhythm sections
RIDE-OUT		Not required	Cleared of all obstacles	Exit may have obstacles or sharp transitions	Exit may have obstacles or sharp transitions
WALL RIDES OR BERMS		Only with wide ride-around	Yes	Yes	Yes

TABLE 5 | SUMMARY OF STANDARDS FOR STRUCTURES

		DESCRIPTION	MINIMUM WIDTH	HEIGHT	GRADE/ANGLE	MATERIALS	NOTES
BRIDGES		Used throughout the trail network to provide stream and wetland crossings, and to protect environmental values	Varies according to trail type, difficulty level and feature being protected, considering: • Up to 5m for Access/Connector • Green trails: 90cm min. • Blue trails: 60cm min. • Black trails: 60cm min. • Double Black: 60cm min.	As needed to provide safe crossing and avoid impacting riparian zone	None	• Raw dimensional cedar sourced from lumber yard • Fir - as alternative to cedar • Anti-slip surface, such as metal grating, should be considered • Peeled whole cedar logs for structural support, as needed	• Bridges should start back from top of bank with features to restrict creek access • Align structure with trail entrance and exit • Bridges over 60cm high should have railings • Consider designing for universal access • Vehicular bridges must follow Building Code
BOARDWALKS		Used throughout the trail network to protect wetlands and other sensitive environments and features such as old growth stands	Varies according to trail type, difficulty level and feature being protected, considering: • Up to 5m for Access/Connector • Green trails: 90cm min. • Blue trails: 60cm min. • Black trails: 60cm min unless clear ridearound is provided • Double Black: 30cm min.	Generally low in height unless used as TTFs	None; where ramps are needed refer to section on TTFs	• Locally sourced rough sawn/edge grain split cedar • Fir - as alternative to cedar • Anti-slip surface, such as metal grating, should be considered • Peeled whole cedar logs for structural support	• Align structure with trail entrance and exit • Consider designing for universal access
STAIRS		Installed for steep trail sections (15%+) where switchbacks are not feasible - not for Class 6	Consistent with width of trail (generally 60-90cm)	As needed	• 2:1 step to tread ratio (optimal 15cm rise to 30cm run)	• Locally sourced cedar with anti-slip surface, such as expanded metal grates • Fir - in certain cases, but not be for supports	• Provide handrails for longer flights or where elevated more than 2ft above ground • Provide landings for longer flights
NATURAL OBSTACLES		Roots, logs or rocks present on the trail surface	N/A	• White trails: none • Green trails: 10cm max • Blue trails: 20cm max • Black trails: 38cm max • Double Black: 38cm max			• White trails: ideally no obstacles • Green trails: roots and logs perpendicular to trail, easily avoidable rocks • Blue trails: avoidable and unavoidable obstacles, medium sized-logs • Black trails: avoidable and unavoidable obstacles, loose rocks, larger sized-logs • Double Black: unavoidable obstacles
TTFs	A-FRAMES	Ladder bridges or planking going up one side of an obstacle and down the other with no platform in between	60cm unless a clear ride-around route is provided	• White/green trails: none • Blue trails: 60cm max • Black trails: 1.8m max • Double Black: 1.8m max	• White trails: none • Green trails: 25% max • Blue trails: 45% max • Black trails: 60% max • Double Black: >60%	• Locally sourced rough sawn/split cedar or fir: all wood sources must be pre-approved by LSCR • Anti-slip surface, such as metal grating, should be considered for smooth surfaces • Peeled whole cedar logs for structural support • Fasteners designed for outdoor use	• Must be built to support at least 225 kg • Space decking ~1-3cm
	RAMPS	Inclined structures typically used to enter or exit a bridge, boardwalk, skinny or drop	60cm unless a clear ride-around route is provided	• White/green trails: none • Blue trails: 60cm max • Black trails: 1.8m max • Double Black: 3m max	• White trails: none • Green trails: 25% max • Blue trails: 45% max • Black trails: 60% max • Double Black: >60%	• Locally sourced rough sawn/split cedar or fir: all wood sources must be pre-approved by LSCR • Anti-slip surface, such as metal grating should be considered for smooth surfaces • Peeled whole cedar logs for structural support	• Must be built to support at least 225 kg • Space decking ~1-3cm
	DROPS	Vertical drop-offs or step downs on the trail surface - either natural or constructed	60cm unless a clear ride-around route is provided	• White/green trails: none • Blue trails: 30cm max • Black trails: 1.0m max or 60cm without ride-around • Double Black: 2.0m max	• White/green trails: none • Blue trails: rollable • Black trails: mandatory air in certain situations • Double Black: mandatory air	• Locally sourced rough sawn/split cedar or fir: all wood sources must be pre-approved by LSCR • Peeled whole cedar logs for structural support • Fasteners designed for outdoor use	• Must be built to support at least 225 kg • Space decking ~1-3cm
	LADDER BRIDGES	A bridge constructed with log stringers and small cedar rungs creating the riding surface	60cm unless a clear ride-around route is provided	• White/green trails: none • Blue trails: 60cm max • Black trails:1.8m max • Double Black: no max	As for ramps	• Locally sourced rough sawn/split cedar or fir: all wood sources must be pre-approved by LSCR • Anti-slip surface, such as metal grating should be considered for smooth surfaces • Peeled whole cedar logs for structural support	• Must be built to support at least 225 kg • Space decking ~1-3cm
	SKINNIES	A ladder bridge, plank or log with a narrow riding surface (~30cm)	60cm unless a clear ride-around route is provided	• White/green trails: none • Blue trails: 60cm max • Black trails: 1.8m max • Double Black: no max	As for ramps	• Locally sourced rough sawn/split cedar or fir: all wood sources must be pre-approved by LSCR • Anti-slip surface, such as metal grating should be considered for smooth surfaces • Peeled whole cedar logs for structural support	• Must be built to support at least 225 kg • Space decking ~1-3cm
	JUMPS	A structure that encourages movement or propels a rider through the air	60cm unless a clear ride-around route is provided	• White/green trails: none • Blue trails: 45cm max, tabletops 60cm • Black trails: 45cm max, tabletops 60cm + • Double Black: no max	As for ramps	• Native soils • Locally sourced rough sawn/split cedar or fir: all wood sources must be pre-approved by LSCR • Peeled whole cedar logs for structural support, as needed	

TABLE 6 | ENVIRONMENTAL STANDARDS*

	IMPACTS	DESCRIPTION	RECOMMENDATIONS
WATER	Sedimentation and pollution	• rainfall events channelize water which runs down steep trail sections, eroding material soil and exposing roots and rocks • water carries sediment and non-organic pollutants into drainage • tread wear exacerbates erosion by creating ruts, further channelizing and concentrating water runoff	• align new trails >15m from all streams that are >15m wide • stream crossings kept to a minimum, when necessary design as per recommendations in Section 4.1
	Impacts to watercourses and riparian vegetation	• improper creek crossings as the source of impact • trail users and dogs can trample sensitive vegetation and contaminate water with additives (sediment and inorganic pollution)	• minimize grades for trails extending down to stream crossings or align trails in flatters to prevent erosion and concentrated runoff • minimize disturbance to all vegetation within 30m of a stream/wetland • prioritize trail upgrades to sections within 30m of watercourses • protect wetlands with boardwalks >60cm wide
	Diversion of surface and ground water flows	• changes hydrology of creeks and wetlands	• trail design to allow water to run slowly down hillsides for water disbursement and infiltration instead of direct flow • frequent grade reversals with maintained outslopes to divert water
VEGETATION	Permanent loss of vegetation and productive growing sites from the trail surface itself	• most detrimental impacts to vegetation occur when the trail is first build and vegetation is permanently removed from the trail surface	• protect all high value wildlife trees that are not rated as high risk • reroute trails if tree is hazard tree • save and redistribute topsoil and plants excavated during building
	Damage to trees including old growth and trees of significance	• impacts occur due to interconnectedness of tree root network including: • cutting or damaging roots during construction	• locate trails away from rare plants, animals and sensitive habitats • favour hand building over machine building • close off trail building • old growth trees should not be cut or pruned, for any purpose • prevent trail building in old growth forest areas
	Potential for invasive species establishment	• cleared areas offer growth opportunities for invasive species • seeds of invasive species can be transported by users	• educate visitors about high risk invasive species and their ability to carry non-native plant seeds on their shoes, clothes or bikes
	Off-trail impacts to vegetation	• when users and their pets stray off trail • mining mineral soil from 'borrow pits'	• rehabilitate off-trail impacts (unsanctioned trails and borrow pits) • use signage to educate users on off-trail impacts
SOILS	Soil erosion	• is caused by poor drainage and exposes plant roots • impact potential is closely related to trail grade • can be caused or exacerbated by gravity, wind or user impacts	• locate trails across slopes or on ridgelines • trails >20% grade should be rerouted to meet new design standards
	Removal of native soils	• during construction and trail use • impacts depend on trail width and slope grade	• restore pit once it is depleted or trail construction is complete
	Water pooling and muddiness	• affects low lying areas with insufficient drainage • exacerbated by soil compaction, displacement, and erosion • can affect off-trail areas when users avoid wetted trail	• incorporate techniques that encourage proper drainage • compact trails with mineral soil or rock to direct water off trail • avoid flat terrain, wet soils and drainage bottom locations • consider rerouting sections or hardening surface with rock armouring
	Soil displacement	• trail use pushes soils outwards • can cause ruts, berms, and cupped treads resulting in pooling or runoff channels on steeper trails	• bank corners and reverse grades to minimize tread wear on class 7 trails • provide higher level of maintenance for trails with high wear and tear
WILDLIFE	Removal, alteration and fragmentation of habitat	• removal of wildlife trees and snags • bisecting trails can cause wildlife habitat fragmentation	• removal of hazard trees and vegetation must be assessed and follow MV Songbird Nesting Protection Guidelines • retain wildlife trees, heritage stumps and large woody debris
	Disturbance and behavioural stress to wildlife	• disturbance is related to potential relative speed and sound level of the activity • habituating wildlife to human sources of food	• educate trail users on importance of not feeding animals and leave no trace • a qualified Professional Biologist is to review all new and modified trail building to ensure ESAs and habitat for species at risk are not impacted
	Impacts to fish and amphibian habitat	• caused by degradation to water quality, often as a result of soil erosion from trails, dogs or people accessing water where trails cross	• all new trail development must be 15m away from any water body and/or stream • existing trails within 15m should be considered for a re-route

*Please refer to Section 4 Environmental Standards + Guidelines for more detail

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METRO VANCOUVER
Lower Seymour Conservation Reserve
Trail Standards
2016-02-17

URBAN PAVED TRAIL
CLASS 1

DIAMOND HEAD
3551 COMMERCIAL STREET
VANCOUVER BC | V5N 4E8
T 604.733.4886 | F 604.733.4879

METRO VANCOUVER
Lower Seymour Conservation Reserve
Trail Standards
2016-02-17

ACCESS/CONNECTOR
CLASS 2

DIAMOND HEAD
3551 COMMERCIAL STREET
VANCOUVER BC | V5N 4E8
T 604.733.4886 | F 604.733.4879

METRO VANCOUVER
Lower Seymour Conservation Reserve
Trail Standards
2016-02-17

MULTI-USE TRAIL
CLASS 3

DIAMOND HEAD

3551 COMMERCIAL STREET
VANCOUVER BC | V5N 4E8
T 604.733.4886 | F 604.733.4879

METRO VANCOUVER
Lower Seymour Conservation Reserve
Trail Standards
2016-02-17

FRONTCOUNTRY
HIKING PRIMARY
CLASS 4

DIAMOND HEAD
3551 COMMERCIAL STREET
VANCOUVER BC | V5N 4E8
T 604.733.4886 | F 604.733.4879

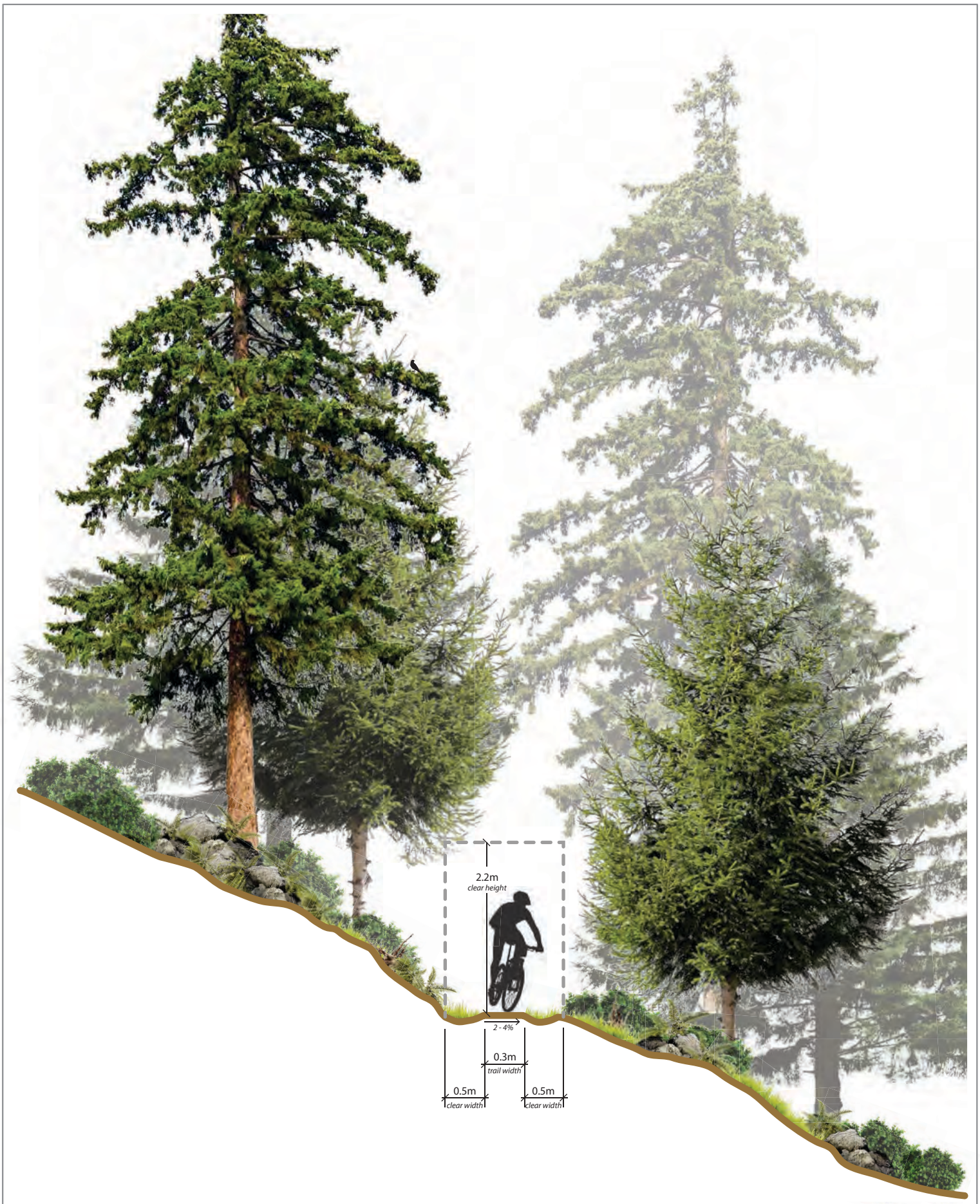
METRO VANCOUVER
Lower Seymour Conservation Reserve
Trail Standards
2016-02-17

FRONTCOUNTRY
MULTI-USE TRAIL
CLASS 5

DIAMOND HEAD
3551 COMMERCIAL STREET
VANCOUVER BC | V5N 4E8
T 604.733.4886 | F 604.733.4879

METRO VANCOUVER
Lower Seymour Conservation Reserve
Trail Standards
2016-02-17

BACKCOUNTRY
HIKING ONLY
CLASS 6



DIAMOND HEAD

3551 COMMERCIAL STREET
VANCOUVER BC | V5N 4E8
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METRO VANCOUVER
Lower Seymour Conservation Reserve
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MOUNTAIN BIKE
PRIMARY
CLASS 7