

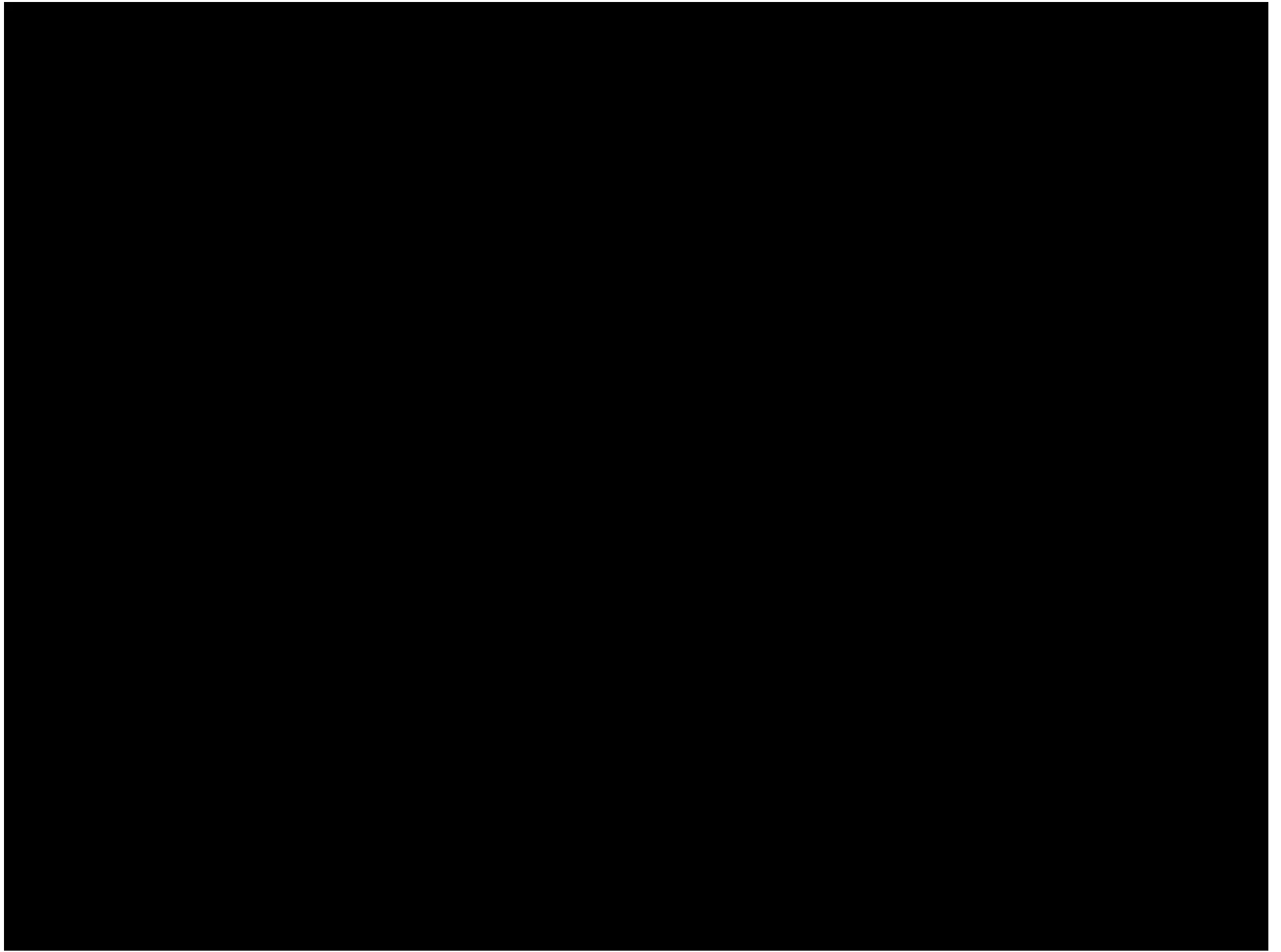


Neil Alden Armstrong, Pioneer, 1930 – 2012



# Creek & Communities: A Freshwater Imperative

Shawnigan Lake Watershed Roundtable  
Aqua-Tex Scientific Consulting Ltd.  
September, 2012





Houston, YOU have a problem

The history (future) of the world is written not  
in ink but in water (Chinese Proverb)

# ystem

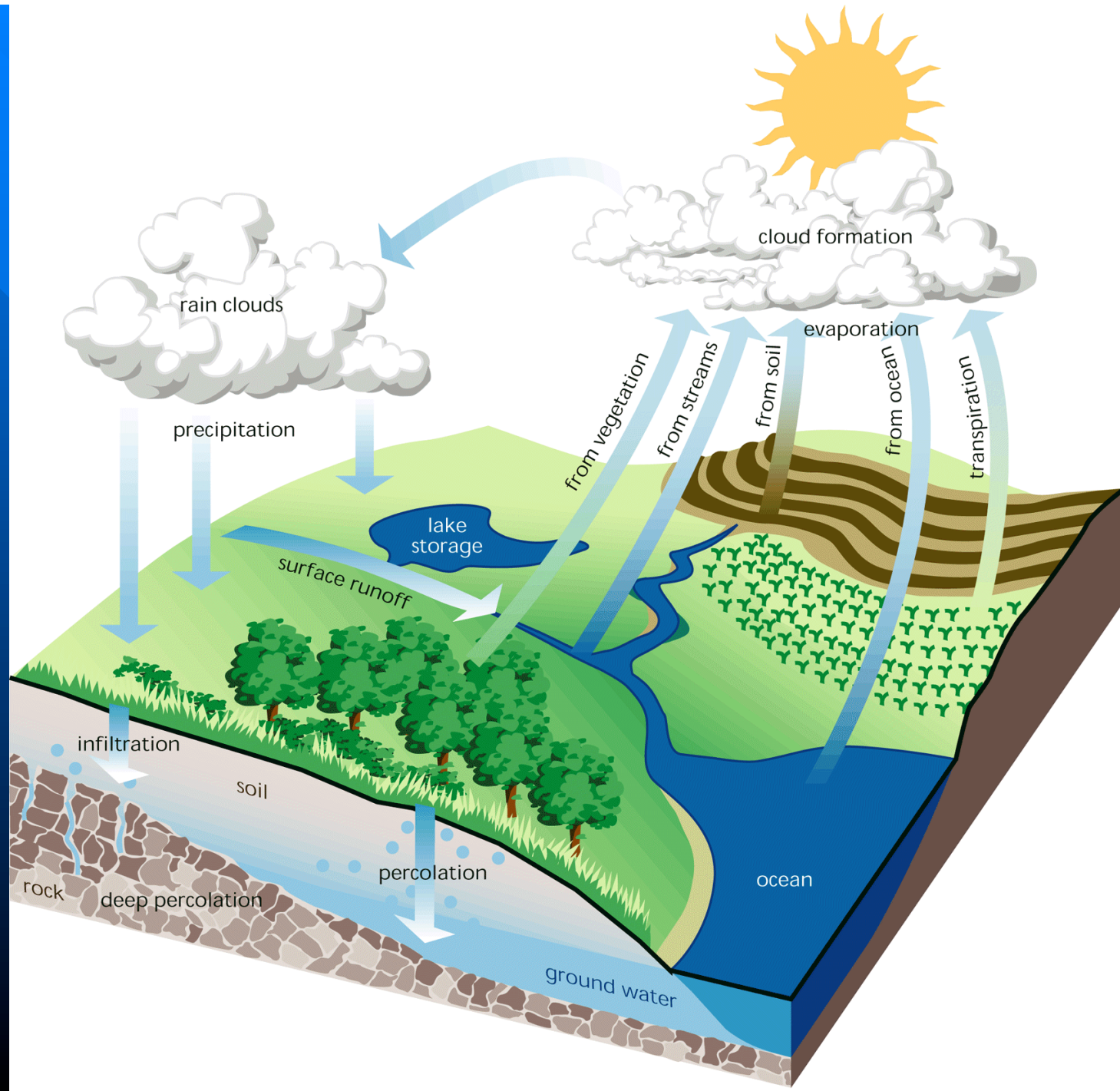


A. World's Total Water Supply  
1 386 million km<sup>3</sup>,  
97.5 % saltwater

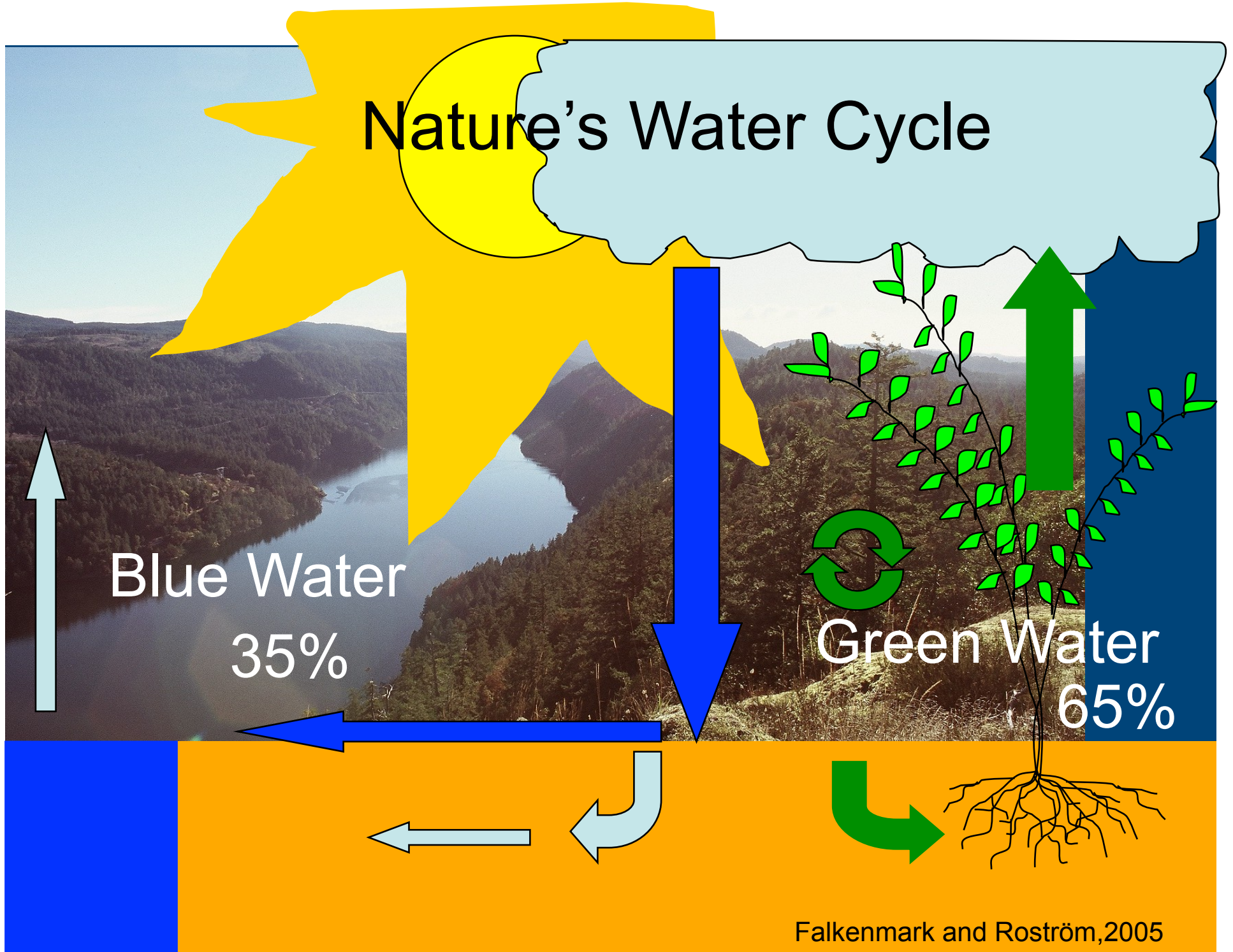
B. This circle represents the 2.5% that is freshwater but almost all of this is in ice or is underground

C. This dot represents the tiny amount (0.01%) that is **not** in ice or underground

DFO, 1987

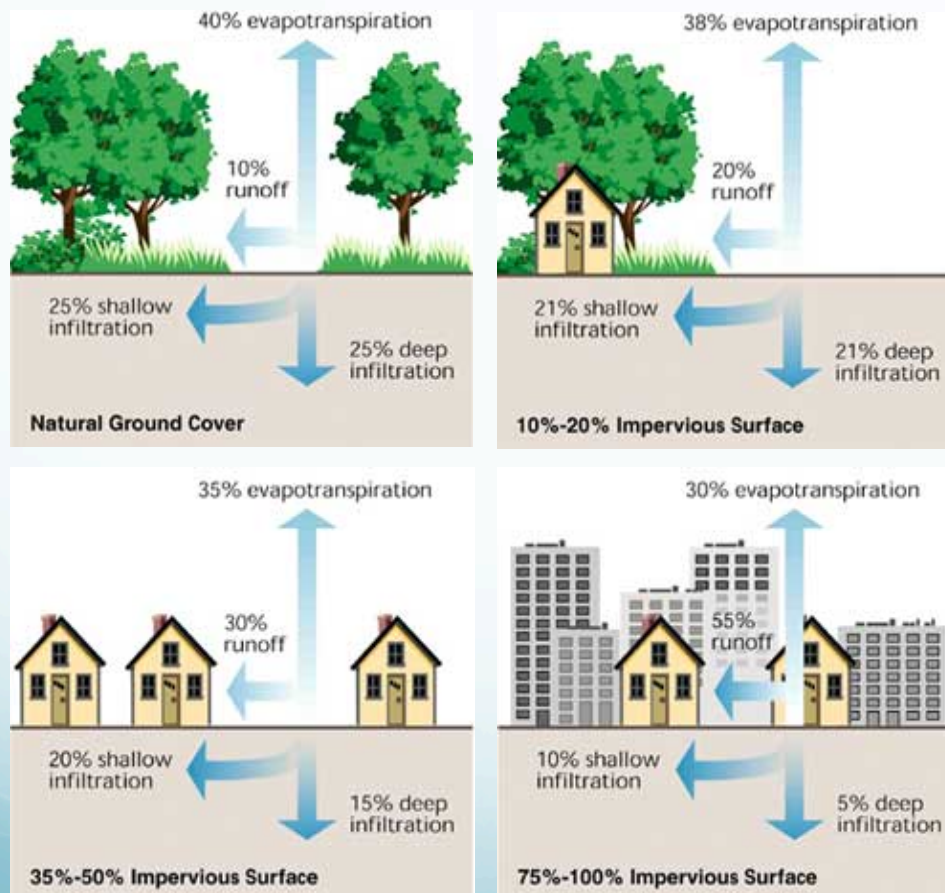


# Nature's Water Cycle



Falkenmark and Roström, 2005

# Changes in land use effect the small water cycle



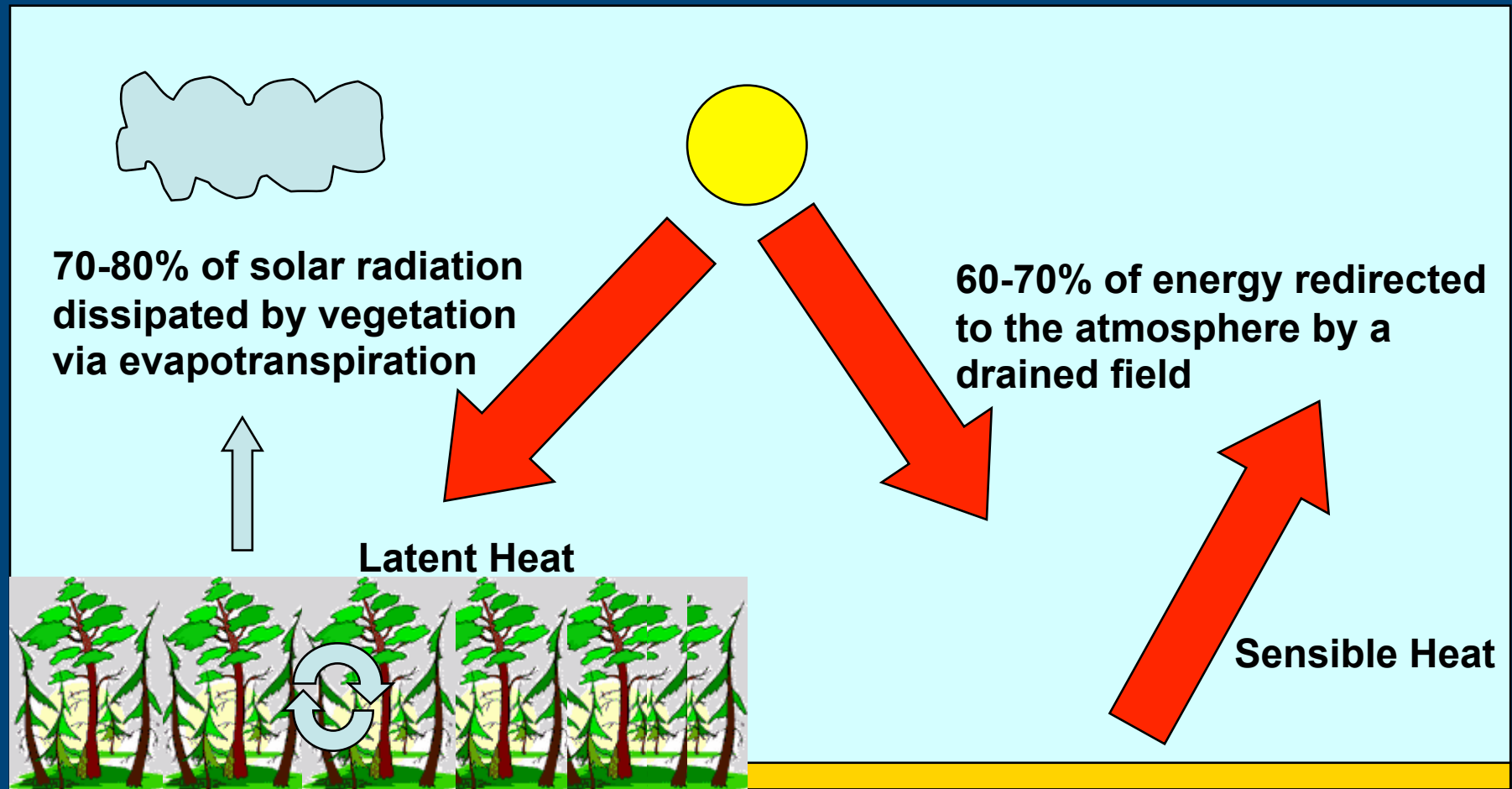
Altering the landscape from its natural form results in:

- Reduced ground-water infiltration and recharge
- Aging of the landscape (nutrient cycle becomes linear)
- Increased surface run-off
- Reduction in green space
- Heat island effect
- Local climate change





# Solar Energy Dissipation & Cooling





Lower Sampson Co., NC



Cimarron Co., OK



S. Lincoln Co., TN



Silicon Valley, CA

- July Hottest Month on Record in U.S
- The lower 48 U.S. states = average July temperature of 25.3 degrees Celsius (1.8 above 20<sup>th</sup>-century avg.)
- The highest July average since record-keeping began in 1895; 2012 warmest Jan.-July period on record
- If it is dry, it tends to be hot; with no water on the ground, all the heat goes into raising temperature and not evaporating moisture
- Drought begets drought. And drought causes heat waves

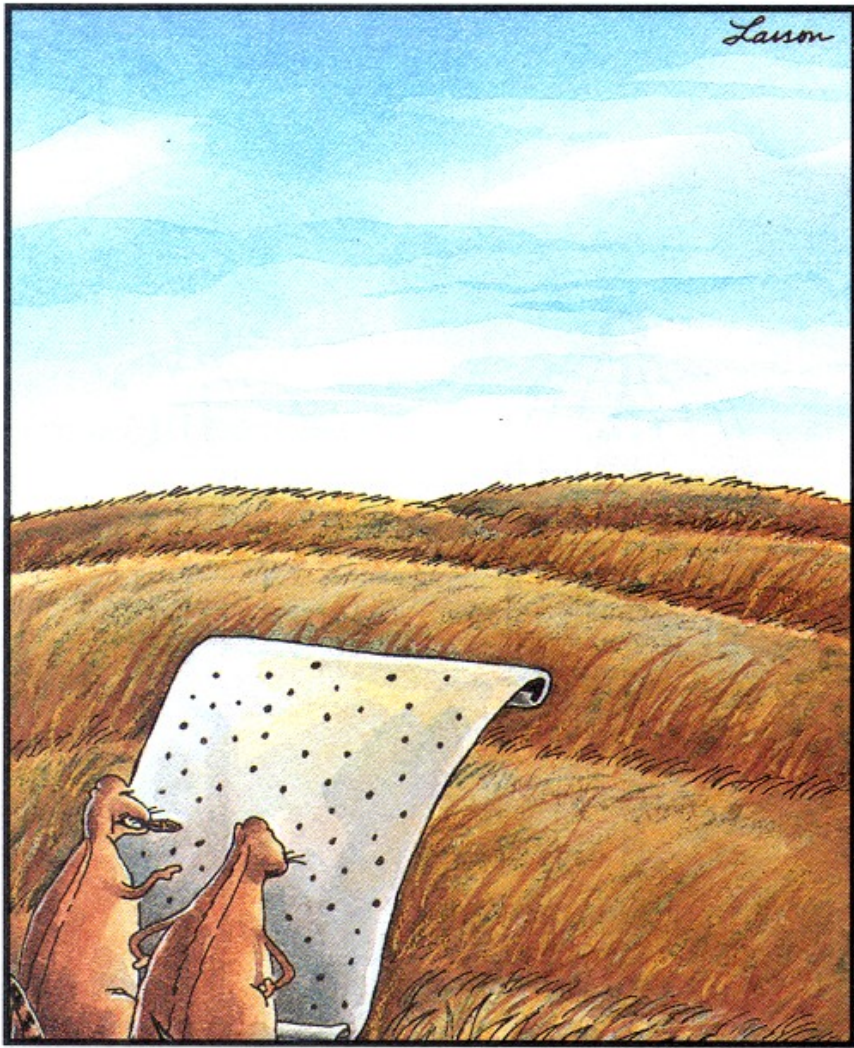
**Can we fix this?**



# Prairie Dog Towns

A landscape photograph of a prairie. In the foreground, there is a field of tall, golden-brown grass. In the middle ground, there are several small, raised mounds of earth, which are prairie dog burrows. The background shows rolling hills under a clear sky. The title 'Prairie Dog Towns' is overlaid in yellow text on the left side of the image.

- Groundwater recharge- tunnels= underground pipelines
- Soil aeration & mixing- creates macropores & rapid infiltration
- Improved forage quality
- Fire refuge for small animals
- Burrows for salamanders, toads, snakes, rabbits, burrowing owls



Prairie dog developers





- Nature's Engineers were once present all over the world
- Beaver dams created lakes & wetlands
- Slowed runoff, captured sediment, captured nutrients, enriched soils
- Recharged groundwater
- Very diverse habitat



A photograph of a bison in a grassy field. The bison is the central focus, standing in a field of tall, green grass. In the background, there are several pine trees. The bison is facing left, and its head is lowered as if grazing. The overall scene is a natural, outdoor setting.

Wallows = nature's infiltration basins

Basins did not plug up because they were regularly used & disturbed

# Creeks & Communities

*“ Restoration will not happen by regulation, changes in the law, more money or any of the normal bureaucratic approaches. It will only occur through the integration of ecological, economic, and social factors, and participation of affected interests.”*

(March 20, 1996; USDI BLM, USDA FS, USDA NRCS  
Interagency strategy)



## Mission Statement:

“ Healthy streams through bringing people together.”

## Goal:

“ Achieving accelerated cooperative riparian restoration and management through collaboration.”

“ Reducing process” (red tape).

## The Foundation Tool:

“ Proper Functioning Condition (PFC).”

# Standard Checklist (Lotic)

Name of Riparian-Wetland Area: \_\_\_\_\_ Date \_\_\_\_\_

Area/Segment ID: \_\_\_\_\_ Location: \_\_\_\_\_

Aerial Photo: \_\_\_\_\_ ID Team Observers: \_\_\_\_\_

Yes	No	N/A	HYDROLOGIC
			1) Floodplain above bankfull inundated in "relatively frequent" events
Rationale			
			2) Where beaver dams are present they are active and stable
Rationale			
			3) Sinuosity, width/depth ratio, and gradient are in balance with the landscape setting (i.e., landform, geology, and bioclimatic region)
Rationale			
			4) Riparian-wetland area is widening or has achieved potential extent
Rationale			
			5) Upland watershed is not contributing to riparian degradation
Rationale			

Yes	No	N/A	VEGETATIVE
			6) There is diverse age-class distribution of riparian-wetland vegetation (recruitment for maintenance/recovery)
Rationale			
			7) There is diverse composition of riparian-wetland vegetation (for maintenance/recovery)
Rationale			
			8) Species present indicate maintenance of riparian soil moisture characteristics
Rationale			
			9) Streambank vegetation is comprised of those plants or plant communities that have root masses capable of withstanding high streamflow events
Rationale			
			10) Riparian-wetland plants exhibit high vigor
Rationale			
			11) Adequate riparian-wetland vegetative cover present to protect banks and dissipate energy during high flows
Rationale			
			12) Plant Communities are an adequate source of coarse and/or large woody material (for maintenance/recovery)
Rationale			

# Standard Checklist (Lotic)

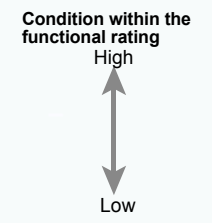
Yes	No	N/A	EROSION/DEPOSITION
			13) Flood plain and channel characteristics (i.e., rocks, overflow channels, coarse and/or large woody material) are adequate to dissipate energy
Rationale			
			14) Point bars are revegetating with riparian-wetland vegetation
Rationale			
			15) Lateral stream movement is associated with natural sinuosity
Rationale			
			16) System is vertically stable
Rationale			
			17) Stream is in balance with the water and sediment being supplied by the watershed (i.e., no excessive erosion or deposition)
Rationale			

Remarks:

## SUMMARY DETERMINATION

### Functioning Rating

Proper Functioning Condition \_\_\_\_\_  
 Functional--At Risk \_\_\_\_\_  
 Nonfunctional \_\_\_\_\_



Rationale: Overwidened channel, lack of riparian-wetland vegetation in appropriate areas, poor vigor in the herbaceous plant areas.

### Apparent Trend for Functional — At Risk

Upward \_\_\_\_\_  
 Downward \_\_\_\_\_  
 Not Apparent \_\_\_\_\_

Rationale:

### Are factors contributing to unacceptable conditions outside the manager's control or management?

Yes \_\_\_ No \_\_\_ If yes, what are those factors?

- |                                   |                               |
|-----------------------------------|-------------------------------|
| _____ Flow Regulation             | _____ Mining Activities       |
| _____ Upstream channel conditions | _____ Channelization          |
| _____ Road encroachment           | _____ Augmentation flows      |
| _____ Recreational Activities     | _____ Agricultural Activities |
| _____ Other (specify)             |                               |

Remarks:



Q 3. sinuosity, w/d, gradient



Q 4. riparian zone widening



Q 4. riparian zone widening





Q 7. diverse composition



Q 7. diverse composition



Q 8. soil moisture



Q 8. soil moisture



Q 13. floodplain, channel characteristics



Q 13. floodplain, channel characteristics



Q 16. vertically stable



Q 16. vertically stable





Q 16. vertically stable



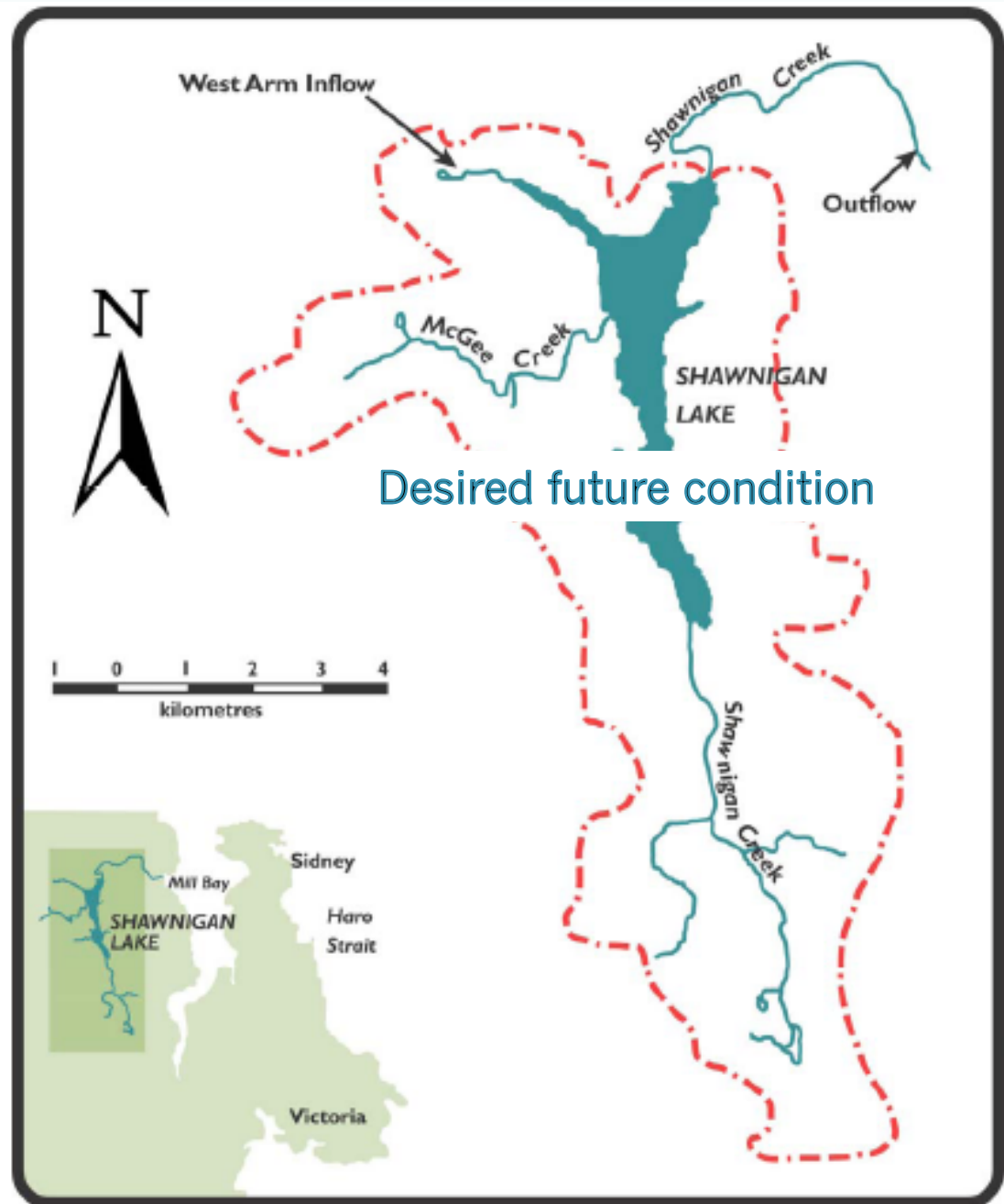
Q 16. vertically stable



Q 17. sediment supply



Q 17. sediment supply





03/30/2012 09:17



03/30/2012 09:15





03/14/2012 10:41



03/14/2012 10:43



03/14/2012 10:32



03/14/2012 11:48



03/23/2012 13:00



03/26/2012 12:59



06/05/2012 12:58



06/05/2012 12:41









# The Shawnigan Basin Society

## Purpose of the Society

- The purpose of the Shawnigan Basin Society is to establish a model of participatory ecological governance of the Shawnigan Community Watershed.

## Goal

- To ensure that the ecosystems, streams, wetlands and lakes of the Shawnigan Community Watershed are maintained in proper functioning condition to provide, in perpetuity, a sufficient quantity and quality of water for domestic, agricultural, commercial and industrial needs of basin residents.

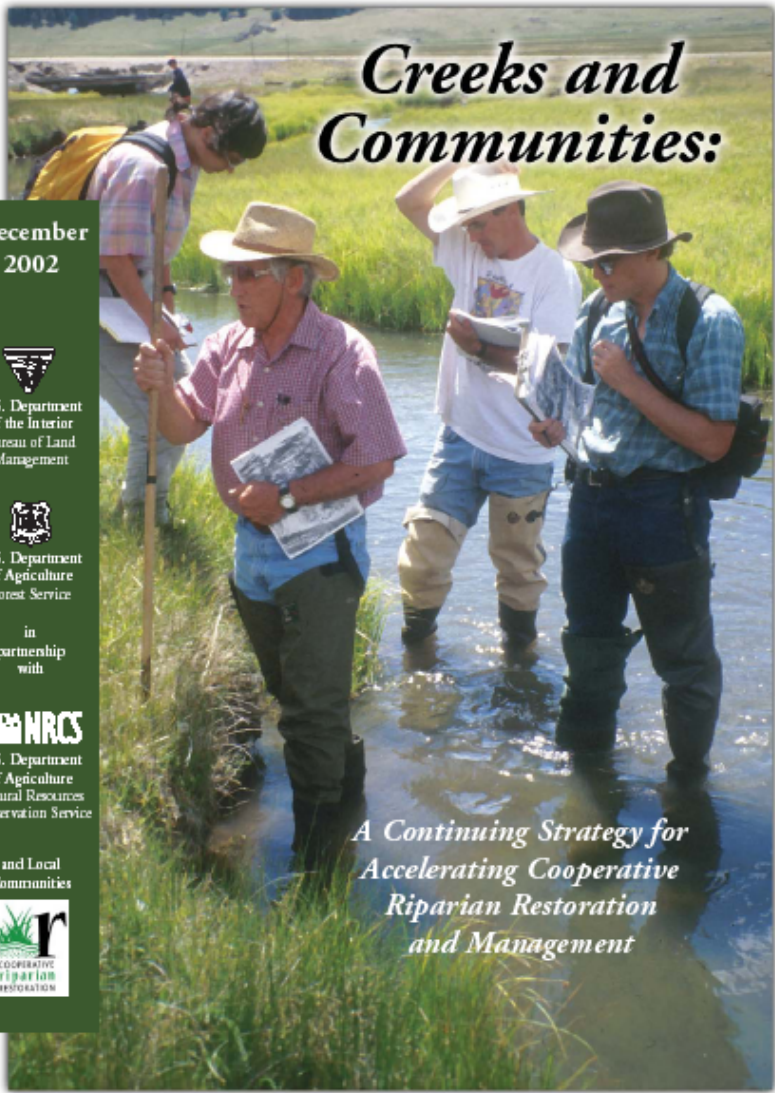
## Objectives

- Establish and maintain a Shawnigan Watershed Roundtable designed to bring together all interested residents, businesses and industries who wish to support the purpose and goal of the Shawnigan Basin Society.

- Conduct and support scientific, economic, social and governance studies necessary to understand the functions of the basin in relation to society's needs for water and to develop the concept of ecological governance as an innovative process of basin management
- Educate the basin public about the functions of the basin and their role in ensuring that the water security goal for the Shawnigan Community Watershed is achieved.
- Prepare a Shawnigan Basin Management Plan, incorporating ecological governance principles and practice, to guide future development, management and restoration of the land and waters of the Shawnigan Community Watershed.
- Establish a design panel to advise those undertaking development within the basin on how to incorporate ecological principles consistent with maintenance of proper functioning condition.

## Strategy

- Incorporate the Shawnigan Basin Society, provide it with a high level Board of Directors, raise supporting funds, hire an executive director to manage the affairs of the society and conduct public and government agency engagement actions to ensure that the objectives are being achieved in a timely manner.



# *Creeks and Communities:*

December  
2002



U.S. Department  
of the Interior  
Bureau of Land  
Management



U.S. Department  
of Agriculture  
Forest Service

in  
partnership  
with



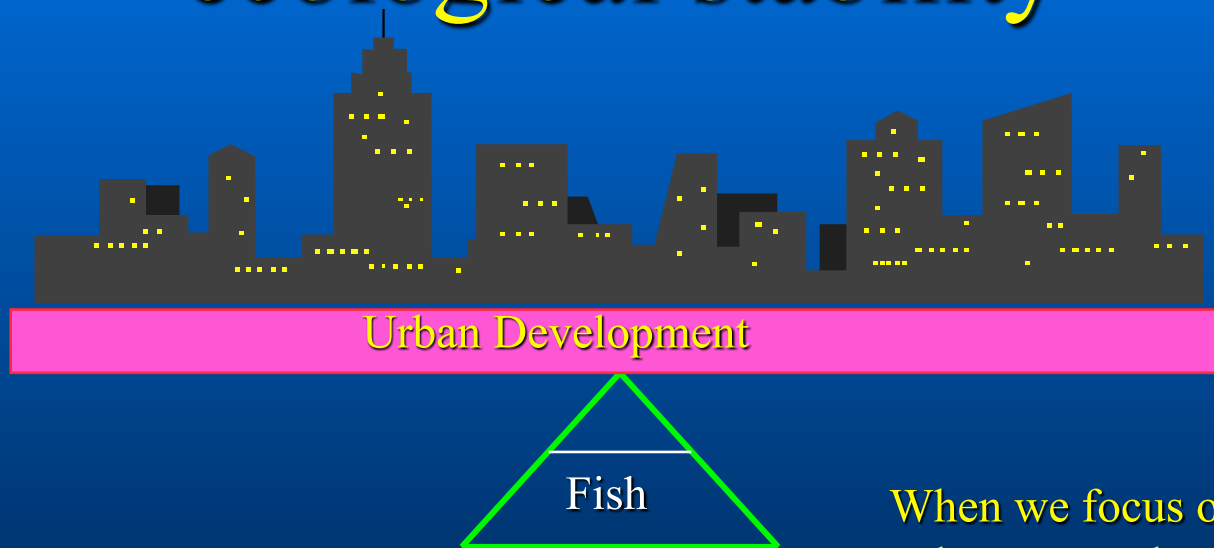
U.S. Department  
of Agriculture  
Natural Resources  
Conservation Service

and Local  
Communities



*A Continuing Strategy for  
Accelerating Cooperative  
Riparian Restoration  
and Management*

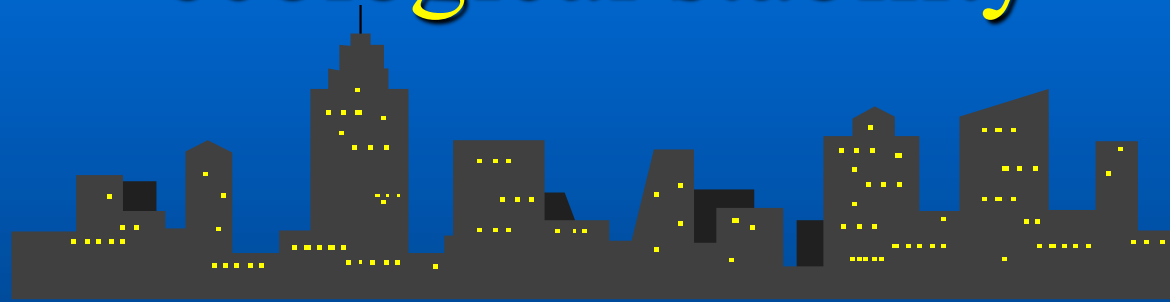
# Balance development on ecological stability



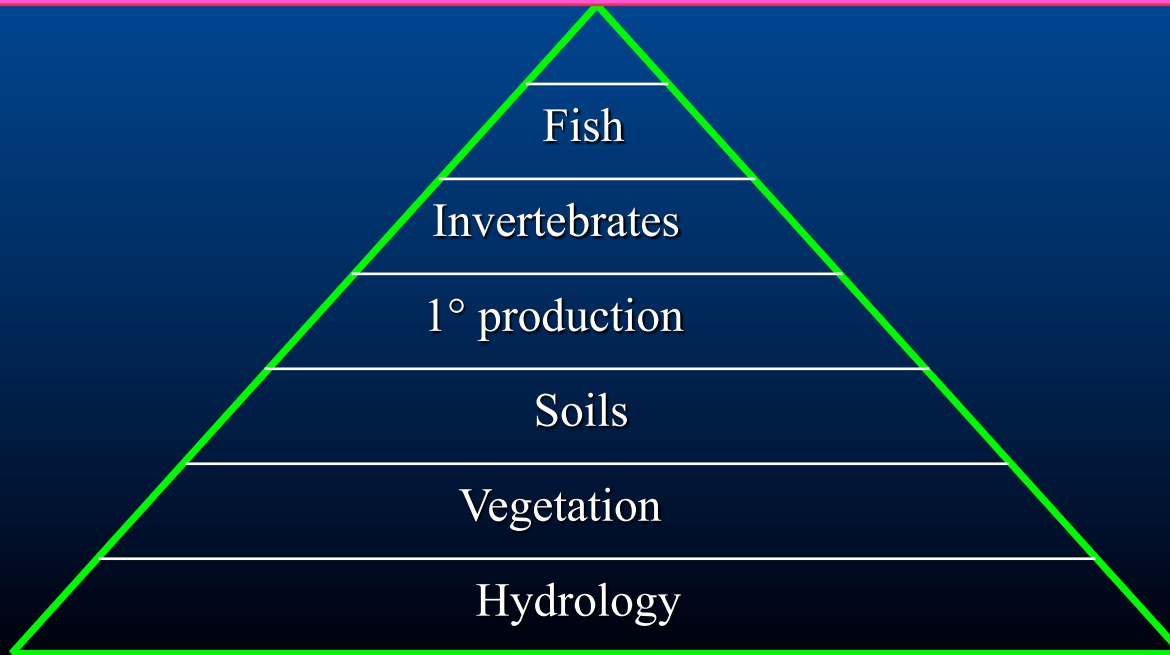
When we focus only on the values, we reduce the strength of the foundation



# Balance development on ecological stability



Urban Development



Fish

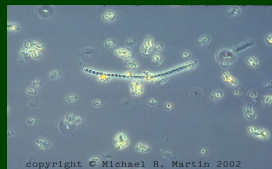
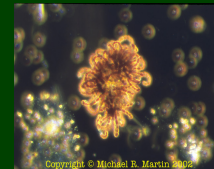
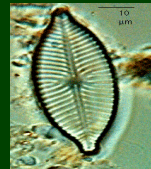
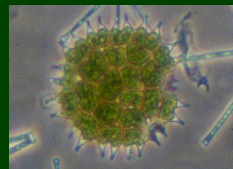
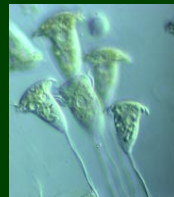
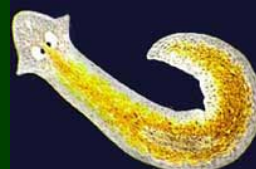
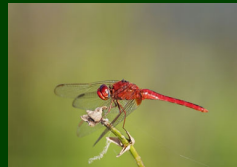
Invertebrates

1° production

Soils

Vegetation

Hydrology



copyright © Michael R. Martin 2002

copyright © Michael R. Martin 2002

copyright © Michael R. Martin 2002

# Natural Riparian Resources

**Water**



**Soil, Landscape**



**Vegetation**

# Blenkinsop Creek 1999

- Ditched to drain a field
- No functional habitat
- Get water off the land- simplify the water's path
- Poor water quality- nutrients become waste

August 2000

Lochside  
Public Trail

Old ditch

- 2 fields
- 2 irrigation systems
- 3 roads/ 3 bridges
- vandalism
- Used potable water for irrigation

## Benefits

- 1 field, 1 irrigation system
- 1 road/ no bridges
- Moat/ hedgerow
  - Enhanced biodiversity
  - Reduced pesticide use
  - Reduced vandalism
- 13% more arable land
- Floodplain restored- reduced downstream flood risk
- Improved water quality
- 3.5 km potential restoration
- 40% less potable water for irrigation
- \$1 600/ac/yr savings in pesticides alone
- Net present value = \$500,000 vs. cost of \$300,000 to build

2002 FCM-  
CH2MHill  
Sustainable  
Communities Award

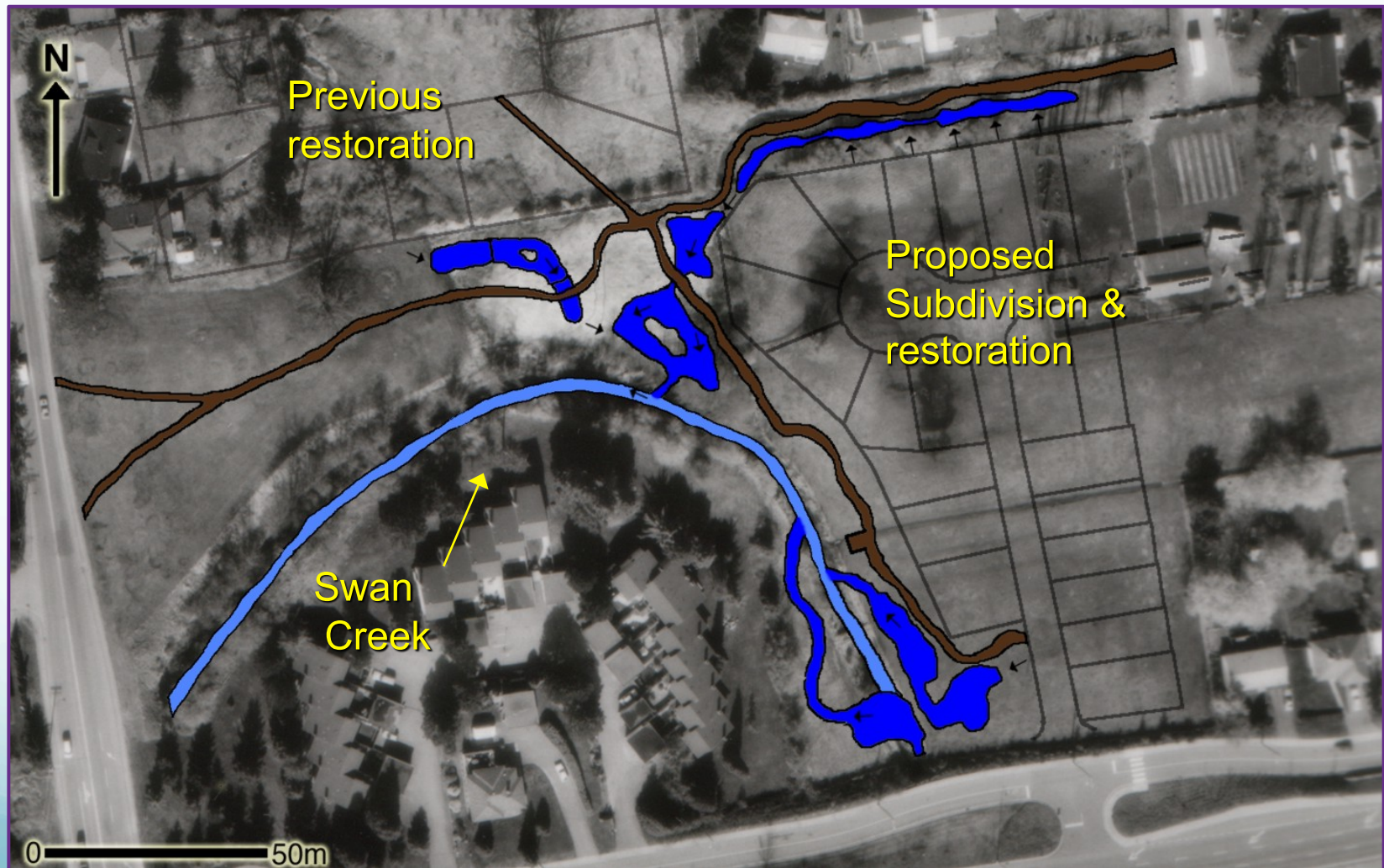


May 2006



2010

# Willowbrook: The Plan









1999



Summer 2000



**May 2004**



May 2006



May 2008



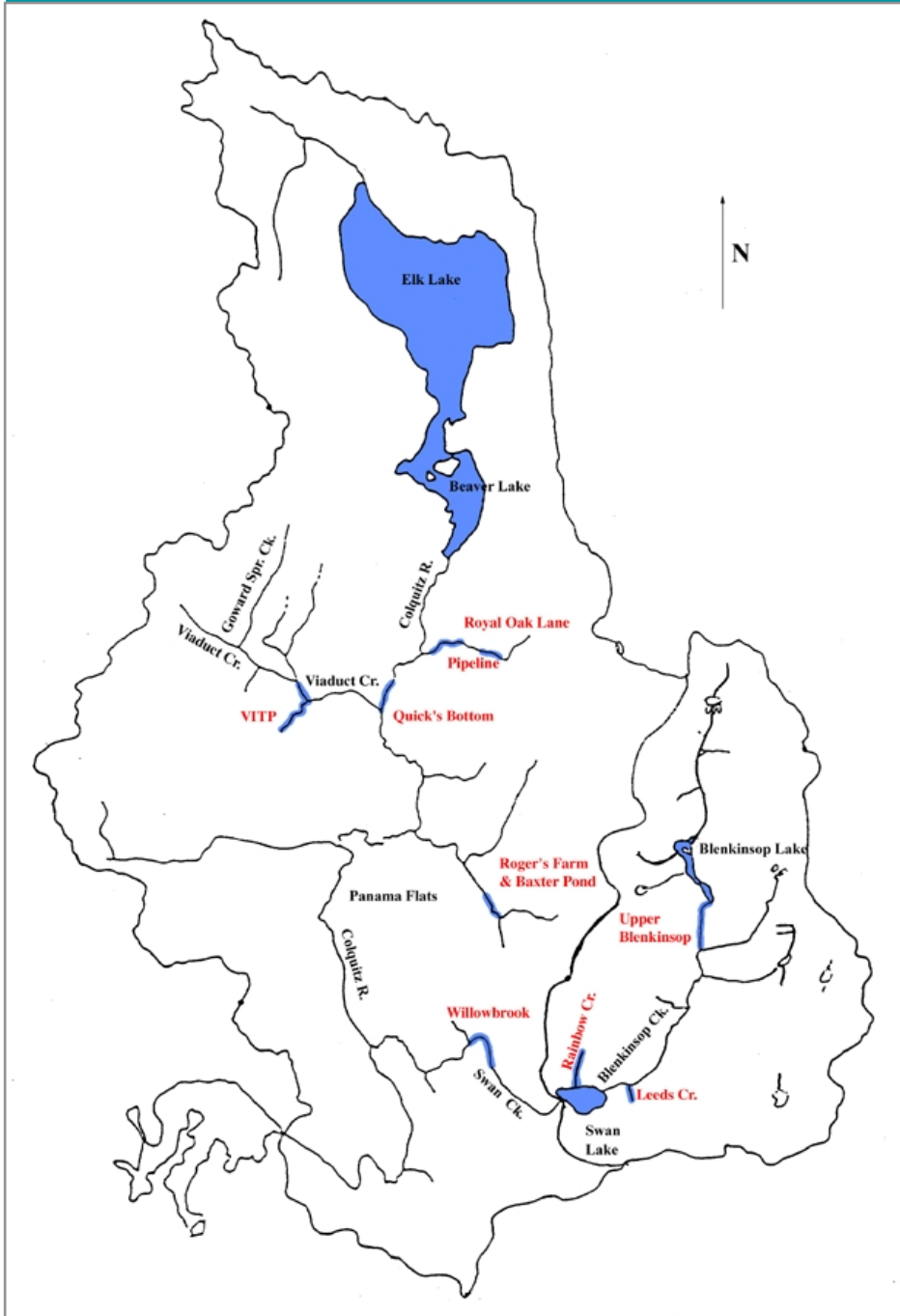


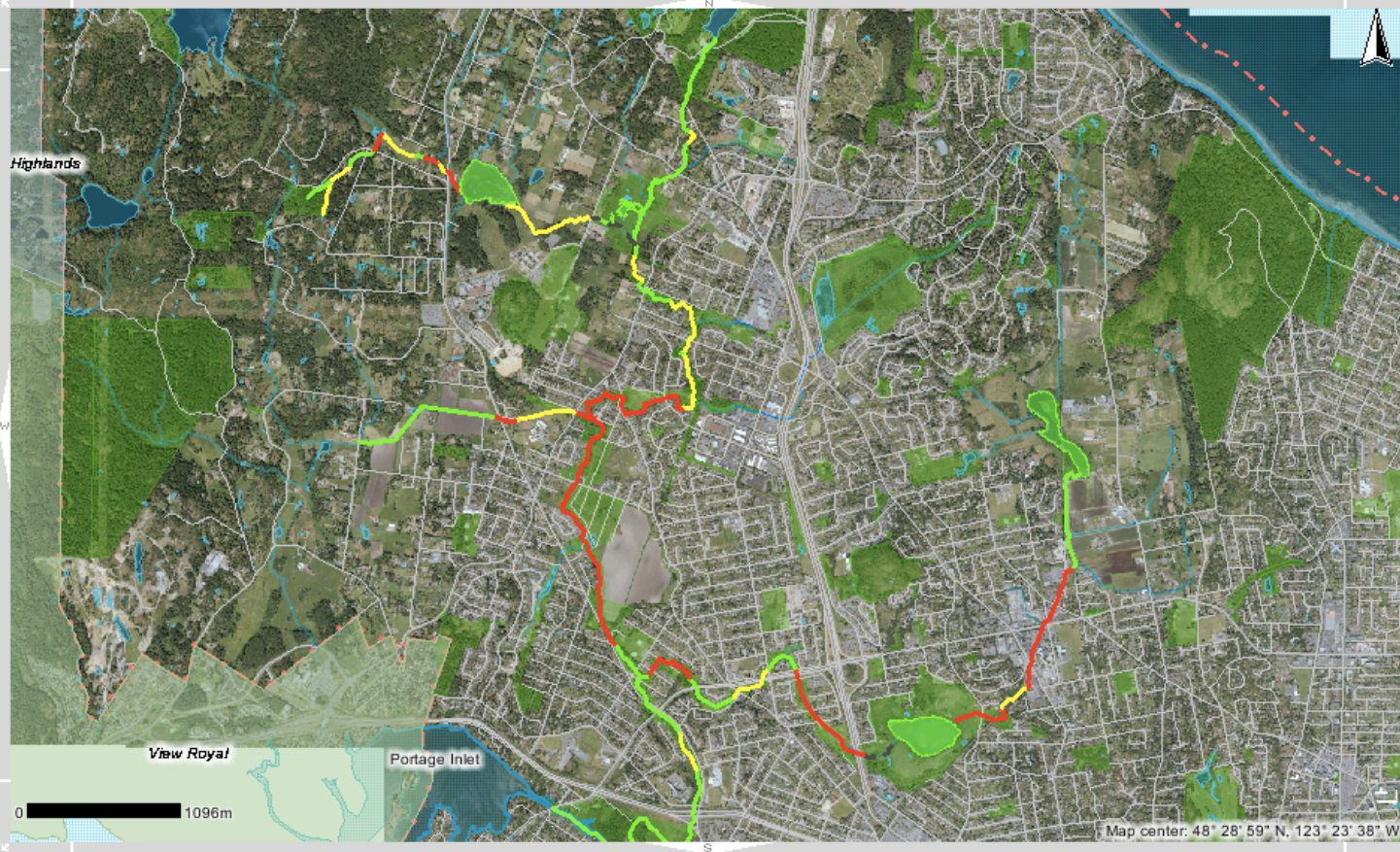


# Colquitz River Watershed Case Study

Integrated Watershed/  
Land Use Planning

Sustainable  
Development Design  
Guidelines





**Map Layers**

- Terrain
- Aerial Photos
  - Colour Photo 2007
  - Colour Photo 2005
  - Colour Photo 2003
  - B&W Photo 1997
- Land
- Transportation
- Parks
- Planning
- Environment
  - Functioning Condition - Lotic
  - Functioning Condition - Lentic
- Engineering and Public Works
- Base Information

Automatically Refresh Map

**Hints:** (click to expand)



- ### Map Layers
- Terrain
  - Aerial Photos
    - Colour Photo 2007
    - Colour Photo 2005
    - Colour Photo 2003
    - B&W Photo 1997
  - Land
  - Transportation
  - Parks
    - Parks
    - Significant Trees
    - Municipal Trail Network
    - Galloping Goose & Lochside Trail
    - Trail Connector
  - Planning
    - Zoning
    - Heritage Sites
  - Environment
    - Functioning Condition - Lotic
    - Functioning Condition - Lentic
  - Engineering and Public Works
    - Sewer
      - Sewer Gravity Main
      - Sewer Pressurized Main
      - Sewer Manhole
      - Sewer Cleanout
      - Sewer Main Cap
      - Sewer Network Structure
      - Sewer Control Valve
      - Sewer System Valve
      - Sewer Lateral
      - Sewer Service Area



- ### Map Layers
- Terrain
  - Aerial Photos
  - Colour Photo 2007
  - Colour Photo 2005
  - Colour Photo 2003
  - B&W Photo 1997
  - Land
  - Transportation
  - Parks
  - Parks
  - Significant Trees
  - Municipal Trail Network
  - Galloping Goose & Lochside Trail
  - Trail Connector
  - Planning
  - Zoning
  - Heritage Sites
  - Environment
  - Functioning Condition - Lotic
  - Functioning Condition - Lentic
  - Engineering and Public Works
  - Sewer
    - Sewer Gravity Main
    - Sewer Pressurized Main
    - Sewer Manhole
    - Sewer Cleanout
    - Sewer Main Cap
    - Sewer Network Structure
    - Sewer Control Valve
    - Sewer System Valve
    - Sewer Lateral
    - Sewer Service App



- ### Map Layers
- Terrain
  - Aerial Photos
    - Colour Photo 2007
    - Colour Photo 2005
    - Colour Photo 2003
    - B&W Photo 1997
  - Land
  - Transportation
  - Parks
    - Parks
    - Significant Trees
    - Municipal Trail Network
    - Galloping Goose & Lochside Trail
    - Trail Connector
  - Planning
    - Zoning
    - Heritage Sites
  - Environment
    - Functioning Condition - Lotic
    - Functioning Condition - Lentic
  - Engineering and Public Works
    - Sewer
    - Storm
      - Storm Gravity Main
      - Storm Manhole
      - Storm Cleanout
      - Storm Silt Trap
      - Storm Network Structure
    - Water
  - Base Information

Scale: 1: 1,003  Map Tool:  Active Layer: **Functioning Condition - Lotic**

The following information was excerpted from the report entitled "Colquitz River Watershed: Proper Functioning Condition Assessment July 2009" prepared by Aqua-Tex Scientific Consulting Ltd. (www.aqua-tex.ca) for the District of Saanich. This project was funded by the Federation of Canadian Municipalities and the Real Estate Foundation of B.C.

**Lotic Checklist**

Name of Riparian-Wetland Area: **Colquitz Watershed**

Date: **July 23, 2007** Segment/Reach ID: **Reach 11: Staked trail off Lindsay Road to Wilkinson Road Bridge**

ID Team Observers: **Cori Barraclough, Sarah Buchanan, Daniel Hegg, Lehna Malmakvist, Kevin O’Riordan**

Potential Riparian-Wetland Vegetation: Coniferous dominated forest with deciduous patches.  
 Potential Channel Characteristics: Rosgen = "B1" channel type

Yes	No	N/A	HYDROLOGICAL
			1) Floodplain above bankfull is inundated in "relatively frequent" events
			2) Where beaver dams are present are they active and stable
			3) Sinuosity, width/depth ratio, and gradient are in balance with the landscape setting (i.e., landform, geology, and bioclimatic region)
			4) Riparian-wetland area is widening or has achieved potential extent
			5) Upland watershed is not contributing to riparian-wetland degradation

Yes	No	N/A	VEGETATION
			6) Diverse age-class distribution of riparian-wetland vegetation (recruitment for maintenance/recovery)
			7) Diverse composition of riparian-wetland vegetation (for maintenance/recovery) ( <i>species present</i> )
			8) Species present indicate maintenance of riparian-wetland soil moisture characteristics

			9) Streambank vegetation is comprised of those plants or plant communities that have root masses capable of withstanding high streamflow events <i>(community types present)</i>
			10) Riparian-wetland plants exhibit high vigor
			11) Adequate riparian-wetland vegetative cover present to protect banks and dissipate energy during high flows <i>(enough)</i>
			12) Plant communities are an adequate source of coarse and/or large woody material (for maintenance/recovery)

Yes	No	N/A	EROSION DEPOSITION
			13) Floodplain and channel characteristics (i.e., rocks, overflow channels, coarse and/or large woody material) adequate to dissipate energy
			14) Point bars are revegetating with riparian-wetland vegetation
			15) Lateral stream movement is associated with natural sinuosities
			16) System is vertically stable <i>(not downcutting)</i>
			17) Stream is in balance with the water and sediment being supplied by the watershed (i.e., no excessive erosion or deposition)

**Remarks**

Start GPS waypoint #30 (BLC): N 48° 29.468' W 123° 23.871'

**Potential channel type: Rosgen B1**

**Present channel type: Rosgen B1**

**Constraints:**

Invasive Species

**Field Notes** (each numbered comment below corresponds to the numbered questions on the checklist above):

- 5. Local compost waste dumped upslope potentially contributing to invasive species.
- 7. Large amounts of invasive species.
- 11. Large amounts of rock in the system.
- 12. Big boulders and rock in reach. Very few conifers.
- 17. Quick's Bottom attenuates flows within this reach.

### SUMMARY DETERMINATION

Proper Functioning Condition

Functional - At Risk

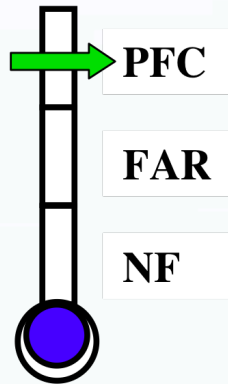
Nonfunctional

Unknown

**Trend for Functional - At Risk:**

Upward

Downward



**Are factors contributing to unacceptable conditions outside the control of the manager?**

Yes

No

**If yes, what are those factors?**

Flow regulations

Mining activities

Upstream channel conditions

Channelization

Road encroachment

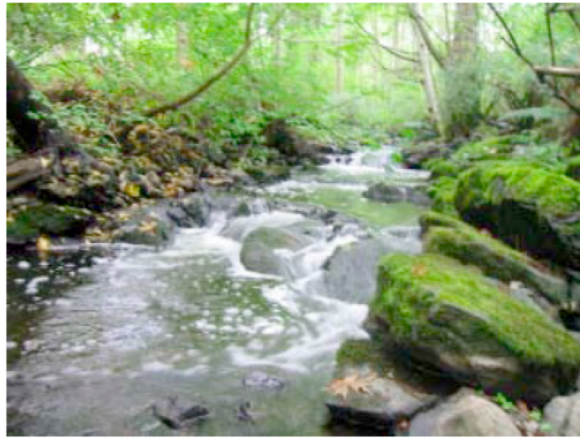
Oil field water discharge

Augmented flows

Other (specify)



## Photographs:



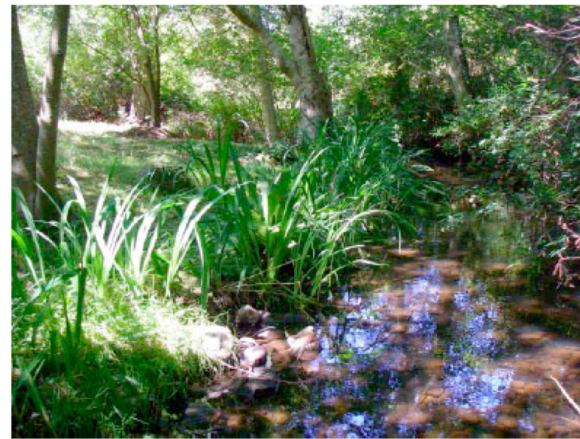
Colquitz River Reach 11, Photo 1, 2007-07-23.  
Facing upstream, creek is lined with large rocks able to dissipate energy and reduce erosion that occurs with high flows.



Colquitz River Reach 11, Photo 2, 2007-07-23.  
Facing downstream. The hydrology of the creek is altered (hence the reach break) at this point due to the change in substrate.

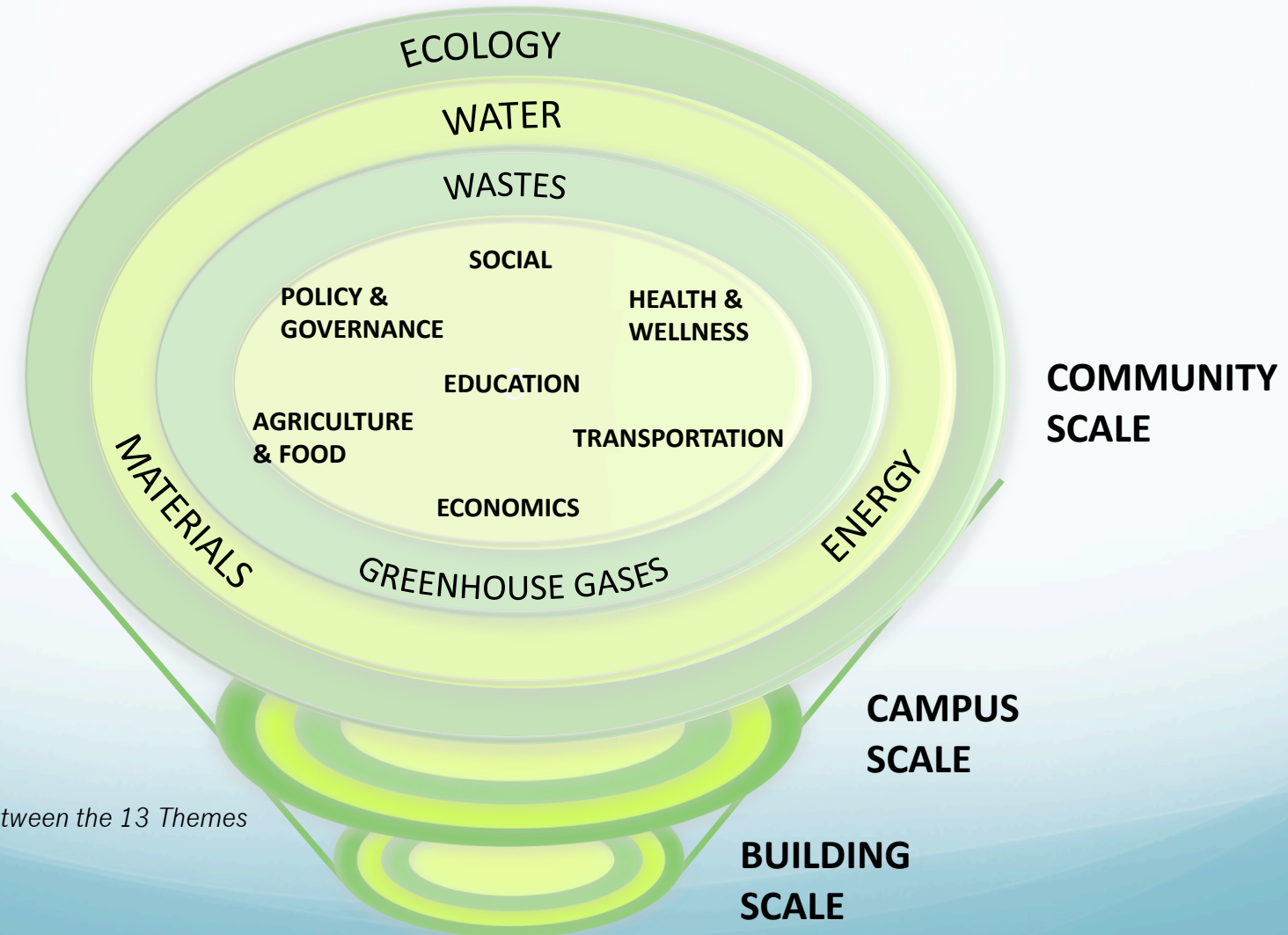


Colquitz River Reach 11, Photo 3, 2007-07-23.  
Adjacent to Lindsay Road, residences have been dumping yard waste.



Colquitz River Reach 11, Photo 5, 2007-07-25.  
Residential backyard maintenance (ie. mowing, non-riparian species) is encroaching on the riparian plant growth.

# Integrated Sustainability Themes

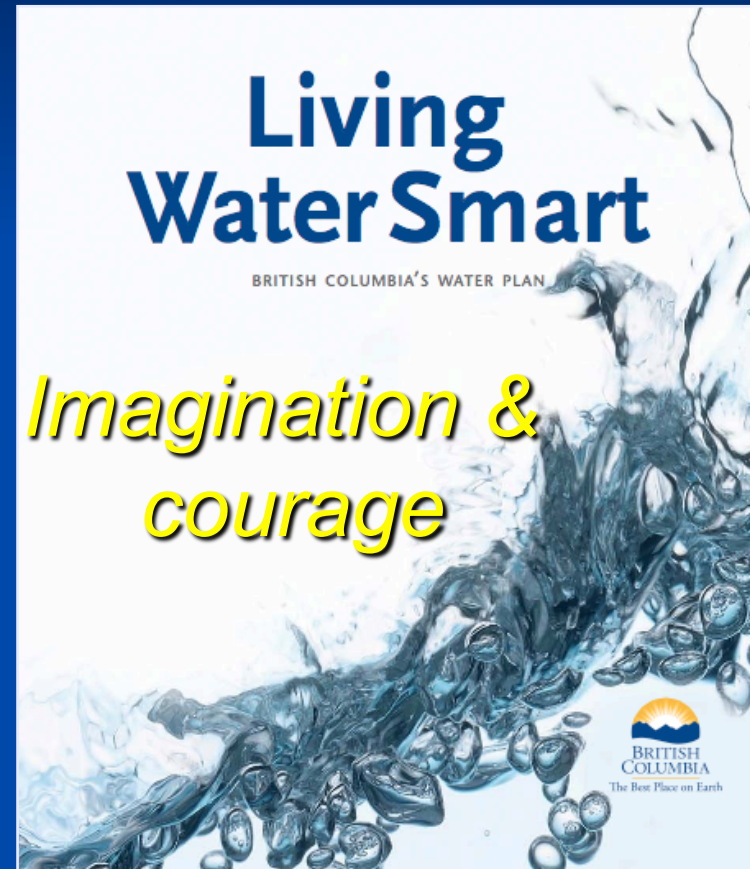


*Relationship between the 13 Themes*

# The Change We Need

“Vision, without implementation, is hallucination; implementation, without vision, is a nightmare”

- General Colin Powell (ret.)



**DRAFT**





*If you are thinking one year ahead, sow seed.  
If you are thinking ten years ahead, plant trees.  
If you are thinking one hundred years ahead,  
educate the people.*

(Chinese proverb)





# City of Cranbrook, BC

## Drinking Water Management

**Benefits of reducing water withdrawals from the reservoir:**

- **Stabilized reservoir ecology and improved water quality**
- **Reduced treatment requirement and costs**
- **Increased water security**
- **More water available for in-stream flows (ecosystem needs)**
- **Meets all drinking water quality standards**
- **Saved community millions of \$dollars**

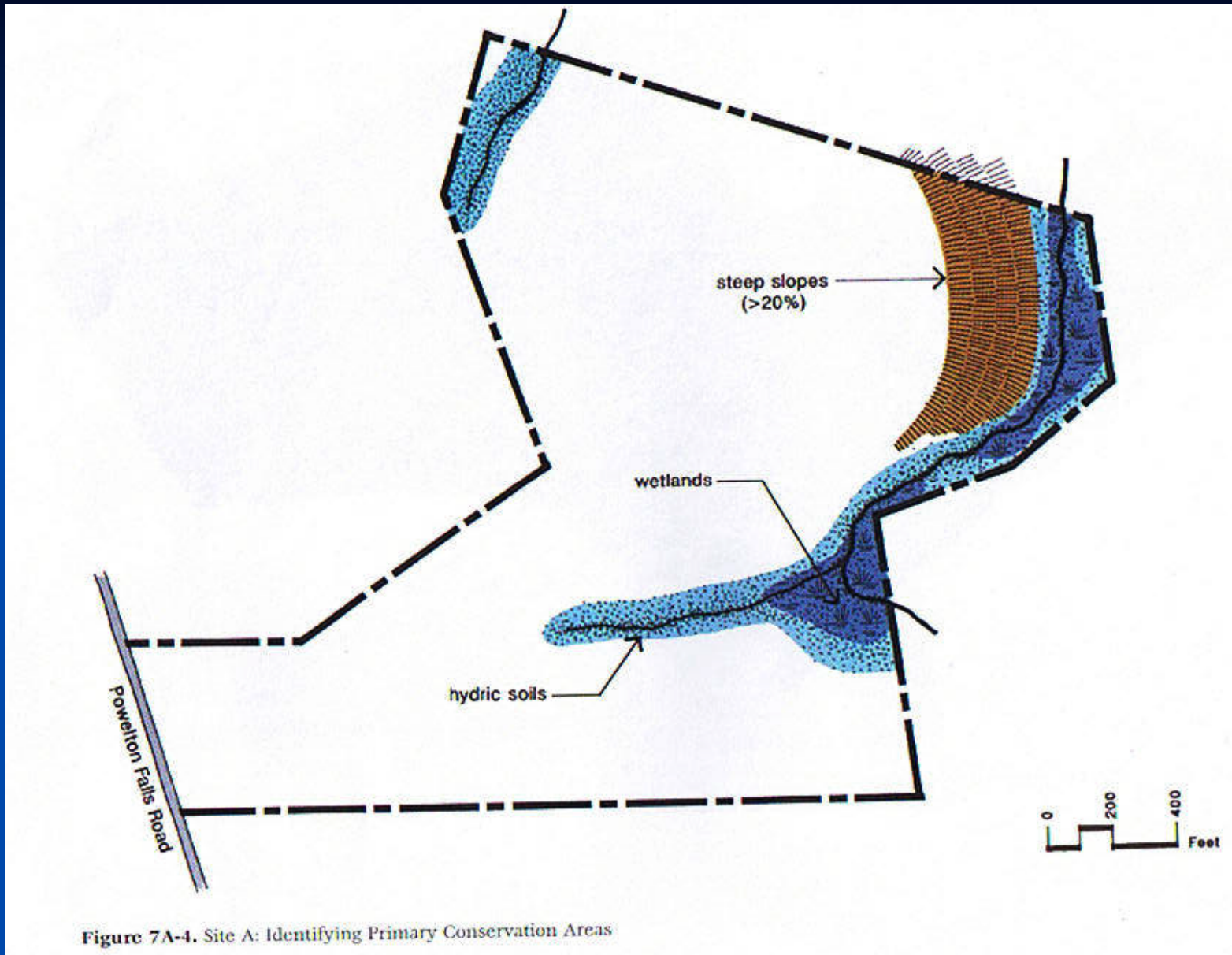


Figure 7A-4. Site A: Identifying Primary Conservation Areas

(Arendt)



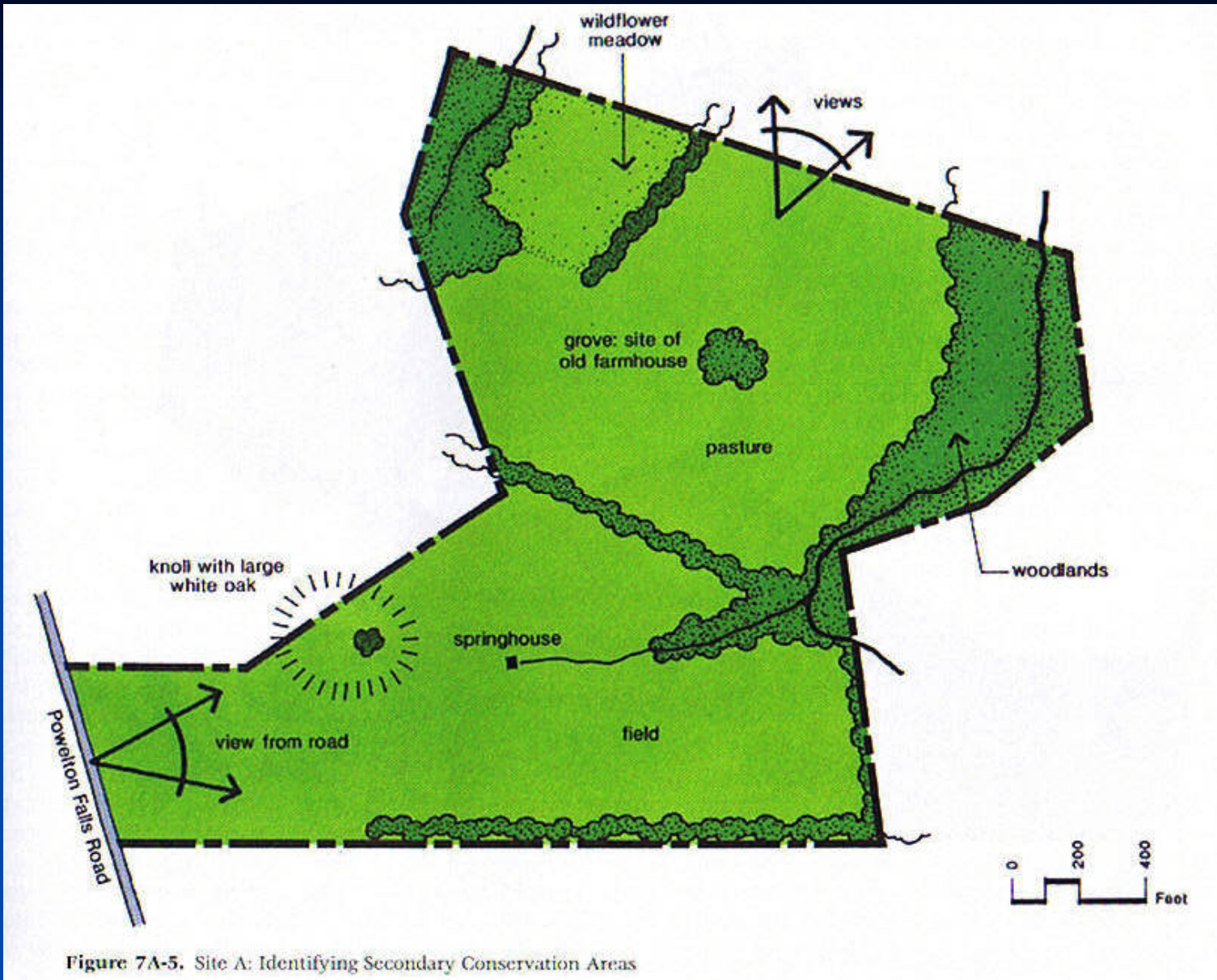


Figure 7A-5. Site A: Identifying Secondary Conservation Areas

(Arendt)

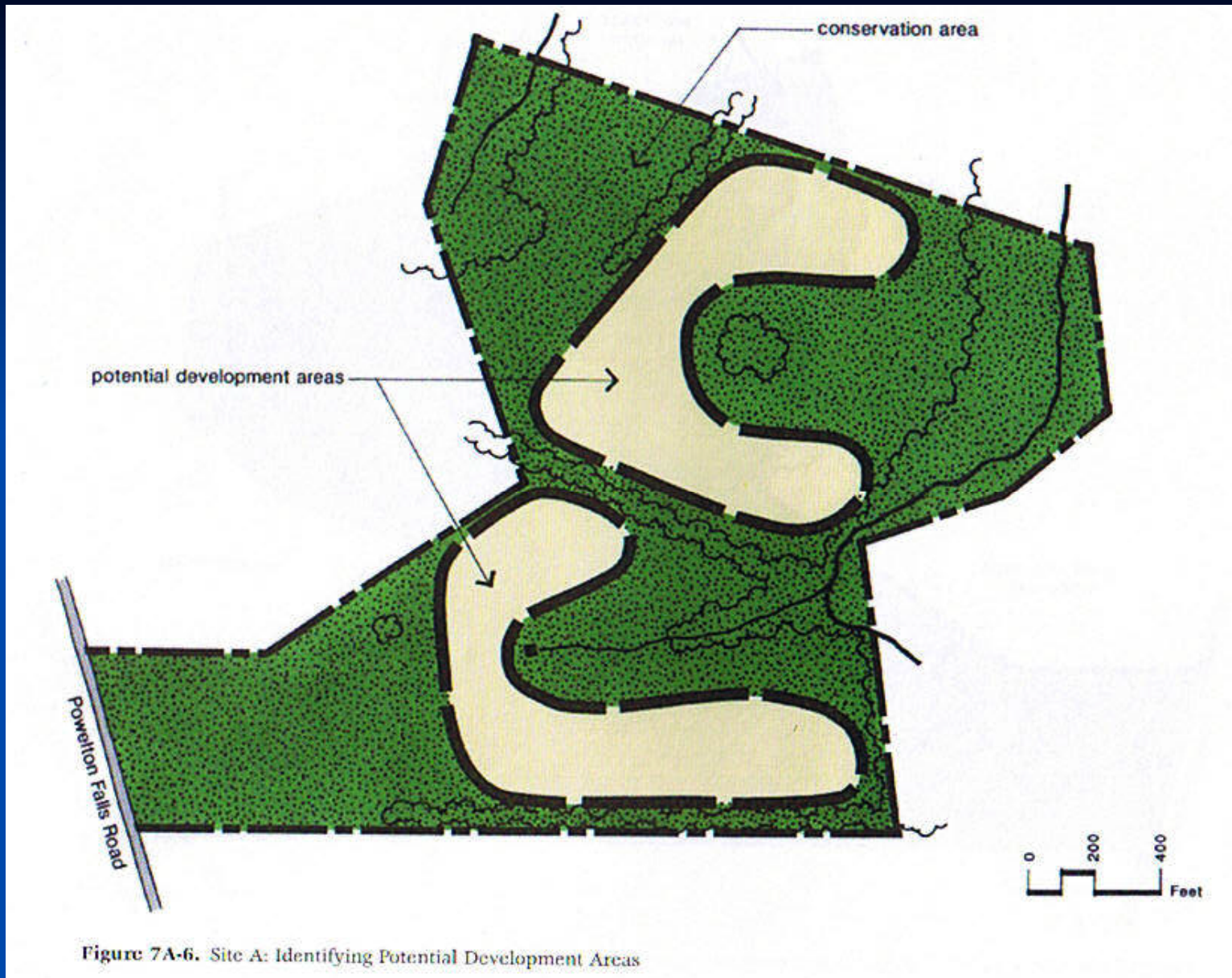
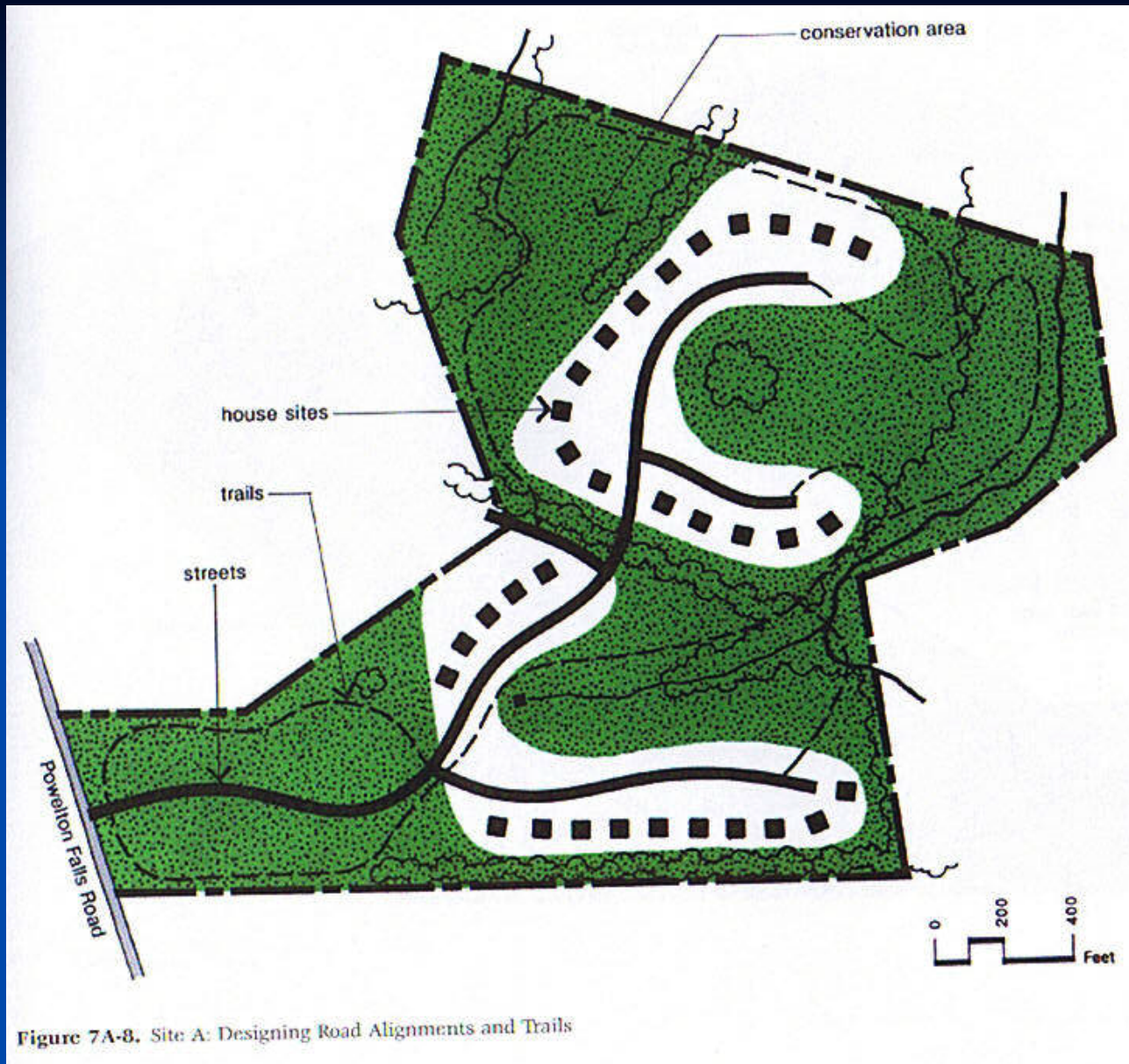


Figure 7A-6. Site A: Identifying Potential Development Areas

(Arendt)



(Arendt)

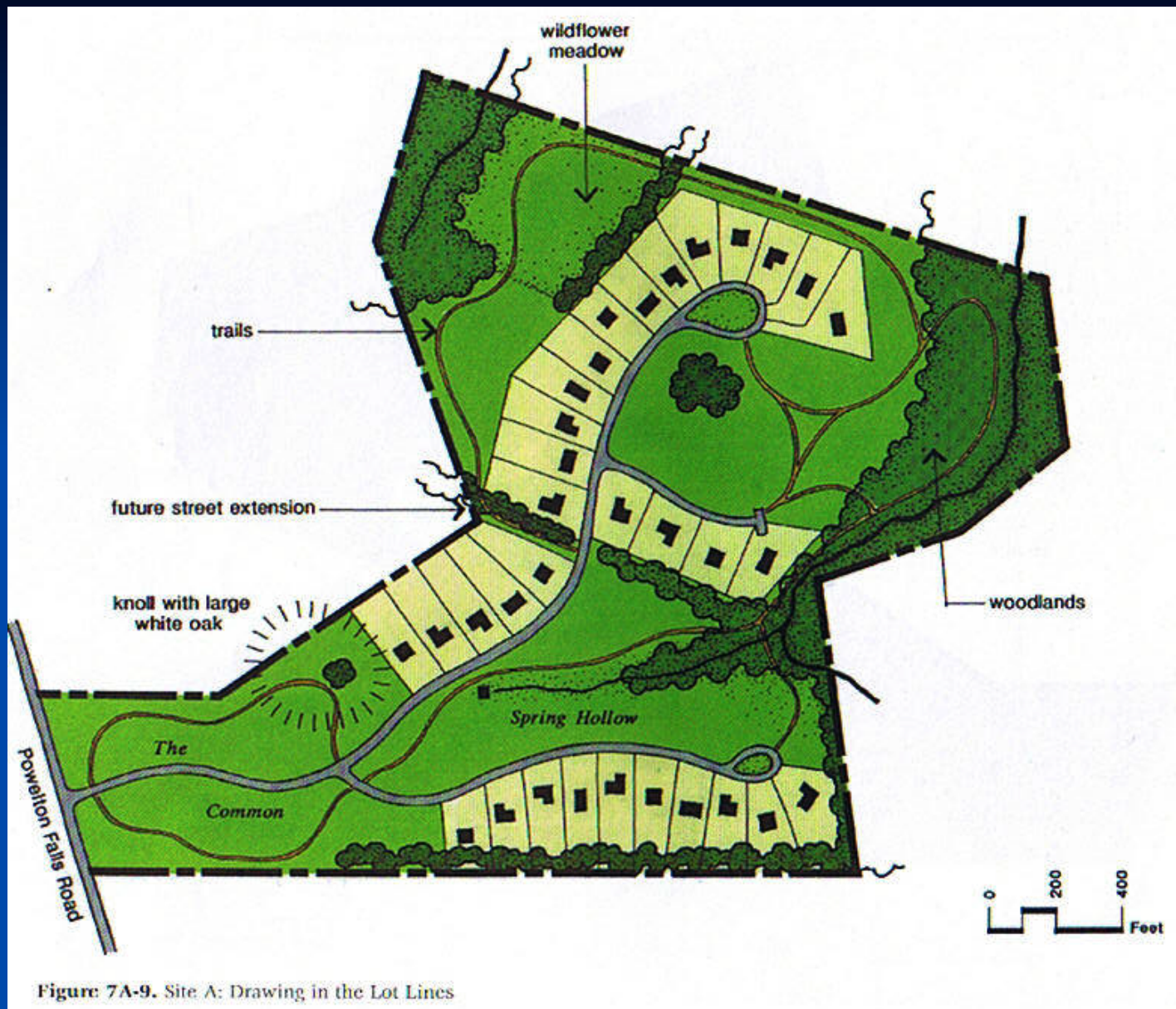


Figure 7A-9. Site A: Drawing in the Lot Lines

(Arendt)

# DRAFT

## Existing and Future Development Context

The Rodgers Creek Area is located immediately west of the Marr Creek corridor which is the conservation area on the western edge of Whitby Estates. Originally, the first phase of Rodgers Creek was to be Taylor's Lookout, the area between Marr Creek and the established subdivision around Chairlift Road. Taylor's Lookout was approved in advance of the Area Plan and is currently under development.

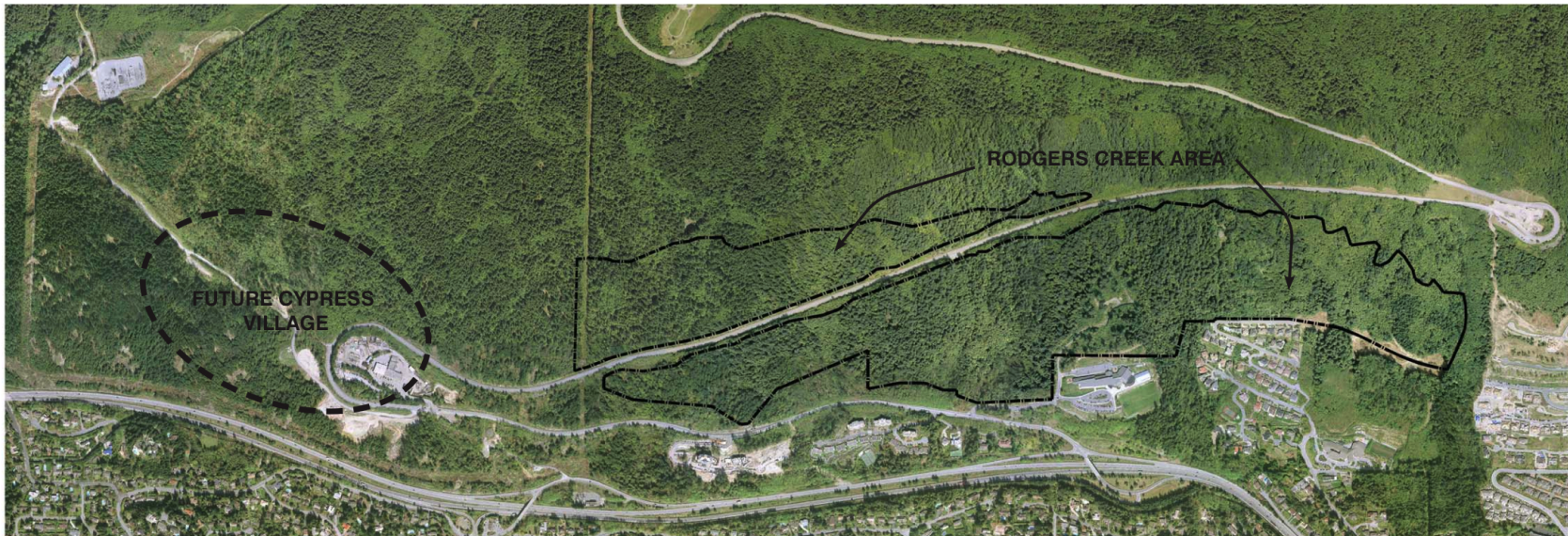
The Rodgers Creek Area is limited at its uphill boundary by the 1200 foot contour line as set by District policy. The downhill boundary is generally established by existing development, including Mulgrave School, and by the Cypress Bowl Road. An unopened road allowance and a BC Hydro powerline corridor form the western boundary.

## Future Cypress Village

The location for a future Village to serve the Upper Lands has been identified in the Official Community Plan generally to the west of the Rodgers Creek Planning Area. The current District Works Yard, one of the areas of moderate topography in the Upper Lands, has the potential to become redeveloped as part of the Village, should the District choose to relocate the current uses at some time in the future. Other sites suited to mixed use development are located on the west side of Godman Creek on a series of terraces with superb view opportunities in the area east of Cypress Falls Park.

The first component of the Village, McGavin Field, is currently under construction. As the Village expands, a fieldhouse, children's playground, and other recreational amenities will be considered for this vicinity. Other land uses expected in the Village include: an

elementary school, locally-oriented stores and services, a staging area and support services for mountain biking and hiking trail users, and residential development of a wide variety including different types of seniors housing, rental housing, units over retail, live/work, townhouses, and apartments.



## Sieve Analysis










**DRAFT****Sieve Methodology**

The sieve analysis has been a work in progress and has been refined a number of times. The original sieve analysis was prepared in collaboration with the land owners and District staff in an intensive workshop session.

Each watercourse was evaluated as a collaborative process at technical meetings, including detailed field review, and categorized with respect to its environmental values as H (high), M (moderate), or L (low).

*Note: After the original Sieve Analysis was completed, the western boundary of the ADP Area above upper Cypress Bowl Road was expanded. The rationale for this expansion and the Sieve Analysis for this expanded area is included in Appendix A.*

**LEGEND**

-  PROTECTED SENIOR GOVERNMENT SETBACK AREA
-  STEEPER SLOPES
-  POTENTIAL GEOTECHNICAL CONSTRAINTS - FURTHER INVESTIGATION REQUIRED
-  STEEP SLOPES - FURTHER INVESTIGATION REQUIRED
-  MUNICIPAL SETBACK AREA - FURTHER INVESTIGATION REQUIRED
-  DEVELOPMENT AREA
-  LARGE FEATURE TREE
-  C04 TRAIL/ ROAD (EXISTING)
-  C04 MOUNTAIN PATH (PROPOSED)

## Definition of Preliminary Planning and Conservation Areas

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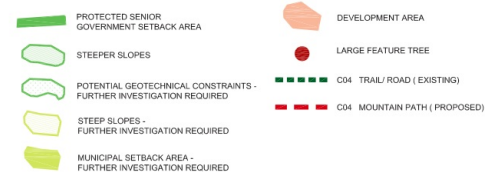
### Preliminary Planning and Conservation Areas

Working together, District staff and the Rodgers Creek land owners identified areas where development planning should focus. These development planning areas are enclosed in black outlines on the above map. The configuration of these potential development areas depends on the confirmation of road alignments, especially for the extension of the Chippendale connector road. District staff have not approved development within all of the areas shown. Final boundaries will be determined at the Development Permit stage and may be smaller than the areas shown, resulting in more conservation area being transferred to the District. Lands outside of the outlines will not be developed and will be preserved and enhanced.

The preliminary planning areas have been numbered and lettered for reference purposes.

*Note: After the original Sieve Analysis was completed, the western boundary of the ADP Area above upper Cypress Bowl Road was expanded. The rationale for this expansion and the Sieve Analysis for this expanded area is included in Appendix A.*

#### LEGEND



# Fast Facts - Shawnigan Lake

- Watershed Area 69km<sup>2</sup>
- Community Watershed Area (to Mill Bay) 110 km<sup>2</sup>
- Lake level maintained by the weir (116.3 to 115.75 GSC)
- Surface area of 537 ha
- Volume 64Mm<sup>3</sup>
- Mean depth 12 m, max depth 52 m
- 225 active surface water licenses as of 2007 to withdraw >7000m<sup>3</sup>/d
- 860 groundwater wells (2007)
- By 1996 there were 616 lots bordering the lake
- Flood construction level is 119.2 m GSC