



District of Summerland

Dam Safety Review

December 2010

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REPORT

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REPORT

1 Introduction

The District of Summerland is located on the west side of Okanagan Lake, about 45 km south of Kelowna and 15 km north of Penticton. The Corporation of the District of Summerland owns and operates a number of dams. The dams are used as raw water storage facilities.

In April, 2010, the District contracted a Dam Safety Review team from Associated Engineering and Golder Associates to inspect and provide dam safety reviews of the following dams:

- Headwaters No.1
- Headwaters No. 2
- Headwaters No. 3
- Headwaters No. 4
- Crescent (Paul) Reservoir
- Whitehead Reservoir
- Aeneas (Eneas) Reservoir
- Tsuh (Deer) Reservoir
- Isintok Reservoir
- Summerland Reservoir
- Garnett (previously Garnet) Reservoir

Thirsk Dam, one of the District's two Very High Consequence Dams, was not included in this review, as that dam was rehabilitated as recently as 2007. Headwaters No 1 Dam was inspected in June 1998 and is currently part of a maintenance upgrading program.

The Dams impound water within two main watersheds within the District of Summerland water supply system: Trout Creek and Aeneas Creek. A general location plan is shown in Figure 1.

The dams were reviewed according to the Dam Safety Guidelines established by Canadian Dam Safety Association, January 1, 2007, as well as the minimum criteria developed by the Ministry of Environment – Dam Safety Branch in 2010, see Appendix D.

2 Dam Safety Review

2.1 General Background

The object of a dam safety review is to assess the performance of the dam as the dam ages, redefining operational and maintenance requirements and ensuring public and environmental safety. The Review process includes an assessment of the current condition of a dam, its related control and emergency structures and the operation and maintenance policies, and recommend identify any deficiency in the safety of the dam. The Review must:

- Meet the requirements of the BC Dam Safety Regulation and the reviewer should utilize the CDA Guidelines as the principle source of standard engineering practice for dam safety.
- Identify, at the outset, possible hazards and associated failure modes of the dam, based on an examination of available information.
- Initially assess potential hazards, with the team then assessing the existing safety management of the dam, and compares design criteria to current requirements and standards.
- Produce outcomes that provide:
 - Confirmation that all things necessary to confirm the safety of the dam are in place, are current and appropriate, and are being followed; or
 - Identification of issues/deficiencies for further investigation in a separate project.

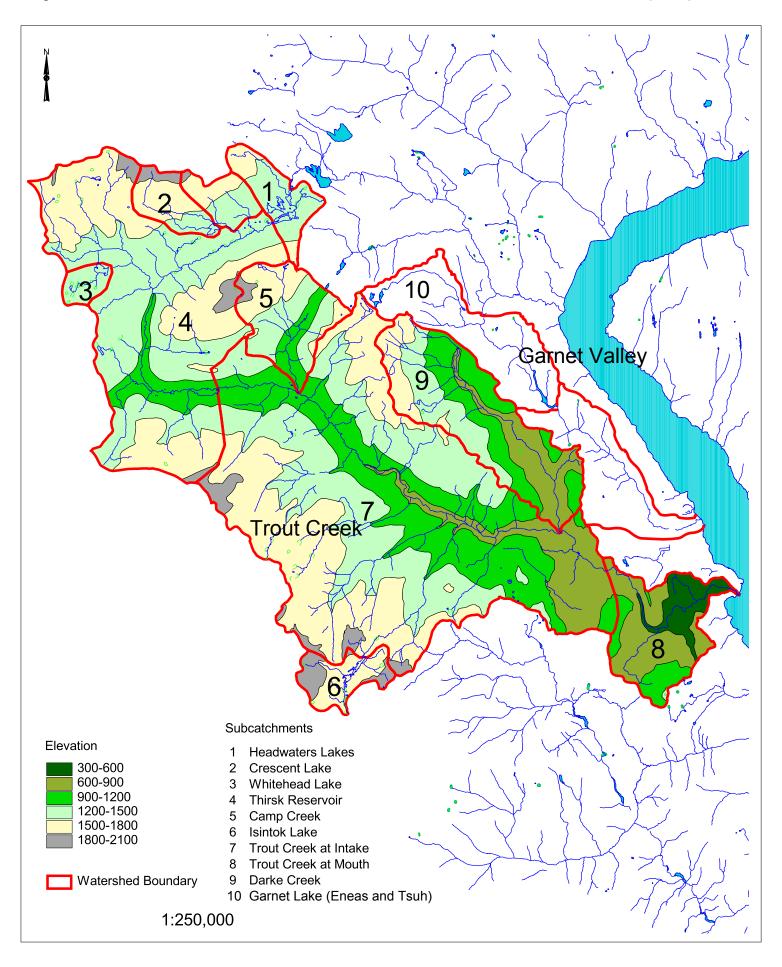
Under Section 7 of the BC Dam Safety Regulation, owners of dams classified as High or Very High Consequence of Failure are required to undertake periodic DSRs. Please see Schedule 1 of the Dam Safety Regulations, Downstream Consequence Classification Guide and Schedule 2 to determine the frequency for preparing DSRs. The Canadian Dam Association (CDA) defines a Dam Safety Review as:

"A comprehensive formal review carried out at scheduled intervals to determine whether an existing dam is safe, and if it is not safe, to determine what improvements are required."

The ideal Dam Safety Management System, Figure 2-1 provides the owner with a process of assuring compliance to the BC Dam Safety Regulations and at the same time allowing non-compliance items to be identified and categorized. This allows the Owner to define risk and enable capital expenditure to be prioritized.

It is the responsibility of the dam owner to review the Dam Safety Review report. A copy of this report should be forwarded to the responsible Dam Safety Officer at the Ministry of Environment.

Figure 1. District of Summerland Watersheds and Sub-Catchments - Taken from WMC (2005)



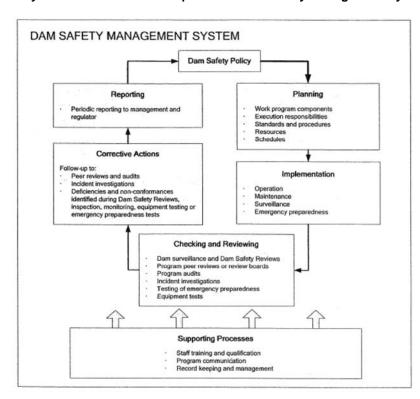


Figure 2-1

Ministry of Environment – Description of a Dam Safety Management System

2.2 Review Process

All of the structures within this report are considered small dams, consisting of earthfill embankments with gated low level outlet works and side channel spillways.

2.3 Review of Reservoir Operations

A project initiation meeting was held with Mr. Shawn Hughes and Mr. Scott Lee from the District of Summerland. These gentlemen are responsible for the day to day operations of the water system, and for the dam operations. Operational plans were reviewed. Requirements for dam owners under the Dam Safety Regulation (inspection frequency, OMS & EPP requirements, etc.) were analyzed based on current guidelines (MOE, 2010).

All the dams impound water in Reservoirs within the Summerland System. Only three dams are operated frequently for water supply, Thirsk Dam, Garnett Reservoir and the Summerland Reservoir. The Summerland water supply comes from two watersheds, Trout Creek and Aeneas Creek.



2.3.1 Trout Creek

Thirsk Dam and Summerland Reservoir

The reservoir operating rules for the Trout Creek Watershed are based on parameters developed by Summit (2007) for the District of Summerland. Under normal operations, water is released from Thirsk to Summerland Reservoir, as required. Under normal conditions, the reservoirs upstream of Thirsk are not part of operations. Under more extreme dry circumstances, where Thirsk Reservoir levels drop, then live storage in the upstream reservoirs may be accessed for water supply downstream.

Under extreme wet conditions, or where flood conditions exist, the reservoirs should be assumed to be full, and would spill immediately. **Figure 1** outlines the sub-catchments of each reservoir. Flood water is spilled as follows:

- Headwaters No.1 flows to Thirsk Reservoir.
- Headwaters Reservoirs Numbers 2, 3 and 4 flows through Headwater Dam No. 1.
- Crescent Reservoir flows directly to Thirsk Reservoir.
- Whitehead Reservoir flows to Thirsk Reservoir.
- Isintok Reservoir is routed via Trout Creek to Okanagan Lake.
- Tsuh Reservoir is routed via Tsuh Creek to Trout Creek to Okanagan Lake.
- Thirsk Reservoir is routed via Trout Creek to Okanagan Lake.

Summerland Reservoir

The Summerland Reservoir levels are controlled by channel supply from intake structure off Trout Creek. The dam itself is constructed from gravelly material local to the area, and is prone to seepage. Immediately downstream of the structure are residences and orchard farmland.

2.3.2 Garnett Reservoir

The Aenas Creek Watershed, upstream of the Garnett dam, supplies between 5 and 10 percent of the District of Summerland water supply. This watershed includes Finley Creek, Lapsley Creek and two small high-level reservoirs, Aeneas Reservoir and Tsuh Reservoir. The bulk of this water supply is for municipal and agricultural purposes.

Under extreme wet conditions, or where flood conditions exist, Aeneas and Tsuh are always assumed to be full and spill immediately.

- Aeneas and Tsuh Reservoir flow into Garnett Reservoir,
- Garnett spills are routed to Okanagan Lake.

3 Site Inspection of Dams and Ancillary Structures

Site inspections were completed on four different days. Inspection sheets provided by the Ministry of Environment were completed, and converted to a database, and detailed in Appendix A.

Each dam was inspected based on the following work plan:

- Detailed inspection of the seepage, seepage damage, overtopping, ground conditions and other geotechnical or structural components affecting the stability of the dam.
- Detailed inspection of the low level outlet structure, including concrete condition, gate operations, riprap condition and general operations.
- Detailed inspection of the service and emergency spillways, including concrete quality, cracking, debris levels, riprap quality and downstream conditions.
- A review of personal safety aspects, including level of access to the public.
- Advising the District of Summerland of any items requiring immediate attention.

4 Dam Breach Issues

Dam breaches can generally be by sunny day failure, flood failures or Acts of God.

- Sunny day failures can result from simple structural failures to failures of individual
 components, such as a broken low level outlet structure, piping, erosion or failure of the
 spillway structure, plugged filter systems, or other similar failures caused by inadequate
 maintenance, upgrades or monitoring.
- Flood failures can occur to any component of the dam, and result generally from the additional erosive forces and forces overcoming a spillway system that is inadequately sized or maintained.
- Acts of God, such as earthquakes, lightning strikes or tornadoes.

Table 4-1 summarizes breach issues for the District's Dams. These issues form part of the Hazard Consequence Classification in Section 5.



Table 4-1 **Summary of Dam Breach Modes and Concerns**

	Hazard Classification	Likely Failure Mode	Downstream Development	Comments
Headwaters No. 1 (includes flows cascaded from breach of Headwaters 2, 3, 4 or Crescent Reservoir)	Low	Flood	None	Cascade into Thirsk Reservoir
Crescent	Very Low	Flood		Cascades into Thirsk
Whitehead	Very Low	Flood		Cascades into Thirsk
Summerland Reservoir	High	Sunny Day	Ranches, farmland	Loss of supply intake to Town, houses immediately downstream,
Isintok	High	Flood	Lower Summerland, Okanagan Lake	Disruption to flows in Trout Creek, supply to town.
Garnett Dam (includes flows cascaded from breach of Aeneas or Tsuh Dams)	Very High	Flood	Ranches, Farmland, environmental	Loss of supply to 10 percent of District, downstream farmland, road, some loss of life.

5 **Hazard Consequence Classification Review**

The BC Dam Safety Division has provided a document called the Interim Consequence Classification Policy for Dams in British Columbia, February 2010.

The BC Dam Safety Hazard Classification System is based on 1999 Canadian Dam Association (CDA) guidelines, but updated in 2010 to accommodate the 2007 CDA guidelines, Table 5-1. There is currently a caveat in the BC regulations that dam safety reviews constructed prior to 2007 can continue to be classified under the 1999 definitions (No High-High or High-Low classifications). Classifications are generally based on the incremental losses that a failure of a dam might inflict on downstream areas, upstream areas or at the dam location. Incremental losses are those over and

above losses which might have occurred for the same natural event or conditions, had the dam not failed. The incremental losses from a dam failure are evaluated in terms of three consequence categories:

- Loss of life.
- Economic value of other losses and/or damage to property.
- Other less quantifiable consequences related to social, cultural, and environmental damages.

Table 5-1 **Consequence Classifications (BC Ministry of Environment, 2010)**

Consequence Classifications	Loss of Life		at Risk Only)	Economic and Social Losses ²		Environmental Loss	Consequence Classifications	
BC Dam Safety Regulation	BC Reg. ³	CDA	Persons at Ris (CDA Only)	BC Reg. ⁴	CDA	BC Reg.	CDA	CDA 2007
Very High	>100	>100	ls.	>\$100M Very High Infrastructure; Public, Commercial, Residential	Extreme - Critical Infrastructure or Services	Nationally & Provincially Important Habitat & Sites - Restoration Chance Low	Major Loss of Critical Habitat - No Restoration Possible	Extreme
High (High ⁵)	< 100	< 100	Permanent Residents	< 100M Substantial Infrastructure; Public, Commercial	Very High - Important Infrastructure or Services	Same as Above but Restoration Chance High	Significant Loss of Critical Habitat - Restoration Possible	Very High
High (Low ⁵)	< 10	< 10		< \$10M Same as Above	High – Infrastructure, Public Trans & Commercial	Same as Above	Significant Loss of Important Habitat - Restoration Possible	High
Low	Some Possible	Unspecified ⁶	Temporary Only	< \$1M Limited Infrastructure; Public, Commercial	Temporary & Infrequent	Regionally Important Habitat & Sites - Restoration Chance High	No Significant Loss of Habitat - Restoration Possible	Significant
Very Low	Minimal	0	None	< \$100K Minimal	Low	No Significant Loss of Habitat or Sites	Minimal Short Term Loss	Low

Table 5-2 provides the results of our analysis of each dam's hazard consequence.



CDA name this category 'Infrastructure & Economics'
 Conservative estimate of loss of life amongst population affected by the flood waters (may equal Population at Risk)
 Dollar values from year 2000

Internal "High" sub-classification used for Dam Safety Program risk-based assessment.

Significant category may not always line up with Low (BC Reg). A temporary population (e.g. in recreation al areas) could be quite large and a "sunny-day" failure could result in multiple fatalities.

Table 5-2 Summary of Hazard Categories (using CDA 2007)

Dam	Loss of Life	Economic and Social Losses	Environmental and Cultural Losses	Overall Hazard Classification
Headwaters 1	Very Low	Low	Very Low	Very Low
Headwaters 2	Very Low	Very Low	Very Low	Very Low
Headwaters 3	Very Low	Very Low	Very Low	Very Low
Headwaters 4	Very Low	Very Low	Very Low	Very Low
Crescent Reservoir	Very Low	Very Low	Very Low	Very Low
Whitehead Reservoir	Very Low	Very Low	Very Low	Very Low
Aeneas Reservoir	Very Low	Very Low	Very Low	Very Low
Isintok Reservoir	Very Low	High	High	High
Tsuh Reservoir	Very Low	Very low	Very Low	Very Low
Gamett Reservoir	High	Very High	High	Very High
Summerland Reservoir	Low	High	Very Low	High

Our dam safety review team reviewed each dam's historical hazard consequence rating, then revised, where required, the consequence classification from our findings in this report, including inspection of the dam sites, observations of the upstream and downstream conditions and estimating the consequences of dam failure. The evaluation of potential losses, both with and without dam failure, are normally based on inundation studies and should consider existing and anticipated future downstream development and land uses. No inundation studies have been completed for any of the dams examined.

The three higher consequence dams, Garnett Reservoir, Isintok and the Summerland Reservoir are determined as follows:

Garnett Dam

A breach at this dam can cause significant Economic and social losses in the Summerland area. Drinking water supply to the valley residents would be compromised, and the erosion and deposition on agricultural lands downstream would be very significant. There is only one access road along the creek. This road would likely be destroyed or compromised, restricting emergency access to both the dam operations and downstream affected stakeholders. Classification: Very High.

Isintok

This reservoir is the only small reservoir on the Trout Creek system that does not cascade into Thirsk Dam. The result of a breach of this dam would likely be significant damage to Trout Creek. As with Testalinden Creek in 2010, the quantity of material routed to the downstream reaches of Trout Creek could be up to 10 times the Reservoir volume. This could impact Highway 97,

agricultural properties and the lower town near Okanagan Lake. A dam breach study is recommended. Classification: High.

Summerland Reservoir

A breach of the Summerland Reservoir would affect a number of residences immediately downstream of the structure. While the volumes of water are small, the impact to lives and agricultural properties are potentially significant. The only breach scenario is a sunny day breach, as the only inflow is from a channel and intake off Trout Creek. There is a negligible watershed. There is an electronic level sensor and alarm system at the structure to warn staff of operational issues at Summerland Reservoir. Classification: High.

6 Review of Inflow Design Floods and Structure Capacity

A review of Inflow Design Floods for all reservoirs was performed to review spillway capacity requirements. In each instance, we examined or estimated the Inflow Design Flood for the dam, and determined if the spillway structures could meet the required capacities within their current freeboard conditions.

Since little is known of the design characteristics of each dam, it is up to the dam safety reviewer to determine the appropriate Inflow Design Flood. Table 6-1 below describes Inflow Design Flood (IDF) minimum requirements for various Hazard Consequences.

Table 6-1
Suggested IDF and Earthquake Factors (CDA 2007)

Dam class	AEP					
[note 1]	IDF [note 2]	EDGM [note 3]				
Low	1/100	1/500				
Significant	Between 1/100 and 1/1000 [note 4]	1/1000				
High	1/3 between 1/1000 and PMF [note 5]	1/2500 [note 6]				
Very high	2/3 between 1/1000 and PMF [note 5]	1/5000 [note 6]				
Extreme	PMF [note 5]	1/10,000				

Acronyms: AEP, annual exceedance probability; EDGM, earthquake design ground motion; IDF, inflow design flood; PMF, probable maximum flood.

Note 1. As defined in Table 2-1, Dam Classification.

Note 2. Extrapolation of flood statistics beyond 1/1000 year flood (10⁻³ AEP) is discouraged.

Note 3. AEP levels for EDGM are to be used for mean rather than median estimates of the hazard.

Note 4. Selected on the basis of incremental flood analysis, exposure, and consequences of failure.

Note 5. PMF has no associated AEP. The flood defined as "1/3 between 1/1000 year and PMF" or "2/3 between 1/1000 year and PMF" has no defined AEP.

Note 6. The EDGM value must be justified to demonstrate conformance to societal norms of acceptable risk. Justification can be provided with the help of failure modes analysis focused on the particular modes that can contribute to failure initiated by a seismic event. If the justification cannot be provided, the EDGM should be 1/10,000.



Out of the 11 reservoirs examined in this review, three can be classified as high consequence. Initially, we assume examined all high consequence dams for 1:1000 year flood should be the minimum design IDF for these structures. The remaining 8 reservoirs had Very Low consequence ratings, requiring 1:100 year IDF. We analyzed these structures for a 1:100 and 1:200 year storm, as several historical criteria assumed this flood assessment.

Inflow Design Floods would likely result from the combination of severe rainfall and snow-melt events. As there are no past hydrological studies of each specific dam, the reviewers performed a review of flood parameters to assess dam safety concerns. The review team examined various flood routing methodologies.

6.1 Rational Method

Regional methodology is generally considered suspect for watershed smaller than 10 km²; therefore, the Rational Formula is commonly used to estimate design peak flows for small watersheds in B.C. (Coulson 1991). The basic assumptions of the Rational Formula are as follows:

- a. Rainfall occurs at a uniform intensity for a duration at least equal to the time-of-concentration¹:
- b. Rainfall occurs at a uniform intensity over the entire area of the watershed; and
- c. A single runoff coefficient is representative of the entire are of the watershed.

The Rational Formula equation used to calculate the IDF discharge for the Summerland reservoirs are:

$$Q_{pIDF} = \frac{0.28CPA}{T_c}$$

And:
$$T_c = (n L)^{0.467} S^{-0.234}$$

where:

 $Q_{pIDF} = IDF discharge (m³/s);$

C = runoff coefficient (dimensionless);

P = total precipitation occurring within the time-of-concentration (mm), during the 1:100 or

1:1000 maximum precipitation event;

A = drainage area (km²); and

 T_c = time-of-concentration (hrs).

n = Roughness coefficient

L = Watershed Length (km)

S = Watershed Slope

¹ This is the time required for surface runoff generated at the most distant point in the drainage basin to reach the point-of-interest.

The derived factors are found in **Tables 6-2** and **Table 6-3**. A detailed process is provided in **Appendix D**. We also examined the effects for a different hydrologic zone such as Penticton. It should also be noted that dam sites are approximately 1000 metres higher than most Environment Canada weather stations in the area.

6.2 Other historical IDF Calculations

Designs in both the Okanagan and by recent designs in the interior of British Columbia were examined for similar sized reservoirs and structures for their hydraulic considerations. The CDA Guidelines suggest a minimum of IDF of 1:100 for Very Low Consequence dams. Most other analyses in the Okanagan start at 1:200, and account for local weather patterns, and the effects of pine beetle and other elevation factors.

Notes:

- Coulson (1973) summarized from past experience and observations that Inflow Design
 Floods have ranged between 50 to 150 cfs/square mile of watershed in the Okanagan
 Regional. In very small and high elevation watersheds, however, he felt that potential
 snowmelt and rainfall conditions would prevail, and that the peak inflows of 228 cfs/square
 mile were more reliable.
- During a review of the Garnett dam safety, Imada (1999) noted that other similar sized dams within BC Hydro were designed to 1:1000 storms, where the spillway capacities were calculated between 2.7 and 3.0 cfs per square mile of watershed.
- Hay (2007) reviewed Trout Creek, Table 6-4. It was also reported in this study that the Mountain Pine Beetle infestation and climate change could significantly affect runoff capacity requirements.



Table 6-2 **Summary of Inflow Design Flood Reviews**

	Trout Creek Watershed						Garnet Valley	Watershed
	HW 1	HW 2-4	Crescent	Whitehead	Isintok	Tsuh	Aeneas	Garnett
A (ha)	1,918	500	1,554	540	1,640	244	310	10,000
A (km²)	19.2	5.0	15.5	5.4	16.4	2.4	3.1	100.0
L (m)	6,650	6,650	2,000	2,000	4,260	1,000	2,000	16,000
L (km)	6.7	6.7	2.0	2.0	4.3	1.0	2.0	16.0
n S	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
C	0.069 0.25	0.069 0.25	0.020 0.25	0.106 0.25	0.223 0.25	0.143 0.25	0.100 0.25	0.040 0.25
C ₁₀₀	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
C ₁₀₀₀	0.31	0.31	0.31	0.38	0.38	0.31	0.38	0.31
Tc (hr)	2.5	2.5	1.9	1.3	1.5	0.38	1.3	4.2
Tc (min)								
` ′	149	149	113	77	92	52	78	254
i ₁₀₀ (mm/h)	9	9	11	17	14	19	17	7
i ₁₀₀₀ (mm/h)	26	26	31	34	38	52	42	18
P ₁₀₀ (mm)	22	22	21	22	21	16	22	28
P ₁₀₀₀ (mm)	64	64	58	43	58	45	54	76
Capacities from Rational	Equation (r	n³/s)						
Q _{Rational 1:100}	15.1	3.9	15.0	8.0	20.1	4.1	4.6	58.6
Q _{Rational 1:1000}	52.4	13.7	50.6	19.3	65.4	13.3	13.7	189.0
Other estimates for 1:200	storm from	past desig	gns or stud	dies (m³/s)				
Q _{0.93 m3/s/km2}	17.8	4.7	14.5	5.0	15.3	2.3	2.9	93.0
Q _{50cf s/mi2}	10.5	2.7	8.5	3.0	9.0	1.3	1.7	54.7
Q _{Hay&Co 1:200}								11.4
Other estimates for 1:1000) storm from	n past des	igns or stu	ıdies (m³/s)	ı			
Q _{228cf s/mi2} -Coulson(1973)	47.8	12.5	38.7	13.5	40.9	6.1	7.7	
Q _{150cf s/mi2}	31.5	8.2	25.5	8.9	26.9	4.0	5.1	164.0
Q _{BCHy dro-LOW}	51.8	13.5	42.0	14.6	44.3	6.6	8.4	270.0
Q _{BCHy dro-HIGH}	57.5	15.0	46.6	16.2	49.2	7.3	9.3	300.0
Recommended IDF - 2010	15.1	3.9	15.0	8.0	65.4	4.1	4.6	164.0
Volume of Runoff (Q . T _c) (m ³)	134,590	35,090	101,530	36,910	359,530	12,580	21,480	2,499,410

Table 6-3
Review of Spillway or Flood Control Capacities Based on IDF

					Estimated	Capacity	Required	Capacity	
	Hazard Classification	IDF	Weir Type	Base Weir Length (m)	Maximum Q _c (m ³)	Depth of Spillway (m)	IDF Q _r (m ³ /s)	Minimum Depth d _r (m)	Comments
Headwaters 1	Very Low	1:100	Rectangular	9.14	32.2	1.53	15.0	0.92	Ok
Headwaters 2	Very Low	1:100	Trapezoid	3.00	15.8	1.57	3.9	1.40	Ok
Headwaters 3	Very Low	1:100	Trapezoid	2.40	15.8	1.57	3.9	1.40	Ok
Headwaters 4	Very Low	1:100	Trapezoid	3.00	15.8	1.57	3.9	1.40	Ok
Crescent Lake	Very Low	1:100	Rectangular	8.50	24.5	1.34	14.5	0.95	Ok
Isintok	High	1:1000	Rectangular	4.00	41.0	3.12	40.9	3.14	Requires Further Review
Whitehead	Very Low	1:100	Trapezoid	5.79	21.5	1.15	13.5	0.51	Ok
Gamett Dam	High	1:1000	Cipolletti	12.20	70.0	2.12	164.0	3.74	Requires Further Review
Aeneas	Very Low	1:100	Rectangular	4.57	11.2	1.20	7.7	0.95	Ok
Tsuh Dam	Very Low	1:100	Trapezoid	3.00	10.9	1.07	6.1	0.79	Ok
Intake Dam	High	N/A	None						N/A

IDF - Inflow Design Flood

Current assumes maximum spillway capacity without overtopping the dam but using the full freeboard.

Table 6-4
Trout Creek Watershed Flood at Entrance to Okanagan Lake (Hay, 2007)

Return Period (years)	Peak Discharge (m³/s)
2	22.9
5	34.7
10	42.1
20	49.0
50	57.7
100	64.0
200	70.3

6.3 Discussion

Inflow Design Floods - Low or Very Low Consequence Dams

- The eight Very Low consequence dams were constructed in remote uplands, and are typically above 1200 m in elevation. Although the dams pose little risk to downstream users or uses, the Emergency Flood Control structures must still be adequately designed to pass floods between the 1:200 year and 1:1000 events.
- Upon review of the designs, the flood control structures on Headwaters, Crescent Reservoir, Whitehead Reservoir, Aeneas and Tsuh are adequately sized to pass the IDF.
- Headwaters No. 1 is a Low Consequence dam. There is a minor risk that there could be



temporary silt overload in Thirsk Dam. This can only be confirmed with further study. If Thirsk were somehow found to fail under this scenario, then Headwaters No. 1 could be upgraded to a High Consequence dam.

Inflow Design Floods - High Consequence Dams

- The flood control structures on two of the three High Consequence dams must pass at least the 1:1000 year flood, and possibly higher.
- Isintok Dam spillway size may require further review. As the spill into Isintok Creek could significantly impact lower Trout Creek, it will be important to review IDF requirements for this reservoir. It is currently undersized for a 1:1000 year storm consistent with the analysis above.
- The Very High Consequence Rating requires that the Garnett Dam spillway be sized for a storm 2/3 somewhere between 1:1000 and the PMF. Regardless, the spillway is too small for the 1:1000 storm, and therefore requires review. In addition, the channel capacity downstream of the spillway is restricted by a culvert crossing that would be immediately washed out. Access to the dam in these emergency circumstances would be a significant challenge.
- The Summerland Reservoir dam IDF is not based on watershed parameters, but canal operational failure. It is not applicable in this circumstance.

Notes on Climate Change

- The issue of climate change on inflow design floods in the Okanagan has been discussed in recent years. It is generally accepted at this time that climate change would reduce the quantity of storage, as noted in Water Management Consultants (2005). The District has increased storage at the Thirsk Reservoir in 2007.
- Concerning dam safety, climate change would likely affect the severity of storms, and render past return storm analyses as suspect. The only spillway of concern at this time is at Garnett Valley. Long term climate change would likely only exacerbate this issue.

7 Review of Dam Design and Construction

As part of the inspection process, each dam design was reviewed, where possible, and compared to current design practices. Most of the very low consequence dams in the District of Summerland are earthen dams constructed of homogeneous materials. Detailed Inspection sheets containing results of individual inspections can be found in Appendix A. Photographs from each inspection are found in the accompanying CD ROM disk. Some photos with key issues itemized in Appendix C.

7.1 Structural Stability

The stability of the upstream and downstream slopes of the District's dams was reviewed and assessed. The dam sections analyzed were based on descriptions provided in the Operation and Maintenance Manual for the Water Storage Dams and an assumed phreatic surface based on observed seepage and location of the full supply level from HWL to the toe of slope.

Static and pseudo static analyses of the dams were undertaken. The analyses considered the consequence of full rapid drawdown under static and pseudo static conditions.

The choice of the peak horizontal ground acceleration used in the analyses was based on the screening level consequence category. The maximum design earthquake (MDE) used in this stability assessment of the Districts earthen dams was obtained from CDA 2007, summarized in Table 7.1. The 1998 dam safety review values are included for comparison. The selection of the appropriate annual probability of exceedance was based on the level consequence category.

Table 7.1

Annual Probability of Exceedance versus

Peak Ground Acceleration (PGA (%g))

1998 (Coursier D	am - Revelstoke)	2010 (NBCC 2005 1:2475 yr)		
Annual Probability of Exceedance	Peak Ground Acceleration (%g)	Annual Probability of Exceedance	Peak Ground Acceleration (%g)	
0.001	6.5	EDGM (low) = 1/500	8.0	
0.0001	22.0	EDGM (High) = 1/2500	14.0	

As in the previous dam safety inspections, there was a lack of as-constructed information available. We assumed that the dams consisted of a homogeneous section. A friction angle of 32 degrees and a $\gamma = 19.5 \text{ kN/m}^3$ was used for the dam fills and foundation soils, respectively. **Table 7-2** summarizes generally accepted minimum factors of safety for various loading conditions.



Table 7-2 **Loading Conditions and Minimum Accepted Factor of Safety**

Loading Conditions	Minimum Accepted Factor of Safety				
Loading Conditions	1998	2010			
Steady-State Seepage with Full Reservoir	1.5	1.5			
Full Rapid Drawdown	1.2 – 1.3	1.2 – 1.3			
Earthquake	1.2	1.2			

Table 7-3 summarizes the factors of safety for the various dams. Note that D/S and U/S stand for downstream and upstream, respectively.

Table 7-3 **Factors of Safety for the Assessed Dams**

	Factor of Safety					
DAM	Ctatia	Earthquake E	vent			
	Static	1/2500	1/500			
Headwater No. 1	1.9	>1.2	>1.4			
Headwater No. 2	2.5	-	>1.5			
Headwater No. 3	2.4	-	>1.5			
Headwater No. 4	2.2	-	>1.5			
Crescent Reservoir	1.49	-	1.2			
Whitehead Reservoir	1.8	-	1.3			
Isintok Reservoir	1.75 - 1.3					
Summerland Reservoir	-	-	-			
Aeneas Reservoir	1.6	-	1.3			
Tsuh Reservoir	1.9	-	1.4			
Garnett Reservoir	1.3 0.87 - 0.99 <1.1					

Table 7-4 **Comments on Stability of Dams**

	Meets minimum factor of safety requirement for slope failures?	Meets minimum safety factor for combined rapid drawdown and a 0.001 earthquake?	Meets minimum safety factor required for stability under rapid drawdown condition?
Headwaters 1	Yes	Questionable	Yes
Headwaters 2	No – slightly low, but acceptable		No
Headwaters 3	Yes	Yes – Slightly low, but acceptable	Yes
Headwaters 4	Yes	Questionable	Yes
Crescent Reservoir	Yes	Questionable	Yes
Isintok	No – Upstream Slope is slightly lower.	Questionable	Yes
Whitehead	No – slightly low, but acceptable	Questionable	Yes
Summerland Reservoir Dam	Yes	Questionable	Yes
Garnett Dam	No	No - Severely compromised under both a 0.001 and 0.0001 earthquake event. This includes full rapid drawdown of the reservoir.	No - Severely compromised under both a 0.001 and 0.0001 earthquake event. This includes full rapid drawdown of the reservoir.
Aeneas Dam	Yes	Questionable	
Tsuh Dam	Yes	Questionable	



8 Operations, Maintenance and Surveillance Review and Compliance

A review of procedures and methods used to operate the dam during normal and emergency conditions was performed. This review included:

- Dam maintenance records for any errors, omissions and deficiencies.
- Safety related documentation regarding the facility.
- Current dam management practices.

Dam Maintenance Records (notes are included in the inspection checklist in Appendix A)

- Generally, the dams are all well maintained. Due to the remote nature of several of the
 very low consequence dams, operations are limited to spill control. The low level outlets
 remain closed unless there is a need for additional water downstream, or that a lower
 reservoir level is required.
- Upgrades since the last Dam Safety Review:
 - District appears to have been diligent in the removal of brush and trees in all the dams.
 Some additional care should be given to maintaining some of the gates and concrete structures in working order. Some structures had plugging issues, and gates were sometimes difficult to seal completely.
 - Upgrades were completed on Headwaters No. 1 dam to improve the structural factor of safety.
 - Some of the recommended upgrades from the 1999 Dam Safety Review were not completed. Some of these upgrades are included in the recommendations in this report.
 - There have been no reports of emergencies within the last 10 years. All maintenance activities have been documented.

Safety Compliance

- Public Safety:
 - Most of the high elevation dams in the District include forestry campgrounds, recreational trails and forestry roads within their watersheds. There are apparently blue "Watershed Protection Zone" signs on most of the reservoirs. The review team only saw one sign advising the public that the reservoirs impounded by these dams were for water consumption by the District of Summerland (Isintok). Signs should be noticeable at all access points.
 - Notable exceptions:
 - Garnett Reservoir: The District has fenced around the dam and spillway area, and particularly along the Garnett Valley road.
 - Isintok: There is a sign advising the public to avoid using the dam. Foot and wheel tracks are evidence that the public does not heed the warnings.
 - Headwaters dams: There are forestry campgrounds with signs limiting fires.

Vehicular Traffic

Isintok: Isintok's granular sand slopes appear to be highly erosive, and subject to
rutting from vehicular traffic. This traffic could be restricted by installing a large rock
at key entry points. While it will be impossible to limit all traffic, it is hoped to keep
larger vehicles out; particularly off the slopes of the dam.

Water Quality Safety

The potential for pollutants entering the system is relatively low. As with any
remote Reservoir or reservoir, there is the potential for point source pollutants
entering the system. There are also always the potential of criminal acts, however
there is little surveillance available to monitor this.

Operations Safety.

- Staff follow general safety practices as dictated through WCB. The OMS report loosely refers to these practices. This protocol should be updated to 2010 requirements. These practices include communications, travel practices, weather, first aid, etc.
- The noticeable items to the review team were:
 - Communications: Both regular and emergency communications are impossible on many of the dams. Use of a satellite phone is spotty at best.
 A communications plan should be included in the OMS plan update.
 - Access to Tsuh and Aeneas Reservoir dams is very difficult. There are
 many risks along the forestry roads. The roads are full of sharp rocks,
 twists and fallen trees. Simple protocols such as spare tires, first aid kits,
 weather safety kids and flares are suggestions.
 - There is no path to get to Tsuh Dam. There should at least be an ATV path.

Current Dam Management Practices

The last Operations and Maintenance manual for the Summerland Water Storage Dams was one prepared by UMA in 1991. This report recommended that at the end of the irrigation season the reservoirs should be at low levels in order to prevent ice build-up on the spillways during winter operation and to provide potential for some attenuation of peak flood flows in the following spring. The storage of some flood runoff in the spring reduces the possibility of spillway channel erosion

Water Management Consultants (2005) recommended that the District not generally operate the reservoirs explicitly for flood control in the late fall. If there is a large snowpack in a given year, Summerland operators now pre-spill from the reservoirs; not compromising normal water supply storage and refilling.

Recommendation

The Operations, Maintenance and Surveillance Manual requires updating. The manual must include dam management practices for each dam. This manual should have appendices which



include all current inspections, and a checklist of required practices. The manual can also include the Emergency Preparedness Plan and any Response Plans as discussed in the next section.

9 Emergency Preparedness Plan (EPP) Review

The team conducted a review of the Emergency Preparedness Plan. The District's EPP for all its small dams are in one document. A second meeting with Mr. Scott Morgan of the Ministry of Environment discussed all operations and maintenance. Current Emergency Preparedness Plans, O&M Manuals and inspection documentation were reviewed at this meeting.

Recommended Changes

- The Plan itself should be arranged in such a format that it can be easily accessed by any staff member during an emergency.
- Telephone numbers of all emergency contacts, available local contractors, helicopter contacts, the RCMP and the BC Government Emergency Contact.
- A copy of the District of Summerland Emergency Response Plan, and those to be contacted.
- All flood inundation mapping for all dams, including potential road washout locations.
- Design information on each specific dam.
- The EPP user must be aware to contact landowners immediately downstream of Summerland Reservoir when a potential or imminent breach scenario occurs. Landowners further downstream may be contacted using public radio or other services.
- Maps of access routes are required for each dam. This mapping should include recommended transportation, and an estimate of time required based on either direction.
- Helicopter Access should describe potential location of nearest landing area in vicinity of the dam.
- The Contact list should be updated regularly.
- A separate EPP file should be created for Garnett Reservoir dam.

10 Conclusions and Recommendations

A dam safety review was conducted for ten dams within the District of Summerland water supply system. The dams impound water within the District's two main watersheds, Trout Creek and Garnett Valley.

Detailed results of the review are included in the report. A summary of these conclusions and recommendations are presented in **Table 10-1** below.

Table 10-1 Comments, Concerns and Recommendations

ltem	Comments or Concerns	Recommendations
Headwaters No. 1	 Risk of pluggage at spillway from downed logs. During major event, these can block the spillway 	 Low Hazard Consequence Dam Remove logs where possible. Add log boom Cut and remove brush and trees in spillway riprap.
Headwaters No. 2	 Low Level Outlet - Corrugated pipe is failing slightly (see photo). Gate leaks slightly, but not a concern. 	 Very Low Hazard Consequence Dam Monitor annually at outlet for pipeline condition. Remove logs around spillway. Maintain earth spillway elevations where machinery available. Flush outlet regularly
Headwaters No. 3	 Maintenance required on low level outlet. Cleaning and Rock removal. Gate leaks slightly, but not a concern. 	 Very Low Hazard Consequence Dam Minor Maintenance only. Remove logs around spillway. Maintain earth spillway elevations where machinery available. Flush outlet regularly.
Headwaters No 4	 Maintenance required on low level outlet. Cleaning and Rock removal. Gate leaks slightly, but not a concern. Minor seepage along south edge of outlet channel. 	 Very Low Hazard Consequence Dam Minor Maintenance only. Remove logs around spillway. Maintain earth spillway elevations where machinery available.
Crescent (Paul) Reservoir	 Old low level outlet has been plugged, but there is debris. Seepage is evident around the outlet. Spillway debris evident. Seepage along south side of low level outlet, D/S of toe of dam. 	 Very Low Hazard Consequence Dam Add log boom away from the spillway. Monitor the old inlet and outlet of the low level outlet structure. Visually monitor seepage flows around old outlet during regular maintenance visits. Report any changes to clarity or volumes.



ltem	Comments or Concerns	Recommendations
Whitehead Reservoir	 Further review is required to determine freeboard requirement for this dam. Stated as 1.15 m, but looks more like 800 mm. Water level should be lowered. Low level outlet concrete has failed. Significant sloughing of earth. Spillway contains debris. 	 Very Low Hazard Consequence Dam Repair or replace concrete outlet structure. Clear vegetation and re-grade spillway channel. Examine design of dam and reservoir. Reservoir should be operated at or lower than it high water level. This allows access over the spillway to the main dam.
Aeneas Reservoir	 Spillway concrete has failed. Will not survive major flow event. Very difficult dam to access. Gate Handle difficult to turn. 	 Very Low Hazard Consequence Dam Clean out outlet pipeline and outlet channel. Repair or replace spillway. Maintain log removal around spillway entrance. Monitor logs around the inlet gate stem.
Tsuh (Deer) Reservoir	 Presently accessible only by foot or boat. Log debris. Brush was cleared while at site. Log boom would prevent some pluggage at the spillway channel inlet. 	 Very Low Hazard Consequence Dam Construct vehicle access to dam. Clean out the outlet pipe on regular basis. Inspect the inlet structure. Clear area as required.
Isintok Reservoir	 Significant evidence of public traffic on both slopes of dam. Old gravel pit adjacent to dam used as motocross track. Soil sloughed around Gate handle. Difficult to turn. Downstream flooding could directly affect Summerland downstream. 	 High Hazard Consequence Dam Further review is required to determine if the spillway capacity can meet the 1:1000 flow. From our initial review, it is slightly lower than the required capacity. Flood inundation study required to determine effects of breach. Maintenance required on surface of dam. Remove ruts. Additional public signage Add vehicle barriers or large rock to restrict access to larger vehicles. Keep vehicles off the slopes.
Garnett Reservoir	 The spillway is obstructed by a road and culvert. The culvert and road access will most likely be destroyed in a significant storm event. The last time this access was destroyed was in 1980. The District considers this as a sacrificial crossing during a major storm event. The spillway capacity is likely lower than the required IDF and freeboard. Based on comparisons with other dams and similar watersheds, IDF is higher than current capacity of this Very High Consequence Dam. Spillway design parameters, including joints between slabs and side walls improperly sealed, side 	 Very High Consequence Dam New 3 m wide toe berm starting about 4.5 m below the top of dam required to reach a Factor of Safety of 1.2 for a 1/2500 year earthquake event. Immediately review hydrology and hydraulics of Gamett Reservoir watershed. Flood Inundation study for downstream of the Gamett Dam. Determine adequacy of flood routing facilities based on review. Continue to monitor seepage. Continue to remove tree and brush growth.

Item	Comments or Concerns	Recommendations
	walls showing minor signs of settling, minor concrete spalling on downstream slabs, absence of wing walls at extremity of downstream slab to minimize lateral effects (roller) during high discharges. Factor of safety estimated at 0.87, and is below the minimum 1.2 CDA requirement for earthquake event.	
Summerland Reservoir	 First dam safety review for the Summerland Reservoir. No watershed. Only flood scenario is sunny day breach from overtopping. Houses and agricultural area immediately downstream. 	 High Hazard Consequence Dam. Monitor water levels and operate accordingly. Examine overtopping protection options along the channel system.
EPP	 The District has an Emergency Preparedness Plan. There is a lack of understanding of the consequences of a dam breach. 	 More detail is required within the plan. The District should exercise the plan, and determine areas of improvement. Staff should be made aware of the importance of dam safety, and the extreme consequences of a failure.
O, M & S	 The District operates and maintains the dams responsibly. The dams are old, subject to extreme conditions, and require on-going maintenance. The flood control structures are beginning to age. 	 Budget is required to begin upgrading the low level outlets. This includes gate seal replacement, gear replacements and riprap repair. Access to Aeneas and Tsuh Dams is poor. This lack of access is one reason why the reservoirs are not maintained as much as the others.





11 References

- Associated Engineering, 1997. Water System Master Plan, Report to the District of Summerland.
- Canadian Dam Association, Dam Safety Guidelines, 2007 (http://www.cda.ca)
- Coulson and Obedkoff. March 1998. British Columbia Streamflow Inventory.
- Letvak, D.B. 1989. Water Supply Analysis for Trout Creek and the District of Summerland,
 BC Ministry of Environment.
- Ministry of Environment, 2008. Plan Submission Guidelines, Water Stewardship Division
- Ministry of Environment, 2010. Interim Consequence Classification Policy for Dams in British Columbia,
- Natural Resources Canada Earthquakes (http://earthquakescanada.nrcan.gc.ca/indexeng.php)
- Reksten, D.E. 1973. Trout Creek Water Supply for the District of Summerland, BC Ministry of Environment.
- UMA. 1991. Water Storage Dams, Operation and Maintenance Manual. Report to the District of Summerland.
- US Dept. of the Interior, 1987. Design of Small Dams, BUREC, Third Edition.
- Washington State Dam Safety.
 (http://www.ecy.wa.gov/programs/wr/dams/GuidanceDocs.html)
- Water Management Consultants. April 2005. Trout Creek Water Supply System Water Use Plan. Technical Background Document on Hydrology, Water Usage and Reservoir Operations.
- Weiss, E. 1981. Trout Creek Water Supply Study, BC Ministry of Environment.

REPORT

Appendix A - Site Inspections



Dam Safety Review Check Sheet

Dam: District of Summerland Dams	D#:	Date	e OF DSR: Spring 2010		
Owner: District of Summerland Eng.	Engineer: Rod MacLean, P. Eng./Gerald Imada, P.				
Engineering Firm: Associated/Golder	Report	file No.:			
DSR Guideline					
Section No.: DSR Content:	Done or	not done?	Comments:		
2.2. Site Inspection performed?	Yes 🖂	No 🗌			
2.2. Dam Owner interviewed?	Yes 🖂	No 🗌			
2.3. Dam data and Records compiled?	Yes 🗌	No 🖂	Not part of report/ in Summerland		
2.4. Consequence Classification reviewed?	Yes 🖂	No 🗌			
Dam Breach Calculation, done? recommended for Garnet and Isintok Reservoirs.	Yes 🗌	No 🖂	Further inundation study		
2.5. Dam Safety Analysis, done?	Yes 🖂	No 🗌			
- Hazards and Failure Modes					
& effects identified?	Yes 🖂	No 🗌			
- Flood Capacity assessed?	Yes 🖂	No 🗌			
- Seismic Stability assessed?	Yes 🖂	No 🗌			
- Deficiencies documented?	Yes 🖂	No 🗌			
2.6. OMS reviewed?	Yes 🖂	No 🗌			
OMS Compliance determined?	Yes 🖂	No 🗌			
2.7. Emergency Preparedness Plan reviewed?	Yes 🔀	No 🗌			
2.8. Public Safety & Security looked at?	Yes 🖂	No 🗌			
2.9. Dam Safety Management System reviewed?	Yes 🔀	No 🗌			

3. Dam Safety Review Report presented?	Yes 🗌	No 🗌	To be confirmed
- Recommendations made?	Yes 🖂	No 🗌	
General Comments:			
Reviewed by: Rod MacLean/Gerald Imada/	'Ed Bird		Date reviewed:
December 23, 2010			

Dam Safety Inspection Checklist

Name of Dam	Headwaters N	o. 1 Ir	spection Date	30-	Apr-10	Observed Conditions
Current Weathe	ther: Cloudy-Some Sun Previou		revious Week	:		S- Satisfactory
Name of Creek, Stream, River Trout C		rout Creek			F - Fair	
Water Licence:						P - Poor
Owners Name	The Co	rporation	of the Distric	t of Summerlan	nd	U - Unsatisfactory
Address	13211 Henry Avenue				Ni - Not Inspected	
City Summe	ty Summerland Postal Code V0H 1Z0					_
Telephone	250-404-3000	Alternate	Phone			
Email		_				_
Pre-Inspection	on Interview v	vith Own	er <u>* See P</u>	ast Reports or oth	ner File Information	<u>L</u>
Owner or Repre	esentative preser	nt?	No			
How long have	you owned the c	lam?	1962			
Any Prior proble			Yes			
	ifications? (wher	e, when)	1999 -	Seepage Repai	irs	
	cidents/Breach?			lity - 1970		
Works Currently						
	nd plans availab		am Material K			ation? Yes
Was the dam de		_		_Company	1999 - UMA Er	
Are dam constru		_	ES	_Where?	1999 Design R	leport
	nsequence Clas					
Dam Sa	afety Regulation	Low	CDA G	uidelines:		
Dam Informa	tion					
	ition	Earth Em	bankment	May Haight of	Dom: 1202.4	5 m (6 71 m)
Type of Dam:	on:	1280.92 n		Max. Height of		.5 m (6.71 m)
Spillway Elevati			<u> </u>	Spillway Width		<u> </u>
Freeboard (@full supply level) Reservoir Storage Volume 1.53 m 2,611 ML (Live		/Livo)	Freeboard (at t Licenced Stora			
Neservon Stora	ge volume	2,011 WIL	(LIVE)	_Licericed Stora	ige volume	
Dam Environ	ment					
Drainage Area S	Size	36 km²		Reservoir Area	ı:	
Inflow Design F	lood: Q m³/s	3	13	Flood AEP (Re	eturn Period)	200 yr IDF (0.52 m FB)
Other Inflow Stu	ıdy: Q m³/s	s		Flood AEP (Re	eturn Period)	
Post Inspect	ion Evaluatio	n - Ela	phorate in the In	spection Report a	e required	
•	w development	·			as required	
-	elopment initiate				tion?	
OMS Manual C	•		MS Adequate		OMS being foll	owod?
			PP Adequate?		_	
DSR Required?			SR completed			
•			•		Deficiencies Ac	
	te access adequ		-			
Any other conce	enis in the water	sneu mat c	ould impact th	e udiii?		
Inonacted L.	,	Dad M- 1	D. 5 1	(A accessate d =	ilm a a sim av	
Inspected by	' :			(Associated Eng		
		Liorald Im	ada D Eng (Golder Associat	120	

			F	Requ	ired /	Actio	'n
			None	Monitor	Maintenance	Repair	Not Applicable
Emb	ankment	t Dam					
1. Ups	stream SI	lope					
	VEGETATION	•	п	Х	П	П	П
	Type						
	SLOPE PROTE	Recommendations:		х	П	П	П
	Type		ч	^	ч	ч	Ч
	5500001	Notes	_	_	_	_	
	EROSION	Type (wave/runoff/unknown) Length Width		х	Ц	Ц	Ц
		Notes Minor Wave	_	_	_	_	
	INSTABILITIES Slides	S s (Yes/No/Could not Inspect)	Ц	Х	Ш	Ш	Ц
	Olidet	Length Width Location					
	0 1	Notes/Causes None		_		_	
	Crack	ks (Transverse/Longitudinal/Other) QuantityLengthWidth Location		Х	Ц	Ц	Ц
	Dulas	Notes/Causes None			_	_	
	Buige	es/Depressions/Hummocky Size Height Depth	Ш	Х	Ц	Ц	Ц
		Location					
	OTHER	Notes/Causes None	_		П	П	
		ows, Ruts, Other Concerns Location		х	Ц	Ц	Ц
		Notes/Causes None	_				
2. Cre	est						
	ACCESS			Χ			
	Is the	ere public access to the crest? YES e crest marked or signed? NO hicle access to the crest restricted? NO					
	VEGETATION		_	-			
	Trees	s NO Location	ш	X	Ц	Ц	Ц
		Notes	_				
	Brush			Χ			
		LocationNotes	_				
	Groun	nd Cover BARE	П	Χ	П	П	П
		Quantity (bare/sparse/adequate/dense) Appearance (too tall/too short/good) Notes					
	EROSION	NONE	П	Χ	П	П	
		Type (wave/runoff/unknown) Length Width		_		_	
	SETTLEMENT	Notes None	П	Х	П	П	П
		Location		انت	ш	لب	ш
		Notes/Causes	_				

								Requ	ired Ad	ction	ı
44074.0	" ITIFO							None Monitor	Maintenance	Repair Not Applicable	
INSTABI		Transverse	a/Longitud	linal/Other	۲)	NONE			ЦΙ	┙┕	l
	Cracks (Width					
		Location									
OTHER		Notes/Ca	uses								
OTHER	Burrows	Ruts, Oth	er Concer	ns				X	пι	- -	1
	Danowo,	Location		110					ш		•
		Notes/Ca	uses								
3. Downstr	oam 9	Slone									
VEGETA		nope								- -	1
VEGETA	Trees		NO						ш	ᆚᆫ	ı
	11003	Location	140								
		Notes									
	<u>Brush</u>		SPARSE					X		╗┖	l
		Location									
	Ground (Notes	GRASS						П	- -	i
	Oloulla C	Notes	OINAGO	SPARSE	:				ш		ı
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	<u>Type</u>		NONE								ľ
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		Location	ATV-MO	TORCYCI	LE TRAFF MINOR	IC					
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	Slides	Length		Width		Location	1		ш,		•
		Notes/Ca									
	Cracks (Transverse				NONE		Х	ЦΙ	╛┖	ı
				Length		Width					
		Location Notes/Ca									
	Bulges/D	epression		cky	NONE			Х	ПΙ	٦Г	1
	Ū	Size		Height		Depth			'		ľ
		Location									
OTHER		Notes/Ca	uses								
OTHER	Burrows	Ruts, Oth	er Concer	ns	NONE			X		7 6	i
	Danowo,	Location	01 00110011		HOHE				ш.		
		Notes/Ca	uses								
SEEPAG	_							X		┚┖	
	Wet Area	a/Flow/Boil			ALONG I	D/S TOE					
		Flow Rate Location	3								
			/egetation		(Yes/No)	YES				
		Rust Cold	ored Depo		(Yes/No		NO				
		Sediment	in Flow		(Yes/No)	NO				
		Other Notes/Ca	IIISAS								
EMBAN	KMENT D			NONE F	OUND				П	Х	i
	Type								ш.		ĺ
	Flow rate			Size		Number					
	Location										
MONITO	Notes	TRUMEN	TATION C	חדוחאם	N				X	7 -	i
	2		_		Weir	Г	Flume	υЦ	^		
1	Nome (found)		√ Piezomete	as [L					
	Notes	VERIFICA	ATION RE	QUIRED	- THERE	WAS A S	TEEL PIPE.				

	Required Action
	None Monitor Maintenance Repair Not Applicable
Spillway	
GENERAL CONDITIONS	
Type Concrete Rectangular Weir Notes	
1. Spillway Crest or Control Section	
OBSTRUCTION	
<u>Debris</u> Yes	
Location Some logs and debris upstream of the spillway.	
Notes None in the spillway section	_
Vegetation None/Sparse/Dense	
Location Downstream - Within Riprap Notes If significant movement of the debris upstream, then spillway v	
Other (beaver activity, trash rack problems, etc.)	round be cashly plagged
Evidence of old log boom. Broken.	
SPILLWAY CREST MATERIALS	$X \square \square \square \square$
Condition Concrete	
Notes	_
OTHER SPILLWAY CREST PROBLEMS	
Damage If water were to crest, eddy erosion would occur around abutments	\sqcap \sqcap \sqcap \sqcap \sqcap
Location	
Notes/Cause Additional Riprap required	
2. Spillway Conveyance Section: Channel, Chute or Conduit	
OPEN CHANNEL CROSS SECTION	
CHANNEL OBSTRUCTION	
SPILLWAY CONVEYANCE MATERIALS	
OTHER SPILLWAY CONVEYANCE PROBLEMS	
<u>Damage</u>	$X \; \square \; \square \; \square \; \square$
Location	
Notes/Cause	
3. Energy-Dissipating or Terminal Section	
EROSION CONTROL STRUCTURE	\sqcap \sqcap \square \sqcap \sqcap
Type Rock Lined Channel	
Notes Larger bushes should be cleared downstream	

v Level Outlet	None Monitor Maintenance Repair
Level Ouliet	
GENERAL	\square \square \square \square \square
Type Gated Pipe Structure None	
ACCESS TO VALVE/GATE	
Not accessible rom shore Walkway By boat Other	
Notes Locked - Functional	
Walkway Condition <i>N/A</i>	
LOW LEVEL OUTLET COMPONENTS	
Valve Control Device	
Yes None No Stem pamaged stem pther	
Other/Notes	
Operational? Ves No Poorty Not tested	
Notes	
Valve / Gate	
Location Upstream Slanted	
Condition Under water	
Leakage L_ ^{yes} L __ No Flow Rate Negligible	
Outlet Pipe	
✓ Metal Plastic Concrete Other	
Diameter <i>600 mm</i> Condition <i>Good</i>	
Outlet Obstruction (note vegetation, sediment blockage, etc.)	
Notes None	
OUTLET EROSION CONTROL STRUCTURE Type Rock riprap - Concrete	
Concrete Condition Good	
Outlet Area Seepage	
Description Minor Flow Estimate	
Location	
Undermining	
Location None Notes/Cause:	
Downstream Channel Into larger swamp Free Draining? Yes	
Blockages or Potential Blockages?	
Erosion Control? Rip-Rap? Some - Adequate	

Current Weathe Name of Creek, Water Licence: Owners Name Address City Summe	Stream, River The Co 13211 Henry Averland	Previou Trout (e District		Apr-10	S- Satisf F - Fair P - Poor U - Unsa	Conditions actory htisfactory Inspected
Pre-Inspection	n Interview w	ith Owner	* See Pa	ast Reports or oth	er File Informatio	<u>n</u>	
Owner or Repre	sentative presen	t?	No				
How long have y	ou owned the da	am?	1966				
Any Prior proble	ms?		No				
Repairs or Modif	fications? (where	e, when)	No				
Past Failures/Ind	cidents/Breach?		No				
Works Currently	Fully Operation	al?	Yes				
Design report ar	nd plans available	No Dam M	laterial K	nown? Yes	Found	dation? Yes	
Was the dam de	signed by an En	gineer? Unkno	wn	Company			
Are dam constru	ction details kno	wn? No		Where?			
Downstream Co	nsequence Clas	sification - Curre	ent	_			
Dam Sa	fety Regulation	High	CDA G	uidelines:			
Dam Informa Type of Dam: Spillway Elevatio Freeboard (@ful Reservoir Storage	on: Il supply level)	Earth Embank		Max. Height of Spillway Width: Freeboard (at ti Licenced Stora	ime of visit)		
Dam Environ	ment						
Drainage Area S		36 km ²		Reservoir Area	:		
Inflow Design Fl	_		}	Flood AEP (Re		200 vr IDF	(0.52 m FB)
Other Inflow Stu			•	Flood AEP (Re		,	, ,
Carlot Itiliow Old	۵,			cou / Li (i/c	tanni onouj		
Post Inspecti	on Evaluatio	1 - Elaborate	e in the In	spection Report a	s required		
Evaluate any ne			zone do	wnstream	Head	waters 1 is d	lownstream
Should new dev	•				tion?	No	
OMS Manual Cu	•		dequate		OMS being fo	lowed?	Yes
EPP Manual Cu			dequate?		EPP being exe		
DSR Required?	No		ompleted		Deficiencies A	_	No
Site Access - sit			•			_	Yes
Any other conce	·						No
,							

								Requ	ired A	Actio	n
								None Monitor	Maintenance	Repair	Not Applicable
Emb	ankme	nt D	am								
1. Up	stream	Slop	е								
•	VEGETATIO	-					ſ	х	П	П	П
	Ty		Some G		Location	Near water edge					
	SLOPE PRO			nendations:					П	П	П
	SLOPE PRO		ON	None/Sparse/Dens	e		L	Х	Ц	Ц	Ч
			Notes					<u> </u>			
	EROSION		Туре	(wave/runoff/unknow Length	n) Width			х			
			Notes	Minor Wave							
	INSTABILIT		,, ·-					Х			
	Sli		s/No/Co Length	uld not Inspect) Width		Location					
			Notes/C			Location					
	Cr	acks (T	ransvers	e/Longitudinal/Other)			Х			
			Quantity			Width			_	_	
			Location Notes/C								
	Bu			ns/Hummocky				Х	П	П	П
			Size	Height		Depth					
			Location Notes/C								
	OTHER		INOIGS/O	auses Itolie				х	П	П	П
	Bu			ner Concerns					_	سا	
			Location Notes/C								
			NOIES/C	auses <u>None</u>							
2. Cr	est										
	ACCESS						[Х			
				ess to the crest? d or signed?	YES NO						
	ls '	vehicle		o the crest restricted							
	VEGETATIC Tre	ees		NO			r	Х	П	П	П
	<u></u>		Location				<u> </u>	تا لـ	ш	ш	ш
			Notes						_		
	Bri	<u>ush</u>		NONE			L	Х	Ц	Ц	Ц
			Location Notes								
	<u>Gr</u>	ound Co		BARE				Х	П		
				(bare/sparse/adequa)					
			Appeara Notes	nce (too tall/too shor	t/good)						
	EROSION		NONE					Х	П	П	
				(wave/runoff/unknow	n)						
			Notes	Length	Width						
	SETTLEME		Notes	NONE				Х	П	П	П
			Location					ت ب	ш	_	
			Notes/C	auses							

					R	equired Action
					Φ	Monitor Maintenance Repair Not Applicable
					None	Monitor Mainten Repair Not App
INSTAB		se/Longitudinal/Other	·) N	IONE		<u>Ш</u> Ц Ц L
		yLength		Vidth		
	Locatio	n				
OTHER	Notes/0	Causes				
OTHER	Burrows, Ruts, O	ther Concerns				
	Locatio					
	Notes/0	Causes				
Downstr	eam Slope					
VEGET/	-					
VLOLIA	Trees	NO				
	Locatio	n				
	Notes					
	<u>Brush</u>	SPARSE				
	Locatio Notes	n				
	Ground Cover	BARE				\square \square \square \square
	Notes					
SLOPE	PROTECTION					\times \square \square
	<u>Type</u>	NONE				
EROSIO	Notes					ЯППГ
LNOSIO		n NONE				шццц
	Notes					
INSTAB		NONE				\times
	Slides Length		L	ocation		
		Causes rse/Longitudinal/Other)	·) N	IONE		\square \square \square
		yLength		Vidth		
	Locatio	n				
		Causes				
	Bulges/Depression	ons/Hummocky Height	NONE	epth		
	Locatio					
		Causes				
OTHER						
	Burrows, Ruts, O		NONE			
	Locatio Notes/0	Causes				
SEEPAC						$X \sqcap \Gamma$
	Wet Area/Flow/B		NONE			
	Flow R					
	Locatio Aquatio	n Vegetation	(Yes/No)			
		olored Deposits	(Yes/No)			
		ent in Flow	(Yes/No)			
	Other					
FMR AN	Notes/C KMENT DRAINS	Causes NONE FO	OLIND			
LIIDAN	Type	NONET	OOND			
	Flow rate	Size	N	lumber		
	Location					
MONTO	Notes	NTATION CONDITION	A.			
_		NTATION CONDITION	Weir	Thum:		
V	None found	Piezometers	_lvveii	flume		
	Notes					

	Re	equi	ired A	Actio	n
	None	Monitor	Maintenance	Repair	Not Applicable
Spillway					
GENERAL CONDITIONS	_		_	_	
Type Earthen Emergency Spillway - Concrete Brig	ЦΙ	Х		Ш	Ц
Notes North of the dam - Cut through woods	-				
1. Spillway Crest or Control Section					
OBSTRUCTION		Χ	П		
<u>Debris</u> Yes					
Location Large log used to protect the wooden bridge.	- _	<u> </u>	· =	<u>Q.</u>	=
Notes None in the spillway section	Non	Mor	Maii	Rep	Not
<u>Vegetation</u> Sparse Location <i>Well maintained. No riprap</i>					
Notes	-				
Other (beaver activity, trash rack problems, etc.)					
Log boom intact at mouth.		_		_	
SPILLWAY CREST MATERIALS	Ш	Х	П	Ш	Ш
Condition Earthen - 3:1 sideslopes	-				
Notes	-				
OTHER SPILLWAY CREST PROBLEMS					
<u>Damage</u> None	П	П	П	П	X
Location			_		
Notes/Cause					
2. Spillway Conveyance Section: Channel, Chute or Conduit					
OPEN CHANNEL CROSS SECTION OK		X			
CHANNEL OBSTRUCTION None		Χ			
SPILLWAY CONVEYANCE MATERIALS		X			
OTHER SPILLWAY CONVEYANCE PROBLEMS					
<u>Damage</u>	Х				
Location					
Notes/Cause	-				
3. Energy-Dissipating or Terminal Section					
EROSION CONTROL STRUCTURE	П	Х	П	П	П
Type Earthen channel through woods	ш		ш	ш	Ш
Notes	-				

			Red	quired	Actio	n
Low Lovel Outlet			None	Maintenance	Repair	Not Applicable
Low Level Outlet			XI F	1 [п	П
	pe Structure	None			ш	Ш
ACCESS TO VALVE/GATE			X	ם כ		
Not accessible	from shore Walkv	way By boat Other		_		
Notes Locked -	Functional					
Walkway Condition	N/A					
LOW LEVEL OUTLET COM Valve Control Devi						
✓ Yes None	No Stem Da	amaged stem				
Other/No	tes			a 🗆	_	П
Operational? ✓/es No Notes		lot tested It could not close tight.		9 🗀	, ப	Ц
Valve / Gate				X 🗆		
Location Condition		m Slanted vater	_			
Leakage	No e Negligib	ole		₃ □		
Outlet Pipe			пι	X	П	П
<u>ver_r</u>	stic Concrete C	Other		. E	ш	
Diameter						
Condition Outlet Obstruction		near outlet. Capacity reduced by ~5%. getation, sediment blockage, etc.)	_			
Notes		moss around the outlet mouth				
OUTLET EROSION CONTR Type <u>Concret</u> e						
Concrete Condition	on Good					
Outlet Area Seepa	ne			- — a □	П	П
Description	None			ب د	ш	Н
Flow Estimate Location			_			
Undermining				а п	П	П
Location	None		<u></u>	יין ני	ш	ш
Notes/Cause:					_	
Downstream Char Free Draining?	nnel	Into channel, and swamp downstream Yes				
Blockages or Poter	=	No				
Erosion Control? R	ip-Rap?	Some - Adequate	_			

name of Dam	Headwaters	No. 3	_Inspection Dat	te30-	Apr-10	Observed Conditions
Current Weath	er: Cloud	y-Some sun	Previous Wee	k:		S- Satisfactory
Name of Creek	k, Stream, Rive		Trout Creek			F - Fair
Water Licence:	:					P - Poor
Owners Name	The	Corporation	on of the Distri	ct of Summerlar	ıd	U - Unsatisfactory
Address	13211 Henry	Avenue				Ni - Not Inspected
City Summ	erland	Postal	Code	V0H 1Z0		
Telephone	250-404-300) Alterna	te Phone			
Email						
Pre-Inspecti			vner <u>* See</u>	Past Reports or oth	ner File Information	<u>n</u>
Owner or Repr	esentative pres	ent?	No			
How long have	you owned the	dam?	1930'	s		
Any Prior probl	ems?		No			
Repairs or Mod	difications? (wh	ere, when)) <u>No</u>			
Past Failures/In	ncidents/Breac	า?	No			
Works Current	ly Fully Operati	onal?	Yes			
Design report a	and plans avail	able Yes	_Dam Material	Known? Yes	Found	lation? Yes
Was the dam of	designed by an	Engineer?	Unknown	Company		
Are dam consti	ruction details l	nown?	Unknown	Where?		
Downstream C	onsequence C	assificatio	n - Current			
Dam S	Safety Regulation	n High	CDA (Guidelines:		
Dam Informa	ation					
Dam Information	ation	Earth I	Embankment	Max. Height of	Dam: :88.85	(6.25
			Embankment 92.35			(6.25 - Trapezoid
Type of Dam:	tion:	129		Max. Height of	2.5 m	·
Type of Dam: Spillway Elevat	tion: ull supply level	129	92.35	Max. Height of Spillway Width	: 2.5 m	- Trapezoid
Type of Dam: Spillway Elevat Freeboard (@f	tion: ull supply level	129	92.35 3.17 m	Max. Height of Spillway Width Freeboard (at t	: 2.5 m	- Trapezoid 1.57 m
Type of Dam: Spillway Elevat Freeboard (@f	tion: ull supply level age Volume	129	92.35 3.17 m	Max. Height of Spillway Width Freeboard (at t	: 2.5 m	- Trapezoid 1.57 m
Type of Dam: Spillway Elevat Freeboard (@f Reservoir Stora	tion: ull supply level age Volume nment	129	92.35 3.17 m 618 ML	Max. Height of Spillway Width Freeboard (at t	: 2.5 m ime of visit) age Volume	- Trapezoid 1.57 m
Type of Dam: Spillway Elevat Freeboard (@f Reservoir Stora Dam Enviro	tion: ull supply level age Volume nment Size	129 36 km² (92.35 3.17 m	Max. Height of Spillway Width Freeboard (at the Licenced Stora	: 2.5 m ime of visit) age Volume	- Trapezoid 1.57 m 618 ML
Type of Dam: Spillway Elevat Freeboard (@f Reservoir Stora Dam Enviro Drainage Area	tion: ull supply level age Volume nment Size Flood: Q m	129 36 km² (92.35 3.17 m 618 ML	Max. Height of Spillway Width Freeboard (at t Licenced Stora Reservoir Area Flood AEP (Re	: 2.5 m ime of visit) age Volume :: sturn Period)	- Trapezoid 1.57 m 618 ML 23 ha
Type of Dam: Spillway Elevat Freeboard (@f Reservoir Stora Dam Enviro Drainage Area Inflow Design F	tion: ull supply level age Volume nment Size Flood: Q m	129 36 km² (92.35 3.17 m 618 ML	Max. Height of Spillway Width Freeboard (at t Licenced Stora	: 2.5 m ime of visit) age Volume :: sturn Period)	- Trapezoid 1.57 m 618 ML 23 ha
Type of Dam: Spillway Elevat Freeboard (@f Reservoir Stora Dam Enviro Drainage Area Inflow Design F	tion: ull supply level age Volume nment Size Flood: Q m tudy: Q m	36 km²(92.35 3.17 m 618 ML (all headwaters) 12.5	Max. Height of Spillway Width Freeboard (at t Licenced Stora Reservoir Area Flood AEP (Re	: 2.5 m ime of visit) age Volume a: eturn Period) eturn Period)	- Trapezoid 1.57 m 618 ML 23 ha
Type of Dam: Spillway Elevat Freeboard (@f Reservoir Stora Dam Enviro Drainage Area Inflow Design F Other Inflow St Post Inspec	tion: ull supply level age Volume nment Size Flood: Q m tudy: Q m	36 km² (92.35 3.17 m 618 ML (all headwaters) 12.5	Max. Height of Spillway Width Freeboard (at the Licenced Storal Reservoir Area Flood AEP (Referenced Storal)	: 2.5 m ime of visit) age Volume a: atturn Period) as required	- Trapezoid 1.57 m 618 ML 23 ha
Type of Dam: Spillway Elevat Freeboard (@f Reservoir Stora Dam Enviro Drainage Area Inflow Design F Other Inflow St Post Inspec Evaluate any n	tion: ull supply level age Volume nment Size Flood: Q m tudy: Q m tion Evaluat ew developme	36 km² (36 km² (3/s ion - nt in the integral of the integral	3.17 m 618 ML (all headwaters) 12.5 Elaborate in the undation zone of	Max. Height of Spillway Width Freeboard (at the Licenced Storal Reservoir Area Flood AEP (Referenced AEP) Flood AEP (Referenced AEP)	z. 2.5 m ime of visit) age Volume at: atturn Period) atturn Period) as required Heads	- Trapezoid
Type of Dam: Spillway Elevat Freeboard (@f Reservoir Stora Dam Enviro Drainage Area Inflow Design F Other Inflow St Post Inspec Evaluate any n	tion: ull supply level age Volume nment Size Flood: Q m tudy: Q m tion Evaluat lew developme	36 km² (36 km² (3/s ion - nt in the integral of the integral	3.17 m 618 ML (all headwaters) 12.5 Elaborate in the undation zone of working the Consection of the C	Max. Height of Spillway Width Freeboard (at to Licenced Stora Reservoir Area Flood AEP (Reference AEP) Flood AEP (Reference AEP) Inspection Report and AEP (Reference Classifica	z. 2.5 m ime of visit) age Volume at: aturn Period) aturn Period) as required Heady tion?	- Trapezoid 1.57 m 618 ML 23 ha 200 yr IDF waters 1 is downstream No
Type of Dam: Spillway Elevat Freeboard (@f Reservoir Stora Dam Enviro Drainage Area Inflow Design F Other Inflow St Post Inspec Evaluate any n Should new de	tion: ull supply level age Volume nment Size Flood: Q m tudy: Q m tion Evaluat ew developme evelopment initi	36 km² (36 km² (3/s ion - nt in the integral of the integral	3.17 m 618 ML (all headwaters) 12.5 Elaborate in the undation zone of the Consequence of	Max. Height of Spillway Width Freeboard (at to Licenced Stora Reservoir Area Flood AEP (Reference Flood AEP) Inspection Report a downstream quence Classifica re? Yes	z. 2.5 m ime of visit) age Volume at: aturn Period) aturn Period) as required Heady tion? OMS being fol	- Trapezoid 1.57 m 618 ML 23 ha 200 yr IDF waters 1 is downstream No lowed? Yes
Type of Dam: Spillway Elevat Freeboard (@f Reservoir Stora Dam Enviro Drainage Area Inflow Design F Other Inflow St Post Inspec Evaluate any n Should new de OMS Manual C EPP Manual C	tion: ull supply level age Volume nment Size Flood: Q m tudy: Q m tion Evaluat lew developme evelopment initi. Current? NO urrent? Yes	36 km² (36 km² (3/s ion - nt in the integral of the integral	3.17 m 618 ML (all headwaters) 12.5 Elaborate in the undation zone of the Consequence o	Max. Height of Spillway Width Freeboard (at 1 Licenced Stora Reservoir Area Flood AEP (Re Flood AEP (Re Inspection Report a downstream quence Classificate? Yes	z. 2.5 m ime of visit) age Volume at: aturn Period) aturn Period) as required Heady tion?	- Trapezoid 1.57 m 618 ML 23 ha 200 yr IDF waters 1 is downstream No lowed? Yes ercised? Yes
Type of Dam: Spillway Elevat Freeboard (@f Reservoir Stora Dam Enviro Drainage Area Inflow Design F Other Inflow St Post Inspec Evaluate any n Should new de OMS Manual C EPP Manual C DSR Required	tion: ull supply level age Volume nment Size Flood: Q m tudy: Q m tion Evaluat ew developme evelopment initi. Current? NO urrent? Yes ?	36 km² (3/s 3/s ion - nt in the integrate a review	3.17 m 618 ML (all headwaters) 12.5 Elaborate in the undation zone of the Consequence o	Max. Height of Spillway Width Freeboard (at 1 Licenced Stora Reservoir Area Flood AEP (Re Flood AEP (Re Inspection Report a downstream quence Classificate? Yes ed date? 06/10	z. 2.5 m ime of visit) age Volume turn Period) as required Heady tion? OMS being fol EPP being exe	- Trapezoid 1.57 m 618 ML 23 ha 200 yr IDF waters 1 is downstream No lowed? ercised? ddressed? Yes ddressed? Yes
Type of Dam: Spillway Elevat Freeboard (@f Reservoir Stora Dam Enviro Drainage Area Inflow Design F Other Inflow St Post Inspec Evaluate any n Should new de OMS Manual C EPP Manual C DSR Required' Site Access - s	tion: ull supply level age Volume nment Size Flood: Q m tudy: Q m tion Evaluat ew developme evelopment initi. Current? NO urrent? Yes ? Yes ite access ade	36 km² (36 km² (37 sion - nt in the initiate a revieu	3.17 m 618 ML (all headwaters) 12.5 Elaborate in the undation zone of the Consequence o	Max. Height of Spillway Width Freeboard (at 1 Licenced Stora Reservoir Area Flood AEP (Re Flood AEP (Re Inspection Report a downstream quence Classificate Reservoir Area Glownstream quence Classificate Reservoir Area Reservoir Area Flood AEP (Re Reservoir Area Re	z. 2.5 m ime of visit) age Volume turn Period) as required Heady tion? OMS being fol EPP being exe	- Trapezoid 1.57 m 618 ML 23 ha 200 yr IDF waters 1 is downstream No lowed? Yes ercised? Yes

			Re	∍qui	red A	ctio	n
			None	Monitor	Maintenance	Repair	Not Applicable
Emb	ankmen	t Dam					
1 Un	stream S	lone					
Ор	VEGETATION	•	П	Х	П	П	П
	Type	Some Grass Location Above high water line		ш	ш	ш	Ч
	C/ ODE DDOT	Recommendations:	_		П	Н	Н
	SLOPE PROT		Ц.	Х	Ц	Ц	Ц
	<u>.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,</u>	Notes			_	_	
	EROSION	Type (wave/runoff/unknown) Length Width		Х			
	INSTABILITIES	Notes Minor Wave	П.	v	П	П	П
		s (Yes/No/Could not Inspect)	ш !	Х	Ц	ш	Ц
		LengthWidthLocation					
	0	Notes/Causes None	_		_	Н	Н
	Crac	ks (Transverse/Longitudinal/Other) QuantityLengthWidth Location		Х	Ц	Ц	Ц
	Dules	Notes/Causes None	_		_		
	Bulge	es/Depressions/Hummocky Size Height Depth	Ш	Х	Ц	Ш	Ц
		Location					
		Notes/Causes None	_	_	_	_	
	OTHER Burro	ows, Ruts, Other Concerns Location	Ш,	Х	Ц	Ц	Ц
		Notes/Causes None					
2. Cre	set						
2. 0.0	ACCESS		П	X	П	П	П
	Is the	ere public access to the crest? YES e crest marked or signed? NO hicle access to the crest restricted? NO			ш	ш	ш
	VEGETATION						
	Trees	<u>s</u> NO		Χ			
		Location Notes					
	Brusl		П	Х	П	П	П
		Location	_	_	ш,	ч	_
	0	Notes	_	V	_	_	
	Grou	nd Cover BARE Quantity (bare/sparse/adequate/dense)		Λ	Ц	Ц	Ц
		Appearance (too tall/too short/good) Notes					
	EROSION	NONE	П	Х	П	П	
		Type (wave/runoff/unknown)	_		_		
		LengthWidthNotes					
	SETTLEMENT		П	X	П	П	П
		Location	_	_	_	_	
		Notes/Causes					

							Requi	ired Action	on
							None X Monitor	Maintenance Repair	Not Applicable
INSTABI							X		
			e/Longitudii			NONE			
		Location		Length		Width			
		Notes/Ca							
OTHER			-						
		Location	er Concern	ıs			X		
		Notes/Ca	uses						
. Downstr	eam S	lope							
VEGETA		•					Х	ПП	ΙП
	Trees		NO						
		Location							
		Notes							. —
	<u>Brush</u>		SPARSE				Х	ЦЦ	ΙЦ
		Location Notes							
	Ground C		GRASS					пп	ιп
		Notes	CINAGO					шц	ιш
SLOPE E	PROTECTI						X	пп	ιп
020.2.	Type		GRASS						. ш
		Notes							
EROSIO	N						X		
		Location	NONE						
		Notes					_ =		. —
INSTABI			NONE				Х	ЦЦ	ΙЦ
		Length Notes/Ca		Width		Location			
			uses e/Longitudii	nal/Other	١	NONE	Х	пп	ιп
			/ Longitudii		,	Width		чч	ιц
		Location		_og					
		Notes/Ca							
	Bulges/De	epression	s/Hummoc		NONE		X		
		Size		Height		Depth			
		Location							
OTHER		Notes/Ca	uses						
OTHER	Rurrowe	Pute ∩th	er Concern		NONE		Х	пп	П
		Location	ei Concein	13	NONL			чч	ΙЦ
		Notes/Ca	uses						
SEEPAG	ЭΕ.		-				X	пп	ΙП
	Wet Area	/Flow/Boil	/Sinkhole		NONE				_
		Flow Rate	e						
		Location	/tt:		/ \/ /NI - \				
			egetation ored Depos	site	(Yes/No) (Yes/No)				
		Sediment		onto	(Yes/No)				
		Other			(
		Notes/Ca	uses						
EMBAN	KMENT DR	RAINS		NONE F	DUND		ШШ		X
	Туре			٥.					
	Flow rate			Size		Number			
	Location Notes								
MONITO		RUMEN	TATION CO	ONDITIO	V		ПП		Х
_	Nione (found)	1	Piezometer	-	Weir	Flume		шШ	ت ،
L.	Turante: cantant	ı	rezurreter	, L	_				
	Notes								

		Required Actio				
		None	Monitor	Maintenance	Repair	Not Applicable
Spillway						
GENERAL CONDI	TIONS		_	_	_	
	Emergency Spillway - Concrete Sill	Ш	Х	П	Ц	Ц
Notes West end	d of dam	-				
OBSTRUCTION	or Control Section			Х		
<u>Debris</u>	Some					
	Location Logs in the lake and just downstream of concrete. Notes Some noted in the channel	-				
Vegetatio		-				
<u>r ogotatio</u>	Location Well maintained. No riprap					
	Notes					
<u>Other</u>	(beaver activity, trash rack problems, etc.)					
	m intact at mouth.	_			_	_
SPILLWAY CREST		Ш	X	П	Ц	Ц
	Condition Concrete - Rectangular Notes Maintains water level and crosses road.	-				
	ividinianis water level and crosses road.	-				
OTHER SPILLWA	Y CREST PROBLEMS					
<u>Damage</u>	None	X		П		
	Location					
	Notes/Cause	_				
2. Spillway Conv	eyance Section: Channel, Chute or Conduit					
OPEN CHANNEL	CROSS SECTION			Х		
CHANNEL OBSTR	DUCTION			Х		
SPILLWAY CONV	EYANCE MATERIALS		Х			
OTHER SPILLWA	Y CONVEYANCE PROBLEMS				_	
<u>Damage</u>	Channel is rectangular and cut through the woods. Prone to tree fall.			Χ		
	Location Downstream Channel	_				
	Notes/Cause Constant flows from the lake	_				
3. Energy-Dissipa	ating or Terminal Section					
EROSION CONTR	•	П	х	П	П	П
Туре	Pond at the end.		ائت		_	
Notes						

			Req	uired A	Action	n
Low Lovel Outlet			None Monitor	Maintenance	Repair	Not Applicable
Low Level Outlet			XI F	П	П	п
Type Gated Pipe S	Structure	None		' Ш	ш	Н
ACCESS TO VALVE/GATE			X	П	П	П
Not accessible ror	n shore Walkw	vay By boat Other				
Notes Locked - Full	nctional - Stem	slightly bent - Wheel cracked and welded				
Walkway Condition N/A	ı					
LOW LEVEL OUTLET COMPON						
Valve Control Device	ENIS	_	П			
✓Yes None No	Stem Da	amaged stem Dther				
Operational?					П	П
Operational?	Poorly	lot tested		ιЦ	ш	Ц
Notes			_			
Valve / Gate						
Location Condition	Upstrea Under w	m Slanted vater				
Leakage 🔽 res	No		Пх	П	П	П
Flow Rate	Minor			. —	_	_
Outlet Pipe				X		
Metal Plastic	Concrete V	Other Concrete arch Pipeline				
Diameter 450						
Condition Go Outlet Obstruction		getation, sediment blockage, etc.)	_			
Notes Ye	- Rocks and o	debris have plugged the structure. Significant i	ron dep	osits		
OUTLET EROSION CONTROL S	TRUCTURE		□ X			
Type <u>Concrete</u>						
Concrete Condition	Good		∐ Ľ	ΙЦ	Ц	Ц
Outlet Area Seepage				X		
Description So. Flow Estimate	me - Evidence	of riprap failure				
Location						
Undermining			口口	Х		
Location So. Notes/Cause: Out		I level are flat sloped. Evidence of earth movemen	t			
Downstream Channel		Into channel, and swamp downstream	ПГ	X	П	П
Free Draining?		Yes			Ш	_
Blockages or Potential Erosion Control? Rip-R	•	Some fallen trees Some - Could use some adjustments				
Ziodon control: Np N						

	aters No. 4	Inspection Date		Apr-10	Observed	
Current Weather:	Cloudy-Some Sun	_Previous Week	c:		_ S- Satisf	actory
Name of Creek, Stream,	River	Trout Creek			_ F - Fair	
Water Licence:					_ P - Poor	
Owners Name	•	on of the Distric	t of Summerlar	nd	_	tisfactory
	lenry Avenue				Ni - Not	nspected
City Summerland	Postal		V0H 1Z0		_	
Telephone 250-404	I-3000 Alterna	ite Phone			_	
Email					_	
Pre-Inspection Inter	view with O	wner * See E	Paet Paparte or oth	ner File Information		
Owner or Representative		No No	ast iteports or ou	lei i lie illioilliation		
How long have you own	•	1930's	•			
• •	ed tile daili:	No				
Any Prior problems? Repairs or Modifications	2 (whore when					
Past Failures/Incidents/E		No No				
		Yes				
Works Currently Fully Op Design report and plans		Dam Material k	Known? Yes	Found	ation? Yes	
Was the dam designed b		_	Company	1 Outluc	1011: 163	
Are dam construction de	, ,	Unknown	_Company Where?			
			_ vviiele:			
Downstream Consequer Dam Safety Reg			Guidelines:			
Daili Salety Reg	Julation High	CDA (dudelines.			
Dam Information						
Type of Dam:	Earth	Embankment	Max. Height of	Dam: 1295	.28	8.96 m
Spillway Elevation:	129	92.05	Spillway Width	: 2 m		
Freeboard (@full supply	level)	3.23 m	Freeboard (at	time of visit)	3 m	
Reservoir Storage Volun		L (409 ac-ft)	_ Licenced Stora	,	5240 ML	. (AII)
ŭ		· · · ·	_			<u> </u>
Dam Environment						
Drainage Area Size	25 km ² ((all headwaters)	Reservoir Area	a:	45 acres	5
Inflow Design Flood:	Q m ³ /s	13	Flood AEP (Re	eturn Period)		(0.52 m FB)
Other Inflow Study:	Q m ³ /s		Flood AEP (Re	eturn Period)		,
				,		
Post Inspection Eva	luation -	Elaborate in the II	nspection Report a	as required		
Evaluate any new develo					aters 1 is d	ownstream
Should new developmen	-				No	
	NO	OMS Adequate		OMS being folk		Yes
EPP Manual Current?		_ EPP Adequate		EPP being exe	_	
DSR Required?	No	DSR complete		Deficiencies Ac	_	No
Site Access - site access						Yes
Any other concerns in the	-	-				No
,, OLLIOI OOLIOOILIO III III						

						Requi	red Ac	ion
					None	Monitor	Maintenance	Not Applicable
Emb	oankmen	t Dam						
1. Up	stream S	lope						
•	VEGETATION	•				Х	\Box	
	Type		Locatinendations:	on				
	SLOPE PROT		nendations			х	ΠГ	1 П
	Type	_	None/Sparse/Dense	NONE		'		
	EROSION	Notes						
	EROSION	Туре	(wave/runoff/unknown) Length Width			х	шь	
		Notes	Minor Wave			. —		
	INSTABILITIE Slide		ould not Inspect)			Х	ЦL	ΙЦ
	Silde	Length	Width	Location				
		Notes/C						
	Crac	cks (Transvers) Quantity Location		Width		х	ЦЦ	1 4
		Notes/C	auses None			_		
	Bulg	es/Depression Size	ns/Hummocky Height	Donth		Х	ЦΙ	Ј Ц
		Location		Depth				
		Notes/C	auses None			. —		
	OTHER Burr	ows, Ruts, Otl Location				х	ЦL	ם נ
		Notes/C						
2. Cr	est							
	ACCESS					Х	ΠГ	1 П
	Is the	e crest marke	ress to the crest? YES d or signed? NO to the crest restricted? NO			. —		
	VEGETATION		to the crest restricted? NO					
	Tree		NO			X		
		Location Notes	1					
	Brus		NONE			Х	ПΕ	1 🗆
		Location	n					
	Grou	Notes and Cover	BARE			X	пг	1 [
	<u>5.0.</u>	Quantity Appeara	v (bare/sparse/adequate/den ance (too tall/too short/good)	se)				
	EROSION	Notes NONE				Х	пг	
	2,100,011	Туре	(wave/runoff/unknown) Length Width					. L
	CETTI EMENT	Notes	NONE			▽		7 🖂
	SETTLEMENT	Location	NONE			X	шL	لالد
		Notes/C						

								Requi	red Acti	ion
								None X Monitor	Maintenance Repair	Not Applicable
INSTABI								X		
	Cracks (T		e/Longitud			NONE				
		Location		Length		Width				
		Notes/Ca								
OTHER										
	Burrows,	Ruts, Oth Location	er Concer	กร				X	ЦЬ	JЦ
		Notes/Ca	uses							
B. Downstro	eam S	lope								
VEGETA								Х	ΠГ	1 🗖
720277	Trees		NO						ш	
		Location								
		Notes								
	<u>Brush</u>	Location	SPARSE					Х	ЦЦ	IЦ
		Notes								
	Ground C		BARE					Х	ПГ	П
		Notes								
SLOPE F	PROTECT	ION						Х	\Box \Box	
	<u>Type</u>	Notes	NONE							
EROSIOI	v	Notes						Х	пг	ιп
	-	Location	NONE						ш	. ш
		Notes								
INSTABI			NONE					Х	\Box \Box	
	Slides	Length Notes/Ca		Width		Location	า	-		
	Cracks (T		uses e/Longitud	inal/Other	۲)	NONE		Х	пг	ιп
	0.00.00 (.	Quantity	, 201.g.t.a.a	Length	,	Width				
		Location								
	D	Notes/Ca			NONE					. —
	Bulges/D	epression Size	s/Hummod	ску Height	NONE	Depth		X	шц	ΙЦ
		Location		rieigni		Debin				
		Notes/Ca	uses							
OTHER										. —
	Burrows,		er Concer	ns	NONE			X	ЦЬ	JЦ
		Location Notes/Ca	uses							
SEEPAG	E							X	ПГ	ΙП
	Wet Area		/Sinkhole		VERY M	INOR				
		Flow Rate		ADOLINI	OUTLET	OTDLIO	TUDE			
		Location	egetation		OUTLET Yes/No (NO			
			ored Depo		(Yes/No		YES			
		Sediment	in Flow		(Yes/No)	NO			
		Other Notes/Ca								
FMRANK	KMENT DE		uses	NONE F	OLIND				пг	X
2.11.27.111	Type			NOIL I	00115			шш	шц	
	Flow rate			Size		Number	•			
	Location									
MONITO	Notes	TDIIMEN	TATION C	ONDITIO	A.I					
_			_		Weir	г	Flume		ЦЬ	^
V	Nome (found)	l	Piezomete	15		L				
	Notes									

		Req	uired	Actio	n
		Monitor	Maintenance	Repair	Not Applicable
Spillway					
GENERAL CONDITIONS				_	
	llway - with Concrete Rectangular Inlet	<u> </u>			Ц
Notes Sound-West end of dam					
1. Spillway Crest or Contro	ol Section		_	_	
OBSTRUCTION		<u> </u>			Ш
<u>Debris</u> Some					
	in the lake and just downstream of concrete.		· <u>=</u>	g.	=
Notes		Mo	Mai	Rep	Not
Vegetation Spars	e maintained. No riprap				
Notes	папкатеч. Но пртар				
	sh rack problems, etc.)				
Log boom intact at mou					
SPILLWAY CREST MATERIALS		X			
Condition Conc	rete - Rectangular				
Notes Mainta	ains water level and crosses road.				
OTHER SPILLWAY CREST PROB	LEMO				
<u>Damage</u> None		a r	1	П	П
Location		ם נ	. L	. Ш	ш
Notes/Cause					
2. Spillway Conveyance Se	ection: Channel, Chute or Conduit				
OPEN CHANNEL CROSS SECTIO	N [] [x			
CHANNEL OBSTRUCTION		X			
SPILLWAY CONVEYANCE MATE	RIALS] [x			
OTHER SPILLWAY CONVEYANCE	E PROBLEMS				
<u>Damage</u> Channel is cut t	hrough the woods	X			
Location					
Notes/Cause	Constant flows from the lake				
3. Energy-Dissipating or To	erminal Section				
EROSION CONTROL STRUCTUR		7 F	1 🗆		П
Type Pond at the en		J L^		Ш	Ш
Notes					

		Requ	uired A	ction
our Lovel Outlet		None Monitor	Maintenance	Repair Not Applicable
ow Level Outlet GENERAL		X		пп
Type Gated Pipe Structure	None		.	
ACCESS TO VALVE/GATE		Х	П	пп
Not accessible from shore Walk	way By boat Other			
Notes Locked - Functional				
Walkway Condition <i>N/A</i>				
LOW LEVEL OUTLET COMPONENTS				
Valve Control Device Ves None No Stem	namaged stempther			
Other/Notes				
Operational? ✓ Yes No Poorly Notes Some Leakage	Not tested	υ⊔	X	ЦЦ
Valve / Gate			I 🗆 I	
Location Upstreat Condition Under to	am Slanted water			
Leakage ☑yes ☐No Flow Rate Negligi l	blo			
	oie -	-		
Outlet Pipe	h	X	· LJ I	⊔Ц
Metal Plastic √concrete Diameter 450 mm	Other	_		
Condition Good condition		_		
Outlet Obstruction (note ve Notes Minor	egetation, sediment blockage, etc.)			
OUTLET EROSION CONTROL STRUCTURE				
Type <u>Concrete</u>		- 		
Concrete Condition Good		LI X	 	ЦЦ
Outlet Area Seepage		X		
Description Some growth Flow Estimate Location				
Undermining				
Location Negligible		_ ഥ	.	— ш
Notes/Cause: Outlet and channel	el level are flat sloped. Evidence of earth movemen			
Downstream Channel	Into channel, and swamp downstream	X		\Box
Free Draining? Blockages or Potential Blockages?	Yes Monitor			
Erosion Control? Rip-Rap?	Good			

Name of Creek, Stream, River Water Licence: Water L	Name of Dam C	Crescent Lake	Inspect	ion Date	30-	Apr-10	Observed	Conditions
Water Licence: Owners Name Owners Name Owners Name Address 13211 Henry Avenue City Summerland Postal Code Alternate Phone Email Pre-Inspection Interview with Owner Owner or Representative present? How long have you owned the dam? Any Prior problems? Repairs or Modifications? (where, when) Past Failures/Incidents/Breach? Works Currently Fully Operational? Design report and plans available? Was the dam designed by an Engineer? Are dam construction details known? Downstream Consequence Classification - Current Dam Safety Regulation Zoned Earthfill Max. Height of Dam: Spillway Elevation: 1335.32 m Spillway Width: 8.51 m Freeboard (@full supply level) Reservoir Storage Volume Total Que Material Reservoir Area: 159 ha Inflow Design Flood: Other Inflow Study: Q m³/s Post Inspection Evaluation - Elaborate in the Inspection Report as required Evaluate any new development in this inte a review of the Consequence Classification? No No Reservoir No Hownown Preeboard (at time of visit) 1.2 m Reservoir Storage Volume Post Inspection Evaluation - Elaborate in the Inspection Report as required Evaluate any new development in the inundation zone downstream Should new development initiate a review of the Consequence Classification? OMS Adequate? Yes OMS Adequate? Yes OBS Required? No Deficiencies Addressed? Yes OBS Required? No Deficiencies Addressed? No Site Access - site access adequate for safe operation and maintenance? Very Eou Deficiencies Addressed? No Ostice Access - site access adequate for safe operation and maintenance? Very Eou Deficiencies Addressed? No De	Current Weather:	Sunny-Some clo	ud Previou	ıs Week:			S- Satis	factory
The Corporation of the District of Summerland Ni - Not Inspected	Name of Creek, S	Stream, River	Trout C	Creek			_ F - Fair	
Address 13211 Henry Avenue City Summerland Postal Code V0H 120 Freehone 250-404-3000 Alternate Phone Freehone 250-404-3000 Alternate	Water Licence: _						P - Poo	r
City Summerland	Owners Name	The Corporation	of the District o	of Summerlar	nd		U - Uns	atisfactory
Telephone 250-404-3000 Alternate Phone Email	Address 1	3211 Henry Avenue					Ni - Not	Inspected
Pre-Inspection Interview with Owner Owner or Representative present? No How long have you owned the dam? Any Prior problems? Any Prior problems? No Repairs or Modifications? (where, when) Past Failures/Incidents/Breach? Works Currently Fully Operational? Design report and plans available? No Dam Material Known? No Was the dam designed by an Engineer? Are dam construction details known? Downstream Consequence Classification - Dam Safety Regulation Very Low CDA Guidelines: Dam Information Type of Dam: Spillway Elevation: 1355.32 m Spillway Width: 8.51 m Freeboard (@full supply level) Reservoir Storage Volume 769 ML Licenced Storage Volume 1683 ML Dam Environment Drainage Area Size Inflow Design Flood: Q m³/s 12.5 Flood AEP (Return Period) Post Inspection Evaluation - Elaborate in the Inspection Report as required Evaluate any new development in titate a review of the Consequence Classification? No Yes DSR Required? No DSR completed date? Deficiencies Addressed? No Yes Post Consequence? Post Consequence? Post Consequence? Post Consequence? Post Consequence? Post Consequence? Post Consequence Classification? No OMS Manual Current? Post Sep Pubanual Current? Post Consequence? Post Consequence? Post Consequence? Post Consequence? Post Consequence? Post Consequence Classification? No OMS Manual Current? Post Consequence? Post C	,	land	Postal Code	V0H	1Z0		_	
Pre-Inspection Interview with Owner Owner or Representative present? How long have you owned the dam? Any Prior problems? Repairs or Modifications? (where, when) Past Failures/Incidents/Breach? Works Currently Fully Operational? Design report and plans available? Was the dam designed by an Engineer? Are dam construction details known? Downstream Consequence Classification - Current Dam Safety Regulation Zoned Earthfill Max. Height of Dam: Spillway Elevation: 1355.32 m Spillway Width: Reservoir Storage Volume Teeboard (@full supply level) Ti.34 m Freeboard (aftime of visit) Pasinga Free Volume Toge ML Licenced Storage Volume Dam Safety Regulation Licenced Storage Volume Dam Safety Regulation Licenced Storage Volume Dam Environment Drainage Area Size Inflow Design Flood: Cy m³/s Inflow Study: Cy m³/s Inflow Design Flood: Cy m³/s Inflow Study: Cy m³/s C		50-404-3000	_Alternate Phone				_	
Owner or Representative present? How long have you owned the dam? Any Prior problems? Any Prior problems? No Repairs or Modifications? (where, when) Past Failures/Incidents/Breach? Works Currently Fully Operational? Design report and plans available? Was the dam designed by an Engineer? Are dam construction details known? Dam Material Known? One Material Known? Where? Unknown Unknown Where? Downstream Consequence Classification - Current Dam Safety Regulation Very Low CDA Guidelines: Dam Information Type of Dam: Spillway Elevation: Type of Dam: Spillway Elevation: 1355.32 m Spillway Width: 8.51 m Freeboard (@full supply level) 1.34 m Freeboard (at time of visit) Reservoir Storage Volume 769 ML Licenced Storage Volume Licenced Storage Volume Dam Environment Drainage Area Size 1554 ha Reservoir Area: 159 ha Inflow Design Flood: Q m³/s 12.5 Flood AEP (Return Period) Post Inspection Evaluation - Elaborate in the Inspection Report as required Evaluate any new development in ittiate a review of the Consequence Classification? OMS Manual Current? Yes OMS Adequate? Yes OMS being followed? Yes DSR Required? No Site Access - site access adequate for safe operation and maintenance? Positine Access - Site access adequate for safe operation and maintenance?	Email						_	
Owner or Representative present? How long have you owned the dam? Any Prior problems? Any Prior problems? No Repairs or Modifications? (where, when) Past Failures/Incidents/Breach? Works Currently Fully Operational? Design report and plans available? Was the dam designed by an Engineer? Are dam construction details known? Dam Material Known? One Material Known? Where? Unknown Unknown Where? Downstream Consequence Classification - Current Dam Safety Regulation Very Low CDA Guidelines: Dam Information Type of Dam: Spillway Elevation: Type of Dam: Spillway Elevation: 1355.32 m Spillway Width: 8.51 m Freeboard (@full supply level) 1.34 m Freeboard (at time of visit) Reservoir Storage Volume 769 ML Licenced Storage Volume Licenced Storage Volume Dam Environment Drainage Area Size 1554 ha Reservoir Area: 159 ha Inflow Design Flood: Q m³/s 12.5 Flood AEP (Return Period) Post Inspection Evaluation - Elaborate in the Inspection Report as required Evaluate any new development in ittiate a review of the Consequence Classification? OMS Manual Current? Yes OMS Adequate? Yes OMS being followed? Yes DSR Required? No Site Access - site access adequate for safe operation and maintenance? Positine Access - Site access adequate for safe operation and maintenance?	Pre-Inspection	Interview with Owi	ner	* See Past R	enorts or o	her File Informatio	n	
How long have you owned the dam? Any Prior problems? Any Prior problems? Repairs or Modifications? (where, when) Past Failures/Incidents/Breach? Works Currently Fully Operational? Was the dam designed by an Engineer? Are dam construction details known? Downstream Consequence Classification - Current Dam Safety Regulation Type of Dam: Spillway Elevation: Treeboard (@full supply level) Reservoir Storage Volume Toga ML Licenced Storage Volume Licenced Storage Volume Dam Environment Dam Environment Dam Safety Regulation - Elaborate in the Inspection Report as required Evaluate any new development in titiate a review of the Consequence Classification? OMS Adequate? No No No No No Poundation? No Foundation? No Unknown Company Unknown Where? Unknown Company Unknown Where? Unknown Company Unknown Where? Dam Safety Regulation - Current Very Low CDA Guidelines: Dam Environment Freeboard (@full supply level) 1.34 m Freeboard (at time of visit) 1.2 m Freeboard (at time of visit) 1.2 m Freeboard (at time of visit) 1.2 m Freeboard (at time of visit) 1.2 m Freeboard (Return Period) Dam Environment Dam Environ	•				oporto or o	ner i ne mnormatio	<u></u>	
Any Prior problems? Repairs or Modifications? (where, when) Past Failures/Incidents/Breach? Works Currently Fully Operational? Design report and plans available? Was the dam designed by an Engineer? Are dam construction details known? Downstream Consequence Classification - Current Dam Safety Regulation Type of Dam: Spillway Pievation: Spillway Pievation: Spillway Width: Spillway Width: Spillway Width: Basin m Treeboard (@full supply level) Dam Environment Drainage Area Size Inflow Design Flood: Dam Safety Regulation Type of Mare Total angle Area Size Inflow Study: Q m³/s Teleborate in the Inspection Report as required Evaluate any new development in the inundation zone downstream Should new development initiate a review of the Consequence Classification? No No No Tyes No No No Foundation? No Spillway Width: Spillway W	•	•						
Repairs or Modifications? (where, when) Past Failures/Incidents/Breach? Works Currently Fully Operational? Design report and plans available? Was the dam designed by an Engineer? Are dam construction details known? Downstream Consequence Classification - Current Dam Safety Regulation Type of Dam: Spillway Elevation: Spillway Elevation: Type of Dam: Spillway Elevation: Type of Jame Reservoir Storage Volume Type Of ML Licenced Storage Volume Type of	,							
Past Failures/Incidents/Breach? Works Currently Fully Operational? Design report and plans available? Was the dam designed by an Engineer? Are dam construction details known? Downstream Consequence Classification - Current Dam Safety Regulation Type of Dam: Spillway Elevation: Type of Dam: Spillway Elevation: Treeboard (@full supply level) Parainage Area Size Inflow Design Flood: Dam Environment Drainage Area Size Inflow Study: Q m³/s Type of Inspection Evaluation Post Inspection Evaluation Post Inspection Evaluation Post Required? Post Required? Post Required? Post Required? Post Required? Post Required? Post Consequence Classification - Elaborate in the Inspection and maintenance? Post Required? No Dam Rederical Known? No Dam Reterial Known? No Dam Atterial Known? No Dam Material Known? No Dam Material Known? No Poundation? Post Ompany Where? Unknown Where? Unknown Where? Unknown Where? Dam Max. Height of Dam: S.93 m S.93 m								
Design report and plans available? No Dam Material Known? No Foundation? No Was the dam designed by an Engineer? Are dam construction details known? Dam Safety Regulation Very Low CDA Guidelines: Dam Information Type of Dam: Spillway Elevation: Tereboard (@full supply level) Reservoir Storage Volume Table Dam Environment Drainage Area Size Inflow Design Flood: Dam Safety Regulation Total Inflow Study: Dam Environment Drainage Area Size Inflow Study: Dam Information Teleboard (Q m³/s Inflow Design Flood: Dam Environment Drainage Area Size Inspection Evaluation Elaborate in the Inspection Report as required Evaluate any new development in titale a review of the Consequence Classification? OMS Adequate? Ves Das Gerondation? No Site Access - site access adequate for safe operation and maintenance? Very Low CDA Guidelines: Dam: Foundation? No Foundation? Foundation? No Foundation? Foundation? Foundation? No Foundation?	•	, ,						
Design report and plans available? Was the dam designed by an Engineer? Are dam construction details known? Downstream Consequence Classification - Current Dam Safety Regulation Type of Dam: Spillway Elevation: 1355.32 m Spillway Width: 1355.32 m Spillway Width: 8.51 m Freeboard (@full supply level) Reservoir Storage Volume Taige Foundation Total figure F								
Was the dam designed by an Engineer? Are dam construction details known? Downstream Consequence Classification - Current Dam Safety Regulation Type of Dam: Spillway Elevation: 1355.32 m Spillway Width: Spillway Elevation: Treeboard (@full supply level) Reservoir Storage Volume Torainage Area Size Inflow Design Flood: Q m³/s Other Inflow Study: Q m³/s Telaborate in the Inspection Report as required Evaluate any new development in ittae ta review of the Consequence Classification? OMS Manual Current? Yes DSR Required? No Unknown Where? DAM Height of Dam: S.93 m Should time of visit) 1.2 m Freeboard (at time of visit) 1.2 m Freeboard (at time of visit) 1.2 m Freeboard (at time of visit) 1.2 m Freeboard (at time of visit) 1.2 m Freeboard (at time of visit) 1.2 m Freeboard (at time of visit) 1.2 m Freeboard (at time of visit) 1.2 m Freeboard (at time of visit) 1.2 m Freeboard (at time of visit) 1.2 m Freeboard (at time of visit) 1.2 m Freeboard (at time of visit) 1.2 m Freeboard (at time of visit) 1.2 m Freeboard (at time of visit) 1.2 m Freeboard (at time of visit) 1.2 m Freeboard (at time of visit) 1.2 m Freeboard (at time of visit) 1.2 m Freeboard (at time of visit) 1.2 m Freeboard (at time of visit) 1.2 m Freeboard (at time of visit) 1.2 m Freeboard (at time of visit) 1.2 m Freeboard (at time of visit) 1.2 m Freeboard (at time of visit) 1.2 m Freeboard (at time of visit) 1.2 m Freeboard (at time of visit) 1.2 m Freeboard (at time of visit) 1.2 m Freeboard (at time of visit) 1.2 m Freeboard (at time of visit) 1.2 m Freeboard (at time of visit) 1.2 m Freeboard (at time of visit) 1.2 m Freeboard (at time of visit) 1.2 m Freeboard (at time of visit) 1.2 m Freeboard (at time of visit) 1.2 m Freeboard (at time of visit) 1.2 m Freeboard (at time of visit) 1.2 m Freeboard (at time of visit) 1.2	•		No Dam M		? No	Found	ation? No	
Are dam construction details known? Downstream Consequence Classification - Current Dam Safety Regulation Very Low CDA Guidelines: Dam Information Type of Dam: Spillway Elevation: 1355.32 m Spillway Width: 8.51 m Freeboard (@full supply level) 1.34 m Freeboard (at time of visit) 1.2 m Reservoir Storage Volume 769 ML Licenced Storage Volume 1683 ML Dam Environment Drainage Area Size Inflow Design Flood: Q m³/s Teleboard Q m³/s Teleboard Q m³/s Teleboard Return Period) Teleboard Return Period) Post Inspection Evaluation Flood AEP (Return Period) Floo	• .	•						
Downstream Consequence Classification - Current Dam Safety Regulation Very Low CDA Guidelines: Dam Information Type of Dam: Spillway Elevation: 1355.32 m Spillway Width:								
Dam Information Type of Dam: Spillway Elevation: 1355.32 m Spillway Width: Ereeboard (@full supply level) Reservoir Storage Volume 769 ML Licenced Storage Volume 1554 ha Reservoir Area: Inflow Design Flood: Inflow Study: Q m³/s Telaborate in the Inspection Report as required Evaluate any new development initiate a review of the Consequence Classification? OMS Manual Current? Yes OMS Adequate? Yes OMS being followed? Yes Site Access - site access adequate for safe operation and maintenance? Zoned Earthfill Max. Height of Dam: 5.93 m Spillway Width: 8.51 m Freeboard (at time of visit) 1.2 m Reservoir Area: 1.59 ha Reservoir Area: 159 ha 12.5 Flood AEP (Return Period) 200 yr IDF No No No DSR completed date? Deficiencies Addressed? No Yes			-				_	
Dam Information Type of Dam: Spillway Elevation: 1355.32 m Spillway Width: Ereeboard (@full supply level) Reservoir Storage Volume 1.34 m Freeboard (at time of visit) Reservoir Storage Volume 1683 ML Dam Environment Drainage Area Size 1554 ha Reservoir Area: 159 ha Inflow Design Flood: Q m³/s 12.5 Flood AEP (Return Period) Other Inflow Study: Q m³/s Flood AEP (Return Period) Post Inspection Evaluation - Elaborate in the Inspection Report as required Evaluate any new development initiate a review of the Consequence Classification? No Should new development initiate a review of the Consequence Classification? No OMS Manual Current? Yes OMS Adequate? Yes OMS being followed? Yes EPP Manual Current? Yes DSR Required? No DSR completed date? Deficiencies Addressed? No Yes		•		CDA Guideli	nes:			
Type of Dam: Spillway Elevation: 1355.32 m Spillway Width: Freeboard (@full supply level) Reservoir Storage Volume 769 ML Licenced Storage Volume 1554 ha Reservoir Area: Inflow Design Flood: Q m³/s Type of Dam: Elaborate in the Inspection Report as required Evaluate any new development in itiate a review of the Consequence Classification? OMS Manual Current? Yes OMS Adequate? Yes DSR Required? No Site Access - site access adequate for safe operation and maintenance? Spillway Width: 8.51 m Index Spillway Width: 8.51 m Index Spillway Width: 8.51 m Index Spillway Width: 8.51 m Index Spillway Width: 8.51 m Index Spillway Width: 8.51 m Index Spillway Width: 8.51 m Index Spillway Width: 8.51 m Index Spillway Width: 8.51 m Index Spillway Width: Index S		, , ,		_				
Spillway Elevation: Freeboard (@full supply level) Reservoir Storage Volume Tog ML Licenced Storage Volume Tog ML Licenced Storage Volume Licenced St		on						
Freeboard (@full supply level) Reservoir Storage Volume Top ML Licenced Storage Volume Licenced Storage Volume Top ML Licence Sto			Zoned Earthfill		•		m	
Reservoir Storage Volume 769 ML Licenced Storage Volume 1683 ML Dam Environment Drainage Area Size Drainage Area Size Inflow Design Flood: Q m³/s Inflow Study: Q m³/s Inflow AEP (Return Period) Post Inspection Evaluation - Elaborate in the Inspection Report as required Evaluate any new development in the inundation zone downstream Should new development initiate a review of the Consequence Classification? OMS Manual Current? Yes OMS Adequate? Yes OMS being followed? Yes DSR Required? No DSR completed date? Deficiencies Addressed? No Site Access - site access adequate for safe operation and maintenance? Value Licenced Storage Volume 1683 ML Licenced Storage Volume 1683 ML No 200 yr IDF No Post Inspection Report as required Evaluate any new development in the inundation zone downstream Should access a Separation and maintenance? No Yes	Spillway Elevation	n:	1355.32 m	Spill	way Width	n: 8.51 m	1	
Drainage Area Size 1554 ha Reservoir Area: 159 ha Inflow Design Flood: Q m³/s 12.5 Flood AEP (Return Period) Other Inflow Study: Q m³/s Flood AEP (Return Period) Post Inspection Evaluation - Elaborate in the Inspection Report as required Evaluate any new development in the inundation zone downstream Should new development initiate a review of the Consequence Classification? OMS Manual Current? Yes OMS Adequate? Yes OMS being followed? Yes EPP Manual Current? Yes EPP Adequate? Yes EPP being exercised? Yes DSR Required? No DSR completed date? Deficiencies Addressed? No Site Access - site access adequate for safe operation and maintenance?			1.34 m	Free	eboard (at	time of visit)	1.2 m	
Drainage Area Size	Reservoir Storage	e Volume	769 ML	Lice	nced Stor	age Volume	1683	ML
Drainage Area Size	Dam Environn	nent						
Inflow Design Flood: Q m³/s			1554 ha	Res	ervoir Are	a·	150) ha
Other Inflow Study: Q m³/s Flood AEP (Return Period) Post Inspection Evaluation - Elaborate in the Inspection Report as required Evaluate any new development in the inundation zone downstream Should new development initiate a review of the Consequence Classification? OMS Manual Current? Yes OMS Adequate? Yes OMS being followed? Yes EPP Manual Current? Yes EPP Adequate? Yes EPP being exercised? Yes DSR Required? No DSR completed date? Deficiencies Addressed? No Site Access - site access adequate for safe operation and maintenance?	•	•						
Post Inspection Evaluation - Elaborate in the Inspection Report as required Evaluate any new development in the inundation zone downstream Should new development initiate a review of the Consequence Classification? OMS Manual Current? Yes OMS Adequate? Yes OMS being followed? Yes EPP Manual Current? Yes EPP Adequate? Yes EPP being exercised? Yes DSR Required? No DSR completed date? Deficiencies Addressed? No Site Access - site access adequate for safe operation and maintenance?	•				•	,		'
Evaluate any new development in the inundation zone downstream Should new development initiate a review of the Consequence Classification? OMS Manual Current? Yes OMS Adequate? Yes EPP Adequate? Yes EPP being exercised? Yes DSR Required? No DSR completed date? Deficiencies Addressed? Yes Ves Ves	Other milet Otac	y. Q 11170			arter (it	stani i onoa)		
Evaluate any new development in the inundation zone downstream Should new development initiate a review of the Consequence Classification? OMS Manual Current? Yes OMS Adequate? Yes EPP Adequate? Yes EPP being exercised? Yes DSR Required? No DSR completed date? Deficiencies Addressed? Yes Ves Ves	Post Inspection	n Evaluation - E	laborate in the Insp	ection Report	as required			
OMS Manual Current? Yes OMS Adequate? Yes OMS being followed? Yes EPP Manual Current? Yes EPP Adequate? Yes EPP being exercised? Yes DSR Required? No DSR completed date? Deficiencies Addressed? No Site Access - site access adequate for safe operation and maintenance? Yes	-							
OMS Manual Current? Yes OMS Adequate? Yes OMS being followed? Yes EPP Manual Current? Yes EPP Adequate? Yes EPP being exercised? Yes DSR Required? No DSR completed date? Deficiencies Addressed? No Site Access - site access adequate for safe operation and maintenance? Yes	•	•			tion?		No	
EPP Manual Current? Yes EPP Adequate? Yes DSR Required? No DSR completed date? Deficiencies Addressed? Yes No Yes No Yes		•	•			OMS being foll	owed?	Yes
Site Access - site access adequate for safe operation and maintenance? Yes	EPP Manual Curr	ent? Yes			Yes			Yes
Site Access - site access adequate for safe operation and maintenance? Yes	DSR Required?	No	DSR co	mpleted date	?	Deficiencies A	ddressed?	No
	•	access adequate for saf		•				Yes
								No

										Requi	red A	ction
									euo V	Monitor	Maintenance	Repair Not Applicable
Emb	ankm	ent E	Dam									
1. Up:	stream	n Slop	эе								_	
	VEGETA						1	Al 12 al		х	П	\Box
		<u>Type</u>		Grass nmendations:			_Location	Above high water				
	SLOPE P	ROTECT								Х		
		<u>Type</u>	Notes		None/Sp	arse/Den	se					
	EROSION	ı	Notes							х	П	пп
			Type	(wave/runoff/u								
			Notes		Length Minor W	21/0	Width					
	INSTABIL	ITIES	NOIGS		WIIIOI W	ave				х	П	пп
		Slides (Y		Could not Inspe	ct)		NONE					
			Length	n Causes		Width		Location				
		Cracks (rse/Longitudina	al/Other)		NONE			х	П	пп
		,	Quanti			Length		Width				
			Location	on Causes		None						
		Bulges/D		ons/Hummocky	/	HONE				х	П	пп
			Size			Height		Depth			_	
			Location Notes	on Causes		None						
	OTHER		140103/	Oauses		None				х	П	пп
		Burrows,		Other Concerns		BURRO						
			Location	on Causes		Small R	odents					
			110100/	Caases								
2. Cre											_	
	ACCESS	la thara i	oublio o	ccess to the cre	ot?		YES		L	X	Ц	U U
				ced or signed?	:St:		NO					
			e acces	s to the crest re	stricted? I	NO						
	VEGETA	TION Trees			NO				_	Х	П	пп
		11003	Location	on	140				_		ш	
			Notes							7 (27		
		<u>Brush</u>	Location	an.	NONE				L	Х	Ш	ЦЦ
			Notes	JII								
	,	Ground (BARE					X		
				ty (bare/sparse rance (too tall/t								
			Notes	rance (too tali/t	oo shoriyg	joou)						
	EROSION	,	NONE							Х		
			Type	(wave/runoff/u			Width				_	
			Notes		Length		_ vvidtri					
	SETTLEN	<i>IENT</i>			NONE					X		ПП
			Location	on Causes								
			NOIES/	Causes								

							Require	ed Action	
							None X Monitor	Maintenance Repair Not Applicable	
	INSTABILITIES Cracks	(Transverse/Longitudina Quantity Location	al/Other)	_Length		NONE Width			
	OTHER	Notes/Causes							
		s, Ruts, Other Concerns Location Notes/Causes				NONE			
3.	Downstream	Slope							
	VEGETATION	•					Х		l
	<u>Trees</u>	Location Notes	NO						
	Brush		NONE				X		ĺ
		Location Notes							
	Ground		GRASS				X		ĺ
	SLOPE PROTEC	Notes CTION					Х	ппг	ĺ
	<u>Type</u>		NONE						ı
	EROSION	Notes					Х	ппп	ĺ
			NONE						J
	INSTABILITIES	Notes	NONE				Х	ппп	ĺ
	Slides	Length		Width		Location	 		ı
	Cracks	Notes/Causes (Transverse/Longitudina Quantity	al/Other)	Length		NONE Width	X		ļ
		Location Notes/Causes							
	Bulges	/Depressions/Hummocky Size	/	Height	NONE	Depth	X		
		Location Notes/Causes							
	OTHER Burrow	s, Ruts, Other Concerns			SMALL	RODENTS	X		l
		Location Notes/Causes							
	SEEPAGE						X		l
	Wet Ar	ea/Flow/Boil/Sinkhole Flow Rate Location			WET AR	EAS			
		Aquatic Vegetation Rust Colored Deposits Sediment in Flow Other	5		(Yes/No (Yes/No (Yes/No))			
	EMBANKMENT	Notes/Causes DRAINS		NONE F	OUND		ппп		ı
	Туре						 		1
	Flow ra Locatio			Size		Number			
	Notes								ŀ
	MONITORING IN	ISTRUMENTATION COI	NDITION		Weir	Flume		Х	j
	Notes	nezonneters		, and the second	∟ ,	Liune			

		Required Action
		None Monitor Maintenance Repair Not Applicable
Spillway		
GENERAL CONDITIONS		
Type Earthen Channel Spillway -	••	
Notes East end of Saddle Dam - F	lowing Eastward	
1. Spillway Crest or Control S	Section	
OBSTRUCTION		
<u>Debris</u>		
Location	Some logs and debris lodged in Channel and concrete	Non Maii Rep
Notes Vegetation	Log (Boom?) across front of structure Sparse	No Maii No
<u>vegetation</u> Location	Well maintained.	
Notes	Tron mamana.	
Other (beaver activity, trash rac	ck problems, etc.)	
No Log Boom		
SPILLWAY CREST MATERIALS		
Condition	Concrete - Rectangular	
Notes	Spilling at time (approximately 15 cm)	
OTHER SPILLWAY CREST PROBLEM	MS	
<u>Damage</u>	None	
Location		
Notes/Cause		
2. Spillway Conveyance Sect	tion: Channel, Chute or Conduit	
OPEN CHANNEL CROSS SECTION	GOOD	
CHANNEL OBSTRUCTION	NONE	
SPILLWAY CONVEYANCE MATERIA	LS	00000
OTHER SPILLWAY CONVEYANCE PI Damage	ROBLEMS NONE	
Location		
Notes/Cause		
3. Energy-Dissipating or Terr	ninal Section	
EROSION CONTROL STRUCTURE	iiiiai ocoloii	
Type ROCK LINED CHA	NNEL	
Notes		

				Requ	uired A	ction
Low Level Out	lo4			None Monitor	Maintenance	Repair Not Applicable
GENERAL	iei					пп
Type	Gated Pipe Structur	re	None		. [шш
ACCESS TO VAL	VE/GATE			XП	П	пп
Not access		Walk	way By boat Other		. ப	⊔ ⊔
Notes	Locked - Not tested					
Notes	Locked - Not lested	i, but appears rund	ciona			
Walkwa	y Condition	N/A				
	LET COMPONENTS				. —	
Valve Co	ontrol Device		amaged stem Other	Х	ıЦ	ЦЦ
V es		ئــا	amaged stem — The			
Operatio	Other/Notes				П	пп
✓Yes	No Poorly		lot tested	کا لا		
	Notes	Some Leakage		_		
Valve / 0				X		
	Location Condition	Slanted Under				
Lastrasa	es	No				
Leakage	Flow Rate	MINOR		X	. Ш	υ⊔
Outlet Pi	ine					
_	etal Plastic	✓ ¢oncrete	Other		. Ш	υ⊔
	Diameter	600 mm				
	Condition	Good condition				
Outlet O	bstruction Notes	(note ve	egetation, sediment blockage, etc.)			
	Notes					
OUTLET EROSIO Type	N CONTROL STRUC	TURE				ЦЦ
					. —	
Concret	e Condition	Good		X	ıШ	ЦЦ
	rea Seepage			X		
Descript Flow Est				_		
Location						
Underm	ining			X	П	
Location	1	Little				
Notes/Ca	ause:					
	ream Channel		Channel cut into Bank, some sloughing	X		
Free Dra	aining? es or Potential Blockaç	nes?	Yes Monitor			
	Control? Rip-Rap?	g00:	Monitor			

Address 13211 Henry Avenue City Summerland Post	Previous Week: Trout Creek ation of the District of Summer	I5-Jul-10	Observed Conditions S- Satisfactory F - Fair P - Poor U - Unsatisfactory Ni - Not Inspected
Pre-Inspection Interview with 0	Owner * See Past Reports or	other File Information	
Owner or Representative present?	No		
How long have you owned the dam?			
Any Prior problems?	No		
Repairs or Modifications? (where, whe	en) No		
Past Failures/Incidents/Breach?	No		
Works Currently Fully Operational?	Yes		
Design report and plans available No	Dam Material Known? No	Founda	tion? No
Was the dam designed by an Enginee	er? Unknown Company		
Are dam construction details known?	No Where?		
Downstream Consequence Classifica	tion - Current		
Dam Safety Regulation High	CDA Guidelines:	High	
Spillway Elevation: Freeboard (@full supply level)		dth: None at time of visit)	imately 3 m
Reservoir Storage Volume App	rox Licenced St	orage Volume	
Dam Environment Drainage Area Size <1 h	a Reservoir A	roo.	1 ha
Inflow Design Flood: Q m ³ /s		(Return Period)	200 yr IDF (0.52 m FB)
Other Inflow Study: Q m ³ /s		Return Period)	200 yr IDF (0.32 III FB)
Other milow Study. Q m /s	FIOOD AEP (Return Period)	
Post Inspection Evaluation - Evaluate any new development in the	Elaborate in the Inspection Repo	ort as required Yes	
•			No
Should new development initiate a rev OMS Manual Current? NO	OMS Adequate? Yes		No wed? Yes
EPP Manual Current?	EPP Adequate?	EPP being exer	
		Deficiencies Ad	
LISE REQUIRED NO	DSR completed data?		araccad' Nia
DSR Required? No	DSR completed date?		
Site Access - site access adequate fo Any other concerns in the watershed t	r safe operation and maintenanc		Yes No

			Red	quired	Actio	'n
			None	Maintenance	Repair	Not Applicable
Emb	ankmen	nt Dam				
1. Un	stream S	Slone				
• •	VEGETATION)	ап	П	П
	Type				. —	
	SLOPE PROT	Recommendations:		, , ,		П
	Type)	1	ч	Ц
		Notes				
	EROSION	Type (wave/runoff/unknown) Length Width			lШ	Ц
	INCTA DII ITIE	Notes	— F			
	INSTABILITIE Slide	es (Yes/No/Could not Inspect))	IJЦ	ш	Ш
	0	Length Width Location				
	0	Notes/Causes None	— F			
	Crac	cks (Transverse/Longitudinal/Other) QuantityLengthWidth Location			IЦ	Ц
	Dula	Notes/Causes None	_ [a 🗖		
	Buig	ges/Depressions/Hummocky Size Height Depth)	i Li	ιц	Ш
		Location				
	OTHER	Notes/Causes None	_ [a 🗖		
		rows, Ruts, Other Concerns Location			·	Ш
		Notes/Causes None				
2. Cre	est					
	ACCESS)	₹ □	П	П
	Is th	nere public access to the crest? YES ne crest marked or signed? NO shicle access to the crest restricted? NO				
	VEGETATION					
	Tree)		Ш	Ш
		Location Notes				
	<u>Brus</u>)	(
		Location				
	Gro	Notes und Cover BARE		aП	П	П
	<u> </u>	Quantity (bare/sparse/adequate/dense)	Ľ	ى د	. —	۲
		Appearance (too tall/too short/good) Notes				
	EROSION	NONE		X		
		Type (wave/runoff/unknown)			_	
		LengthWidthNotes				
	SETTLEMEN			X		
		Location				
		Notes/Causes				

					R	equired Action
					Φ	Monitor Maintenance Repair Not Applicable
					None	Monitor Mainten Repair Not App
INSTAB		se/Longitudinal/Other	·) N	IONE		<u>Ш</u> Ц Ц L
		yLength		Vidth		
	Locatio	n				
OTHER	Notes/0	Causes				
OTHER	Burrows, Ruts, O	ther Concerns				
	Locatio					
	Notes/0	Causes				
Downstr	eam Slope					
VEGET/	-					
VLOLIA	Trees	NO				
	Locatio	n				
	Notes					
	<u>Brush</u>	SPARSE				
	Locatio Notes	n				
	Ground Cover	BARE				\square \square \square \square
	Notes					
SLOPE	PROTECTION					\times \square \square
	<u>Type</u>	NONE				
EROSIO	Notes					ЯППГ
LINOSIO		n NONE				шццц
	Notes					
INSTAB		NONE				\times
	Slides Length		L	ocation		
		Causes rse/Longitudinal/Other)	·) N	IONE		\square \square \square
		yLength		Vidth		
	Locatio	n				
		Causes				
	Bulges/Depression	ons/Hummocky Height	NONE	epth		
	Locatio					
		Causes				
OTHER						
	Burrows, Ruts, O		NONE			
	Locatio Notes/0	Causes				
SEEPAC						$X \sqcap \Gamma$
	Wet Area/Flow/B		NONE			
	Flow R					
	Locatio Aquatio	n Vegetation	(Yes/No)			
		olored Deposits	(Yes/No)			
		ent in Flow	(Yes/No)			
	Other					
FMR AN	Notes/C KMENT DRAINS	Causes NONE FO	OLIND			
LIIDAN	Type	NONET	OOND			
	Flow rate	Size	N	lumber		
	Location					
MONTO	Notes	NTATION CONDITION	A.			
_		NTATION CONDITION	Weir	Thum:		
V	None found	Piezometers	_lvveii	flume		
	Notes					

	Re	quir	red A	Actio	n
	None	Monitor	Maintenance	Repair	Not Applicable
Spillway					
GENERAL CONDITIONS		╗	П	П	П
Type NONE Notes	ЦĽ	<u> </u>	Ц	Ц	Ц
1. Spillway Crest or Control Section OBSTRUCTION Debris	× []			
Location Notes	-				
Vegetation Sparse Location Notes	-				
Other (beaver activity, trash rack problems, etc.)					
Log boom intact at mouth. SPILLWAY CREST MATERIALS Condition Earthen - 3:1 sideslopes Notes	× [J			
OTHER SPILLWAY CREST PROBLEMS Damage None	X []	П		
Location Notes/Cause	-				
2. Spillway Conveyance Section: Channel, Chute or Conduit					
OPEN CHANNEL CROSS SECTION OK	х				
CHANNEL OBSTRUCTION None	×]			
SPILLWAY CONVEYANCE MATERIALS	Х		П		
OTHER SPILLWAY CONVEYANCE PROBLEMS Damage Location	⊠ [J			
Notes/Cause					
3. Energy-Dissipating or Terminal Section EROSION CONTROL STRUCTURE Type None	× []			
Notes	-				

	Required Action
Low Level Outlet	None Monitor Maintenance Repair Not Applicable
GENERAL GENERAL	\square \square \square \square \square
Type Intake pipeline into WTP	
ACCESS TO VALVE/GATE	
Not accessible from shore Walkway sy boat ther	
Notes Automated indoors	
Walkway Condition N/A	
LOW LEVEL OUTLET COMPONENTS Valve Control Device ✓ Yes None No Stem Damaged stem Dther	
Other/Notes	
Operational? Ves No Poorly Not tested Notes	
Valve / Gate Location Control Building Condition Good	
Leakage ☑Yes □No Flow Rate None	
Outlet Pipe	
Metal Plastic Concrete Other	
Diameter <i>Unknown</i>	
Condition Unknown Outlet Obstruction (note vegetation, sediment blockage, etc.) Notes	
OUTLET EROSION CONTROL STRUCTURE Type	
Concrete Condition	\square \square \square \square \square
Outlet Area Seepage	
Description	
Flow Estimate Location	
Undermining	
Location	
Notes/Cause:	
Downstream Channel Free Draining?	
Blockages or Potential Blockages?	
Erosion Control? Rip-Rap?	

Name of Dam Is	sintok Lake	Inspect	ion Date	15	-Jul-10	Observed	Conditions
Current Weather:	Sunny	Previou	ıs Week:			S- Satis	factory
Name of Creek, S	tream, River	Isintok	Creek			F - Fair	
Water Licence: 0	CL16414					P - Poo	=
Owners Name	The Corporation	of the District o	f Summerlan	d		U - Uns	atisfactory
Address 1	3211 Henry Avenue					Ni - Not	Inspected
City SummerI	and	Postal Code	V0H	1 Z 0			
Telephone 2 Email	50-404-3000	_Alternate Phone				_	
Pre-Inspection	Interview with Owi	ner	* See Past Re	ports or ot	her File Informatio	<u>n</u>	
Owner or Represe	entative present?		Yes				
How long have yo	u owned the dam?		1930's				
Any Prior problem	is?		No				
Repairs or Modific	cations? (where, when)		No				
Past Failures/Incid	dents/Breach?		No				
Works Currently F	Fully Operational?		Yes				
Design report and	l plans available?	No Dam M	aterial Known	? No	Found	ation? No	
Was the dam des	igned by an Engineer?	Unknow	wn Com	pany			
Are dam construc	tion details known?	Unknow	wn Whe	re?			
Downstream Cons	sequence Classification	- Current					
Dam Safe	ety Regulation	Very Low	CDA Guidelir	nes:			
Dam Informati	on						
Type of Dam:	OII	Earth Embanki	ment Max	Height of	Dam: 10.5	7 m	
Spillway Elevation) *	1645.62		vay Width			
Freeboard (@full		3.12 m		•	time of visit)	3 m	
Reservoir Storage		1385 ML		•	age Volume	3 III 1665 I	ЛІ
Reservoir Storage	e volume	1363 IVIL	LICEI	iceu Stora	age volume	_ 1003 1	<i>"</i> L
Dam Environm	nent						
Drainage Area Siz		1640 ha	Rese	ervoir Area	a:		86 ha
Inflow Design Floo		44	Flood	d AEP (Re	eturn Period)	1:200 ye	ear
Other Inflow Study	y: Q m³/s		Floor	d AEP (Re	eturn Period)		
Post Inspectio	n Evaluation - <u>E</u>	laborate in the Insp	ection Report a	s required			
Evaluate any new	development in the inur	ndation zone dowr	nstream		No		
	opment initiate a review			ion?		No	
OMS Manual Curr	rent? Yes	OMS A	dequate?	Yes	OMS being foll	owed?	Yes
EPP Manual Curr	ent? Yes	EPP Ac	lequate?	Yes	EPP being exe		Yes
DSR Required?	No		mpleted date?	? 6/10	Deficiencies Ad	ddressed?	No
Site Access - site	access adequate for saf	e operation and n	naintenance?				Yes
Any other concern	ns in the watershed that	could impact the o	dam?				No

							R	equired A	Action
							None	Monitor	Repair Not Applicable
	pankment								
1. Up	stream Slo	pe							
	VEGETATION							х	
	<u>Type</u>	Some Grass Recommendations:			Locatior	າ			
	SLOPE PROTEC			NONE				Х	пп
	<u>Type</u>		None/Sp	arse/Den	nse				
	50000N	Notes							
	EROSION	Type (wave/runoff/	unknown))	Width			LX	ЦЦ
		Notes		ave/ VEI	HICLE TR	AFFIC			
	INSTABILITIES	0.4 0.40 1.4			NONE			х	\Box
	Slides	(Yes/No/Could not Inspe Length Notes/Causes	:ct)	_Width	NONE	Location			
	Cracks	(Transverse/Longitudin	al/Other)		NONE			х	
		Quantity		Length		Width			
		Location Notes/Causes		None					
	Bulges	/Depressions/Hummock	.y					х	пп
	· ·	Size		_Height		Depth			
		Location Notes/Causes		None					
	OTHER	Notes/Causes		None				х	пп
		s, Ruts, Other Concerns	3	BURRO	ows				шш
		Location		Crest					
		Notes/Causes		ATV's a	and Motor	cycle access			
2. Cr	est								
	ACCESS							X	ПП
		public access to the cr	est?		YES				
		rest marked or signed? cle access to the crest re	o atriata da	NO	NO				
	VEGETATION	de access to the crest n	ssincled?	NO					
	Trees		NO					X	
		Location							
	<u>Brush</u>	Notes	NONE					Х	
	Diusii	Location	NONL						шш
		Notes							
	Ground	l Cover	BARE	<i>,</i> ,				X	
		Quantity (bare/sparse Appearance (too tall/							
		Notes	100 311010	good)					
	EROSION							X	
		Type (wave/runoff/)					
		Notes	Length Vehicle	Traffic	Width				
	SETTLEMENT	. 10100	NONE					X	
		Location							
		Notes/Causes							

						R	equired A	Action
INSTABILIT	ies					None	X Monitor Maintenance	Repair Not Applicable
	acks (Transverse/Longitud Quantity Location Notes/Causes	inal/Other)	_Length	NONE Width				
OTHER Bu	rrows, Ruts, Other Concer Location	ns		NONE	<u> </u>		X	
D	Notes/Causes							
Downstrea VEGETATION	•							
Tre	Location	YES Small fir	trees - Very sp	arse				
Bru		NONE					X	
Gr	Location Notes ound Cover	GRASS					◱▢	пп
SLOPE PRO	Notes	very spa	rse					
<u>Ty</u>		NONE						
EROSION	Location	NONE					Х	
INSTABILIT	Notes IES des Length	NONE	Width	Locat	ion		Х	
	Notes/Causes acks (Transverse/Longitud	inal/Other)	Widii	NONE			XП	пп
	Quantity Location		_Length	Width				
Bu	Notes/Causes Iges/Depressions/Hummo Size	cky	NO! Height	NE Depth	1		X	
	Location Notes/Causes							
OTHER Bu	rrows, Ruts, Other Concer Location	ns	Ruts Vehicle Traffic				X	
SEEPAGE	Notes/Causes						Х	
W.	et Area/Flow/Boil/Sinkhole Flow Rate Location Aquatic Vegetation Rust Colored Depo Sediment in Flow	Both on	t time of inspe Northa nd sou (Ye (Ye		Outlet YES NO NO			
EMBANKME	Other Notes/Causes ENT DRAINS		NONE FOUN	D			пп	
Lo	w rate		_Size	Numb	per			
	tes IG INSTRUMENTATION C If fiezomete		Wei	r	Flume			
_	tes			<u> </u>				

			Required Action
			None Monitor Maintenance Repair Not Applicable
Spillway			
GENERA	L CONDITIONS		
Type Notes	Earthen Channel Spillway -	Concrete Sill and Sidewalls	
1. Spillway	Crest or Control	Section	
OBSTRU			\sqcap \square \sqcap \sqcap \sqcap
	<u>Debris</u>		
	Location	No	
	Notes		Nor Maii Non
	Vegetation	Sparse	
	Location	Well maintained.	
	Notes Other (beaver activity, trash ra	ok probleme eta)	
	No Log Boom	ck problems, etc.)	
	Y CREST MATERIALS		
	Condition	Concrete - Rectangular	
	Notes	Little flow	
	SPILLWAY CREST PROBLE		\square \square \square \square
	<u>Damage</u> <u>Location</u>	None	
	Notes/Cause		
2. Spillway	Conveyance Sec	tion: Channel, Chute or Conduit	
OPEN CH	HANNEL CROSS SECTION	Trapezoidal - Creek	
CHANNE	L OBSTRUCTION	None	
SPILLWA	AY CONVEYANCE MATERIA	LLS Creek bed	
OTHER S	SPILLWAY CONVEYANCE P	ROBLEMS	
	<u>Damage</u>		
	Location		
	Notes/Cause		
2 Energy D	liceinating or Ter	minal Saction	
	Dissipating or Ter	illilai Section	
	N CONTROL STRUCTURE		
	Type None	_	
,	Notes		

		Require	ed Action
Low Level Outlet		None Monitor	Maintenance Repair Not Applicable
GENERAL			
Type Gated Pipe	Structure		
ACCESS TO VALVE/GATE		\square \square \square	
	om shore Walkway By boat other		
	lot tested, but appears functional		
Walkway Condition	<u>N/A</u>		
LOW LEVEL OUTLET COMPO			
Valve Control Device	o Stern parmaged stern other		
Other/Notes			
Operational?	Roorly Not tested		
Notes	Some Leakage	_	
Valve / Gate			
Location	Slanted Gate		
Condition	Under water		
Leakage ✓ es Flow Rate	∟n⁰∘ Negligible		
Flow Nate	negligible		
Outlet Pipe			
Metal Flastic	c oncrete other		
Diameter Condition	600 mm Good condition	_	
Outlet Obstruction	(note vegetation, sediment blockage, etc.)		
Notes			
OUTLET EROSION CONTROL	. STRUCTURE		
Type <u>Concrete</u>			
Concrete Condition	Good		
Outlet Area Seepage	•		
Description Flow Estimate		_	
Location			
Undermining			
Location	Little		
Notes/Cause:		_	
Downstream Channe		X	
Free Draining? Blockages or Potentia	Yes al Blockages? Monitor		
Erosion Control? Rip-	-		

	Eneas Lake	Inspecti	ion Date	22-	Jun-10	Observed	Conditions
Current Weathe	r: Rain	Previou	s Week:			S- Satis	factory
Name of Creek,	Stream, River	Eneas	Creek			F - Fair	
Water Licence:	CL164	16				P - Poor	
Owners Name	The Co	orporation of the	District o	f Summerla	nd	U - Unsa	atisfactory
Address	13211 Henry A	venue				Ni - Not	Inspected
City Summe	erland	Postal Code	V	0H 1Z0			
Telephone	250-404-3000	_Alternate Phone					
Email							
Pre-Inspection	on Interview v	with Owner	* See Past	Reports or of	her File Information	on	
-	sentative prese		No	11000110 01 01		<u> </u>	
	you owned the d		1930's				
Any Prior proble			No				
	fications? (wher	e. when)	No				
Past Failures/In	,		No				
	Fully Operation		Yes				
,	nd plans availab		aterial Kno	wn? No	Foun	dation? No	
	-	ngineer? Unknow		ompany		110	
	uction details kn	-		/here?			
				riicic:			
Downetroom Co			nt				
				lalinas:			
	afety Regulation		nt _CDA Guic	lelines:			
Dam Sa	afety Regulation			lelines:			
Dam Sa	afety Regulation		CDA Guio	lelines: lax. Height o	f Dam: 15 6	63.20	
Dam Sa Dam Informa Type of Dam:	Regulation	Very Low	_CDA Guid				
Dam Sa Dam Informa Type of Dam: Spillway Elevati	afety Regulation tion on:	Very Low Earth Embank	CDA Guid	lax. Height o	1: 2.5 m		
Dam Sa Dam Informa Type of Dam: Spillway Elevati Freeboard (@fu	afety Regulation tion on: Il supply level)	Earth Embanki 1560.2	CDA Guid	lax. Height o pillway Widtl	time of visit)	1	
Dam Sa Dam Informa Type of Dam: Spillway Elevati Freeboard (@fu Reservoir Stora	afety Regulation ition on: Il supply level) ge Volume	Earth Embanki 1560.2 1.2 m	CDA Guid	lax. Height o pillway Widtl reeboard (at	time of visit)	1.2 m	
Dam Sa Dam Informa Type of Dam: Spillway Elevati Freeboard (@fu Reservoir Stora	afety Regulation ution on: Ill supply level) ge Volume	Earth Embanki 1560.2 1.2 m 153 ML	CDA Guid ment M S F	lax. Height o pillway Widtl reeboard (at icenced Stor	time of visit) age Volume	1 1.2 m 616.5	i
Dam Sa Dam Informa Type of Dam: Spillway Elevati Freeboard (@fu Reservoir Stora Dam Environ Drainage Area S	afety Regulation ation on: Ill supply level) ge Volume ament Size	Earth Embanks 1560.2 1.2 m 153 ML	CDA Guid	lax. Height o pillway Width reeboard (at icenced Stor eservoir Are	a: 2.5 m time of visit) age Volume	1.2 m 616.5 7 ha	i
Dam Sa Dam Informa Type of Dam: Spillway Elevati Freeboard (@fu Reservoir Stora Dam Environ Drainage Area S	afety Regulation ition on: ill supply level) ge Volume iment Size lood: Q m³/s	Earth Embanki 1560.2 1.2 m 153 ML 310 ha	CDA Guid	lax. Height o pillway Width reeboard (at icenced Stor eservoir Are lood AEP (R	a: 2.5 m time of visit) age Volume a: eturn Period)	1 1.2 m 616.5	i
Dam Sa Dam Informa Type of Dam: Spillway Elevati Freeboard (@fu Reservoir Stora Dam Environ Drainage Area S	afety Regulation tion on: Il supply level) ge Volume ment Size lood: Q m³/s	Earth Embanki 1560.2 1.2 m 153 ML 310 ha	CDA Guid	lax. Height o pillway Width reeboard (at icenced Stor eservoir Are lood AEP (R	a: 2.5 m time of visit) age Volume	1.2 m 616.5 7 ha	i
Dam Sa Dam Informa Type of Dam: Spillway Elevati Freeboard (@fu Reservoir Stora Dam Environ Drainage Area S Inflow Design F Other Inflow Stu	afety Regulation tion on: Il supply level) ge Volume ment Size lood: Q m³/s idy: Q m³/s	Earth Embanki 1560.2 1.2 m 153 ML 310 ha 7.7	CDA Guid	lax. Height o pillway Width reeboard (at icenced Stor eservoir Are lood AEP (R lood AEP (R	time of visit) age Volume a: eturn Period) eturn Period)	1.2 m 616.5 7 ha	i
Dam Sa Dam Informa Type of Dam: Spillway Elevati Freeboard (@fu Reservoir Stora Dam Environ Drainage Area S Inflow Design F Other Inflow Stu	afety Regulation ation on: Il supply level) ge Volume ament Size lood: Q m³/s idy: Q m³/s ion Evaluatio	Earth Embanki 1560.2 1.2 m 153 ML 310 ha 7.7 6	CDA Guid	lax. Height o pillway Width reeboard (at icenced Stor eservoir Are lood AEP (R lood AEP (R	a: 2.5 m time of visit) age Volume a: eturn Period) eturn Period) as required	1.2 m 616.5 7 ha	i
Dam Sa Dam Informa Type of Dam: Spillway Elevati Freeboard (@fu Reservoir Stora Dam Environ Drainage Area S Inflow Design F Other Inflow Stu Post Inspect Evaluate any ne	afety Regulation ation on: Il supply level) ge Volume ament Size lood: Q m³/s idy: Q m³/s ion Evaluation	Earth Embanki 1560.2 1.2 m 153 ML 310 ha 7.7 n - Elaborate in the inundation	ment M S F Li R F F In the Inspector	lax. Height o pillway Width reeboard (at icenced Stor eservoir Are lood AEP (R lood AEP (R ection Report instream	a: 2.5 m time of visit) age Volume a: eturn Period) eturn Period) as required No	1.2 m 1.2 m 616.5 7 ha 200 yr IDF	i
Dam Sa Dam Informa Type of Dam: Spillway Elevati Freeboard (@fu Reservoir Stora Dam Environ Drainage Area S Inflow Design F Other Inflow Stu Post Inspect Evaluate any ne Should new dev	afety Regulation ation on: Ill supply level) ge Volume ament Size lood: Q m³/s ady: Q m³/s ion Evaluation and development relopment initiate	Earth Embanks 1560.2 1.2 m 153 ML 310 ha 3 7.7 3 In the inundation of a review of the (ment M S F Li R F F In the Inspector	lax. Height o pillway Width reeboard (at icenced Storeservoir Are lood AEP (Rection Reportestream ace Classifica	a: 2.5 m time of visit) age Volume a: eturn Period) eturn Period) as required No ation?	1.2 m 1.2 m 616.5 7 ha 200 yr IDF	·
Dam Sa Dam Informa Type of Dam: Spillway Elevati. Freeboard (@fu Reservoir Stora Dam Environ Drainage Area S Inflow Design F Other Inflow Stu Post Inspect Evaluate any ne Should new dev OMS Manual Co	afety Regulation ation on: Ill supply level) ge Volume ament Size lood: Q m³/s ady: Q m³/s con Evaluation and Evaluation an	Earth Embanki 1560.2 1.2 m 153 ML 310 ha 3.7.7 3. n - Elaborate in the inundation a review of the 0 OMS Ac	ment M S F Li In the Inspector consequer dequate?	lax. Height o pillway Width reeboard (at icenced Stor eservoir Are lood AEP (R lood AEP (R ection Report instream	a: eturn Period) eturn Period) as required nation? OMS being for	1.2 m 1.2 m 616.5 7 ha 200 yr IDF No ollowed?	i
Dam Sa Dam Informa Type of Dam: Spillway Elevati Freeboard (@fu Reservoir Stora Dam Environ Drainage Area S Inflow Design F Other Inflow Stu Post Inspect Evaluate any ne Should new dev OMS Manual Cu EPP Manual Cu	afety Regulation ation on: Il supply level) ge Volume ament Size lood: Q m³/s ady: Q m³/s ady: Q m³/s aw development relopment initiate aurrent? NO Interest?	Earth Embanki 1560.2 1.2 m 153 ML 310 ha 7.7 The interior of the Grant of the Gra	ment M S F Lin the Inspector consequer dequate?	lax. Height o pillway Width reeboard (at icenced Stor eservoir Are lood AEP (R lood AEP (R ection Report estream ice Classifica Yes	a: eturn Period) eturn Period) as required No etion? OMS being fo	1.2 m 616.5 7 ha 200 yr IDF No ollowed?	Yes
Dam Sa Dam Informa Type of Dam: Spillway Elevati: Freeboard (@fu Reservoir Stora Dam Environ Drainage Area S Inflow Design F Other Inflow Stu Post Inspect Evaluate any ne Should new dev OMS Manual Cu EPP Manual Cu DSR Required?	afety Regulation ation on: Ill supply level) ge Volume ament Size lood: Q m³/s ady: Q m³/s ady: Q m³/s and Evaluation and E	Earth Embanki 1560.2 1.2 m 153 ML 310 ha 7.7 n - Elaborate in the inundation e a review of the 0 OMS Ad EPP Ad DSR co	ment M S F Linthe Inspector dequate? dequate? dequate? dequate defuncted def	lax. Height o pillway Width reeboard (at icenced Stor eservoir Are lood AEP (R lood AEP (R ection Report estream ice Classifica Yes	a: eturn Period) eturn Period) as required No etion? OMS being for EPP being ex Deficiencies in	1.2 m 616.5 7 ha 200 yr IDF No ollowed?	Yes
Dam Informa Type of Dam: Spillway Elevati Freeboard (@fu Reservoir Stora Dam Environ Drainage Area S Inflow Design F Other Inflow Stu Post Inspect Evaluate any ne Should new dev OMS Manual Cu EPP Manual Cu DSR Required? Site Access - sit	afety Regulation ation on: Ill supply level) ge Volume ament Size lood: Q m³/s ady: Q m³/s ady: Q m³/s and Evaluation and	Earth Embanki 1560.2 1.2 m 153 ML 310 ha 7.7 The interior of the Grant of the Gra	ment M S F Linthe Inspector dequate? dequate? dequate? dequate definition and m	lax. Height o pillway Width reeboard (at icenced Stor eservoir Are lood AEP (R lood AEP (R ection Report estream ice Classifica Yes eate? eate? eate?	a: eturn Period) eturn Period) as required No etion? OMS being for EPP being ex Deficiencies in	1.2 m 616.5 7 ha 200 yr IDF No ollowed?	Yes

			Required A	ction
			None Monitor Maintenance	Repair Not Applicable
Emb	ankment	t Dam		
1. Up:	stream SI	one		
• •	VEGETATION	-		пп
	<u>Type</u>	Small Shrubs/Grass Location		
	SLOPE PROTE	Recommendations:		\Box
	Type	None/Sparse/Dense		чч
		Notes Shrubs, grass and cluster of boulders near spillway		
	EROSION	Type (wave/runoff/unknown) NONE Length Width		ЦЦ
	INSTABILITIES	Notes None Noted	ПхП	пп
		s (Yes/No/Could not Inspect) NONE		шш
		Length Width Location		
	Crack	Notes/Causes ss (Transverse/Longitudinal/Other' NONE		\Box
	Clack	Quantity Length Width	L X L	чч
		Location		
	Rulge	Notes/Causes None es/Depressions/Hummocky		пп
	Duige	Size Height Depth		шш
		Location		
	OTHER	Notes/Causes None	ТхП	\neg
		ws, Ruts, Other Concert BURROWS		шш
		Location Small Rodents		
		Notes/Causes		
2. Cre	est			
	ACCESS		X	
		re public access to the crest? YES crest marked or signed? NO		
		nicle access to the crest restricted? NO		
	VEGETATION	NO		
	Trees	NO Location		υц
		Notes		
	<u>Brush</u>		X	\Box
		LocationNotes		
	Groun	nd Cover BARE	X	
		Quantity (bare/sparse/adequate/dense)		
		Appearance (too tall/too short/good) Notes		
	EROSION	NONE	X	
		Type (wave/runoff/unknown)		
		LengthWidthNotes		
	SETTLEMENT	NONE		
		Location		
		Notes/Causes		

					Required	d Action
					eou	Repair Not Applicable
					None Monitor Maintenance	pair t Appli
INSTAB	II ITIES				None X Monitor Mainten	Repair Not Ap
INSTABI		verse/Longitudinal/Other	r) NONE			
	Qua	ntityLength				
		ition s/Causes				
OTHER	14016					
	Burrows, Ruts Loca	Other Concerns	NONE		Х	
	Note	s/Causes				
Downstr	eam Slop	e				
VEGETA	-				Х	тпг
	<u>Trees</u>	NO				
	Loca Note					
	Brush	NONE			Х	тпг
	Loca				_	
	Note					
	Ground Cover Note					1 11 1
SLOPE	PROTECTION	is inioderate Cover				тпг
0_0	Type	NONE				
	Note	Grass and shrubs				
EROSIO		tion NONE			Х	IJ L L
	Loca Note	ition NONE				
INSTAB		NONE			Х	тпг
	Slides Leng		Location			
		s/Causes verse/Longitudinal/Other	r) NONE			7
		ntityLength			X	
	Loca	ition				
		s/Causes				
	Bulges/Depres Size	ssions/Hummocky Height	NONE Depth		Х	1 11 1
	Loca		Deptil			
	Note	s/Causes				
OTHER	Durrous Dut-	Other Concesses	CMALL DODENTO		ТХ	7 [-
	Loca	Other Concerns	SMALL RODENTS		X	1 11 1
		s/Causes				
SEEPAG					Х] 🗆 🖸
		//Boil/Sinkhole Rate	WET AREAS			
	Loca					
		atic Vegetation	(Yes/No)			
		Colored Deposits ment in Flow	(Yes/No)			
	Othe		(Yes/No)			
	Note	s/Causes				
EMBANI	KMENT DRAIN	NONE F	OUND			
	Type Flow rate	Size	Number			
	Location	OIZE	INGITIDE			
	Notes					
_	-	MENTATION CONDITIO				
V	Diame: foundi	Piezometers	Weir	flume		
	Notes					

		Re	quire	ed Ac	tior	1
		None	Monitor	Maintenance	Кераіг	Not Applicable
Spillway						
GENERAL CONDITION	ONS					
Type Concrete A	Apron with wingwalls	∐ L	┚┖	┚╻	Χ	
Notes Upper part	t of walls braced to prevent inward tilt					
1. Spillway Crest o	or Control Section					
OBSTRUCTION			Х	7 [1	П
<u>Debris</u>	Some					
L	ocation Some logs and debris lodged in Channel and concrete					
N	otes Log (Boom?) across front of structure	-				
<u>Vegetation</u>	•					
	ocation Soil has subsided					
	loteseaver activity, trash rack problems, etc.)					
No Log Bo						
SPILLWAY CREST I	MATERIALS		X		1	
C	Condition Concrete - Rectangular (4.57 m wide)					
N	lotes Spilling at time (approximately 15 cm)					
OTHER CRILLINAY	CDECT DDOD! EMC					
OTHER SPILLWAY (Damage		х	ΠГ	7 [1	П
	ocation				_	Ч
	lotes/Cause					
2. Spillway Conve	yance Section: Channel, Chute or Conduit					
OPEN CHANNEL CF	ROSS SECTION Rectangular] [] [Χ	
CHANNEL OBSTRU	CTION Concrete Abutment - Off Vertical] [X	
	Ground has subsided around concrete		Ţ,		_	
SPILLWAY CONVEY	YANCE MATERIALS Walls - Failing	ШL	┚┖	IJ Į	X	Ш
	Pressure on Vertical walls					
	CONVEYANCE PROBLEMS	пг	¬г	ਹ [_	П
<u>Damage</u>	continue Changel aut through woods	ЦΙ	_	X	_	Ц
	ocation Channel cut through woods lotes/Cause Some rocks, debris and logs	-				
IN	Some rocks, debris and rogs					
3. Energy-Dissipat	ting or Terminal Section					
EROSION CONTRO	L STRUCTURE		Х] [
Type N	lone					
R	tiprap Channel					
Notes T	emporary footbridge could plug spillway in major event.					

	R	equir	red A	ction	
Low Level Outlet	None	Monitor	Maintenance	Repair	Not Applicable
GENERAL GENERAL	П	Х	П	П	П
Type Gated Pipe Structure		لندر		ш,	
ACCESS TO VALVE/GATE	Х		П		
Not accessible from shore Walkway boat Other					
Notes Locked - Not tested, but appears functional	_				
Walkway Condition N/A					
LOW LEVEL OUTLET COMPONENTS Valve Control Device ✓ ves None No Stem Damaged stem Other		X			
Other/Notes Unknown. We had worries it might not seal properly. Operational? Ves Notes Some Leakage			X		
Valve / Gate Location Slanted Gate Condition Gate Requires Key		X			
Leakage		X			
Outlet Pipe		X	П		
Metal Plastic ✓Concrete Dther					
Diameter 600 mm - Approximately 23 m long Condition Good condition	_				
Outlet Obstruction (note vegetation, sediment blockage, etc.) Notes Several Logs					
OUTLET EROSION CONTROL STRUCTURE Type <u>Concrete</u>		X			
Concrete Condition Good	П	х	П	П	П
Outlet Area Seepage		Х			
Description Flow Estimate					
Location	-				
Undermining Location Notes/Cause:		X			
Downstream Channel Channel cut into Bank, some sloughing Free Draining? Blockages or Potential Blockages? Some rock and debris inside			X		_
Erosion Control? Rip-Rap? Adequate					

Dam Safety Inspection Checklist

Name of Dam Weather:	Garnet Dam Overcast - Cool	Previo	tion Date		29-7	Apr-10	S- Satis	Conditions actory
Name of Creek		Eneas	Creek				F - Fair	
Water Licence: Owners Name		rporation of th	a Distric	t of Sum	merlan		P - Poor	atisfactory
Address	13211 Henry A		C DISTITIO	t or ourn	inciian	<u>u</u>	_	Inspected
City Summ		Postal Code		V0H 1Z	0			
Telephone	250-404-3000	Alternate Phon	ie				_	
Email							_	
D								
-	on Interview v			ast Repor	ts or oth	er File Information	<u> </u>	
	esentative preser		No 1930's					
Any Prior proble	you owned the d	amr	No					
	lifications? (where	e when)	No					
	ncidents/Breach?	o, whom	No					
	y Fully Operation	al?	Yes					
	and plans availab		/laterial K	nown?	Yes	Founda	ation? Yes	
	esigned by an Er			Compar				
	uction details kno			Where?	,		_	
Downstream Co	onsequence Clas	sification - Curre	ent	_				
	afety Regulation			uidelines	:			
	, 0							
Dam Informa	ation							
Type of Dam:		Earth Embank	kment	Max. He	ight of	Dam: 634.	84	
Spillway Elevat	ion:	632.72		Spillway	Width:		12.2 m	
Freeboard (@fu	ull supply level)	2.12 n	า	Freeboa	rd (at t	ime of visit)	2.2 m	
Reservoir Stora	age Volume	2304 ML (Live	·)	Licence	d Stora	ge Volume	1850 M	
D								
Dam Enviro				_				
Drainage Area	•	5680 ha		Reservo			97 acre	S
Inflow Design F				_	,	turn Period)		
Other Inflow St	udy: Q m³/s			_ Flood A	EP (Re	turn Period)		
Post Inspect	tion Evaluatio	n - Flahorat	e in the In	spection F	Report a	s required		
•	ew development	· · · · · · · · · · · · · · · · · · ·				No		
•	velopment initiate						No	
OMS Manual C	•		Adequate		Yes	OMS being foll		Yes
EPP Manual Co			.dequate?		Yes	EPP being exe		Yes
DSR Required?			ompleted		06/10	_ Deficiencies Ac	-	No
•	Site Access - site access adequate for safe opera							Yes
	erns in the water							No
•								

Inspected by:

Rod MacLean, P. Eng. (Associated Engineering)
Gerald Imada, P. Eng. (Golder Associates)

								Required Action				n
								None	Monitor	Maintenance	Repair	Not Applicable
∟mb	ankm	ent D	am									
1. Up	stream	1 Slop	e									
•	VEGETA	-						ПΙ	Х	П	П	П
		Type .	Little			Location	Above high water				_	
				endations:					_	_	_	
	SLOPE P		ION		NONE			ЦΙ	Х	Ц	Ц	Ц
		<u>Type</u>	Notes	None/Spa	irse/Dens	se						
	EROSION		110100					ПΙ	Х	П	П	П
			Type (wave/runot	ff/unknow	vn)		_ '			_	
				Length		Width						
	INOTABI		Notes	Minor Wa	ive erosi	ion		—		_	П	Н
	INSTABIL		es/No/Co	uld not Insp	nect)	NONE		ШΙ	Χ	ш	Ц	Ц
			Length		Width	NONE	Location					
			Notes/Ca					<u>L</u> .		_	_	
				e/Longitudi		r) NONE		ЦI	Х			
			Quantity		Length			 -				
			Location Notes/Ca		None			-				
				ns/Hummod				пι	Х	П	П	П
			Size		Height		Depth	ш,	^	ш	ш	ш
			Location		- 3							
			Notes/Ca	auses	None				_	_		
	OTHER	_						ШΙ	X	Ш	Ш	Ш
			Ruts, Oth Location	er Concer	Small R							
			Notes/Ca		Jiliali K	ouents		-				
2. Cre	est											
	ACCESS								X			
				ess to the c		YES						
				d or signed o the crest		NO NO						
	VEGETA		access to	o the crest	restricted	a: 140						
		Trees		NO				ПΙ	X	П	П	П
			Location								_	
			Notes							_	_	
		<u>Brush</u>		NONE				ЦΙ	X	Ц	Ц	Ц
			Location Notes					-				
		Ground C		BARE				пι	X	П	П	П
				(bare/spars	se/adequ	ate/dense)	ш,	^`	ш	ш	ш
			Appeara	nce (too tal	I/too sho	rt/good)						
			Notes						_	_		
	EROSION		NONE	, ,		,		ЦΙ	X	П	Ц	Ц
			Type (wave/runol Length	ıı/unknow	vn) Width						
			Notes	Lengui		_ vvidti						
	SETTLEN			NONE					X	П	П	П
			Location					_ '				
			Notes/Ca	auses								

		Required Action
		X None Monitor Maintenance Repair Not Applicable
INSTABILITIES	(Transverse / on situdinal/Other) NONE	lacksquare $lacksquare$
Cracks	s (Transverse/Longitudinal/Other) NONE Quantity Length Width	
	Location	
071150	Notes/Causes	
OTHER Burrow	vs, Ruts, Other Concerns NONE	lacksquare
Bullot	Location	
	Notes/Causes	
Downstream	Slone	
VEGETATION	Ciope	lacksquare
Trees	NO	
	Location	
5 .	Notes	
<u>Brush</u>	NONE Location	
	Notes	
Ground	d Cover GRASS	lacksquare
	Notes	
SLOPE PROTE		oxdot $oxdot$ $oxdot$ $oxdot$
<u>Type</u>	NONE Notes	
EROSION		
	Location NONE	
INSTABILITIES	Notes	
Slides	NONE Length Width Location	
Ciidoo	Notes/Causes	
Cracks	s (Transverse/Longitudinal/Other) NONE	
	QuantityLengthWidth	
	LocationNotes/Causes	
Bulges	s/Depressions/Hummocky NONE	
	SizeHeightDepth	
	LocationNotes/Causes	
OTHER	INDIES/ OduSES	
	vs, Ruts, Other Concerns NONE	
	Location	
SEEPAGE	Notes/Causes	
	rea/Flow/Boil/Sinkhole Minor Seepage	
	Flow Rate	
	Location West side @ toe	
	Aquatic Vegetation (Yes/No) YES Rust Colored Deposits (Yes/No) YES	
	Sediment in Flow (Yes/No) NO	
	Other	
EMD ANGMENT	Notes/Causes	
EMBANKMENT Type	DRAINS NONE FOUND	
Flow ra	ate Size Number	
Location		
Notes	NOTE UMENTATION CONDITION	
_	NSTRUMENTATION CONDITION meti □biezometers □Weir □flume	
Dinne: fina	ındı	
Notes	2 weirs. One in seepage area and one at outlet structure.	

	Required Action				n
	None	Monitor	Maintenance	Repair	Not Applicable
Spillway					
GENERAL CONDITIONS				_	
Type Concrete Spillway and Channel			Х		
Notes East side of dam	_				
1. Spillway Crest or Control Section OBSTRUCTION	П	X	П	П	П
Debris Some	ш		ш	ш	ч
Location Logs in the lake and just downstream of concrete.					
Notes	Non	Mor	Maii	Rep	Not
<u>Vegetation</u> Sparse					
Location Minor grass growing in expansion joints	_				
Notes	_				
Other (beaver activity, trash rack problems, etc.) Log boom intact at mouth.					
SPILLWAY CREST MATERIALS	П	Х	П	П	П
Condition Concrete - Rectangular		_	ш	_	Н
Notes Maintains water level Mild vertical cracks					
OTHER SPILLWAY CREST PROBLEMS		П			
<u>Damage</u> None	Х	Ц	Ц	Ц	Ц
Location Notes/Cause	_				
Notes/Cause					
2. Spillway Conveyance Section: Channel, Chute or Conduit					
OPEN CHANNEL CROSS SECTION Riprap		X			
CHANNEL OBSTRUCTION Access road crosses spillway channel		X			
SPILLWAY CONVEYANCE MATERIALS		X			
OTHER SPILLWAY CONVEYANCE PROBLEMS					
<u>Damage</u> Culvert Crossing at road is not large enough and will wash away in major floo	od		П	X	
Location					
Notes/Cause Access will be compromised in large storm.	_				
3. Energy-Dissipating or Terminal Section					
EROSION CONTROL STRUCTURE	x	П	П	П	П
Type NONE		Ц	Ц	Ш	
Notes					

		Re	quired	l Action	1
ovel avail Ovellat		None	Monitor Maintenance	Repair	Not Applicable
W Level Outlet GENERAL			х	П	Н
Type Gated Pipe Structure	None	ш		.	Ш
ACCESS TO VALVE/GATE		X		ιП	П
Not accessible from shore	/alkway By boat Other				
Notes Locked - Functional					
Walkway Condition <i>N/A</i>					
LOW LEVEL OUTLET COMPONENTS					
Valve Control Device ✓ Yes \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	Damaged stem Other	Ш	X	lЦ	Ц
Other/Notes Hand	l Wheel is broken				
Operational? Ves No Poorly Notes	Not tested			X	
Valve / Gate			Х		
	cal Gate in Chamber er water	_			
Leakage	icible		х	ΙO	
	gibie	_	a =		
Outlet Pipe	Dut	Ш	Х	lЦ	Ц
MetalPlastic _✓¢oncrete Diameter 600 mm	Other	_			
Condition Good conditio	n				
Outlet Obstruction (note Notes	vegetation, sediment blockage, etc.)				
OUTLET EROSION CONTROL STRUCTUR	E		X 🗌		
Type <u>Concrete</u>		_		. —	
Concrete Condition Good	d	_Ц	X	ıЦ	Ц
Outlet Area Seepage			X		
Description Some growth Flow Estimate Location					
Undermining			\mathbf{x}		П
Location Negligible				اسيد	
Notes/Cause: Outlet and char Downstream Channel	nnel level are flat sloped. Evidence of earth movem			I 🗆	
Free Draining?	Into channel, and swamp downstream Yes	_Ц		ιШ	Ш
Blockages or Potential Blockages?	Monitor				
Erosion Control? Rip-Rap?	Good				

Dam Safety Inspection Checklist

Current Weather: Name of Creek, Stream Water Licence: Owners Name Address 13211 City Summerland	CL 16414 The Corporat Henry Avenue Posta	Inspection Date Previous Week Findlay Creek ion of the District I Code ate Phone			Observed Conditions S- Satisfactory F - Fair P - Poor U - Unsatisfactory Ni - Not Inspected
Pre-Inspection Int	erview with O	wner * See P	ast Reports or other File I	nformation	
Owner or Representat		No	•		
How long have you ow	•	1930's			
Any Prior problems?		No			
Repairs or Modification	ns? (where, wher	n) No			
Past Failures/Incidents		No			
Works Currently Fully	Operational?	Yes			
Design report and plar	ns available No	Dam Material K	nown? No	Foundation	on? No
Was the dam designed	d by an Engineer	? Unknown	Company		
Are dam construction of	details known?	Unknown	Where?		
Downstream Consequ	ence Classification				
Dam Safety R	egulation High	CDA G	uidelines:		
Dam Information					
Type of Dam:		Embankment	Max. Height of Dam:	1569.72	<u>. </u>
Spillway Elevation:		68.65	_Spillway Width:	3.05 m	
Freeboard (@full supp	Freeboard (@full supply level)				
· · · · · · · · · · · · · · · · · · ·		1.07	Freeboard (at time of v	,	1 m
Reservoir Storage Vol	•	1.07 309 ML	_Freeboard (at time of v _Licenced Storage Volu	,	1 m 300
Reservoir Storage Vol	ume		_ `	,	
Reservoir Storage Vol	ume	309 ML	Licenced Storage Volu	,	300
Reservoir Storage Volument Drainage Area Size	ume	309 ML	Licenced Storage Volu	ime	300 52 ac
Dam Environment Drainage Area Size Inflow Design Flood:	ume : : Q m³/s	309 ML	Licenced Storage Volu Reservoir Area: Flood AEP (Return Pe	riod)	300
Reservoir Storage Volument Drainage Area Size	ume	309 ML	Licenced Storage Volu	riod)	300 52 ac
Dam Environment Drainage Area Size Inflow Design Flood: Other Inflow Study:	Q m ³ /s Q m ³ /s	309 ML 6.1	Licenced Storage Volu Reservoir Area: Flood AEP (Return Pe Flood AEP (Return Pe	riod) riod)	300 52 ac
Dam Environment Drainage Area Size Inflow Design Flood: Other Inflow Study: Post Inspection Experience of the state of th	ume 244 ha Q m³/s Q m³/s	6.1 Elaborate in the In	Licenced Storage Volu Reservoir Area: Flood AEP (Return Pe Flood AEP (Return Pe	riod) _ riod) _ red	300 52 ac
Dam Environment Drainage Area Size Inflow Design Flood: Other Inflow Study: Post Inspection Evaluate any new devi	ume 244 ha Q m³/s Q m³/s Valuation - elopment in the in	6.1 Elaborate in the Innundation zone do	Licenced Storage Volu Reservoir Area: Flood AEP (Return Pe Flood AEP (Return Pe	riod) _ riod) _ riod) _ <u>ed</u> 	300 52 ac 1:200
Dam Environment Drainage Area Size Inflow Design Flood: Other Inflow Study: Post Inspection Evaluate any new developm	ume 244 ha Q m³/s Q m³/s Valuation - elopment in the in ent initiate a revie	6.1 Elaborate in the Innundation zone doew of the Consequence	Reservoir Area: Flood AEP (Return Pe Flood AEP (Return Pe spection Report as require townstream uence Classification?	riod) riod) riod) <u>ed</u> <u>No</u>	300 52 ac 1:200
Dam Environment Drainage Area Size Inflow Design Flood: Other Inflow Study: Post Inspection Evaluate any new developm OMS Manual Current?	Q m³/s Q m³/s Q m³/s valuation - elopment in the inent initiate a revie	6.1 Elaborate in the Innundation zone do ew of the Conseque OMS Adequate	Reservoir Area: Flood AEP (Return Pe Flood AEP (Return Pe spection Report as require winstream uence Classification? Yes OMS	riod) riod) ed No being follow	300 52 ac 1:200
Dam Environment Drainage Area Size Inflow Design Flood: Other Inflow Study: Post Inspection Evaluate any new developm OMS Manual Current? EPP Manual Current?	Q m³/s Q m³/s Q m³/s Valuation - elopment in the inent initiate a review NO Yes	6.1 Elaborate in the Innundation zone doew of the Conseque OMS Adequate EPP Adequate 3	Reservoir Area: Flood AEP (Return Pe Flood AEP (Return Pe Spection Report as require swinstream uence Classification? Yes OMS Yes EPP to	riod) riod) riod) ed No being follow	300 52 ac 1:200 lo ed? Yes sed? Yes
Dam Environment Drainage Area Size Inflow Design Flood: Other Inflow Study: Post Inspection Evaluate any new developm OMS Manual Current? EPP Manual Current? DSR Required?	Q m³/s Q m³/s Q m³/s Valuation - elopment in the inent initiate a review NO Yes No	6.1 Elaborate in the Innundation zone do ew of the Conseque OMS Adequate EPP Adequate DSR completed	Reservoir Area: Flood AEP (Return Pe Flood AEP (Return Pe Flood AEP (Return Pe spection Report as require swinstream uence Classification? Yes OMS Yes EPP to	riod) riod) ed No being follow	300 52 ac 1:200 10 ed? Yes sed? Yes essed? No
Dam Environment Drainage Area Size Inflow Design Flood: Other Inflow Study: Post Inspection Evaluate any new developm OMS Manual Current? EPP Manual Current?	Q m³/s Q m³/s Q m³/s valuation - elopment in the ir ent initiate a revie NO Yes No ess adequate for	6.1 Elaborate in the Innundation zone doew of the Conseque OMS Adequate EPP Adequate DSR completed safe operation and	Reservoir Area: Flood AEP (Return Pe Flood AEP (Return Pe Flood AEP (Return Pe spection Report as require swnstream uence Classification? Yes OMS Yes EPP to I date? Deficited	riod) riod) riod) ed No being follow	300 52 ac 1:200 lo ed? Yes sed? Yes

Inspected by:

Rod MacLean, P. Eng. (Associated Engineering)
Gerald Imada, P. Eng. (Golder Associates)

			Required Action			n	
			None	Monitor	Maintenance	Repair	Not Applicable
Emb	oankment L	Dam					
1 Ur	stream Slo	ne					
•	VEGETATION		п	П	Х	П	П
	Type	Some Grass Location Near water edge		ш	_	ш	Н
	OLODE DDOTEO	Recommendations: Excessive Growth	_		_	П	
	SLOPE PROTEC	None/Sparse/Dense	Ч	Х	Ц	Ц	Ц
	<u>.,,po</u>	Notes				_	
	EROSION	Type (wave/runoff/unknown) Length Width		Х			
	INCTA DII ITIEC	Notes Minor Wave	_		_	П	
	INSTABILITIES Slides ()	/es/No/Could not Inspect)	Ш	Х	Ц	Ш	Ш
	Olides (1	Length Width Location					
		Notes/Causes None	_		_	_	
	Cracks (Transverse/Longitudinal/Other) QuantityLengthWidth Location		х	Ц	Ц	Ц
	Pulaco/I	Notes/Causes None Depressions/Hummocky		V		П	П
	Bulges/L	Size Height Depth	ч	Х	ш	ш	Ц
		Location					
	OTHER	Notes/Causes None	_		_	П	
		, Ruts, Other Concerns Location		Х	Ц	Ц	Ц
		Notes/Causes None					
2. Cr	est						
	ACCESS		П	X	П	П	П
	Is the cr	public access to the crest? YES est marked or signed? NO e access to the crest restricted? NO					
	VEGETATION					_	
	Trees	NO Lasation	Ш	X	Ш	Ш	Ц
		LocationNotes	_				
	<u>Brush</u>	NONE		Χ			
		Location					
	Ground	Notes Cover BARE	-	X	П	П	П
	<u> Siodila</u>	Quantity (bare/sparse/adequate/dense) Appearance (too tall/too short/good)			ш	ш	
	EROSION	Notes NONE	П	X	П	П	
		Type (wave/runoff/unknown) Length Width			Ц	Ч	Ч
	SETTLEMENT	NotesNone	$\neg \neg$	X	П	П	П
	CL!!LLINLIN!	Location	Ш		Ц	ш	Ш
		Notes/Causes					

					F	Require	ed Action
					None	Monitor	Maintenance Repair Not Applicable
INSTABILITI						Χ	\sqsupset \square \square
Cra		e/Longitudinal/Other)		NONE			
	Quantity Location	Length		Width			
	Notes/Ca						
OTHER							
Bu	rrows, Ruts, Oth Location					Χ	
	Notes/Ca	uses					
3. Downstrea	m Slope						
VEGETATIO	-					X	тпп
	ees	NO					
	Location						
	Notes						
<u>Bru</u>	<u>ısh</u>	SPARSE				Х	$\sqcup \sqcup \sqcup$
	Location						
	Notes	DADE					
Gr	ound Cover	BARE				^	
SLOPE PRO	Notes					∇	7 0 0
SLOPE PRO		NONE					
<u>1 y</u> 1	Notes	NONL					
EROSION						X	\neg \Box \Box
	Location	NONE				ш.	
	Notes						
INSTABILITI	ES	NONE				X	\Box \Box \Box
Slie	des Length	Width		Location		_	
	Notes/Ca				_		
Cra		e/Longitudinal/Other)		NONE	Ц	Χ	ᆚᄔᄔ
		Length		Width			
	Location Notes/Ca						
Ru			NONE			Х	
54	Size	Height		Depth		ا لا	
	Location						
	Notes/Ca	uses					
OTHER					_		
Bu	rrows, Ruts, Oth	er Concerns	NONE		Ц	Χ	ᆚᄔᄔ
	Location						
SEEPAGE	Notes/Ca	uses					
	et Area/Flow/Boil	/Sinkholo	Wet Area			Х	
VVE	Flow Rate		Wel Alea				
	Location		of outlet. a	nd along of abutment			
	Aquatic V	/egetation	(Yes/No)				
		ored Deposits	(Yes/No)				
	Sediment	in Flow	(Yes/No)				
	Other						
EMBANKME	Notes/Ca	NONE FO	סואוס				
Tyl		NONETO	JUND		<u> </u>	ш	
	w rate	Size		Number			
	cation			- 1120 201			
	tes						
MONITORIN	G INSTRUMENT	TATION CONDITION	N		П		X
✓ Niam	e ffound	Piezometers	Weir	Flume			
No	tes						

		Re	qui	red A	ctio	n
		None	Monitor	Maintenance	Repair	Not Applicable
Spillway						
GENERAL CONDITI	IONS					
Type Earthen C	hannel Spillway - Trapezoid Concrete Weir	ШΙ	X		Ш	Ш
Notes South of L	Dam - Flowing South					
1. Spillway Crest of	or Control Section					
OBSTRUCTION		ПΙ	X	П	П	П
<u>Debris</u>	Being cut when we were there.			_	_	
L	_ocation	_		_	_	
N	Notes No Log Boom	No.	Mor	Mai	Rep	Not
<u>Vegetation</u>	•					
	ocation Well maintained.	_				
	Notes Lots of mosquitos	-				
<u>Other</u> (b	beaver activity, trash rack problems, etc.)					
SPILLWAY CREST	MATERIALS	пι	X	П	П	П
	Condition Concrete - Trapezoidal	ш.	ت	ш	ш	Н
	Notes Spilling at time (approximately 15 cm)					
OTHER SPILLWAY	CREST PROBLEMS					
<u>Damage</u>	None	Χ	Ш	Ц	Ц	Ш
	ocation					
Ŋ	Notes/Cause	_				
2. Spillway Conve	yance Section: Channel, Chute or Conduit					
OPEN CHANNEL C	ROSS SECTION		X	П		
0114111151 00000	10 7 1011	н.	V	П	П	П
CHANNEL OBSTRU	ICTION	ШΙ	X	Ш	Ш	Ш
SPILLWAY CONVE	YANCE MATERIALS		X			
OTHER SPILLWAY	CONVEYANCE PROBLEMS					
<u>Damage</u> N	No access to dam when spillway in operation.	П	Х	П	П	П
L	ocation	_	_			
N	Notes/Cause					
3. Energy-Dissipa	ting or Terminal Section					
EROSION CONTRO			X	П		
Type /	None				اسد	
Notes						

					Required Action					
Low Lovel Outlet			None Monitor	Maintenance	Repair	Not Applicable				
Low Level Outlet			Пх		П	П				
	e Structure	None		, 1_1	ш	Ш				
ACCESS TO VALVE/GATE			X		П	Н				
	i	vay By boat Other		. L	ш	Ц				
	rom shore Walkw									
Notes <u>Locked</u> -	Not tested, but ap	pears functional								
Walkway Condition_	N/A		_							
LOW LEVEL OUTLET COMP Valve Control Devic ✓/esNone _	e	maged stem		ΙП						
Other/Note	es									
Operational? Ves Notes		lot tested pproximately 1/2 cfs		X						
Valve / Gate Location	Slanted		□ x							
Condition	Under w	rater	_							
Leakage Ves	No		X							
Flow Rate	Negligib	ile	-							
Outlet Pipe			X							
✓ Metal Plas	tic Concrete D	Other								
Diameter										
Outlet Obstruction	Good condition (note veg Sediment should	getation, sediment blockage, etc.) be kept clear.	-							
OUTLET EROSION CONTRO	L STRUCTURE		X	ΙП						
Type <u>Concrete</u>			_							
Concrete Condition	n Good					П				
Outlet Area Seepag	ne			П	П	П				
Description					_					
Flow Estimate Location			_							
-				. —	_					
Undermining Location	End was cloqued	with rocks, but cleaned after.	Х	ıШ	Ц	Ш				
-	Was cleaned out	•								
Downstream Chan Free Draining?	nel	Channel cut into Bank, some sloughing Yes		X						
Blockages or Potent	_	Monitor								
Erosion Control? Rip	o-Rap?	Fair - Could use some maintenance								

Dam Safety Inspection Checklist

Current Weathe	Whitehead La		tion Date	30-	Apr-10	Observed	
Nome of Ore-i-			us Week:			S- Satis	factory
name of Creek	, Stream, River	Trout (Creek			F - Fair	
Water Licence:						P - Poor	
Owners Name		orporation of the	e District of	Summerlar	nd		atisfactory
Address	13211 Henry A					Ni - Not	Inspected
City Summ		Postal Code		H 1Z0			
Telephone	250-404-3000	_Alternate Phon	е				
Email							
Pro Inchasti	on Interview v	with Owner	* Coo Doot D) on orto or oth	ner File Informatio	n	
-	esentative prese		No	reports or our	iei riie inioimalio	<u>11</u>	
	you owned the o		1930's				
_	•	iam?					
Any Prior proble		ra whan)	No No				
•	lifications? (wher ncidents/Breach?		No				
	y Fully Operation		Yes laterial Know	n? Vas	Гант	lation? V	
	nd plans availab				Found	dation? Yes	<u> </u>
	•	ngineer? Unkno		mpany			
	uction details kn			ere?			
		ssification - Curre					
Dam S	afety Regulation	High	_CDA Guide	lines:			
Dam Informa	ation						
Type of Dam:	111011	Earth Embank	ment Ma	x. Height of	Dam: 1440	73 m (5.67 n	n)
Spillway Elevati	ion:	1439.59		illway Width		<u> </u>	'/
		1.15 m		•			
Freeboard (@fu				eboard (at t	ime of visit)	1.2 m	
•				eboard (at t		1.2 m	
Freeboard (@fu Reservoir Stora		1013 N		eboard (at tenced Stora		1.2 m 1134 ML (
Reservoir Stora	age Volume			•			
Reservoir Stora Dam Enviror	nment	1013 N	//L Lice	enced Stora	age Volume	1134 ML ((920 ac-ft)
Reservoir Stora Dam Enviror Drainage Area	age Volume nment Size	1013 N 540 ha	AL Lice	enced Stora	age Volume		(920 ac-ft)
Reservoir Stora Dam Enviror Drainage Area Inflow Design F	nge Volume nment Size Tlood: Q m³/s	1013 M 540 ha S 13.5	AL Lice	enced Stora servoir Area od AEP (Re	age Volume	1134 ML ((920 ac-ft)
Reservoir Stora Dam Enviror	nment Size Tood: Q m ³ /s	1013 M 540 ha S 13.5	AL Lice	enced Stora servoir Area od AEP (Re	age Volume	1134 ML ((920 ac-ft)
Pam Enviror Drainage Area Inflow Design F Other Inflow Sto	nment Size Flood: Q m ³ /s udy: Q m ³ /s	1013 M 540 ha 5 13.5	Re: Flo	enced Stora servoir Area od AEP (Re od AEP (Re	age Volume a: eturn Period) eturn Period)	1134 ML ((920 ac-ft)
Post Inspect	nment Size Flood: Q m³/s udy: Q m³/s	1013 M 540 ha 5 13.5 5 Elaborate	Reconstruction Recons	servoir Area od AEP (Re od AEP (Re	age Volume a: eturn Period) eturn Period) as required	1134 ML ((920 ac-ft)
Post Inspect Evaluate any ne	nment Size Flood: Q m³/s udy: Q m³/s tion Evaluatio	540 ha 5 13.5 S Elaborate in the inundation	Reconstruction Recons	servoir Area od AEP (Re od AEP (Re od AEP (Re ction Report a	age Volume at the turn Period) at required No	1134 ML (44.8 ha 1:200	(920 ac-ft)
Dam Enviror Drainage Area Inflow Design F Other Inflow Sto Post Inspect Evaluate any ne Should new dev	nment Size Flood: Q m³/s udy: Q m³/s tion Evaluation we development	1013 M 540 ha 5 13.5 5	Reconstruction Recons	servoir Area od AEP (Re od AEP (Re stion Report a tream e Classifica	age Volume at: eturn Period) eturn Period) as required No tion?	1134 ML (44.8 ha 1:200	(920 ac-ft)
Dam Enviror Drainage Area Inflow Design F Other Inflow Sto Post Inspect Evaluate any ne Should new dev OMS Manual C	nment Size Flood: Q m³/s udy: Q m³/s tion Evaluation ew development velopment initiate current? Yes	540 ha s 13.5 s In the inundation e a review of the	Resolved Floor Floor E in the Inspect of zone downs Consequence Adequate?	servoir Area od AEP (Re od AEP (Re stion Report a tream e Classifica Yes	age Volume atturn Period) atturn Period) as required No tion? OMS being fo	1134 ML (44.8 ha 1:200 No lowed?	(920 ac-ft)
Dam Enviror Drainage Area Inflow Design F Other Inflow Sto Post Inspect Evaluate any ne Should new dev OMS Manual C EPP Manual C	nment Size Flood: Q m³/s udy: Q m³/s tion Evaluatio ew development velopment initiate current? Yes urrent? Yes	540 ha s 13.5 s In the inundation e a review of the EPP A	Resolved Flow Flow Flow Flow Flow Flow Flow Flow	servoir Area od AEP (Re od AEP (Re stion Report a tream e Classifica Yes Yes	age Volume a: eturn Period) eturn Period) as required No tion? OMS being fo EPP being exceptions	1134 ML (44.8 ha 1:200 No llowed? ercised?	Yes Yes
Dam Enviror Drainage Area Inflow Design F Other Inflow Sto Post Inspect Evaluate any ne Should new dev OMS Manual C EPP Manual C DSR Required?	nment Size Flood: Q m³/s udy: Q m³/s tion Evaluatio ew development velopment initiate current? Yes urrent?	540 ha s 13.5 s In the inundation e a review of the EPP A	Rein the Inspector Azone downsequenco Adequate? dequate? dequated dati	servoir Area od AEP (Re od AEP (Re tion Report a tream e Classifica Yes Yes e? 6/10	age Volume at: eturn Period) eturn Period) as required No tion? OMS being fo EPP being ex Deficiencies A	1134 ML (44.8 ha 1:200 No llowed? ercised?	(920 ac-ft)

Inspected by:

Rod MacLean, P. Eng. (Associated Engineering)
Gerald Imada, P. Eng. (Golder Associates)

			R	equi	ired A	Actio	n
			None	Monitor	Maintenance	Repair	Not Applicable
Emb	ankmer	nt Dam					
1. Ups	stream S	Slope					
•	VEGETATIO		П	Х		П	П
	Typ			_			
	SLOPE PRO	Recommendations:	П	Х	П	П	П
	Typ		ч	_	ч	ч	ч
		Notes			_		
	EROSION	Type (wave/runoff/unknown) Length Width		х	П	П	П
		Notes Minor Wave		_	_		
	INSTABILITIE		Ш	Х	Ш	Ш	Ш
	Slid	des (Yes/No/Could not Inspect) Length Width Location					
		Notes/Causes None	_				
	Cra	acks (Transverse/Longitudinal/Other)		Х			
		Quantity Length Width Location	_				
		Notes/Causes None	-				
	Bulç	ges/Depressions/Hummocky	П	Х			
		Size Height Depth					
		Location Notes/Causes None	_				
	OTHER	Notes/Oddses	П	Х	П	П	П
	Bur	rrows, Ruts, Other Concerns			_	_	
		Location Notes/Causes None	_				
		Notes/Causes None	_				
2. Cre	est						
	ACCESS			X			
		here public access to the crest? YES he crest marked or signed? NO					
		rehicle access to the crest restricted? NO					
	VEGETATIO				_		
	Tree		Ш	Χ	Ш		Ш
		Location Notes	-				
	Brus		П	Χ	П	П	П
		Location		_	_		
	0	Notes	_	V	_	_	
	Gro	ound Cover BARE Quantity (bare/sparse/adequate/dense)	Ш	Χ	ш	ш	Ц
		Appearance (too tall/too short/good)					
		Notes	_		_		
	EROSION	NONE Type (wewelfunefflunkneum)	Ц	Х		Ц	
		Type (wave/runoff/unknown) Length Width					
		Notes					
	SETTLEMEN		П	Χ			
		Location Notes/Causes	_				
			_				

						Requi	red Actio	'n
					guy	X Monitor	Maintenance Repair	Not Applicable
INSTABILITI						Х		
Cra		e/Longitudinal/Other		NONE				
	Location	Length		Width				
	Notes/Ca							
OTHER								
Bu	rrows, Ruts, Oth Location					X	ЦЦ	Ш
	Notes/Ca	uses						
3. Downstrea	m Slope							
VEGETATIO	-					Х	ΠП	П
Tre		NO			<u> </u>	انا لـ		ш
	Location							
	Notes							
<u>Bru</u>		SPARSE				Х	$\sqcup \sqcup$	Ц
	Location							
0	Notes	DADE				7 🖂		
Gro	ound Cover	BARE			L		υυ	Ш
SLOPE PRO	Notes					¬¬¬	пп	П
<u>Tvr</u>		Grass			L		шш	ш
<u> 147</u>	Notes	Some cobbles and	boulders					
EROSION						Х	ΠП	П
	Location	NONE						_
	Notes							
INSTABILITI	ES	NONE				X		
Slic	des Length	Width		Location				
•	Notes/Ca					7 157		
Cra	acks (Transverse	e/Longitudinal/Other)	NONE	L	Х	цц	Ц
	Location	Length		Width				
	Notes/Ca							
Bul		s/Hummocky	NONE			Х	пп	П
	Size	Height		Depth	-			
	Location			· -				
	Notes/Ca	uses						
OTHER _		_				7 6		_
Bui	rrows, Ruts, Oth	er Concerns	NONE			Х	$\sqcup \sqcup$	Ц
	Location Notes/Ca							
SEEPAGE	Notes/Ca					Х	пп	П
	et Area/Flow/Boil	I/Sinkhole	WET ARE	=Δ	L		шш	ш
***	Flow Rate		***	-/ \				
	Location	COULD E	BE SNOW	MELT				
		egetation/	(Yes/No)					
		ored Deposits	(Yes/No)					
	Sedimeni Other	t in Flow	(Yes/No)					
	Notes/Ca	2021						
EMBANKME		NONE FO	DUND			η П		X
Тур					<u> </u>			
	w rate	Size		Number				
Loc	cation							
No								
MONITORIN	G INSTRUMEN	TATION CONDITIO	_			┚╚		X
✓ Niome	e ffournitl	Piezometers	Weir	Flume				
No	tos							
INO								

	Required Action
	None Monitor Maintenance Repair Not Applicable
Spillway	
GENERAL CONDITIONS	
Type Earthen Channel Spillway - Concrete Spton	
Notes East side of dam - Flowing North	
1. Spillway Crest or Control Section	
OBSTRUCTION	
<u>Debris</u> Little	
Location Some logs and debris lodged in Channel	
Notes	Not Rep Not Not Not Rep Not
<u>Vegetation</u> Sparse Location <i>Well maintained</i> .	
Notes	
Other (beaver activity, trash rack problems, etc.)	
No Log Boom	
SPILLWAY CREST MATERIALS	
Condition Concrete - Trapezoidal	
Notes Maintains water level.	
OTHER SPILLWAY CREST PROBLEMS	
Damage No access to dam when spillway in operation	\square \square \square \square
Location Water spilling - approx .5 m above spillwa	
Notes/Cause	
2. Spillway Conveyance Section: Channel, Chute or C	Conduit
OPEN CHANNEL CROSS SECTION	
CHANNEL OBSTRUCTION	
SPILLWAY CONVEYANCE MATERIALS	
OTHER SPILLWAY CONVEYANCE PROBLEMS	
Damage No access to dam when spillway in operation.	$\sqcap \bowtie \sqcap \sqcap \sqcap$
Location	
Notes/Cause	
3. Energy-Dissipating or Terminal Section	
EROSION CONTROL STRUCTURE	ПЯППП
Type None	
Notes	

	Required Action
Lave Lave L Overtlad	None Monitor Maintenance Repair Not Applicable
Low Level Outlet	
Type Gated Pipe Structure None	
ACCESS TO VALVE/GATE	
Not accessible	ther
Notes Locked - Not tested, but appears functional	
Walkway Condition N/A	
·	
LOW LEVEL OUTLET COMPONENTS Valve Control Device	
yes None No Stem pamaged stem other	
Other/Notes	
Operational? ✓/res No Poorly Not tested	
Notes Some Leakage	
Valve / Gate	
Location Slanted Gate	
Condition Under water	
Leakage ✓/es □No	
Flow Rate Negligible	
Outlet Pipe	
☐Metal ☐Plastic ☐✓Concrete ☐Other	
Diameter 600 mm	
Condition Good condition Outlet Obstruction (note vegetation, sediment bloc	kage, etc.)
Notes	
OUTLET EROSION CONTROL STRUCTURE	
Type <u>Concrete</u>	
Concrete Condition Poor - Cracked and failed win	ngwalls on end
Outlet Area Seepage	
Description Some seepage, including filter pipe	
Flow Estimate Location At outlet	
Undermining	
Location Embankment is pressuring against the	
Notes/Cause: Riprap has shifted as well.	
Downstream Channel Channel cut into wo	ods. Some seepage
Free Draining? Blockages or Potential Blockages? Wonitor	
Blockages or Potential Blockages? Erosion Control? Rip-Rap? Monitor Needs work	

REPORT

Appendix B – Hydraulics Calculations



Hydraulic Analysis (Background information for Tables 6-2 and 6-3 in Report)

The Rational Formula equation used to calculate the IDF discharge is:

$$Q_{pIDF} = \frac{0.28 \, CPA}{T_c} \qquad \text{(Coulson, 1991)}$$

$$T_{\rm c} = \frac{(\rm nL)\,0.467}{1.65\,\rm S^{0.234}}$$

where:

 $\mathsf{Q}_{\mathit{pIDF}}$ = IDF discharge (m³/s);

C P = runoff coefficient (dimensionless);

= total precipitation occurring within the time-of-

concentration (mm), during the maximum precipitation;

= drainage area (km²); and = time-of-concentration (hrs). = Roughness coefficient n = Watershed Length (km) L = Watershed Slope

TABLE 3. Runoff Coefficient (C)

SURFACE COVER PHYSIOGRAPHY	IMPER- MEABLE	FORESTED	AGRICUL- TURAL	RURAL	URBAN
mountain	1.00	0.90			
steep slope	0.95	0.80	0.40	-	-
moderate slope	0.90	0.65	0.50	0.75	0.85
rolling terrain	0.85	0.50	0.40	0.65	0.80
flat	0.80	0.40	0.30	0.55	0.75
RI 10-25 years	+0.05	+0.02	+0.07	+0.05	+0.05
RI > 25 years	+0.10	+0.05	+0.15	+0.10	+0.10
Snowmelt	+0.10	+0.10	+0.10	+0.10	+0.10

C Factor Derivation (Lindsey et al. 1992)

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SURFACE COVER	n
smooth impervious	0.02
smooth bare packed soil	0.10
poor grass, row crops	0.20
rough bare soil	0.30
pasture or range land	0.40
deciduous timber land	0.60
coniferous timber land	0.70
timber land with deep litter	0.80

TABLE 4. Roughness Coefficient (n)

Table 1: Runoff coefficients for the Rational method

Hydrologic Soil Group		A			В			C			D	
Recurrence Interval	5	10	100	5	10	100	5	10	100	5	10	100
Land Use Or Surface Characteristics Business: A. Commercial Area B. Neighborhood Area	.75	.80 .55	.95	.80	.85	.95	.80	.85	.95	.85	.90	.95
Residential:	.50	,33	.03	.55	.00	.70	.00	.03	.13	.03	.70	.00
A. Single Family B. Multi-Unit (Detached) C. Multi-Unit (Attached)	.25 .35 .45	.25 .40 .50	.30 .45 .55	.30 .40 .50	.35 .45 .55	.40 .50 .65	.40 .45 .55	.45 .50 .60	.50 .55 .70	.45 .50 .60	.50 .55 .65	.55 .65 .75
D. 1/2 Lot Or Larger	.20	.20	.25	.25	.25	.30	.35	.40	.45	.40	.45	.50
E. Apartments	.50	.55	.60	.55	.60	.70	.60	.65	.75	.65	.70	.80
Industrial A. Light Areas B. Heavy Areas	.55	.60 .80	.70	.60 .80	.65 .85	.75	.65	.70 .85	.80	.70	.75 .85	.90
Parks, Cemeteries Playgrounds	.10	.10	.15	.20	.20	.25	.30	.35	.40	.35	.40	.45
Schools	.30	.35	.40	.40	.45	.50	.45	.50	.55	.50	.55	.65
Railroad Yard Areas	.20	.20	.25	.30	.35	.40	.40	.45	.45	.45	.50	.55
Streets A. Paved B. Gravel	.85	.90 .25	.95 .30	.85	.90 .40	.95 .45	.85 .40	.90 .45	.95 .50	.85	.90 .45	.95
Drives, Walks, & Roofs	.85	.90	.95	.85	.90	.95	.85	.90	.95	.85	.90	.95
Lawns A. 50%-75% Grass (Fair Condition) B. 75% Or More Grass	.10	.10	.15	.20	.20	.25	.30	.35	.40	.30	.35	.40
(Good Condition)	.05	.05	.10	.15	.15	.20	.25	.25	.30	.30	.35	.40
Undeveloped Surface ¹ (By Slope) ² A. Flat (0-1%) B. Average (2-6%) C. Steep	0	.04-0.0 .09-0.1	14	0	.07-0. .12-0.	17	0	.11-0. .16-0. .23-0.	21	0	.15-0.2 .20-0.2	25

 ¹ Undeveloped Surface Definition: Forest and agricultural land, open space.
 ² Source: Storm Drainage Design Manual, Erie and Niagara Counties Regional Planning Board.

Runoff coefficient. The runoff coefficient (C) represents the integrated effects of infiltration, evaporation, retention, flow routing, and interception; all of which affect the time distribution and peak rate of runoff. The runoff coefficient is the variable of the Rational method least-susceptible to precise determination and requires judgment and understanding on the part of the designer. While engineering judgment will always be required in the selection of runoff coefficients, a typical coefficient represents the integrated effects of many drainage basin parameters. The Engineer should realize that the C values shown in Table 1 are typical values, and may have to be adjusted if the site deviates from typical conditions such as an increase or decrease in percent impervious.

The values are presented for different surface characteristics, as well as for different aggregate land uses. The coefficient for various surface areas can be used to develop a composite value for a different land use. The runoff values for business, residential, industrial, schools, and railroad yard areas are an average of all surfaces typically found in the particular land use.

The hydrologic soil groups, as defined by NRCS soil scientists and used in Table 1 are:

- Group A. Soils having low runoff potential and a high infiltration rate, even when thoroughly wetted, consisting chiefly of deep, well- to excessively well-drained sands or gravels.
- b. Group B. Soils having a moderate infiltration rate when thoroughly wetted, consisting chiefly of moderately-deep to deep, moderately-well to well-drained soils, with moderatelyfine to moderately-coarse texture.
- Group C. Soils having a slow infiltration rate when thoroughly wetted, consisting chiefly of
 soils with a layer that impedes downward movement of water or soils with moderately-fine to
 fine texture.
- d. Group D. Soils having high runoff potential and a very slow infiltration rate when thoroughly wetted, consisting chiefly of clay soils with a high swelling potential, soils with a
- Adjustment of C values. For larger storm events (less-frequent, higher-intensity storms), use multipliers in Table 2 to adjust the 5-year C values.

Table 2: Frequency factors for Rational formula

Recurrence Interval (years)	$C_{\rm f}$
25	1.1
50	1.2
100	1.25

1000 1.5

For the Summerland dams IDF, the C value was examined in Table 3 in Coulson (1991) which expresses C as a function of the surface cover (impermeable, forested, agricultural, rural, or urban) and physiography (mountain, steep slope, moderate slope, rolling terrain, or flat). This table is inconsistent with other C values derived from the US Corps of Engineers and state C factors (as suggested table above. The C factor is therefore calculated (somewhat conservatively) using the process above. We have also included a measure for melting snow's contribution to the runoff event by adding a constant (0.10) to the runoff coefficient. For T_c , the value was taken from Figure 1 in Coulson (1991); in which curves relating T_c to A are presented for different physiographic classifications. The value of P was taken from the intensity-duration-frequency (IDF) curve developed for Summerland (Environment Canada 2010) extrapolated to the required storm rainfall intensity. Table 7-2 presents the parameters used and the estimated IDF discharge.

			Trout Creel	k Watershed			Garnet Valley	Watershed
	HW 1	HW 2-4	Crescent	Whitehead	Isintok	Tsuh	Aeneas	Garnett
A (ha)	1,918	500	1,554	540	1,640	244	310	10,000
A (km ²)	19.2	5.0	15.5	5.4	16.4	2.4	3.1	100.0
L (m)	6,650	6,650	2,000	2,000	4,260	1,000	2,000	16,000
L (km)	6.7	6.7	2.0	2.0	4.3	1.0	2.0	16.0
n	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
S C	0.069	0.069	0.020	0.106	0.223	0.143	0.100	0.040
	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
C ₁₀₀	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31
C ₁₀₀₀	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38
Tc (hr)	2.5	2.5	1.9	1.3	1.5	0.9	1.3	4.2
Tc (min)	149	149	113	77	92	52	78	254
i ₁₀₀ (mm/h)	9	9	11	17	14	19	17	7
i ₁₀₀₀ (mm/h)	26	26	31	34	38	52	42	18
P ₁₀₀ (mm)	22	22	21	22	21	16	22	28
P ₁₀₀₀ (mm)	64	64	58	43	58	45	54	76
Capacities from Rational E	quation (m ³	³ /s)						
Q _{Rational 1:100}	15.1	3.9	15.0	8.0	20.1	4.1	4.6	58.6
Q _{Rational 1:1000}	52.4	13.7	50.6	19.3	65.4	13.3	13.7	189.0
Other estimates for 1:200 s	storm from	past design	ns or studi	es (m³/s)				
Q _{0.93 m3/s/km2}	17.8	4.7	14.5	5.0	15.3	2.3	2.9	93.0
Q _{50cfs/mi2}	10.5	2.7	8.5	3.0	9.0	1.3	1.7	54.7
Q _{Hay&Co 1:200}								11.4
Other estimates for 1:1000	storm from	past desig	ns or stud	lies (m³/s)				
Q _{228cfs/mi2-Coulson(1973)}	47.8	12.5	38.7	13.5	40.9	6.1	7.7	
Q _{150cfs/mi2}	31.5	8.2	25.5	8.9	26.9	4.0	5.1	164.0
Q _{BCHydro-LOW}	51.8	13.5	42.0	14.6	44.3	6.6	8.4	270.0
Q _{BCHydro-HIGH}	57.5	15.0	46.6	16.2	49.2	7.3	9.3	300.0
Recommended IDF - 2010	15.1	3.9	15.0	8.0	40.9	4.1	4.6	164.0
Volume of Runoff (Q . T _c) (m ³)	134,590	35,090	101,530	36,910	224,620	12,580	21,480	2,499,410

					Estimated	Capacity	Required	Capacity	
	Hazard Classification	IDF	Weir Type	Base Weir Length (m)	Maximum $Q_c (m^3)$	Depth of Spillway (m)	IDF Q _r (m ³ /s)	Minimum Depth d _r (m)	Comments
Headwaters 1	Very Low	1:100	Rectangular	9.14	32.2	1.53	15.0	0.92	Ok
Headwaters 2	Very Low	1:100	Trapezoid	3.00	15.8	1.57	3.9	1.40	Ok
Headwaters 3	Very Low	1:100	Trapezoid	2.40	15.8	1.57	3.9	1.40	Ok
Headwaters 4	Very Low	1:100	Trapezoid	3.00	15.8	1.57	3.9	1.40	Ok
Crescent Lake	Very Low	1:100	Rectangular	8.50	24.5	1.34	15.0	0.97	Ok
Isintok	High	1:1000	Rectangular	4.00	41.0	3.12	40.9	3.14	Requires Further Review
Whitehead	Very Low	1:100	Trapezoid	5.79	21.5	1.15	8.0	0.51	Ok
Garnett Dam	High	1:1000	Cipolletti	12.20	70.0	2.12	164.0	3.74	Requires Further Review
Aeneas	Very Low	1:100	Rectangular	4.57	11.2	1.20	4.6	0.67	Ok
Tsuh Dam	Very Low	1:100	Trapezoid	3.00	10.9	1.07	4.1	0.79	Ok
Intake Dam	High	N/A	None						N/A

IDF - Inflow Design Flood
Current assumes maximum spillway capacity without overtopping the dam but using the full freeboard.
Weir Types:

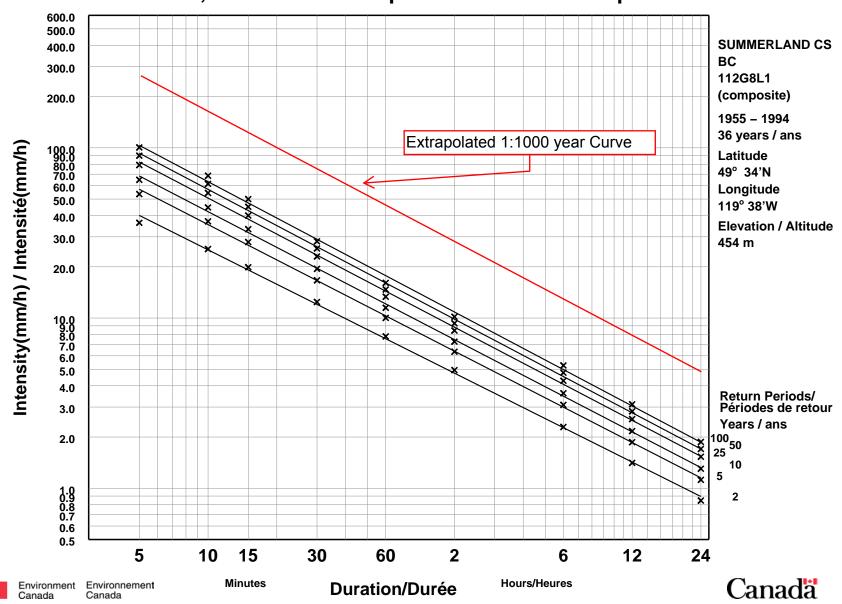
Equation (cfs) Q = 3.367 L H^{3/2} Q = 3.33 L H^{3/2} v = R^{2/3} S^{1/2} Q = vA Cipolletti Rectangular Trapezoid

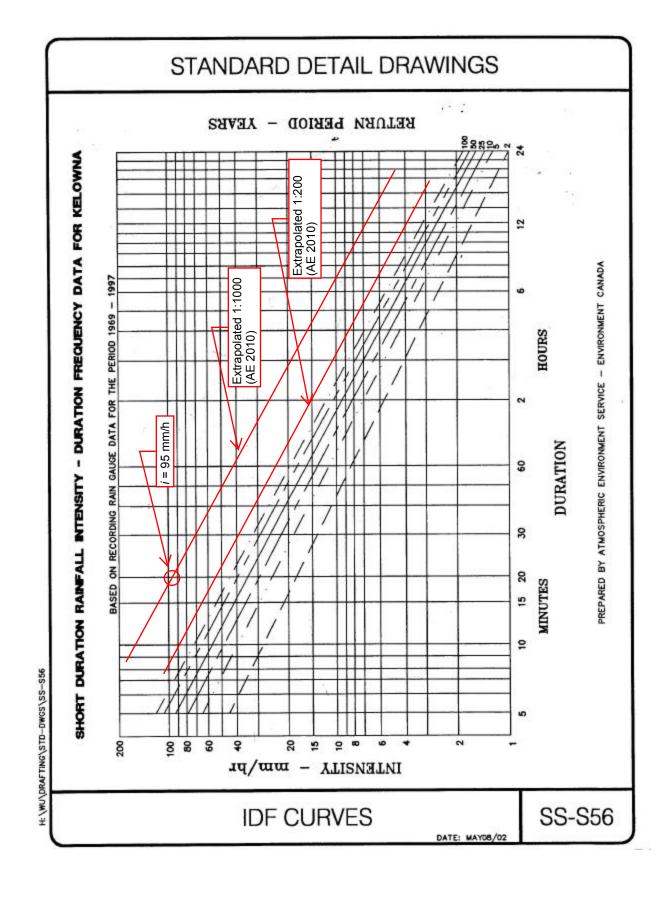
C 3.367 3.33

Trapezoid Spillway Channel Parameters

Trapozora opinitaj orialition arametero							
	Units	Tsuh	Whitehead	Headwaters			
				2,3 & 4			
n		0.04	0.04	0.04			
S		0.01	0.01	0.01			
b	m	3	5.79	2			
Freeboard	m	1.07	1.15	1.57			
Z		2	2.273	1.5			
Α	m ²	5.50	9.66	6.84			
wp	m	7.79	11.50	7.66			
R	m	0.71	0.84	0.89			
V	m/s	1.98	2.23	2.32			
Q	m ³ /s	10.91	21.51	15.85			

Short Duration Rainfall Intensity-Duration-Frequency Data 2010/04/13 Données sur l'intensité, la durée et la fréquence des chutes de pluie de courte durée





Dam		Consequences of Failure		Site	Owner	Data & Records		Dam Safety Management			Public Security	
	Existing Hazard Classification	Potential Downstream Affected Areas following a breach	Consequences	Inspection Ir	Interview	Inundation Study or Mapping?	OMS Manuals	EPP/ ERP?	New Revised Hazard Classification	EPP/ERP?	Recommended IDF	or Safety
Headwaters No. 1 Dam	Very Low	Upper Trout Creek Minor Forestry Roads Flow into Trout Creek upstream of Thirsk Dam	Breaches Minor Water Quality Issues in Thirsk Dam Extreme low risk of Thirsk Dam failure.	1	V	No	No - in files only	Yes	Very Low	Reviewed every 10 years	1:100 to 1:1000	Minor local issues
Headwaters No. 2 Dam	Very Low	Upper Trout Creek Flows into Headwaters 1	Potential damage issues with Headwaters 1	V	√	No	No - in files only	Yes	Very Low	Reviewed every 10 years	1:100 to 1:1000	Negligible Risk
Headwaters No. 3 Dam	Very Low	Upper Trout Creek Flows into Headwaters 1	Potential damage issues with Headwaters 1	V	√	No	No - in files only	Yes	Very Low	Reviewed every 10 years	1:100 to 1:1000	Negligible Risk
Headwaters No. 4 Dam	Very Low	Upper Trout Creek Flows into Headwaters 1	Potential damage issues with Headwaters 1	√	√	No	No - in files only	Yes	Very Low	Reviewed every 10 years	1:100 to 1:1000	Negligible Risk
Whitehead Reservoir Dam	Very Low	Upper Trout Creek Flow from breach enters upstream of Thirsk Dam	Minor forestry road failures. Minor Water Quality Issues in Thirsk Dam Extreme low risk of Thirsk Dam failure.	V	1	No	No - in files only	Yes	Very Low	Reviewed every 10 years	1:100 to 1:1000	Negligible Risk
Isintok Dam		Isintok Creek 12 km away from Trout Creek Isintok Creek Bed Secondary Forest Service Road Princeton-Summerland Highway Okanagan Lake (34 km) Highway 97	Short term compromise to Summerland water supply Significant Erosion Reconstruction Likely Negligible Negligible Negligible	4	٧	No	No - in files only	Yes	High	Reviewed every 10 years	0.736111111	Negligible Risk
Crescent Dam	Very Low	Upper Trout Creek		√	V	No	No - in files only	Yes	Very Low	Reviewed every 10	1:100 to 1:1000	Negligible Risk
Tsuh (Deer) Reservoir Dam	Very Low	Extremely difficult access 4 km to Forest Road Crossing Additional 2.5 km to Trout Creek	Machinery repair Evacuations by helicopter only, Likely culvert and road failure Downstream of Thirsk. Short term compromise to Summerland water supply	V	V	No	No - in files only	Yes	Very Low	Reviewed every 10 years	1:100 to 1:1000	None
Aeneas Reservoir Dam	Very Low	Extremely difficult access Garnett Valley Reservoir	Machinery repair Evacuations by helicopter only. Negligible effects from Breach. Too little water.	٧	V	No	No - in files only	Yes	Very Low	Reviewed every 10 years	1:100 to 1:1000	None
Garnett Reservoir Dam		Garnett Dam Access Road Garnett Valley Road Houses along Garnett Creek flood plain starting at 3.4 km from dam. Water Supply to area	Failure likely Significant Risk of failure along creek bed. Significant Risk of damage and loss of life. Significant compromise to Summerland water supply along Garnett Valley.	٧	٧	No	No - in files only	Reviewed every 5 years	High	Reviewed every 5 years	PMF - Sunny Day Breach - Full Reservoir Condition	Significant - Water Supply Cutoff to 2000 population.
Summerland Reservoir		No Spillway Sunny Day Failure: ie. Broken Gate on River System Houses and Agricultural Property	Low Risk - Only scenario where overtopping can occur. Potential Loss of Life Potential Loss of Agricultural Land	٧	V	High	No - in files only	Reviewed every 5 years	Very High None	Reviewed every 5 years	PMF	Significant - Water Supply Cutoff to Summerland

REPORT

Appendix C - Photos





Photo 1.1. U/S Slope of dam – Good condition



Photo 1.2. Emergency Spillway – Concrete is structurally sound. Note backfill needs and brush removal on far abutment.

Headwaters No.1 (Cont'd)



Photo 1.3. Low Level Outlet Structure



Photo 1.4. General Note: D/S Berm constructed in 2000.



Photo 2.1 Slopes of dam – Good condition



Photo 2.2 Emergency Spillway – Good condition. Requires monitoring for excessive public access and placement of logs and bridges.

Headwaters No. 2 (Cont'd)



Photo 2.3 Low Level Outlet Structure – Deflection in outlet of CSP pipe. Monitor for further deflections or failure. Requires more frequent exercise to clear dirt and debris.



Photo 2.4. General Note: Outlet Structure in good shape. .



Photo 3.1 Low Level Outlet – Backfill and replacement of riprap required around structure. Rocks, debris and dirt clog outlet.



Photo 3.2 Emergency Spillway – Signs of significant use. Channel requires shaping. Potential for log jam is high.

Headwaters No. 3 (Cont'd)



Photo 3.3 Low Level Outlet Structure – parabolic channel in good condition. Requires more frequent exercise to clear dirt and debris.



Photo 3.4. General Note: Low Level Gate in fair condition.



Photo 4.1 U/S Slope of dam – Good condition. Note old log boom.



Photo 4.2 Emergency Spillway – Not well defined. Channel requires shaping. Some minor potential for log jams.

Headwaters No. 4 (Cont'd)



Photo 4.3 Low Level Outlet Structure – Backfill and riprap should be maintained. Rock was plugging outlet at time of inspection. Requires more frequent exercise to clear dirt and debris.



Photo 4.4. General Note: Concrete Conduit in good condition.

5. Crescent Reservoir



Photo 5.1 U/S Slope of dam – Fair-Good condition. Note old vertical intake pipe.



Photo 5.2 Emergency Spillway – Operational. Log boom operational. Required minor cleaning and debris removal.

Crescent Reservoir (Cont'd)



Photo 5.3 Low Level Outlet Structure – Earth backfill is sloughing over the concrete outlet. Brush has been removed. Maintenance required, including additional riprap.



Photo 5.4. General Note: Old outlet structure has minor leakage. Frequent monitoring recommended.

6. Whitehead Reservoir



Photo 6.1 Looking across spillway and along center of dam. Water level was at or over FSL at inspection. Difficult to cross to visit dam.



Photo 6.2 Emergency Spillway Channel – Operational. Channel maintenance and cleaning required on a regular basis.

Whitehead Reservoir (Cont'd)



Photo 6.3 Low Level Outlet Structure – Concrete has failed in all directions. Earth sloughing.



Photo 6.4. General Note: Concrete failure and significant Seepage.

7. Aeneas Reservoir



Photo 7.1 D/S abutment. Note low level outlet on right.



Photo 7.2 Emergency Spillway. Significant earth slouging and lack of riprap on both sides of vertical walls. Concrete failed in several locations.

Aeneas Reservoir (Cont'd)



Photo 7.3 Low Level Outlet – concrete in good shape. Backfill and riprap require maintenance around structure. Some earth sloughing. Clean out of debris required.



Photo 7.4. Emergency Spillway: Brush intrusion, earth sloughing, excess debris and concrete failures.

8. Tsuh Reservoir



Photo 8.1 Looking at U/S face of dam and spillway. Inspection is after 800 m hike through steep forest.



Photo 8.2 Emergency Spillway. Channel through dam. Minor brush removal required. (Performed during site visit). Note concrete entrance. No log boom.

Tsuh Reservoir (Cont'd)



Photo 8.3 Low Level Outlet – concrete in good shape. Backfill and riprap require maintenance around structure. Some earth sloughing. Maintenance was performed during inspection.



Photo 8.4 Low Level Outlet – Corrugated Steel pipe in fair condition.

9. Isintok Reservoir



Photo 9.1 Significant footprints and traffic marks on gravelly sand material. Crest or road is undefined. Note gravel pit is popular motocross location.

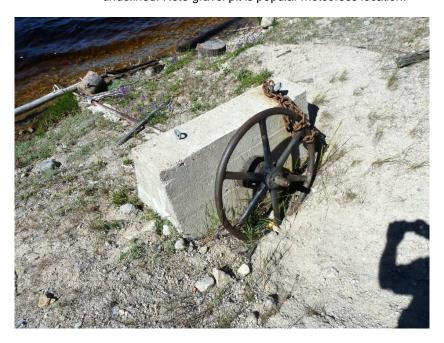


Photo 9.2 Low Level Outlet gate – Adjustment of backfill required to operate gate.

Isintok Reservoir (Cont'd)



Photo 9.3 Low Level Outlet – concrete in good shape. Some seepage from abutment at structure. Some flow. Note water, but no flow from outlet.



Photo 9.4 Emergency Spillway – Log Boom, channel in good condition.

10. Summerland Reservoir



Photo 10.1 U/S pond level. Additional crest protection (note vehicle)



Photo 10.2 From top of dam. Pond elevation is maintained approximately 3 m below top of dam. No emergency spillway.

Summerland Reservoir (Cont'd)



Photo 10.3 Summerland intake control buildings.



Photo 10.4 Groundwater intrusion along left edge of pond. Not part of dam.

11. Garnett Reservoir



Photo 11.1 U/S Embankment – 1:1 slope, no riprap. Some erosion at base.



Photo 11.2 D/S Embankment – Steep slope. Riprap is not well defined.

Garnett Reservoir (Cont'd)



Photo 11.3 Emergency Spillway – Concrete spillway. Some shifting and cracking in concrete. Minor debris. Note road and safety fence.



Photo 11.4 Emergency Spillway – Access Road and culvert. Good riprap cover. Culvert and road would likely be destroyed in a major storm event.

Garnett Reservoir (Cont'd)



Photo 11.5 Low Level Outlet – Handwheel requires replacement.



Photo 11.6 Low Level Outlet. Good condition. Seepage flow is from drain outlet beside the structure.

REPORT

Appendix D – Dam Safety Guidelines





Interim Consequence Classification Policy For Dams in British Columbia

February 2010

Background

In 1999 the Canadian Dam Association (CDA) published Dam Safety Guidelines to establish safety requirements for new and existing dams, enable the consistent evaluation of dam safety deficiencies and to provide a basis for dam safety legislation and regulation. The 1999 CDA Guidelines defined 4 dam classifications in Table 1-1, "Classification of Dams in terms of Consequence of Failure". In February 2000, the BC Dam Safety Regulation, under the *Water Act* of BC, was enacted. The BC Dam Safety Regulation also defined 4 dam classifications in Schedule 1, "Downstream Consequence Classification Guide". The two systems are similar; both use the same classification names, but Schedule 1 defines the classifications in greater detail than Table 1-1. An important distinction to note is that Dam Safety Regulation classifications are for **dam owner** requirements and the CDA Guidelines classifications are for **dam design** criteria.

The Water Stewardship Division has assigned consequence classifications to most of the 1,980 dams in BC based on available information and using Schedule 1. Many dam owners or their engineering consultants have undertaken dam break inundation studies which have confirmed the consequence classifications or provided evidence for a revised classification. As of June 2008, the numbers of dams in the 4 consequence classifications is as follows: Very High – 31, High – 257, Low – 498, Very Low or not regulated ¹ – 1194.

Canadian Dam Association 2007 Dam Safety Guidelines

The CDA Guidelines were completely rewritten and published in 2007 along with a binder of Technical Bulletins. One important change is the new consequence classification system as described in Table 2-1 "Dam Classification". Table 2-1 describes 5 new consequence classifications that are described in more detail than the 1999 CDA Table 1-1. It is possible to make a reasonably good conversion table between the new CDA Classification table and Schedule 1 in the Dam Safety Regulation. Please see the comparison table attached.

¹ These dams would be one of the following: too small, removed, not yet constructed or unclassified.

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Consequence Classifications	Loss	of Life	at Risk Only)	Economic and S	Social Losses ²	Environmental and Cultural Losses		Consequence Classifications
BC Dam Safety Regulation	BC Reg. ³	CDA	Persons at Risk (CDA Only)	BC Reg. ⁴	CDA	BC Reg.	CDA	CDA 2007
Very High	>100	>100		>\$100M Very High Infrastructure; Public, Commercial, Residential	Extreme - Critical Infrastructure or Services	Nationally & Provincially Important Habitat & Sites - Restoration Chance Low	Major Loss of Critical Habitat - No Restoration Possible	Extreme
High (High ⁵)	< 100	< 100	Permanent Residents	< 100M Substantial Infrastructure; Public, Commercial	Very High - Important Infrastructure or Services	Same as Above but Restoration Chance High	Significant Loss of Critical Habitat - Restoration Possible	Very High
High (Low ⁵)	< 10	< 10	H	< \$10M Same as Above	High – Infrastructure, Public Trans & Commercial	Same as Above	Significant Loss of Important Habitat - Restoration Possible	High
Low	Some Possible	Unspecified ⁶	Temporary Only	< \$1M Limited Infrastructure; Public, Commercial	Temporary & Infrequent	Regionally Important Habitat & Sites - Restoration Chance High	No Significant Loss of Habitat - Restoration Possible	Significant
Very Low	Minimal	0	None	< \$100K Minimal	Low	No Significant Loss of Habitat or Sites	Minimal Short Term Loss	Low

² CDA name this category "Infrastructure & Economics"

³ Conservative estimate of loss of life amongst population affected by the flood waters (may equal Population at Risk)

⁴ Dollar values from year 2000

⁵ Internal "High" sub-classification used for Dam Safety Program risk-based assessment.

⁶ Significant category may not always line up with Low (BC Reg). A temporary population (e.g. in recreation al areas) could be quite large and a "sunny-day" failure could result in multiple fatalities.

Interim Policy for using both classification systems

The Water Stewardship Division (WSD) may recommend that the 2007 CDA Dam Safety Guidelines consequence classification system be incorporated into the Dam Safety Regulation if that regulation is revised. For the time being, the interim policy on the application of the Regulation with respect to the revised 2007 CDA guidelines has 2 parts as follows:

- 1. For the purpose of undertaking Dam Safety Reviews (by review engineers) and plans review for new and existing dams (by the Dam Safety Officers) the dams should be classified under both the Dam Safety Regulation and the 2007 CDA Dam Safety Guidelines. The attached comparison chart shows how the WSD interprets the two different classifications and where the 2 consequence classification ratings align. Dam review engineers may use their discretion when they assign consequence classifications based on the 2 systems.
- 2. Until further notice, for the purpose of reviewing dam design criteria only, the 1999 CDA Guidelines may be used for dams constructed before 2008 (see CDA 1999 Tables 5-1 & 6-1). The main reason for this policy is the change in the Inflow Design Flood (IDF) and Maximum Design Earthquake⁷ (MDE) recommended for the "High" consequence dams in the 2007 CDA Guidelines (see CDA 2007 Table 6-1). The 2007 CDA Guidelines suggest 3 classes where a permanent population is at risk (High, Very High and Extreme). For dams where less than 10 people are at risk (High), this results in a recommendation for a more conservative IDF and MDE than the 1999 guidelines. Some owners of dams classified as "High" consequence have previously been informed that a minimum IDF and MDE of 1:1000 would be acceptable. It would be inappropriate now to require that the higher 2007 CDA Guidelines IDF and MDE be applied immediately. However, the WSD recommends that the owner make every effort to move toward these new design criteria targets as soon as possible.

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⁷ Now called *earthquake design ground motion* (EDGM) in the 2007 CDA Guidelines

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TABLE 1-1 CLASSIFICATION OF DAMS IN TERMS OF CONSEQUENCES OF FAILURE

	POTENTIAL INCREMENTAL CONSEQUENCES OF FAILURE ^[a]		
CONSEQUENCE CATEGORY	LIFE SAFETY ^[b]	SOCIOECONOMIC FINANCIAL & ENVIRONMENTAL ^{[b] [c]}	
VERY HIGH	Large number of fatalities	Extreme damages	
HIGH	Some fatalities	Large damages	
LOW	No fatalities anticipated	Moderate damages	
VERY LOW	No fatalities	Minor damages beyond owner's property	

- [a] Inotemental to the impacts which would occur under the same natural conditions (flood, earthquake or other event) but without failure of the dam. The consequence (i.e. loss of life or economic losses) with the higher rating determines which category is assigned to the structure. In the case of tailings dams, consequence categories should be assigned for each stage in the life cycle of the dam.
- [b] The criteria which define the Consequence Categories should be established between the Owner and regulatory authorities, consistent with societal expectations. Where regulatory authorities do not exist, or do not provide guidance, the criteria should be set by the Owner to be consistent with societal expectations. The criteria may be based on levels of risk which are acceptable or tolerable to society.
- [c] The Owner may wish to establish separate corporate financial criteria which reflect their ability to absorb or otherwise manage the direct financial loss to their business and their liability for damage to others.

Schedule 1 – Dam Safety Regulation, Feb. 2000

Downstream Consequence Classification Guide

Rating	Loss of Life	Economic and Social Loss	Environmental and Cultural Losses
VERY	Large potential for multiple loss of life involving residents and working, travelling and/or recreating public. Development within inundation area (the area that could be flooded if the dam fails) typically includes communities, extensive commercial and work areas, main highways, railways, and locations of concentrated recreational activity. Estimated fatalities could exceed 100.	Very high economic losses affecting infrastructure, public and commercial facilities in and beyond inundation area. Typically includes destruction of or extensive damage to large residential areas, concentrated commercial land uses, highways, railways, power lines, pipelines and other utilities. Estimated direct and indirect (interruption of service) costs could exceed \$100 million.	Loss or significant deterioration of nationally or provincially important fisheries habitat (including water quality), wildlife habitat, rare and/or endangered species, unique landscapes or sites of cultural significance. Feasibility and/or practicality of restoration and/or compensation is low.
HIGH	Some potential for multiple loss of life involving residents, and working, travelling and/or recreating public. Development within inundation area typically includes highways and railways, commercial and work areas, locations of concentrated recreational activity and scattered residences. Estimated fatalities less than 100.	Substantial economic losses affecting infrastructure, public and commercial facilities in and beyond inundation area. Typically includes destruction of or extensive damage to concentrated commercial land uses, highways, railways, power lines, pipelines and other utilities. Scattered residences may be destroyed or severely damaged. Estimated direct and indirect (interruption of service) costs could exceed \$1 million.	Loss or significant deterioration of nationally or provincially important fisheries habitat (including water quality), wildlife habitat, rare and/or endangered species, unique landscapes or sites of cultural significance. Feasibility and practicality of restoration and/or compensation is high.
LOW	Low potential for multiple loss of life. Inundation area is typically undeveloped except for minor roads, temporarily inhabited or non- residential farms and rural activities. There must be a reliable element of natural warning if larger development exists.	Low economic losses to limited infrastructure, public and commercial activities. Estimated direct and indirect (interruption of service) costs could exceed \$100 000.	Loss or significant deterioration of regionally important fisheries habitat (including water quality), wildlife habitat, rare and endangered species, unique landscapes or sites of cultural significance. Feasibility and practicality of restoration and/or compensation is high. Includes situations where recovery would occur with time without restoration.
VERY LOW	Minimal potential for any loss of life. The inundation area is typically undeveloped.	Minimal economic losses typically limited to owner's property not to exceed \$100 000. Virtually no potential exists for future development of other land uses within the foreseeable future.	No significant loss or deterioration of fisheries habitat, wildlife habitat, rare or endangered species, unique landscapes or sites of cultural significance.

Table 2-1: Dam Classification

Dam class	Population at risk [note 1]	Incremental losses			
		Loss of life [note 2]	Environmental and cultural values	Infrastructure and economics	
Low	None	0	Minimal short-term loss No long-term loss	Low economic losses; area contains limited infrastructure or services	
Significant	Temporary only	Unspecified	No significant loss or deterioration of fish or wildlife habitat Loss of marginal habitat only Restoration or compensation in kind highly possible	Losses to recreational facilities, seasonal workplaces, and infrequently used transportation routes	
High	Permanent	10 or fewer	Significant loss or deterioration of important fish or wildlife habitat Restoration or compensation in kind highly possible	High economic losses affecting infrastructure, public transportation, and commercial facilities	
Very high	Permanent	100 or fewer	Significant loss or deterioration of critical fish or wildlife habitat Restoration or compensation in kind possible but impractical	Very high economic losses affecting important infrastructure or services (e.g., highway, industrial facility, storage facilities for dangerous substances)	
Extreme	Permanent	More than 100	Major loss of <i>critical</i> fish or wildlife habitat Restoration or compensation in kind impossible	Extreme losses affecting critical infrastructure or services (e.g., hospital, major industrial complex, major storage facilities for dangerous substances)	

Note 1. Definitions for population at risk:

None—There is no identifiable population at risk, so there is no possibility of loss of life other than through unforeseeable misadventure.

Temporary—People are only temporarily in the dam-breach inundation zone (e.g., seasonal cottage use, passing through on transportation routes, participating in recreational activities).

Permanent—The population at risk is ordinarily located in the dam-breach inundation zone (e.g., as permanent residents); three consequence classes (high, very high, extreme) are proposed to allow for more detailed estimates of potential loss of life (to assist in decision-making if the appropriate analysis is carried out).

Note 2. Implications for loss of life:

Unspecified — The appropriate level of safety required at a dam where people are temporarily at risk depends on the number of people, the exposure time, the nature of their activity, and other conditions. A higher class could be appropriate, depending on the requirements. However, the design flood requirement, for example, might not be higher if the temporary population is not likely to be present during the flood season.

TABLE 5-1 USUAL MINIMUM CRITERIA FOR DESIGN EARTHQUAKES

CONSEQUENCE	MAXIMUM DESIGN EARTHQUAKE (MDE)		
CATEGORY [a]	DETERMINISTICALLY DERIVED PROBABILISTICALLY D (Annual exceedance pro		
Very High	MCE ^[b]	1/10,000	
High	50% to 100% MCE [c] [d]	1/1000 to 1/10,000 ^[d]	
Low	_ (e)	1/100 to 1/1000 ^[e]	

- [a] See Section 1.4 for consequence classification.
- [b] For a recognised fault or geographically defined tectonic province, the Maximum Credible Earthquake (MCE) is the largest reasonably conceivable earthquake that appears possible. For a dam site, MCE ground motions are the most severe ground motions capable of being produced at the site under the presently known or interpreted tectonic framework.
- [c] MDE firm ground accelerations and velocities can be taken as 50% to 100% of MCE values. For design purposes the magnitude should remain the same as the MCE.
- [d] In the High Consequence category, the MDE is based on the consequences of failure. For example, if one incremental fatality would result from failure, an AEP of 1/1000 may be acceptable, but for consequences approaching those of a Very High Consequence dam, design earthquakes approaching the MCE would be required.
- [e] If a Low Consequence structure cannot withstand the minimum criteria, the level of upgrading may be determined by economic risk analysis, with consideration of environmental and social impacts.

TABLE 6-1 USUAL MINIMUM CRITERIA FOR INFLOW DESIGN FLOODS

CONSEQUENCE CATEGORY [a]	INFLOW DESIGN FLOOD (IDF)
Very High	Probable Maximum Flood (PMF) ^[b]
High	Annual Exceedance Probability (AEP) between 1/1000 and the PMF ^[c]
Low	AEP between 1/100 and 1/1000 ^{[c] [d]}

- [a] See Section 1.4 for consequence classification
- [b] An appropriate level of conservatism shall be applied to loads from this event, to reduce the risks of dam failure to tolerable values. Thus, the probability of dam failure could be much lower than the probability of extreme event loading.
- [c] Within the High Consequence category, the IDF is based on the consequences of failure. For example, if one incremental fatality would result from failure, an AEP of 1/1000 could be acceptable, but for consequences approaching those of a Very High Consequence dam, design floods approaching the PMF would be required.
- [d] If a Low Consequence structure cannot withstand the minimum criteria, the level of upgrading may be determined by economic risk analysis, with consideration of environmental and social impacts.

Table 6-1: Suggested Design Flood and Earthquake Levels (for Use in Deterministic Assessments)

Dam class	AEP				
[note 1]	IDF [note 2]	EDGM [note 3]			
Low	1/100	1/500			
Significant	Between 1/100 and 1/1000 [note 4]	1/1000			
High	1/3 between 1/1000 and PMF [note 5]	1/2500 [note 6]			
Very high	2/3 between 1/1000 and PMF [note 5]	1/5000 [note 6]			
Extreme	PMF [note 5]	1/10,000			

Acronyms: AEP, annual exceedance probability; EDGM, earthquake design ground motion; IDF, inflow design flood; PMF, probable maximum flood.

Note 1. As defined in Table 2-1, Dam Classification.

Note 2. Extrapolation of flood statistics beyond 1/1000 year flood (10^{-3} AEP) is discouraged.

Note 3. AEP levels for EDGM are to be used for mean rather than median estimates of the hazard.

Note 4. Selected on the basis of incremental flood analysis, exposure, and consequences of failure

Note 5. PMF has no associated AEP. The flood defined as "1/3 between 1/1000 year and PMF" or "2/3 between 1/1000 year and PMF" has no defined AEP.

Note 6. The EDGM value must be justified to demonstrate conformance to societal norms of acceptable risk. Justification can be provided with the help of failure modes analysis focused on the particular modes that can contribute to failure initiated by a seismic event. If the justification cannot be provided, the EDGM should be 1/10,000.