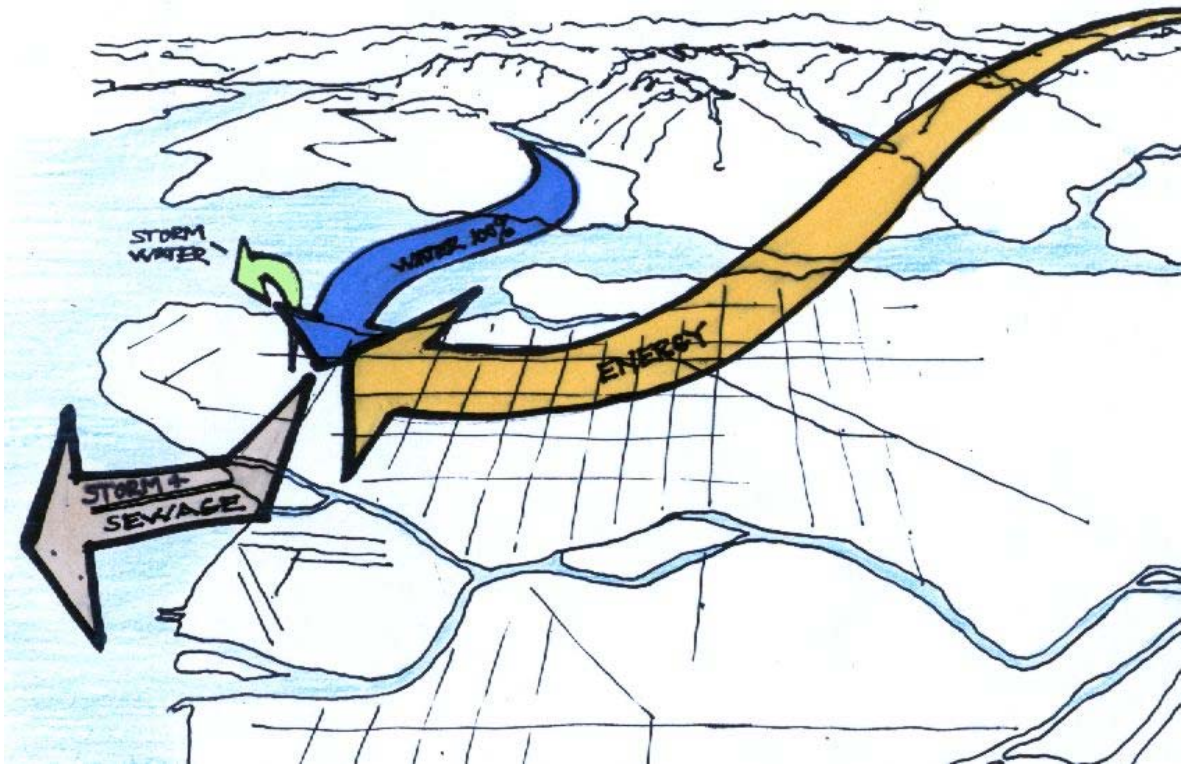
INFRASTRUCTURE --- The REGION



Existing Model: the large external inputs and outputs of an unsustainable system

Four Components of Analysis:

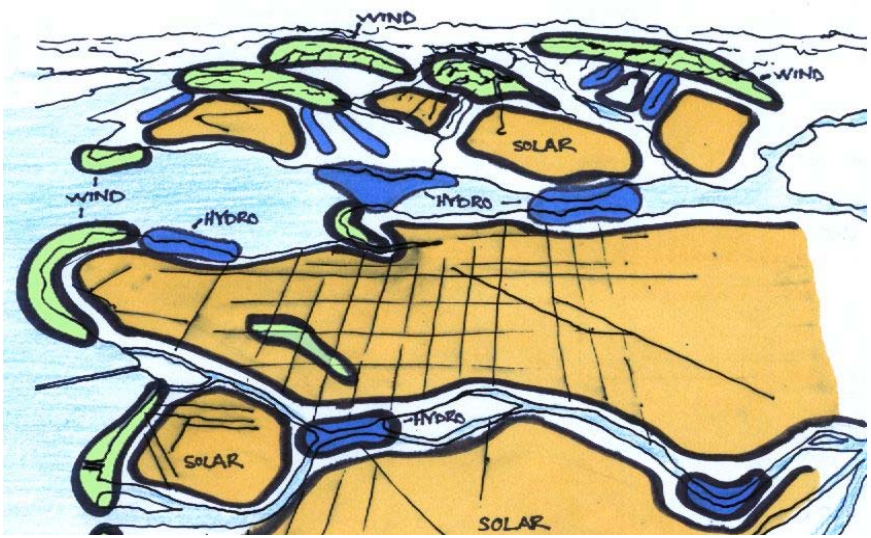
1. Sanitary Sewer System
2. Potable Water System
3. Energy System
4. Storm Water System

The **four component of analysis** were **studied at four different scales**. In particular, the parcel, block, district and region were used to frame the analysis of infrastructure.

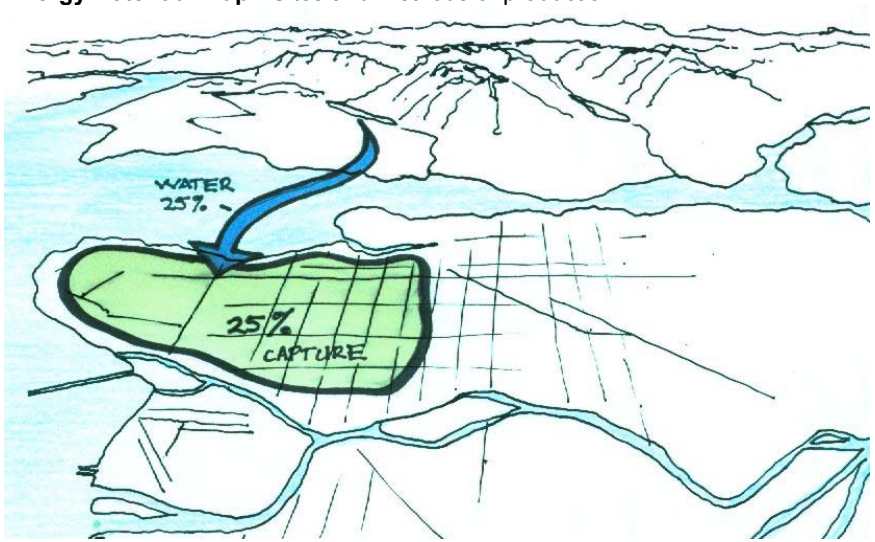
The following pages will lay out the **existing infrastructural framework**. Subsequently, **proposed alternatives** for achieving a more sustainable infrastructure will be given.

Lastly, a series of **targets** will be used to quantify the effect that the proposals might achieve. These are given as **20 year and 100 year targets**.

It should be noted here that for the most part, the **proposals involve physical changes** to infrastructure. However, in some cases, **policy changes** will be suggested as a method for instituting change.



Energy Potential Map: Sites and methods of production



Water Consumption Map: Reduction in use

ENERGY

20 year target – 10% local source

- **Solar potential** city wide
- **Wind potential** on ocean bluffs and mountain ridges
- **Micro hydro potential** at points of constriction in coastline and along streams and rivers

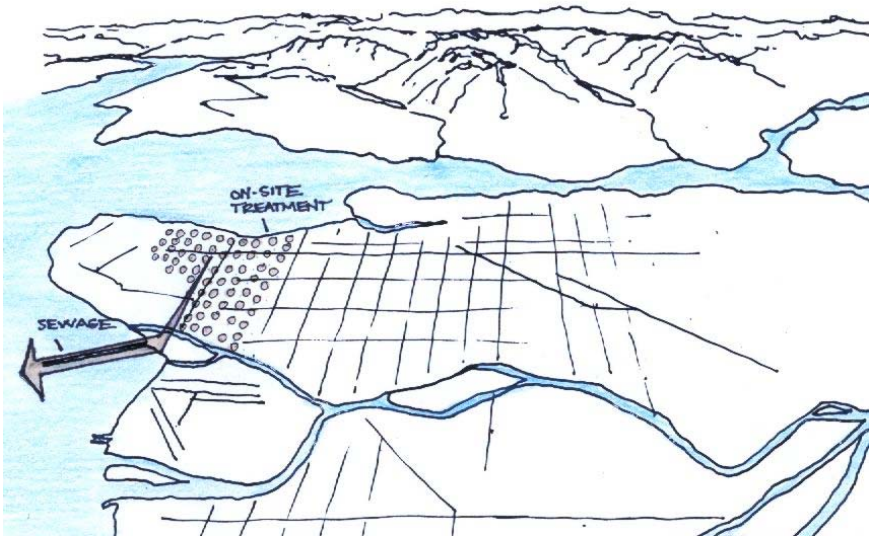
100 year target – 100% local source

WATER

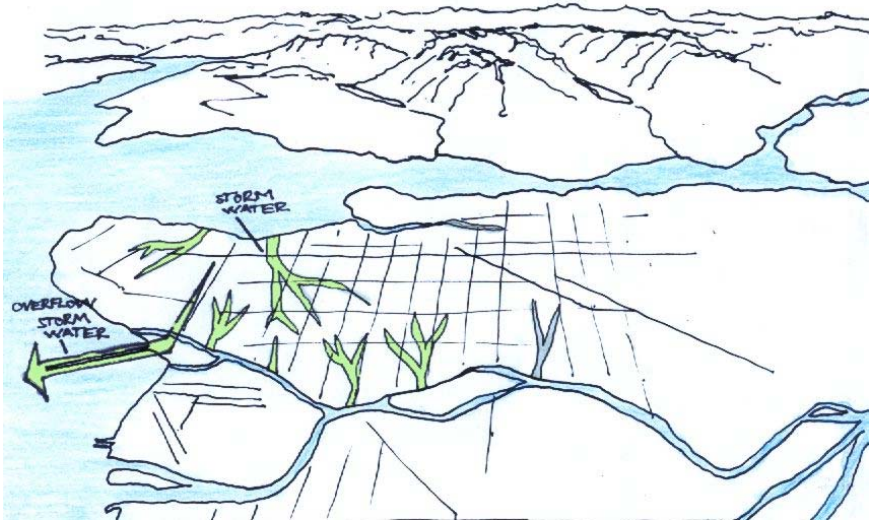
20 year target – 50% reduction

- Reduction in imported water use through **conservation programs and metering of water use**
- Reduction in imported water use through **alternative sources of water for uses other than drinking water**. This might include collection of water in cisterns for use in toilets, car washing, etc.

100 year target – 75% reduction



Sanitary Sewer: Reduced volume for off-site treatment



Storm water: Daylight streams and restore summer base flows

SEWER

20 year target – 10% local treatment

- Reduction in production of sewage through **on-site treatment**
- Reduction in production of sewage through **elimination of combined sewers** and **reduced water use**

100 year target – 100% local treatment

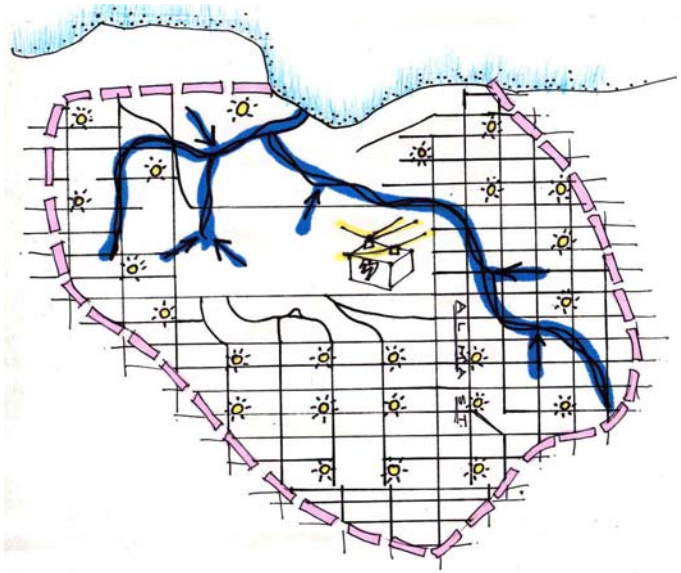
STORM WATER

20 yr target – 60% effec. impermeable

- **Day-lighting of streams**
- **Infiltration basins**
- **Depression storage** basins
- **Elimination of combined sewers**
- **Green roofs**

100 yr target – 75% eff. impermeable

Existing district infrastructure systems follow street grid.



New district boundary reflects new infrastructure systems based primarily on uncovering streams.

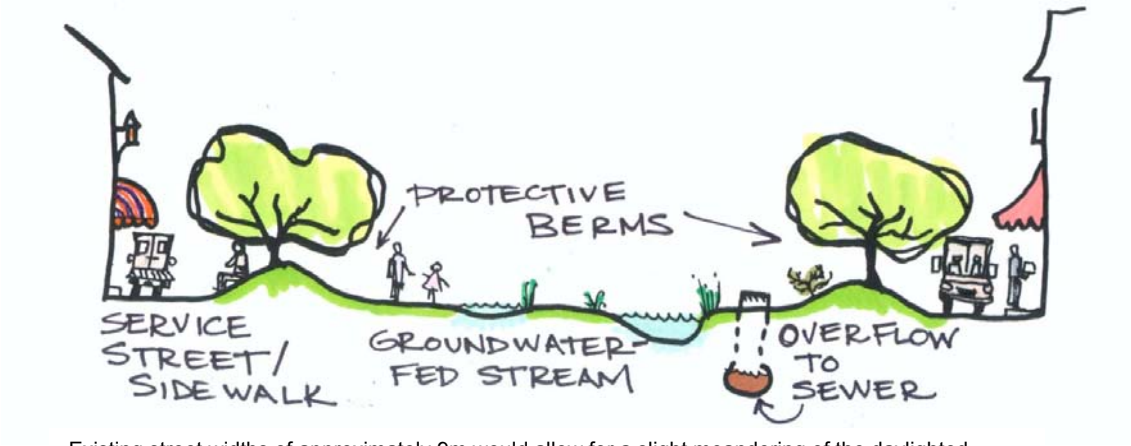
DISTRICT

Existing

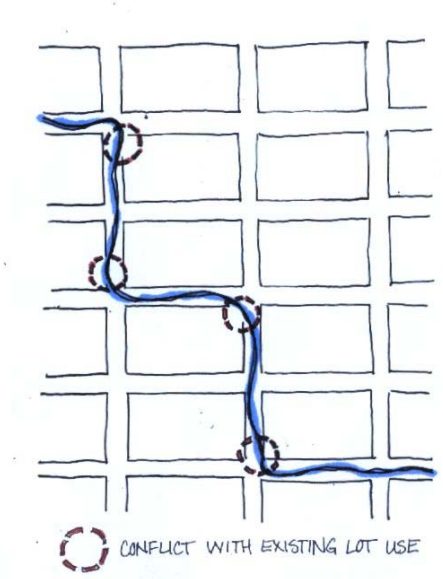
- Streets are the boundaries for the district, establishing a roughly square area chosen arbitrarily
- Infrastructure runs along street corridors beneath ground
- Storm and sanitary sewers are combined
- Four systems of infrastructure begin and end outside the district – these systems pass through the district from elsewhere, and continue on

20 Years

- Drainage boundaries of streams define the district boundary (small watershed)
- Culverted streams are daylighted, providing opportunities for drainage of stormwater as well as energy generation
- District stores energy generated within the district at a central location, to redistribute as needed



Existing street widths of approximately 9m would allow for a slight meandering of the daylighted stream channel within the right-of-way, as well as provide social space and access routes to existing buildings.



Corner lots may need to be acquired to allow streams to make loose right angle turns. Laying out of the channel for two to three blocks at a time between turns would minimize property acquisition while retaining the feeling of a meandering stream.

DISTRICT CORRIDORS

Existing

Streets as impermeable grey corridors with multiple functions:

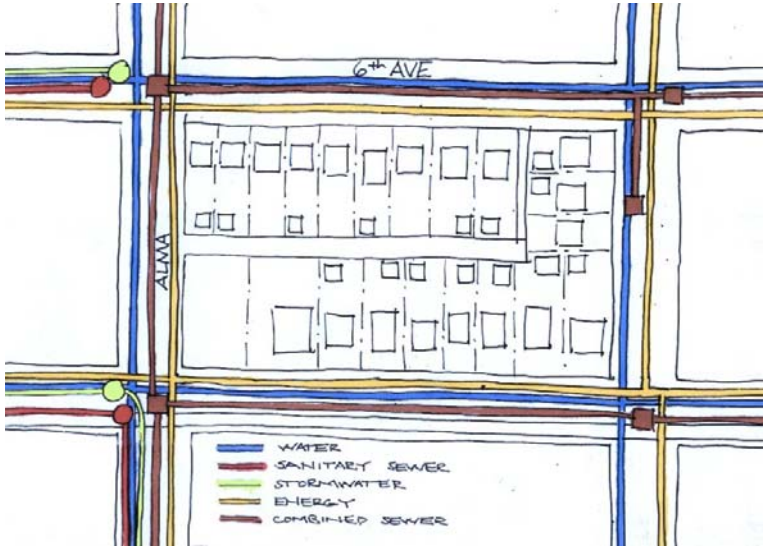
- movement of people, vehicles, goods
- access to homes, businesses, services
- conduit for infrastructure which delivers water and energy, and removes stormwater and wastewater

20 Years

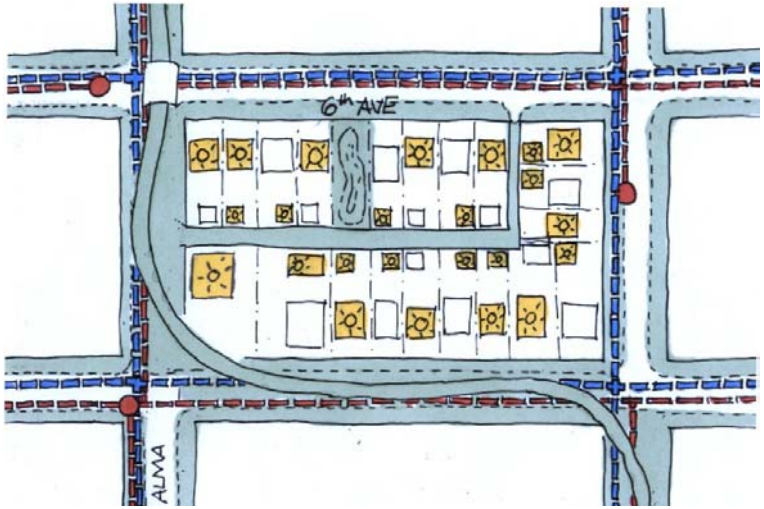
Streets become greenway corridors providing multiple functions in a sustainable way:

- movement of people, vehicles, goods
- access to homes, businesses, services
- conduit for backup infrastructure which delivers water and energy, and removes stormwater and wastewater

Corridors serving the same functions as before, but now allow for infiltration, positive social spaces, habitat, and micro-hydrolic energy generation. Streams follows existing street layout to minimize impacts on developed communities.



Existing infrastructure systems ensnare each block.



Storm sewers are replaced by a stream channel and an increase in permeable area (shown in green). Sanitary lines and water lines remain, but their use is reduced.

Greywater treatment lots collect from topographically higher areas to reduce the need for more infrastructure to be built. Hence, though located on each block, a "green lot" may service other blocks as well.

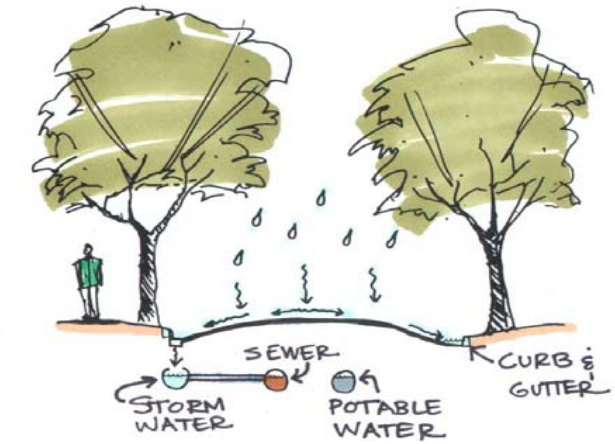
BLOCK

Existing

- Infrastructure systems surround every block
- Some blocks serviced by combined sewers, some by separate sanitary and storm lines

20 Years

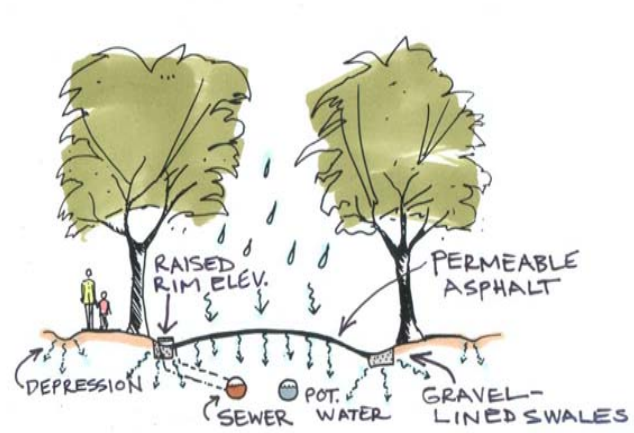
- Drainage of stormwater achieved through stream catchment and conveyance, infiltration strips at streetside, permeable lane surfaces, and the combined permeable areas of all lots on the block
- Sanitary sewers provide a backup system for intense storm events
- Sanitary sewers continue to serve the block while the transition to 100 percent on site waste treatment is implemented
- Greywater capture and treatment at strategic locations on each block allows for reuse of this water for situations when potable water is not needed – decreasing the drain on our reservoirs
- Possibility of using existing power lines to transmit district-generated energy reserves (not shown)



Existing Urban Street

OLD SYSTEM

- Impermeable asphalt
- Curb and gutter
- Storm water and sewer often combined
- Yard runoff runs to street
- Dry groundwater starves trees and streams



New Sustainable Street

NEW SYSTEM

- Permeable asphalt
- Gravel-lined swale instead of curb
- No storm water pipes, overflow runs to sewer
- Depressions in yards catch runoff

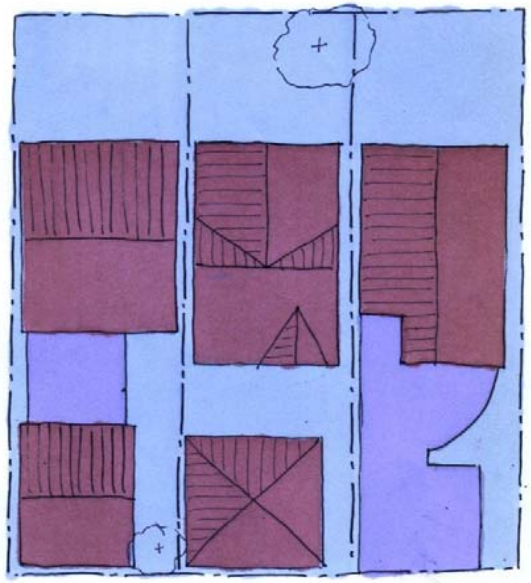
BLOCK CORRIDOR - STREET

Existing

The current system prevents 50% of all rainfall from penetrating the earth. Storm water is seen as a problem, rather than something beneficial—it is literally carted off as a waste product.

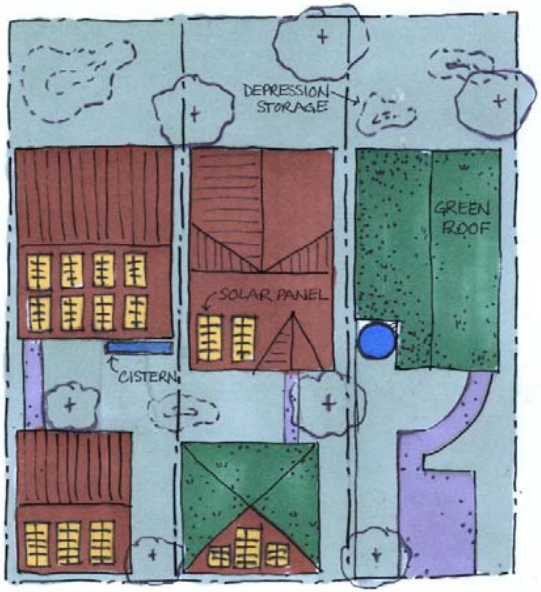
20 Years

Our aim is to increase the permeability of the land surface to help replenish groundwater supplies. New technologies in asphalt permit infiltration. We would like to see Vancouver replace street surfaces with this product. Back alleys would be gravel paved. The curb and gutter system would be replaced with gravel-lined swales, which provide water for street trees. In the event of total saturation from periods of heavy rains, a raised rim elevation on existing catchment basins would allow only these flood waters to flow to the sewer. As a final solution the street could act as a flood channel, draining off the more elevated residential property.
The complete conversion of all streets to sustainable systems in 100 years would lead to an over 85% permeability rate in the City of Vancouver.



Existing Parcel Plan

- All roof run-off goes to street, wasted.
- Roof surface non-energy productive.
- Large amounts on non-permeable land surface.
- Limited ground water recharge.



New Parcel Plan

- Solar panels on roof.
- Green roofs, lessening runoff.
- Cisterns for grey-water.
- Less impervious land surface.
- Depressions in yards to help groundwater recharge.

PARCEL

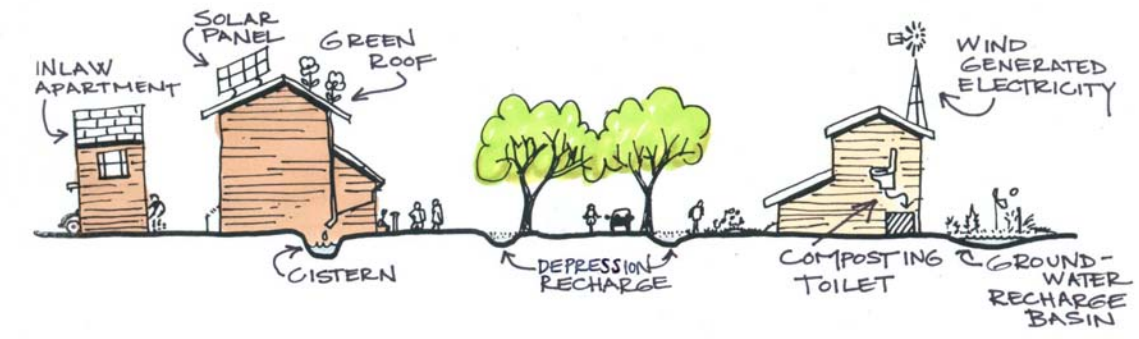
Existing

Opportunities are lost to promote sustainable means. Roofs and driveways prevent rains from reaching the ground water. Conventional energy-use predominates.

20 Years

Sustainable practices often begin on the individual level, as seen by the recycling movement. In the beginning we hope to encourage these positive trends with incentives such as tax benefits and low-cost home improvement loans.
The roof is one untapped resource for homes. Solar panels often supply an entire family's needs for electricity. The green roof not only is aesthetically appealing, but it helps retain run-off and aids insulation.
Another measure to promote ecological principles is the use of cisterns to store grey-water. Grey-water can be used for operating toilets and watering plants.
Eventually sustainable methods will not be an alternative, but will be institutionalized in building code requirements. Homes produce all their own energy and the grid-system will be phased-out.

Existing Residential Parcels



Sustainable Residential Parcels

PARCEL SECTIONS

Existing

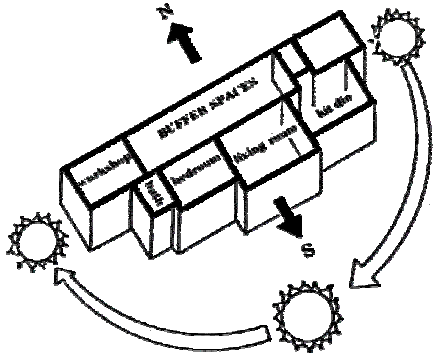
Low-density housing doesn't serve the growing population well. Conventional energy appliances predominate. Limited groundwater recharge from rainfall.

20 Years

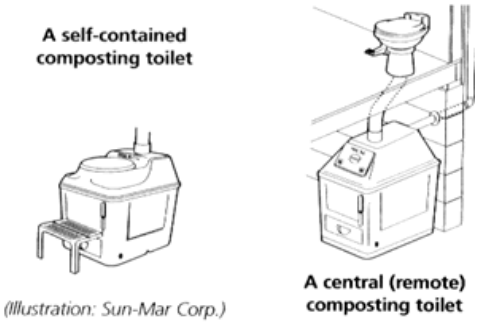
Aim to make the individual less dependent on large-scale conventional infrastructure.
An innovative and enterprising spirit of adaptability will lead people to alternative, sustainable methods. In addition to solar panels, small windmills can be designed to generate electricity. Composting toilets use little or no water; they will be installed on a wide-scale. These toilets will eliminate the need for wastewater treatment plants. Homeowners can build in-law suites above back garages, providing not only additional income for the owner, but supplying homes for renters. Groundwater will be recharged with catchment depressions and basins. In time, laws and codes will support individual pioneering efforts at sustainability. Residential communities will aim to be entirely self-sufficient.

An Opportunistic Home

Solar Panel Array



Solar Orientation



Composting Toilet

Recharge Bio-Pond

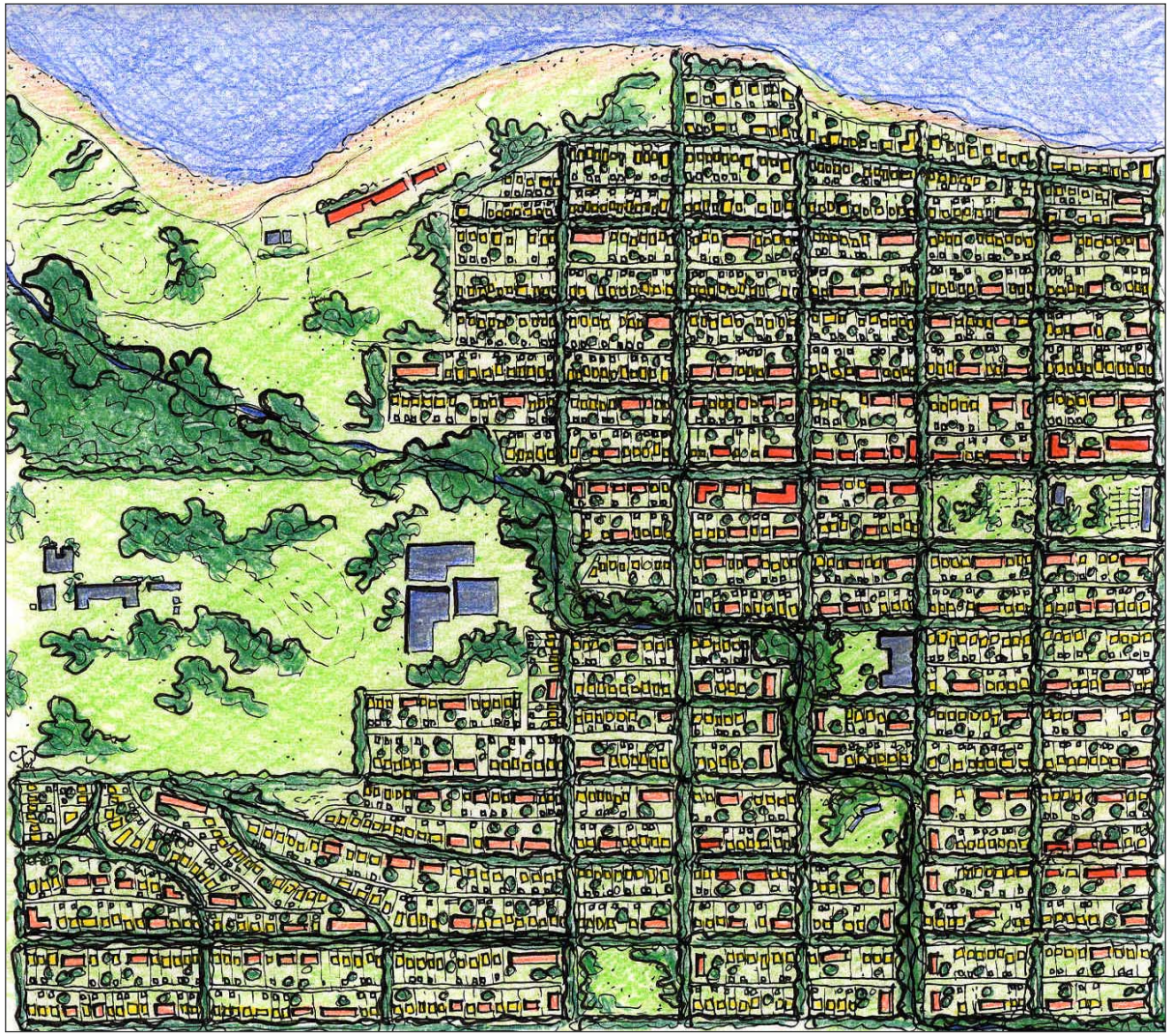
Beautiful Windmill

SUSTAINABLE STRATEGIES

There are many ways the individual person can contribute to a more ecologically –friendly city. While at first these measures may seem strange, they will come to be seen as inspirational and savvy.
The initial costs will quickly be mitigated by the long-term savings, to the Earth and the pocketbook.
Additionally, homeowners can find many of these new alternatives on the web, where diverse strategies at sustainability are showcased.
Both new Inventions and time-honored methods are there for purchase.

Other Bold Ideas

- Sanitized toilet compost could be used as a fertilizer.
- Organic kitchen scraps can be composted.
- Goats can be used to clear weedy vegetation instead of power tools or herbicides.
- Orient new homes to benefit from passive solar heating.



Illustrative Plan – "Old Streams, New Tricks"

This plan highlights the central idea that forms the basis of the long term plan - the daylighted stream. The stream corridor moves through the existing block pattern, working to disrupt as little as possible the existing and relatively successful neighbourhood.

The stream acts as an ordering principle for new systems of infrastructure, which will contribute to the sustainability of the district and the larger region.

CONCLUSIONS --- Old Streams, New Tricks

Existing Infrastructure systems are costly, complex and inherently unsustainable. The approach used in this section was to first attempt to come to some appreciation of the existing infrastructure system and to look for ways to use it in a more sustainable way. Then, new approaches and ideas were integrated with, or proposed to replace existing infrastructures. The result is a mixture of old and new infrastructures working together; a combination of *'old streams*' and '*new tricks'*.

PROBLEMS and QUESTIONS:

- How long must old systems be maintained? How does the transition occur?
- Variability of climate could potentially cause unforeseen problems
- How should the dynamics of a stream channel be contained?
- What is the best mechanism for dealing with expropriation of land? What is an acceptable cost?
- Is it necessary to implement changes to jurisdictions and governmental control to reflect the new district boundaries?
- How much does public acceptance of proposals and education factor into the ability to implement some of these proposals?
- What is the cost and risk in pioneering new technologies?
- How can the plan be made flexible enough to be accepting of unforeseen influences (political direction, economic forces and technological breakthroughs)?

SUMMARY of PROPOSALS:

ENERGY

- Local generation
- Diversified generation
- Creative and alternative use of existing infrastructure

WATER

- Consumption reduction through on-site interventions
- Local rainwater interception, storage and use
- Reduced overall dependence on central system

STORMWATER

- Daylight streams by following streets and publicly owned land
- Groundwater infiltration – need policy or educational interventions to curb pollutants
- Rainwater collection and use
- Increased effective impervious surfaces

SEWAGE

- Reduce volume by eliminating combined sewers, reducing water consumption and education programs
- Implement on-site treatment systems