Clause 26 in Report No. 12 of Committee of the Whole was adopted, by the Council of The Regional Municipality of York at its meeting held on June 25, 2015 with the following recommendation:

26
York Telecommunications Network

Committee of the Whole recommends adoption of the recommendations contained in the report dated June 3, 2015 from the Chief Administrative Officer and the Commissioner of Finance, as amended:

1. This report be referred to the Broadband Task Force for further consideration in the context of the Council approved Broadband Strategy.

2. The Regional Clerk circulate this report to local municipalities *requesting comments by September 30, 2015.*

3. Recommendations

It is recommended that:

1. This report be referred to the Broadband Task Force for further consideration in the context of the Council approved Broadband Strategy.

2. The Regional Clerk circulate this report to local municipalities.

4. Purpose

This report provides background information on the York Telecommunications Network (YTN) program and describes the YTN review that is currently under way.

This is the first of two planned reports on the YTN. The second report is expected to include recommendations to Council on the future direction of the YTN and is slated for early 2016.

5. Background

The YTN is York Region owned fibre infrastructure

The YTN is York Region owned and operated fibre optic telecommunications infrastructure connecting Regional locations and facilities. The YTN services only a small portion of the total Regional Wide Area Network (WAN) (i.e., the network that connects Regional buildings and facilities to each other). The majority of Regional WAN connections are managed through contracts with third party telecommunications companies. The YTN also connects a limited number of other public sector facilities that reside along the fibre cable's path.

Fibre cables transmit information at the speed of light

A strand of optical fibre is flexible, transparent, and made of pure glass, not much thicker than a human hair. Fibre functions as a "light road", transmitting information (i.e., voice, data and video) on a beam of light between the connected locations. When there are no network devices connected on either end, fibre is considered "dark". The YTN is dark fibre infrastructure.

Fibre's capacity is virtually unlimited. For example, one strand of fibre can transmit 58 years of high definition video from here almost to Buffalo in one second. The transfer limitation is in the network equipment connected to each end of the fibre. As network equipment improves, and the price falls, organizations can obtain additional capacity over the same strands of fibre simply by upgrading the network connections. The fibre does not need to be replaced.

An individual fibre cable in the YTN can contain up to 144 individual strands. The YTN infrastructure is both underground, in conduits under Regional rights of way, and above ground, connected to utility poles. Since fibre cables are made of glass and can break, underground fibre installations require a conduit (essentially a plastic pipe) to house and protect the fibre.

Dark fibre can be used by the owner or leased to others

The leasing of dark fibre involves providing dedicated access to strands of fibre between two points with the subscriber providing the network equipment at either end that determines the speed of the connection.

Traditional telecommunications services, available from large telecommunications companies, are based on a fixed monthly cost for a given capacity between two points along with the network equipment required to make this connection. Although the customer is paying for a connection between two sites, the physical connection goes from the customer to the nearest carrier hub site, after which it traverses the carrier's existing infrastructure. In this way, the

carriers can have many customers sharing the same physical strands of fibre in their network.

The YTN was originally designed as a means of connecting Regional offices to each other

The YTN started in 2002 as a means of connecting Regional offices to each other. These initial connections were lower cost than third party connections.

The YTN has grown incrementally to add more Regional buildings over time. Design and installation of approximately 270 kilometres of fibre cables is under way. By the end of 2014, 77 kilometres of fibre infrastructure had been constructed, with 133 connections – of which 78% are Regional facilities (i.e., buildings), including six York Regional Police buildings, and other Regional nodes (i.e., traffic control/cameras, Viva, water/wastewater monitoring systems, etc.), colloquially called “things”. The remaining 22% of connections are for the local municipalities and the York Region District School Board.

Of the completed cables, 56% are attached to hydro poles and the remaining 44% are underground. In many cases, laying fibre cable has been carried out in conjunction with capital projects delivered by Environmental Services, Transportation Services and Viva.

The YTN has expanded to connect other Regional “things”

In February 2007, workshops were held with representatives from Transportation and Works (now Transportation Services and Environmental Services), Corporate Services and Finance to develop a high-level vision of how emerging network technologies could be deployed across the Region. From these workshops an operational plan emerged to support the vision of key internal stakeholders. The plan was developed into an internal document entitled the York Region Network Strategic Plan (the “plan”).

As part of the plan, the need for one network to service many IT demands was identified. The plan identified a number of existing departmental technologies on separate special purpose networks (e.g., water/wastewater monitoring, traffic signals, rapid transit) and connections from the Region to external networks (e.g., provincial government network, public internet and the public telephone network).

Through these findings, the plan identified the need for a single “cross Region network” to consolidate the needs of the Regional departments.

By the end of 2014, it is estimated that 60% of all connections to the YTN were non-facility Regional nodes, or simply “things”, rather than building-to-building

connections. Regional “things” include traffic control/cameras, Viva monitoring and payment systems, and water/wastewater monitoring systems.

The data requirements of these other “things” need to be investigated further to determine whether the high-speed connection available over fibre is required, or if another economical means of connecting these things could be used.

Viva rapidway construction has driven recent YTN growth

Viva rapidway construction has been identified as one of the main drivers of recent YTN expansion. It is estimated that by the end of 2015, Viva and traffic control connections will represent nearly 60% of all YTN connections, up from only 34% of connections in 2013.

As part of the operational analysis for the technology required along the Viva rapidways, Transportation Services determined that fibre was the preferred mode of communication. A number of transportation-related connectivity issues were considered and to meet these needs, along with the future scalability of the system, a fibre optic network was recommended.

The YTN was identified by Transportation Services as the desired solution for fibre infrastructure because the long-term operating costs would be lower than with a third party provider.

However, since the YTN has been extended to Viva rapidway connections, the average cost per kilometer has increased because the majority of fibre installations have been buried. The cost of connecting the fibre infrastructure for the Viva rapidways is shared between ITS and Transportation Services. ITS pays the majority of the fibre infrastructure costs and Transportation Services funds the specific technological requirements for the Viva rapidways, such as switches.

Local municipalities and some other public sector organizations have subscribed to the YTN

The YTN’s first non-Regional customer was the Town of Newmarket, which connected to the YTN in 2011. The rationale for connecting to the YTN included cost-effectiveness, increased bandwidth and simplified network monitoring capabilities. To date, the Town of Newmarket has connected 15 locations.

Currently, the Town of Georgina, Town of Richmond Hill, Town of Aurora and York Region District School Board have connected a total of 16 locations to the YTN.

Table 1 provides a summary of the YTN’s existing subscribers.

Table 1
Existing YTN Subscribers

Subscriber	Current Locations	Annual Fees
Town of Newmarket	15	$56,500
Town of Georgina	2	$6,000
Town of Richmond Hill	3	$9,350
Town of Aurora	9	$21,750
York Region District School Board	2	TBD

An ORION link has been established

The Ontario Research and Innovation Optical Network (ORION) is a fibre optic network that supports research, education, collaboration and innovation across Ontario. ORION connects nearly all of Ontario's research and education institutions, including every university, most colleges, several teaching hospitals, public research facilities and several school boards to one another and to the global grid of research and education networks.

One of the action items in York Region's Economic Development Action Plan is to “identify opportunities for establishing ORION points of presence to facilitate post-secondary research and presence and hub development”.

The Region is building a direct link, through the YTN, for ORION between York University and Southlake Regional Health Centre this year. In the interim, a temporary link has been established through a managed solution with a third-party provider until the YTN fibre build is complete. ORION is receiving two strands of dedicated fibre for a total payment of $565,000 to the Region.

The Region has obtained a non-dominant carrier’s license from the Canadian Radio-television and Telecommunications Commission

To accommodate the expansion of the YTN, and meet the legislative requirements of the Telecommunications Act, the Region took out a “non-dominant” carrier’s license with the Canadian Radio-television and Telecommunications Commission (CRTC).

The Region applied for a license from the CRTC in 2013 as a “non-dominant carrier”. This decision coincided with the Region’s expansion of the YTN to service other public service entities such as school boards. An external legal opinion obtained at that time advised that such expansion was viewed as an activity that confirmed the Region as a “telecommunications common carrier” that owned a transmission facility to provide telecommunications services to the public for compensation. Prior to this the Region’s provision of services to local municipalities was not viewed as providing services to the public.

A non-dominant carrier’s licence is required for the Region to provide telecommunications services as a facilities-based provider. A facilities-based provider owns or operates a “transmission facility” used by that provider (or another provider) to offer telecommunications services to third parties for compensation.

Non-dominant status implies that the Region does not have any significant impact on competition for such services in the marketplace. However, if the annual revenues from telecommunications services exceed $10 million, the status changes and the reporting and regulatory rules become more involved. In 2015, annual revenues from YTN subscribers are projected to reach $745,000 – $180,000 from annual subscribers plus a one-time payment of $565,000 from ORION.

As of April 2015, there were 260 non-dominant carriers in Canada offering a range of telecommunications services, including public sector providers such as the Regional Municipality of Peel. There is no cost to register for a non-dominant carrier’s license. The Region can cancel a non-dominant carrier’s license if it chooses to no longer offer services to third parties for compensation.

6. Analysis and Options

A comprehensive review is under way

In 2014, Regional staff launched a comprehensive review of the opportunities and challenges associated with the future of the YTN. The review is jointly led by the CAO’s Office, ITS and the Office of the Budget, with a steering group that includes staff from Audit, Legal and Economic Strategy.

Upon completion, the review will have examined the following:

1. A comprehensive stakeholder analysis;

2. An environmental scan, covering both external and internal drivers;

3. A detailed requirements analysis from the stakeholder needs assessment to ensure the YTN will satisfy the needs of its subscribers;

4. A comparative analysis of similar systems in North America;

5. An analysis of current capital expenditure and operating expenditure projections for the YTN;

6. An analysis of business and governance options;

7. Evaluation criteria to assess the proposed business and governance options; and,

8. A review of technological options available to the Region.

The project is being conducted in two phases. In the first phase, options for potential governance and business models for the YTN are being assessed. The Region engaged Red Mobile Consulting, jointly with KPMG and Milrad Law, for phase one.

Phase 2 of the project includes the development of a detailed business and implementation plan based on the Council approved direction determined in Phase 1 of the project.

A follow-up report to Council will include a summary of the findings, which will inform staff advice to Council on the policy, financial and implementation implications for a range of business and governance models. The follow-up report to Council is slated for early 2016.

The YTN has become increasingly complex

The YTN started as a Regional office connectivity solution and has grown incrementally to include other public sector offices and facilities, including those of some local municipalities.

The YTN fibre infrastructure is currently managed in-house by two existing Information Technology Services staff as a full-time responsibility. However, with the expansion of the YTN and its relationship to the Broadband Strategy, the Viva rapidway expansion and the ORION link, the demands and complexity of the YTN have significantly outgrown staff capacity and the current administrative structure.

Costs continue to rise

Since the YTN has historically been run part-time by ITS staff, not all staff costs were captured in the YTN's capital plan.

These costs included direct costs and also allocated costs related to staff time for activities that were not directly captured (i.e., general overhead, initial internal design and engineering, external design and engineering, permit applications with railways/ MTO/others, purchasing, legal, commissioning and project management). Additionally, some costs specific to the YTN expansion were identified in transportation and other public works projects.

It is estimated that if the YTN had continued on its planned growth path the cumulative all-in capital costs would have reached approximately $20 million by the end of 2015, and operating expenditures in 2015 would have reached $800,000.

Attachment 1 shows the initially planned expansion of the YTN up to the end of 2015.

Financial sustainability needs to be considered

Subscriber revenues are modest. By 2014, the YTN had recovered a total of approximately $527,000. Subscriber fees do not cover the costs of operating the YTN. Recoveries in 2014 were approximately $160,000 while operating expenditures were $200,000. The gap is expected to grow based on current practices and projections. Recoveries for 2015 are projected to be approximately $180,000, with operating expenditures estimated to be approximately $250,000.

Customer fees have historically been calculated by the length of fibre cable utilized by each customer to connect their locations. The current cost of connecting to the YTN for local municipalities and other public organizations is $2,000 per kilometer per year for the first pair of fibre strands and $1,000 per kilometer per year for each additional pair of fibre strands, plus a one-time connection fee of $2,500 per location. For example, the Town of Aurora's nine locations are in close proximity to each other, which results in lower annual fees.

Subscriber fees were set in the early stages of the YTN. Further analysis of pricing methods will be developed for the second report to Council.

By 2014, estimated all-in costs per kilometer had increased from $52,000 per km in 2011 to $90,000 per km, a 73% increase. This is due to the changing mix of fibre installations, as the YTN has moved from a predominately aerial installation to more expensive buried installations. Through Regional infrastructure projects, such as Viva rapidway construction and water/wastewater projects, an opportunity was identified to leverage the road works to install buried fibre. Although more expensive, buried fibre is more reliable and less prone to damage from extreme weather events than aerial fibre installations.

Figure 1 outlines the estimated capital costs under the original expansion plan for the YTN, before the current review was under way. As evidenced in the chart, the capital costs were set to grow significantly starting in 2015. By 2023, all-in cumulative capital costs would have reached $58 million under this plan.

Figure 1
Analysis of Projected Capital Costs
Under Original YTN Expansion Plan (Before Review)

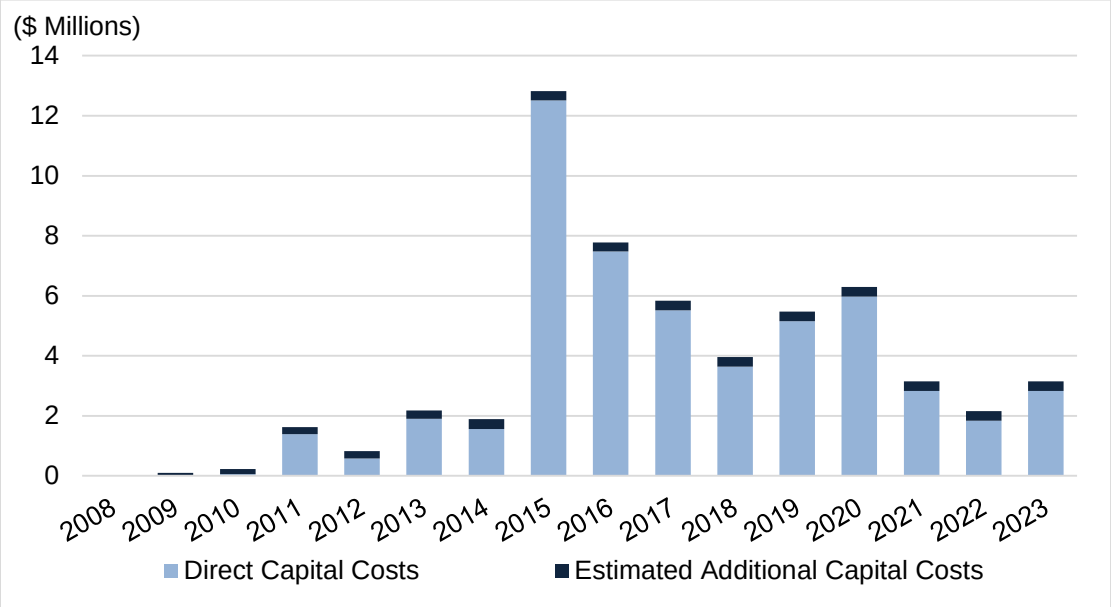
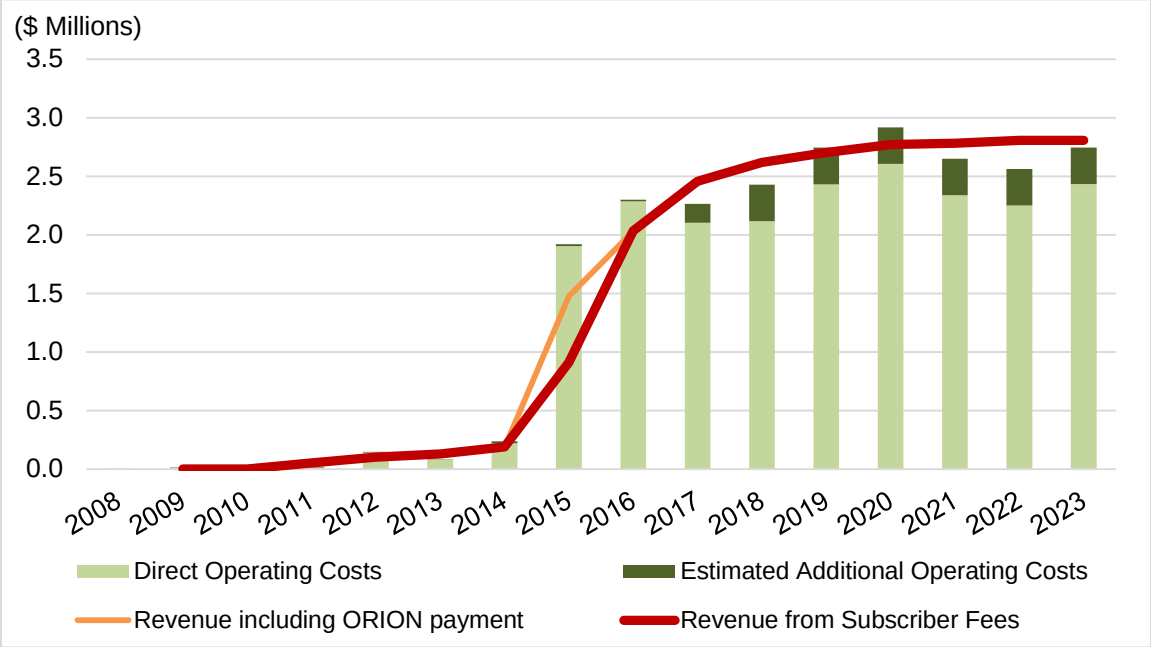


Figure 2 outlines the estimated operating costs and projected revenues under the original expansion plan for the YTN, before the current review was under way. Operating costs include costs that the consultants identified as “best practices” that are currently not being undertaken, such as contributions to a disaster recovery fund.

Operating costs were projected to increase to over $2.5 million per year by 2019. Revenue from subscriber fees are based on internal estimates of potential additional subscribers from the broader public service sector, including subscribers from municipalities, universities, school boards and hospitals (i.e., the MUSH sector).

Figure 2
Analysis of Projected Operating Costs and Revenues
Under Original YTN Expansion Plan (Before Review)



Other jurisdictions operate regional and municipal networks

There are a number of municipal/regional high-speed networks across North America. The consulting team highlighted networks that more closely resemble the structure of the YTN in its current form and potential models that could form the basis of a future YTN. Table 2 highlights some examples.

Table 2
Interjurisdictional Analysis

Jurisdiction	Name of Network	Key Facts
Regional Municipality of Peel	Peel Public Service Network	• One of the largest public service networks in North America • Developed to meet network needs essential to the public sector (i.e., municipalities, hospitals and educational institutions) • Strategic vision for end state network developed in early stages of project • Developed as a public sector solution with partnership between Peel Region, City of Brampton and City of Mississauga

Jurisdiction	Name of Network	Key Facts
Eastern Ontario	Eastern Ontario Regional Network	• Pan-regional telecommunications solution to bring high speed access to small to medium sized communities • Long-term strategic vision and goals of network developed in advance of construction with public and private partners • Funded by both public and private entities; infrastructure will transfer to the private sector after seven years
City of Chattanooga, Tennessee	Electric Power Board (EPB)	• Leveraged the city-owned electric company to deliver its “Fibre to the Home” initiative, providing fibre connectivity to every customer in its service area • Launched in 2009, EPB Fiber Optics now serves 61,000 homes and more than 5,000 businesses
Town of Olds, Alberta	O-Net	• Olds, Alberta is 14.9 km^2 with a population of 8,200 • After conducting several studies, talking to the local service providers and reviewing funding options, the town decided to build its own network • Town and private economic development agency jointly founded a for-profit company to install a network consisting of buried and aerial fibre • As no commercial Internet providers were willing to offer services on a network they had not built, town’s private economic development agency established their own ISP called O-Net • Services offered include Internet, telephone and HDTV/video
City of Coquitlam, British Columbia	Coquitlam Optical Network Corporation (QNet)	• Provides businesses, schools and residential high-rises with access to 60km city-owned fibre optic network • City ran conduits in 1980s for traffic signal system, used this network to run fibre cables to support public-sector services. Leases unused capacity for private sector use

Jurisdiction	Name of Network	Key Facts
City of Stratford, Ontario	Rhyzome Networks	• City-owned fibre optic and WiFi networks serving Stratford and six rural communities in southwest Ontario • The fibre network consists of 70 km of buried optical fibre. WiFi network nodes are mounted on utility poles throughout the city • Networks serve both public and private customers

In addition to these networks, a number of municipal broadband initiatives were started by local municipal hydro utilities in Ontario in the 1990's. Local municipal hydro utilities had been established by the Province of Ontario as Local Distribution Corporations (or "LDCs") to manage electrical distribution in many urban areas on behalf of Ontario Hydro.

In 1996 LDCs were reconfigured to be able to operate as "for profit" corporations and to merge or amalgamate. Many LDCs became Internet Service Providers, and combined their fibre assets. For example, in 2005 Guelph and Waterloo created the corporation Atria, which had 1,000 km of fibre deployed. In 2006, Atria was purchased by a private investment company, Birch Hill Equity Partners.

Atria continued to acquire fibre assets, including those of Powerstream and SCBN Telecom Inc. in York Region, Hamilton FibreWired, Ottawa Hydro Telecom, Peterborough Hydro and Halton Hills Fibre Wired. In 2011, Atria was sold to Rogers Communications, at which time the network had grown to 6,500 km.

The YTN has evolved into an economic model that shares some similarities with utility companies

Analyzing the functions, risks and subscribers of the YTN provides an indication of the evolution of the YTN’s business model.

Through the YTN, the Region has been involved in the design, installation and provision of dark fibre infrastructure to connect both internal (i.e., Regional) users and local municipalities across a limited geography in York Region. The overall scale of the YTN network remains limited.

Similar high bandwidth services could be obtained through other technologies or from the Canadian large telecommunications companies. The YTN only provides dark fibre infrastructure for subscribers to connect their locations. Large

telecommunications companies typically provide the network connections at either end of the fibre.

The main business risk associated with the provision of services through the YTN would be a disruption in the physical network that could create outages for customers. This requires monitoring of the network and the provision of break/fix service contracts. Break/fix service contracts are in place to ensure the service is repaired as quickly as possible. These contracts are an industry standard.

Based on the review of the functions, key risks and subscribers of the YTN, the services provided by the YTN are reasonably similar to a utility company involved in the design, installation and leasing of infrastructure.

Potential future business and governance models are being considered

The consultants provided a range of business and governance models. The following tables provide a high-level overview of these potential business and governance models. The second report will provide greater detail on these models and how they could be structured for the YTN.

At a high-level, there are three general ownership structures under analysis: (i) public-owned; (ii) public-private partnership; and, (iii) private ownership/divestiture.

Table 3 provides a summary of the two main public ownership models that are being considered as part of the review: (i) wholly-owned by the Region; and, (ii) jointly-owned by the Region and other public sector partners (e.g., local municipalities).

Table 3
Potential Public Ownership Models

Model	Key Features
Wholly-owned by Region	• Specific models could include a regulated utility, Region-owned non-profit corporation or stand-alone entity • Region largely maintains control and has more flexibility to adapt to its changing needs • Region fully bears operational, technology and network evolution risks associated with operating the YTN
Jointly-owned by Region and public sector partners (e.g., local municipalities)	• Similar to Region-only ownership but in partnership with local municipalities • More complex governance structure and may require negotiations to determine where risks are borne and how

Model	Key Features
	costs are split • Business case must make sense for each partner as well as whole entity • May be difficult with a large number of partners

Table 4 provides a summary of the three main public-private partnership models that are being considered as part of the review: (i) public-private joint venture; (ii) design-build-finance-maintain-operate (DBFMO); and, (iii) concession.

Table 4
Potential Public-Private Partnership Models

Model	Key Features
Public-Private joint venture	• YTN is jointly-owned with a private sector organization • Similar to the jointly-owned public model, there is a need to divide ownership and risks between the partners • Potential funding could be available from senior levels of government (e.g., P3Canada, Building Canada Fund) • Control of the asset would be dependent on shareholder agreements
Design, Build, Finance, Maintain and Operate (DBFMO)	• A private sector partner designs, builds, finances, maintains and operates the YTN with the Region retaining ownership and the rights to revenues • Private sector partner receives guaranteed payment to recover their investment • Likely limited flexibility to adjust the private sector partner's responsibilities unless built and priced into contract
Concession	• A private entity makes the investments, sets prices, receives revenue and operates the YTN for a fixed period of time after which the ownership reverts back to the public sector • Private entity would need to determine if there was a business case for running the YTN, including potential revenues from subscriber fees and costs associated with running the YTN • Likely limited flexibility to meet the Region's needs unless built and priced into contract

Model	Key Features
	• More private sector involvement than in DBFMO and more risk transferred to private sector partner

Table 5 provides a summary of the two main privatization/divestiture options that are being considered: (i) sale to a single owner; and, (ii) sale to an ownership group or consortium.

Table 5
Potential Privatization/Divestiture Options

Privatization/ Divestiture Option	Key Features
Sale to a single owner	• Pricing to Region becomes fully commercial (may be negotiated as part of sale) • Scope of services offered will likely be limited to those with highest profitability and may no longer meet the needs of the Region and its public sector partners • Risks transferred to private owner • Evolution of the YTN after sale will be based solely on commercial considerations • Could include leaseback provisions, but sale revenue would be lower
Sale to an ownership group or consortium	• Similar features as a sale to a single owner

Business, governance and pricing models will need to balance policy objectives with potential issues and risks

The choice of the optimal business, governance and pricing model for the future of the YTN will depend on the policy objectives Council wishes to achieve and how the Region can best manage the issues and risks associated with the chosen path.

Table 6 outlines the potential policy objectives that could be achieved through the future YTN and the potential issues and risks that may need to be managed.

Table 6
Potential Policy Objectives, Issues and Risks

Potential Policy Objectives	Potential Issues and Risks
• Building block for advanced broadband capability (economic development) • Improve quality and efficiency of Regional services • Lower Regional costs • Provide services to local municipalities and/or other public sector organizations whether on a cost recovery or subsidized basis • Provide services to under-served areas in the Region (rural areas, business parks) • Generate revenue	• Risk of technological obsolescence or displacement, resulting in stranded costs • High cost • Crowding out of other capital investment priorities • Marketability to potential subscribers at cost recovery • Relationships between pricing and customer base • Governance – how to avoid over-building and under-pricing • Regulatory compliance

Link to key Council-approved plans

The 2015 to 2019 Strategic Plan, *From Vision to Results*, identifies four Strategic Priority Areas. Within the Economic Vitality Strategic Priority Area the Region has identified a strategic objective of "focusing on networks and systems that connect people, goods and services". This implementation of the Broadband Strategy and review of the YTN are linked to the Strategic Plan through this strategic objective.

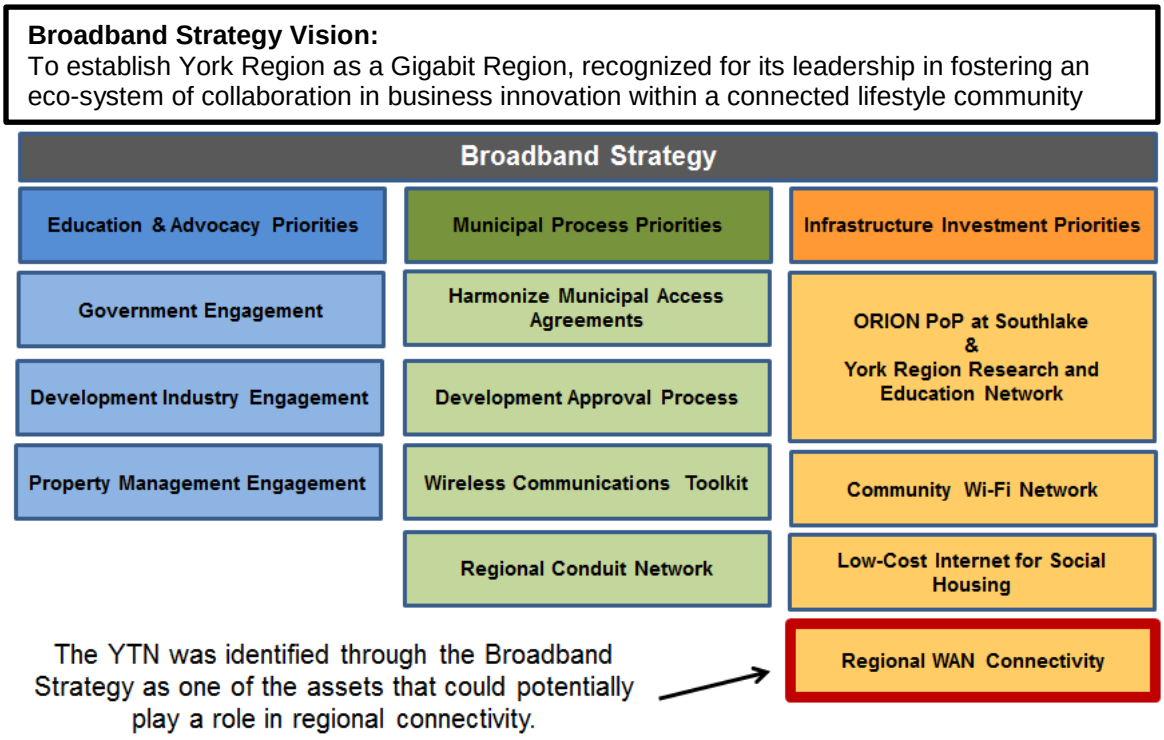
Goal 2 of the Economic Development Action Plan is to "Provide connectivity infrastructure to support innovation".

The YTN is referenced in the Region's Broadband Strategy

York Region's Broadband Strategy outlines the vision for connectivity in the Region. The YTN was identified through the Broadband Strategy as one of the elements potentially playing a role in advancing the goals of the strategy. The Broadband Strategy recommended that the YTN be developed to meet the Region's WAN connectivity requirements and provide interconnectivity between the Region and its public sector partners.

Figure 2 illustrates the vision and scope of the York Region Broadband Strategy as captured in the May 15, 2014 report entitled "York Region Broadband Strategy: Establishing York Region as a 21st Century, Knowledge-Based Community".

Figure 2
York Region Broadband Strategy Overview



7. Financial Implications

By the end of 2014, the YTN's cumulative all-in capital costs had reached $7.3 million. Operating costs for the YTN in 2014 were $0.2 million. Future costs related to the expansion of the YTN will depend on the business and governance model chosen as part of the YTN review.

The costs of the YTN review are accommodated within the Finance (IT) budget.

8. Local Municipal Impact

As part of the review process, there have been consultations with the local Chief Administrative Officers. Further consultation with local municipalities is planned.

9. Conclusion

As the YTN has expanded from connecting Regional buildings and facilities to also connecting public sector subscribers and other Regional things such as traffic control/cameras and water and wastewater monitoring systems, it has become increasingly complex, expensive, with increasing capital expenditures and growing operating costs, and administratively challenging. The Region is at a key juncture in determining the future of the YTN.

The review under way will provide Council with policy options and recommendations on business and governance models.

For more information on this report, please contact John Swan, Director, Information Technology Services, at ext. 71756, or David Rennie, Director, Strategies and Initiatives, CAO's Office, at ext. 72013.

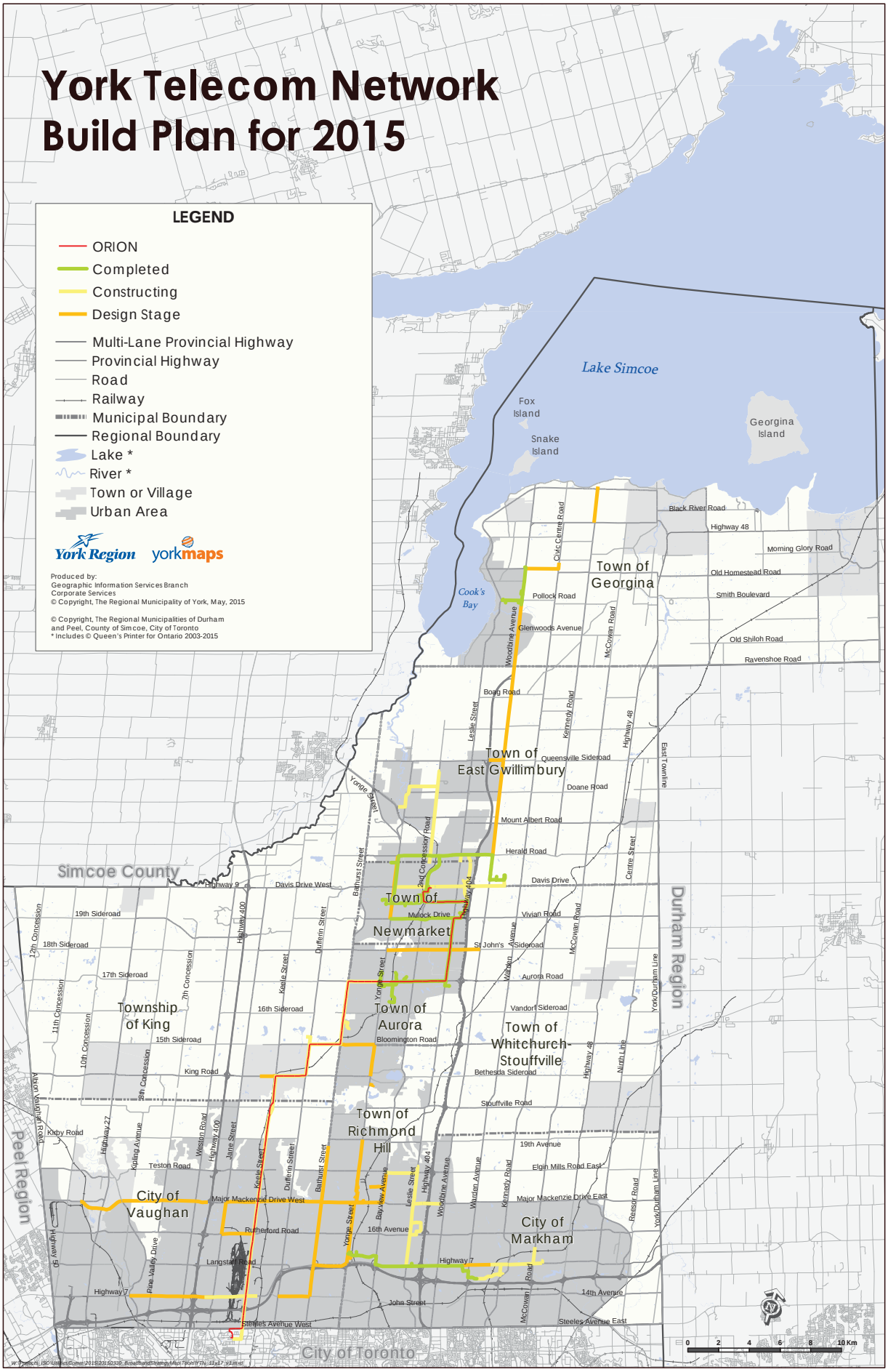
The Senior Management Group has reviewed this report.

June 3, 2015

Attachment – 1

eDOCS 6136683

Accessible formats or communication supports are available upon request


York Telecom Network
Build Plan for 2015
LEGEND
ORION
Completed
Constructing
Design Stage
Multi-Lane Provincial Highway
Provincial Highway
Road
Railway
Municipal Boundary
Regional Boundary
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River *
Town or Village
Urban Area
York Region
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Town of Newmarket
Township of King
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Town of Whitchurch-Stouffville
Town of Richmond Hill
City of Vaughan
City of Markham
City of Toronto
Simcoe County
Durham Region
Peel Region
Black River Road
Highway 48
Morning Glory Road
Old Homestead Road
Smith Boulevard
Old Shiloh Road
Ravenshoe Road
Pollock Road
Glenwoods Avenue
Cook's Centre Road
Woodbine Avenue
McCowan Road
Boag Road
Leslie Street
Kennedy Road
Queensville Sideroad
Doane Road
Mount Albert Road
Herald Road
Davis Drive
Davis Drive West
Yonge Street
2nd Concession Road
Bathurst Street
Highway 404
Centre Street
East Townline
Mulock Drive
Vivian Road
St John's Sideroad
Aurora Road
Vandorf Sideroad
Bloomington Road
Bethesda Sideroad
Stouffville Road
Nuttli Line
York/Durham Line
Highway 48
McCowan Road
Warden Avenue
Dufferin Street
Keele Street
Highway 400
19th Sideroad
18th Sideroad
17th Sideroad
16th Sideroad
15th Sideroad
King Road
12th Concession
11th Concession
10th Concession
9th Concession
7th Concession
Highway 9
Highway 27
Kirby Road
Teston Road
Major Mackenzie Drive West
Major Mackenzie Drive East
Rutherford Road
Langstaff Road
Highway 7
Steeles Avenue West
Steeles Avenue East
John Street
14th Avenue
16th Avenue
19th Avenue
Elgin Mills Road East
Bayview Avenue
Jane Street
Weston Road
Kipling Avenue
Pine Valley Drive
Highway 50
Kennedy Road
Reesor Road
Woodbine Avenue
Leslie Street
0 2 4 6 8 10 Km