ENTRA CONSULTANTS

City of Yellowknife

Yellowknife Transit

Route Analysis Study
Final Report

October 2008

Excellence in Transportation Planning

City of Yellowknife – Yellowknife Transit

Yellowknife Transit

Route Analysis Study Final Report

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Route Analysis Study

Final Report

1. Background

1.1 Study Objectives

Based on the Request for Proposals for this study, the objectives of this study are to:

- review the existing service, including routes, schedules, stop placement, number of buses, hours of operation and service area, with suggested improvements
- examine routing options to reduce travel time and increase ridership, with resource and cost requirements and anticipated ridership
- examine fare options

1.2 Study Process

ENTRA Consultants completed the analysis for this study during January and February of 2008. This process included an on-site review of the system, meetings with stakeholders, a public forum at the outset of the study to identify issues, and the development of alternatives.

In April 2008 a public forum was held to review and comment on the alternative, followed by a comment period.

This report summarizes the study process, findings and routing and fare options.

2. Existing Service Review

This section summarizes the review of the existing service, including service descriptions, stakeholder consultation and service assessment.

2.1 Service Description

Yellowknife Transit currently operates three regular routes and two express routes, as described in Exhibit 1.

2.1.1 Weekday Service

Route 1 (shown in Exhibit 2) operates from 6:40 AM to 7:10 PM, with half-hour service, Monday through Friday.

Route 2 (shown in Exhibit 3) operates from 7:10 AM to 7:15 PM with 40-minute service, Monday through Friday. This route meets Route 1 for potential transfers once in every two-hour period. Other transfers are possible due to the overlap of service on Franklin Avenue.

Route 3 (shown in Exhibit 4) is a combined route used for Saturday service throughout the year as well as weekday service in the summer period.

2.1.2 Express routes

The express service supplements Route 1 and operates during the AM and PM peaks, Monday through Friday. This service includes two trips in the morning at 7:50 AM from Borden/Northlands and one trip in the beginning at 7:55 AM from Frame Lake. The afternoon trips both depart the high schools at 3:45 PM with service to Borden/Northlands and Frame Lake.

2.1.3 Weekend Service

Regular Saturday service operates from 8:15 AM to 11:15 AM then from 3:00 PM to 6:00 PM, with hourly service.

The Summer service begins on the Monday following the end of the school calendar year and runs until the Friday before the start of the new school year. Service operates from 6:50 AM to 6:50 PM with 30-minute service during the peak periods, then hourly service during the off-peak periods.

There is no service to the areas of School Draw, Forrest Drive, Northlands, Magrum Crescent or Stanton during the Summer schedule.

There is no Sunday or Holiday service.

Exhibit 1 – Existing Service

Route	Hours of Service	Monday to Friday	Saturday
1 Borden/Downtown/Range Lake	6:40 AM to 7:10 PM	✓	
2 N'dilo/Downtown/Forrest Drive	7:10 AM to 7:15 PM	✓	
3 Saturday/Summer	Saturday: 8:15 AM - 11:15 AM 3:00 PM - 6:00 PM		✓
	Summer: 6:50 AM - 6:50 PM		✓
Express - Borden/Northlands	7:50 AM and 3:45 PM	✓	
Express - Frame Lake South	7:55 AM and 3:45 PM	✓	

Exhibit 2 – Existing Route 1

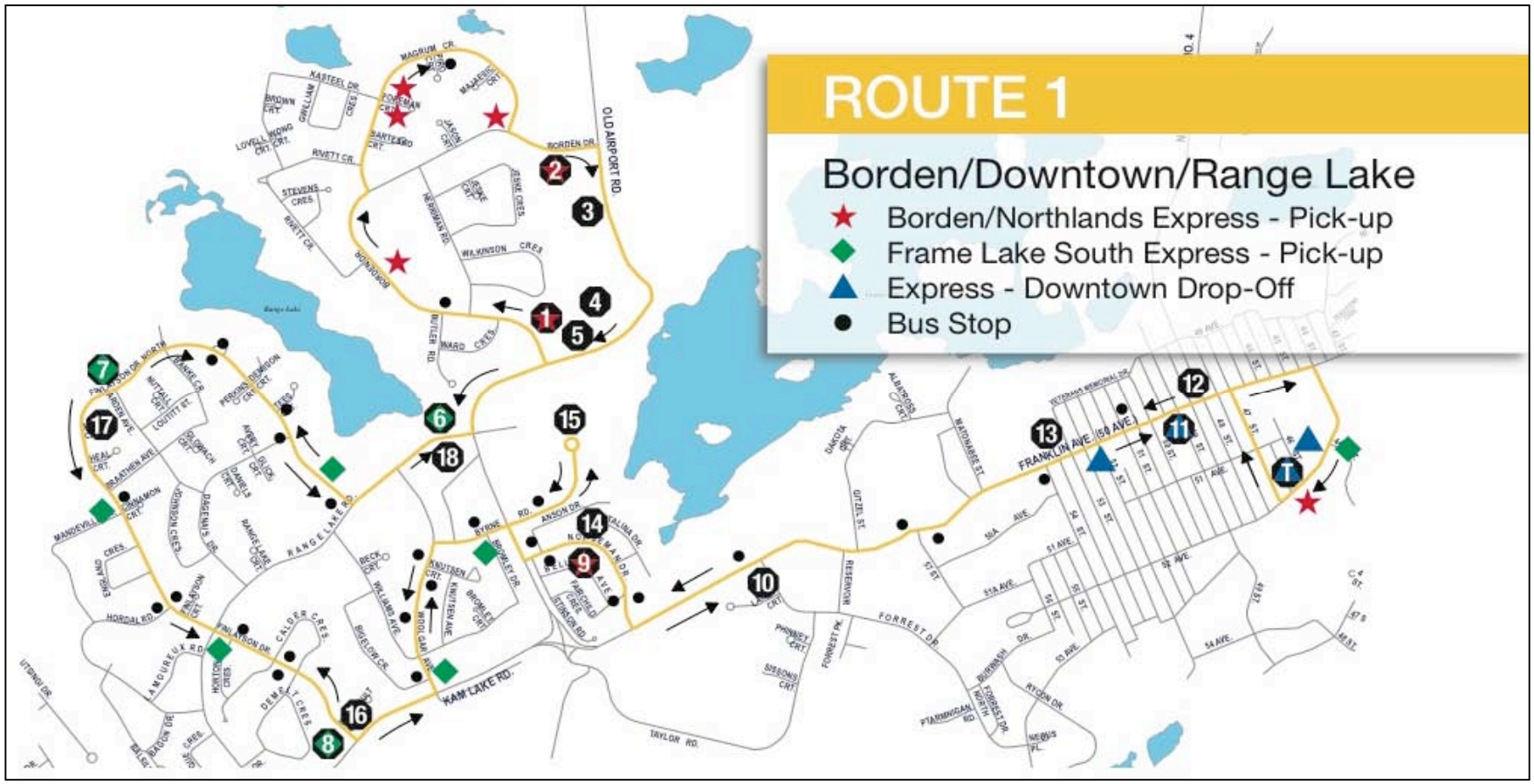


Exhibit 3 – Existing Route 2

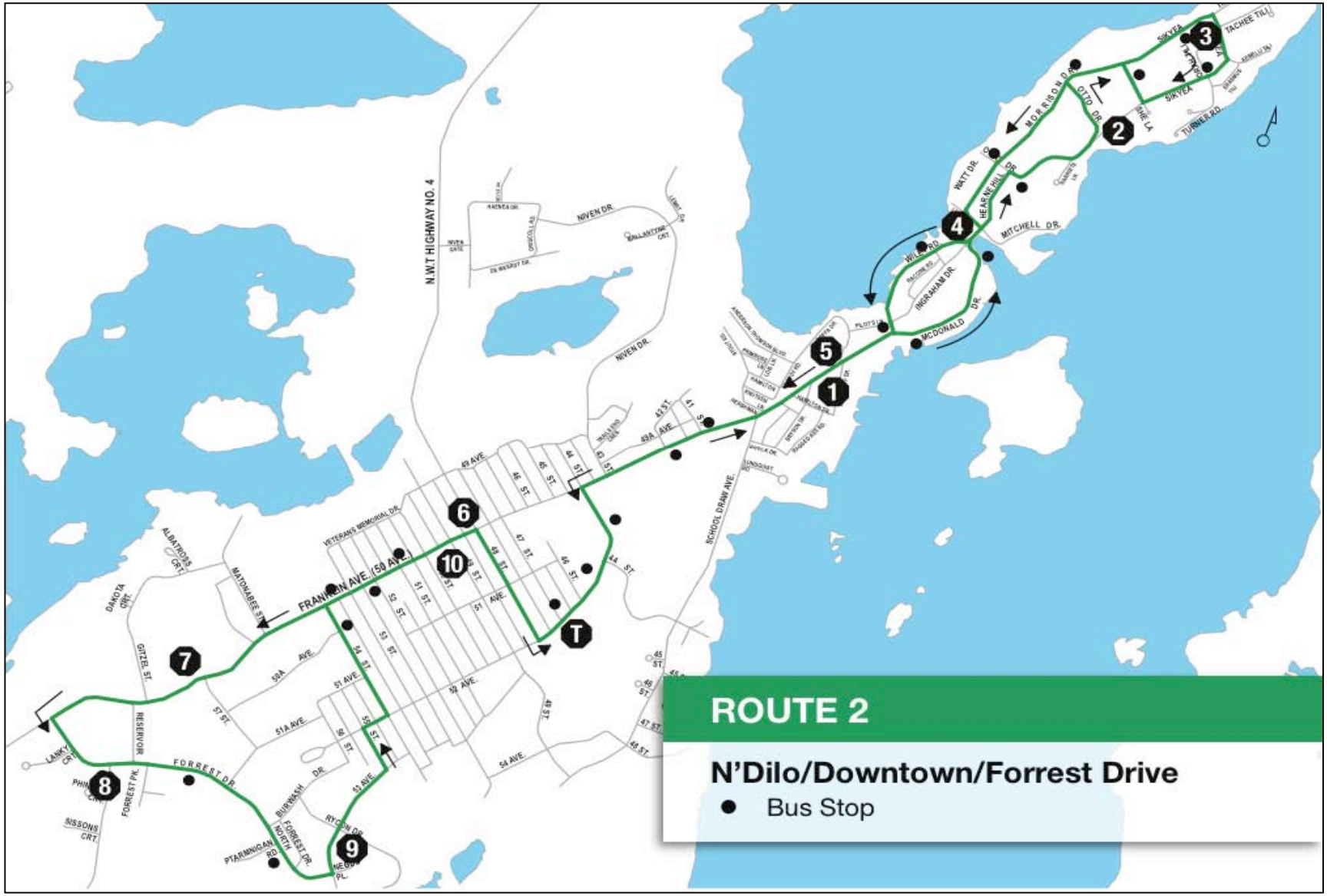
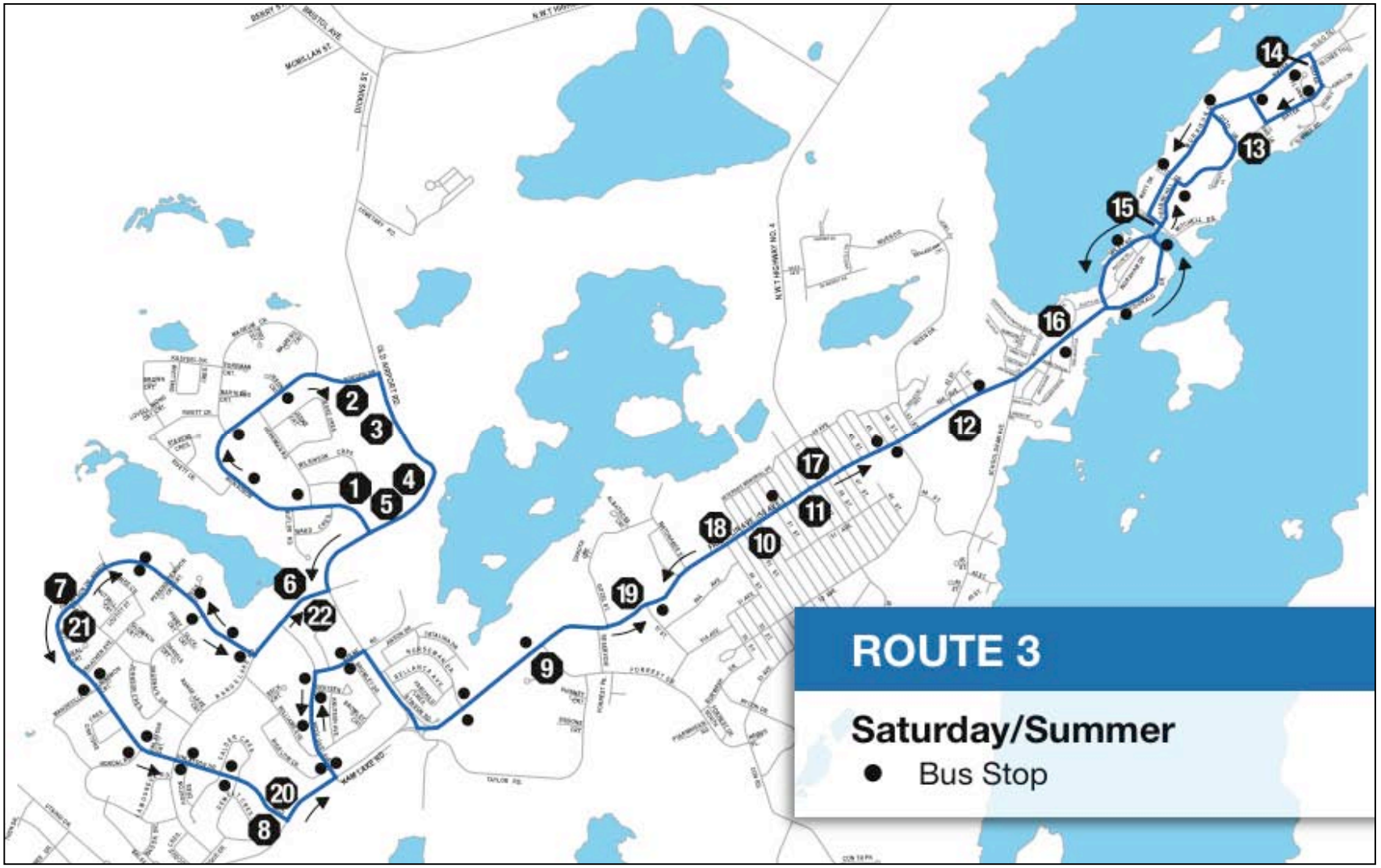


Exhibit 4 – Existing Route 3



2.2 Fare Structure

Existing fares (shown in Exhibit 5, excerpted from the City's website) are $2.50 for adults, with discounted fares for students, and seniors. Registered users of the paratransit service (YATS) are eligible to ride the conventional system free of charge.

A punch pass is available, offering 11 rides for the price of 10 (a 9 percent discount). Punch passes are available in all rider categories, similar to the cash fare.

Monthly passes are available at a cost of approximately 27 punch pass rides for adults, seniors and college students, as well as elementary students with a school bus pass. Other students, including elementary students without a school bus pass, pay a multiple of approximately 41 student cash rides.

Exhibit 5 – Existing Fare Structure

Public Transit Fares
(Effective February 12th, 2007)

Single Ticket	
Adults (18 or more years of age)	$2.50
Students (6-17 years of age attending elementary or secondary school)	$1.50
Seniors (65 or more years of age)	$1.50
Children (5 or less years of age when accompanied by an adult)	No Charge
Persons with Disabilitites	
Yellowknife Public Transit	$1.50
Yellowknife Accessible Transit (YATS)	$2.50
Registered YATS User - Yellowknife Public Transit	No Charge
Monthly Pass (Unlimited Rides)	
September to June	
Adults (18 or more years of age)	$62.00
High School Students*	$62.00
Elementary Students without a School Bus Pass	$62.00
Aurora College Students	$40.00
Elementary Students with a School Bus Pass	$40.00
Seniors (65 or more years of age)	$40.00
Persons with Disabilities	$40.00
July to August	
All riders 6 years of age or older	$40.00
Punch Pass (11 rides for the price of 10)	
Adults (18 or more years of age)	$25.00
Students (6-17 years of age attending elementary or secondary school)	$15.00
Seniors (65 or more years of age)	$15.00
Persons with Disabilities	
Yellowknife Public Transit	$15.00
Yellowknife Accessible Transit (YATS)	$25.00

2.3 Previous Assessments

In 2006, the City of Yellowknife completed a Transit Marketing Study, which developed a framework for the transit service. As part of that process, consultation and surveys were used to identify current issues with the service. These included:

- lack of adherence to route design – skipping stops;
- lack of schedule adherence;
- overcrowded buses;
- lack of coordinated route schedules between Route 1 and Route 2;
- lack of weekday and evening service and
- inadequate service coverage.

2.4 Consultation Summary

At the outset of the study, ENTRA met with a variety of stakeholders to confirm the known issues, identify other issues, and explore ways in which the service could be improved.

Stakeholders included members of council, senior staff from the City of Yellowknife, Yellowknife Transit's contract operations manager, staff of the federal and territorial governments recruited as downtown employees and non-users, transportation representatives from the two school boards, and members of the Transportation Issues Committee of Ecology North.

A public forum was also held at the outset of the study to gather input and comment on the existing service

Generally, these discussions confirmed that transit service had improved with the introduction of a new operations manager with the contractor, who had addressed many of the operations-related issues, such as missing stops, and schedule adherence within the operator's control.

These discussions also confirmed that many of the issues were systemic, and need a review of the system to improve upon.

Key issues of continuing concern included:

- Overcrowding;
- lack of service coverage and
- poor weekend and evening service.

2.5 Service Assessment

This section provides an assessment of the existing service and fare structure, based on the consultation process and ENTRA's own observation and assessment of the system.

2.5.1 Routes and Schedules

There is considerable evidence to suggest that many of the operational problems encountered during the review as part of the 2006 marketing study have been or are being addressed.

Customer communication has also improved significantly, with improved route maps and schedules, web site availability, and improved marketing and communication through both the web and print materials.

The most significant issues remaining within the system, and representing significant barriers to growth in the system are:

- long circuitous routes, with long travel times, particularly from the Borden area;
- lack of coordination between routes, effectively eliminating the opportunity for transfers, and limiting the ability to travel from the Old Town or N'Dilo areas to key destinations such as the hospital or the shopping areas;
- overcrowded peak buses;
- under used off-peak services;
- lack of coverage to key neighborhoods and
- lack of evening service and Sunday service and limited Saturday service.

The existing service is primarily a service for commuters, either workers or students, with very little off-peak ridership. For peak riders, the share of all trips taken by transit in Yellowknife is estimated in the 3 percent to 5 percent range – a very respectable value for a community of 20,000 people. In the midday periods however, the share of travel on transit is negligible. Modal split is defined as the proportion of trips dived by mode of transportation, usually between public transportation and private cars.

It is ENTRA's opinion that the ability to attract off-peak ridership through increased midday service is negligible, and that equal benefit can be achieved by making the service more reliable and convenient, through improved routing and connections, even at reduced service levels. A focus on improving peak period service, and service coverage in the peaks will likely be the most effective investment.

However, off-peak services are also known to support peak services – for employees working early or late shifts or weekends, for recreational and medical trips that may extend into the evening, or for regular day workers that may occasionally work late. The provision of off-peak service, including evenings and weekends, is an important part of making transit a more viable choice for travel.

2.5.2 Fares

The existing cash fares offer a relatively deep discount for concession fares such as seniors and students, at approximately 40 percent. Many transit systems are abandoning cash fare discounts in favour of a flat cash fare, in an attempt to move riders to prepaid media such as passes.

This type of structure relies on the availability of other media to offer riders an alternative, and to make the transition as close to revenue neutral as possible. This may require an expansion of the availability of punch passes from local merchants.

Also, the discount on the punch pass is relatively low, at about 9 percent (11 rides for the price of 10). In conjunction with a move to flat cash fare, Yellowknife Transit may consider a discount in the 15 to 20 percent range to make tickets more attractive. It is important to note however, that punch pass discounts reward advance purchase, not necessarily volume of use. An infrequent rider may purchase a punch pass and make it last an entire year for example, by only riding about once per month.

For this reason, incentives to move to monthly passes are more desirable. Frequent riders use monthly passes, since they expire at the end of the month. This ensures that the discount is a benefit to the higher frequency user.

For adults, seniors and students with school passes, the monthly pass offers a generous discount, requiring the rider to ride about 27 times per month (about 3 weeks out of the month to and from work or school) before breaking even with the price of a punch pass. This is also the case with the student passes. At a multiple greater than 40, these passes are not attractive, and the only viable option is the annual pass subsidized by the school boards for eligible students.

Many systems set this price multiple at about 40 discounted rides, with the theory that regular riders will use transit about 40 to 44 times per month to and from work or school, then benefit from essentially free travel in other periods, such as evenings or weekends. Given the lack of evening service and the poorer quality of the Saturday-only weekend service, the larger discount for monthly pass riders in Yellowknife is appropriate. Without a multiple below 40, few riders would purchase passes.

Some have experimented with off-peak discounts to promote ridership in this period and the practice is not uncommon in the United States. However, off-peak reductions can lead to revenue loss as well as customer confusion as to when the different fares are in effect resulting in fare disputes with drivers.

Despite the recommendation to focus on peak ridership, off-peak fare reductions may be worth testing in Yellowknife. Risks with this type of initiative would be minimal, since off-peak ridership is already very low. Also, customer confusion can be minimized in the Yellowknife schedule since the infrequent off-peak service would allow simple identification of reduced price trips on the public schedules.

Off-peak discounts would only apply to cash fares, since pass holders ride fare-free with their pass and we do not recommend introducing an off-peak punch pass for a fare experiment. The discount should be $0.50, making the off-peak fare a simple $2.00 fare. Since this is cheaper than the punch pass price, punch pass users may elect to pay

cash for off-peak rides. If the initiative proves successful and is maintained, Yellowknife should consider an off-peak punch pass, providing 11 off-peak rides for $20.00 (similar 11 for the price of 10 discount currently in place).

3. Service Options

3.1 Service Objectives

Based on the overall assessment of the existing service, the following objectives were established for the development of new route and service options. These objectives were reviewed and confirmed with stakeholders at the public forum.

- provide service options for Niven Lake area
- reduce circuitous routing, improve travel times, especially for Route 1 service areas
- operate all routes on similar headways to facilitate transfers
- provide increased peak service to promote ridership
- examine reduced off-peak service relative to demand
- examine service options for other areas, such as Kam Lake or School Draw
- examine alternative off-peak service delivery options

3.2 Base Conditions

Exhibit 6 illustrates the existing service design, requiring 5 peak buses and about 20 revenue vehicle hours in peak, plus 18 off-peak revenue vehicle hours, for a daily total of about 38 revenue vehicle hours.

This service design represents the best case for comparison to the new options in terms of resource requirements, service frequency and hours of operation. In the balance of this section, a variety of options are described and measured.

Exhibit 6 – Existing Service Hours

	Peak Period length	Peak Period Buses	Peak Vehicle-Hours	Off-Peak Period length	Off-Peak Period Buses	Off- Peak Vehicle-Hours
Route 1	6	2	12	6	2	12
Route 2	6	1	6	6	1	6
Express Borden	0.9	1	0.9	5	0	0
Express Frame Lake	0.9	1	0.9	5	0	0
Total		5	19.8		3	18

3.3 Ridership Estimates

Ridership impacts of each of the options were estimated in two components. For options that extend service to new or unserved neighborhoods, the existing or projected population of the area was used to estimate ridership based on the rides per capita for the existing service.

For impacts on existing areas, ridership was estimated based on the increase in the number of vehicle hours of service provided, factored with the current number of rides per service hour. In addition to this factor, a slight increase was calculated for the overall ridership expected to result from increased reliability, availability of connections and improved service quality.

3.4 Option 1

Option 1 (shown in Exhibit 9) involves minimal modifications to the existing service, maintains the existing number of buses and adjusts the frequency of the service between the peak and off peak hours. Please refer to the Exhibit 2 and Exhibit 3 to compare the existing routes with the proposed modifications on the route design.

The service can be provided during the AM and PM peak hours with a frequency of 30 minutes for Route 1 and 40 minutes for Route 2. In the beginning of the peak period either for AM and PM, the service will start with one bus and after one hour a second bus would start the service. In the off-peaks, the frequency is 60 minutes for both routes due to the low ridership during the off peaks. Exhibit 7 and Exhibit 8 shows more detail about the number of hours per day for each route with the proposed frequency.

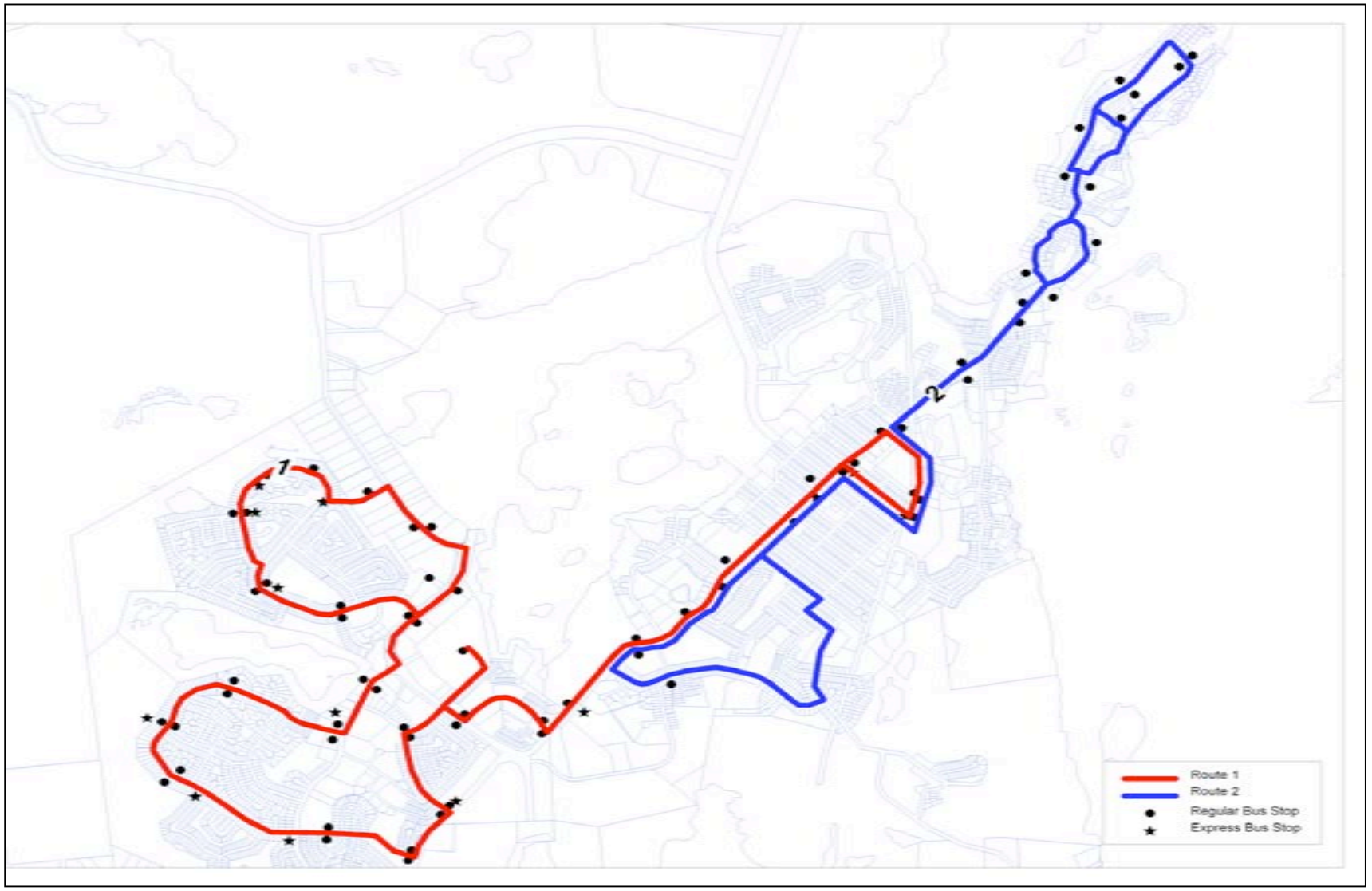
Exhibit 7 – Option 1 Service Design

Route	Cycle Time		Headway		Vehicles Required	
	Peak	Off-Peak	Peak	Off-Peak	Peak Period	Off-Peak Period
Route 1 – Borden/Northlands-Frame Lake Downtown	60	60	30	60	2	1
Route 2 – N'Dilo – Downtown – Forrest Drive	40	40	40	40	1	1
Express-Borden/Northlands					1	0
Express Frame Lake South					1	0

Exhibit 8 – Option 1 Operating Hours

	Peak Period Duration (hrs)	Peak Period Buses	Peak Vehicle-Hours	Off-Peak Period Duration (hrs)	Off-Peak Period Buses	Off-Peak Vehicle-Hours
Route 1	7	2	12	5	1	5
Route 2	7	1	7	5	1	5
Express Borden	0.9	1	0.9	5	0	0
Express Frame Lake	0.9	1	0.9	5	0	0
Total		5	20.8		2	10

Exhibit 9 – Route Option 1



3.4.1 Option 1 Evaluation

Advantages

- off-peak service more representative of demand
- potential for savings of 7 revenue vehicle-hours per day, or about 1,800 hours per year

Disadvantages

- no new service opportunities
- limited ridership growth opportunities
- does not correct mismatched services on Route1/Route 2

Ridership Impacts

New Service Areas

This option does not provide service to any new areas, and therefore will not attract additional ridership in these areas.

Service Increase Impacts

Since there are no service changes in the peaks and no ridership impacts are expected. Because of the very low midday ridership, no loss of ridership is expected with the change to hourly service.

3.5 Option 1 Alternatives

Option 1 reduces required vehicle-hours by approximately seven hours per day, or approximately 1,800 hours annually. There are a variety and combination of ways that these hours could be re-allocated to service expansion or improvement at no cost.

Some of these alternatives (and their required vehicle-hour cost) include:

- up to two additional AM and PM trips on each of the express routes (1800 hours) (described in more detail in Options 1A)
- increase cycle time on Route 2 to 60 minutes, and add one vehicle to increase frequency to 30 minutes and serve Niven in peak periods (1800 hours) (described in more detail as Option 1B)
- introduction of express trips on Route 2 during the peak time, and also one trip at noon (600 hours)
- extended service early in the morning and later in the evening (between 1 and 2 hours for both cases – 1800 hours)
- provide two express trips at noon to Borden and Frame Lake South (one for each zone – 900 hours)

- improve regular Saturday service to eliminate the midday service gap, and improve service to half-hour service all day (250 hours)
- add hourly evening service on non-summer weekdays (250 hours per day of the week, for service extended to 10:00 PM) – for example, late service on Thursdays and Fridays would require 500 hours in the non-summer period)

3.6 Option 1A

Option 1A (with routing similar to Exhibit 9) adds additional express trips on Route 1. The available hours from the midday service reduction should be able to accommodate four additional trips, one each to Borden and Frame Lake. Note that the proposed service design and resource requirements in Exhibit 10 and Exhibit 11 actually reduce daily hours by 0.8 hours. The same criteria for AM and PM peaks in Option 1 will be applied in Route 1 to reduce the number of hours.

Exhibit 10 – Option 1A Service Design

Route	Cycle Time		Headway		Vehicles Required	
	Peak	Off-Peak	Peak	Off-Peak	Peak Period	Off-Peak Period
Route 1 – Borden/Northlands-Frame Lake Downtown	60	60	30	60	2	1
Route 2 – N'Dilo – Downtown – Forrest Drive	40	40	40	40	1	1
Express-Borden/Northlands	40		40		1	0
Express Frame lake South	40		40		1	0

Exhibit 11 – Option 1A Operating Hours

	Peak Period Duration (hrs)	Peak Period Buses	Peak Vehicle-Hours	Off-Peak Period Duration (hrs)	Off-Peak Period Buses	Off-Peak Vehicle-Hours
Route 1	7	2	12	5	1	5
Route 2	7	1	7	5	1	5
Express Borden	4	1	4	5	0	0
Express Frame Lake.	4	1	4	5	0	0
Total		5	27		2	10

3.6.1 Option 1A Evaluation

Advantages

- off-peak service more representative of demand
- off-peak savings re-allocated to additional express trips
- reduce over-crowding on existing express trips
- provide more attractive peak service, with ridership increases

Disadvantages

- no new service area opportunities
- does not correct mismatched services on Route1/Route 2

Ridership Impacts

New Service Areas

This option does not provide service to any new areas, and therefore will not attract additional ridership in these areas.

Service Increase Impacts

The additional express trips are expected to both reduce overcrowding by redistributing trips as well as increase ridership by making peak services more attractive. Net new ridership is estimated in the range of 5,000 to 10,000 trips annually.

3.7 Option 1B

Option 1B (shown in Exhibit 14) uses the hours reallocated from the midday service reduction to provide peak period service to the Niven area. This would involve increasing the cycle time on Route 2 to 60 minutes, adding a vehicle to improve service in the entire route to a 30-minute frequency, and provide more running time to serve the Niven area. Similar to the other options, Route 1 and Route 2 would operate with one bus in the first hour of service, with 30-minute service beginning at 7:00 AM.

Exhibit 12 – Option 1B Service Design

Route	Cycle Time		Headway		Vehicles Required	
	Peak	Off-Peak	Peak	Off-Peak	Peak Period	Off-Peak Period
Route 1 – Borden/Northlands-Frame Lake Downtown	60	60	30	60	2	1
Route 2B – N'Dilo – Niven - Downtown – Forrest Drive	60	60	30	60	2	1
Express-Borden					1	0
Express Frame Lake					1	0

Exhibit 13 – Option 1B Operating Hours

	Peak Period Duration (hrs)	Peak Period Buses	Peak Vehicle-Hours	Off-Peak Period Duration (hrs)	Off-Peak Period Buses	Off-Peak Vehicle-Hours
Route 1	7	2	12	5	1	5
Route 2B	7	2	12	5	1	5
Express Borden	0.9	1	0.9	5	0	0
Express Frame Lake	0.9	1	0.9	5	0	0
Total		6	25.8		2	10

3.7.1 Option 1B Evaluation

Advantages

- off-peak service more representative of demand
- off-peak savings re-allocated to serve Niven
- provides opportunity to match schedules between Route 1 and Route 2B
- potential for savings of two revenue vehicle-hours per day, or about 500 hours per year

Disadvantages

- Route 2B is somewhat circuitous and may be confusing, though few riders if any will need to ride multiple sections of the route
- does not provide off-peak service in Niven

Ridership Impacts

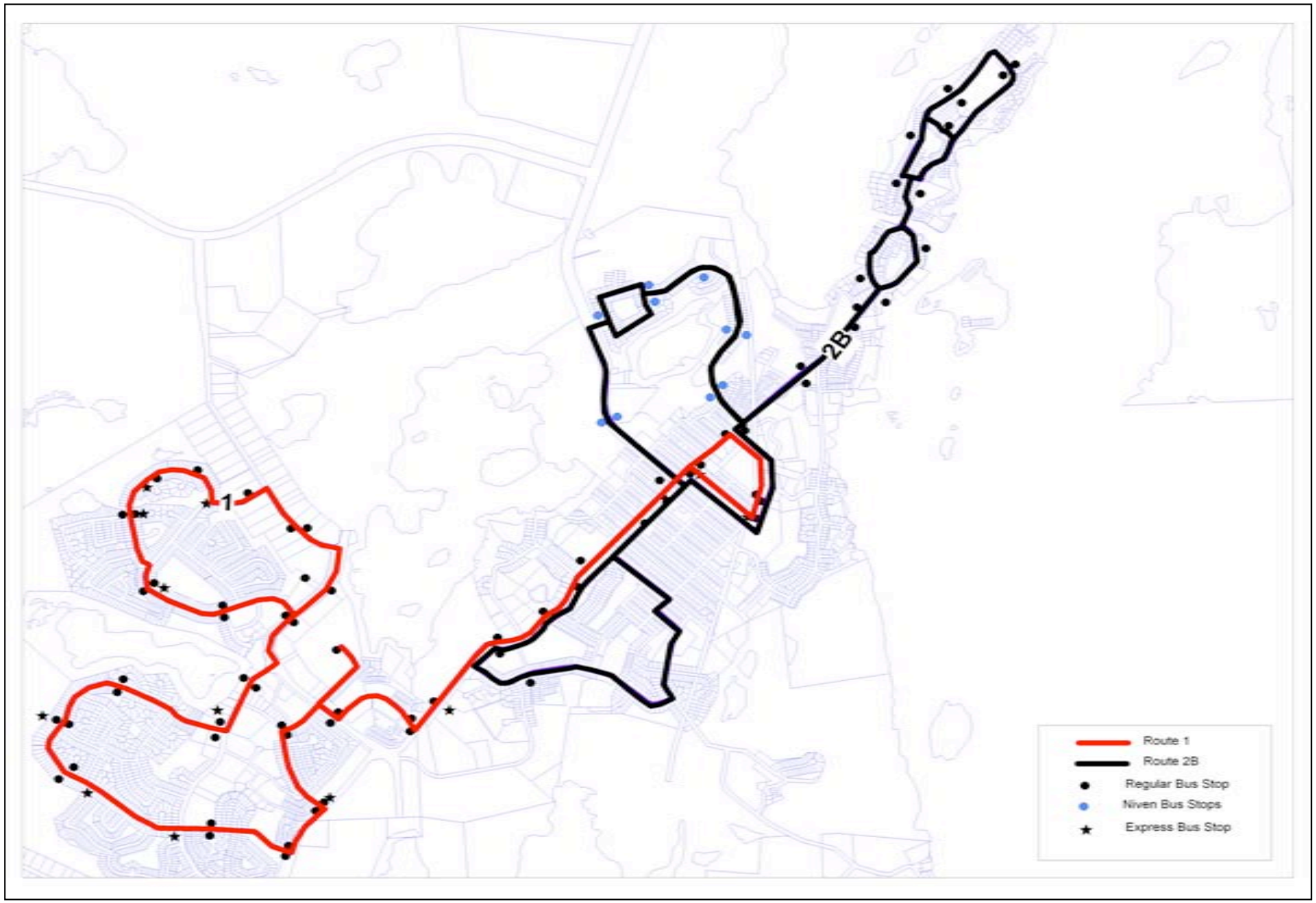
New Service Areas

Based on peak hour service, and the population in Niven, new ridership is estimated in the range of 3,000 to 4000 trips annually.

Service Increase Impacts

The increased service and coordinated schedules are expected to attract more ridership to the system, making this the biggest benefit of this option. Additional ridership is estimated in the rage of 5,000 to 10,000 annual trips, bringing the total in the range of 8,000 to 14,000 annual trips

Exhibit 14 – Option 1B



3.8 Option 2

Option 2 attempts to address the travel time issues for Route 1 by splitting the route into two separate routes, separating Borden/Northlands from Frame Lake, with service from both areas to the downtown, as illustrated in Exhibit 16. This option also introduces service to the Niven Lake area, with a modification to Route 2. To achieve this, the Forest Drive area is eliminated from Route 2, and covered by a new Route 4, which also serves Kam Lake. Because of the more direct service from Borden and Frame Lake, and the increased service levels, Express service is eliminated.

Route 1 and Route 2 in this option operates on 40-minute round trips times with two buses, providing 20-minute service in peak periods. In off-peak periods, service on all routes is reduced to 60 minutes, due to the low ridership. This modification will require additional layover time, but also allows coordination of service between the routes to minimize transfer time and coordinate to school and work schedules.

3.8.1 Route 2 Modification

In this option, Route 2 is modified to eliminate the Forrest Drive portion, and add a Niven loop. The frequency of the service in this route is 20 minutes in peaks with two buses (40-minute round trip) and 60 minutes (one bus) in off-peaks.

3.8.2 New Route: Kam Lake – Forrest Drive - Downtown

A new Route 4 is added in this option to replace the Forrest Drive area eliminated from Route 2, and service Kam Lake with spare capacity on the route. The frequency for this route will be 30 minutes during the AM and PM peak hours and a frequency of 60 minutes during the off-peak hours. Exhibit 15 and Exhibit 17 show details of the vehicle requirements and operating hours for the routes.

Exhibit 15 – Option 2 Service Design

Route	Cycle Time		Headway		Vehicles Required	
	Peak	Off-Peak	Peak Headway		Peak Period	Off-Peak Period
Route 1A – Borden-Northlands - Downtown	40	40	20	60	2	1
Route 1B – Frame Lake South -Downtown	40	40	20	60	2	1
Route 2 – N'Dilo – Niven - Downtown	40	40	40	40	2	1
Route 4 – Kam Lake Forrest Drive - Downtown	60	60	30	60	2	1

Exhibit 16 – Option 2

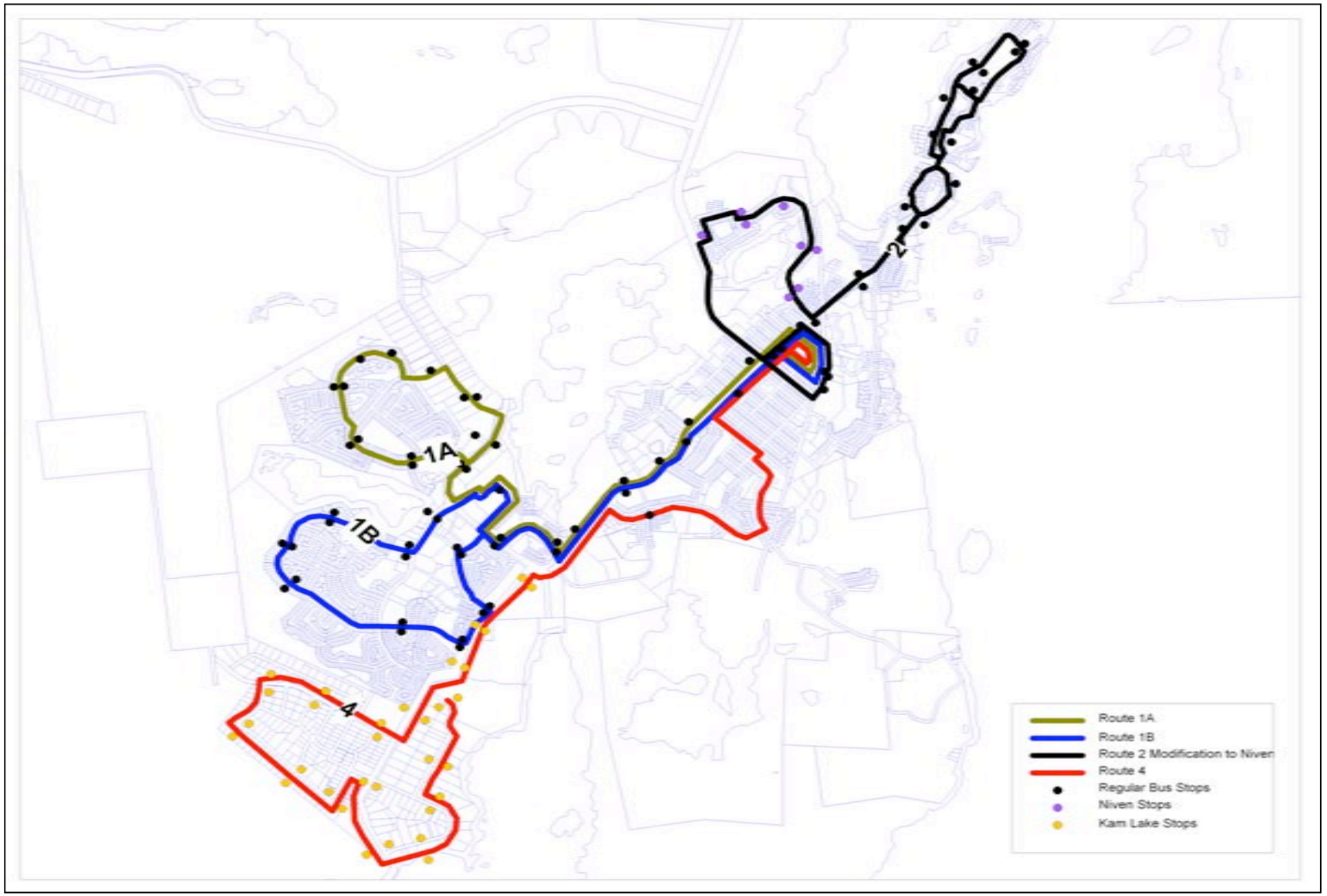


Exhibit 17 – Option 2 Operating Hours

	Peak Period Length	Peak Period Buses	Peak Vehicle-Hours	Off-Peak Period Length	Off-Peak Period Buses	Off-Peak Vehicle Hours
Route 1A	7	2	12	5	1	5
Route 1B	7	2	12	5	1	5
Route 2	7	2	12	5	1	5
Route 4	7	2	12	5	1	5
Total		8	48		4	20

3.8.3 Option 2 Evaluation

Advantages

- new service to Niven Lake area and Kam Lake;
- improved travel time from Borden;
- increased service on all routes;
- coordinated schedules between routes and
- off-peak service more representative of demand.

Disadvantages

- increased vehicle and operating requirements (approximately 80 percent increase in hours) and
- excess layover in off-peak periods.

Ridership Impacts

New Service Areas

With new all day service to Niven and Kam Lake, new ridership from these previously unserved areas is estimated to range from 5,000 to 7,000 new trips annually.

Service Increase Impacts

The improved service on Route 1 and Route 2, and the coordinated schedules between the two routes are expected to result in ridership increases in the range of 45,000 to 90,000 new rides, resulting in a total of about 50,000 to 100,000 new rides.

3.9 Option 2A

In this alternative to Option 2 (shown in Exhibit 20), the Forrest Drive area is served by a diversion of Route 1B-1 from Frame Lake South, and eliminating service to Kam Lake.

This reduces the number of vehicles by two and the number of daily hours by approximately 17 when compared to Option 2 (shown in Exhibit 19).

Exhibit 18 – Option 2A Service Design

Route	Cycle Time		Headway		Vehicles Required	
	Peak	Off-Peak	Peak	Headway	Peak Period	Off-Peak Period
Route 1A Downtown – Borden/Northlands	40	40	20	60	2	1
Route 1B-1 Downtown – Forrest Drive - Frame Lake South	40	40	20	60	2	1
Route 2 Modification to Niven	40	40	40	40	2	1
Optional:						
Express Service	60	60	30	60	2	1

Exhibit 19 – Option 2A Operating Hours

	Peak Period Length	Peak Period Buses	Peak Vehicle-Hours	Off-Peak Period Length	Off-Peak Period Buses	Off- Peak Vehicle Hours
Route 1A	7	2	12	5	1	5
Route 1B-1	7	2	12	5	1	5
Route 2	7	2	12	5	1	5
Optional:						
Express Service	60	2	30	60	0	0
Total		8	36		3	15

3.9.1 Option 2A Evaluation

Advantages

- new service to Niven Lake area
- improved travel time from Borden
- increased service on all routes
- coordinated schedules between routes
- off-peak service more representative of demand

Disadvantages

- increased vehicle and operating requirements (approximately 35 percent increase in hours)
- excess layover in off-peak periods.

Ridership Impacts

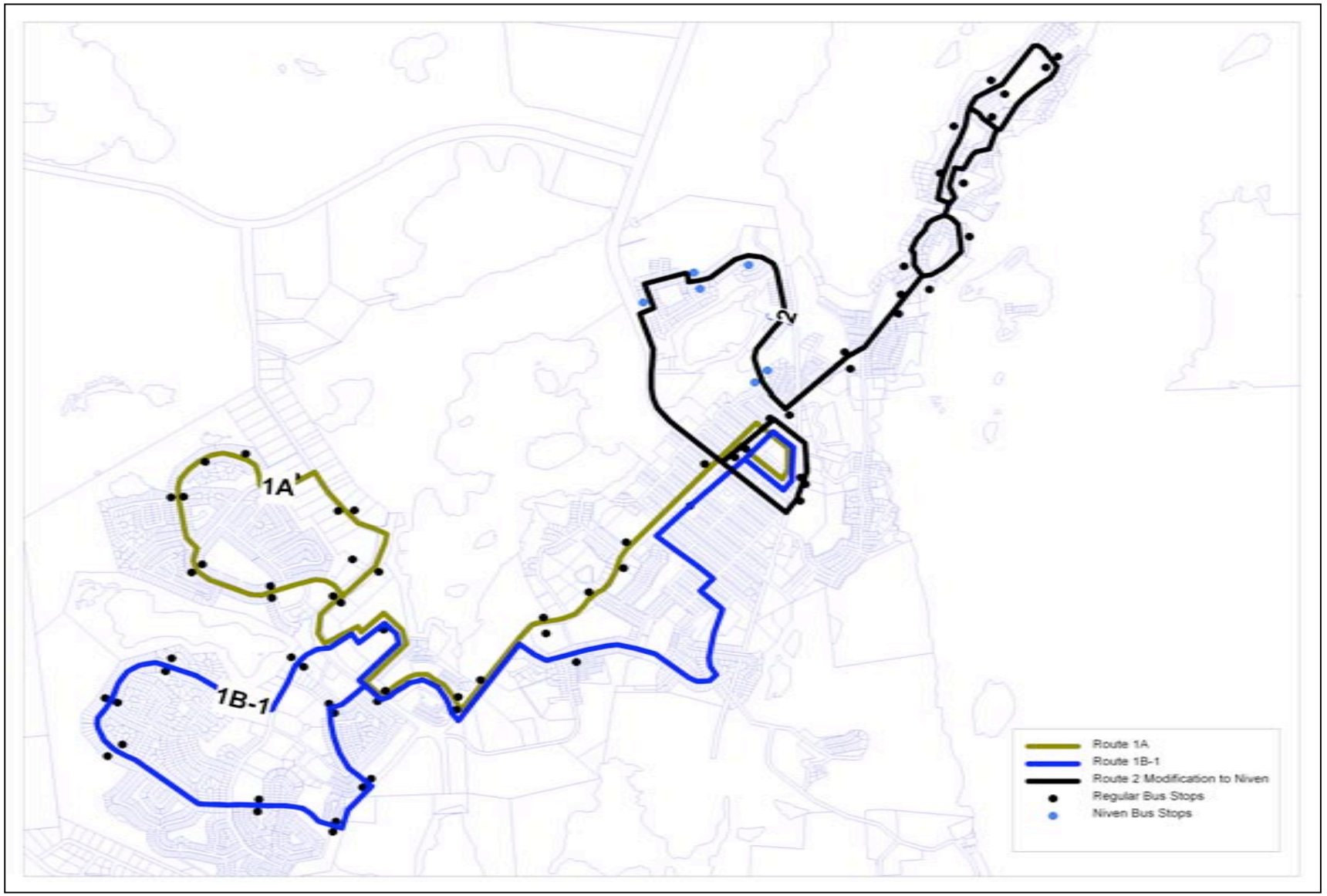
New Service Areas

Without service to Kam Lake ridership from new service areas is limited to 3,00 to 5,000 annual rides.

Service Increase Impacts

Despite the reductions from Option 2, this option still provides a general service increase to the system, and is expected to result in ridership increases in the range of 35,000 to 55,000 new rides, resulting in a total of about 40,000 to 60,000 new rides.

Exhibit 20 – Option 2A



3.10 Option 3

Option 3 uses the same split route concept for Frame Lake and Borden, but connects the Frame Lake South portion to existing Route 2. This creates a city-wide route (Route 5) from N'Dilo, through the high schools, Downtown, School Draw, Forrest Drive and Frame Lake South (shown in Exhibit 23).

A new Route 6 is added in this option (shown in Exhibit 23) to provide additional service in the Borden area and commercial district, and service to the Niven area, linking also the industrial area (Kam Lake), and the Franklin corridor. This is accomplished by operating in a loop, using Old Airport Road and the highway to connect from the Borden area to Niven. While ridership in this area is expected to be minimal, the faster travel time facilitates the route operation, and may allow limited trips to the airport.

The Borden area route remains essentially the same as in Option 2, which can be identified in this option as Route 1A (shown in Exhibit 23)

Route 1 – Borden would operate on a 40 minute round trip time, with two buses in peak periods providing 20-minute service (shown in Exhibit 21). Route 5 and Route 6 have 60-minute round trip times, with two buses on each providing 30 minute service. Off-peak service on all routes is 60 minutes.

Exhibit 21 – Option 3 Service Design

Route	Cycle Time		Headway		Vehicles Required	
	Peak	Off-Peak	Peak	Headway	Peak Period	Off-Peak Period
Route 1A – Borden-Northlands Downtown	40	40	20	60	2	1
Route 5 – N'Dilo – Downtown - School – Draw – Forrest Drive - Frame Lake	60	60	30	60	2	1
Route 6 – Kam Lake-Multiplex-Airport-Niven-Downtown	60	60	30	60	2	1

Exhibit 22 – Option 3 Operating Hours

	Peak Period Length	Peak Period Buses	Peak Vehicle-Hours	Off-Peak Period length	Off-Peak Period Buses	Off-Peak Vehicle-Hours
Route 1A	7	2	12	5	1	5
Route 5	7	2	12	5	1	5
Route 6	7	2	12	5	1	5
Total		6	36		3	15

3.10.1 Option 3 Evaluation

Advantages

- new service to Niven Lake area, Kam Lake and School Draw
- improved travel time from Borden
- increased service on all routes
- coordinated schedules between routes
- off-peak service more representative of demand

Disadvantages

- increased vehicle and operating requirements (approximately 35 percent increase in hours
- excess layover in off-peak periods

Ridership Impacts

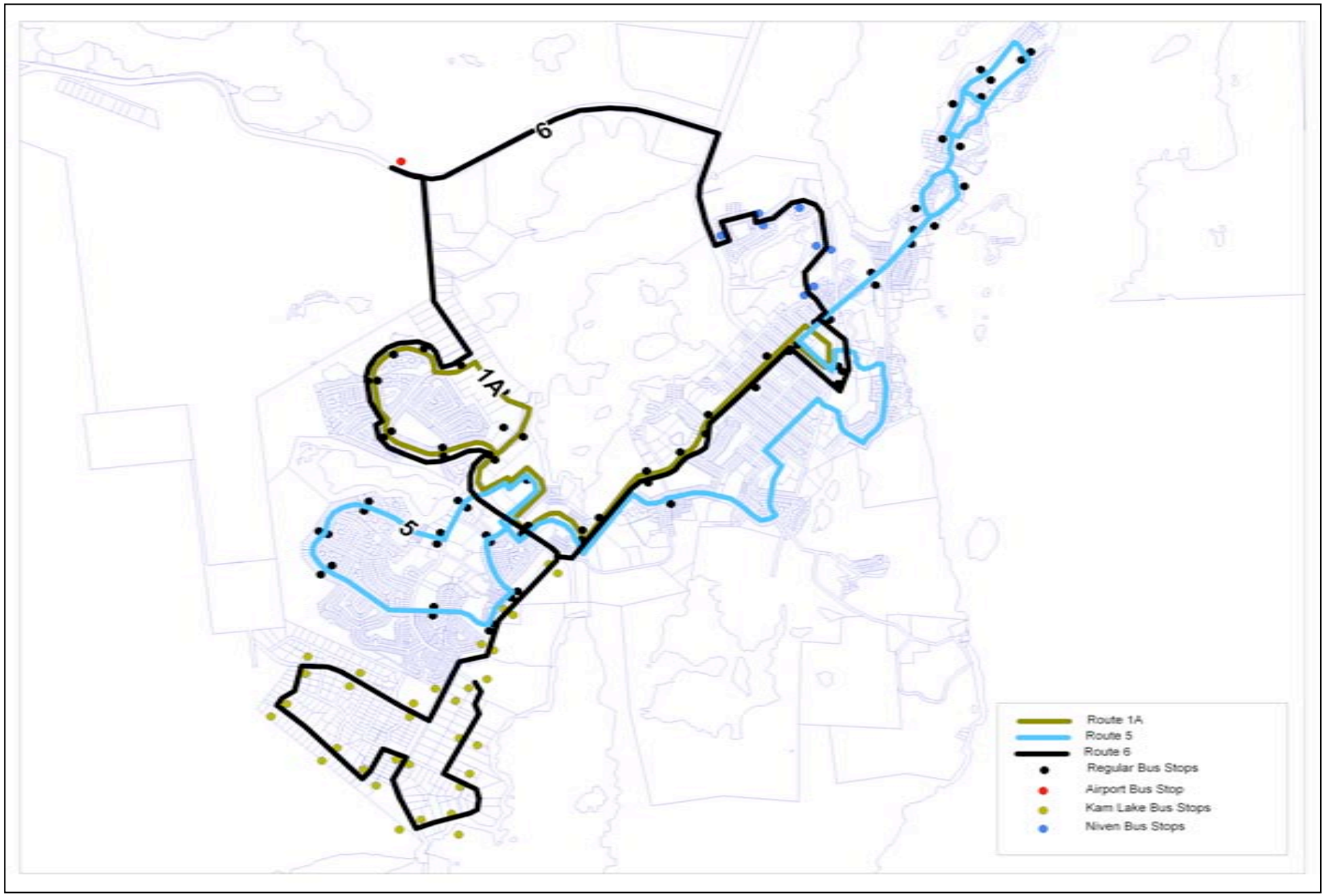
New Service Areas

Service to the variety of new areas is expected to result in new ridership in the range of 8,000 to 10,000 new trips annually.

Service Increase Impacts

The improved service throughout the system, and the coordinated schedules between Route 5 and Route 6 are expected to result in ridership increases in the range of 30,000 to 50,000 new rides, resulting in a total of about 40,000 to 60,000 new rides.

Exhibit 23 – Option 3



3.11 Option 4

Option 4, illustrated in Exhibit 26, reduces the proposed loop route (Route 6) to one-way service, and operating in peak periods only. This route would alternate directions in the morning and afternoon peaks, to provide more direct service (clockwise in AM and counter-clockwise in PM).

The resources from this route are diverted to additional service connecting Frame Lake, downtown and Forrest Drive, as well as Kam Lake, which is the original Route 4 used in Option 2.

Exhibit 24 and Exhibit 25 illustrate the service design and operating hours for Option 4.

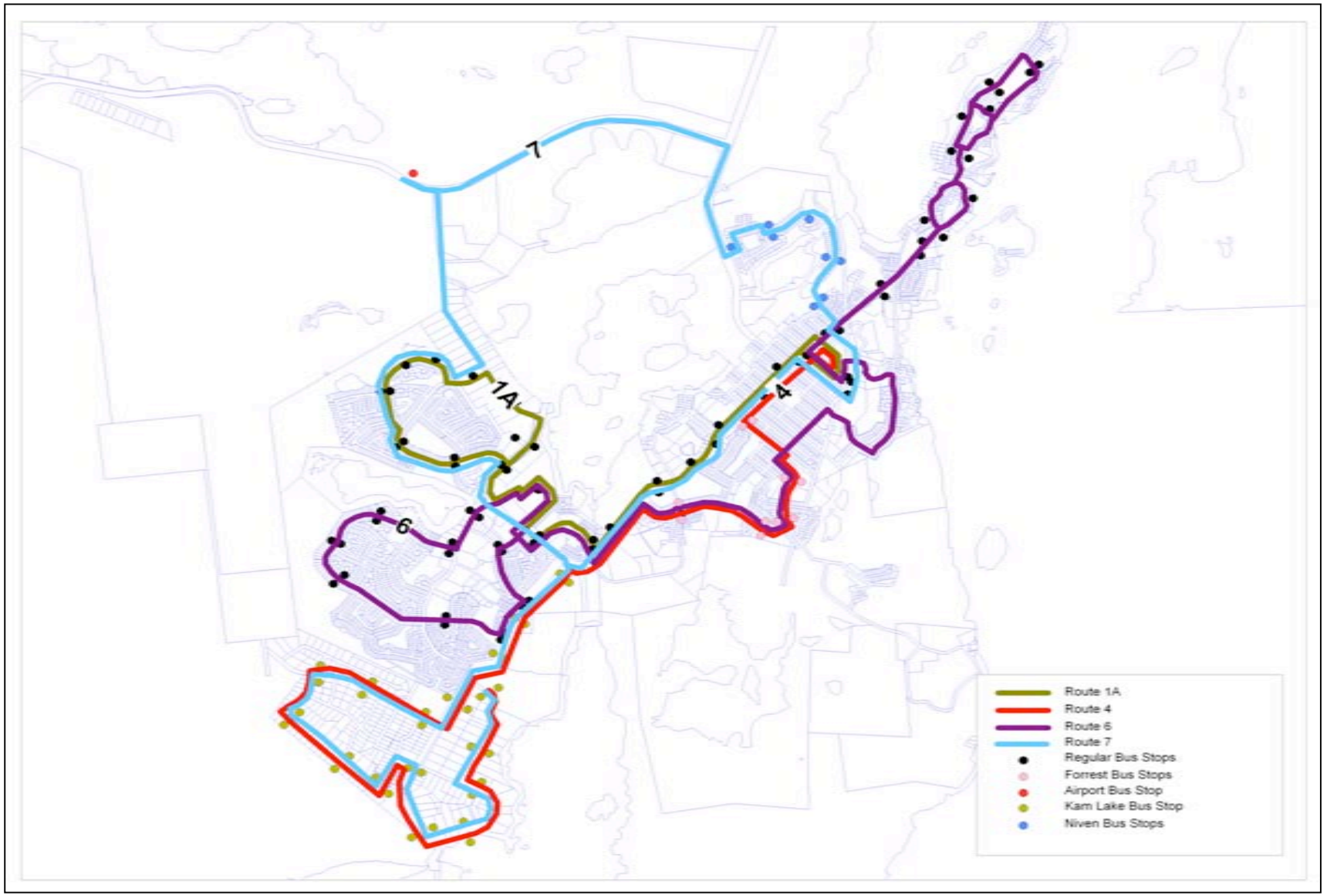
Exhibit 24 – Option 4 Service Design

Route	Cycle Time		Headway		Vehicle Required	
	Peak	Off-Peak	Peak	Headway	Peak Period	Off-Peak Period
Route 1A – Borden/Northlands-Downtown	40	40	20	60	2	1
Route 4 – Kam Lake – Forrest Drive - Downtown	60	60	30	60	2	1
Route 6 – N'Dilo-Downtown-School Draw – Forrest Drive - Frame Lake	60	60	30	60	2	1
Route 7 – Kam Lake-Multiplex-Airport-Niven-Downtown					1	0

Exhibit 25 – Option 4 Operating Hours

	Peak Period Length	Peak Period Buses	Peak Vehicle-Hours	Off-Peak Period Length	Off-Peak Period Buses	Off-Peak Vehicle-Hours
Route 1A	7	2	12	5	1	5
Route 4	7	2	12	5	1	5
Route 6	7	1	7	5	0	0
Route 7	7	2	12	5	1	5
Total		7	43		3	15

Exhibit 26 – Option 4



3.11.1 Option 4 Evaluation

Advantages

- high degree of service coordination
- new service to Niven Lake area and Kam Lake and School Draw

Disadvantages

- complicated route structure
- increased vehicle and operating requirements (approximately 53 percent increase in hours)
- some duplication of service

Ridership Impacts

New Service Areas

Service to the variety of new areas is expected to result in new ridership in the range of 8,000 to 10,000 new trips annually.

Service Increase Impacts

The improved service throughout the system, the coordinated schedules between the Route 4 and Route 7 and the focus on improving service in good performing areas are expected to result in ridership increases in the range of 40,000 to 60,000 new rides, resulting in a total of about 50,000 to 70,000 new rides.

3.12 Comparison of Options

Exhibit 27 shows a comparison of each of the major options, indicating the number of vehicles required and the cost of the new service based on additional vehicle hours of service, and the ridership estimates, as described in the previous sections. Costs and new ridership are combined to illustrate the cost per new ride resulting from each option.

Exhibit 27 – Comparison of Options

Option	Additional Peak Vehicles	Total Operating Hours		Additional Cost	New Ridership Low	New Ridership High	Min Cost per New Ride	Max Cost per New Ride
		Proposed	Difference					
Option 1	0	30.8	-7	($131,000)				
Option 1A	0	37	-0.8	($15,000)	5,000	10,000		
Option 1B	1	35.8	-2	($37,000)	10,000	15,000		
Option 2	3	68	30.2	$563,000	50,000	100,000	$5.63	$11.26
Option 2A	1	51	13.2	$246,000	40,000	60,000	$4.10	$6.15
Option 3	1	51	13.2	$246,000	40,000	60,000	$4.10	$6.15
Option 4	2	58	20.2	$377,000	50,000	70,000	$5.39	$7.54

Assumptions	
Existing Operating Hours	**37.8**
Ridership	**161,187**
Total Operating Cost	**$738,858**
Current Rate	**$74**
Cost per Ride	**$4.58**

4. Off-Peak Service Delivery Options

4.1 Option A – Reduced Service Frequency

Each of the main options presented in Section 1.1 rely on reduced service frequency on the proposed routes to tailor service to demand and achieve savings to redeploy to other time periods.

Reducing midday frequency as a strategy for reducing service has one key advantage – it is simple to understand since the routes do not change. Throughout the day, all routes operate on consistent routes, and only the service frequency changes.

The key disadvantage of this strategy is its limited flexibility. Since the routes and travel times are fixed, there is a minimum level of service that must be provided, regardless of the level of demand.

4.2 Option B – Demand Response Services

To address the issue of limited flexibility of the fixed route-fixed schedule service, different demand response alternatives might be considered.

4.2.1 Option B-1 – Demand Response Service

In this option, the service operates as a fully demand responsive service, similar to the specialized service operated by YATS. This means that riders would call for service and a dispatcher would arrange schedules. To be truly effective, this service requires an advance call-in period to allow optimization of schedules, otherwise it operates in a similar direct-ride format as taxi service and cost-effectiveness is reduced or lost. This call-in period might vary from a couple hours to the day before, with the trade-off of efficiency over convenience.

4.2.2 Option B-2 – Zone Bus

The zone bus concept is a hybrid between the conventional fixed route service and the fully demand responsive service. In this concept, schedules are fixed, but routes remain flexible. This means that riders still need to call for service, but the need for a long advance call-in period is eliminated. For hourly service, for example, riders would need to call in during the hour preceding their planned trip. The dispatcher then organizes the route for the next trip and relays this information to the driver. Riders are picked up at the regular route stop closes to their origin.

Popular destination can also be included in the fixed schedule. For example, downtown or Wal-Mart or the hospital could be established as fixed points on each trip, since most trips would involve a stop at that location. In this way, rides boarding at these location do not need to call in advance, but need only board the bus and inform the driver of their destination.

The key advantage of this system is that it allows a consistent schedule, while allowing much greater coverage with a single bus, since the driver only goes where passengers actually are. It also has the advantage of improving public perception of the service, since buses are rarely empty.

Given the observed level of demand in off-peak periods in Yellowknife today (maximum 11 passengers per hour on all routes), it is quite likely that an off-peak zone service could be accomplished with one vehicle between the hours of 10:00 AM and 3:00 PM.

Exhibit 28 shows the estimated savings in daily and annual operating hours derived from the zone bus system, if applied to each of the proposed options. Note that each of the new options already included reduced off-peak service frequency as part of their service design.

Exhibit 28 – Zone Bus Option – Additional Savings

Option	Off-Peak Vehicle Hours (10:00AM – 3:00 PM)	Potential Savings (Vehicle-Hours)	
		Daily	Annual
Existing	15	10	1,700
Option 1	10	5	850
Option 2	20	10-15	1,700-2,250
Option 3	15	10	1,700
Option 4	15	10	1,700