infrastructure
hastings corridor analysis

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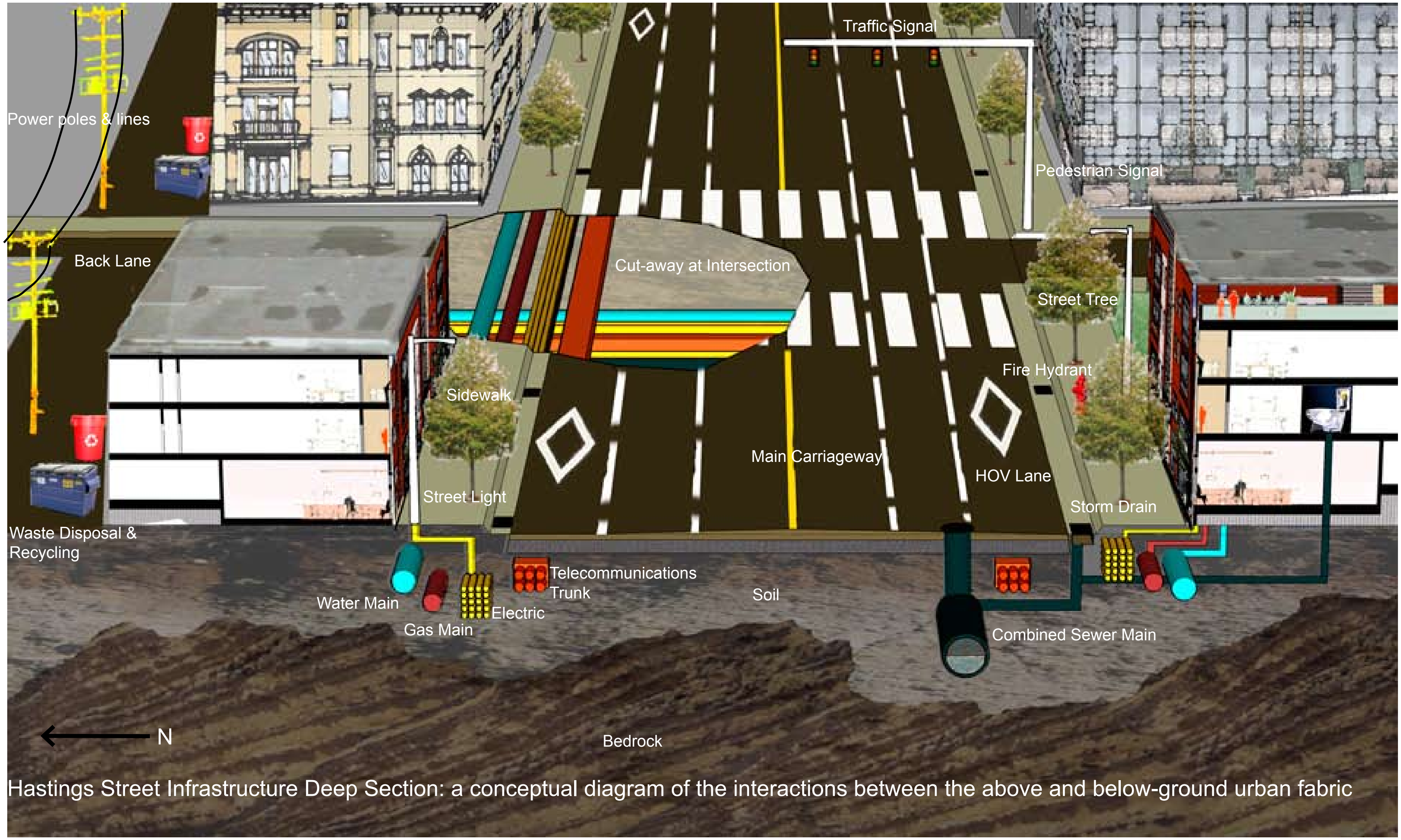
sustainable urbanism : the hastings corridor

ubc urban studio : fall 2008



Hastings Street Infrastructure Deep Section: a conceptual diagram of the interactions between the above and below-ground urban fabric

Infrastructure

This chapter examines four components of Hastings' infrastructure: streets, energy, pipes, and waste. The street network is analyzed for it's connectivity, walkability, and how well it serves the region as a commuter route. Patterns of energy consumption are examined and related to built form over a range of scales. Pipe infrastructure which includes water and sewer service relates the local water and sewer systems to the larger region and examines the network's physical pattern within the neighborhood. The potential for green infrastructure to play a larger role in the system. Finally, the section on waste reveals the quantity and destination of Hastings' solid waste, and explores the potential for garbage to be viewed as an energy generating resource.

infrastructure: streets

Street/development Pattern:
The majorstreet pattern is “grid” pattern. The grid manifests into several distinct sub-patterns, including three variations on a east-west block orientation, and a patch of north-south block orientation on Capitol Hill. Neighbourhood patterns in Burnaby over the twentieth century have followed those typical of most North American suburbs. Rural settlement was followed by early urbanization during the 1910s and 1920s. During the postwar years, suburbanization occurred. When “Vancouver Heights” was first developed, block sizes were subdivided. In the past two decades Burnaby has become a more “complete community”. The landscape pattern is distinguished by a hill/valley/ridge terrain. The development in Burnaby that resulted balanced the relationship between the ordered grid and the natural physical underlay.

Street Condition: Hastings St, typically has a ROW of 18.8m which does not include the sidewalk. The carriageway in this case is comprised of 4 lanes (each lane is 3.2m) for traffic and 2 parking lane on both sides. Width of sidewalk are various from 3.5m to 1.6m. There is no boulevard, but a planting strip can be found in some places along the primary arterial. Streets are paved by impervious materials in all cases, contributing to excessive stormwater inputs to the combined sewer system. Commercial buildings are usually built to the sidewalk edge in the Hastings St.

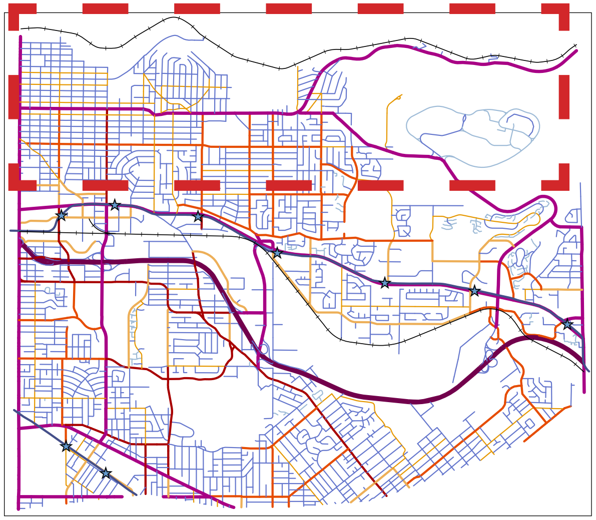


Photo: Burnaby’s regional transporataion infrastructure

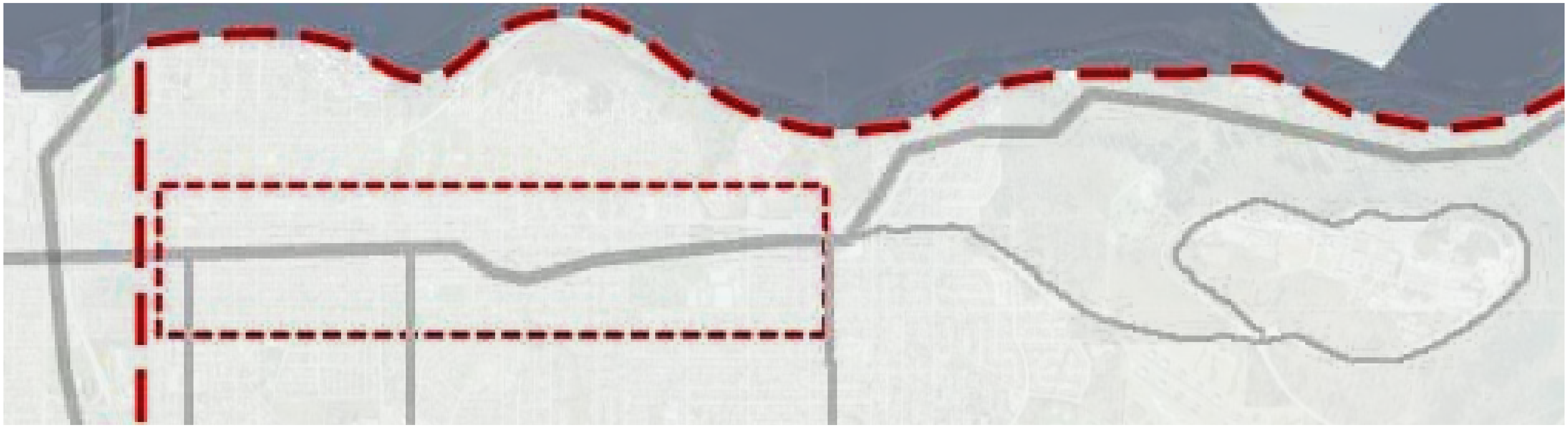
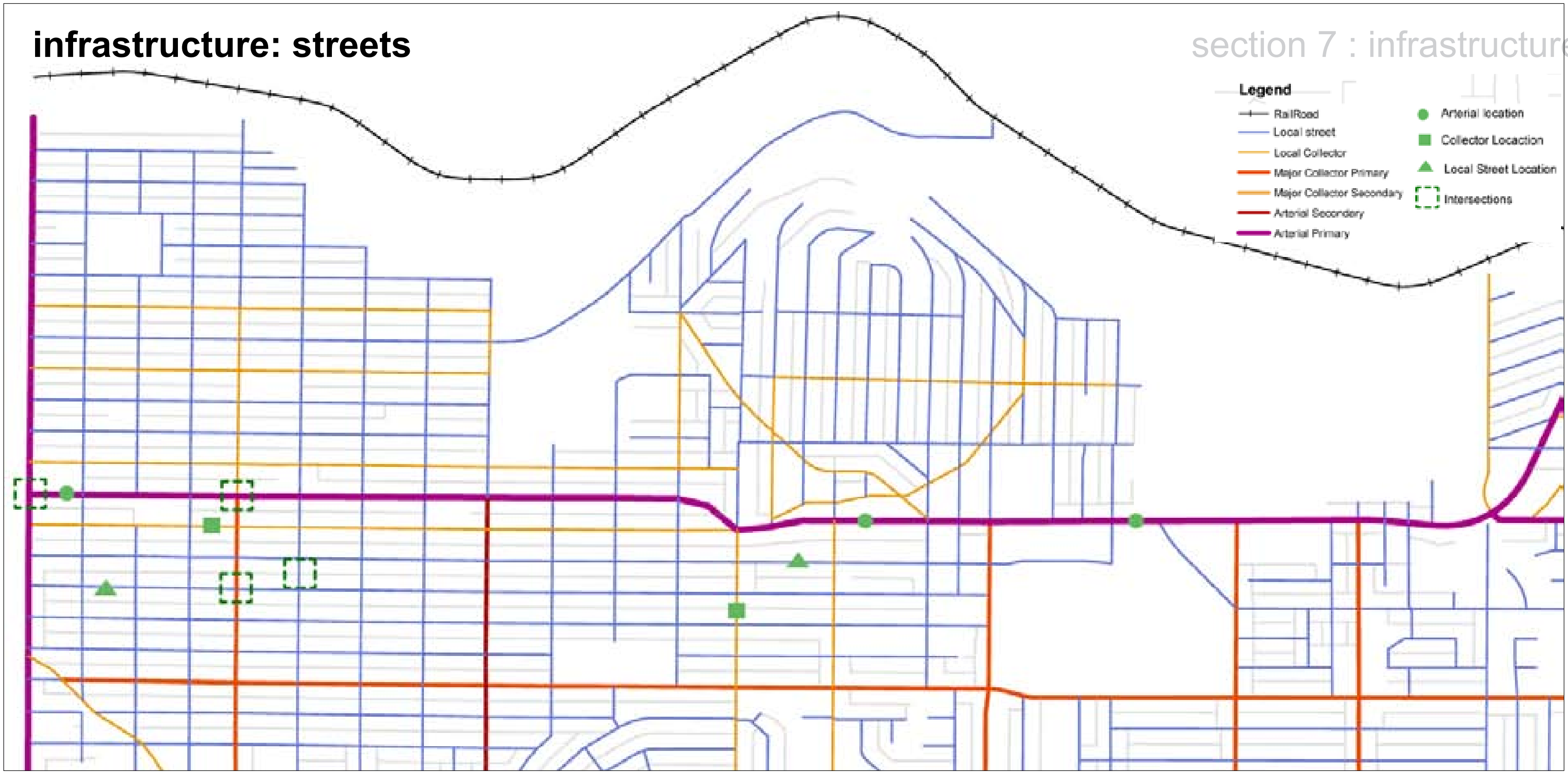
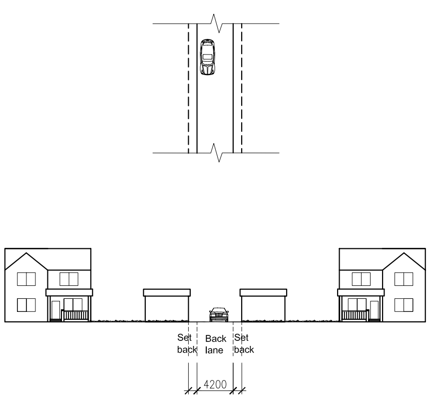


Photo: Study area in relation to major arterial connections

infrastructure: streets



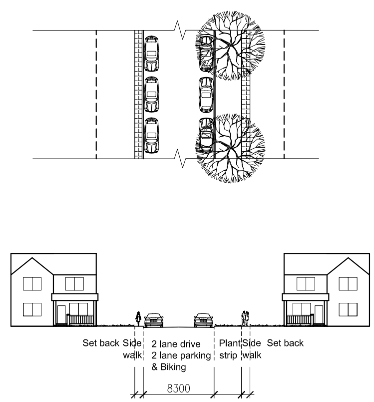
Back Lane



Units: mm

0 5000 10000mm

Local Street E Georgia Street (near Ingleton Ave S)



Local Street with One-side Plant Strip

Units: mm

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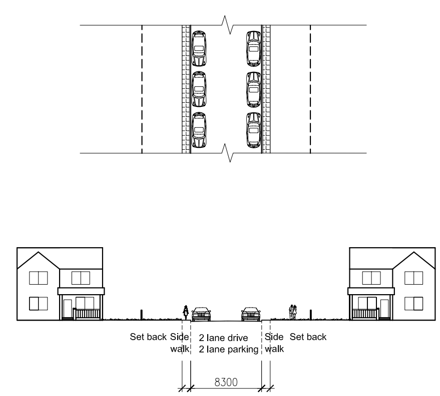
Local Street Frances Street (near Springer Ave)



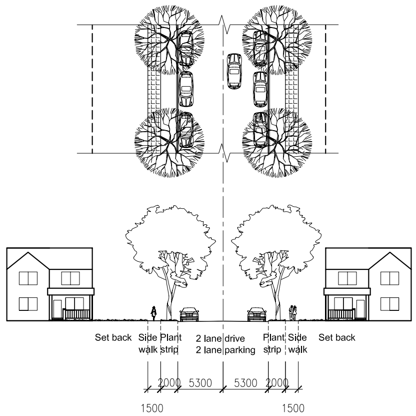
Local Street without Plant Strips

Units: mm

0 5000 10000mm

infrastructure: streets

Collector Pender Street (near Cilmore Ave)



Collector with Both-side Plant Strip

Units: mm
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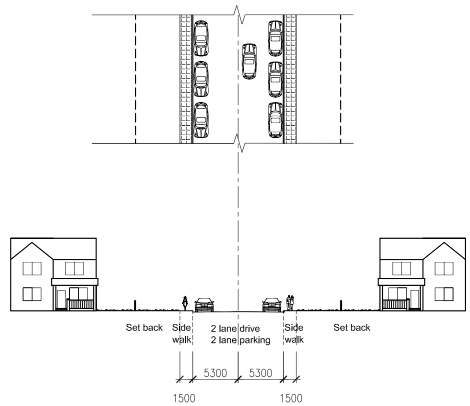
Collector Delta Street (near Georgia St)

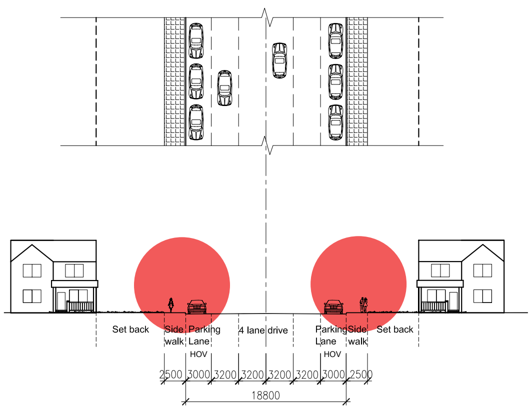


Collector without Plant Strip

Units: mm
0 5000 10000mm

Street Function:
The grid pattern of the Hastings area has great connectivity and a high accessibility which reduces traffic volume and congestion on though street as well as increase choice and variety as travelers choose alternate paths to a common destination.
Multiple choices of transportation are provided in this area. The High Occupancy Vehicle (HOV) lanes on arterial roads in Burnaby to accommodate HOV vehicles is intended to promote transit use, encouraging commuters to carry more people in private vehicles and reducing the travel time for buses and carpools.
This street system has no comprehensive

Arterial Capital Hill Hastings Street (near Springer Ave)



Arterial without Plant Strip

Units: mm
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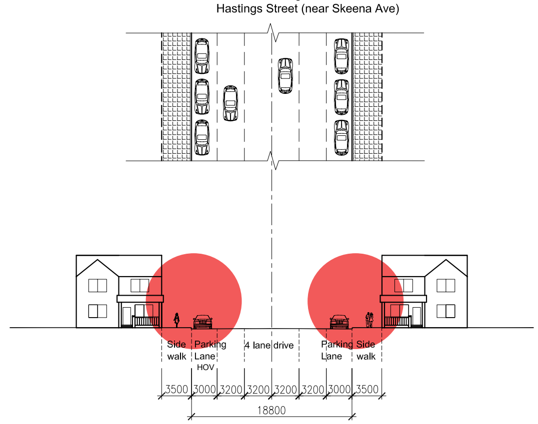
Arterial Vancouver Heights Hastings Street (near Skeena Ave)



Arterial without Plant Strip

Units: mm
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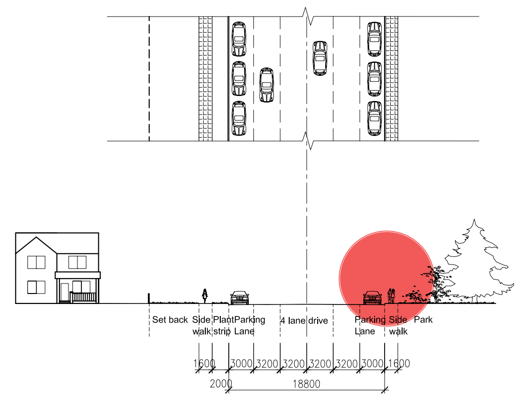
Arterial Shellburn Hastings Street (near Fell Ave S)



Arterial with One-side Plant Strip

Units: mm
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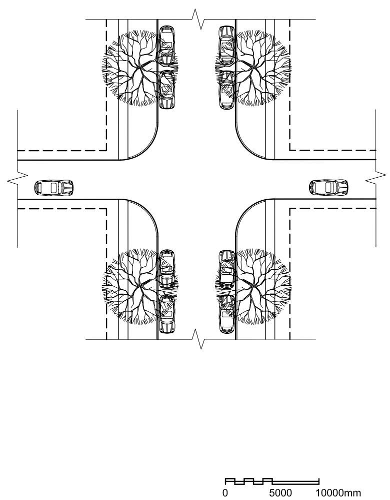
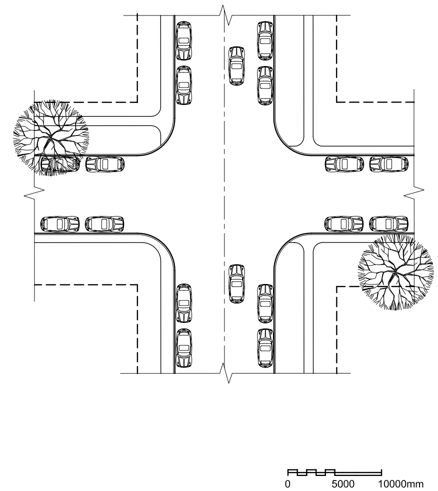
Parking lanes between the sidewalk and traffic lanes along Hsatings Street during rush hour are replaces by HOV lanes. The cars and busses move between 50 and 65 kpm, thus creating an unsafe "freeway" atmosphere on the sidewalks.

infrastructure: streets

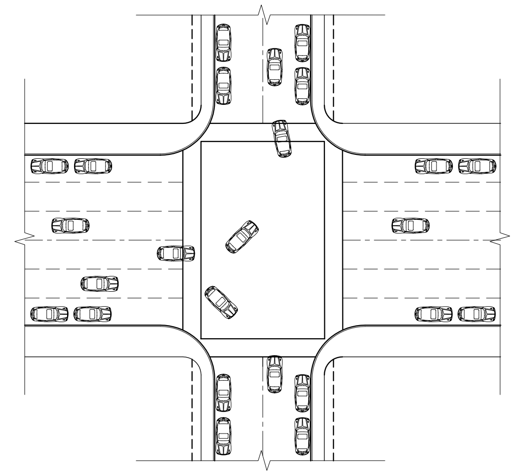
Local Street and Back Lane Intersection
Cilmore Ave & Georgia St

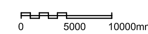


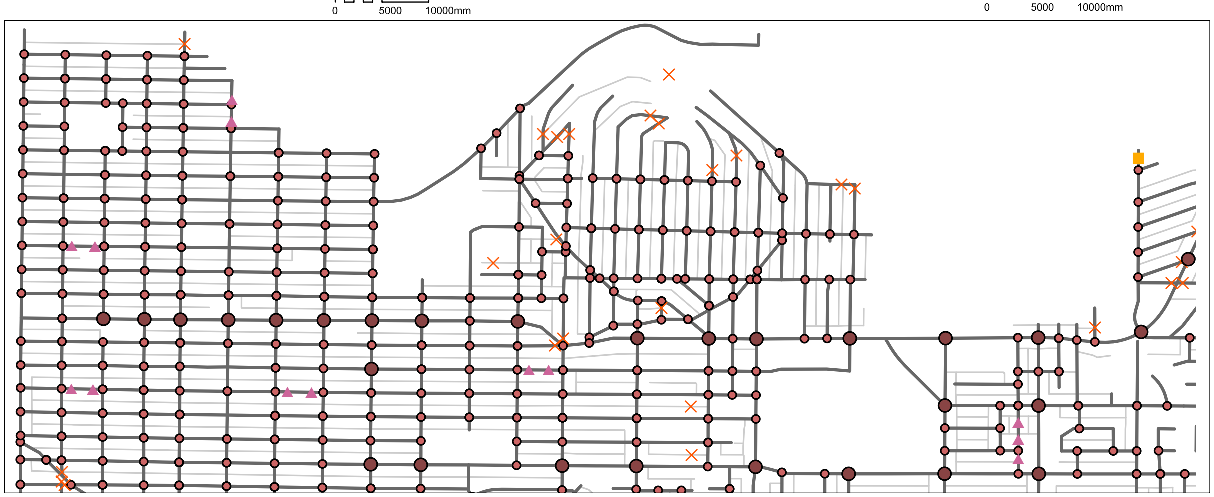
Collector and Local Street Intersection
Cilmore Ave & Georgia St



Arterial and Collector Intersection
Hastings Street & Cilmore Ave



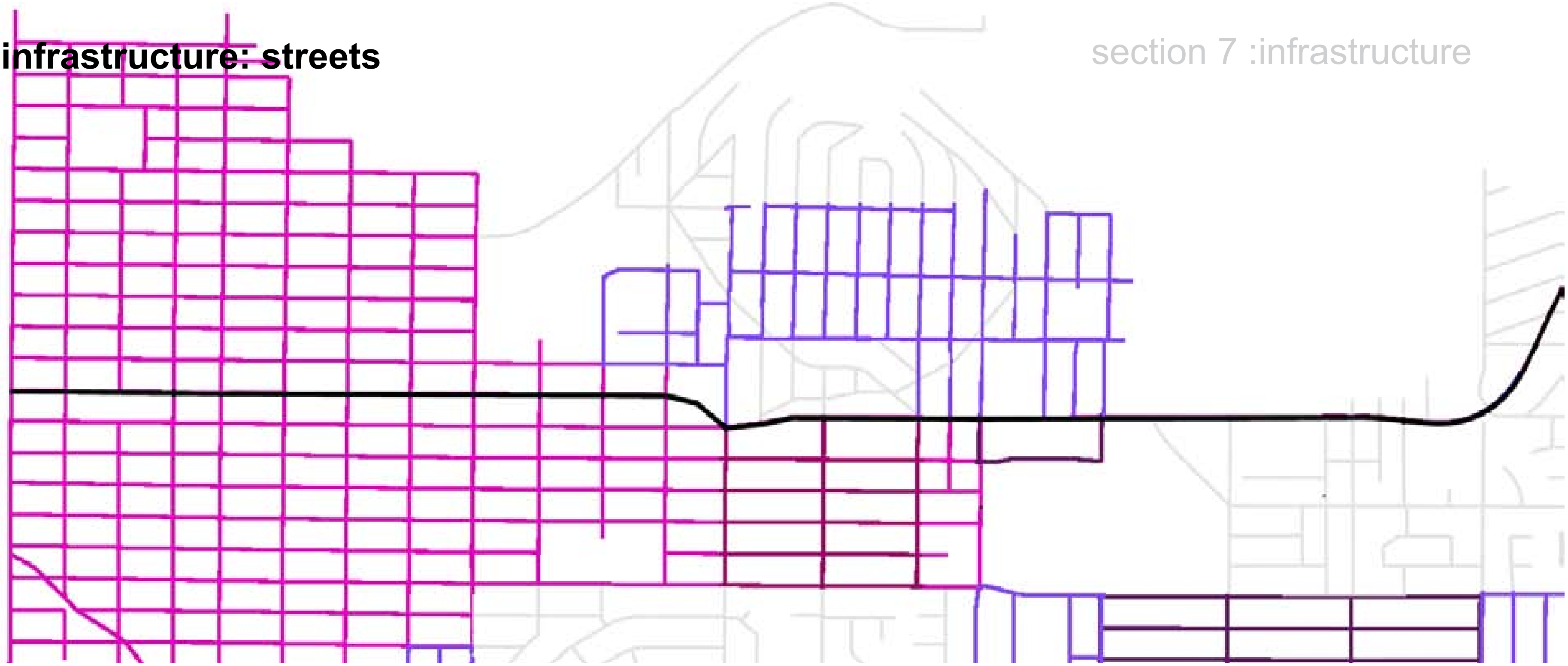




Traffic lights on Hastings Street are engineered to give a far lower priority to north south traffic, including pedestrians. Key intersections are controlled, but the majority are pedestrian operated (flashing) traffic lights that fit in with "green wave" timing, meant to keep car traffic moving at a steady pace down Hastings Street, without having to stop at multiple intersections. During rush hour the north-south crossing time is often barely long enough for children and the elderly.

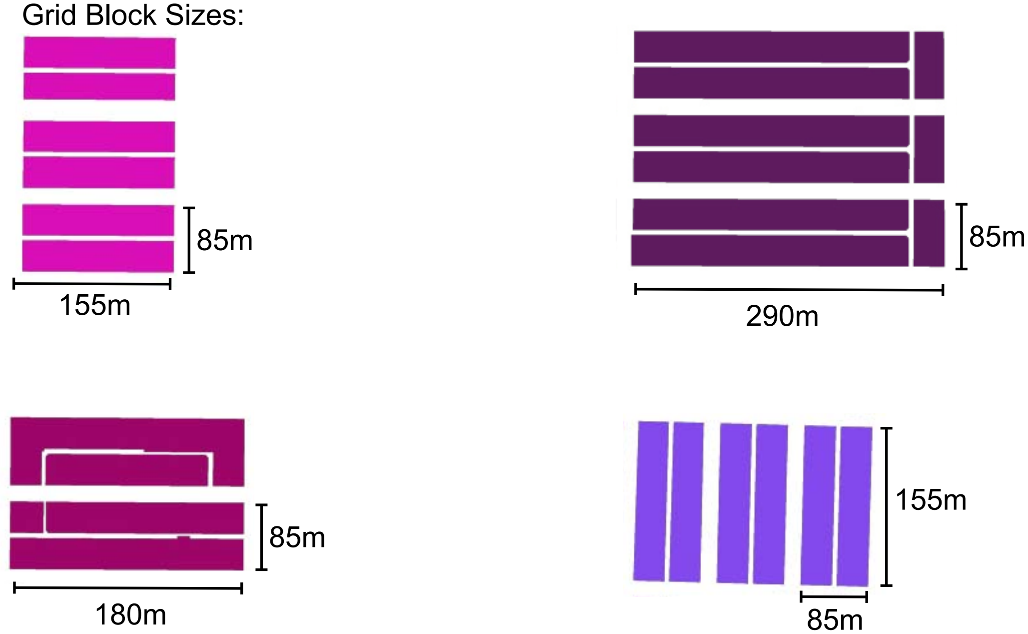
alternative system for moving pedestrians and bicycles. However, due to a great connectivity, all destinations may be reached via internal residential streets, rather than arterial streets. Pedestrian crossings along Hastings favor the automobile flow, and take a very long time to change. Commercial nodes are located along Hastings. Commercial corridors following transit routes. Most customers who arrive by car use on-street parking. There are no planting strips between sidewalk and street, but parking lanes instead between sidewalk

infrastructure: streets



Hastings Neighborhood Grid Network

Grid Block Sizes:



and traffic lane along Hastings St. During rush hours, parking lanes are replaced by HOV. The cars and busses move between 50 and 65kpm, thus creating an unsafe feeling "freeway" atmosphere on the sidewalks. Dust, noise, and at times waves of water and snow from passing busses render the sidewalk an unpleasant place to be. In addition, the shop owners notice a significant decline in business at rush hour (which would normally be peak shopping time) since the arterial is not the pedestrian friendly street and on-street parking is not readily visible.

infrastructure: streets

Hastings Neighborhood Non-Grid Network

Block Sizes: Variety

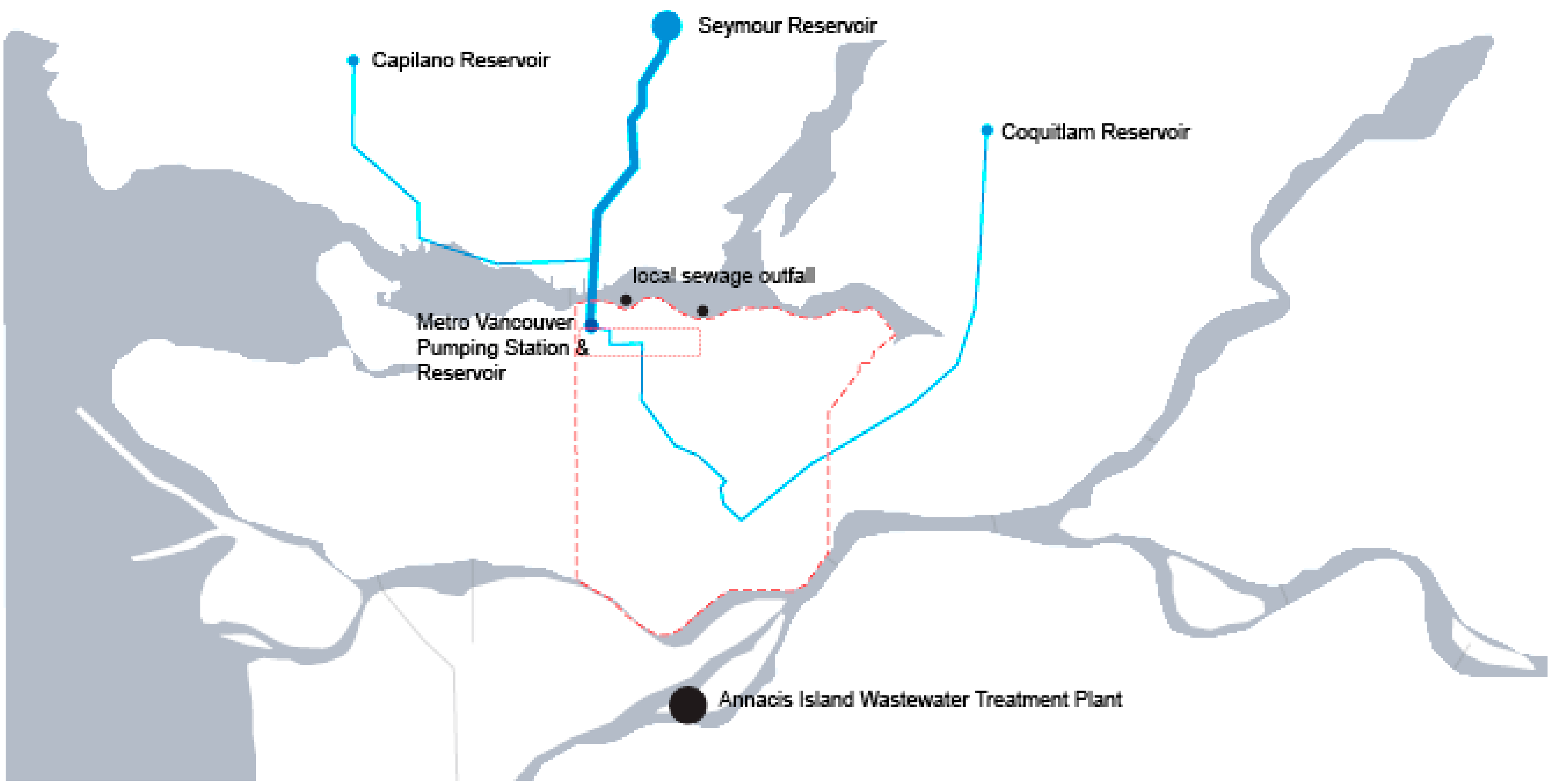
Landscape Pattern

Block Sizes: Variety

Cul-de Sac Pattern

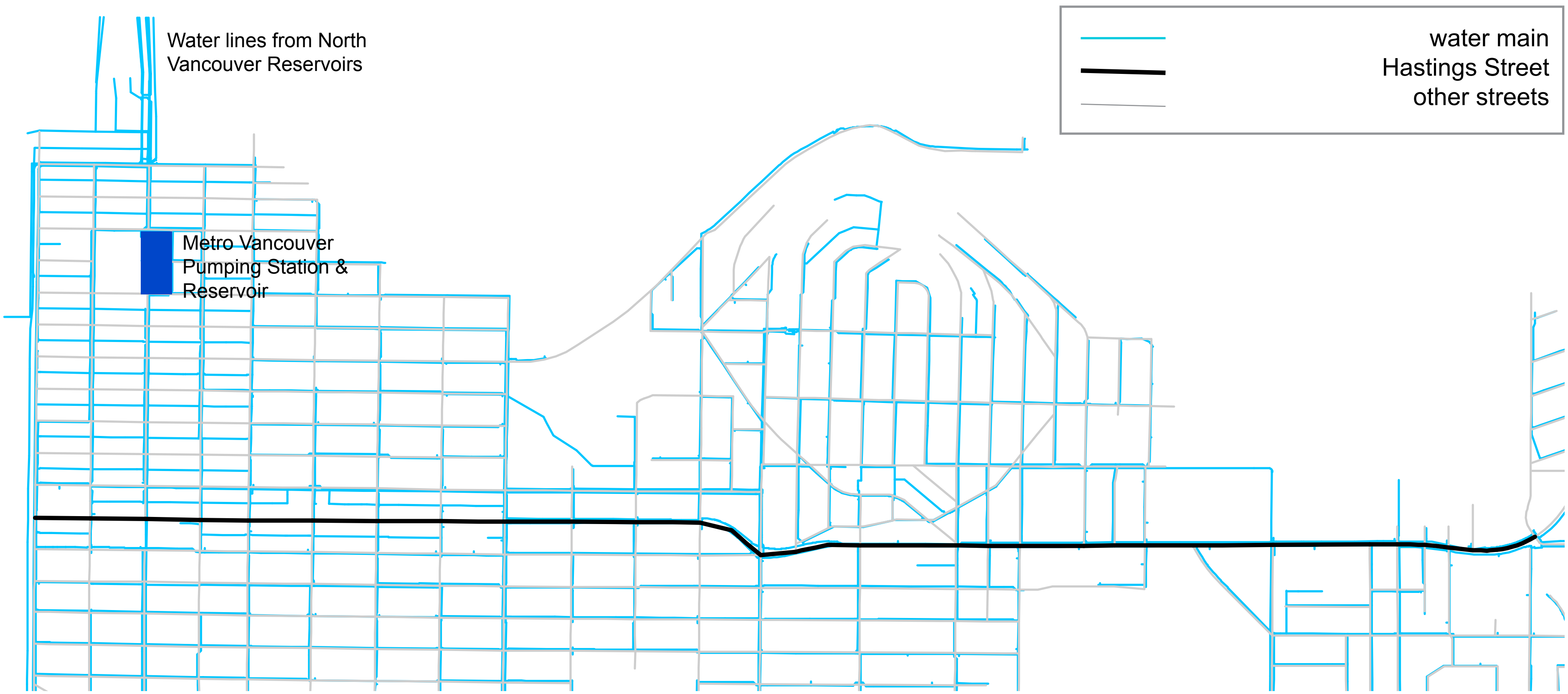
Conclusion: While the neighborhood around Hastings is well-suited for community connectivity, its location along a major commuter route into downtown Vancouver creates a tension between the neighborhood's desire to operate as a "Main Street" and the necessity to move large numbers of people and goods. The design challenges emerging in the streets include the mitigation of stormwater production, improving pedestrian experience and services, while addressing the need for mobility of people and goods.

infrastructure: pipes



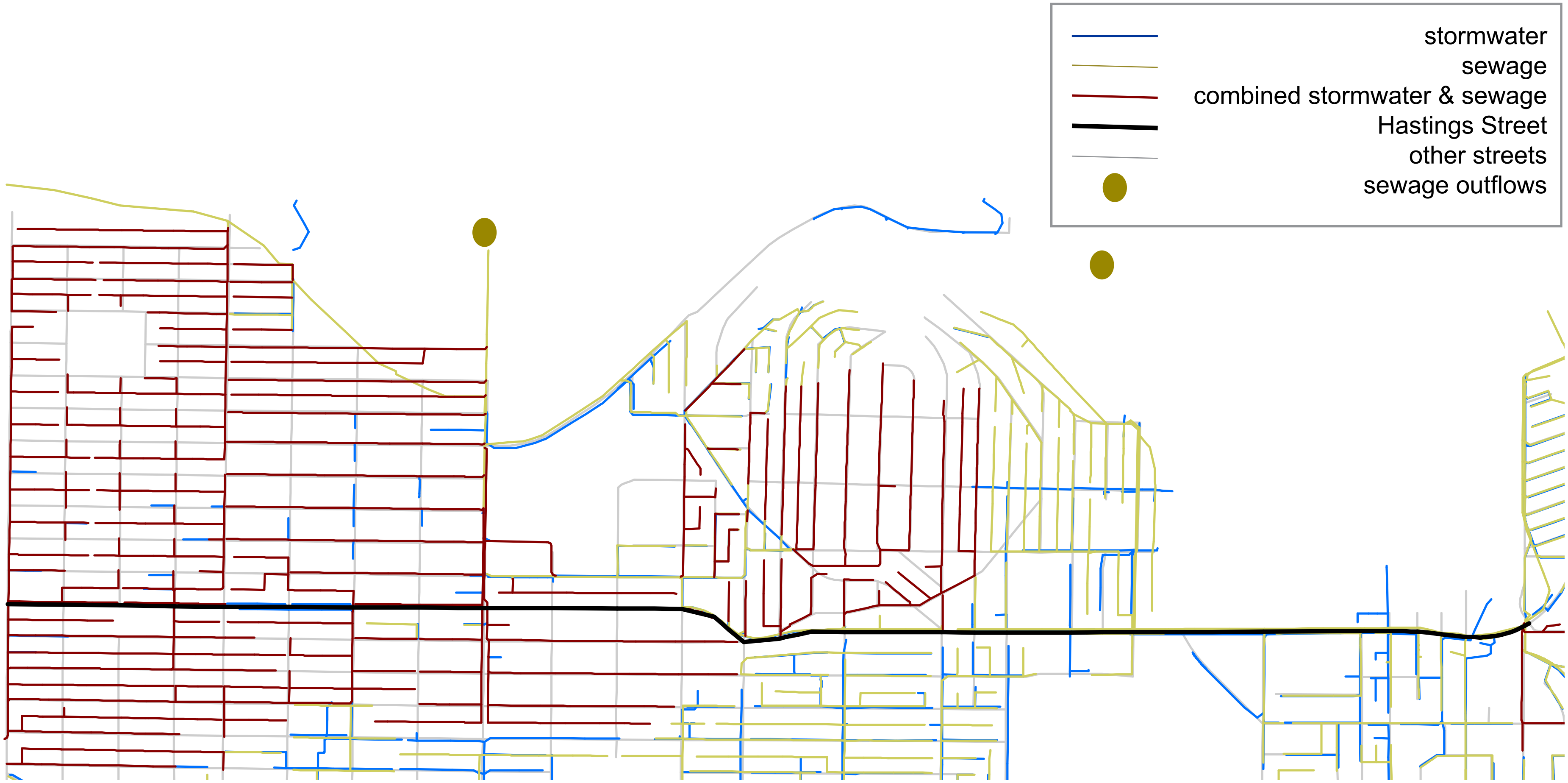
Three reservoirs serve the City of Burnaby, and the region as a whole. The majority of Burnaby's water comes from the Seymour reservoir and is then temporarily stored in a reservoir at the edge of the Hastings corridor, at Burnaby Heights park. Eventually, the water is sent to Annacis Island Wastewater treatment plant.

infrastructure: pipes



The City of Burnaby maintains 678 km of water main, 2,942 hydrants and 36,000 water services. The average Lower Mainland resident uses 325L a day in their home and as such we are one of the highest consumers of water in the world. It costs $19 million a year to maintain Burnaby's potable water system (City of Burnaby).

infrastructure: pipes



The majority of the site is still on a combined sewage – stormwater pipe system. On dry days the contents are taken to a sewage treatment plant, but during heavy rainfall the system is overloaded, and discharge sends raw sewage into the Burrard Inlet.

infrastructure: pipes

Some green infrastructure, in the form of ditches, exist on the site, and could be expanded to create a more cohesive system.

infrastructure: pipes

Upgrading the system

The majority of the site is still on a combined sewage – stormwater pipe system which discharges raw sewage into the Burrard inlet during periods of heavy rainfall. At a cost of $3,000,000 a year Burnaby has made a commitment to retrofit all combined pipes into separate sewage and stormwater pipes at a uniform rate, which should eliminate all outfall into the Vancouver Sewerage Area by 2050 and in the Fraser Sewerage Area by 2075 (Metro Vancouver). Capitol Hill has been identified as high environmental risk and is currently being retrofitted. Other initiatives are at the individual level and include lawn sprinkling restrictions, a rain barrel program and water conservation kits (City of Burnaby).

Source control

Although they are not policies at the City, source control could be done through such techniques and design interventions as: absorbent landscapes, reduced paved surfaces, bioretention, swales, pervious paving, infiltration trenches, extensive green roofs. This system could build on the existing ditch system. Not only would this be a closer fit to the natural system, but also more economically prudent.

In addition to the labour and material costs of installing new pipes, retrofitting existing pipe systems to separate pipes requires roads to be torn up, possibly ahead of their natural replacement cycle. By instead implementing an integrated stormwater management plan, using source control techniques, a considerable amount of money can be saved. Although a greenfield example, a one hectare test site in Cumbria Woods illustrates that by eliminating curb and gutters and the storm sewer in initial development, green infrastructure would cost $1.2million less to install than conventional systems, the equivalent of a 35% reduction in cost (UBC James Taylor Chair). Although our site is already built, these figures suggest that retrofitting engineered pipe systems will be more costly than source control interventions.

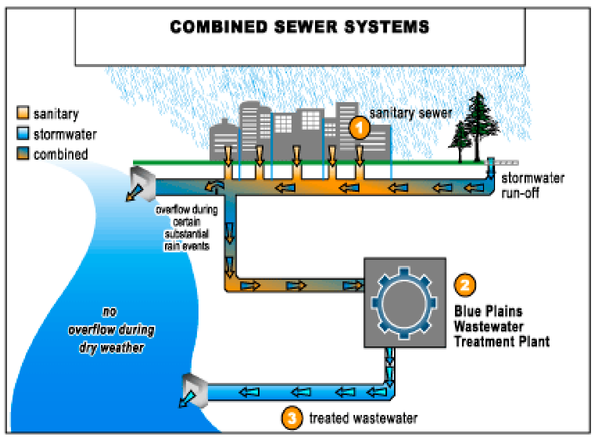


Image: combined sewer system

Photo: Useful **local policy precedents include the Univercity project: predevelopment runoff quality has been maintained and nearly 100% of their stormwater is returned to the ground through community scale facilities, detention ponds, on parcel storage and infiltration systems designed to mimic nature.**

energy infrastructure + the city of burnaby

energy in burnaby
The City of Burnaby's energy infrastructure is sustained through a complex network of underground pipes and overhead wires which deliver gas, electricity, and media from source outlets around the province into individual homes and offices.

Burnaby's built fabric determines, in large part, the patterns of energy consumption within the community. The grain of the fabric and its ability to support a range of modalities determines the energy output necessary for mobility. Building form, density, and orientation determine the energy inputs required for individual units. Together, the infrastructure system determines the energy footprint of Burnaby's residents.

Burnaby is also tied to energy as a cornerstone of economic health in the community. Both the oil refineries that line the waterfront and the waste-to-energy facility are major economic generators for the community.

Finally, energy is responsible for animating Burnaby's urban areas with a sense of life and festivity. Events such as Christmas-in-the-Heights are intimately tied to energy as a way of enlivening public space.

future intiatives in energy

The City of Burnaby is taking a number of initiatives to reduce energy consumption within its boundaries. The local EnergyFit program is a $5.9mil initiative for retrofitting the top 49 energy consuming facilities within the City. Sstarted in 2004, it is projected to reduce facility energy consumption by 14%. Provincially, the City joined the Community Action on Energy Efficiency (CAEE) initiative in 2007. Under the umbrella of the BC Energy Savings Plan (ESP), the initiative allows for the advancement of energy efrficiency through municipal policies and bylaws. ESP also provides grants for energy efficient retrofits to residential and small commercial buildings.

Photo: Guerilla greenhouses take advantage of south facing exposures in back alleys Source: Brooke Dedrick.

Photo: At left, Christmas-in-the-Heights, a yearly lighting of Hastings Street along Burnaby Heights shopping district. At right, event aftermath. Exposed energy infrastructure left in preparation for the next season's celebration. Source: en.wikipedia.org/wiki/Burnaby_Heights; Alia Johnson

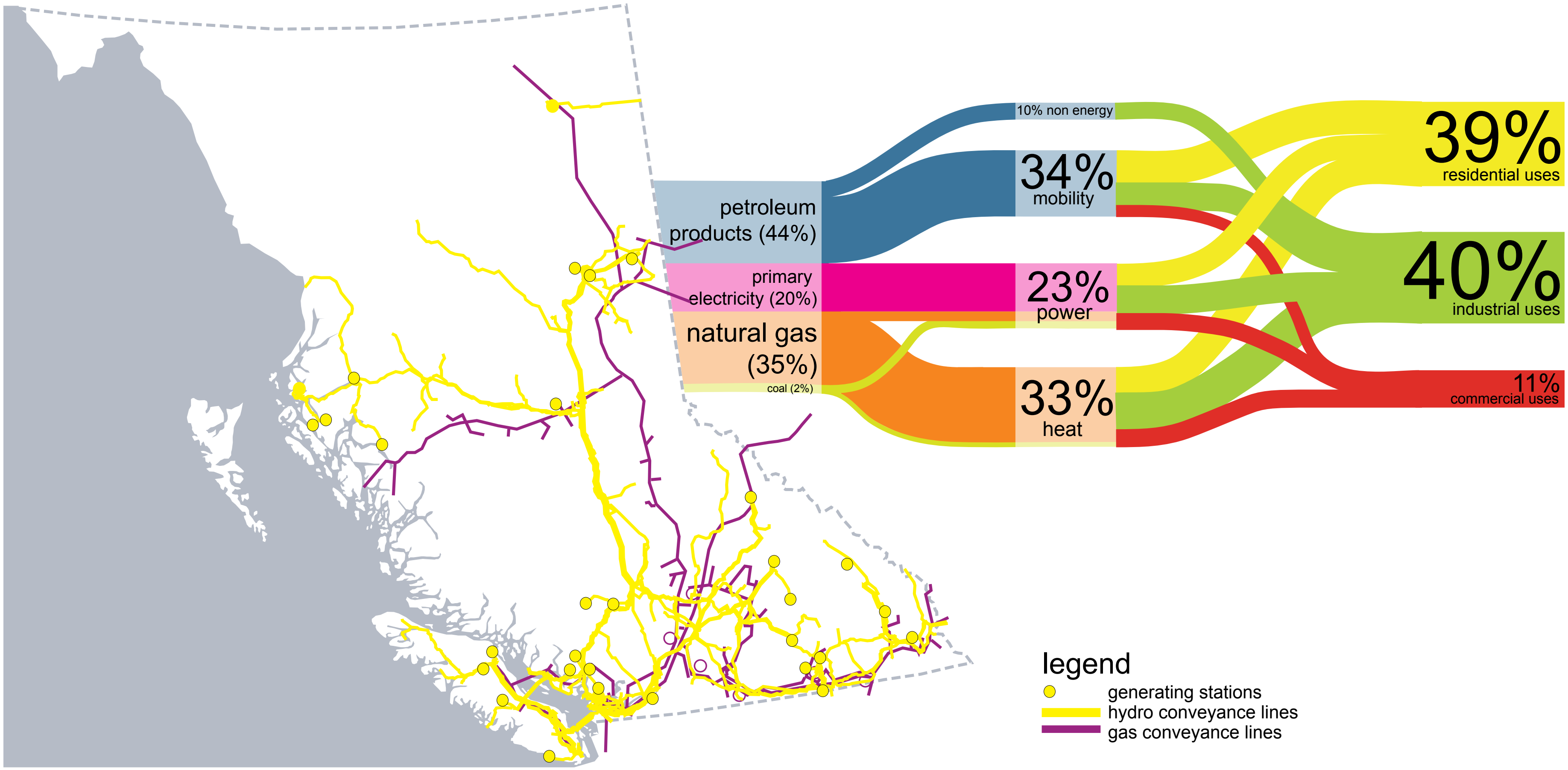


Photo: Tracking energy through the province: conveyance and consumption patterns.

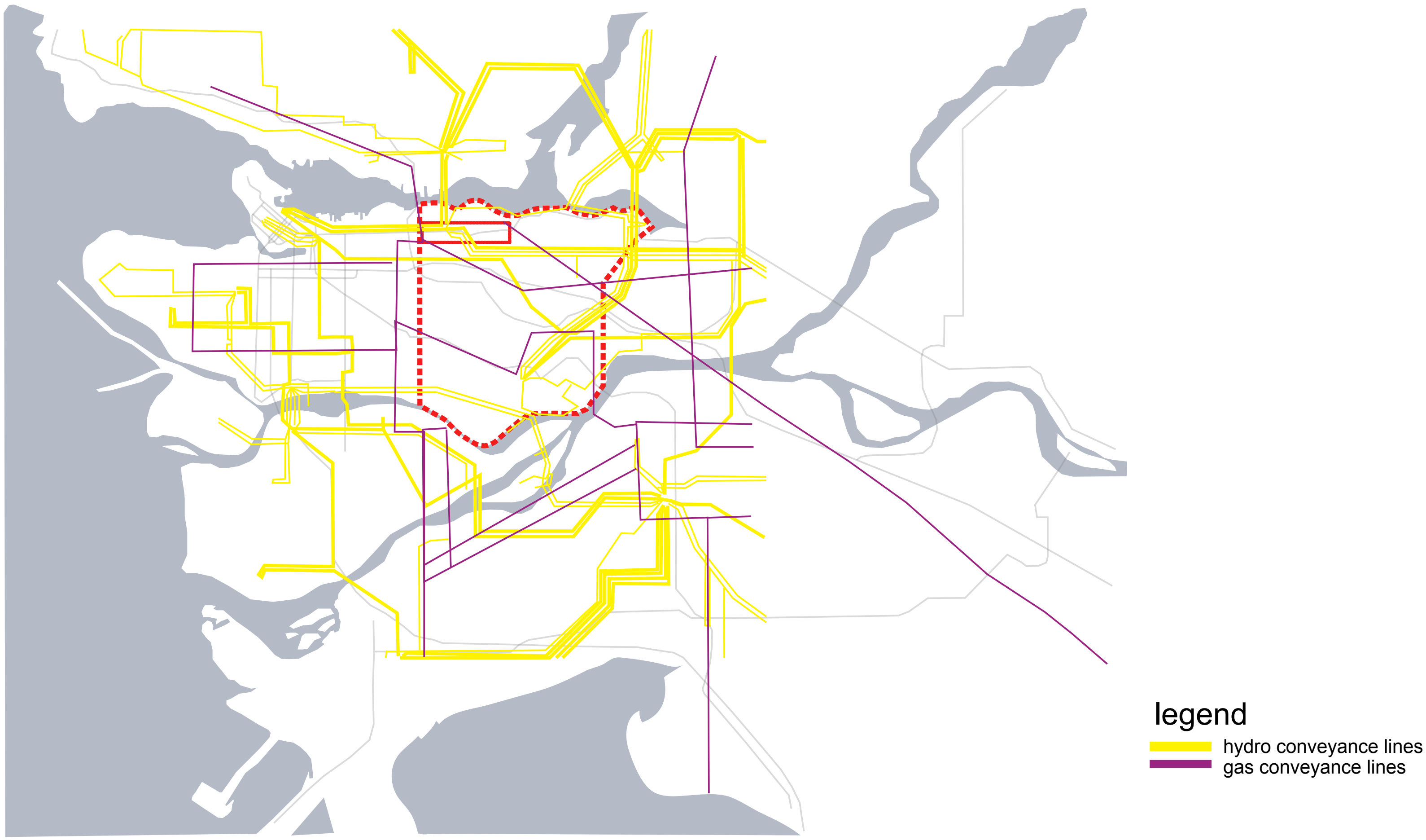


Photo: Energy conveyance through Metro Vancouver. The geographic centrality of the City of Burnaby causes it to act as both a destination and a throughway of energy conveyance in the region. The Hastings Street corridor serves as an essential energy connection along the East-West axis.

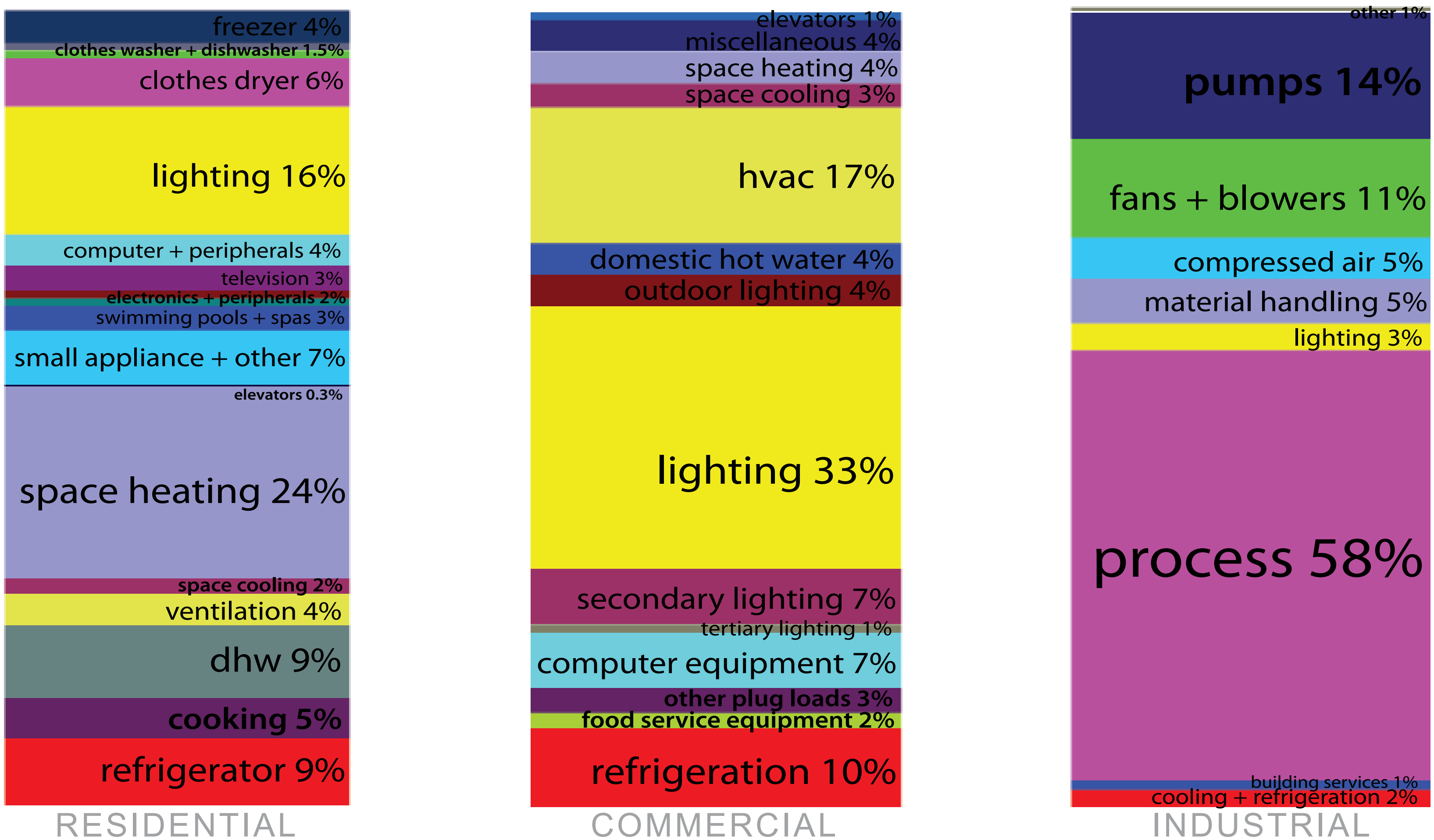
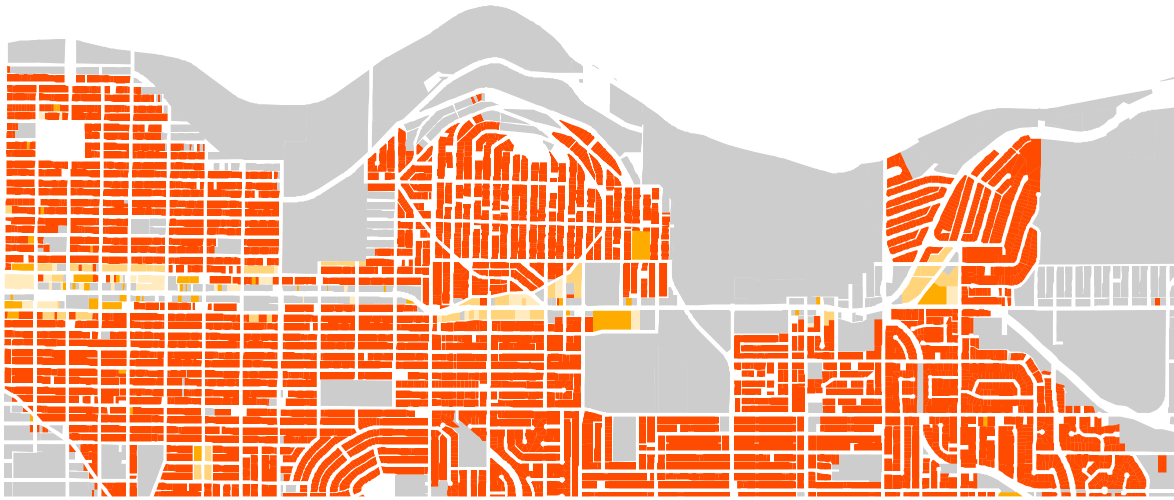


Photo: Energy Consumption Patterns by building type. Temperature control and lighting dominate residential and commercial demand, while process is largest consumer within industrial sector. **Source: BC Hydro Conservation Potential Review (2007)**



City of Burnaby: residential energy requirements by building form

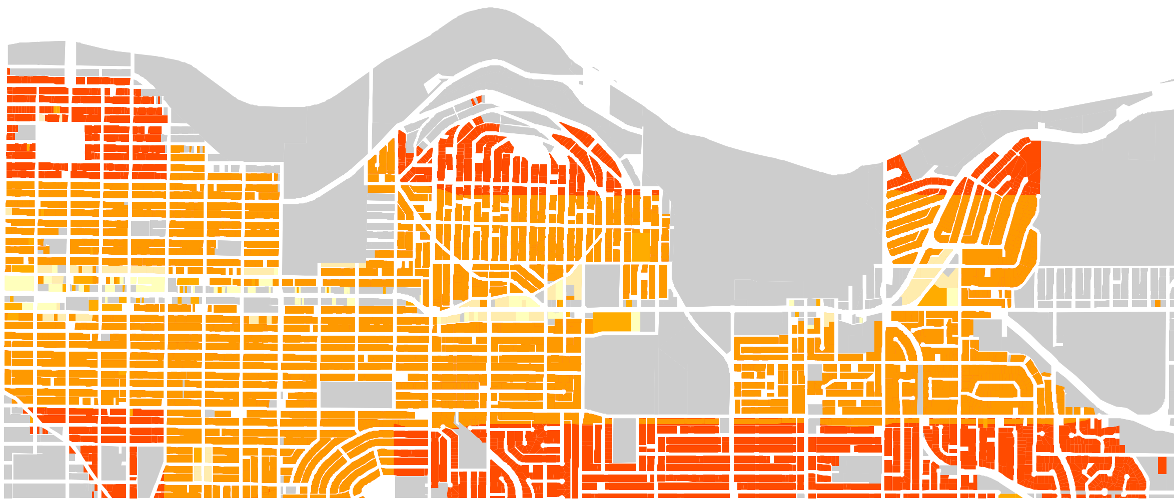
SINGLE FAMILY/DUPLEX
100.35GJ/year

ROWHOUSE
60.60GJ/year

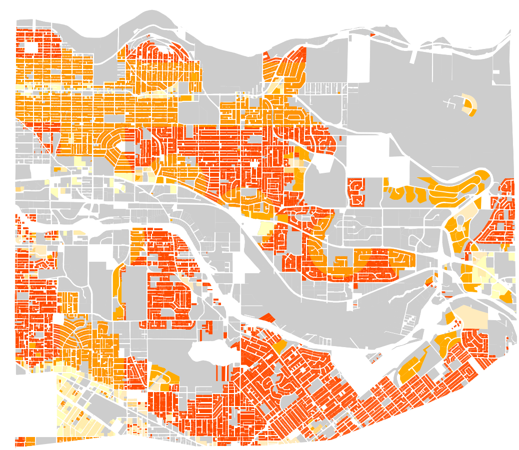
LOW-RISE APARTMENT
28.45GJ/year

HIGH-RISE APARTMENT
45.10GJ/year

Energy consumption by form shows diminishing returns with greater density.

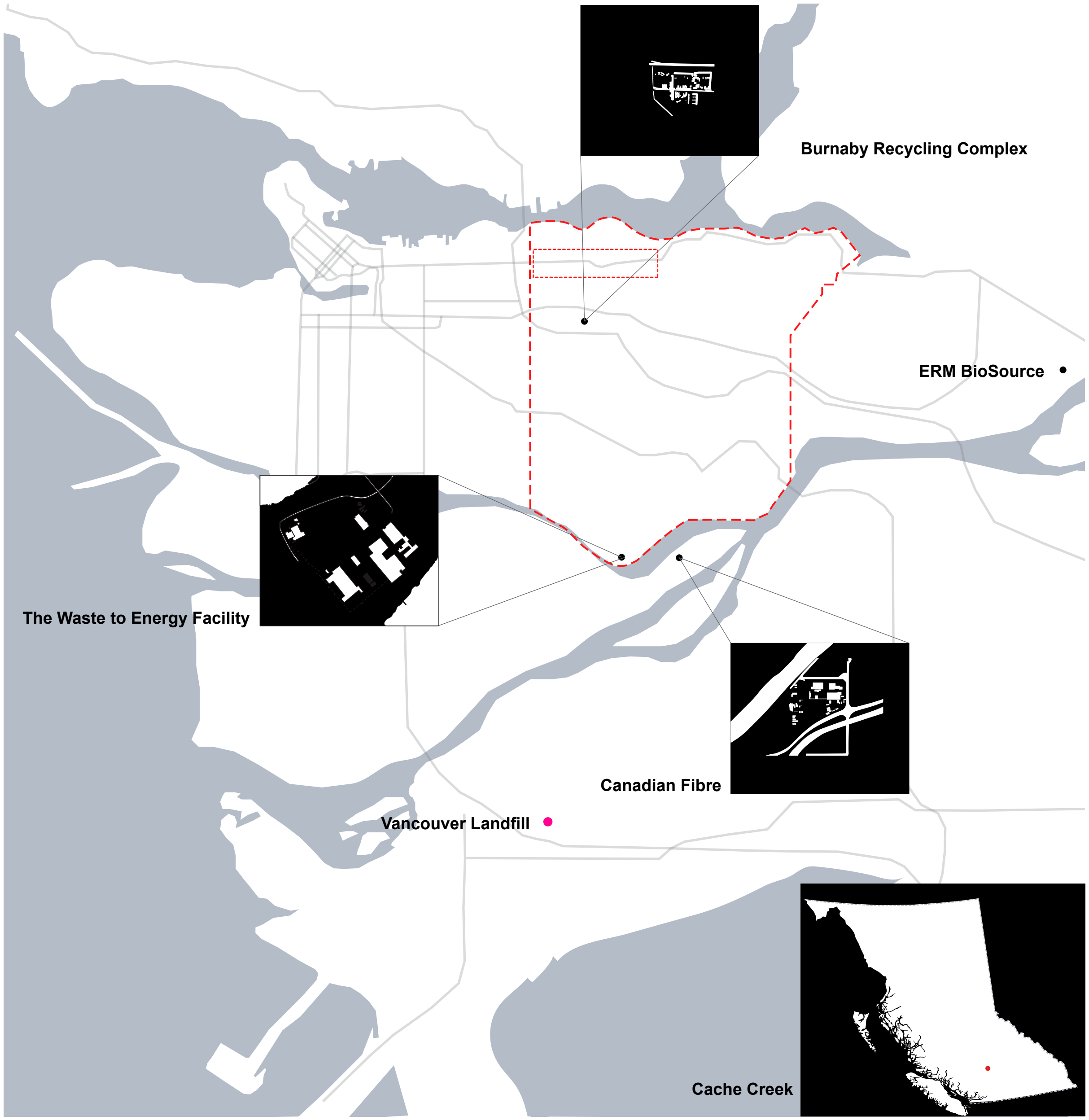


City of Burnaby: residential energy requirements by lifestyle potential



City-wide lifestyle patterns.

Photo: Energy consumption patterns along the Hastings Street Corridor. Residential energy requirements show that the low-rise apartment (30 units) is the most efficient building form. Energy requirements by lifestyle potential overlays structural energy consumption with proximity to high service transit corridors, with the assumption that those within a 10 minute walk of frequent, efficient public transit will have lower total energy demand that those completely reliant on private car ownership. Source: DCS, as reinterpreted from BC Hydro Conservation Potential Review 2007.



Waste To Energy Facility

An incinerator in the South of Burnaby that processes waste from Burnaby, North Vancouver, and some of New Westminster. Steam produced from this facility is pumped to the adjacent paper mill and generated into energy that is bought by BC Hydro and recycled into the grid.

Burnaby Recycling Complex

Established in 2003, this facility provides a transfer point for the blue box program, as well as a place for residents to drop off other recycleable materials and yard compost. Providing this complex has cut down on diesel fuel consumption by approximately 100 000 litres per year (*City of Burnaby 2007 Solid Waste and Recycling Report*).

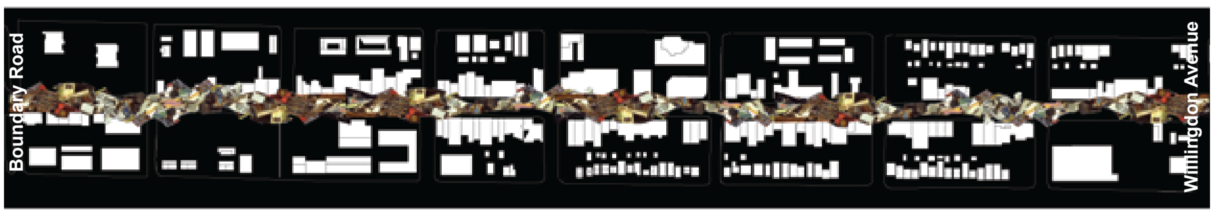
Canadian Fibre

Once the recycling is sorted at the complex in Burnaby, it is brought here, where further sorting occurs. Approximately 80% of the recycled material is shipped to China, and the other 20% is processed in North America (*Canadian Fibre*).

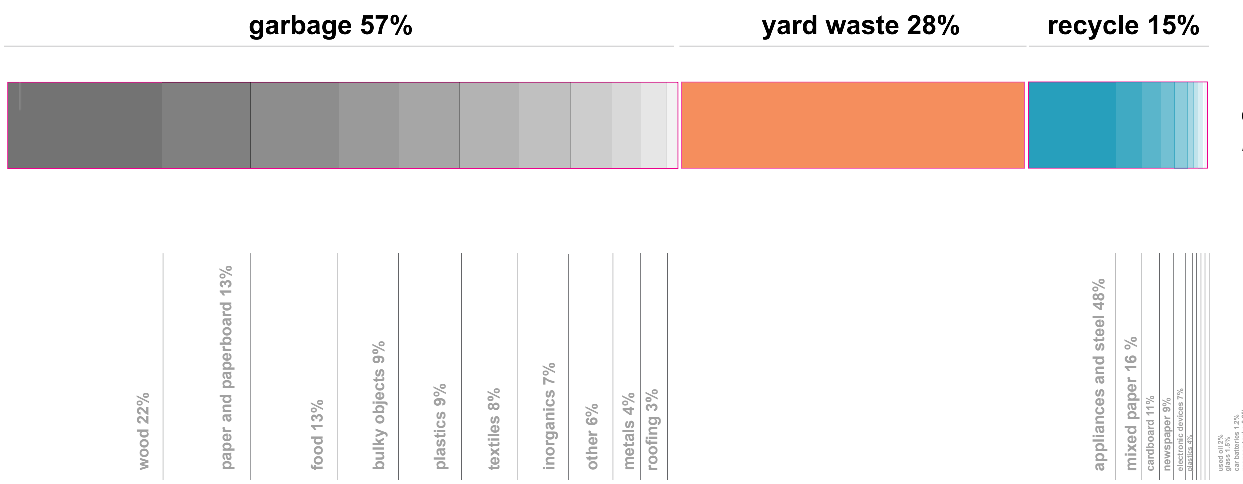
ERM BioSource

Burnaby is taking part in a pilot project that allows residents to bring their cooking grease to the recycling complex, which will then be taken to ERM BioSource in Port Coquitlam to be processed into biofuel.

waste composition



Burnaby disposes approximately 69 794 tonnes of waste per year (*The City of Burnaby 2007 Solid Waste and Recycling Report)*. If we piled this just over one storey high, we could bury hastings street from Boundary Road to Willingdon Ave.



Fortunately, Burnaby recycles almost half of its garbage: 10 412 tonnes are recycled, and 19 218 tonnes are composted (*The City of Burnaby 2007 Solid Waste and Recycling Report)*.

The Waste to Energy Facility (WTEF) and Burnaby

IN

40 164 tonnes Burnaby garbage
290 tonnes lime
2420 MWh electricity
41 131.5 kg ammonia
6968.16 kg activated carbon
106 458 kg phosphoric acid

OUT

45 970 tonnes steam
19 356 MWh of electricity
6532 tonnes of bottom ash, used in road construction
1335 tonnes of fly ash, disposed of at Cache Creek
1306 tonnes of ferrous metals, collected to make steel

Numbers based on the daily input and output of the WTEF

The energy required to power Burnaby for one year is 1 247 853 MWh.

We can look at this in two ways:
1. Burnaby's own garbage can supply power to 1053 (1.35%) of Burnaby's homes for a year.
2. Burnaby can continuously supply 16 500 homes (21% of Burnaby homes) for 48 days.

The amount of MWh the facility produces in a year, 127 750 MWh, would power 7 802 (10%) Burnaby homes for one year.

Sources: *Metro Vancouver, City of Burnaby*
Burnaby Heights Merchants Association
Metro Vancouver:
http://public.metrovancouver.org/about/publications/Publications/LWMP-PoliciesCommitmentsSchedule-CombinedSewers.pdf,
City of Burnaby: http://www.city.burnaby.bc.ca/residents/utilities/water/rnbrrl.html
Stormwater source control design guidelines 2005: GVRD
GVRD liquid management plan (Axys Environmental Consultants, Ltd. 2006
UBC James Taylor Chair "An economic rational for integrated stormwater management"
Univercity: Sustainability
http://www.univercity.ca/about_us/sustainability.46.html
Images:
http://www.dcwasa.com/education/css/combined_sewer.cfm
http://www.univercity.ca/about_us/sustainability.46.html

Conclusion

This section examined the infrastructural components of the Hastings neighborhood as the have manifest in streets, energy infrastructure, pipe systems, and waste disposal. It was discovered that, while the pedestrian and merchant do not seem to be well served by the configuration of Hastings Street, the connectivity of the grid network offers many opportunities for a well-connected circulation system. Investigations into energy use revealed that energy consumption may be greatly reduced by a transformation in built form. The combined sewer system of the Hastings area is an obstacle to sustainability, but with the city's plans to retrofit the system in the coming years, there is opportunity to develop green alternatives to the planned separated sewer system, and save the community a significant amount of money. An examination of the waste disposal system that services Hastings, the composition of solid waste, and the energy potential of that waste revealed a negligible amount of energy generation potential in the burning of the neighborhoos'd garbage.