CONCLUSION

Those of us involved in writing and producing this manual know that achieving more sustainable communities and regions is an evolving process. Our empirical, local, and cultural knowledge of sustainable practices continues to unfold as we continue to learn more about the interactions between human and natural systems.

This being said, the strategies and guidelines in this manual can make a measurable contribution towards making our regions, communities, and neighbourhoods more sustainable. Incorporating years of applied research and community-based design, this manual helps explain why current development trends are incapable of sustaining us in a manner that will allow us to protect human health and the environment in livable, equitable, and affordable ways. It then provides practical strategies and guidelines for reversing these trends.

Upon completion of this manual, the development and approval of detailed engineering standards for East Clayton continues amidst widening policy debate about the value of integrated stormwater management and watershed-based planning in BC. Consequently, the Headwaters Project and East Clayton NCP provided a unique and timely opportunity to influence the most current policy and practice relating to sustainable community design. To varying degrees, this can also be said of two of the other case studies provided in this manual (Southeast False Creek and the Burnaby Mountain Community), which also used charrettes to demonstrate local, regional, and national policy goals pertaining to sustainability. These charrettes proposed viable models for efficient land use, for protecting and restoring important fish and wildlife habitat, for preserving clean and natural stream flows, for providing for a fair share of regional employment, and for providing ample affordable housing and transportation choices. From all of the charrette projects contained in this manual, we derived the design guidelines, contained in Part Three of this manual.

Design – however comprehensive and far-reaching – is only a start. It is now crucial for these sustainable proposals to be implemented so that their environmental, social, and economic performance can be monitored. Their results can then be used to improve our understanding of sustainable community design and to enhance the evolution of better development practices. Where possible and appropriate, we will continue to disseminate the results of these projects to as wide an audience as possible. In this way, we hope this manual can serve as a living record of our collective progress toward creating more environmentally sound, equitable, and complete communities.

Further Research

Given the wide range of variables involved in planning, designing, financing, and implementing more sustainable communities, it is impossible and impractical to cover it in a single volume. In addition to issues related to site and community design (described in detail in this manual) are market, technological, and regulatory variables, all of which also influence the degree of sustainability of any given project. Addressing these will involve continued and coordinated efforts among government, NGOs, and private-sector groups that will have to develop appropriate, equitable, and realistic frameworks for sustaining the health of regions and bioregions over the long term. What follows provides a three-tiered framework (organized under the headings of Economy and Equity; Ecology; and Education) for further discussion and research.

1 Economy and Equity

Incentives

Building sustainable communities means changing how cities are financed and serviced. In a sustainable community, engineering services (drainage, roads, sewage, energy), land uses (compact, mixed-use communities), and financing for infrastructure must be coordinated and affordable for both the developer and the city. What are the range of financing levers, such as development cost charges (DCCs), that can be restructured to help achieve a more sustainable urban landscape, thus enhancing affordability and mitigating the economic and ecological consequences of urban development?

Risk Management

By their very nature, innovative technologies often cost more at the outset than over the long term. Viewed through a lifecycle lens, they may prove much less costly than conventional technologies. However, lifecycles often involve different "owners" of the technology and, therefore, different financial stakes. Financing and risk management programs need to take into account the integrated aspects of sustainable communities and recognize the long-term horizon of community implementation. What are the most effective risk management strategies for both developers and local governments? What are the strategies that enable the additional risks associated with our first efforts towards more sustainable development to be distributed among those who stand to gain long-term benefit?

Alternative Financing

Sustainable communities must also be affordable and fair. Alternative financing tools, such as location-efficient mortgages and tax or development offsets, allow lenders to recognize the hidden assets of complete communities (e.g., public transit and higher density), ensuring that more low- and moderate-income families, first-time homeowners, and dedicated transit users can obtain mortgages (or larger mortgages than those for which they would otherwise qualify). How can these tools increase home purchases in BC communities, boost transit ridership, reduce energy consumption, and improve air quality?

2 Ecology

Urban Forestry

Due to the increasing degradation of stream habitat, urban stream hydrology is becoming an increasingly urgent issue. Research shows that stream hydrology is affected when effective impervious surfaces reach 10% of total watershed area. Urbanization typically results in impervious surfaces of 50% or more. Ways must be found both to reduce the effective impervious surface to below 10% while continuing to accept the necessity of high-density development (for affordability- and transportation-related imperatives). Urban forests (i.e., street trees and yard trees) can absorb, transpirate, evaporate, and mitigate stormwater in a way akin to that of natural forests. Yet region-specific data on urban forests and their influence on watershed quality is rare.

Watershed-based Planning
The emergence of frameworks for community-based watershed planning at various levels of government suggests a more integrated consideration of the impact of urban development on sensitive ecological systems. Watershed-based approaches to development recognize the importance of the watershed as a fundamental unit of planning and design. In simple terms, watershed-based planning means that resource, land use, and community design decisions are made with an eye towards their potential effects on the watershed and the natural systems contained therein. Understanding the human, aquatic, riparian, and terrestrial features, conditions, processes, and interactions of watersheds (and their component parts) in their "natural" state provides a basis for developing performance targets for maintaining the optimum post-development health of natural systems. The use of engineering best management practices and integrated green infrastructure (as described herein) are design strategies whose purpose is to ensure that development reflects the dynamics of the watershed. Continued efforts towards watershed based community planning and management will provide the necessary frameworks for designing, implementing and monitoring integrated green infrastructure systems in our communities.

3 Education
Environmental and Social Learning
Entrenched attitudes and lack of familiarity with new concepts make it difficult to change institutional and individual attitudes towards achieving sustainable community development. Until these attitudes are changed, progress will be slow and halting. Education operates at a variety of levels, from the grade school to the media. Education ministries are struggling to find ways to integrate new information about the sustainability of their communities into the curriculum. However, incorporating green infrastructure into the urban landscape can automatically change the landscape in a way that creates opportunities for learning. These physical opportunities can be integrated into school grounds and supplemented with learning materials. Ideally, this effort could make natural systems a part of the everyday reality of the developing child. Much more research is needed in order to understand how best to achieve this and other educational goals.

Selling Sustainability
At the same time, if the principles of sustainability are to form the basis for a new development movement, consumers must also understand and embrace them. Bringing this about requires developing marketing strategies to appeal not only to early adopters of sustainable communities, but also to those who are not yet aware of the options afforded by more complete community living. This involves educating consumers about the benefits of sustainable communities as well as about the responsibilities of ongoing management and stewardship. Public agencies can provide the lead by developing policies that support more efficient, sustainable land use and development; developers and builders can help make the case by providing affordable, efficient, and attractive communities; and government and non-profit groups can provide a means for helping individuals to understand the benefits of sustainable communities as well as for developing community-based strategies essential for the immediate and long-term stewardship of sustainable community resources.

The "Bottom Line"
All of the principles, strategies, and guidelines outlined in this manual are conceptually linked to one fundamental insight: urban design decisions made on one site, if repeated for all other similar sites, profoundly influence the ecological, social, and economic health of the entire urban region. This fact is increasingly well understood in our region and beyond. Citizens, elected officials, appointed officials, and other stakeholders increasingly recognize that urban design decisions produce regional consequences and that the solutions to many important regional issues must be found at the site level. It is our hope that this manual helps provide some of these much needed solutions.

APPENDIX
Sustainability Checklist

On the pages that follow, we provide a sustainability checklist for evaluating community design proposals. Each item on the checklist is keyed to an item in the manual, and in this way represents an abbreviated summary of our recommendations. We hope that it will be a useful tool for BC citizens, planners, engineers, regulators and developers. Municipalities might decide to use the list as a basis for evaluating development applications and/or assigning infrastructure credits or DCC reductions (if a proposed development achieves a minimum level of compliance). Citizens might use the checklist as a way to discuss a project and evaluate its merit. Developers might use the checklist as a tool to enhance communication with citizens and elected officials, and as a marketing tool. While not intended as a scientific or absolute measure of sustainable development, this checklist does provide a consistent basis for comparison between options, and should help citizens and their elected officials set, and then meet, their sustainability targets.

District
sustainability checklist

		Yes	No	Take Action
1	Do site development, engineering and subdivision requirements reflect the purpose and goals of the regional growth strategy?	☐	☐	☐
2	Do site development, engineering and subdivision requirements reflect Official Community Plan principles?	☐	☐	☐
3	Does the development reflect the goals/objectives of regional Liquid Waste Management, pollution management, and/or watershed plans and strategies?	☐	☐	☐
4	Does the development utilize existing infrastructure networks?	☐	☐	☐
5	Does the development support a coordination between land-use and transportation ?	☐	☐	☐
6	Are residents and community stakeholders involved in the planning and design process?	☐	☐	☐
7	Does the development reflect an understanding of watershed forms and processes?	☐	☐	☐
8	Is the development located outside areas identified as environment tally sensitive and/or hazardous?	☐	☐	☐
9	Does the development support and link to a regional ecological network?	☐	☐	☐
10	Are alternative storm water management design standards incorporated to reduce downstream impacts of development?	☐	☐	☐
11	Does development maintain pre-development hydrological conditions?	☐	☐	☐
12	Are riparian zones sufficient to protect the aquatic and terrestrial features necessary for fish survival?	☐	☐	☐
13	Do riparian zones layer ecological protection and passive recreational access in mutually supportive ways?	☐	☐	☐
14	Are public parks, school sites and wetlands integrated to maximize recreational, environmental learning, and community development opportunities?	☐	☐	☐
15	Is the development concentrated around commercial and transportation nodes?	☐	☐	☐
16	Do residential and employment densities support the regional transit system?	☐	☐	☐
17	Does the development incorporate a mix of uses?	☐	☐	☐

Related Guideline/Pg.	Rationale				
Pg. 20	Regional growth strategies provide a long range course of action for meeting common social, economic and environmental objectives.	✓	✓	✓	✓
Pg. 17	An OCP outlines broad principles and objectives for the form and character of development within a community. It should be supportive of the regional growth strategy.	✓	✓	✓	✓
Pg. 21, 22	Liquid Waste Management Plans, air pollution management strategies and watershed plans are specific tools that support regional environmental protection objectives.	✓			
1.1, 8.2, 8.3	Developing within existing infrastructure networks saves costs associated with expansion of road and water networks.		✓		
6.1, 6.2, 6.3	Coordinating land use and transportation planning can reduce trip distances and vehicle kilometres travelled (VKT) and curb reliance on cars.			✓	
Pg. 24	Multi-stakeholder, community-based processes help ensure that concerns regarding development are voiced and conflicting issues can be reconciled in an efficient, mutually agreeable manner.	✓	✓	✓	✓
3.1, 4.1, 4.2, 5.1	Watershed based planning ensures that resource, land use and community design decisions are made with an eye towards their potential impacts on the watershed and the natural systems therein.	✓	✓		
1.2, 3.1, 3.3, 3.4	Identifying environmentally sensitive and/or hazardous areas prior to development ensures the long term protection of fragile ecological systems.	✓			
3.3, 5.1, 5.5, 5.6, 6.3, 7.3	An ecological network connects habitat corridors, urban forests, large riparian areas and agricultural areas and enhances biodiversity.	✓			
4.2, 4.3, 7.3	Conventional storm water management techniques disrupt surface flow and eliminate the opportunity for groundwater recharge.	✓			
4.1, 4.1, 4.3, 7.3	Maintaining pre-development hydrological conditions after development occurs ensures the hydrological health of the watershed.	✓			
3.1, 3.3, 5.5	Riparian zones are crucial for supporting habitat related to stream health and for filtering sediment and pollutants from runoff.	✓			
3.1, 5.1, 5.5	Combining environmental protection with passive recreation is an important way of increasing public awareness of the value of ecologically sensitive areas and increasing support for their ongoing stewardship.	✓			✓
7.1, 7.2, 7.3, 12.1, 12.2	Combined school/park sites can simultaneously fulfill educational, recreational and community needs in a cost effective manner.	✓			✓
8.2, 8.3, 8.4, 9.2, 9.3	Concentrating and combining land uses creates more complete communities and provides the population densities needed to support transportation modes other than the car.			✓	✓
8.2, 8.3, 9.1, 9.2	A minimum residential density of 25 uph and employment densities of between 125 - 175 employees per hectare on business-related parcels support regional transit service and can lead to significant reductions in VKT.		✓	✓	
10.1, 11.1, 11.2	Mixing land uses provides an opportunity for families to live and work in the same area, curbing reliance on automobiles, and contributing to social vibrancy.		✓	✓	✓

District
sustainability checklist

		Yes	No	Take Action
18	Is the street system interconnected to allow multiple paths for movement through the community?	☐	☐	☐
19	Are all residences in the development located within a 400 metre (5 minute walk) of neighborhood stores, parks and transit?	☐	☐	☐
20	Are greenways and bikeways integrated into the transportation network?	☐	☐	☐
21	Does the development enhance local identity and character?	☐	☐	☐
22	Are public facilities (e.g., schools and community centres) shared to accommodate different uses at different times of the day?	☐	☐	☐
23	Are homes oriented towards open space and/or views to the maximum extent possible?	☐	☐	☐
24	Are opportunities for regional food production maximized?	☐	☐	☐
25	Has the incorporation of district-scale energy and servicing infrastructure been considered?	☐	☐	☐

Corridor

26	Does the development meet requirements for riparian protection?	☐	☐	☐
27	Are streets designed to infiltrate and treat storm water?	☐	☐	☐
28	Are stream crossings designed to minimize impact on aquatic habitat?	☐	☐	☐
29	Are opportunities for habitat enhancement incorporated into streets and corridors?	☐	☐	☐
30	Does the street network respond to existing topography and minimize earth works and site engineering?	☐	☐	☐
31	Are commercial activities centered on a pedestrian oriented 'Main Street'?	☐	☐	☐
32	Are on-site parking requirements minimized while on-street parking is maximized?	☐	☐	☐
33	Is parking located such that it does not detract from the pedestrian environment?	☐	☐	☐
34	Are streets designed to be safe and comfortable for pedestrians and cyclists?	☐	☐	☐
35	Are streets designed to frame important views?	☐	☐	☐

Related Guidelines	Rationale					
6.2, 6.3,11.1, 11.2	An integrated system of streets accommodates all transportation modes within a continuous and connected network and reduces trip distances.	✓		✓		
8.1, 8.3, 13.1	Locating neighbourhood commercial uses and parks within a five minute walk of all residents will dramatically reduce short car trips.			✓	✓	
6.3, 8.1, 13.1	Greenways are important movement corridors for people, water and wildlife both throughout a district and between districts in a region.	✓		✓		
2.1, 2.2, 14.1, 14.2, 14.3	Local identity and character is maintained and fostered through a careful attention to physical and cultural landscape features.				✓	
7.1, 12.1, 12.2	Lectures, exercise classes, gardening and cooking workshops, and community sports are a few of the potential afternoon and evening uses.		✓		✓	
13.1, 13.2, 13.3	Locating homes near and orientating towards park and open space can increase property values.		✓		✓	
8.1,3.4	Preservation of land with high agricultural values or providing open space for community gardens can provide space for food production.		✓		✓	
5.1	Development should be consistent with the minimization of waste disposal needs and energy use.	✓	✓			

Corridor

16.1, 16.2	Maintaining the ecological integrity of riparian systems is crucial for the survival of aquatic and terrestrial species.	✓				
15.3,19.1, 19.2, 19.3, 23.1	Narrow streets require less pavement and reduce runoff quantity, while an interconnected network disperses runoff flow.	✓		✓		
16.1, 17.3	Stream crossings should cause the least possible disruption to stream banks and channel structure.	✓		✓		
20.1, 20.2, 20.3, 21	Traffic bulges, boulevards and traffic islands can be planted to create habitat for birds and other small creatures and to allow for infiltration and evapotranspiration of rainwater.	✓		✓		
15.1, 15.2, 15.3, 23.1, 23.3	Fitting streets to the land minimizes construction costs and environmental impacts.	✓	✓			
22.1, 22.2, 22.3, 24.1	A pedestrian oriented 'Main Street' provides shops and services that cater to the district.			✓	✓	
22.1, 22.3, 26.1	Reducing minimum on-site parking standards is an important transportation demand management strategy which must also be matched by maximizing on-street and lane parking.		✓	✓		
22.3, 24.2, 24.3, 25.1	Locating parking underground or behind buildings reduces the impact of cars on the pedestrian environment. On-street, parallel, or angled parking in both directions gives direct access to storefronts and creates a buffer for pedestrians.		✓	✓		
25.1, 25.2, 26.2	Designing for the needs of pedestrians and cyclists curbs dependence on automobiles.			✓	✓	
13.3	Framing key views connects people to the landscape and can increase the value of homes.				✓	

Block
sustainability checklist

		Yes	No	Take Action
36	Are blocks designed to maximize the infiltration and storage of ground water?	☐	☐	☐
37	Are blocks designed to embrace and protect important environmental features?	☐	☐	☐
38	Do sidewalks connect blocks on both sides of the street?	☐	☐	☐
39	Are interruptions to the sidewalk minimized?	☐	☐	☐
40	Are blocks short enough to provide easy movement for pedestrians?	☐	☐	☐
41	On longer blocks are there mid-block connections to greenways or trails?	☐	☐	☐
42	Are there multiple lot sizes within each block to accommodate many housing and tenure types?	☐	☐	☐
43	Are setbacks minimized to create a sense of enclosure on the street?	☐	☐	☐
44	Do blocks incorporate space for public gathering and/or local stewardship activities (e.g., composting; community gardening)?	☐	☐	☐

Parcel

45	Are building footprints reduced to maximize infiltration of rainwater?	☐	☐	☐
46	Does building and site design minimize energy and material inputs?	☐	☐	☐
47	Are buildings articulated in response to natural features and phenomena?	☐	☐	☐
48	Are opportunities for water reuse and recycling incorporated into the building and site design?	☐	☐	☐
49	Are a variety of living spaces layered within the parcel to accommodate different family and income types?	☐	☐	☐
50	Do homes present a friendly face to the street?	☐	☐	☐
51	Are garages placed behind or recessed back from a house?	☐	☐	☐
52	Are opportunities for social interaction within each parcel maximized?	☐	☐	☐

Related Guidelines	Rationale				
30.1, 30.2, 30.3, 30.4	Each block should incorporate areas for the filtering, absorption, and infiltration of storm water.	✓			
27.1, 27.2, 27.3	The formation of blocks should: a) reflect the landscape structure; and b) maintain a high degree of interconnectivity and permeability.	✓		✓	
28.1	Continuous sidewalks on both sides of the street encourage pedestrian use of the street.			✓	✓
28.2	Curb cuts and driveways are barriers to pedestrian movement. Sharing driveways and locating car storage and services at the rear of the buildings are two ways to minimize interruptions to sidewalks.			✓	✓
29.1	Shorter blocks (of between 150 meters to 180 meters in length) means more intersections, shorter routes, and slower cars.			✓	✓
29.2, 29.4	Mid-block pathways allow pedestrians to move through large blocks.			✓	✓
32.2	Smaller blocks are cost effective and flexible because they can be adapted for multiple types of land-use.		✓	✓	✓
31.4	Buildings should reinforce the edges of the street and provide a comfortable place for users.			✓	✓
31.1, 31.2	Small areas of open space within each block or neighbourhood can become venues for social interaction, habitat enhancement and environmental learning.	✓			✓

Parcel

36.1	Minimizing the floor plate of a building reduces the effective impervious area of a parcel and therefore reduces storm water quantity.	✓			
33.1, 33.2, 3.33, 40.2, 40.3	Optimal solar orientation, high-performance glazing, recycled building materials, and the use of alternative energy sources reduce life-cycle costs of buildings.	✓	✓		
33.2, 40.1, 40.2, 40.3	Articulating building envelopes according to site features and natural phenomena allows light to penetrate into spaces within a building while maximizing views outwards.	✓			✓
34.2, 40.1, 40.2	Disconnecting roof leaders, rain barrels, and porous paving are cost-effective, low maintenance methods of reducing storm water runoff.	✓	✓		
37.1, 37.2, 37.3, 38.1, 8.2	Incorporating multiple dwelling types and tenures into a parcel provides a mortgage helper for homeowners and increases the social diversity of a neighbourhood.		✓		✓
39.1, 39.2, 39.3	Buildings with windows, doors, and porches oriented towards streets allow for passive surveillance while increasing social interaction among neighbours.				✓
36.2, 39.3	Minimizing the impact of garages creates a stronger relationship between public and private space along the edge of the street and parcel.				✓
42.1, 42.2, 42.3, 42.4	Patios, balconies, and rear lanes allow for varying degrees of interaction among residents of a nieghbourhood.				✓