

Flood Control Infrastructure





State of Local Infrastructure

TRCA's Building The Living City Strategic Plan states that TRCA will oversee the "reduction or elimination of existing flood risk within our jurisdiction". Over the last ten years TRCA has made significant investments to remediate its inventory of flood protection structures in order to meet its objectives of protecting the public from flood damage. Conservation authorities are mandated, under Section 21 of the Conservation Authorities Act, to ensure conservation, restoration and responsible management of Ontario's water resources. Specifically, Section 21 states that conservation authorities are empowered to;

- to erect works and structures and create reservoirs by the construction of dams or otherwise;
- to control the flow of surface waters in order to prevent floods or pollution or to reduce the adverse effect thereof;

As part of this mandate, TRCA chooses to develop and maintain programs to prevent loss of life and property damage from flooding and erosion hazards. To meet this objective TRCA has constructed many flood control structures to reduce flood risk in Flood Vulnerable Area's (FVA's). Also Dam safety reviews provide detailed condition assessments, outline the deficiencies discovered during the investigation of the structure and are critical in identifying future capital projects. TRCA currently owns 10 dams and 15 flood control structures that include channels, dykes and flood walls.

TRCA's dam inventory consists of 10 dams of which five provide flood protection. The other dams are historical mill and industrial dams acquired through land acquisitions. TRCA dams' range in age between 40-80 years and most need major capital improvements to meet current dam safety guidelines.

TRCA's channels, berms and other structures are also experiencing some deterioration. For example, some TRCA channels have reduced flood capacity due to the accumulation of sediment, establishment of vegetation, failed concrete panels and erosion of channel banks. These structures were built between the 1950's and 1980's and the design life of these types of structures is typically around 50 years and some structures need some major repairs to extend their functional life.

To obtain an overview of the TRCA's current state of Flood Control Infrastructure assets, the asset inventory, valuation, age, and condition were documented for the following asset categories:

- Dams
- Channels
- Dyke
- Flood Walls
- Hydrometric Equipment



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Asset Data Inventory

The dams and channels assets included in the AMP make up the largest portion of TRCA's assets in terms of financial value and represent the greatest area of risk to public safety.

TRCA's dam inventory consists of 10 dams of which five provide flood protection. The other dams are historical mill and industrial dams acquired through land acquisitions. Also, TRCA have 15 flood control structures that include channels, dykes and flood walls. The information below summarizes the dams, channels and other flood control assets inventory that are included in this AMP.

TRCA DAMS				
Dam Name	Watercourse	Region	Dam Purpose	Unit
G. Ross Lord Dam	West Don River	City of Toronto	Flood Control	Each
Claireville Dam	West Humber River	Peel Region	Flood Control	Each
Stouffville Dam	Stouffville Creek	York Region	Flood Control	Each
Milne Dam	Rouge River	York Region	Flood Control	Each
Black Creek Dam	Black Creek	City of Toronto	Flood Control	Each
Palgrave Dam	Humber River	Peel Region	Recreation	Each
Secord Dam	West Duffins Creek	Durham Region	Recreation	Each
Osler Dam	East Duffins Creek	Durham Region	Recreation	Each
Glen Haffy Dam West	Humber River	Peel Region	Recreation	Each
Glen Haffy Dam East	Humber River	Peel Region	Recreation	Each

TRCA CHANNELS				
Channel Name	Watercourse	Channel Purpose	Channel Type	Channel Length
Yonge York Mills Channel	West Don River	Flood Control	Concrete Trapezoidal/ Gabion Trapezoidal	1670m
Woodbridge Channel	East Humber River	Flood Control	Rip Rap	1850m
Stouffville Channel	Stouffville Creek	Flood Control	Gabion Basket	370m
Black Creek Channel	Black Creek	Flood Control	Concrete Trapezoidal	2370m

Scarlett Channel	Black Creek	Flood Control	Concrete Trapezoidal	3600m
Brampton Channel	Humber River	Flood Control	Concrete Trapezoidal	570m
Sheppard Channel	West Don River	Flood Control/Erosion Control	Gabion Basket	350m
Mimico/Malton Channel	Mimico Creek	Flood Control	Gabion Trapezoidal	650m
Oak Ridges Channel	East Humber River	Flood Control	Gabion Basket	90m

TRCA DYKES			
Dyke Name	Watercourse	Channel Purpose	Dyke Length
Pickering Dyke	Duffins Creek	Flood Control	1250m
Ajax Dyke	Duffins Creek	Flood Control	350m
Bolton Dyke	Humber River	Flood Control	800m
Etobicoke Dyke	Etobicoke Creek	Flood Control	460m
Flood Protection Landform	Don River	Flood Control	710m

TRCA FLOOD WALLS				
Flood Wall Name	Watercourse	Region	Wall Purpose	Unit
Tyndall Flood Wall	Little Etobicoke Creek	Peel	Flood Control	Each

TRCA HYDROMETRIC EQUIPMENT	
Hydrometric Equipment Type	Number
Real-time Stream Gauges	27
Real-time Precipitation Gauges	26
Stand-alone Stream Gauges	28
Stand-alone Precipitation Gauges	16



Asset Valuation

In order to proactively manage assets through their full life cycle, estimated replacement costs are calculated to ensure appropriate funds are being set aside to fund the future rehabilitation and replacement of assets as needed. Replacement values are calculated using historical costs indexed to December 31, 2019. Therefore, the replacement cost valuation is presented in current dollars and does not account for technology improvements.

Replacement Values are used as the basis to estimate the cost of replacing an asset when it reaches the end of its engineered design life. The total replacement value of the dams and channels included in this Plan is \$97,939,131 and \$9,896,900 for other flood control assets for a total of \$107,836,031. The total replacement value of all assets covered under this plan is illustrated in table below.

Replacement Cost Valuation, there is three basic methods to estimate replacement costs needed for infrastructure renewal planning:

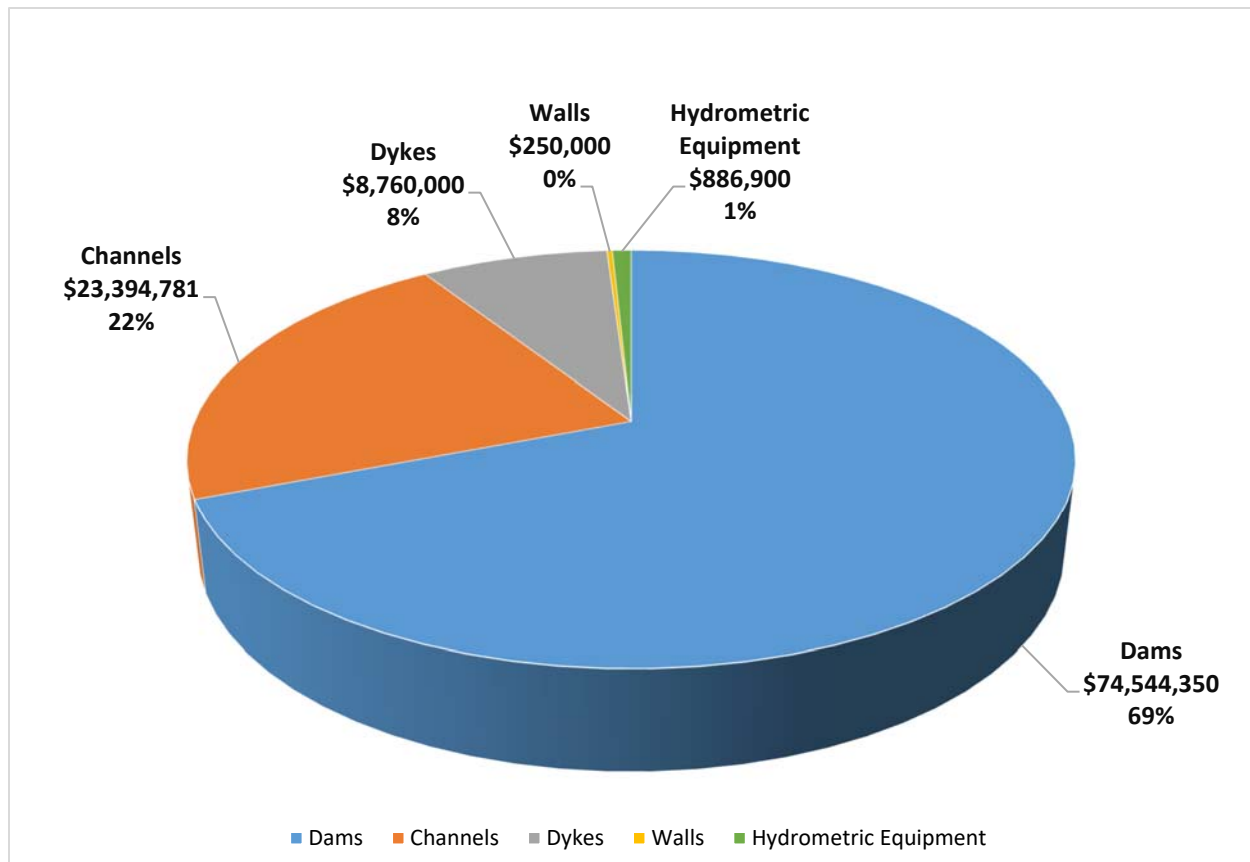
- 1. Local price indices:** This is the most accurate method. TRCA has collected recent acquisition data demonstrating similar replacement activities.
- 2. Published price indices:** Where local indices are not available, TRCA uses published indices which although appropriate and standardized. Not a complete sentence.
- 3. Accounting estimates:** When assets cannot be estimated against either index, TRCA uses accounting methodology based on historic cost, estimated useful life and inflationary effects to determine replacement value. Figure 1- Total Replacement Value.

Asset Type	Replacement Value
Dams	\$74,544,350
Channels	\$23,394,781
Dykes	\$8,760,000
Walls	\$250,000
Hydrometric Equipment	\$886,900
Total	\$107,836,031



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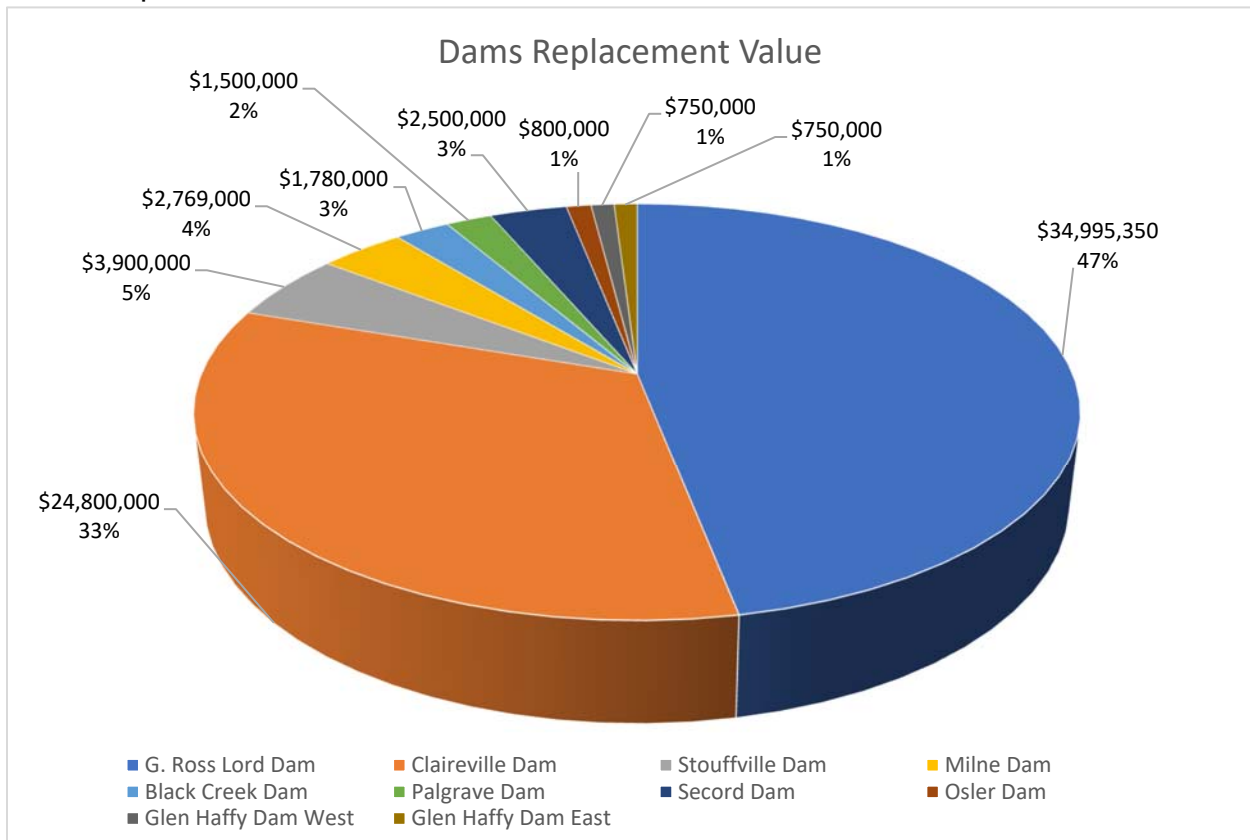
Figure 1 - Total Flood Control Infrastructure Replacement Value.



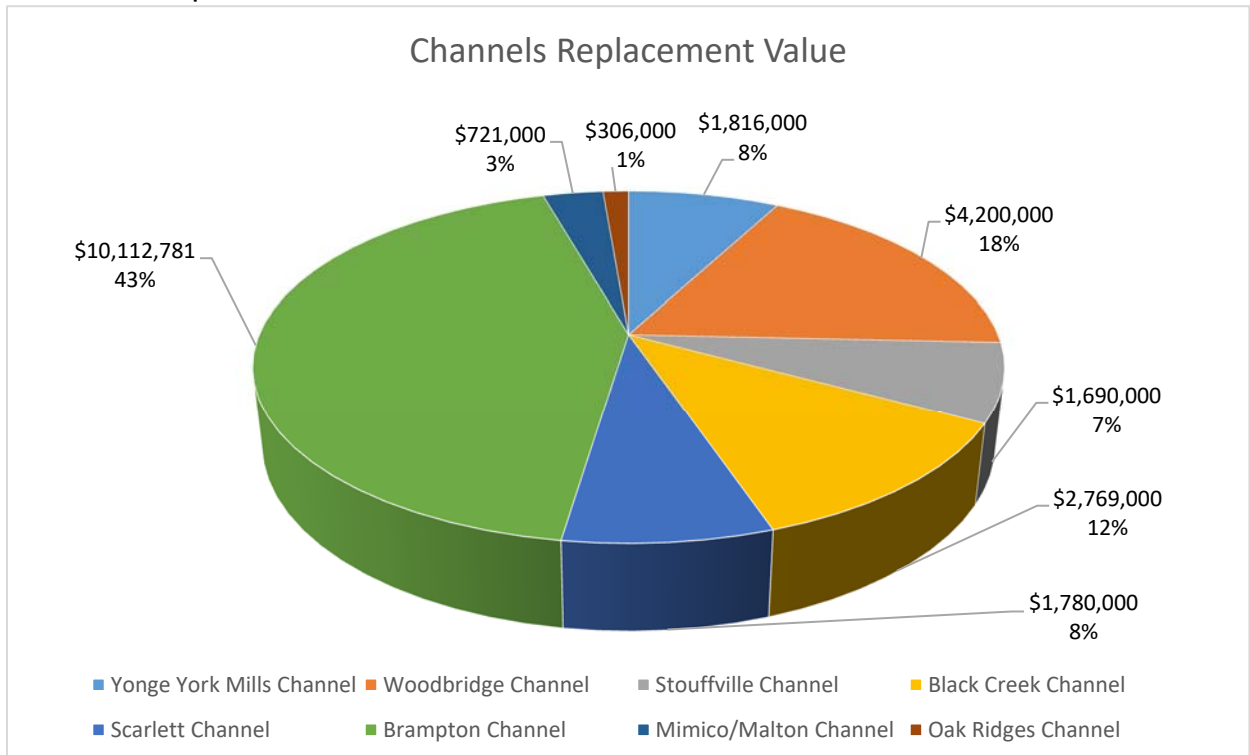


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Dams Replacement Value



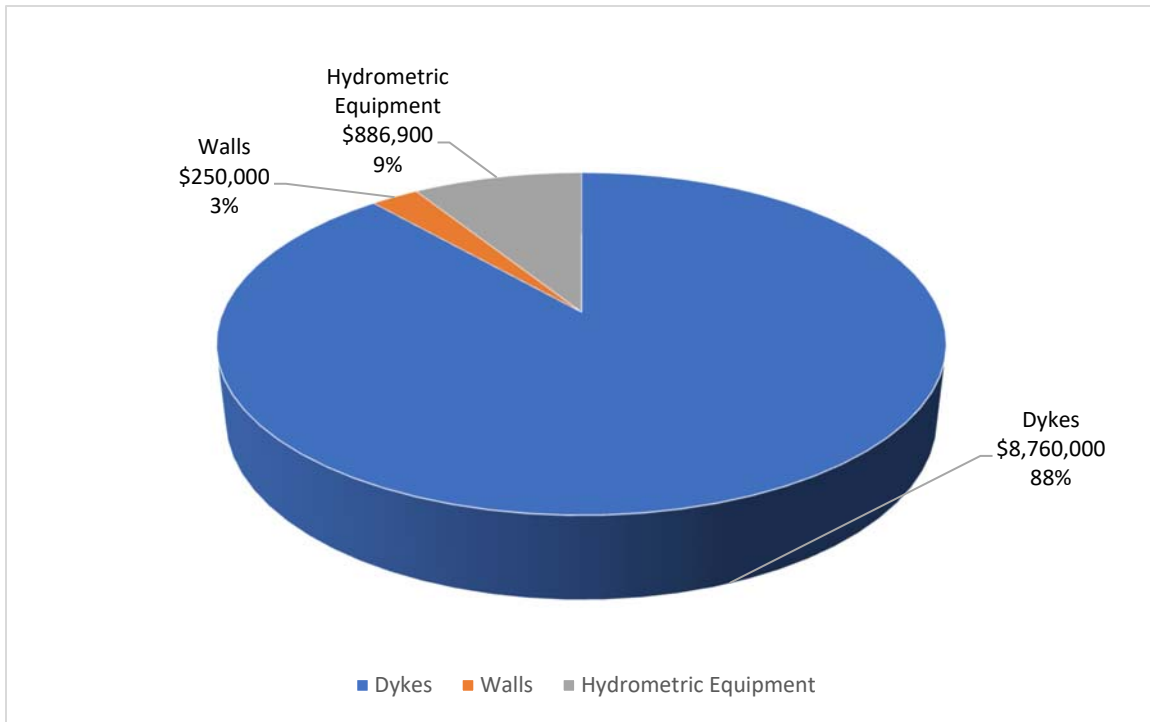
Channels Replacement Value





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Other Assets Replacement Value



Asset Useful Life

The useful life of dams and channels assets was determined during implementation of Public Sector Accounting Board Standard PSAB 3150. The useful life of the assets is shown in the table below:

System	Design Life*
Administration / Operation	80-100 years for physical structures Indefinite for personnel, procedures, and records
Reservoir	Indefinite
Spillway Structures	80 years (Civil)
Mechanical Systems	50 years
Embankment Dams	> 100 years
Groundwater Drainage / Management Systems	50 years
Electric Power Supply	30 years
Control and Monitoring Systems	20 years
Communications	10 years
Safety Systems	10 years

* Ref: EPRI: Hydropower Plant Modernization Guide, 1989.



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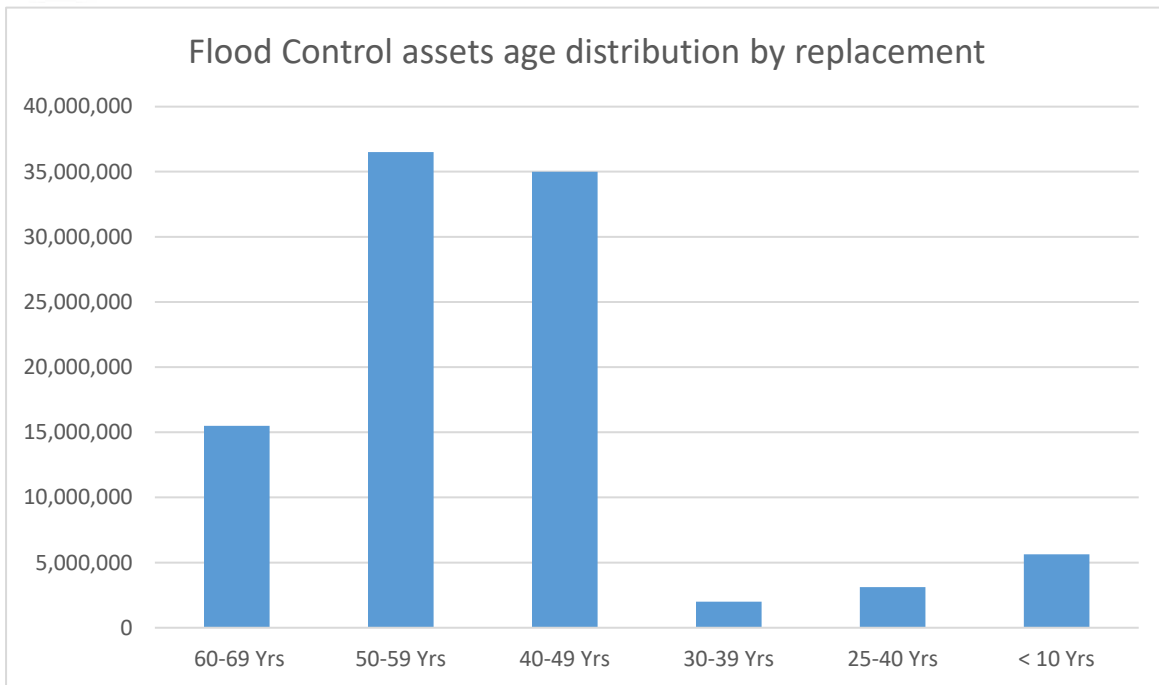


Figure - Flood Control asset age distribution by replacement

TRCA's flood control dam structures range in age from 47 years old to 60 years with an estimated useful life of 75 years, this implies that many of the structures will need significant rehabilitation in the near future, like what has already been seen with the urgent rehabilitation works that are required to Dam. Therefore, significant investments into dam assets will be required in the near future

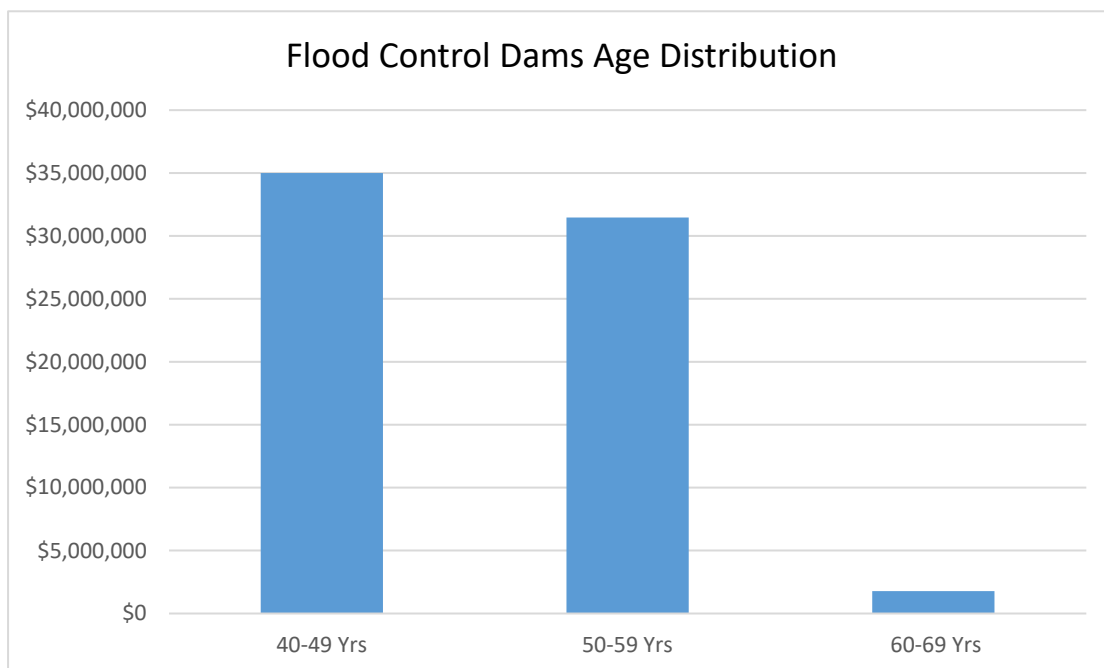


Figure - Dams age distribution by replacement



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90% of channels assets are more than 40 years old and based on a typical useful life of 65 years, these assets are nearing the end of their useful life. Another 10% of assets are between the ages of 30-39 years which is about the mid-point of the useful life. Therefore, channels assets are at or past the mid-point of their useful life and will begin to require rehabilitation or replacement.

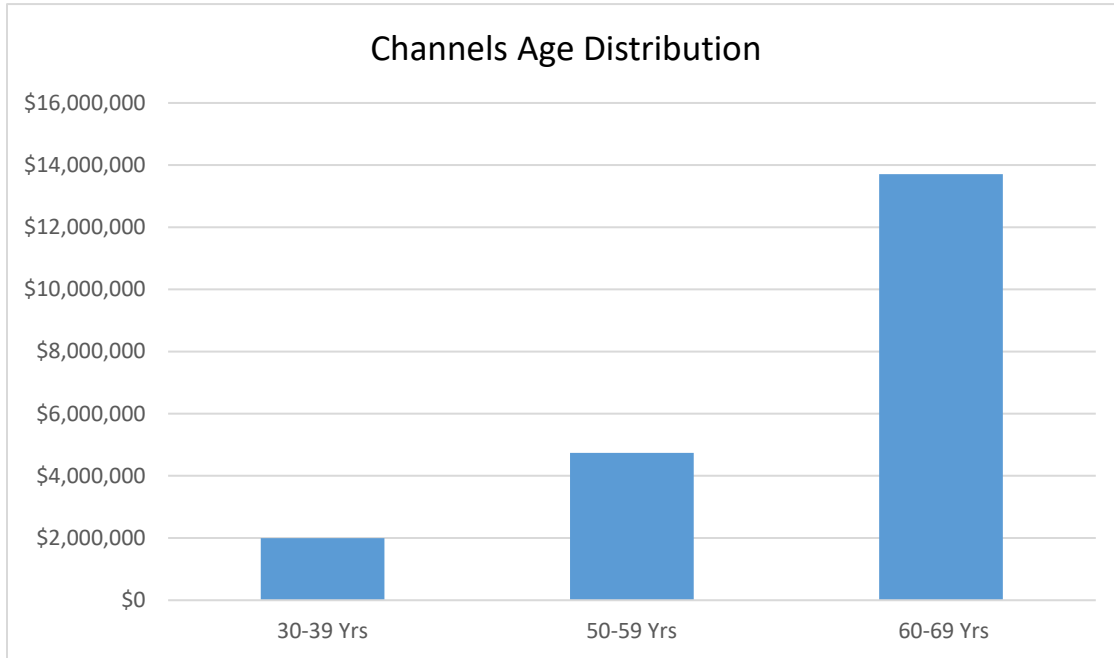
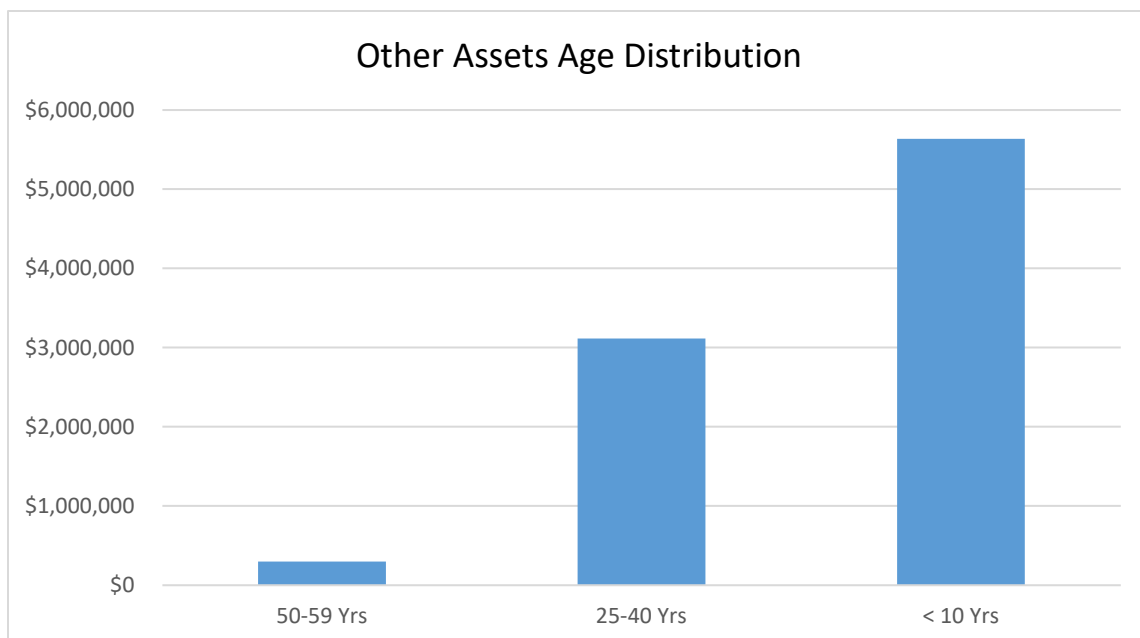


Figure - Channels age distribution by replacement

The remaining of asset distribution by age is comprised of Dyke, Flood Walls, Hydrometric Equipment. Figure - Dyke, Flood Walls, Hydrometric Equipment age distribution by replacement





Asset Condition

The condition of Flood Control assets is reviewed and analyzed on a regular basis by both internal staff at TRCA and external engineering consultants.

Details relating to the condition of each asset are maintained in Excel spreadsheets and an Access database. These details were reviewed and applied against the following 5 Point Rating / Scale, produced by the Federation of Canadian Municipalities (FCM), Canadian Construction

Association (CCA), Canadian Public Works Association (CPWA), and Canadian Society of Civil Engineering (CSCE), to determine the overall condition of the assets. The rating scale ranges from Very Good to Very Poor and is commonly used by other public sector organizations, therefore allowing for benchmarking against other organizations.

Rank	Condition	Definition
1	Very Good	The infrastructure in the system is in generally good condition, typically new or recently rehabilitated. A few elements show signs of deterioration that require attention.
2	Good	The infrastructure in the system is in good condition; some elements show signs of deterioration that require attention. A few elements show sign of significant deficiencies
3	Fair	The infrastructure in the system or network is in fair condition; it shows general signs of deterioration and requires attention. Some elements exhibit significant deficiencies.
4	Poor	The infrastructure in the system or network is in poor condition and mostly below standard, with many elements approaching the end of their service life. A large portion of the system exhibits significant deterioration.
5	Very Poor	The infrastructure in the system or network is in unacceptable condition with widespread signs of advanced deterioration. Many components in the system exhibit signs of imminent failure, which is affecting service.

Table– Five Point Infrastructure Rating Scale

TRCA has made significant progress in upgrading the condition of its flood infrastructure over the last ten years. Numerous projects have been undertaken to restore flood channels and increase dam safety, redundancy and reliability. Thorough DSR's and engineering studies have helped TRCA understand how the structures rank in terms of risk to the public and how to mitigate this risk.

A key part of TRCA Engineering Services role in reducing flood risk is to operate, monitor and maintain various flood protection structures. The Flood Infrastructure and Hydrometrics section conduct daily, monthly and annual inspections on each structure depending on the level of risk and the technical standard of surveillance. For example, large dams with high associated risks are required to have daily, monthly and annual inspections. Small, lower risk structures such as flood protection channels are required to undergo only an annual inspection. Starting in 2016, in order to further reduce risk, TRCA has increased surveillance of small dams so that they will receive monthly and annual inspections. All flood control channels and dykes are inspected annually. The results of these inspections are used to determine if the structure is safe and to prioritize capital works to maintain the safety of these structures.



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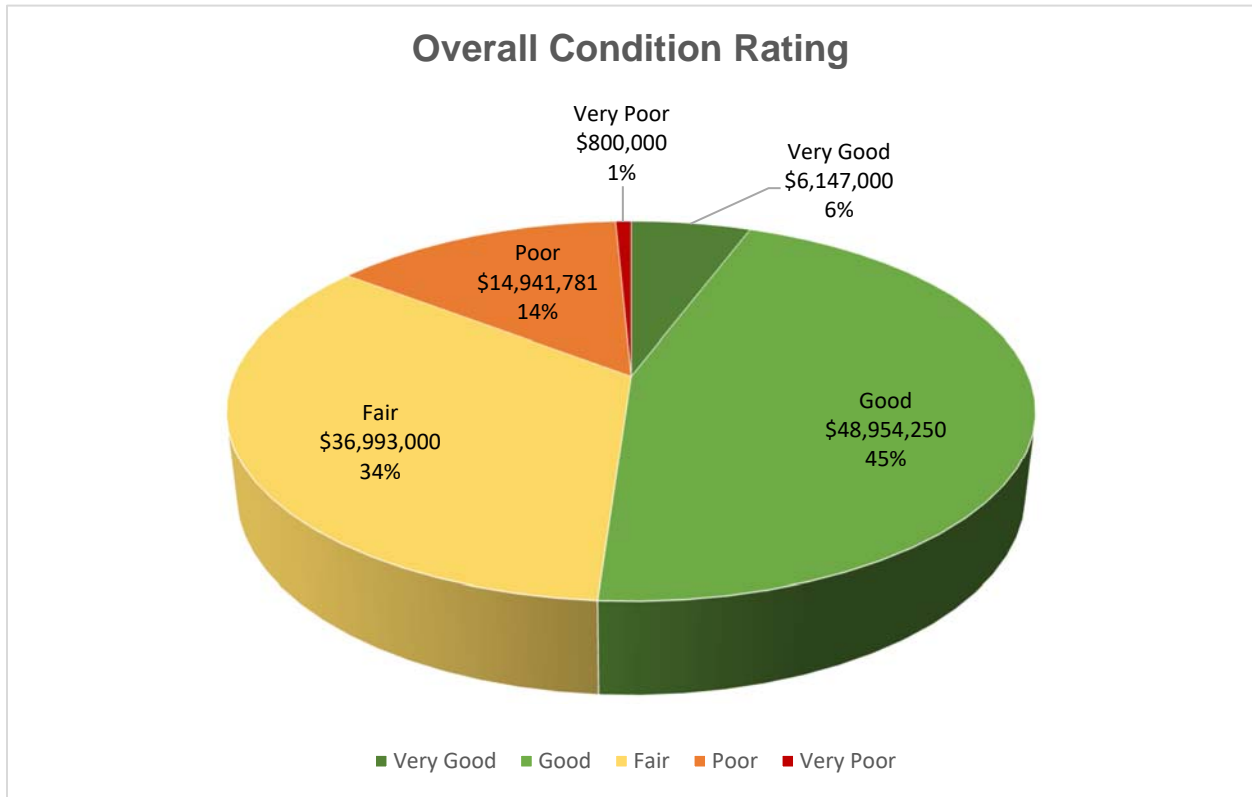
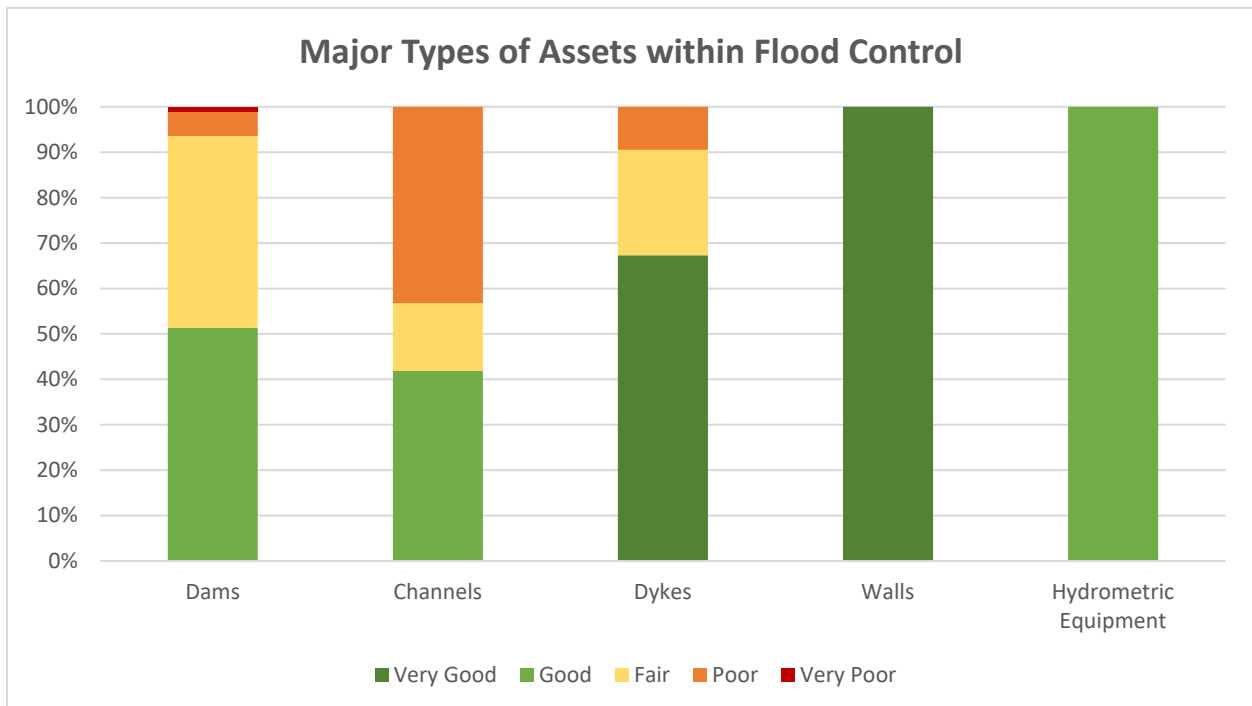


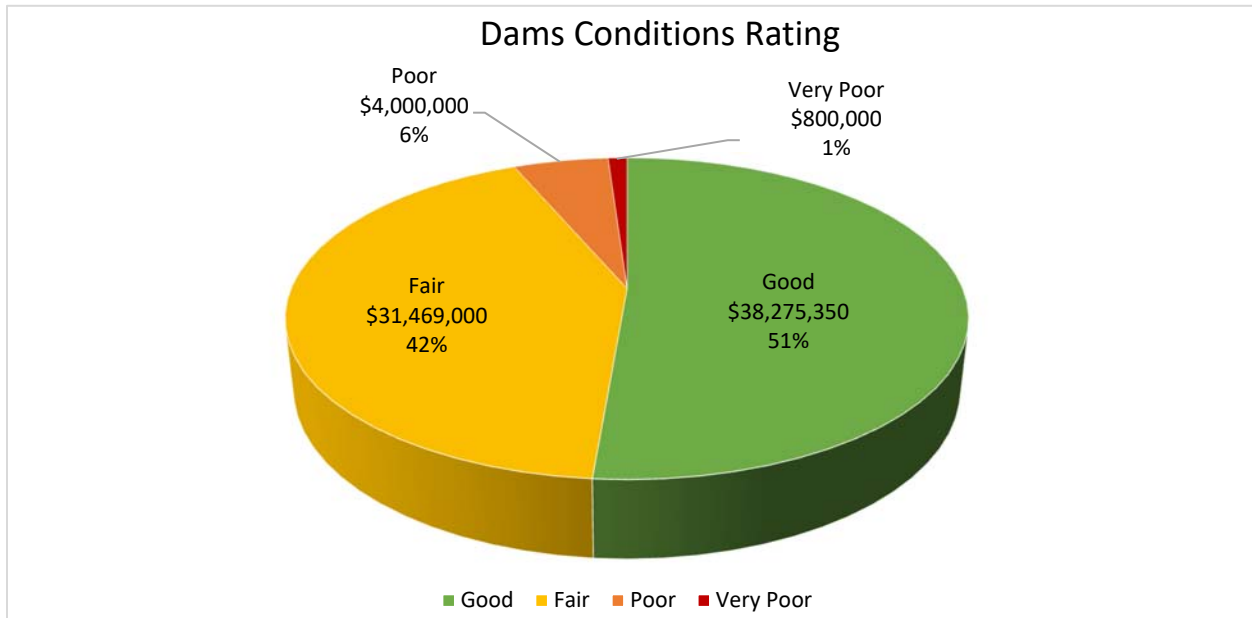
Figure – Overall Condition Rating for Flood Control Infrastructure



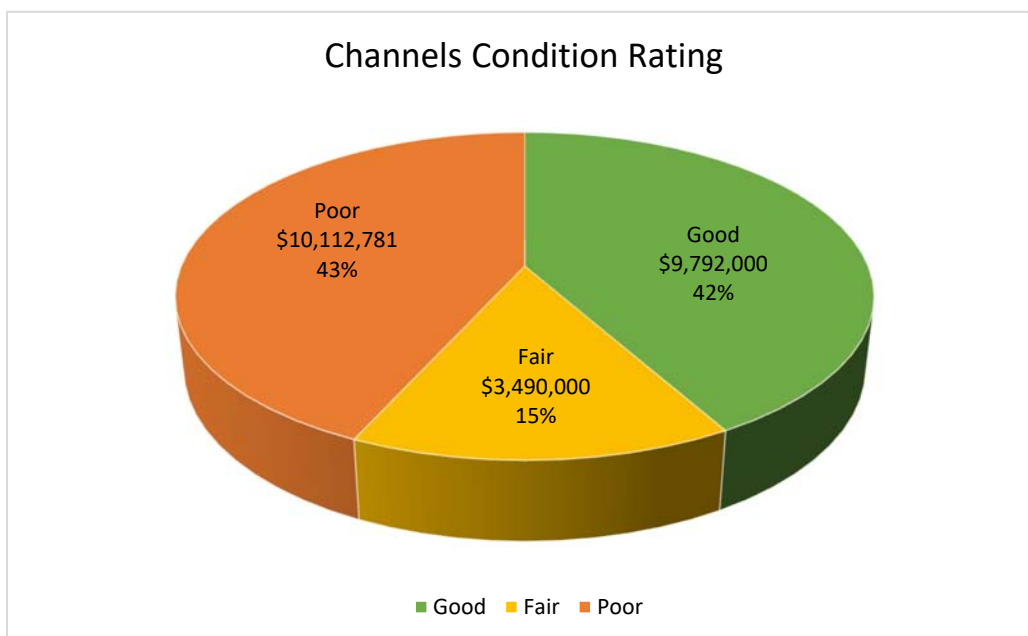


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Although various components may be in better or worse shape, an internal analysis by TRCA staff has determined that generally dam assets are in Good condition overall. G. Ross Lord Dam and Black Creek Dam, representing 51% of assets are in good condition. Claireville Dam, Stouffville Dam and Milne Dam representing 42% of assets are in fair condition. This information is summarized in the table below. Dams Conditions Rating



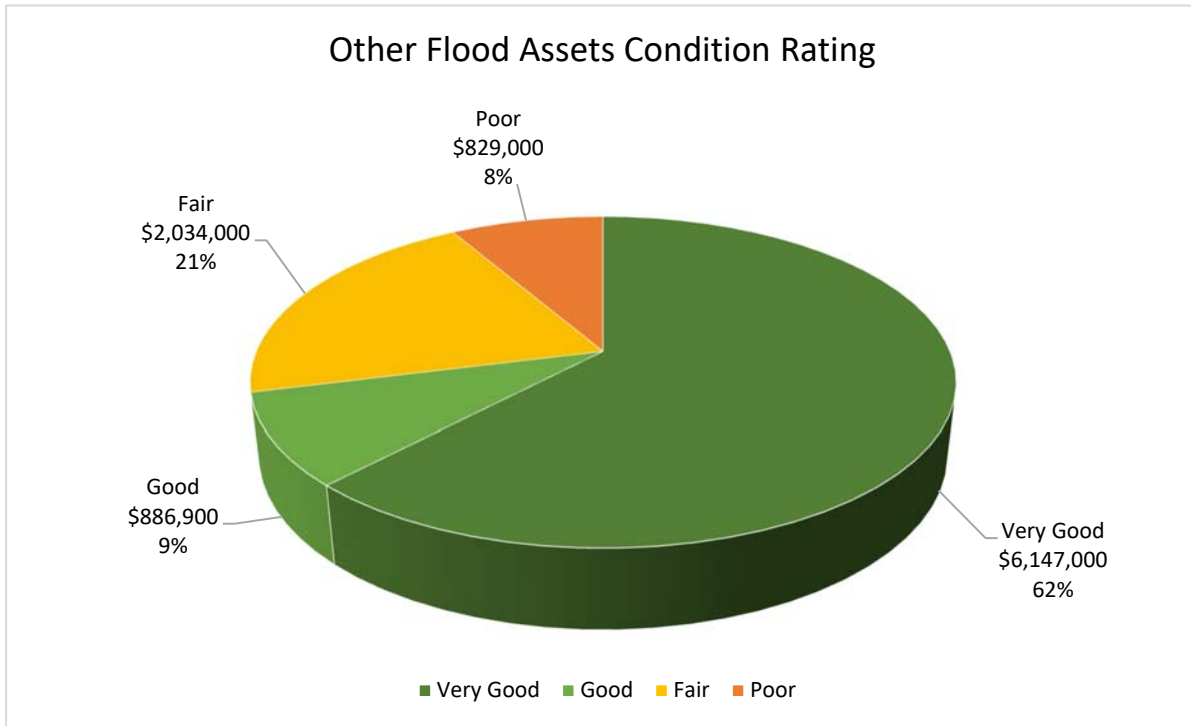
An internal analysis by TRCA staff has determined that, generally, channels assets are in fair to poor condition. Yonge York Mills Channel, Woodbridge Channel and Stouffville Channel are in good condition and represent 33% of the replacement value of the assets. Brampton Channel and Sheppard Channel has been rated as being in poor condition and represents 50% of the replacement value of channel assets. Channels Conditions Rating






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Other Flood Structures Conditions Rating



Service	Asset		Inventory	Unit	Replacement Value (\$000)
 Flood Control	Dams	Flood Control Dams	5	Each	\$68,244,350.00
		Recreation Dams	5	Each	\$6,300,000
	Channels	Flood Control Channels	10,050	Meters	\$23,394,781.00
	Dyke	Flood Control	3,570	Meters	\$8,760,000.00
	Flood Wall	Flood Control Wall	1	Each	\$250,000.00
	Hydrometric Equipment		97	Each	\$886,900.00
TOTAL					\$107,836,031



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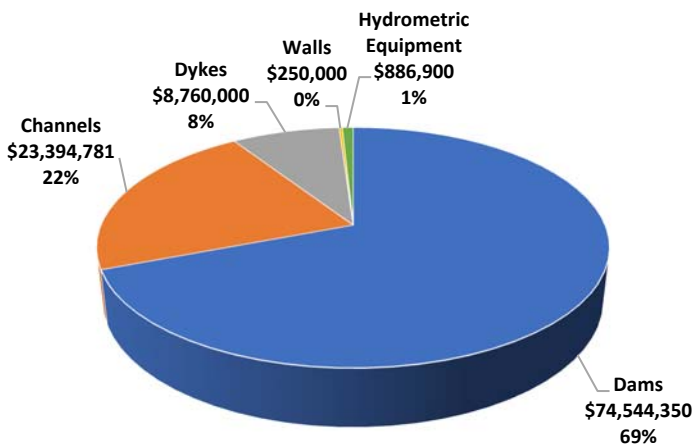
GOOD



Total Asset Replacement Value:	\$107,836,031
Current Condition:	Good
Future Condition Trend (next 10 years):	Increasing
TRCA Strategic Plan:	Reduction or elimination of existing flood risks within our jurisdiction.
Assets Included in this Category:	Dams, Channels, Dyke, Flood Wall and Hydrometric Equipment
Data Confidence and Reliability:	Condition Based: Medium

The total replacement value of TRCA Flood Control infrastructure is \$107.8 million. The 50% of the assets are in Good to Very Good condition, and 34% are in Fair condition, with the remaining assets close to, or past, the end of Service Life. As the TRCAs Flood Control services assets are overall in Good condition, these assets are meeting current needs but aging and may require attention.

REPLACEMENT VALUE BY ASSET TYPES



CONDITION OF FLOOD CONTROL INFRASTRUCTURE ASSETS

