

CLAYTON VILLAGE: A SUSTAINABLE ALTERNATIVE

By

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ABSTRACT

The overall goal of this thesis project was to explore principles of sustainable development through planning and design. A 60-hectare site was chosen in Surrey, where two different community plans were designed based on the proposed Clayton general land use plan. The first community plan was based on typical or status quo development principles. The second community plan was based on alternative or sustainable principles of development as described in the East Clayton Neighbourhood Concept Plan. These two plans were then compared using nine different economic, ecological and social parameters. Further detailed design was then done for two areas on the alternative community plan; Stormwater Park, an integrated park and school site, and the Community Garden. Typical residential and commercial streets were also illustrated in detail.

TABLE OF CONTENTS

ABSTRACT ii

TABLE OF CONTENTS iii

LIST OF FIGURES iv

1.0 INTRODUCTION 1

2.0 THESIS GOAL 5

3.0 THESIS OBJECTIVES 5

4.0 EAST CLAYTON NEIGHBOURHOOD CONCEPT PLAN 6

5.0 SEVEN PRINCIPLES OF SUSTAINABLE DEVELOPMENT 9

6.0 THE SITE 11

7.0 THE TYPICAL COMMUNITY PLAN 15

8.0 THE ALTERNATIVE COMMUNITY PLAN 16

9.0 COMPARISONS 18

10.0 STORMWATER PARK 28

11.0 THE COMMUNITY GARDEN 32

12.0 STREET DETAILS 35

13.0 CONCLUSION 36

14.0 REFERENCES 37

15.0 APPENDIX – PRESENTATION DRAWINGS 39

LIST OF FIGURES

- Figure 1. East Clayton Neighbourhood Concept Plan 8
- Figure 2. Clayton Village and East Clayton sites in relation to the Agricultural Land Reserve and Flood Plain 12
- Figure 3. Existing aerial view of proposed Clayton Village site 13
- Figure 4. Proposed general land use plan for the Clayton area 14
- Figure 5. Area of impervious surfaces for a) the typical plan, and b) the alternative plan 19
- Figure 6. Area of forest cover for a) the typical plan, and b) the alternative plan 20
- Figure 6.1 Length of storm sewers for a) the typical plan, and b) the alternative plan 21
- Figure 7. Length of roads for a) the typical plan, and b) the alternative plan 22
- Figure 8. Length of public and semi-private roads a) the typical plan, and b) the alternative plan 23
- Figure 9. Permeability "loops" for a) the typical plan, and b) the alternative plan 24
- Figure 10. Pedestrian connectivity as indicated by Forman's Index for a) the typical plan, and b) the alternative plan 25
- Figure 11. Road connectivity as indicated by Forman's Index for a) the typical plan, and b) the alternative plan 26
- Figure 12. Average walking distances from three locations to six nodes for a) the typical plan, and b) the alternative Plan 27
- Figure 13. Detailed plan views in Stormwater Park of a) the settling pond, b) the one-car bridge and stream channel crossing, and c) the retaining pond 31
- Figure 14. Detailed plan views in the Community Garden of a) the barn and greenhouse, b) individual and communal gardening plots, 3) the children's plots and play area, and d) the public flower garden 34

1.0 INTRODUCTION

Much of the focus of future development has been centered around the concept of sustainable development. In the famous Bruntland report of 1987 submitted to the UN General Assembly, sustainable development is defined as "development which meets the needs of the present without compromising the ability of future generations to meet their own needs". The establishment of a widely accepted definition of sustainable development has been a critical and necessary step towards any kind of reconcilable relationship between man and earth. However, since this report was published, principles of sustainable development have not yet weaved their way into mainstream thinking at a rate necessary for global change.

Perhaps one reason for this lies in the lack of clarity in *how* sustainable development can be successfully achieved. How do we turn broad philosophies, such as those presented in the Brundtland report, into on-the-ground implementation?

Another reason for the slow assimilation of sustainable principles into conventional practice is that many developers are reluctant to integrate more sustainable practices into their projects. Many fear that anything beyond the typical or status quo development will neither sell, be approved, or be cost-effective. However, there is much evidence that there are significant economic, as well as ecological and social benefits to both building and purchasing homes in communities that are alternatively planned and designed.

In a study by Mark Eppli (as cited in James Taylor Chair, Technical Bulletin #7) it was found that people were willing to pay an average of \$20,000US more for homes built in New Urbanist developments over similar homes in conventional developments.

Another study by the Center for Rural Massachusetts (Lacey as cited in James Taylor Chair, Technical Bulletin #7) suggests that economically, open space can be a more important consideration to potential buyers than even lot size. The study also indicates that a development with access to open space would appreciate by an average of 22% annually. People are willing to pay more for a house in an intermediate density area with additional characteristics of affordability, commuting time, amenities, parks, and a sense of community over a larger house lot without those same characteristics.

Similarly, a 1990 study in New England (Lerner and Poole, 1999) showed that clustered housing appreciated faster than comparable homes on conventional lots. This measure indicated a greater desire for a home with access to permanently protected land over one with a larger lot without the open space amenity.

In Boulder, Colorado, (Lerner and Poole, 1999), property values of an area increased by \$5.4 million after a greenway was built. This increase generated an additional \$500,000 per year in property taxes. In 3 years, the \$1.5 million purchasing price of the land for the greenway was recovered.

Communities designed using sustainable principles also provide important ecological benefits, such as controlling erosion, cleaning air pollutants and mitigating global warming, providing wildlife habitat, absorbing flood and stormwater.

A study done by the James Taylor Chair in Landscape and Liveable Environments (Technical Bulletin No. 8) compared the atmospheric impacts of an alternative community pattern with a more typical suburban development pattern. It was found that a more efficient land use pattern (higher average densities, greater land use mix, and local work opportunities), and an interconnected street system that encouraged less car dependence in the alternative community would lower per capita production of greenhouse gases compared to the typical development pattern.

Another ecological benefit to alternatively planned communities is the maintenance of natural hydrological processes. Alternative stormwater infrastructure such as surface swales, infiltration areas and retention ponds can help negate some of the effects of conventional stormwater management practices such as underground piping and channelling of stormwater runoff. These conventional systems can have effects on groundwater recharge, water table levels, water quality, and cause severe and more frequent flooding and erosion (Girling *et al.* 2000).

Preservation of large tracts of green areas also help to maintain and enhance wildlife habitat, particularly along riparian areas. Riparian corridors are some of the most diverse and

valuable habitat areas to a variety of aquatic, amphibious and terrestrial species (Girling *et al.* 2000).

Maintaining vegetation along riparian areas also benefits water quality and flow in streams, as well as protecting stream banks from erosion.

Many social benefits are also associated with alternative planning and design such as providing recreational opportunities, potential for greater community interaction, creating a sense of place and identity for the community and providing educational opportunities.

Riparian corridors also provide excellent sites for linear recreation such as walking, jogging, and biking (Girling *et al.* 2000).

2.0 THESIS GOAL

The overall goal of this thesis is to explore principles of sustainable development through planning and design.

3.0 THESIS OBJECTIVES

- 1) To plan and design typical and alternative communities
- 2) To develop a set of ecological, social and economic parameters with which to compare the two community plans
- 3) To make comparisons between the two community plans based on those parameters
- 4) To develop a better understanding of how to integrate principles of sustainable development into community planning and design

The methodology used for this thesis was the rational method. The background and framework for this thesis were developed using the East Clayton Neighbourhood Concept Plan (NCP) as a guide. The East Clayton neighbourhood is a 250-hectare area in North Surrey that was chosen as a proposed site for a sustainable community.

4.0 EAST CLAYTON NEIGHBOURHOOD CONCEPT PLAN

The East Clayton Neighbourhood Concept Plan summarizes the results of an integrated planning process that involved several constituencies of interest. The resultant neighbourhood concept plan was generated through the charrette process involving several constituencies of interest such as landowners, developers, environmentalists and municipalities. The resultant neighbourhood plan was generated through the charrette process involving representatives from the above mentioned constituents as well as through public consultation.

The basis for the East Clayton NCP evolved from a need to plan for future urban growth. The City of Surrey plans to effectively manage its share of current urban growth in the Lower Mainland. This urban growth is to be planned within the context of the Greater Vancouver Regional District's (GVRD) planning legislation "The Liveable Region Strategic Plan". The *Liveable Region Strategic Plan* outlines transportation and land use guidelines in the following four strategies:

- 1) Protecting the green zone
- 2) Building complete communities
- 3) Achieving a compact metropolitan region
- 4) Increasing transportation choice

Within the context of the Growth Strategies Statute Amendment Act – Municipal Act, the Cloverdale district was identified as an area where additional growth could occur. This agreement gave the city of Surrey some flexibility in accommodating urban growth and

established the context for the development of a complete community in Clayton, including East Clayton.

Complete and sustainable communities are those that offer a wide range of housing choices, services, and employment opportunities at high enough densities to support convenient access to services and transit, all within a pedestrian-friendly neighbourhood fabric. At the same time, complete communities also protect the quality and integrity of ecosystems by maintaining environmentally sensitive areas (i.e. natural flow-receiving watercourses), and by managing the quantity and quality of stormwater runoff.

Seven principles of sustainable development were developed as a framework to guide the creation of the plan.



Figure 1. East Clayton Neighbourhood Concept Plan (East Clayton NCP 2000).

5.0 SEVEN PRINCIPLES OF SUSTAINABLE DEVELOPMENT

Principle No. 1 *Conserve land and energy by designing compact walkable neighbourhoods. This will encourage pedestrian activities where basic services (e.g. schools, parks, transit, shops, etc.) are within a five- to six-minute walk of their homes.*

The idea of the community built around the "concentrated centre" provides a place where people can live in large numbers, access community services and amenities and work. It is important that the "concentrated centre" is linked to the region via transit making transportation to and from the community a viable and attractive option.

Principle No. 2 *Provide different dwelling types (a mix of housing types, including a broad range of densities from single-family homes to apartment buildings) in the same neighbourhood and even on the same street.*

The rationale behind this principle is to encourage a diversity of housing types. Just as diversity is critical in biological communities, diversity in human communities is also key. A diversity in housing type is a positive attribute of a working community. For example, people don't need to move away from the community when family circumstances or living arrangements change.

Principle No.3 *Communities are designed for people; therefore, all dwellings should present a friendly face to the street in order to promote social interaction.*

Principle No. 4 Ensure that car storage and services are handled at the rear of dwellings.

Principle No. 5 Provide an interconnected street network, in a grid or modified grid pattern, to ensure a variety of itineraries and to disperse traffic congestion; and provide public transit to connect East Clayton with the surrounding region.

Although a typical suburban cul-de-sac or dendritic street pattern reduces traffic on residential streets, it also increases the distances needed to get anywhere. Therefore, there is a greater dependence on the car. A connected grid system provides both a more direct route and lessens traffic stress on main arterials.

Principle No. 6 Provide narrow streets shaded by rows of trees in order to save costs and to provide a greener, friendlier environment.

Principle No. 7 Preserve the natural environment and promote natural drainage systems (in which stormwater is held on the surface and permitted to seep naturally into the ground).

6.0 THE SITE

The 60 ha site is located in the Cloverdale area in East Surrey. It is bordered by the proposed East Clayton site, to the East, the Fraser Highway and North Cloverdale, a newly established residential neighbourhood to the south and low density residential and agricultural areas to the north and west. The Serpentine River and Agricultural Land Reserve (ALR) lands lie to the west and the Nickomeckl and ALR to the south. Soils on the site drain moderately well to poor. In addition, an impervious layer of compacted glacial deposits a half metre below the surface result in lateral movement of water, or interflow.

The headwaters of North Cloverdale Creek originate on the site, eventually draining into the Serpentine. Fish have been found in the creek south of the Fraser Highway. The site slopes in a general south west direction with slopes up to 9%.

Vegetation is dominated by second growth in the Coastal Western Hemlock zone with a significant forest stand in the middle of the site designated as an environmentally sensitive area.

Existing land use on the site includes mainly low density residential, a community park, an elementary school, a newly built high school and commercial along Fraser Highway.

As part of the current Surrey growth management plan and the GVRD's Livable Region Strategic Plan, the city of Surrey has zoned this site, to be known as Clayton Village, to be a medium density, mixed-use residential neighbourhood to accommodate approximately 4000 residents, or approximately 1500 units.

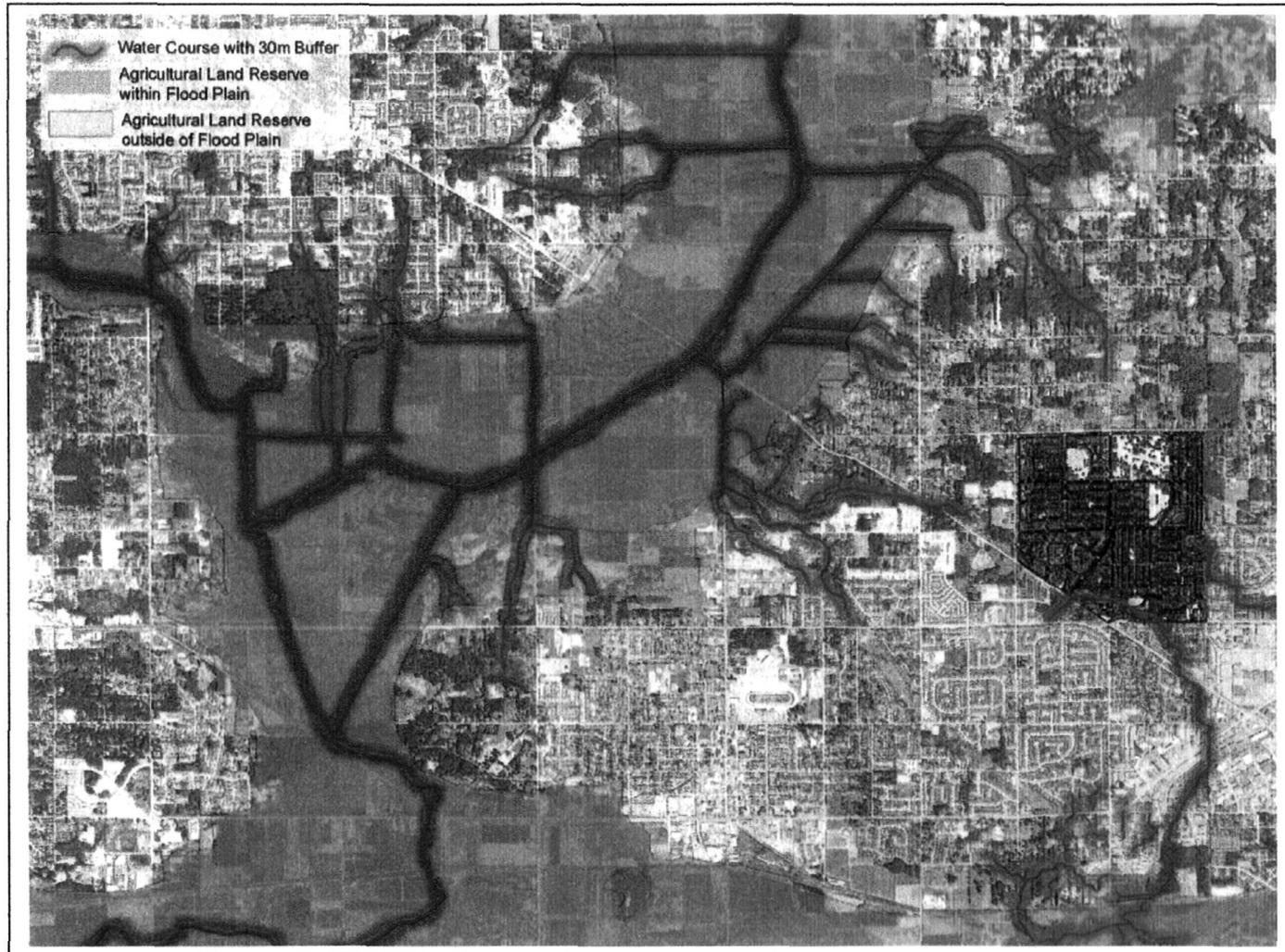


Figure 2. Clayton Village and East Clayton sites in relation to the Agricultural Land Reserve and Flood Plain (East Clayton NCP, 2000).

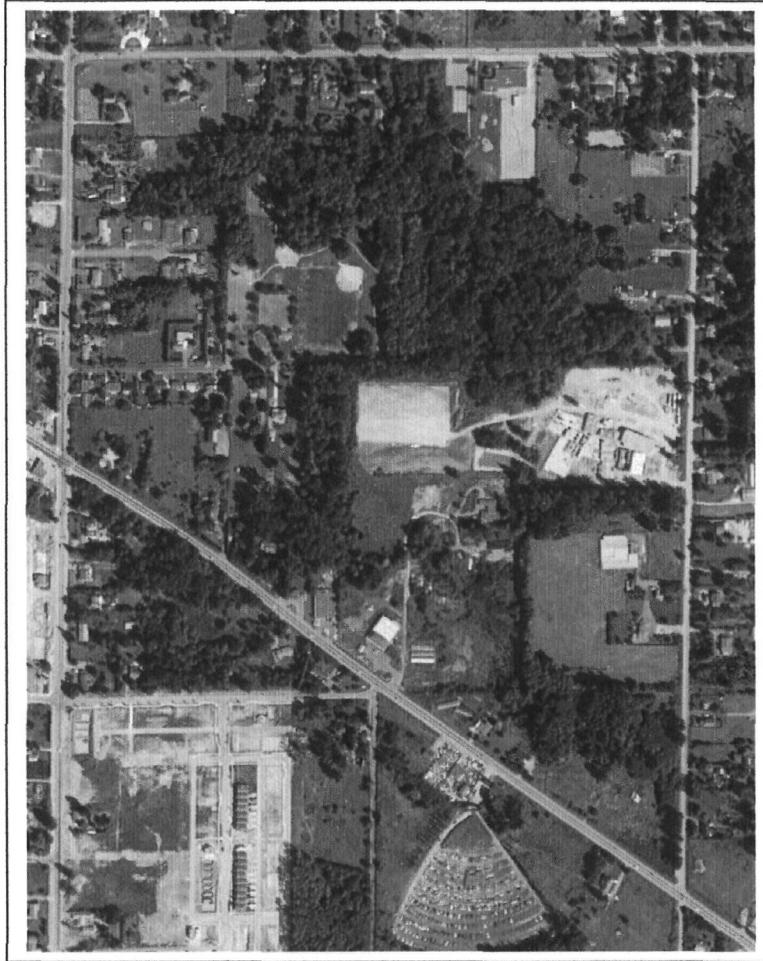


Figure 3. Existing aerial view of proposed Clayton Village site.

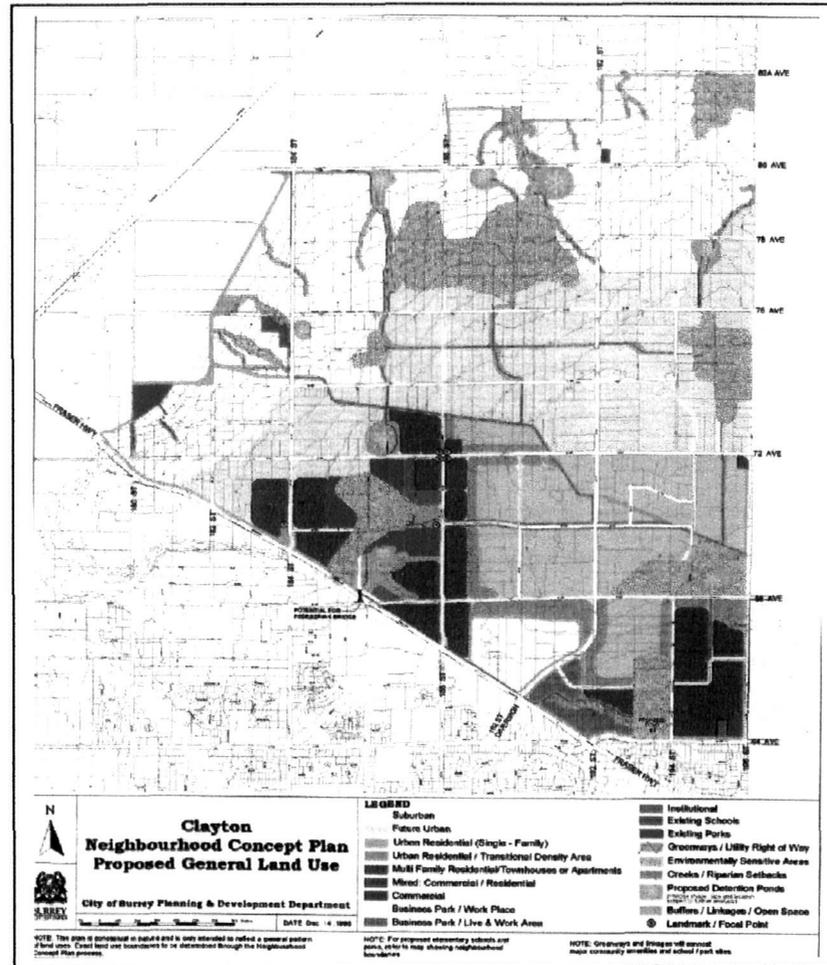


Figure 4. Proposed general land use plan for the Clayton area (East Clayton NCP, 2000).

7.0 THE TYPICAL COMMUNITY PLAN

I planned two communities on the site using the proposed land use plan for both. The first was a typical or status quo community (Appendix - Sheet L3). This was done by overlaying existing residential and commercial developments in and around the Surrey area with some modifications to the road layout. The final typical plan included the following characteristics:

- Road travel focused on the bordering arterials
- A dendritic internal road layout
- 20m ROW with 11m wide paved roadways
- Relatively large areas dedicated to surface parking
- Large development parcels that are often internally oriented with an internal road system
- Curb and gutter stormwater infrastructure with stormwater conveyed directly into the stream or into a detention or holding pond
- Street trees are planted at 10m spacing with 25% canopy cover.

8.0 THE ALTERNATIVE COMMUNITY PLAN

The alternative community plan was designed based on the East Clayton seven principles of sustainable development (Appendix – Sheet L4).

- Principle No. 1. Compact walkable neighbourhoods.* This principle was in part already achieved by the proposed land use plan. In addition, pedestrian-scale shaded sidewalks along every street, a designated East-West multi-use greenway along 70th avenue that connects to East Clayton, a North-South greenway that connects the commercial area to the park/school, through the ESA and north, were also provided.
- Principle No. 2 Different dwelling types.* All the residential areas are zoned for medium density. However, within that density designation, the housing type was varied between 3 storey apartments, townhouses, stacked townhouses and rowhouses. Lot parcels were also partitioned to a maximum width of 40m to encourage smaller scale developments as well as diversity in architecture.
- Principle No. 3 Friendly face to the street.* Building street presence was achieved by incorporating a maximum 4m setback and street oriented entryways, at ground level where possible. Developments on corner lots also wrap around the corner to address both sides of the street. In the commercial

areas, a 2m setback, awnings and street oriented frontage with areas for outdoor seating and interaction are also provided.

Principle No. 4 *Cars at the rear.* Car storage and utilities are handled either at the rear of buildings as surface or underground parking, or as on street parking. Large parking areas are kept to a minimum and where they do occur, large planting areas double as visual screens and biofiltration areas.

Principle No. 5 *Interconnected grid street network.* An interconnected street network in a modified grid pattern is used with the intent of relieving traffic pressures on main arterials, providing shorter and more direct routes, as well as providing a more logical and readable layout.

Principle No. 6 *Narrow planted streets.* Street widths are narrowed to an 8m paved roadway compared to 11m found in the typical plan. Street trees are planted at a 5m spacing with a 50% canopy cover.

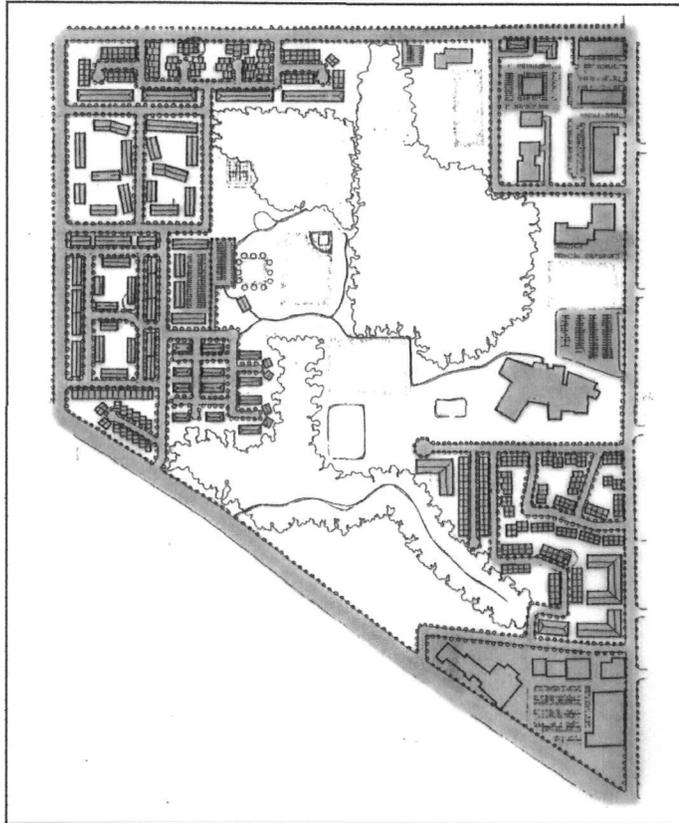
Principle No. 7 *Preserve natural processes.* The natural environment and natural drainage is preserved by maintaining all significant patches of vegetation, as well as enhancing edges with native understory plantings. Stormwater is collected and allowed to infiltrate naturally either on individual lots, or conveyed by surface swales to retention areas. There, water is biofiltered and retained to either evaporate or infiltrate slowly back into the soil and eventually the creek.

9.0 COMPARISONS

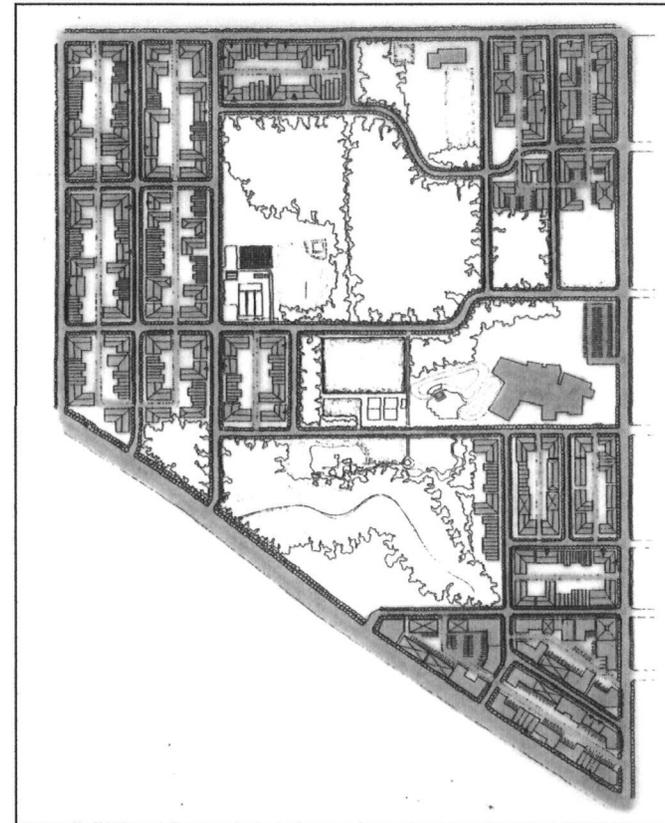
Nine different economic, social and ecological parameters were chosen to compare the typical vs. the alternative community plans. These parameters were chosen from the literature as having either positive or negative impacts on communities. The numbers are expressed as a percentage of one compared to the other with the typical always used as the baseline at 100%.

% Impervious area

Impervious areas inhibit natural infiltration as well as speed up the time for water to move across an area, resulting in greater flashes or pulses in stream flow. The alternative plan had a 115% greater impervious area. This is probably due to the modified grid road layout. However, it is more important to look at effective impervious area. These are the areas that have a significant effect on water flow and quality. For example, precipitation that falls onto a paved roadway that infiltrates naturally in a nearby infiltration area has less impact on streams and waterways than precipitation that falls onto a paved roadway and is channeled directly through pipes to streams. In the typical plan, the percentage of effective impervious area is essentially the same as the percentage of impervious area. However, in the alternative, because 90% of the water is infiltrated naturally through roadside swales, infiltration basins and trenches, and stormwater detention areas, the effective impervious area is reduced significantly to approximately 10% of that of the typical.



a)

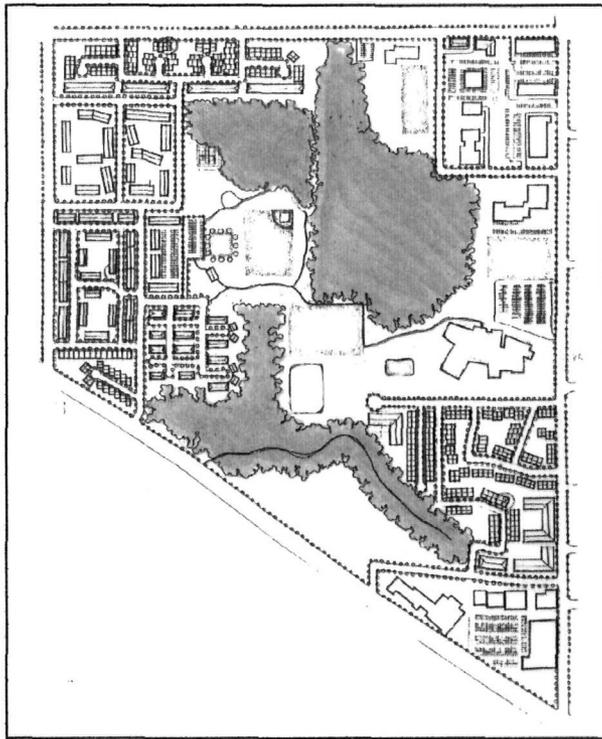


b)

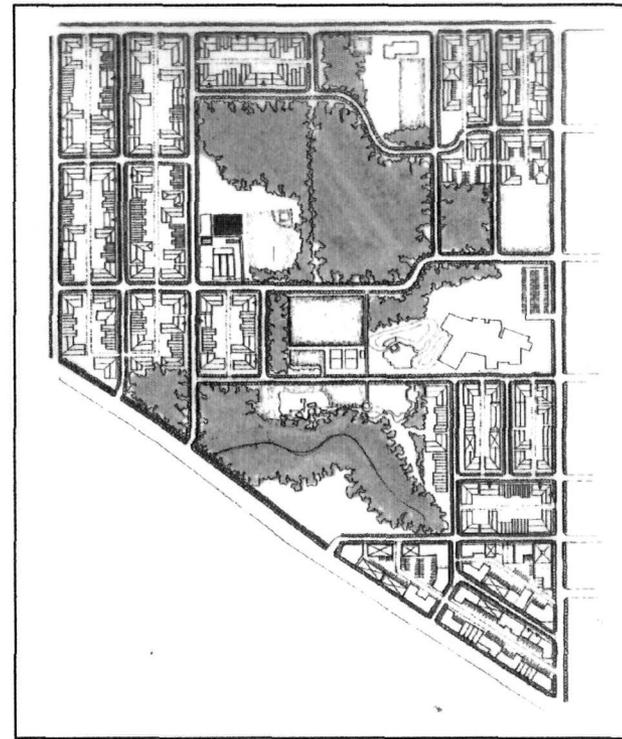
Figure 5. Area of impervious surfaces for a) the typical plan, and b) the alternative plan.

% Forest Cover

Forests, particularly in urban environments, are essential as wildlife habitat, as carbon sinks, as a fundamental step in the hydrologic cycle, as well as providing recreational opportunities and increasing property values. For the purpose of this comparison, I've included large patches of forest and street tree canopy as the percentage of forest cover. Of the 2 plans the alternative had 124% more forest cover than the typical.



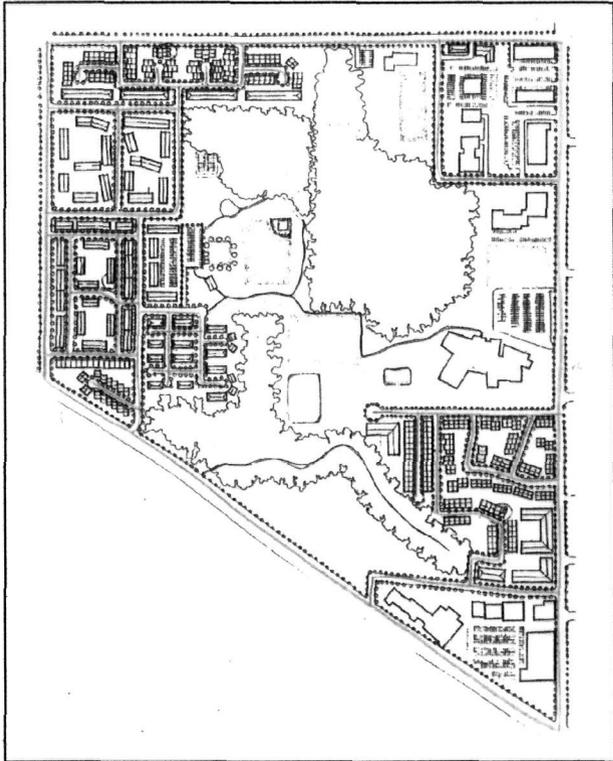
a)



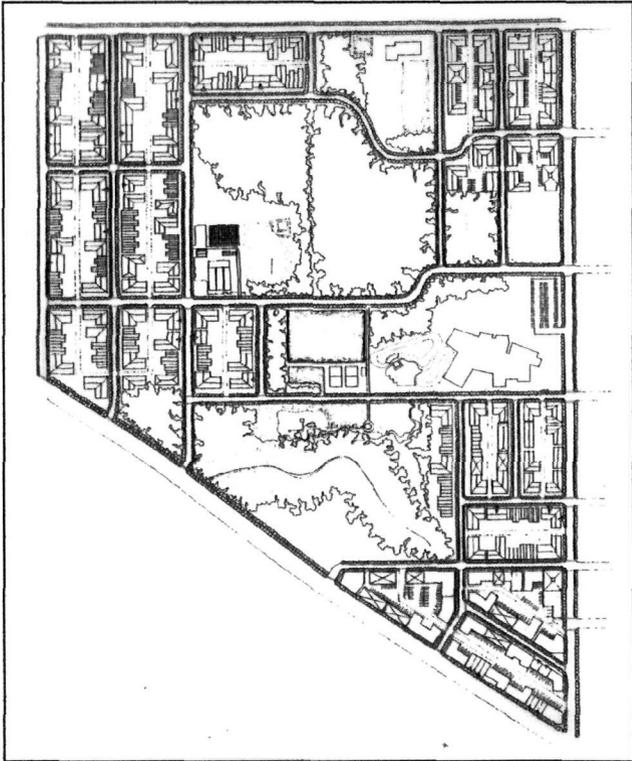
b)

Figure 6. Area of forest cover for a) the typical plan, and b) the alternative plan.

Length of Storm Sewer Conventional storm sewer systems are costly to install and maintain but more importantly, have significant impacts on stream water quality and quantity. The alternative design has only 7% the length of the typical with the only underground piping occurring as culverts at road and laneway crossings.



a)

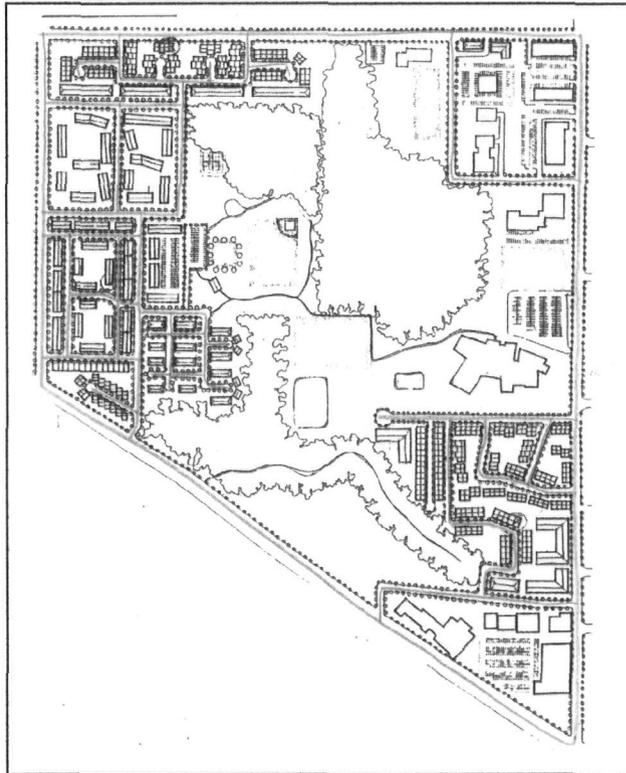


b)

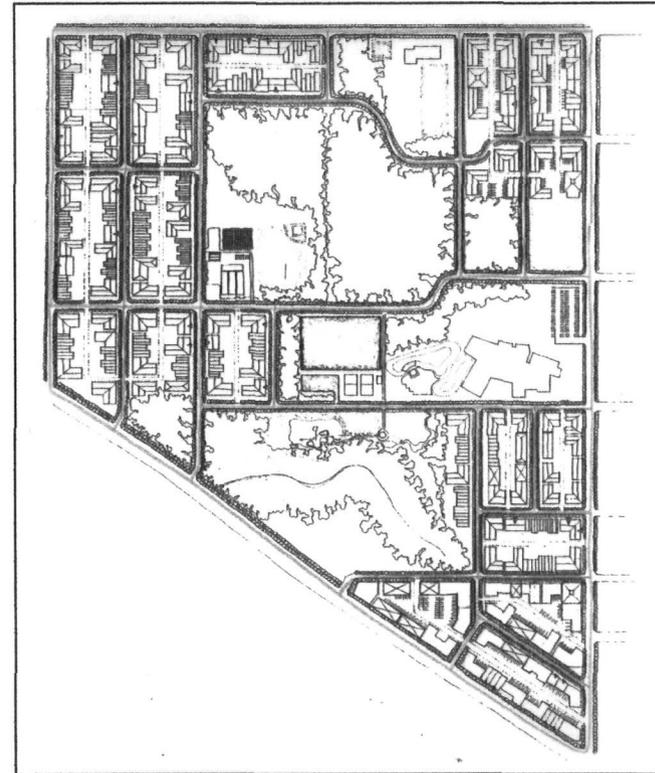
Figure 6. Length of storm sewers for a) the typical plan, and b) the alternative plan.

Length of Roads

Similar to length of storm sewer, length of roads incurs installation and maintenance costs as well as increasing the amount of impervious surface area. The alternative plan had 113% more lineal metres of roads than the typical.



a)

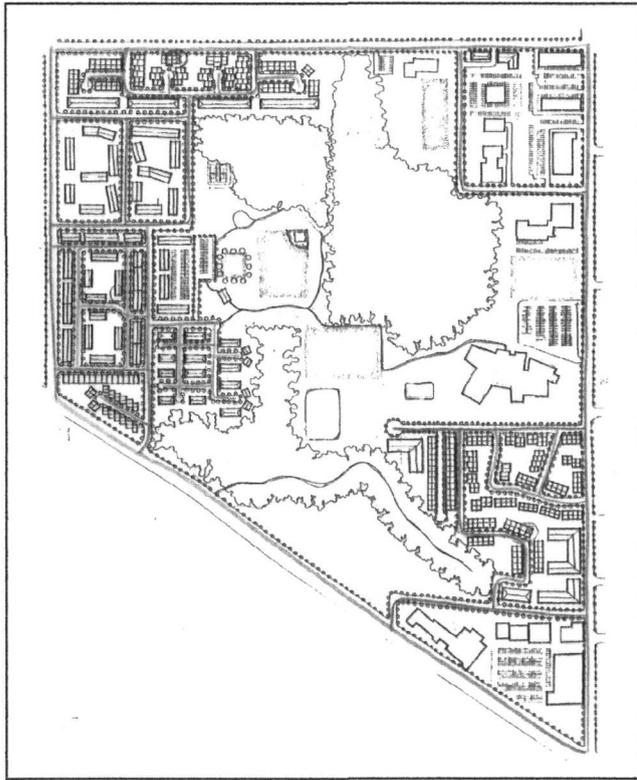


b)

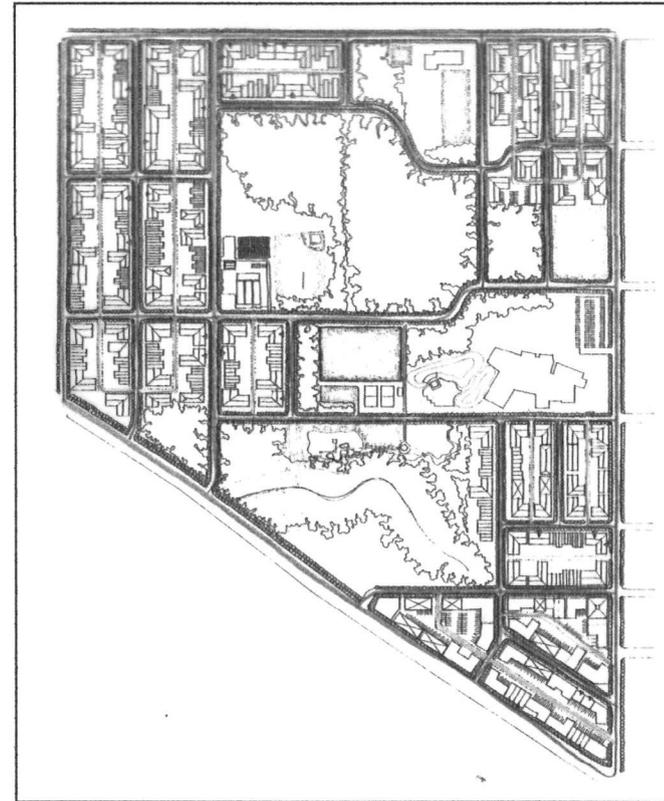
Figure 7. Length of roads for a) the typical plan, and b) the alternative plan.

Public and Semi-private Roads

The alternative design with laneways as semi-private had 216% more semi-private roads.



a)

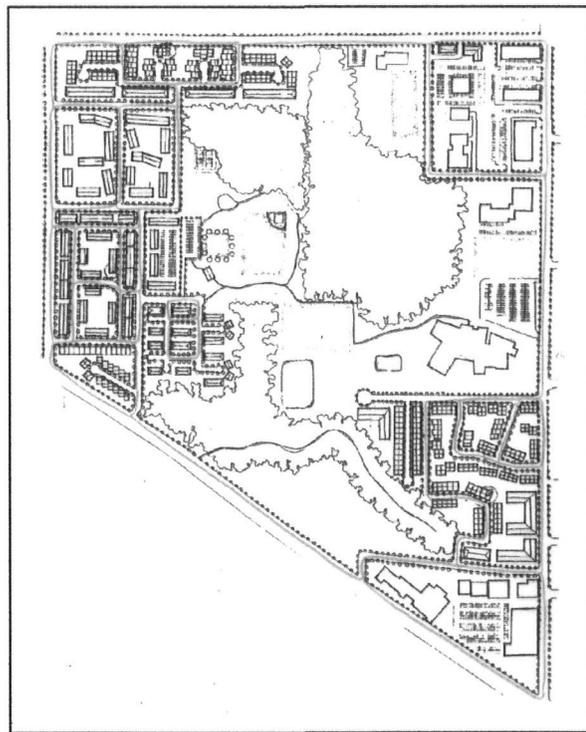


b)

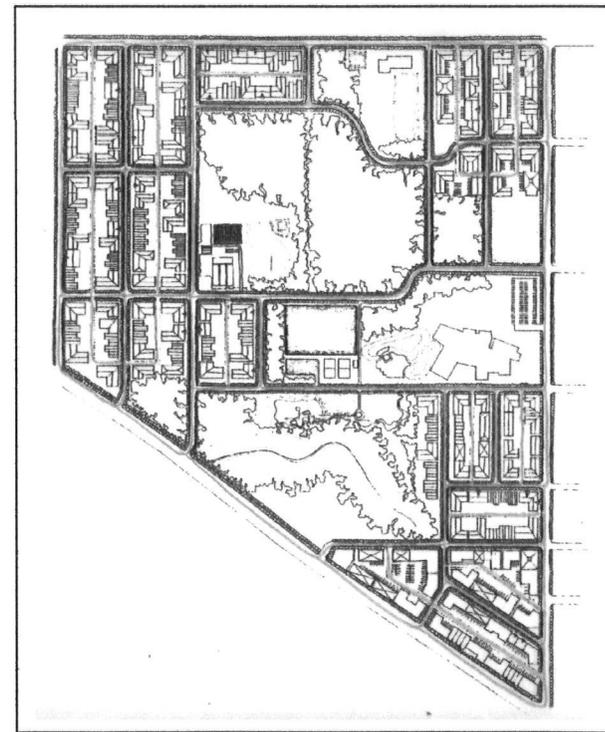
Figure 8. Length of public (purple) and semi-private (blue) roads a) the typical plan, and b) the alternative plan.

Permeability

Permeability can be defined as the number of options one has to penetrate or move through a site. The more options one has, the more opportunities there are to experience and become familiar with the site. The number of circuits or loops one can potentially make is an indicator of permeability. Using the half-block as one unit or "loop", permeability is 210% greater in the alternative than the typical.



a)

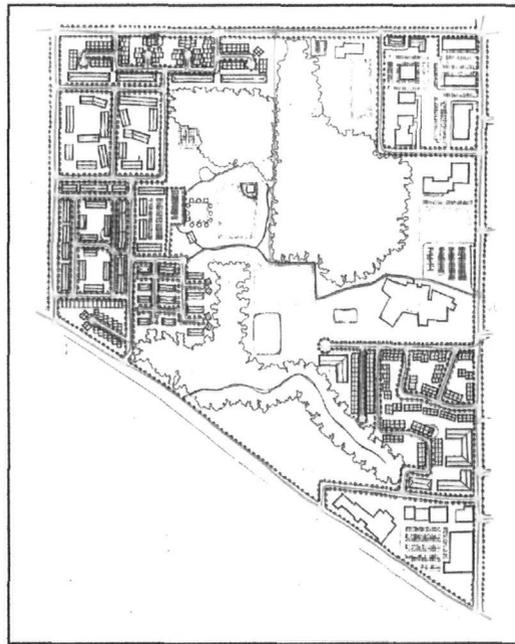


b)

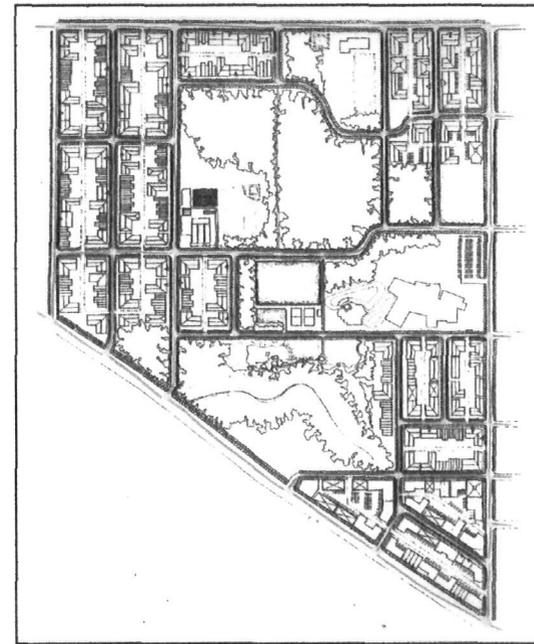
Figure 9. Permeability "loops" for a) the typical plan, and b) the alternative plan.

Pedestrian Connectivity The more connected a site, the easier it becomes for people to move through the site.

The more connected a site for pedestrians, the more likely it is that people will walk from one destination to another. To measure connectivity, I used Forman's Connectivity Index, which measures the relationship of nodes and linkages where the greatest possible connectivity measure approaches 1. Pedestrian connectivity was 132% higher in the alternative plan compared to the typical.



a)



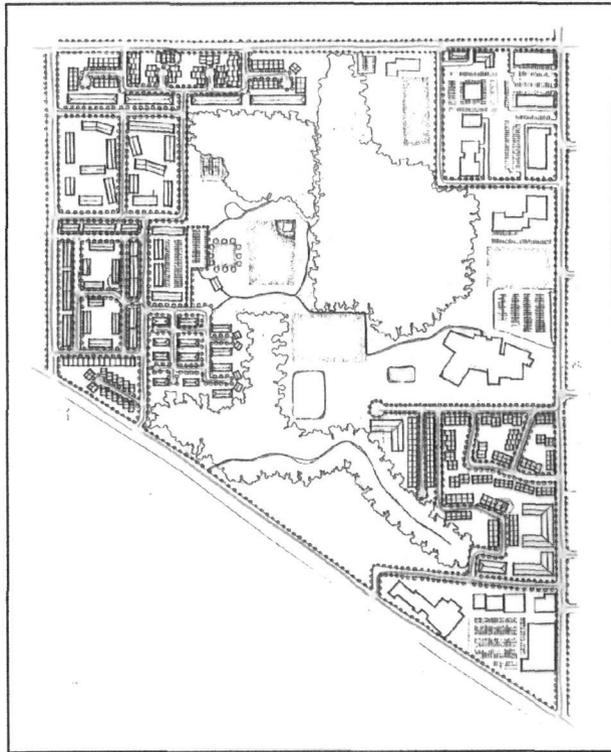
b)

Figure 10. Pedestrian connectivity as indicated by Formans' Index for a) the typical plan, and b) the alternative plan [nodes (yellow), linkages (green)].

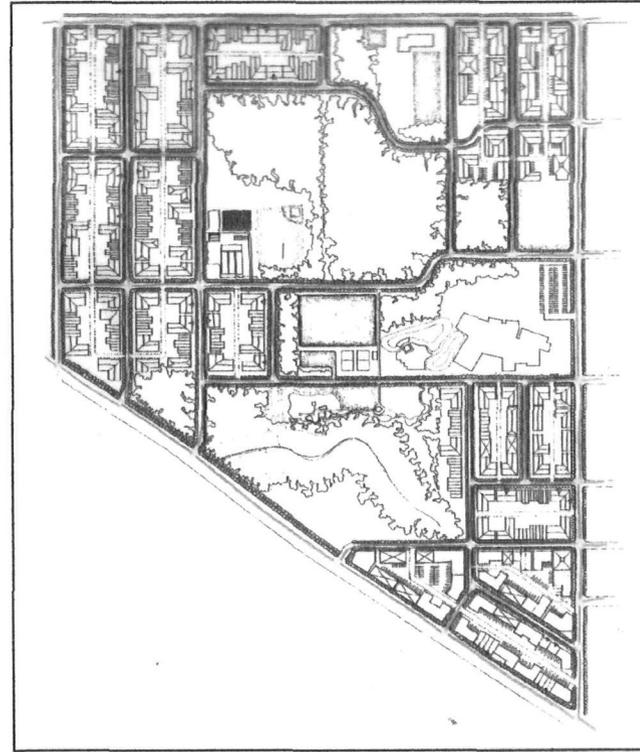
Road Connectivity

Similarly, road connectivity was measured using Forman's Connectivity Index.

Generally, greater road connectivity indicates more direct routes and shorter distances between destinations. Road connectivity was 127% higher in the alternative plan compared to the typical.



a)

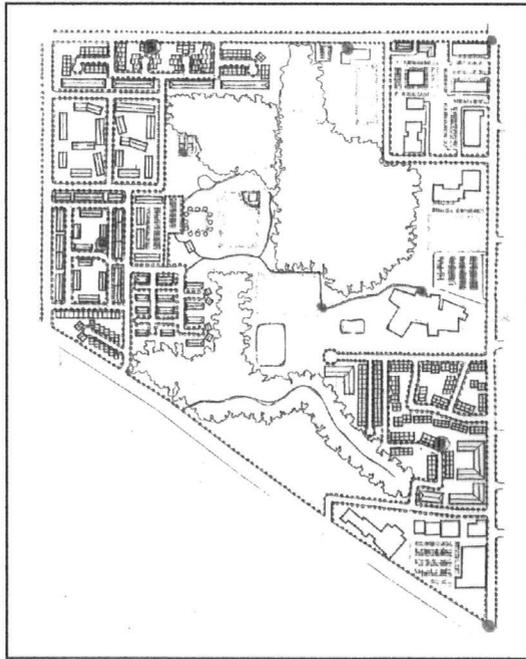


b)

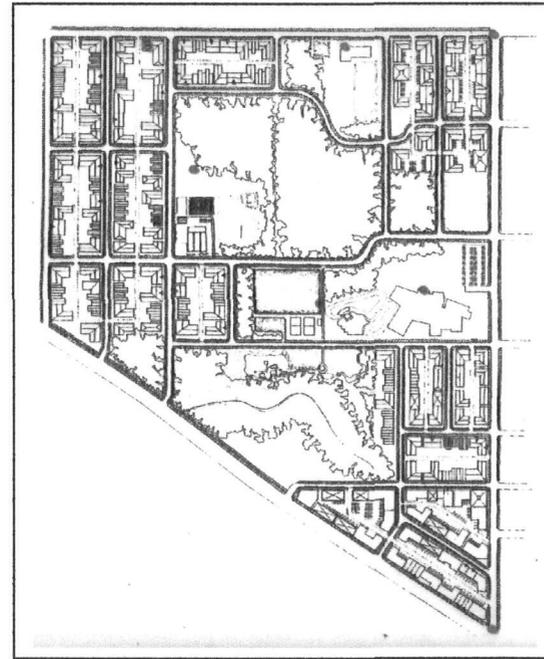
Figure 11. Road connectivity as indicated by Formans' Index for a) the typical plan, and b) the alternative plan [nodes (yellow), linkages (green)].

Average Walking Distances to Key Nodes

The average time to walk 400m is five minutes. It is found that most people will drive rather than walk to their destination if it is greater than a 5-10 minute walk. To compare average walking distances, the distances to 6 key community nodes were measured from 3 random locations. In the alternative plan (622m, 713m, 681m respectively), walking distances were 85%, 98% and 89% of those in the typical plan (703m, 723m, 760m respectively).



a)



b)

Figure 12. Average walking distances from three locations to six nodes for a) the typical plan, and b) the alternative plan.

10.0 STORMWATER PARK

The second component of my project was to do a more detailed design of certain areas of the alternative plan. The first is the Stormwater Park (Appendix - Sheet L9). The primary function of this integrated park and school site is a stormwater retention area for approximately 50% of the Clayton Village site and 30% of the East Clayton site. The stormwater that is not infiltrated within close proximity to where it falls as precipitation is conveyed through the roadside swales that gathers at the north east end of the site of the secondary school. Here, the water enters one large conveyance swale. On the west side of the school, this water enters the first of a series of 2 ponds. The depth of this pond reaches a maximum of 1m at the far end of the pond nearest to its outlet under the road. In this pond, the velocity of the water is slowed down to allow any sediments or contaminants to settle out. Because contaminants and sediments will collect in this pond, periodic dredging may be necessary as part of the stormwater system's maintenance program. The pond is planted with native aquatic emergents (*Typha latifolia*, *Carex* spp., Irlises etc) which contribute to biofiltration of the water.

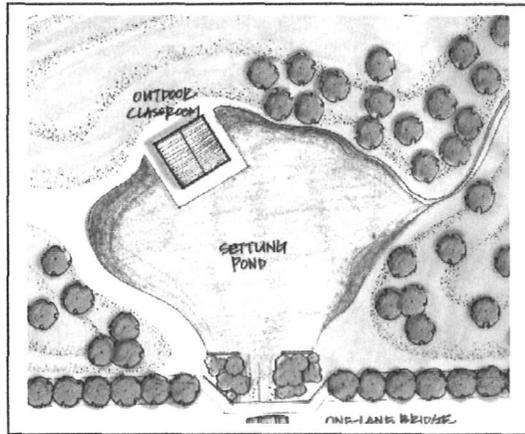
Located on the edge of this pond is a covered structure and amphitheatre style seating which can be used as an outdoor classroom by the adjacent high school and a outdoor theatre by the community. From here, the water is then conveyed through an artificial stream channel across the street under a one lane car bridge, through the park to a marsh complex where the water is further biofiltered by aquatic plants and microorganisms. The snakelike configuration of the marsh complex maximizes the contact time necessary for successful biofiltration.

The water then enters a second pond where it is allowed to slowly infiltrate back into the soil and the nearby creek. In the event of a large storm the site is graded such that the overflow would fill an open lawn area, a children's play area and then the sports field.

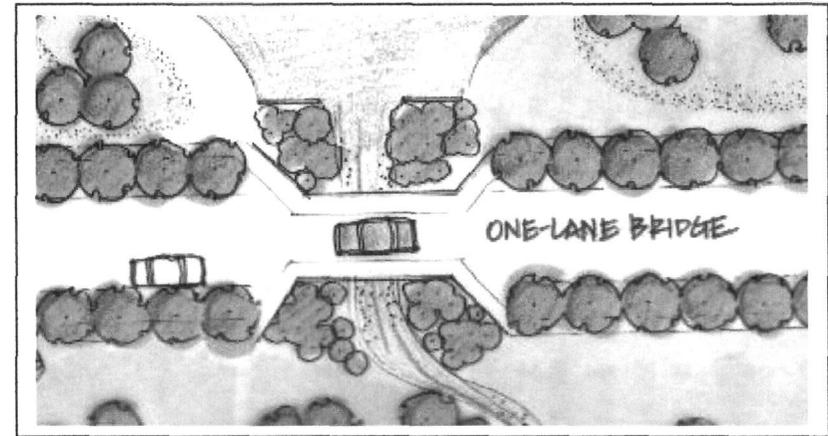
Although the primary function of the ponds is to serve as the main stormwater retention area, it is also important to demonstrate how the stormwater system becomes integrated with the school and park sites, to function as a community amenity (Appendix - Sheets L10, L11, L12). The sections on sheet L10 show the pond in relation to the school in the background and how the water empties into the stream under the bridge and through the park. The berms and vegetation planted on the south and west side of the school building help cool and shade the building during warm weather as well as decrease the scale of the building. The sections on sheet L11 (Appendix) show the second pond with a wooden boardwalk and lookout relative to the street as well as the pond's location relative to the creek and 30 metre riparian buffer. The native aquatic plants, marsh complex, and wildlife islands, also provide interpretive and educational opportunities. Sections on sheet L12 (Appendix) indicate the characters of the *covered structure and one lane car bridge*.

Other features of the park include a gravel parking area sloped towards a rain basin infiltration area. This infiltration area is planted with trees, shrubs and herbaceous plants that can tolerate fluctuating water levels. A gazebo structure is located at the centre of the south edge of the park, for outdoor performances and community events. To the south east of the gazebo is a

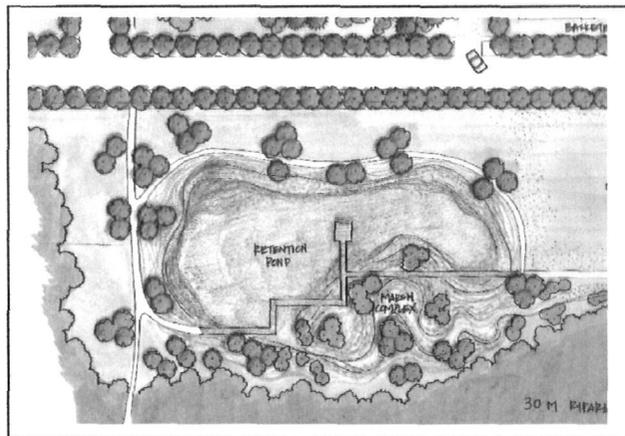
multi-use greenway trail that leads to the commercial area at the south east corner of the Clayton Village site.



a)



b)



c)

Figure 13. Detailed plan views in Stormwater Park of a) the settling pond, b) the one-car bridge and stream channel crossing, and c) the retaining pond (not to scale).

11.0 THE COMMUNITY GARDEN

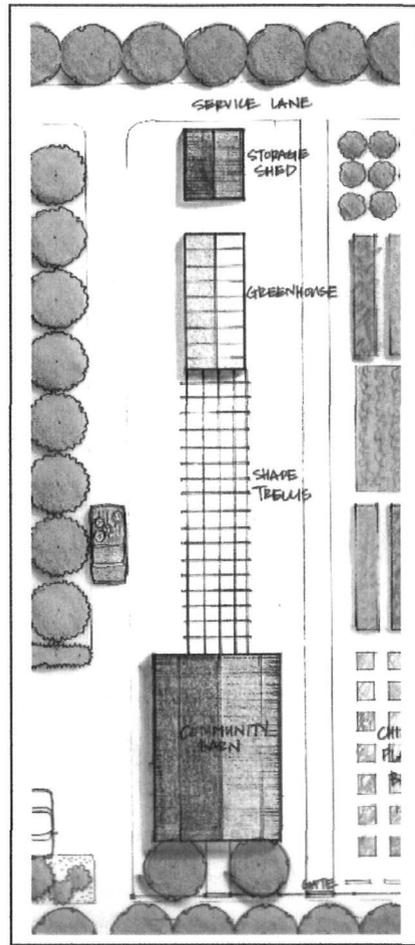
The second area that was designed in greater detail was the existing Clayton Park site. A community garden, which includes a community barn, planting areas, an orchard, a greenhouse and a solar aquatics wastewater treatment facility (Appendix – Sheet L13). The main functions of the garden are to provide a social gathering space, a place for education about sustainable land use practices and simply, an opportunity for people to garden who may otherwise not have access to the land.

The community garden is centered around the multi-use community barn, which is meant as both a work space and community gathering space. The barn can also function as a community resource centre, offering courses and workshops. A gravel parking area with rain basin infiltration area is located on the north side of the barn. Behind the barn, a shaded trellis walkway leads to a greenhouse and storage shed (Appendix - Sheet L15). In the garden, there are individual raised planting beds, communal beds, berry crops, a fruit orchard, children's planting beds and a children's play area. A gravel service lane provides for easy pick-up and delivery of heavy loads such as fruit, equipment and planting soil.

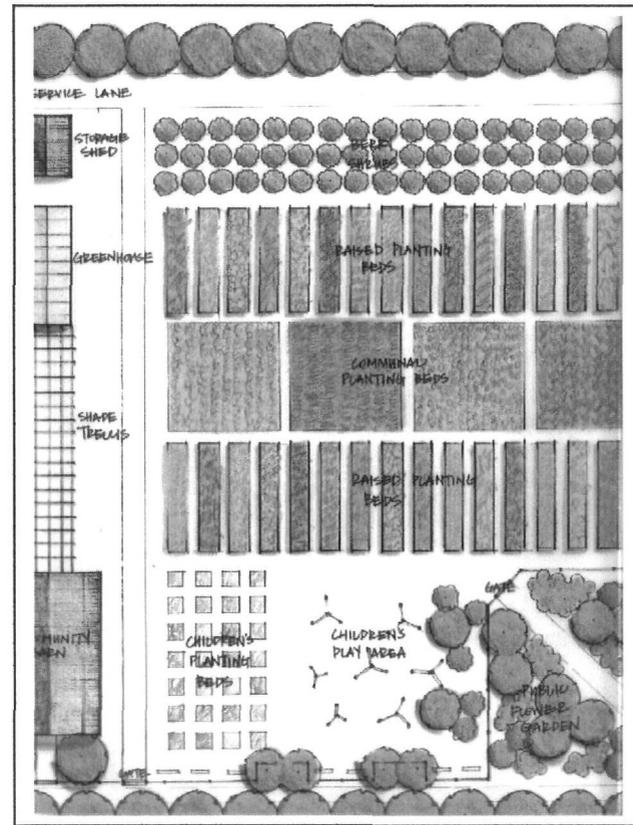
On the site, there is also a solar aquatic wastewater treatment facility sized to service approximately 100 homes in the area. The purpose of this facility is to clean water for re-use in irrigation as well as a demonstration and educational facility. As the community develops over time, the facility could be expanded to service a larger part of the community. Lastly, at the south east corner of the site is a public flower garden which provides a public gathering place for

both gardeners and other members of the community. A community news board at the entrance to the public flower garden provides an opportunity to display information on community garden projects and as well as other community news.

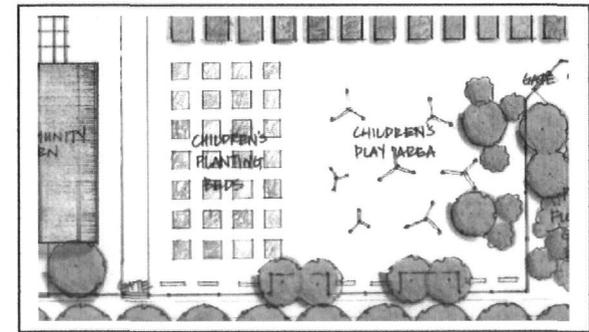
The sections on sheet L14 (Appendix) show how this garden would look from residences across the street. Vegetation buffers the gravel parking area located north of the barn. Several gateways along the street provide access to the barn, the garden area and the public flower garden. Sections on sheet L15 (Appendix) show a view from inside the garden looking towards the barn, trellis walkway and greenhouse. The trellis provides a shaded walkway and seating area, as well as a growing structure for vine crops. Composting bins are located on the north side of the greenhouse with the opportunity to direct heat generated through the composting process into the greenhouse as a heat source. Wooden cold frames are located on the south side of the greenhouse.



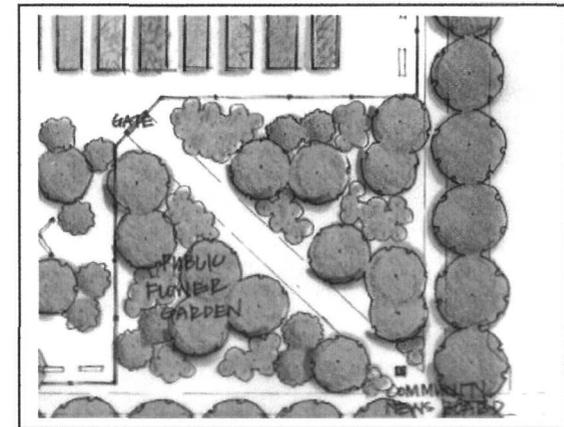
a)



b)



c)



d)

Figure 14. Detailed plan views in the Community Garden of a) the barn and greenhouse, b) individual and communal gardening plots, 3) the children's plots and play area, and d) the public flower garden (not to scale).

12.0 STREET DETAILS

Lastly, I looked at what a typical residential and commercial street might look like. The section on sheet L16 shows a typical residential street with a narrow service laneway. The laneway provides space for overhead utilities as well as rear access to underground parking. In the front, the shallow setback and pedestrian-scale sidewalks with dense street tree plantings enhance the street architecture and encourage social interaction. Drainage swales parallel to the roadway provide surface conveyance of stormwater. Traffic calming measures are also incorporated into the street environment with traffic bulges and accent paving to delineate pedestrian crossings.

The commercial street section (Appendix - Sheet L17) shows a rear service lane with rear surface parking, and screening from the sidewalk. Similar to the residential laneway, overhead utilities and access to underground parking occur here. On the street face, 45 degree angled parking stalls are provided, with gravel infiltration areas and a rain basin that infiltrates and biofiltrates water. Similarly, there are traffic bulges and accent paving. A 2m setback with covered awnings that extend over the sidewalk and outdoor seating areas encourage social interaction and enhance a sense of community ownership and place.

13.0 CONCLUSION

The overall goal for this thesis was to explore principles of sustainable development through planning and design. It was an interesting and educational exercise to do this through comparison of the typical and alternative principles of development.

It was made apparent through this exercise that sustainable principles and practices are not without their flaws, complexities and unknowns. Nature is in constant flux and highly unpredictable, especially when combined with human alteration on the land. We should not, however, see this as a deterrent, rather as a motivator. These uncertainties of nature add further proof that sustainable practices are as critical and relevant as ever.

14.0 REFERENCES

"Alternative Development Standards for Sustainable Communities: Design Workbook". 1998. Fraser Valley Real Estate Board, Surrey, BC.

Dramstad, W.E., Olson, J.D. and R.T.T. Forman. 1996. Landscape Ecology Principles in Landscape Architecture and Land-Use Planning. Harvard University Graduate School of Design, Island Press and the American Society of Landscape Architects, Washington, D.C.

"East Clayton Neighbourhood Concept Plan (NCP)". 2000. City of Surrey.

"Future Directions for the Provision of Parks, Recreation, Heritage and Cultural Facilities and Services". Parks and Recreation Master Plan 1996-2006. City of Surrey, Parks and Recreation Department.

Girling, C., Kellest, R., Rochefort, J. and C. Roe. 2000. Green Neighbourhoods: Planning and Design Guidelines for Air, Water and Urban Forest Quality. University of Oregon Center for Housing Innovation, Eugene, Oregon.

"The Headwater's Project – The East Clayton Neighbourhood Concept Plan Environmental Benefits". James Taylor Chair in Landscape & Liveable Environments Technical Bulletin No. 8, January, 2001.

Lyle, J. T. 1994. *Regenerative Design for Sustainable Development*. John Wiley & Sons, Inc., New York.

Lerner, S. and W. Poole. 1999. *Economic Benefits of Parks and Open Space*. The Trust for Public Land (www.tpl.org).

"Literature Review: The Economic Value of Urban Open Space". James Taylor Chair in Landscape & Liveable Environments, Technical Bulletin No. 7, October 2000.

North Cloverdale East; Neighbourhood Concept Plan. 1994. City of Surrey, Planning and Development Department.

"Our Common Future". 1987. World Commission on Employment and Development Staff. Oxford University Press.

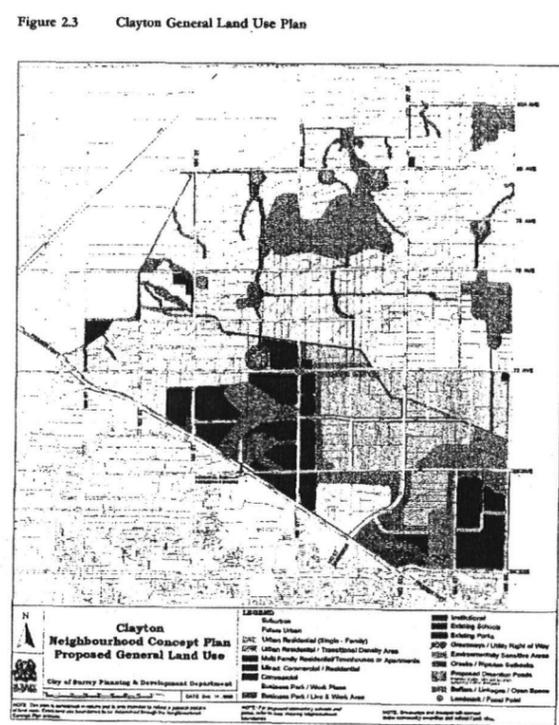
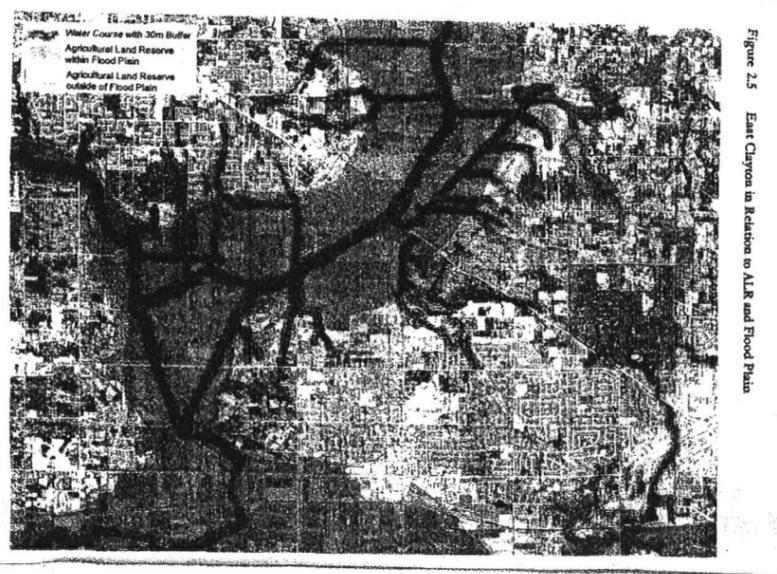
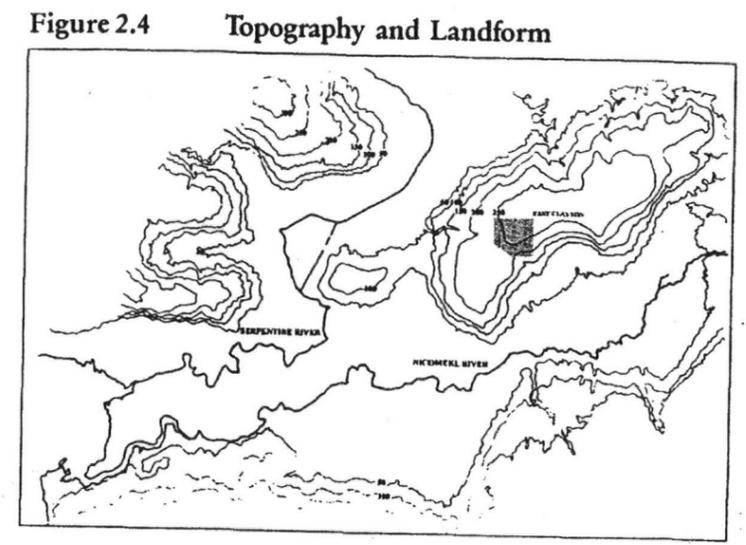
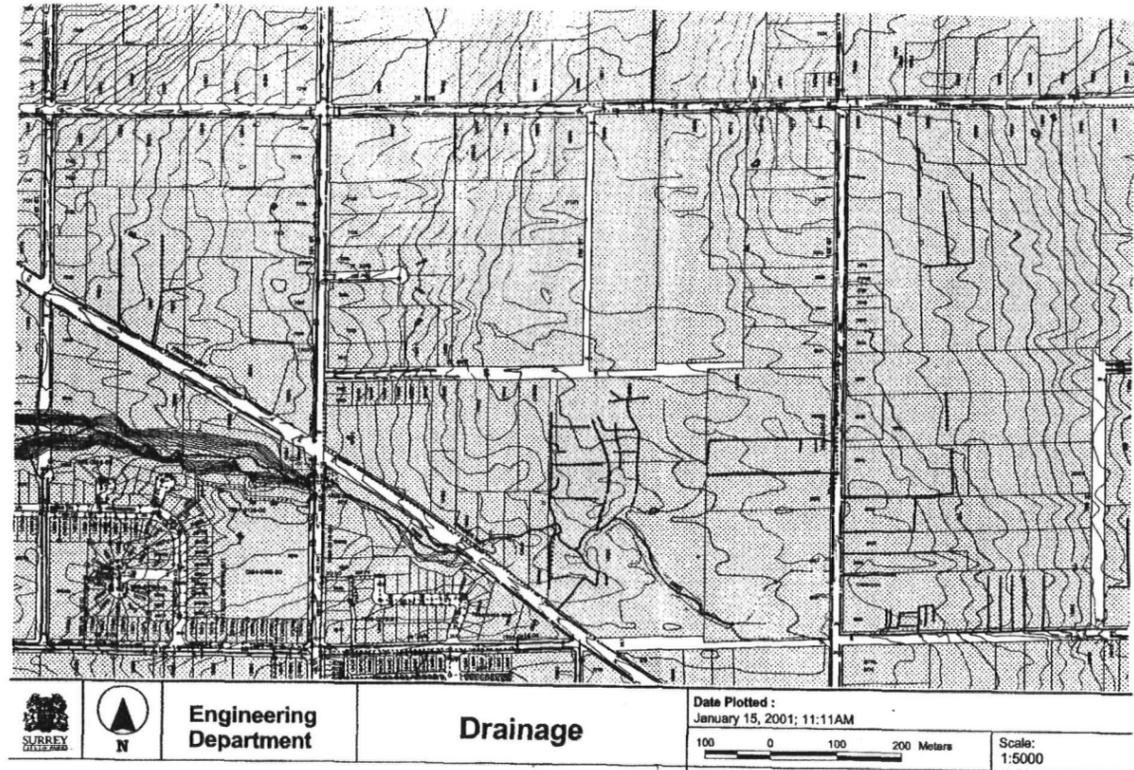
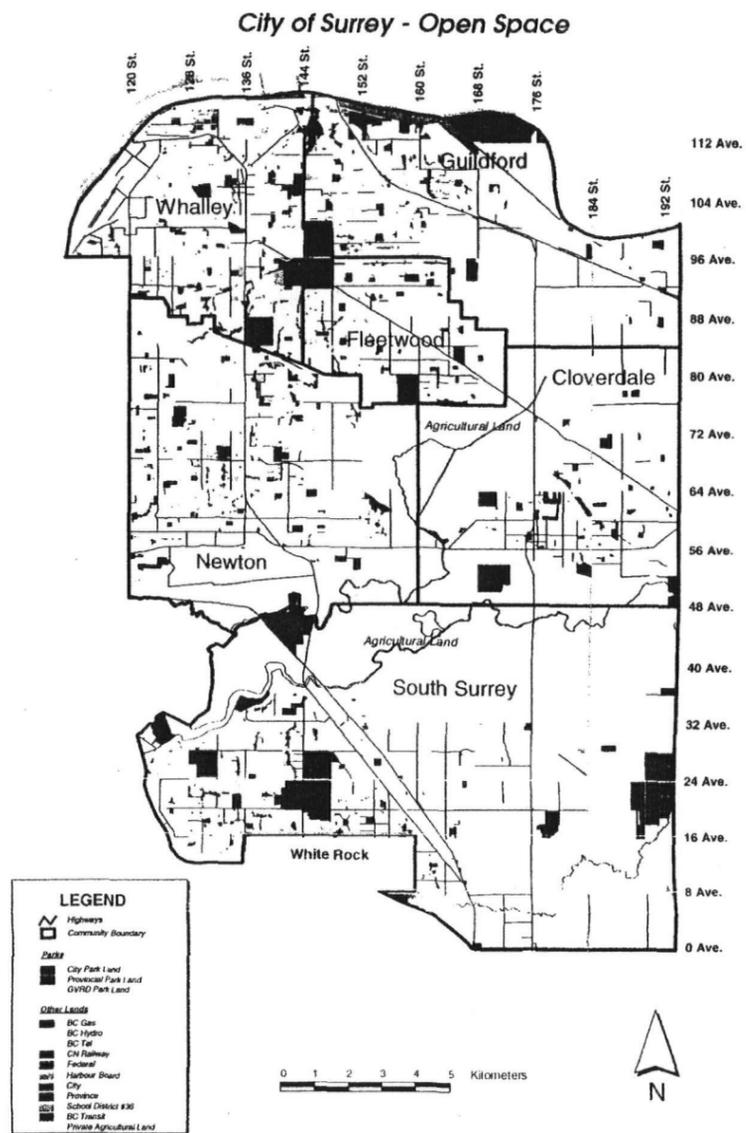
"Sustainable Urban Landscapes: The Surrey Design Charrette". 1996. P. M. Condon (ed.). James Taylor Chair in Landscape & Liveable Environments. University of British Columbia, Vancouver, BC.

Tibbets, J. 1998. *Open Space Conservation: Investing in Your Community's Economic Health*. Lincoln Institute of Land Policy, Cambridge, Massachusetts.

"Wastewater and Stormwater Applications of Wetlands in Canada". North American Wetlands Conservation Council Issues Paper, No. 1994-1.

15.0 APPENDIX – PRESENTATION DRAWINGS

- L1 Regional Context
- L2 The Seven Principles
- L3 Typical Community Plan
- L4 Alternative Community Plan
- L5 Aerial Views
- L9 Stormwater Park Plan
- L10 Stormwater Park Sections
- L11 Stormwater Park Sections
- L12 Stormwater Park Sections
- L13 Community Garden Plan
- L14 Community Garden Sections
- L15 Community Garden Sections
- L16 Street Details
- L17 Street Details
- L18 Street Details



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regional context

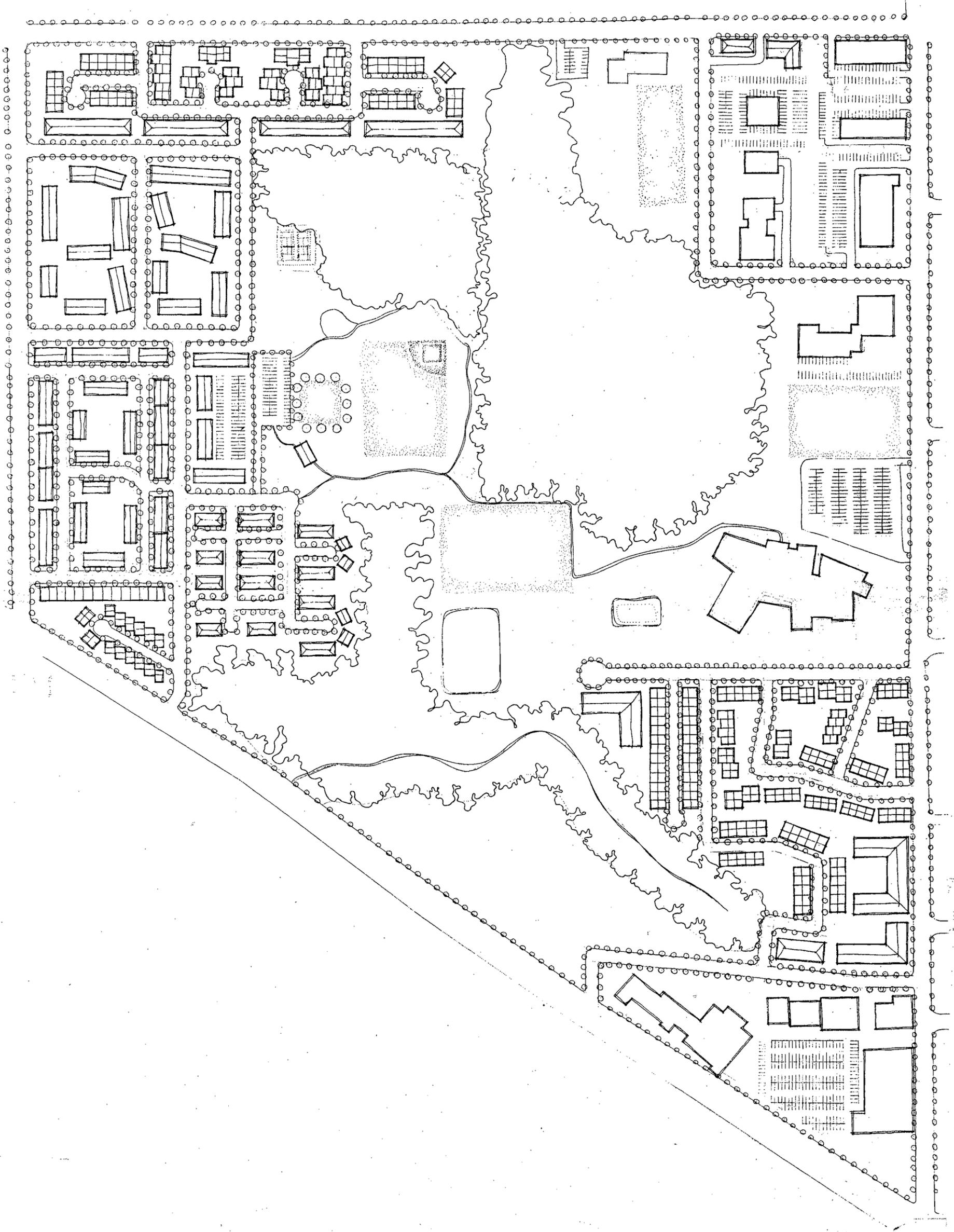
1. Increase density and conserve energy by designing compact walkable neighbourhoods
2. Provide different dwelling types in the same neighbourhood and even on the same street
3. Communities are designed for people; therefore, all dwellings should present a friendly face to the street
4. Ensure that car storage and services are handled at the rear of the dwellings
5. Provide an interconnected street network, in a grid or modified grid pattern
6. Provide narrow streets shaded by rows of trees
7. Preserve the natural environment and promote natural drainage systems

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the seven principles

L2

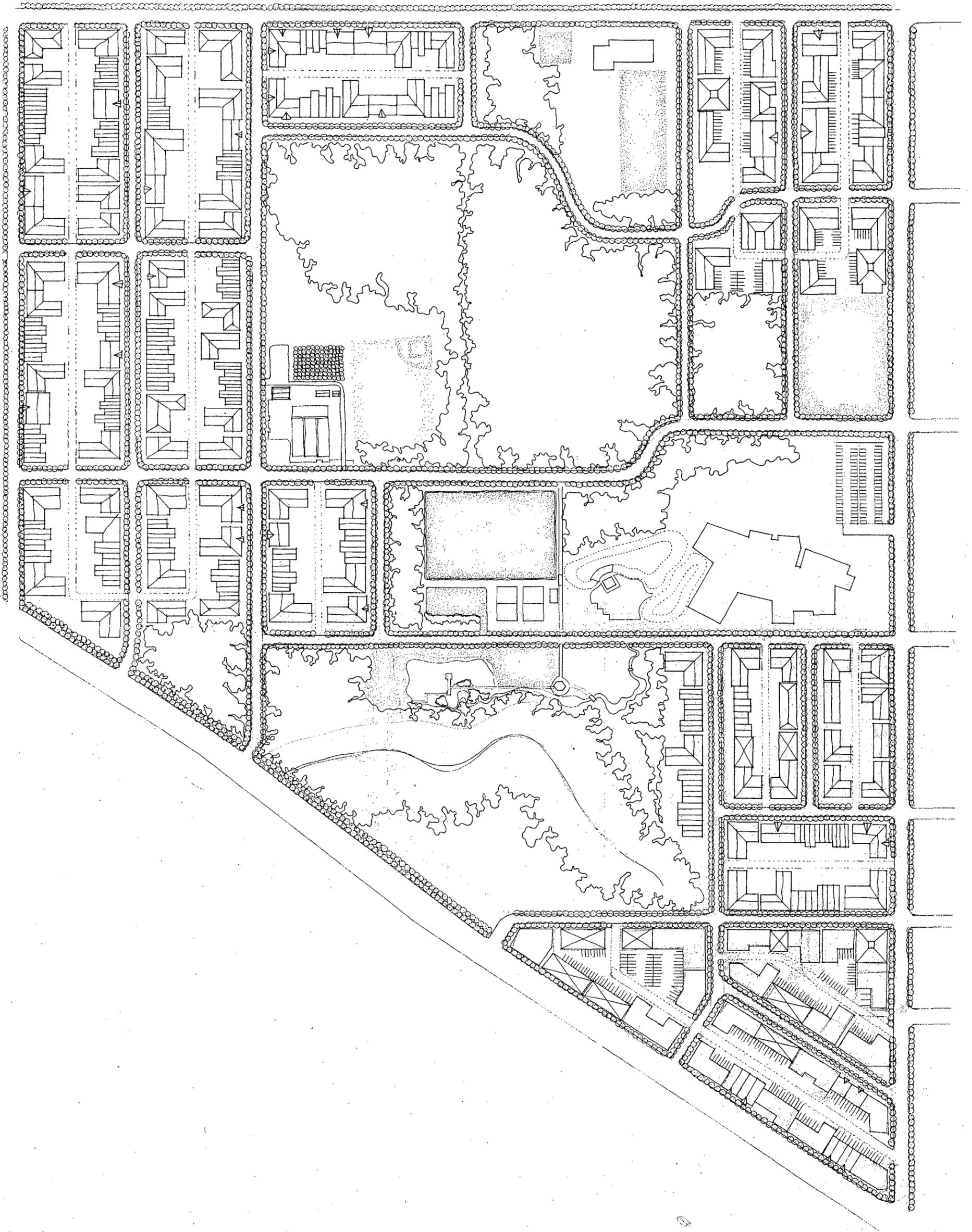


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typical community plan

L3



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alternative community plan



Typical community plan



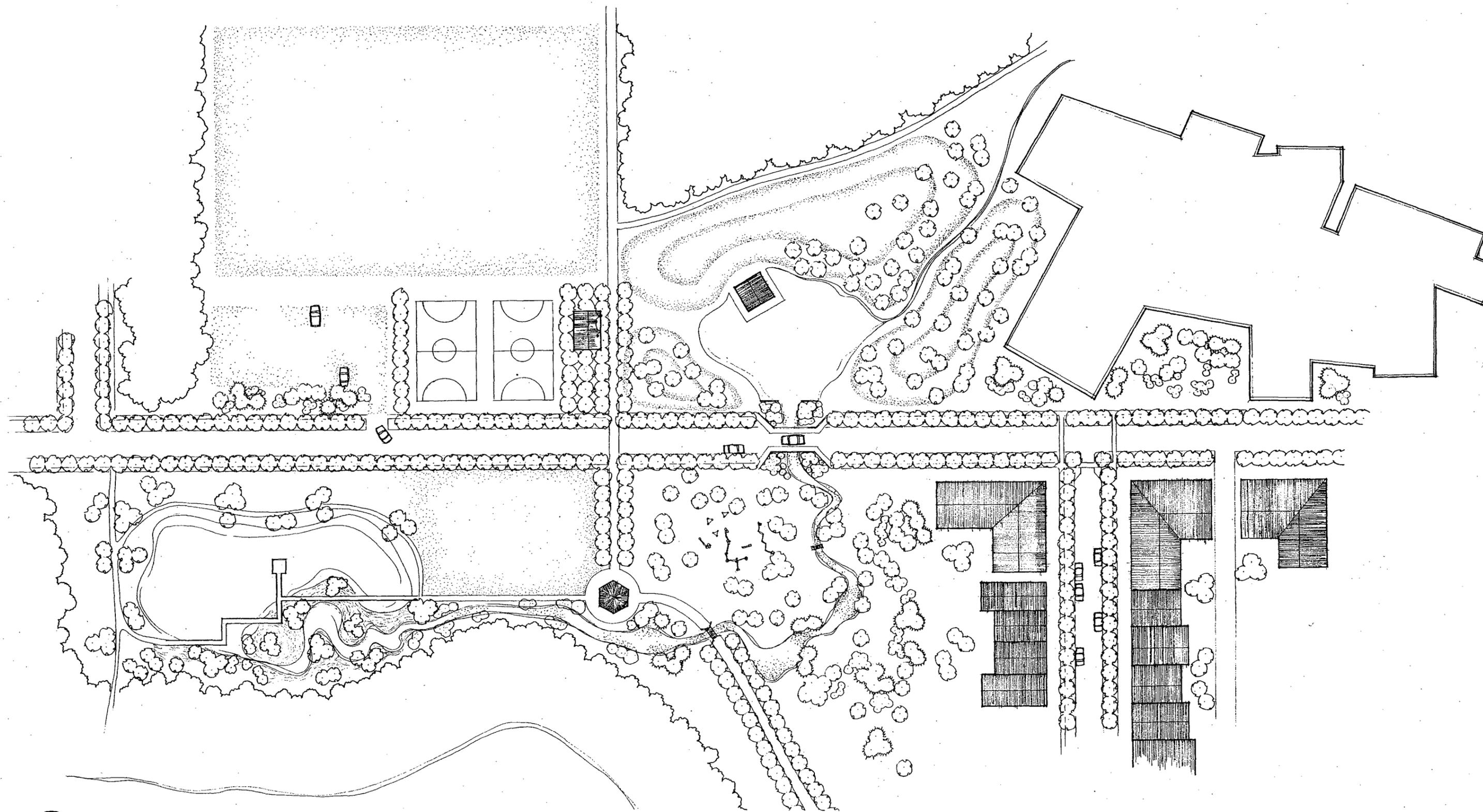
Alternative community plan

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aerial views

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L5

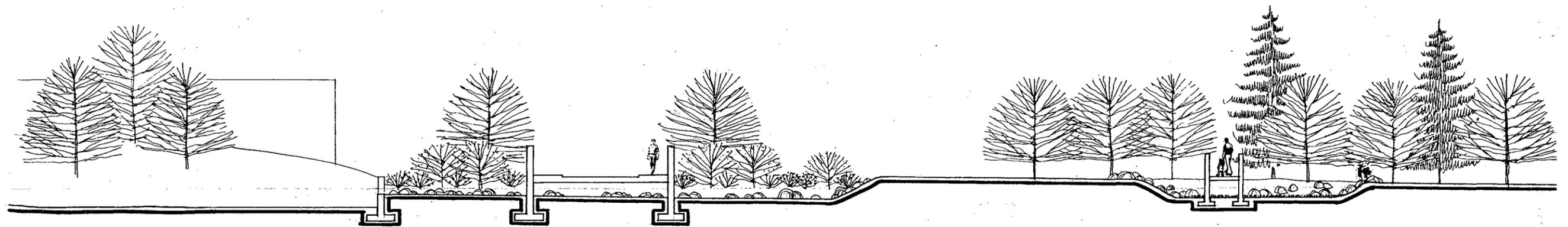
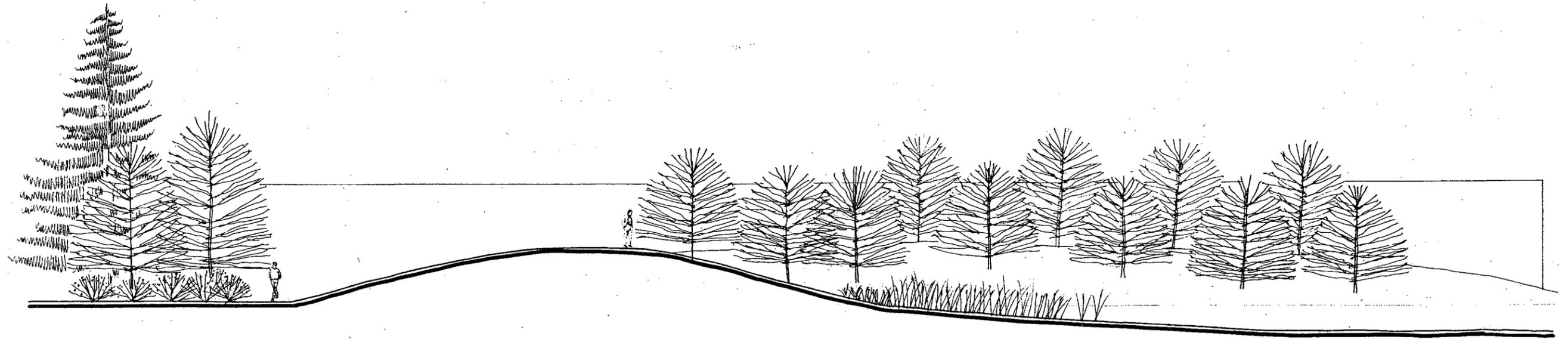


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stormwater park plan

L9

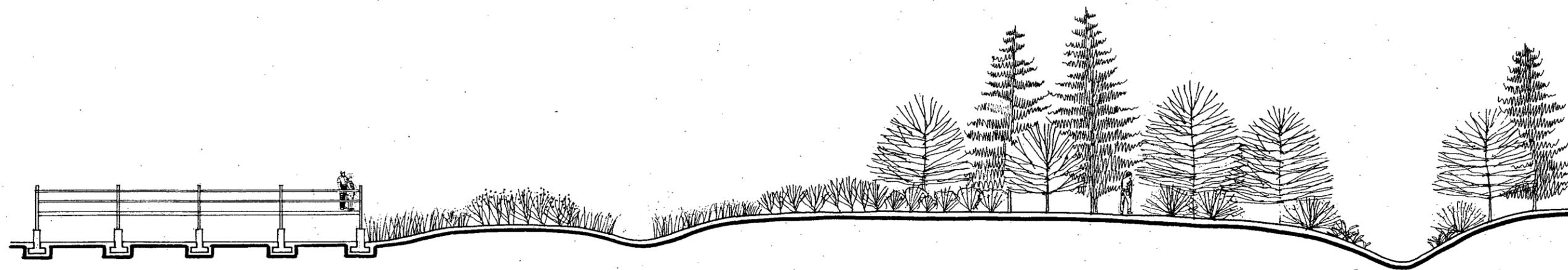
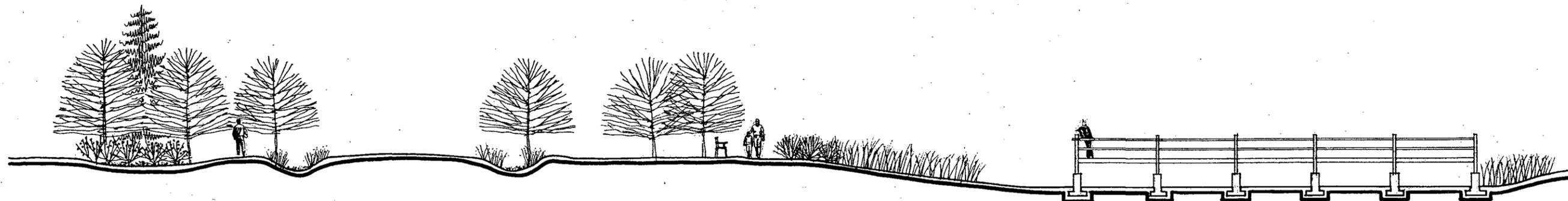


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stormwater park sections

L10

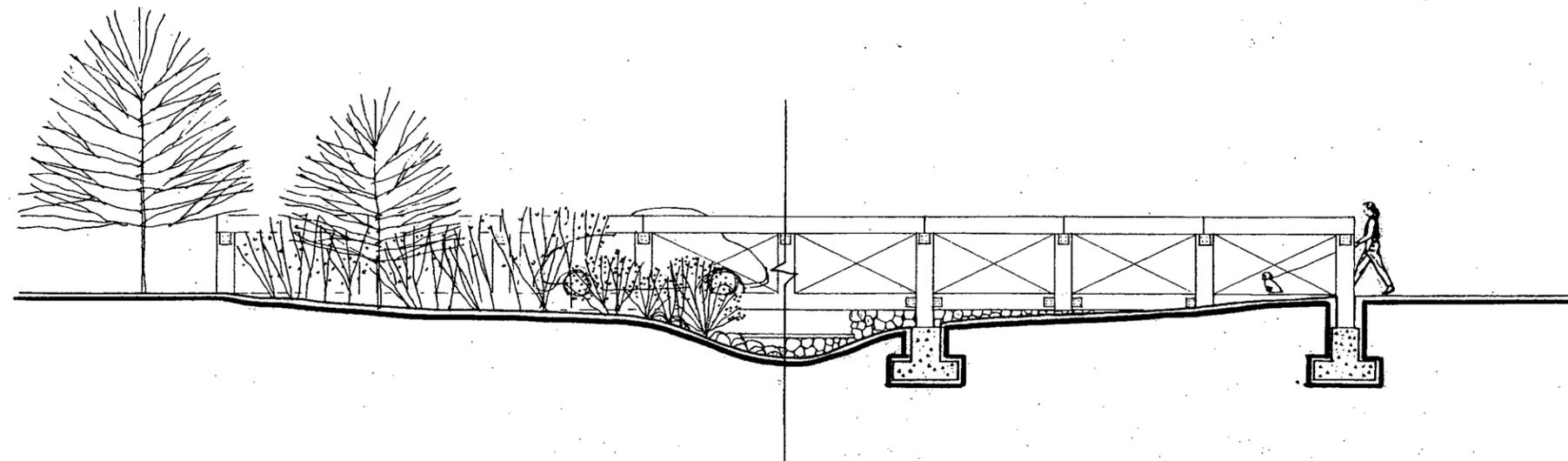
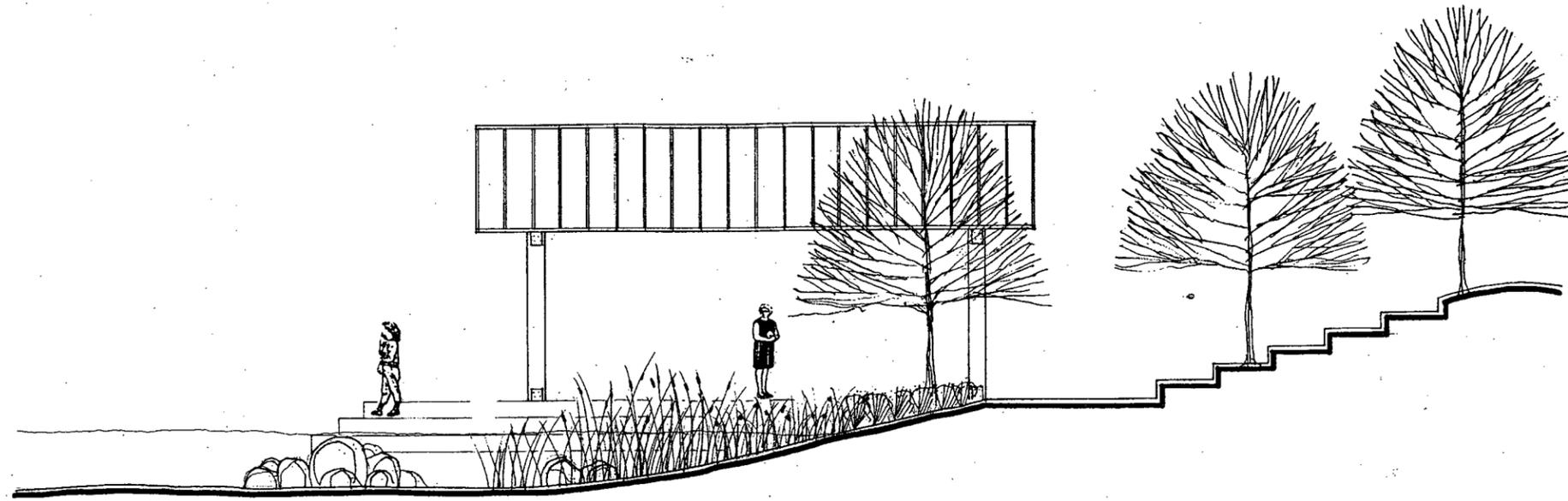


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stormwater park sections

L11

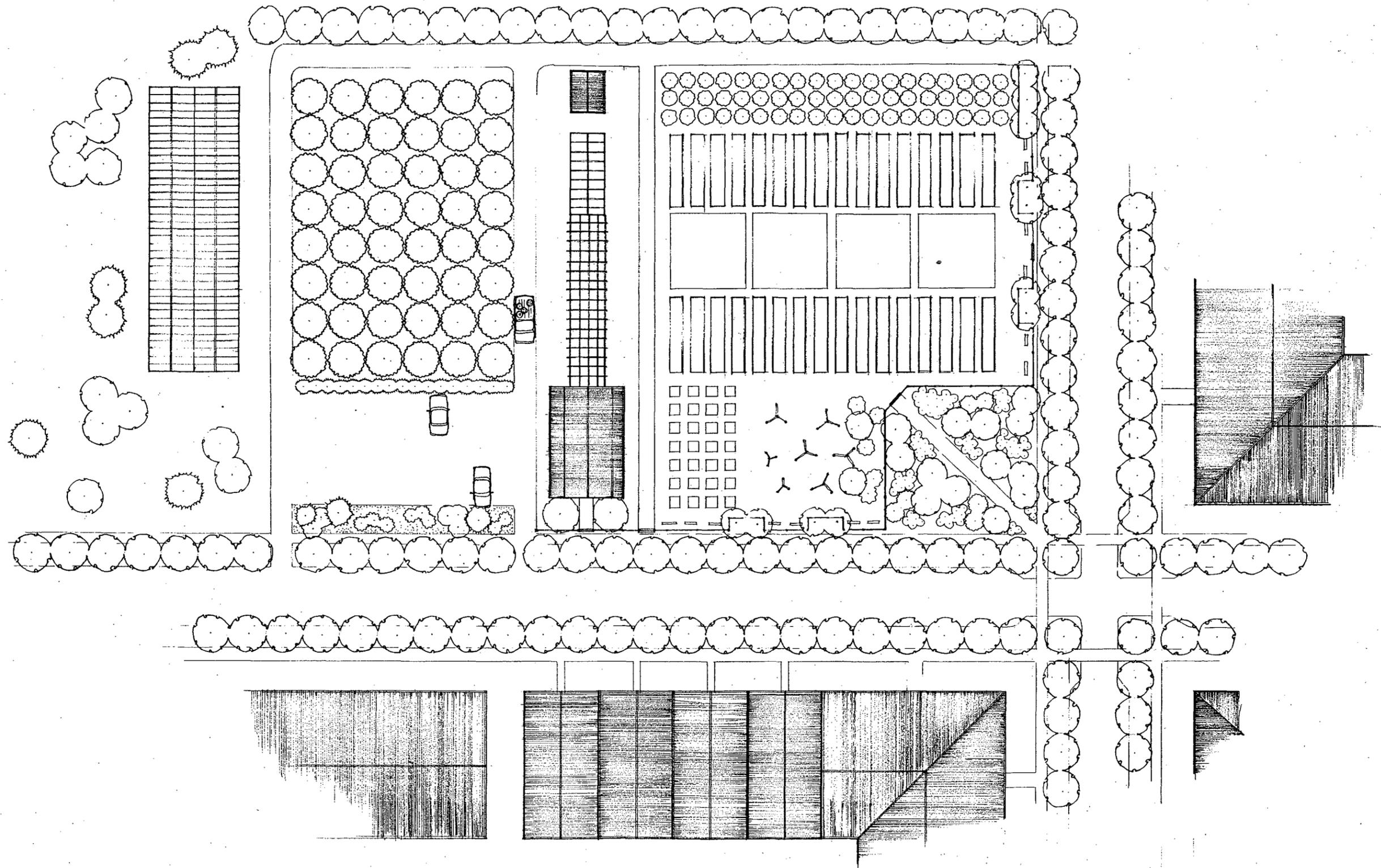


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stormwater park sections

L12

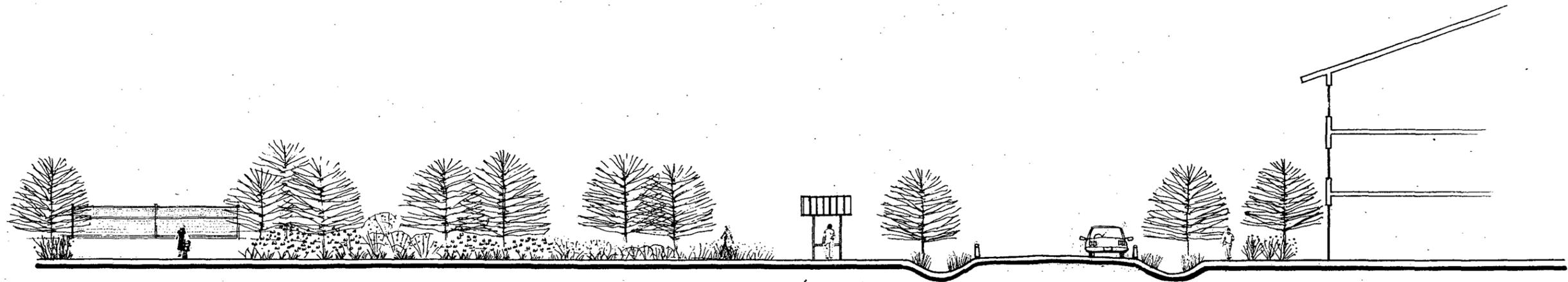
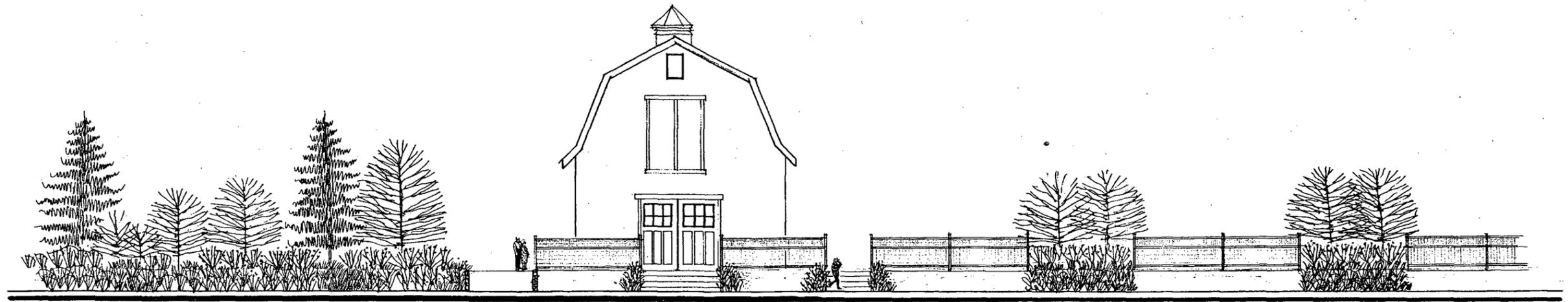


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community garden plan

L13

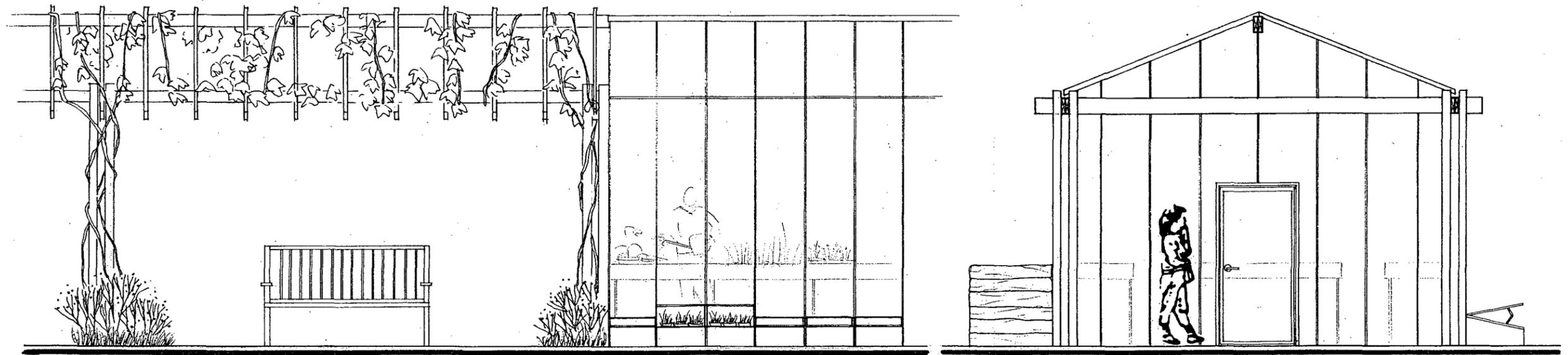
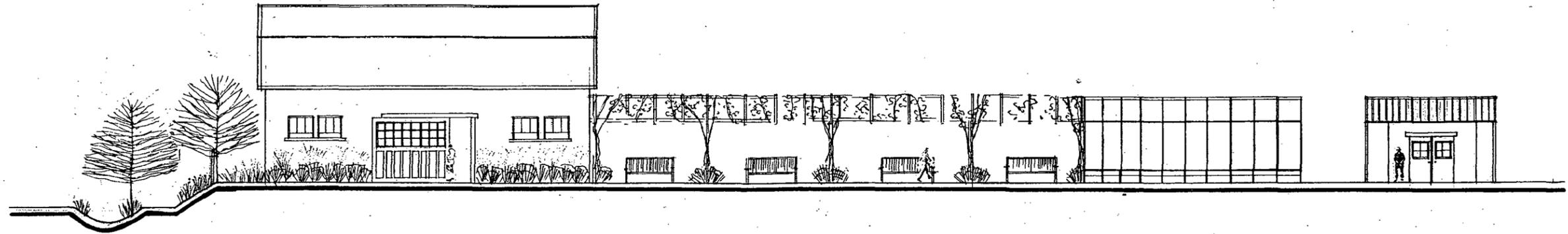


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community garden sections

L14

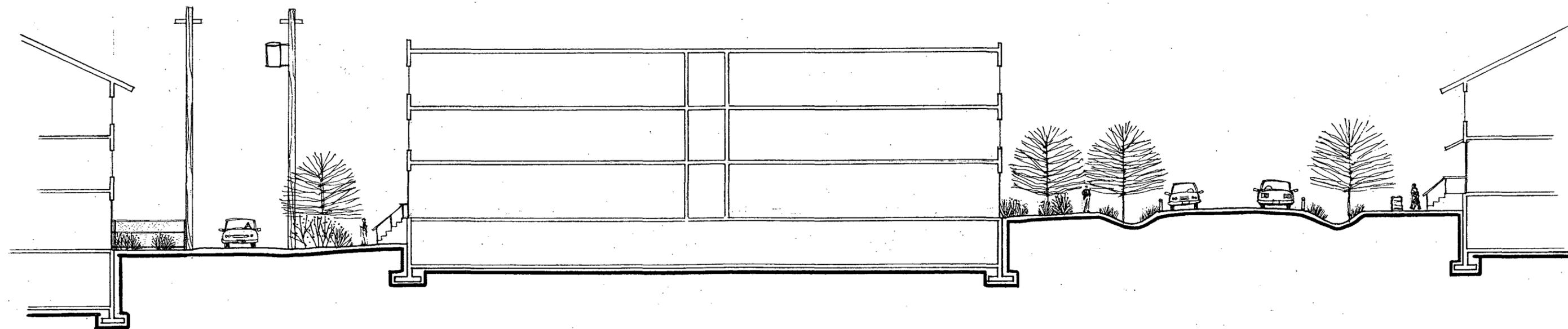
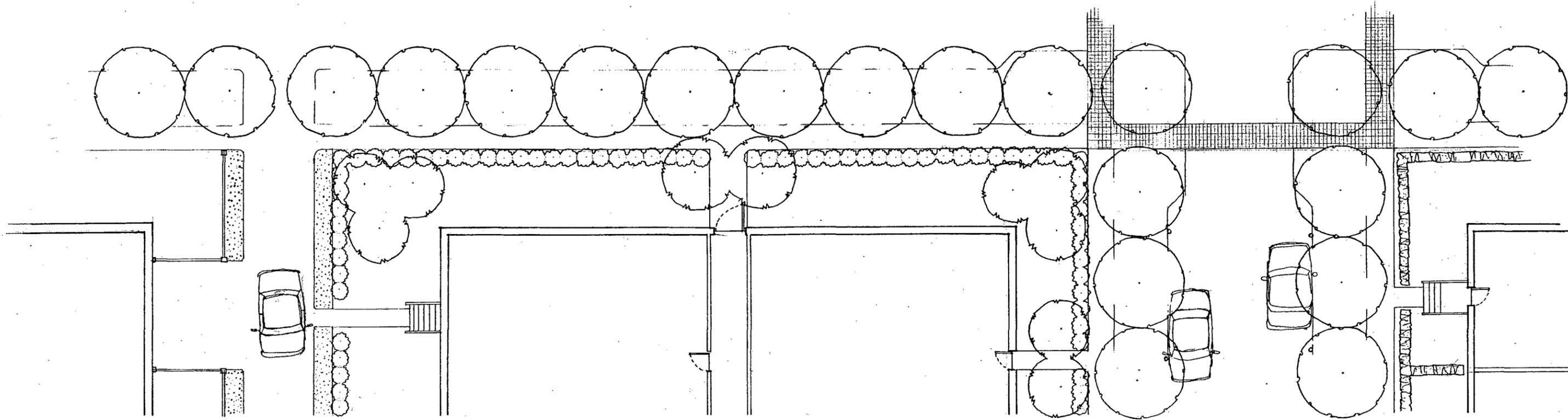


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community garden sections

L15

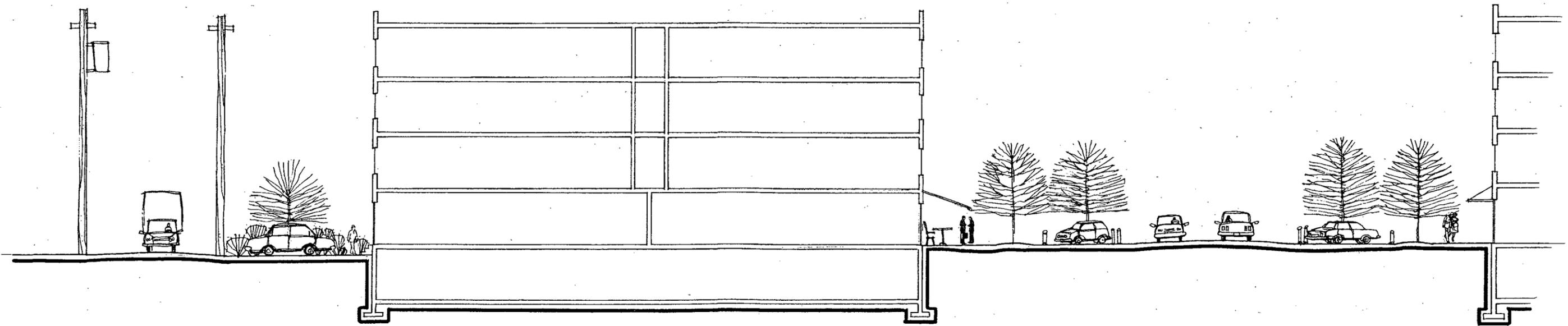
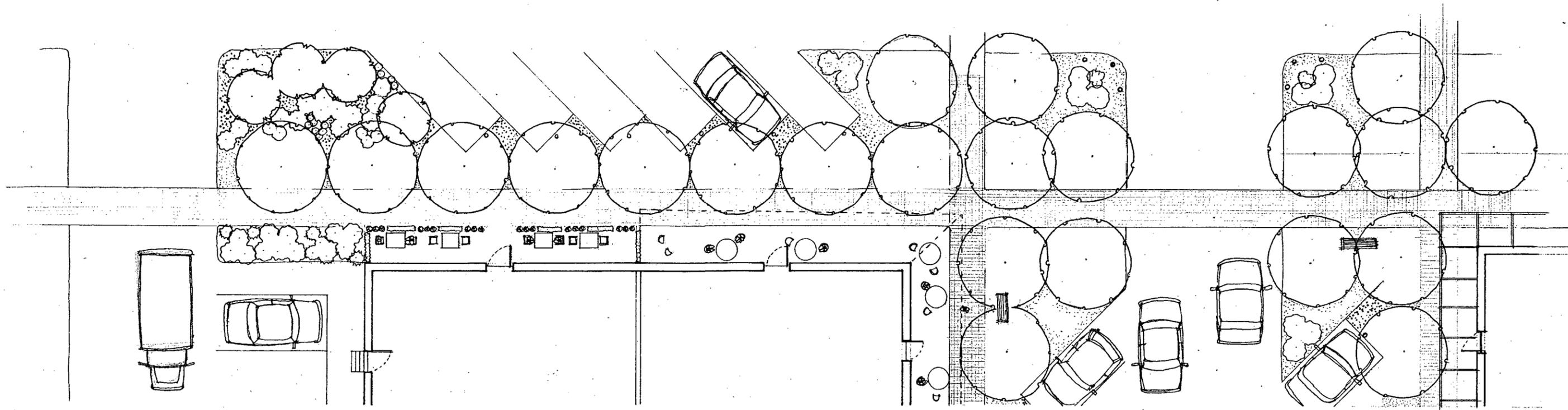


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street details

L16

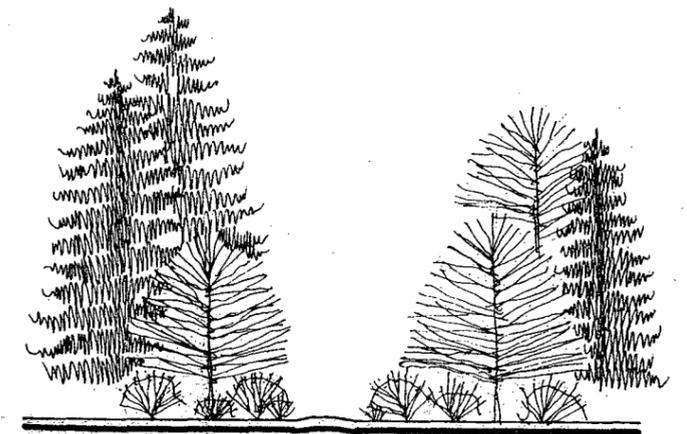
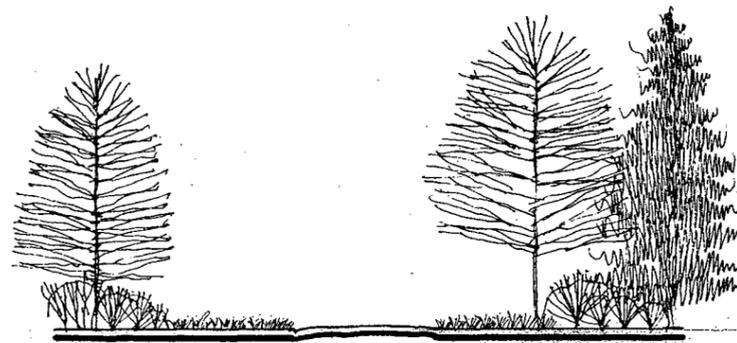


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street details

117



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street details

L18