Upper Thames River Conservation Authority

Operational Plan for Wildwood Dam

November 26, 2024

Table of Contents

Table of Figures

1. Purpose of Operational Plan

Ontario Regulation 686/21 requires that a Conservation Authority (CA) provide programs and services that support the operation, maintenance, repair, and decommissioning of the following types of infrastructure the CA owns or manages:

- Any water control infrastructure, the purpose of which is to mitigate risks to life and damage to property resulting from flooding or to assist in flow augmentation.
- Any erosion control infrastructure.

Programs and services provided shall include the development and implementation of an operational plan on or before December 31, 2024.

Some water control infrastructures in the Upper Thames River Conservation Authority (UTRCA) watershed are not owned by the conservation authority but are managed through an agreement with the owner. These structures also require operational plans.

2. Purpose of Structure

2.1. Flood Control and Flow Augmentation

The construction of a dam on Trout Creek, upstream of the Town of St Marys (Figure 1), was proposed in 1948 as the UTRCA's first major project after its formation in 1947. Originally designed as a flood control reservoir, there was considerable opposition and the project was shelved. It was thought that improving certain land use practices would be more effective at improving flood control.

The Upper Thames Valley Conservation Report (1952) modified the plans for the dam, proposing that, in addition to providing flood protection to downstream communities, the reservoir supplement flows during the drier summer months. Construction began at the dam site in 1962 and finished in 1965. The cost of the dam and land base at that time was approximately $3.5 million.

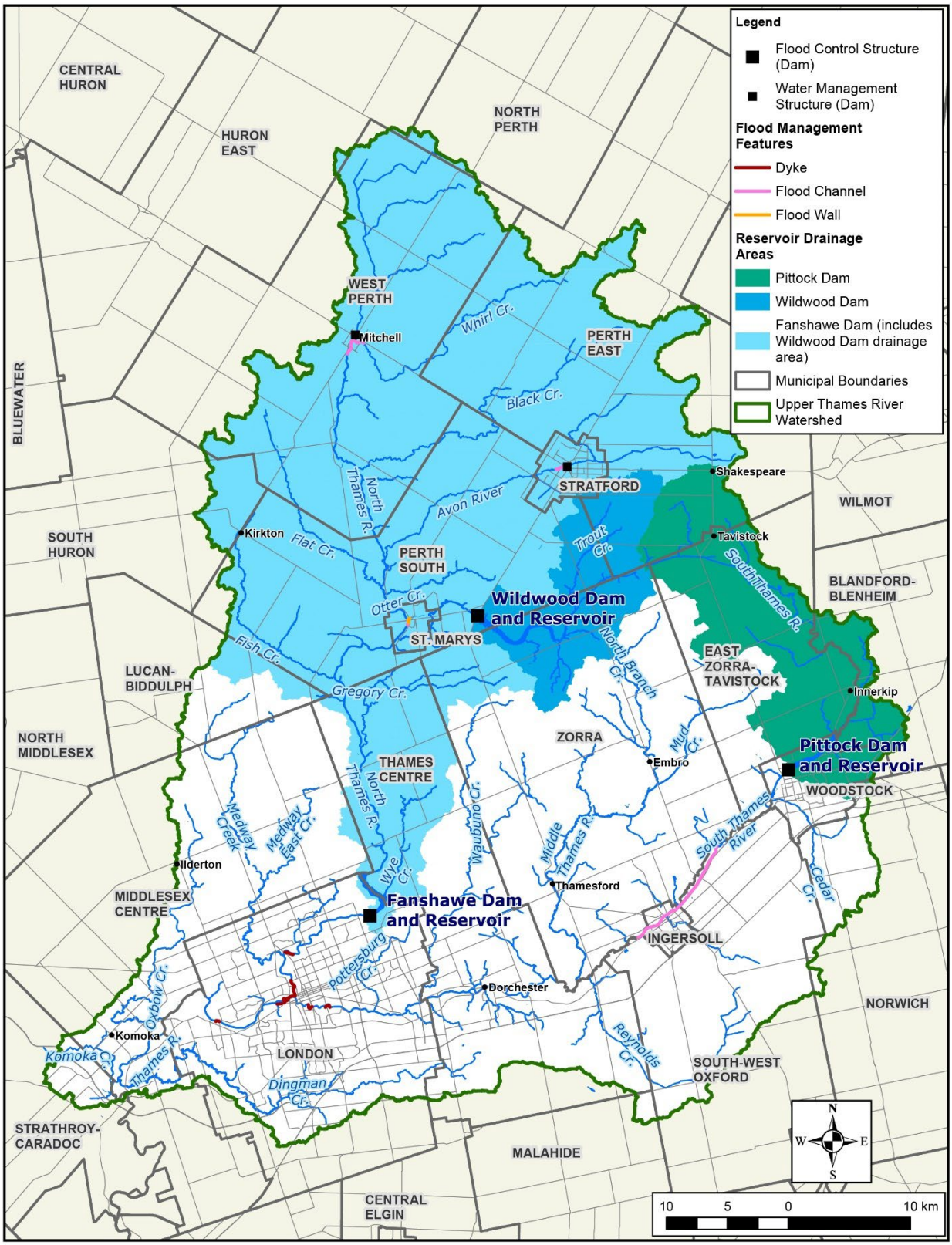

Figure 1. UTRCA water management structures and reservoir drainage areas

Wildwood Dam and Reservoir are designed for both flow augmentation and flood control. The dam operation follows an annual cycle to supplement downstream flows during the drier summer months. At the beginning of the year, the reservoir is at approximately 3 m, relative (321.21 metres above sea level, masl, 1053.8 feet above sea level, fasl), which is its winter holding level to maintain aquatic habitat (Figure 2). The low reservoir has room to manage winter floods and to store runoff from snowmelt and rain in the winter and spring, which is used to fill the reservoir to the summer conservation level of 6.55 m, relative (324.76 masl, 1065.5 fasl) (Figure 3). The summer conservation level is the level needed to provide flow augmentation through the summer and fall.

Approximately 10 million cubic metres of water are required to fill Wildwood reservoir from its winter holding level to its summer conservation level. This volume is the equivalent of 70 mm of water covering the entire 140 km^2 area that drains into the reservoir.

Above the summer conservation level, there is an additional 6.3 million cubic metres of flood storage. This amount is equivalent to 44 mm of water covering the entire drainage area upstream of the reservoir.

The flow augmentation period typically begins in late June. Water is gradually released from the reservoir, augmenting flows in Trout Creek and in the North Thames River downstream to London, providing water quality and aquatic habitat benefits. During a dry summer, this release from Wildwood Reservoir provides 25% to 50% (or more) of the flow in the North Thames River.

By late fall, the reservoir has been drawn down to its winter holding level, maintaining sufficient water for aquatic habitat while increasing flood storage for fall and winter floods and to be ready for the next spring runoff.

During a flood, Wildwood Reservoir can reduce downstream flows on Trout Creek by storing flow in the reservoir and releasing it later. The level of flow reduction can range from 20% to 95%, depending on the type and severity of the flood and when it occurs. Trout Creek contributes only a small portion (13%) of the North Thames River water that flows through St Marys, and operations at Wildwood have a less significant reduction of flows in the North Thames River.

Figure 2. Wildwood Reservoir at winter holding level

Figure 3. Wildwood Reservoir at summer conservation level

The Upper Thames Valley Conservation Report (1952) made several recommendations about various forms of recreation in the UTRCA watershed, including:

- Beaches and pools for swimming,
- Boating and fishing areas,

- Individual picnic sites and group picnic grounds in parks,
- Individual and group camping areas, and
- Trails for riding, hiking, and nature study.

The construction of Wildwood Reservoir included acquisition of the surrounding lands comprising the Wildwood Conservation Area (WCA), which over the years has provided these recreational opportunities. In addition to facilities and services managed by WCA staff, there is also a seasonal Land Lease Community, as well as other leases (such as a cooperatively run sailing club, and a camp leased to a local community group).

3. Level of Service

Level of Service (LOS) refers to the ability of an asset or its components to perform the role for which it was designed and to the level or quantity of use for which it was intended. Because of the importance for Wildwood Dam to continue to reduce the risk of flooding along Trout Creek in the town of St Marys, as well as its role in augmenting stream flow on the Trout Creek and the North Thames River downstream through London in dry months, the required LOS would be high. The amount of attention to and funding for operation and maintenance must reflect the importance of this asset.

LOS will be further considered through Asset Management Planning and this section will be updated to reflect that ongoing work.

3.1. Service Life

A concrete/earthen embankment dam, such as Wildwood Dam, with proper inspection and maintenance should last at least 100 years. The lifespan of hydromechanical steel structures, electromechanical equipment, and control units is shorter than that of the main civil/structural components and is specified by the suppliers, who also provide instruction manuals describing dam operation and maintenance. Continued routine and preventative maintenance along with the timely replacement of equipment will allow the dam to continue to meet its expected level of service and extend the structure's service life considerably.

4. Stakeholders and Beneficiaries

When operating dams, it is important to understand who is impacted by the operations. Stakeholders of Wildwood Dam are discussed below in three groups based on the type of benefits they receive from the operation of the dam.

Funding for the operation and maintenance of Wildwood Dam is levied to the municipalities that shared in the dam construction costs. This was established as 80% from London,14% from St Marys, and 6% allocated to all municipalities based on their relative share of the modified current value assessment of the watershed.

From a flood control perspective, the Town of St Marys, its residents, and business owners whose flood risks are reduced through the operation of the reservoir benefit the most from Wildwood Dam. Flood risk reduction on the North Thames River downstream of the confluence with Trout Creek in St Marys is greatly reduced as Trout Creek is only 13% of the drainage area and contributes a similar proportion of flows downstream.

Wildwood Dam and Reservoir provide flow augmentation by maintaining flow in Trout Creek and the North Thames River. This reliable flow is beneficial for the general health of the watercourse and the aquatic life it supports. When planned, the reservoir was designed to provide reliable flow, in part, to assimilate effluent from downstream wastewater treatment facilities at St Marys and London.

Wildwood Conservation Area was established around the reservoir to take advantage of the large waterbody formed by the dam. It provides recreational opportunities for those using the facilities for camping, boating, fishing, hiking, cycling, and other day use activities. Land lease and other lease holders also benefit from the reservoir. The conservation area is a recreational destination and provides social and economic benefits to the surrounding area.

The stable flows downstream of the dam also benefit recreational uses in the floodplain and watercourse. Flow augmentation benefits those drawing water for such things as irrigation. The reservoir effectively reduces flows downstream of the dam during many runoff events, reducing significantly the frequency of interruptions to recreational activities in the floodplain.

4.1. Communication with Stakeholders

Communication with stakeholders is important to the operation of the dam. Conservation area and property staff have established relationships with the various user groups around the reservoir and can efficiently distribute the messages to these stakeholders. As such, it is important that these staff are kept up to date on any significant variation from typical operating conditions such as unseasonably high or low water levels in the reservoir.

Flood time communications are undertaken directly by flood control staff to municipal flood coordinators. Most operations of Wildwood Dam have little impact on St Marys and none on downstream municipalities; however, in the event of a major flood where significant gate operations are necessary at Wildwood Dam, communications with the Town of St Marys are through their municipal flood coordinator, consistent with the UTRCA Flood Contingency Plan.

Flood control staff have established direct communications with the management team at the St Marys Golf and Country Club so that they are kept apprised of changes in discharge from Wildwood Dam which may affect their golf course.

5. Operations

5.1. Physical Characteristics

Wildwood Dam controls discharge from 140 km^2 of the upstream drainage area with a normal summer surface area of 380 hectares and a maximum surface area of 505 ha. Wildwood is controlled by four low level sluice gates, each measuring 12' x 12', as well as one 18-inch drain valve, and two 18" low flow control valves. Wildwood has a baffle wall above each of the gate bays. Flow starts going over the baffle walls slightly above the normal summer level, over which flow is discharged proportional to the height above the baffle walls. This acts as an automatic spillway (weir) for the structure, should the level rise quickly before operations commence. The maximum discharge capacity of Wildwood Dam is calculated as 545 m^3/s. The Wildwood Reservoir has a maximum operating level of 8.23 m (326.44 masl, 1071 fasl).

5.2. Flood Routing

When Wildwood Dam was first commissioned in 1965, a set of instructions on routing floods through the reservoir was provided. In general, valves alone are to be used when the reservoir is below a threshold level, just above the summer operation level, at 7.01 metres, relative (325.22 masl or 1067 fasl). The caveat is provided that, if a reduction in the reservoir level were planned before or during a major storm, gates could be operated earlier provided the downstream channel capacity (then estimated at 2000 ft^3/sec or 57 m^3/sec) was not exceeded. The opportunity for doing this is likely limited to snowmelt events which provide a longer lead time for forecasts and more reliable runoff forecast. Trying to keep within the more contemporary limit of 5 m^3/sec during summer recreational use downstream significantly limits opportunities for doing this. Wildwood reservoir, when at its summer level of 6.55 m, still retains 44 mm of flood runoff storage.

5.3. Downstream Constraints

While the original dam design suggests 57 m^3/sec (2000 ft^3/sec) as the downstream channel capacity, more recent experience has shown that discharge, while it should not flood homes in St Marys, will come very close to some structures and likely cause other problems. From experience, discharges between 20 and 30 m^3/sec begin to flood backyards in St Marys along Widder Street, but no serious flooding ensues. Once the reservoir level threshold of 7.01 m is reached, gate opening commences, increasing discharge further as the reservoir level continues to rise past higher threshold levels.

Modern operations attempt to keep the discharge at or below 5 m^3/sec to the extent possible. Recreational activities in the floodplain downstream are affected by flows above 5 m^3/sec. If discharges above 5 m^3/sec are necessary, downstream considerations suggest that the duration of flows exceeding 5 m^3/sec be minimized.

A real-time hydrometric gauge called Trout Creek near Fairview (02GD019) is located upstream of the reservoir. It is operated by the Water Survey of Canada, with assistance from UTRCA under agreement. This gauge began recording data and

estimating discharges in 1966, but did not provide real-time data access until 2002. While the Fairview station only measures 45 km^2 of Wildwood's 140 km^2 catchment (32%), it still provides a good indication of inflows (scaled by drainage area) and timing for operation decisions.

It is important that operators consider flow information, snow survey and precipitation data along with improved forecasting tools, which were not available when the original flood routing instructions were established. This engineering judgement is an important part of contemporary operations of the dam.

5.4. Flow Augmentation

Wildwood Dam was designed and built with both flood control and flow augmentation in mind. As such, it can reduce flood risk to downstream communities and provide additional flow during summer and early fall months. The reservoir typically begins the spring season at its winter level of 3.0 m. It is then filled with early spring snowmelt runoff and later spring rainfall runoff, until it reaches its summer level of 6.55 m, generally by early to mid-May. Summer level is intended to be held until the level naturally begins to decrease, depending on the dryness of the year, and as late as the end of June, before augmentation begins. In many years, however, it is often difficult to keep it at its summer level until late June without reducing the discharge.

The reservoir was designed to provide 1.1 m^3/sec (40 ft^3/s) through the drain valve from the end of June until late fall when winter elevation is reached. It is often not possible to maintain 1.1 m^3/sec during the filling stage as the dam was designed to capture all runoff to store sufficient water for maintaining discharge through the augmentation period. During periods when the reservoir is below its desired level, it may also be necessary to reduce discharge during periods when there is an adequate base flow downstream.

In the original design, the assumption was that any inflow to the reservoir was balanced by evaporation from its surface. The winter level in the original design was 0.0 m (318.21 masl, 1044 fasl). In 1993, a study was completed to examine alternate drawdown curves, allowing the winter level to be kept higher, partly to improve aquatic habitat over the winter, and to facilitate the ability to reach summer level by the end of May, which was not always possible historically. That study recommended a winter holding level of 2 m rather than 0 m as was done in the past. In the early 2000s, UTRCA staff evaluated keeping the level between 2.0 m and 3.0 m, which further improves habitat, while posing little additional flood risk due to the reservoir's large remaining storage capacity above 3.0 m. An additional consideration in recent times are early snowmelt events, and the possibility that a new and sufficient snowpack is not established with which to fill the reservoir, requiring higher levels to be held earlier in the year than the original design considered.

Figure 4 is a plot of the annual filling and drawdown guideline. This plot has been developed to reflect the original text description and refined as discussed above.

Watershed conditions can be challenging as they require real-time judgement. The solid green line illustrates that filling was originally intended to capture all runoff, beginning in February, until the reservoir was filled later in the spring. The dashed green line shows, in practice, how filling has been achieved historically. It indicates the long-term median reservoir elevations at the 1st and 15th of each month, from February until early May, and is used by operators as a guide to filling.

The drawdown curve beginning in late June is also derived from the 1st and 15th of each month's long term median level, and coincides with the design that the reservoir provides 1.1 m^3/sec downstream.

The vertical axis on the left represents reservoir elevation, in terms of relative m, and the two vertical axes on the right show the same information presented in terms of first the percentage of reservoir storage used, and then the remaining mm of runoff storage between empty and maximum operating level.

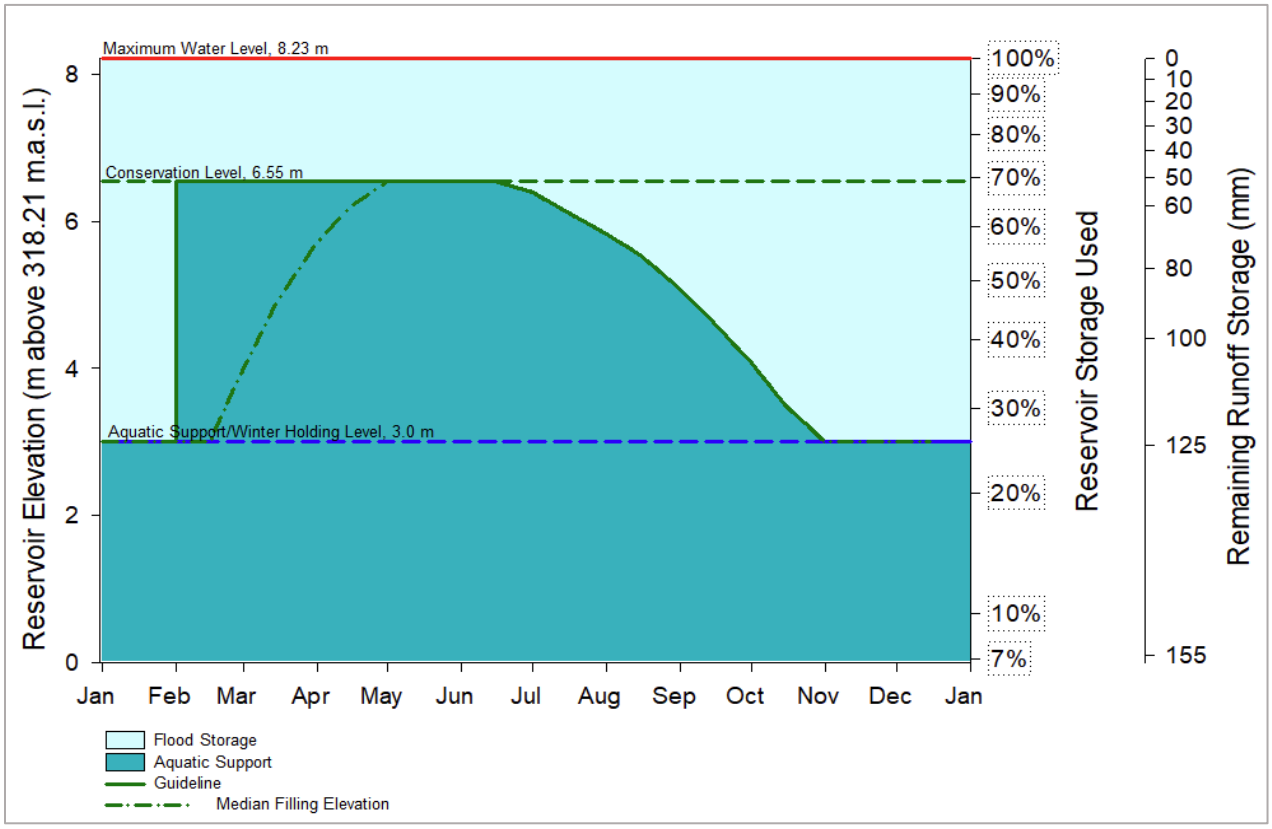

Figure 4. Wildwood Reservoir annual filling and drawdown guidelines

5.5. Reservoir Capacity

Wildwood Reservoir has a large capacity relative to its drainage area of 140 km^2. To meet its summer target elevation (6.55 m) from a winter holding level of 3.0 m, requires 73 mm of runoff to be stored. Once at summer level, there remains 50 mm of runoff storage for managing flooding until the maximum level is reached.

5.6. Climate Change Considerations

It is anticipated that climate change will affect reservoir filling. Current trends seem to suggest more precipitation earlier in the year and an earlier loss of snowpack. This raises uncertainty as to whether to capture runoff from early melt and rainfall events or to draw levels back down in January and February, ensuring appropriate storage for later spring events, while ensuring the target summer level is reached.

Climate change also presents additional challenges during the summer months, with more frequent, early summer events pushing reservoir levels toward the 7 m gate operation threshold. These levels can have a significant effect on recreational uses in the reservoir. Gate operations also have very significant impacts on downstream recreation as described in the Downstream Constraints section above.

6. Routine Maintenance

Routine inspection and maintenance are important to ensure the flood and flow augmentation structures are able to meet their purposes. Inspection and maintenance are guided by the structure's Operation, Maintenance and Surveillance Manual (OMS Manual). This manual identifies:

- Weekly inspections – generally carried out by trained conservation area staff, include a visual inspection of the buildings and equipment, verification of the operation of the discharge facilities (gates, valves) to the extent possible. In the case of Wildwood Dam, gates cannot be operated due to the significant increases in flows which would be released downstream and difficulties in getting the gates to seal.
- Monthly inspections – generally carried out by the maintenance mechanics.
- Annual inspections – generally undertaken by engineering staff and maintenance mechanics, include a more thorough visual inspection of the dam embankment, buildings, and equipment, and testing the operation of equipment.

These inspections are in addition to routine health and safety inspections undertaken by the UTRCA's Joint Health and Safety Committee. Dam Safety reviews and external inspections are also carried out approximately every 10 years.

7. Emergency Planning

As part of the UTRCA's Dam Safety Program, Emergency Preparedness Plans (EPP) and Emergency Response Plans (ERP) are being developed. Responses to dam emergencies that require communication with watershed residents rely on the Flood Contingency Plan, which uses flood bulletins to communicate conditions to municipal flood coordinators, who then implement municipal emergency plans.

8. Roles and Responsibilities

Dam operations are directed by senior engineers based on the general principles described in this document. Careful consideration of watershed conditions and forecasts require the sound application of engineering judgement. Operations are undertaken by trained operators which include conservation area staff, maintenance mechanics, and other trained water and erosion control structure staff. Routine maintenance is undertaken by dam maintenance mechanics and contractors, as necessary.