

# Settlement Pattern & Form with service costs analysis Preliminary Report

Prepared for  
**Regional Planning**  
**Halifax Regional Municipality**  
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# TABLE OF CONTENTS

- INTRODUCTION..... 1
  - Summary ..... 1
  - Methodology ..... 2
  - Next Steps ..... 5
  
- RESIDENTIAL PATTERNS ..... 6
  - Pattern A – Rural On-Site Septic, 2+ Acres ..... 8
  - Pattern B – Rural, On-Site Septic, 1+ Acre Lots ..... 9
  - Pattern C – Suburban Low Density ..... 10
  - Pattern D – Urban Low Density ..... 11
  - Pattern E – Suburban Mid-Density ..... 12
  - Pattern F – Urban Mid-Density ..... 13
  - Pattern G – Urban High Density ..... 14
  
- APPENDICES ..... 15
  - Appendix A – Pattern Attributes ..... 15
  - Appendix B – Unit Costs of Services ..... 16
  - Appendix C – Summary of Estimated Costs ..... 17

# INTRODUCTION

## SUMMARY

Halifax Regional Municipality is in the process of developing a 25-year Regional Plan and, as part of this, is considering alternatives of how and where it should grow. In a sense, one might think of HRM as a growing "family" looking at options for its future "home". And when looking for a new home, it is important to know that what you'll be looking at, and what you may buy, is affordable. HRM's on-going Cost of Servicing study will allow HRM to better understand the cost implications of various growth alternatives.

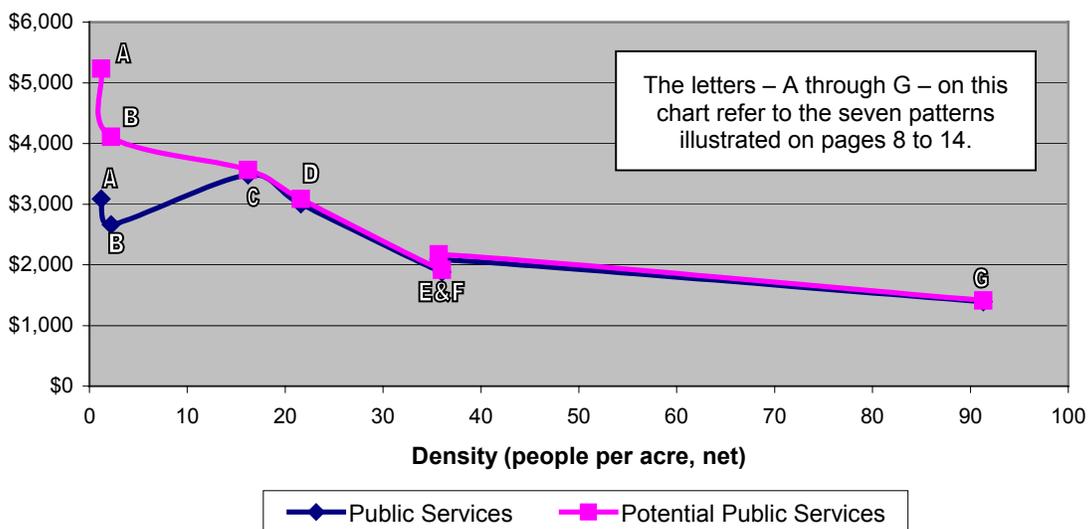
This booklet will show the findings to date of the Cost of Serving study applied to sample settlement patterns that are typical to HRM. Although, not all of the factors influencing costs, such as the effects of specific locations, have yet been included in these numbers, trends are emerging that should support discussions of the relative, incremental costs of the different styles of "rooms" (neighbourhoods) that make up HRM's "home".

This type of analysis is very complex, since many factors affect HRM costs, from the age of our residents (i.e. demographics) to our weather. This study looks to identify cost trends due to the form of our neighbourhoods. The first step in doing this is to see how density affects local costs of services.

Although this document does provide an overall cost for each pattern, there should not be a rush to consider this the final "bottom line." As described in the methodology section which follows, several of these costs are now simply included using an average HRM-wide cost, per household or per resident. In most cases, the location of the pattern has not yet been fully analyzed; this will occur in the second phase of the analysis. Our investigation of service costs will continue as we work toward the evaluation of the alternatives you'd like us to consider, and costing updates will be regularly provided. Nonetheless, some trends – like the influence of density on service costs – can be seen.

The chart (below) attempts to summarize the impact of density on costs. As can be clearly seen, as neighbourhoods become less dense, both municipal and total costs increase.

**Estimated Annual Cost of Services (by household)**



The good news is that all three of the Alternatives, launched May 2004, are cost effective in their common approach of making effective use of infrastructure and encouraging more compact, complete communities. And all three Alternatives offer a range of affordable housing choices, some of which we do not see in HRM today. As you review these Regional Plan Alternatives, let us know what “features” you’d like to see in your growing “home” and we’ll be looking at the cost implications.

## METHODOLOGY

The focus of this study is on the relative cost of services delivered by HRM, although costs of services provided by the Province or homeowner are considered, when appropriate, to give a more-balanced picture of overall costs. However, most private costs, such as the initial development costs or the costs to operate a "second car" are not included.

The following nine HRM services, delivered directly to the public, are being costed:

- Roads
- Transit
- Water
- Wastewater & Stormwater
- Solid Waste
- Parks & Recreation
- Libraries
- Police
- Fire

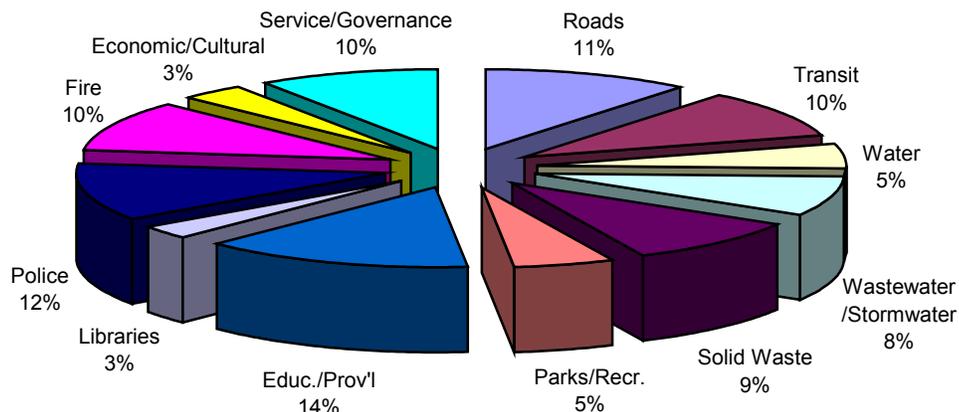
In addition, implications of settlement pattern on school costs are being assessed, since schools are an important element in planning of residential areas.

The following three HRM service/expenditure areas are also shown for completeness, but will not be assessed for each settlement pattern:

- Economic and cultural programs (includes Planning & Development)
- Governance and shared services (includes HR, Finance and Legal)
- Transfers to the Province (88% to School Board)

The following chart shows the relative annual expenditures by HRM in each of these areas. This includes both capital and operational costs, for the 2003-04 fiscal year.

**HRM Expenditures, by Service**



## The Patterns

Seven residential patterns are included in this booklet. They are typical of residential layouts and densities that are seen within HRM. The focus here is on residential patterns -- rather than commercial or industrial -- since one of the main issues in considering HRM's growth is where people will live and what form these new neighbourhoods will take. Of course, the form may be mixed-use, residential and commercial together, but the focus of this study will remain on the residential component and its costs.

The residential patterns are considered to be location independent although they are defined to be rural, suburban or urban. They are also considered to be neutral with respect to demographics, although some general trends such as smaller household sizes in middle and higher density areas were recognized.

It is anticipated that costs for several more patterns will be estimated, both current patterns seen within HRM and new alternatives we may like to see. These patterns and their "costing" will be available on the HRM website, as they are developed.

## The Costs

The costs of most of HRM's services are not budgeted or tracked on a neighbourhood-by-neighbourhood basis, and, likely, never will be. To do so would be complex and expensive. So the challenge is, how do we estimate the cost of providing various services for various settlement patterns?

Research by CMHC<sup>1</sup> and others have shown four factors, related to settlement pattern, that affect the costs of services. We refer to these as the "Four Ds":

- Density
- Distance
- Dispersion/Continuity
- Diversity (Mix of Use)

As well, there are other factors that affect costs that are not directly related to settlement pattern. Two key ones are:

- Demographics
- Delivery Standard (Service Levels)

For each service, the above factors were considered and "cost drivers" were identified. Where possible, depending on the detail and the way in which cost data was compiled, unit costs were found for each relevant cost driver. For example, length (of road) is a cost driver for roads, and consumption (amount used) is a cost driver for water treatment.

The study considers both the operational and capital replacement costs required for each service. In most cases, HRM budget amounts were used to determine the costs of a service. However, in many cases, this approach did not provide enough detail, so costs were assessed using engineering estimates. The average annual "life-cycle" costs

<sup>1</sup> May 2003 draft report CMHC Costing Mechanism to Facilitate Sustainable Community Planning, Phase 1 – Background Research and Costing Framework

were estimated, if possible. [Life-cycle costs are the total costs spent to operate, maintain and repair the item over its entire useful life. For example, in the study, the useful life of a road was estimated to be 70 years, but many repairs were required over that time.] Where engineering life-cycle estimates weren't practical to develop, typical annual operating and capital costs were identified for a group of assets and the average annual cost was estimated for each item/service.

How these costs were determined and what cost drivers were used is summarized, below, by service.

### Road Costs

Road maintenance costs were determined based on design standards and recommended engineering repair and maintenance schedules. These theoretical costs were proportionately reduced to reconcile with current road expenditures. To improve the condition of our roadways, higher expenditures – closer to the theoretical or “optimal” costs – would need to be made. These Optimal Road costs are shown in Appendix C.

Operational costs, such as snow removal and street cleaning, were based on budget expenditures for specific operations or services, weighted by service level requirements, e.g. collector roads would be plowed more frequently than local roads. Different patterns may have different delivery standards, for example, urban and suburban patterns have curbs and sidewalks (on both sides for high density patterns) while rural patterns do not.

Costs for arterial and collector roads have not yet been fully allocated to each pattern. Cost allocations are currently based on the number of people commuting, but not yet on typical distances traveled. The cost implications of the location of each pattern will be considered in the next phase of the study.

### Water Costs

Water costs were assessed by reviewing the level of effort (expenditures) for different activities of the Halifax Regional Water Commission. Primary "cost drivers" were identified for each activity, i.e. the number of customers is a cost driver for quarterly billing, and the number of fire hydrants is a cost driver for fire suppression. [Note: Hydrant costs are included as part of Fire service cost.]

### Wastewater & Stormwater Costs

Wastewater costs were assessed similar to Water, in that costs for specific activities were allocated to their primary costs drivers. For example, the number of connections to the sewer main is a cost driver for sewer lateral replacement costs. Cost drivers that are characteristic of a specific location, such as age or material of pipes, were not included. For the “mains” and “laterals”, engineering life-cycle cost estimates were developed. Their costs drivers are main (road) length and number of connections, respectively. “Trunk” costs have been preliminarily allocated on a per capita basis, not yet by distance (to treatment or outfall). Costs shown for this service include (projected) operating costs at the completion of the Harbour Solutions project.

## Solid Waste

Solid Waste costs were assessed based on the costs per customer in each of the eight solid waste collection contract areas, as developed for the tender process. To the collection costs, the disposal cost at the Solid Waste Management Facility was added. For this service, it became clear that the "distance" to the single landfill was a significant factor, with service in the western part of HRM significantly less expensive than in the eastern. It appears that "density" was a significant factor but, at this time, it is difficult to separate the impacts of density from distance.

## Other Service Costs

Other costs, for this preliminary report, are shown as average costs (per person) across HRM. There may be significant differences in costs for Transit, Fire and Police services, due to settlement pattern, but these services have yet to be fully analyzed.

Transit, Recreation and Library costs are shown "net" of fees for these services. Transit has the potential to self-fund, given the right conditions. At present, six of the current transit routes are 80% (or more) self-funded.

Many of the HRM's provincial payments are driven by legislation and assessment values, however they are shown here simply on a per capita basis.

## **NEXT STEPS**

We will conduct more analysis on the impact of the "distance" factor, to understand in more detail how geographical expansion puts pressures on the infrastructure and impacts costs. This factor is important with respect to transportation demands, as well as other "hard infrastructure" intensive services such as water and wastewater. Once "distance" is factored in, services cost estimates will increase for those patterns farther away:

- 1) from the coast (trunk costs to wastewater treatment facilities);
- 2) from employment centers (arterial and collector road costs);
- 3) from schools (busing costs).

For solid waste management, the "distance" factor also needs to be broken out from the density and dispersion impacts.

A better understanding of how Police and Fire service costs are affected by residential patterns and service levels will be a priority. The efficiency of the Transit systems is significantly affected by residential patterns. This, also, will be analyzed in more detail.

To better understand our current costs, and to be able to test or calibrate the Cost of Services model, we hope to do a geographical survey of residential densities and mix of uses currently seen within HRM.

To find out more about the Cost of Servicing study, you may visit the Regional Planning website [www.halifax.ca/regionalplanning](http://www.halifax.ca/regionalplanning) or contact us at 490-5857 anytime.

## **RESIDENTIAL PATTERNS**

On the following seven pages are samples of different residential patterns that may be seen in HRM. On each page, you will find two diagrams, to give a sense of the style of neighbourhood, along with a description of lot size and density. As well, the estimates (to date) of service costs are included.

Below is a summary of the costs for each of the seven sample patterns. It is clear when looking at the services such as roads and bussing, that density is a significant factor affecting costs. As you look across the table, below, from left to right, density increases from lower to higher, as costs are decreasing. Expect to see this cost trend in other services, in following reports, as more analysis is done.

In the table below, under the heading Common Services one can see the costs across different density patterns for comparable levels of service. For example, road costs show that the estimated lifecycle cost of roads in Pattern A is \$1,050/year vs. \$25 in Pattern G. In itself, this is not surprising. In Pattern A, there are more than 400 feet of total frontage for each household, while the frontage is less than 6 feet per household in Pattern G, which includes apartment buildings.

Of those services that are commonly available, Pattern A is three times more expensive than Pattern G. From the perspective of public services, the higher levels of service available in more urbanized areas, such as sidewalks and central water and wastewater services, will offset some of this differential. However, this is only true to the extent that 1) these services are never extended to the low-density areas and 2) the costs of private water and sewage treatment, as well as other private, social and environmental costs, are excluded.

For the rural patterns, A & B, two cost scenarios are shown for "Water" and "Wastewater": under Other Services, the private costs for a well and on-site wastewater treatment and, below that, the additional local costs, if piped water and wastewater services were extended.

### **Comparison to Average Residential Tax Payment**

The costs presented here are estimates for the typical patterns being analyzed. They are meant to allow comparisons between patterns, to allow for a better understanding of how municipal costs may be impacted by various settlement forms, and other, factors. These costs cannot be readily applied to an individual household, since too many local variations would exist.

As a broad comparison, it may be interesting to note that the average residential property tax (per dwelling) in 2003-04 was about \$1,200, which is less than the estimated costs for any of the seven settlement patterns. In part, this may be because commercial tax rates are 2.5 times the residential tax rate. Although the residential and commercial demand on services is difficult to separate, it is likely that commercial properties are subsidizing residential as well as exempt classes of properties (such as churches, hospitals, universities and some other government properties).

**Summary - Estimated Costs per Household**

Pattern A <sup>1</sup> RCS	Pattern B <sup>1</sup> RCS	Pattern C <sup>1</sup> Suburban	Pattern D <sup>1</sup> Urban	Pattern E <sup>2</sup> Suburban	Pattern F <sup>2</sup> Urban	Pattern G <sup>3</sup> Urban
Low Density 1.2 people/acre	Low Density 2.2 people/acre	Low Density 16 people/acre	Low Density 22 people/acre	Mid Density 36 people/acre	Mid Density 36 people/acre	High Density 91 people/acre

**Common Services:**

Roads (no curbs)	\$1,050	\$621	\$281	\$182	\$76	\$125	\$25
Solid Waste	\$200	\$200	\$185	\$185	\$185	\$185	\$185
Libraries <sup>4</sup>	\$72	\$72	\$72	\$72	\$48	\$48	\$38
Parks/Recreation <sup>4</sup>	\$129	\$129	\$129	\$129	\$86	\$86	\$69
Police <sup>4</sup>	\$360	\$360	\$360	\$360	\$240	\$240	\$192
Fire <sup>4</sup>	\$324	\$324	\$406	\$379	\$231	\$248	\$177
School Bussing	\$186	\$186	\$186	\$25	\$58	\$17	\$13
Culture/Economy	\$36	\$36	\$36	\$36	\$24	\$24	\$19
Governance	\$297	\$297	\$297	\$297	\$198	\$198	\$158
HRM to Province	\$435	\$435	\$435	\$435	\$290	\$290	\$232
<b>Subtotal</b>	<b>\$3,089</b>	<b>\$2,660</b>	<b>\$2,387</b>	<b>\$2,100</b>	<b>\$1,436</b>	<b>\$1,461</b>	<b>\$1,108</b>

**Other Services:**

Curbs & Sidewalks	\$0	\$0	\$196	\$127	\$52	\$87	\$26
Transit <sup>4</sup>	\$171	\$171	\$171	\$171	\$114	\$114	\$91
Water	\$425	\$425	\$197	\$176	\$77	\$146	\$42
Waste/Stormwater	\$625	\$625	\$613	\$514	\$235	\$364	\$146
<b>Subtotal</b>	<b>\$1,221</b>	<b>\$1,221</b>	<b>\$1,177</b>	<b>\$988</b>	<b>\$479</b>	<b>\$711</b>	<b>\$305</b>

extended<sup>5</sup>

Water/Wastewater	\$921	\$231					
<b>TOTAL</b>	<b>\$5,231</b>	<b>\$4,112</b>	<b>\$3,564</b>	<b>\$3,088</b>	<b>\$1,914</b>	<b>\$2,172</b>	<b>\$1,413</b>

RCS = Rural Commutershed

1) Household size estimated at 3 people per household

2) Household size estimated at 2 people per household

3) Household size estimated at 1.6 people per household

4) Impact of Residential Pattern to be assessed; costs allocated simply on "per capita" basis, at this time

5) incremental on-going (annual) costs, only; does not include remediation/installation (capital) costs

# PATTERN A – RURAL ON-SITE SEPTIC, 2+ ACRES



**Pattern Characteristics**

Lot Size:  
2.5 acres per dwelling unit  
(108,000 sq. ft. per dwelling unit)

Road Frontage:  
405 feet per dwelling

Residential Density:  
1.2 people per (residential) acre



**Pattern A - Estimated Annual Service Costs**

Service	per person	per dwelling
Roads	\$ 350	\$ 1,050
Transit	\$ -	\$ -
Water	\$ -	\$ -
Waste/Stormwater	\$ -	\$ -
Solid Waste	\$ 67	\$ 200
Libraries	\$ 24	\$ 72
Parks/Recreation	\$ 43	\$ 129
Police	\$ 120	\$ 360
Fire	\$ 108	\$ 324
Culture/Economy	\$ 12	\$ 36
Governance	\$ 99	\$ 297
Province	\$ 145	\$ 435
School Bussing	\$ 62	\$ 186
<b>Public Service Total</b>	<b>\$ 1,030</b>	<b>\$ 3,089</b>
Private Water/Septic	\$ 350	\$ 1,050
<b>Service Total</b>	<b>\$ 1,380</b>	<b>\$ 4,139</b>
Potential Services <sup>1</sup>	\$ 364	\$ 1,092
<b>Service Total</b>	<b>\$ 1,744</b>	<b>\$ 5,231</b>

<sup>1</sup> includes the additional annual costs of transit, piped water and wastewater/stormwater but not including remediation/installation (capital) costs.

## PATTERN B – RURAL, ON-SITE SEPTIC, 1+ ACRE LOTS



### Pattern Characteristics

**Lot Size:**

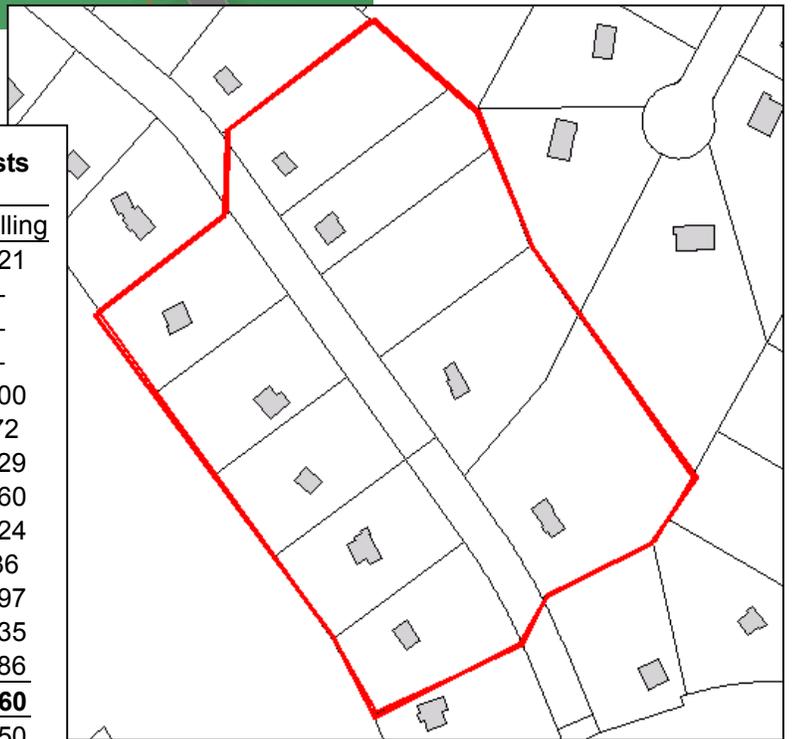
1.3 acres per dwelling unit  
(58,000 sq. ft. per dwelling unit)

**Road Frontage:**

222 feet per dwelling

**Residential Density:**

2.2 people per (residential) acre



### Pattern B – Estimated Annual Service Costs

Service	per person	per dwelling
Roads	\$ 207	\$ 621
Transit	\$ -	\$ -
Water	\$ -	\$ -
Waste/ Stormwater	\$ -	\$ -
Solid Waste	\$ 67	\$ 200
Libraries	\$ 24	\$ 72
Parks/Recreation	\$ 43	\$ 129
Police	\$ 120	\$ 360
Fire	\$ 108	\$ 324
Culture/Economy	\$ 12	\$ 36
Governance	\$ 99	\$ 297
Province	\$ 145	\$ 435
School Bussing	\$ 62	\$ 186
<b>Public Service Total</b>	<b>\$ 887</b>	<b>\$ 2,660</b>
Private Water/Septic	\$ 350	\$ 1,050
<b>Service Total</b>	<b>\$ 1,237</b>	<b>\$ 3,710</b>
Potential Services <sup>1</sup>	\$ 134	\$ 402
<b>Service Total</b>	<b>\$ 1,371</b>	<b>\$ 4,112</b>

<sup>1</sup> includes the additional annual costs of transit, piped water and wastewater/stormwater but not including remediation/installation (capital) costs.

## PATTERN C – SUBURBAN LOW DENSITY



### Pattern Characteristics

Lot Size:

8,100 sq. ft. per dwelling unit

Road Frontage:

98 feet per dwelling

Residential Density:

16 people per (residential) acre



### Pattern C – Estimated Annual Service Costs

Service	per person	per dwelling
Roads	\$ 159	\$ 477
Transit	\$ 57	\$ 171
Water	\$ 57	\$ 171
Waste/Stormwater	\$ 185	\$ 555
Solid Waste	\$ 62	\$ 185
Libraries	\$ 24	\$ 72
Parks/Recreation	\$ 43	\$ 129
Police	\$ 120	\$ 360
Fire	\$ 135	\$ 406
Culture/Economy	\$ 12	\$ 36
Governance	\$ 99	\$ 297
Province	\$ 145	\$ 435
School Bussing	\$ 29	\$ 186
<b>Public Service Total</b>	<b>\$ 1,127</b>	<b>\$ 3,480</b>
Private Water/Sewer	\$ 28	\$ 84
<b>Service Total</b>	<b>\$ 1,155</b>	<b>\$ 3,564</b>

# PATTERN D – URBAN LOW DENSITY



**Pattern Characteristics**

Lot Size:  
6,100 sq. ft per dwelling unit

Road Frontage:  
65 feet per dwelling

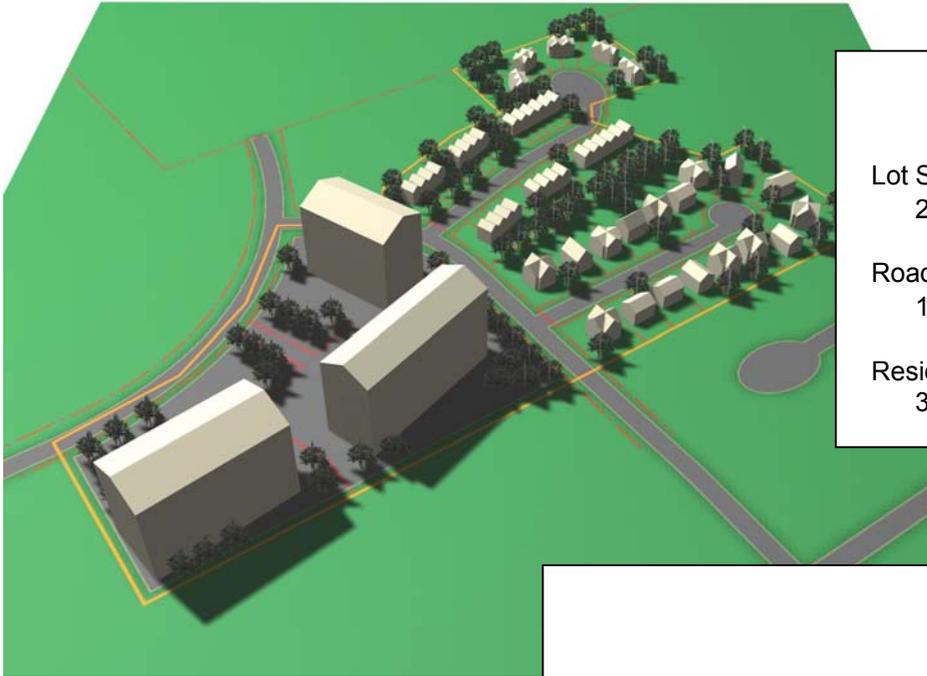
Residential Density:  
22 people per (residential acre)



**Pattern D – Estimated Annual Service Costs**

Service	per person	per dwelling
Roads	\$ 103	\$ 309
Transit	\$ 57	\$ 171
Water	\$ 50	\$ 150
Waste/Stormwater	\$ 152	\$ 456
Solid Waste	\$ 62	\$ 185
Libraries	\$ 24	\$ 72
Parks/Recreation	\$ 43	\$ 129
Police	\$ 120	\$ 360
Fire	\$ 126	\$ 379
Culture/Economy	\$ 12	\$ 36
Governance	\$ 99	\$ 297
Province	\$ 145	\$ 435
School Bussing	\$ 8	\$ 25
<b>Public Service Total</b>	<b>\$ 1,001</b>	<b>\$ 3,004</b>
Private Water/Sewer	\$ 28	\$ 84
<b>Service Total</b>	<b>\$ 1,029</b>	<b>\$ 3,088</b>

# PATTERN E – SUBURBAN MID-DENSITY



## Pattern Characteristics

Lot Size:  
2,400 sq. ft. per dwelling unit

Road Frontage:  
18 feet per dwelling

Residential Density:  
36 people per (residential) acre



## Pattern E – Estimated Annual Service Costs

Service	per person	per dwelling
Roads	\$ 64	\$ 128
Transit	\$ 57	\$ 114
Water	\$ 33	\$ 66
Waste/Stormwater	\$ 105	\$ 210
Solid Waste	\$ 93	\$ 185
Libraries	\$ 24	\$ 48
Parks/Recreation	\$ 43	\$ 86
Police	\$ 120	\$ 240
Fire	\$ 115	\$ 231
Culture/Economy	\$ 12	\$ 24
Governance	\$ 99	\$ 198
Province	\$ 145	\$ 290
School Bussing	\$ 29	\$ 58
<b>Public Service Total</b>	<b>\$ 939</b>	<b>\$ 1,878</b>
Private Water/Sewer	\$ 18	\$ 36
<b>Service Total</b>	<b>\$ 957</b>	<b>\$ 1,914</b>

# PATTERN F – URBAN MID-DENSITY



**Pattern Characteristics**

Lot Size:  
2,400 sq. ft. per dwelling unit

Road Frontage:  
38 feet per dwelling

Residential Density:  
36 people per (residential) acre



**Pattern F – Estimated Annual Service Costs**

Service	per person	per dwelling
Roads	\$ 106	\$ 212
Transit	\$ 57	\$ 114
Water	\$ 60	\$ 120
Waste/Stormwater	\$ 153	\$ 306
Solid Waste	\$ 93	\$ 185
Libraries	\$ 24	\$ 48
Parks/Recreation	\$ 43	\$ 86
Police	\$ 120	\$ 240
Fire	\$ 124	\$ 248
Culture/Economy	\$ 12	\$ 24
Governance	\$ 99	\$ 198
Province	\$ 145	\$ 290
School Bussing	\$ 8	\$ 17
<b>Public Service Total</b>	<b>\$ 1,044</b>	<b>\$ 2,088</b>
Private Water/Sewer	\$ 42	\$ 84
<b>Service Total</b>	<b>\$ 1,086</b>	<b>\$ 2,172</b>

# PATTERN G – URBAN HIGH DENSITY

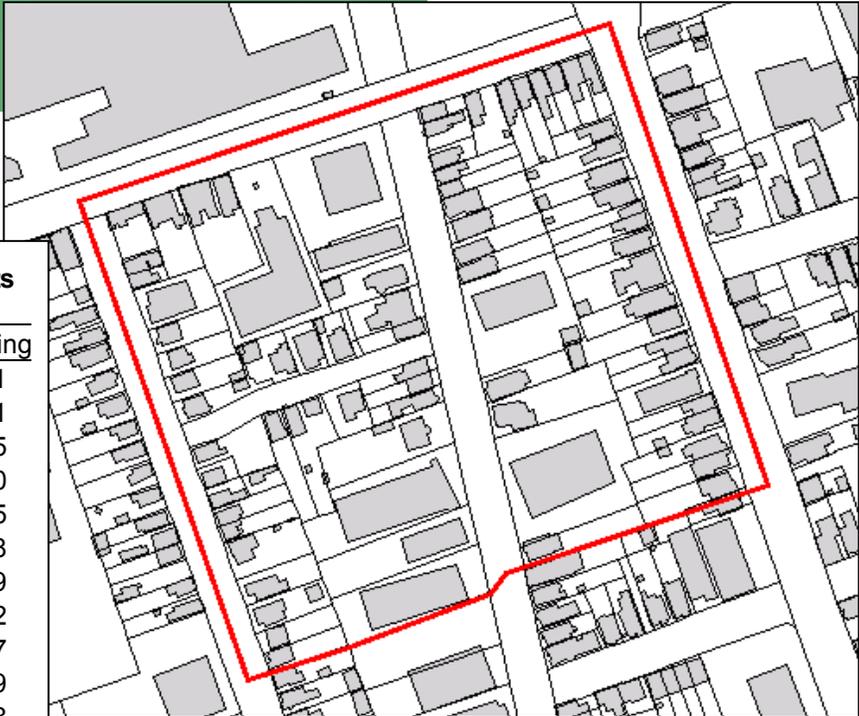


**Pattern Characteristics**

Lot Size:  
760 sq. ft. per dwelling unit

Road Frontage:  
5.2 feet per dwelling

Residential Density:  
91 people per (residential) acre



**Pattern G – Estimated Annual Service Costs**

Service	per person	per dwelling
Roads	\$ 32	\$ 51
Transit	\$ 57	\$ 91
Water	\$ 22	\$ 35
Waste/Stormwater	\$ 81	\$ 130
Solid Waste	\$ 116	\$ 185
Libraries	\$ 24	\$ 38
Parks/Recreation	\$ 43	\$ 69
Police	\$ 120	\$ 192
Fire	\$ 111	\$ 177
Culture/Economy	\$ 12	\$ 19
Governance	\$ 99	\$ 158
Province	\$ 145	\$ 232
School Bussing	\$ 8	\$ 13
<b>Public Service Total</b>	<b>\$ 870</b>	<b>\$ 1,390</b>
Private Water/Sewer	\$ 14	\$ 23
<b>Service Total</b>	<b>\$ 884</b>	<b>\$ 1,413</b>

# APPENDICES

## APPENDIX A

### Pattern Attributes (Metric)

	Gross Study Area (hectares)	Road Length (metres)	Road ROW Width (metres)	Road ROW Area (hectares)	Commer'l Area (hectares)	Parks in Study Area (hectares)	Parks outside Study Area		Road Length Allocated to Resid'l (m)	Net Resid'l Area (hectares)
							(%)	(hectares)		
Pattern A	6.65	313.0	20.0	0.63	0	0	5%	0.33	370.4	6.02
Pattern B	6.00	284.1	20.0	0.57	0	0	5%	0.30	338.9	5.43
Pattern C	5.95	854.2	16.0	1.37	0	0	5%	0.30	909.0	4.58
Pattern D	5.19	677.0	16.0	1.08	0	0	5%	0.26	728.0	4.11
Pattern E	5.33	491.9	16.0	0.79	0	0	5%	0.27	543.9	4.54
Pattern F	3.43	567.7	16.0	0.91	0	0.32	0%	0	567.7	2.20
Pattern G	5.74	547.0	16.0	0.88	0.50	0	5%	0.29	544.8	4.86

### Pattern Attributes (Imperial)

	Gross Study Area (acres)	Road Length (feet)	Road ROW Width (feet)	Road ROW Area (acres)	Commer'l Area (acres)	Parks in Study Area (acres)	Parks outside Study Area		Road Length Allocated to Resid'l (ft)	Net Resid'l Area (acres)
							(%)	(acres)		
Pattern A	16.43	1027	66	1.56	0	0	5%	0.82	1215	14.88
Pattern B	14.83	932	66	1.41	0	0	5%	0.74	1112	13.42
Pattern C	14.7	2802	52	3.39	0	0	5%	0.74	2982	11.32
Pattern D	12.82	2221	52	2.67	0	0	5%	0.64	2388	10.16
Pattern E	13.17	1614	52	1.95	0	0	5%	0.67	1784	11.22
Pattern F	8.48	1863	52	2.25	0	0.79	0%	0	1863	5.44
Pattern G	14.18	1795	52	2.17	1.24	0	5%	0.72	1787	12.01

### Other Pattern Attributes

	Sidewalks	Transit Frequency	Hydrants	No. of Utility Connections	Dwelling Units	Household Size	No. of People	% Children Bussed
Pattern A	No	30 min.	No	6	6	3.0	18	75%
Pattern B	No	30 min.	No	10	10	3.0	30	75%
Pattern C	1 side	30 min.	Yes	61	61	3.0	183	35%
Pattern D	1 side	30 min.	Yes	73	73	3.0	219	10%
Pattern E	1 side	30 min.	Yes	87	202	2.0	404	35%
Pattern F	1 side	30 min.	Yes	97	97	2.0	194	10%
Pattern G	2 sides	30 min.	Yes	123	685	1.6	1,096	10%

Conversions  
 approx.: 1 hectare = 2.471 acres  
 1 metre = 3.281 feet

## APPENDIX B – UNIT COSTS OF SERVICES

<b>Roads</b>	Local Road (sidewalk, 2 sides)	Local Road (sidewalk, 1 side)	Local Road (no curb/sidewalk)		
Cost Driver	\$31.80 / metre	\$26.10 / metre	\$15.40 / metre		
	Collector/Arterials Urban	Collector/Arterials Suburban	Collector/Arterials Rural Commutershed	Collector/Arterials Rural	
	\$16.54 / person	\$29.20 / person	\$33.22 / person	\$ 9.69 / person	
<b>Roads (optimal)</b>	Local Road (sidewalk, 2 sides)	Local Road (sidewalk, 1 side)	Local Road (no curb/sidewalk)		
Cost Driver	\$63.00 / metre	\$54.00 / metre	\$28.00 / metre		
	Collector/Arterials Urban	Collector/Arterials Suburban	Collector/Arterials Rural Commutershed	Collector/Arterials Rural	
	\$20.07 / person	\$35.57 / person	\$40.41 / person	\$11.76 / person	
<b>Transit</b>	Urban	Suburban	Rural Commutershed	Rural	
Cost Driver	\$ 57 / person	\$ 57 / person	\$ 57 / person	\$ 57 / person	
<b>Water</b>	Consumption	Customer (lateral)	Local Pipe Length		
Cost Driver	\$12.00 / person	\$70.00 / connection	\$ 4.44 / meter (road)		
<b>Wastewater</b>	Consumption	Customer (lateral)	Local Pipe Length	Trunk Pipe	
Cost Driver	\$40.50 / person	\$58.00 / connection	\$ 9.80 / meter (road)	\$24.40 / person	
<b>Stormwater</b>			Local Pipe Length		
Cost Driver			\$10.50 / meter (road)		
<b>Solid Waste</b>	Urban/Suburban	Rural Commutershed	Rural		
Cost Driver	\$ 185 / dwelling	\$ 200 / dwelling	\$ 240 / dwelling		
<b>Libraries</b>	\$ 24 / person				
<b>Parks/Recreation</b>	\$ 43 / person				
<b>Police</b>	\$ 120 / person				
<b>Fire</b>	\$ 108 / person			Fire Protection \$ 827 / hydrant	
<b>Culture/Economy</b>	\$ 12 / person				
<b>Governance</b>	\$ 99 / person				
<b>Province</b>	\$ 145 / person				
<b>School Bussing</b>	\$ 530 / child, bussed				
<b>Private Water/Sewer</b>	Urban - High Density	Urban/Suburban	Rural Commutershed	Rural	
Cost Driver	\$ 126 / connection	\$ 84 / connection	\$1,050 / dwelling	\$1,050 / dwelling	

Other numbers used in calculations:

- 15.6% of total population are school students
- 72,000 litres of water used / person / year
- 150meter spacing between hydrants

# APPENDIX C

## Summary - Estimated Costs per Household, with Optimal Road Maintenance

	Pattern A <sup>1</sup> RCS	Pattern B <sup>1</sup> RCS	Pattern C <sup>1</sup> Suburban	Pattern D <sup>1</sup> Urban	Pattern E <sup>2</sup> Suburban	Pattern F <sup>2</sup> Urban	Pattern G <sup>3</sup> Urban
	Low Density 1.2 people/acre	Low Density 2.2 people/acre	Low Density 16 people/acre	Low Density 22 people/acre	Mid Density 36 people/acre	Mid Density 36 people/acre	High Density 91 people/acre
<b>Common Services:</b>							
Roads (no curbs)	\$1,050	\$621	\$281	\$182	\$76	\$125	\$25
Solid Waste	\$200	\$200	\$185	\$185	\$185	\$185	\$185
Libraries <sup>4</sup>	\$72	\$72	\$72	\$72	\$48	\$48	\$38
Parks/Recreation <sup>4</sup>	\$129	\$129	\$129	\$129	\$86	\$86	\$69
Police <sup>4</sup>	\$360	\$360	\$360	\$360	\$240	\$240	\$192
Fire <sup>4</sup>	\$324	\$324	\$406	\$379	\$231	\$248	\$177
School Bussing	\$186	\$186	\$186	\$25	\$58	\$17	\$13
Culture/Economy	\$36	\$36	\$36	\$36	\$24	\$24	\$19
Governance	\$297	\$297	\$297	\$297	\$198	\$198	\$158
HRM to Province	\$435	\$435	\$435	\$435	\$290	\$290	\$232
<b>Subtotal</b>	<b>\$3,089</b>	<b>\$2,660</b>	<b>\$2,387</b>	<b>\$2,100</b>	<b>\$1,436</b>	<b>\$1,461</b>	<b>\$1,108</b>
<b>Other Services:</b>							
Curbs & Sidewalks	\$0	\$0	\$196	\$127	\$52	\$87	\$26
Transit <sup>4</sup>	\$171	\$171	\$171	\$171	\$114	\$114	\$91
Water	\$425	\$425	\$197	\$176	\$77	\$146	\$42
Waste/Stormwater	\$625	\$625	\$613	\$514	\$235	\$364	\$146
<b>Subtotal</b>	<b>\$1,221</b>	<b>\$1,221</b>	<b>\$1,177</b>	<b>\$988</b>	<b>\$479</b>	<b>\$711</b>	<b>\$305</b>
extended <sup>5</sup>							
Water/Wastewater	\$921	\$231					
<b>Roads, Optimal<sup>6</sup></b>	<b>\$801</b>	<b>\$450</b>	<b>\$435</b>	<b>\$291</b>	<b>\$88</b>	<b>\$176</b>	<b>\$31</b>
<b>TOTAL</b>	<b>\$6,032</b>	<b>\$4,562</b>	<b>\$3,999</b>	<b>\$3,379</b>	<b>\$2,002</b>	<b>\$2,348</b>	<b>\$1,444</b>

RCS = Rural Commutershed

- 1) Household size estimated at 3 people per household
- 2) Household size estimated at 2 people per household
- 3) Household size estimated at 1.6 people per household
- 4) Impact of Residential Pattern to be assessed; costs allocated simply on "per capita" basis, at this time
- 5) incremental on-going (annual) costs, only; does not include remediation/installation (capital) costs
- 6) incremental on-going (annual) costs for improved road maintenance and condition rating