Environmental Consequence Classification of Mine Dam Failures: Updating the Canadian System

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Environmental Consequence Classification System

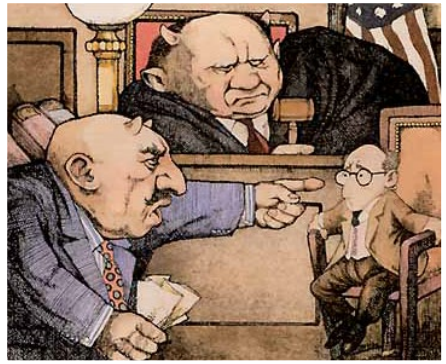
WHAT THE ENVIRONMENTAL CONSEQUENCE CLASSIFICATION IS AND IS NOT

What the ECC is intended to be:

- A tool to inform design, operation, maintenance, and inspection of mining dams that is:
  - Reproducible
  - Broadly applicable across Canada's varied environments
  - Based on high level (only 4(?) categories) gradation of potential impacts

Environmental Consequence Classification System

WHAT THE ENVIRONMENTAL CONSEQUENCE CLASSIFICATION IS AND IS NOT



What the ECC is not intended to be:

- A statement about mine dam failure regarding:
  - level of societal or political concern
  - Statement of legal acceptability
  - A statement of a community's values, sentiments, etc.
- Detailed statement of impact or a method for assessing the impact of an actual dam failure (requires detailed study)

The Existing Consequence Classification System (CDA 2007)

WHY DO WE NEED TO CHANGE?

CONSEQUENCE CATEGORY	POP'N AT RISK	INCREMENTAL LOSSES		
		LOSS OF LIFE	ENVIRONMENTAL & CULTURAL VALUES	INFRASTR. & ECONOMICS
EXTREME	Permanent	More than 100	Major loss… Restoration impossible…	Extreme losses…
VERY HIGH	Permanent	100 or fewer	Significant loss… Restoration impractical…	Very high economic losses…
HIGH	Permanent	10 or fewer	Significant loss… Restoration probable…	High economic losses…
SIGNIFICANT	None	Unspecified	No significant loss…	Loss to recreational facilities…
LOW	Temporary Only	0	No long term loss…	Low economic loss…

The Existing Consequence Classification System (CDA 2007)

WHY DO WE NEED TO CHANGE?

CONSEQUENCE CATEGORY	INCREMENTAL LOSSES
	ENVIRONMENTAL
EXTREME	• Major loss of critical fish or wildlife habitat. • Restoration or compensation in kind impossible.
VERY HIGH	• Significant loss or deterioration of critical fish or wildlife habitat. • Restoration or compensation in kind possible but impractical.
HIGH	• Significant loss or deterioration of important fish or wildlife habitat. • Restoration or compensation in kind highly possible.
SIGNIFICANT	• No significant loss or deterioration of fish or wildlife habitat. • Loss of marginal habitat only. • Restoration or compensation in kind highly possible.
LOW	• Minimal short-term loss • No long term loss

The Existing Consequence Classification System (CDA 2007)

WHY DO WE NEED TO CHANGE?

CONSEQUENCE CATEGORY	INCREMENTAL LOSSES
	ENVIRONMENTAL
EXTREME	**Major** loss of **critical** fish or wildlife habitat. Restoration or compensation in kind **impossible**.
VERY HIGH	**Significant** loss or **deterioration** of **critical** fish or wildlife habitat. Restoration or compensation in kind possible but **impractical.**
HIGH	**Significant** loss or **deterioration** of **important** fish or wildlife habitat. Restoration or compensation in kind **highly possible**.
SIGNIFICANT	No **significant loss** or **deterioration** of fish or wildlife habitat. Loss of **marginal** habitat only. Restoration or compensation in kind highly possible.
LOW	**Minimal** short-term loss No long term loss

Ambiguity

The Existing Consequence Classification System (CDA 2007)

WHY DO WE NEED TO CHANGE?

Is there a place for Judgment in Environmental decision-Making?

- *Yes, but the nature of that judgment matters*
- *So does transparency*
- *Some guidance under which judgment is exercised also helps*
- *And a few other things…*

The Existing Consequence Classification System (CDA 2007)

WHY DO WE NEED TO CHANGE?

VALUE JUDGMENT

- Opinion based on your principles and beliefs

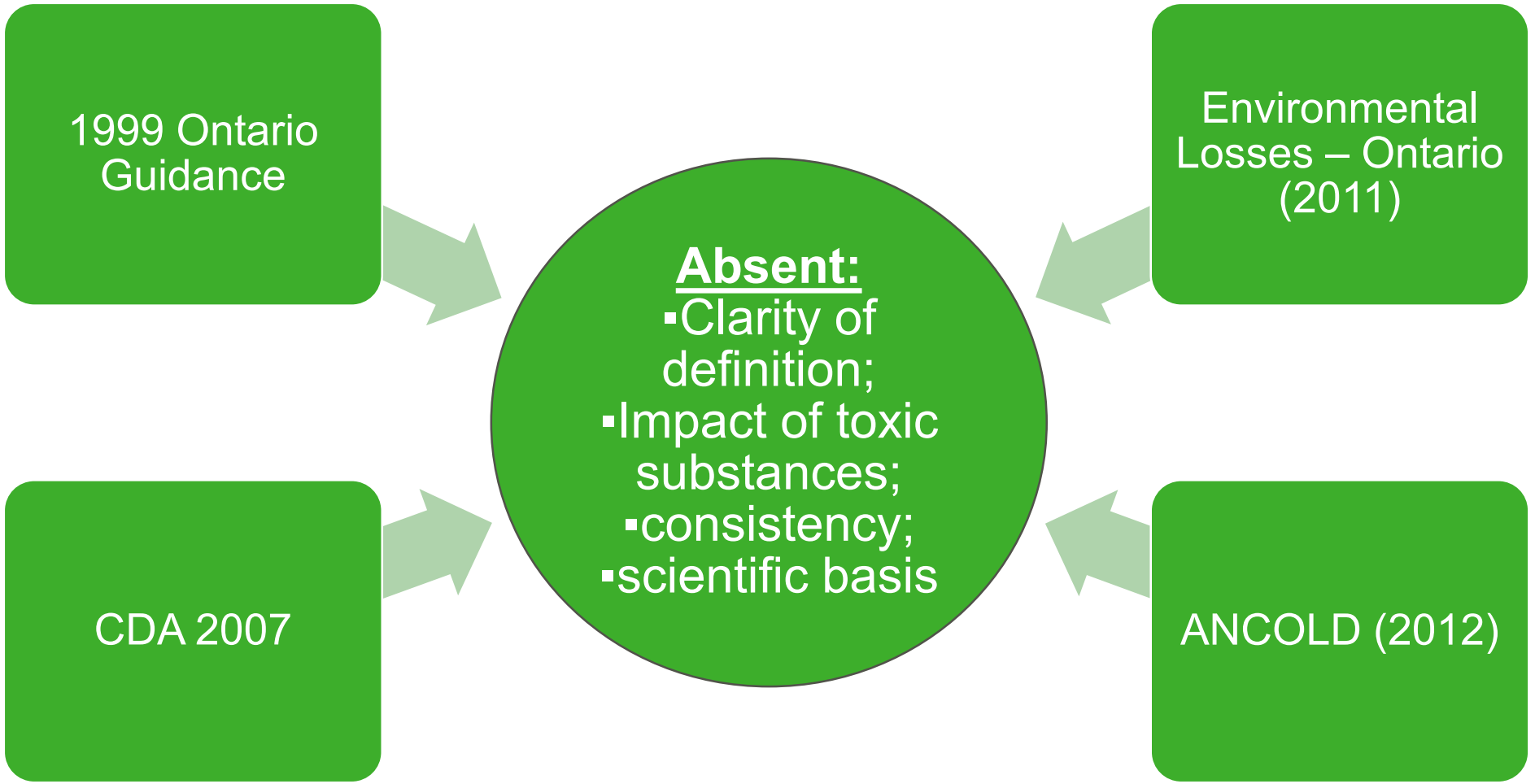
Vs.

PROFESSIONAL JUDGMENT

- Opinion originating from training and experience and relying on verifiable facts, data, scientific principles

What do others do?

CAN WE ~~STEAL~~ LEARN FROM THEM?



Goals for a new system

(Proposed) Environmental Consequence Classification Framework

DAM FAILURES IMPACT ON HABITATS OF LIVING THINGS

Three variables are used to classify environmental consequence:

Ecological Impact

Based on a **species of special interest**

Percent of **regional habitat** damaged from the physical effects of a breach

Intrinsic Hazard of Contents

Characteristics such as toxicity, metal-leaching, radionuclides

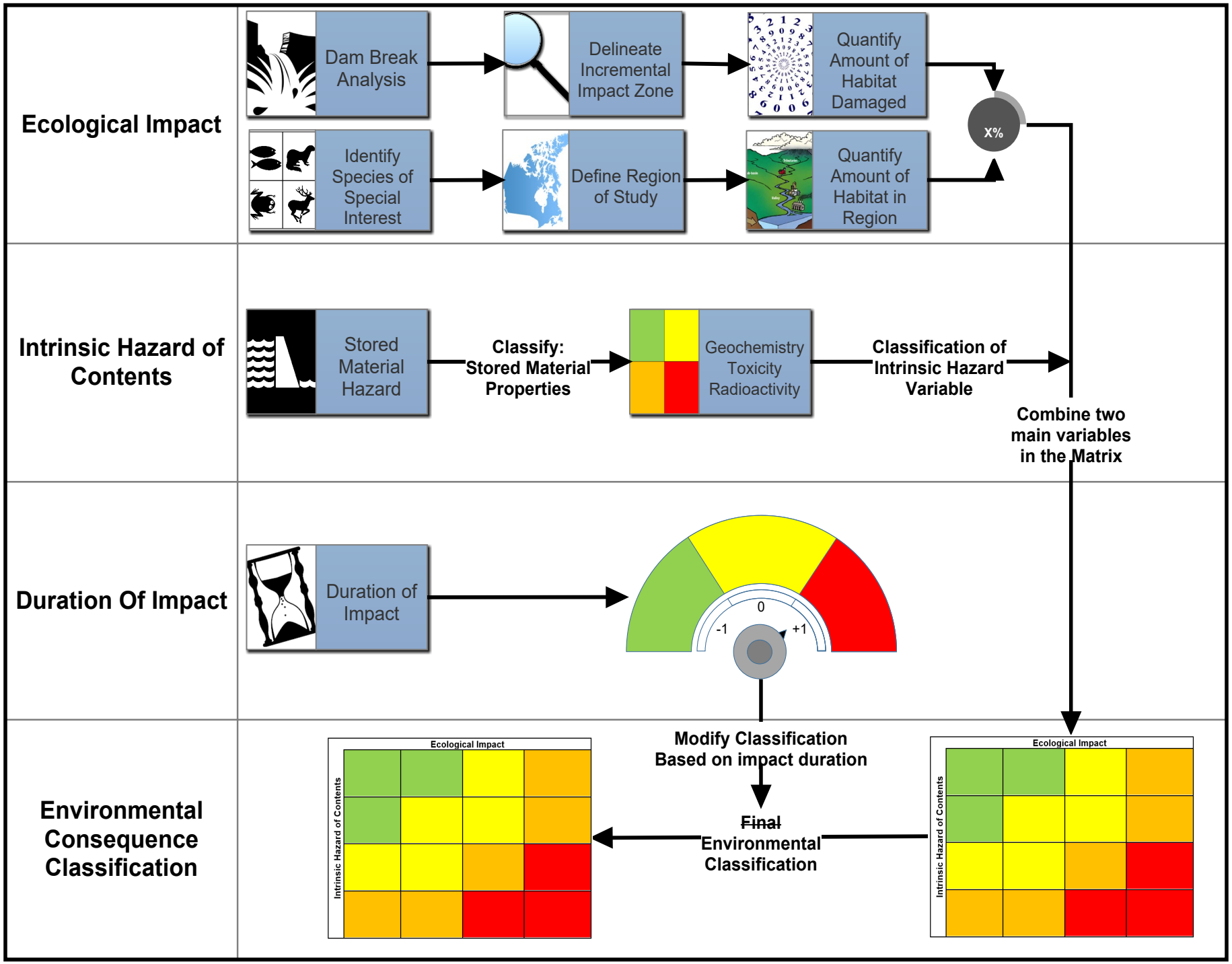
Increases environmental damage beyond physical

Duration of Impact

A modifying variable to reflect duration of effect

Enables consideration of ecosystem types and range in climate

The Proposed Environmental Consequence Classification Framework



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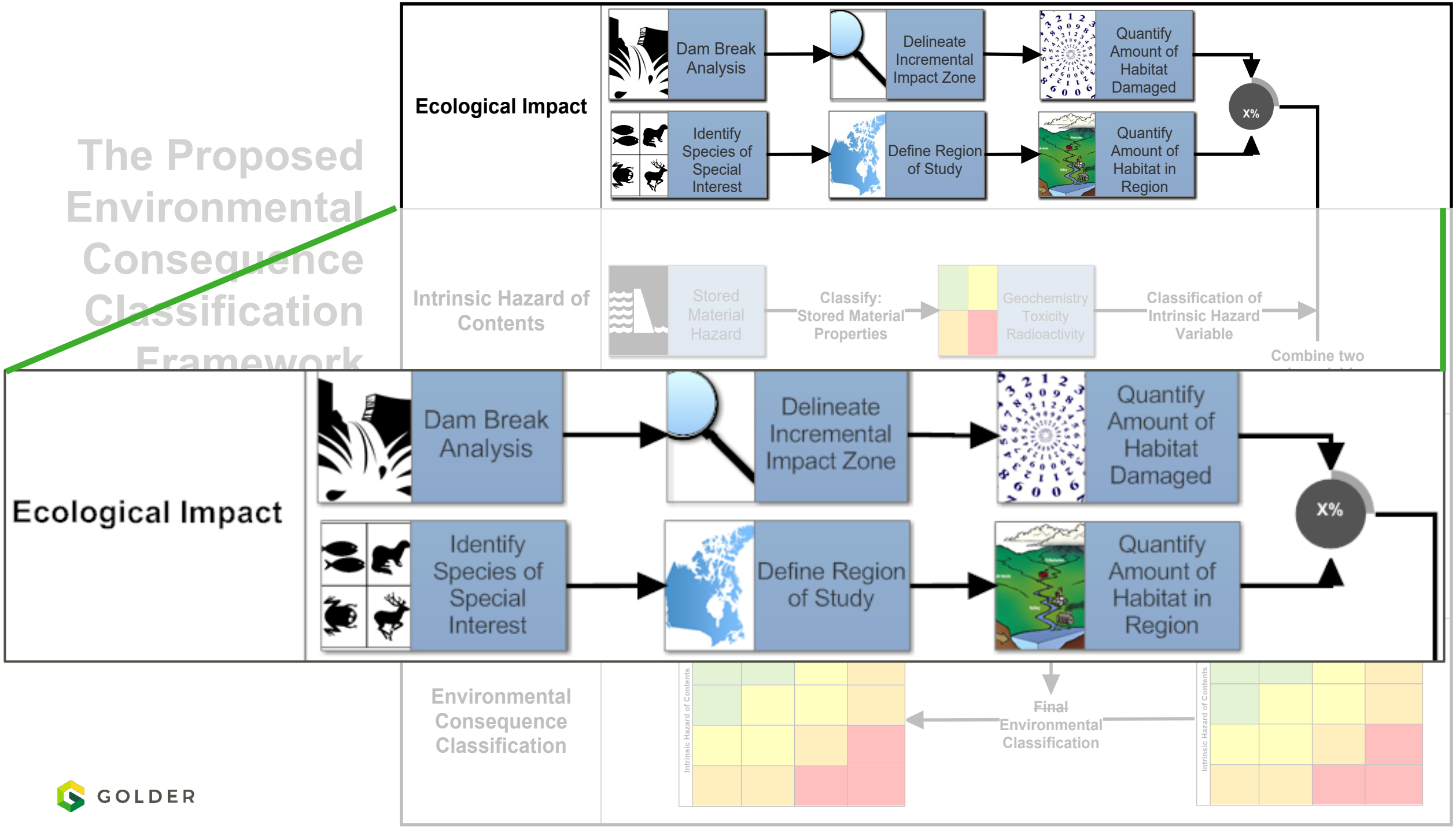
The Proposed Environmental Consequence Classification Framework



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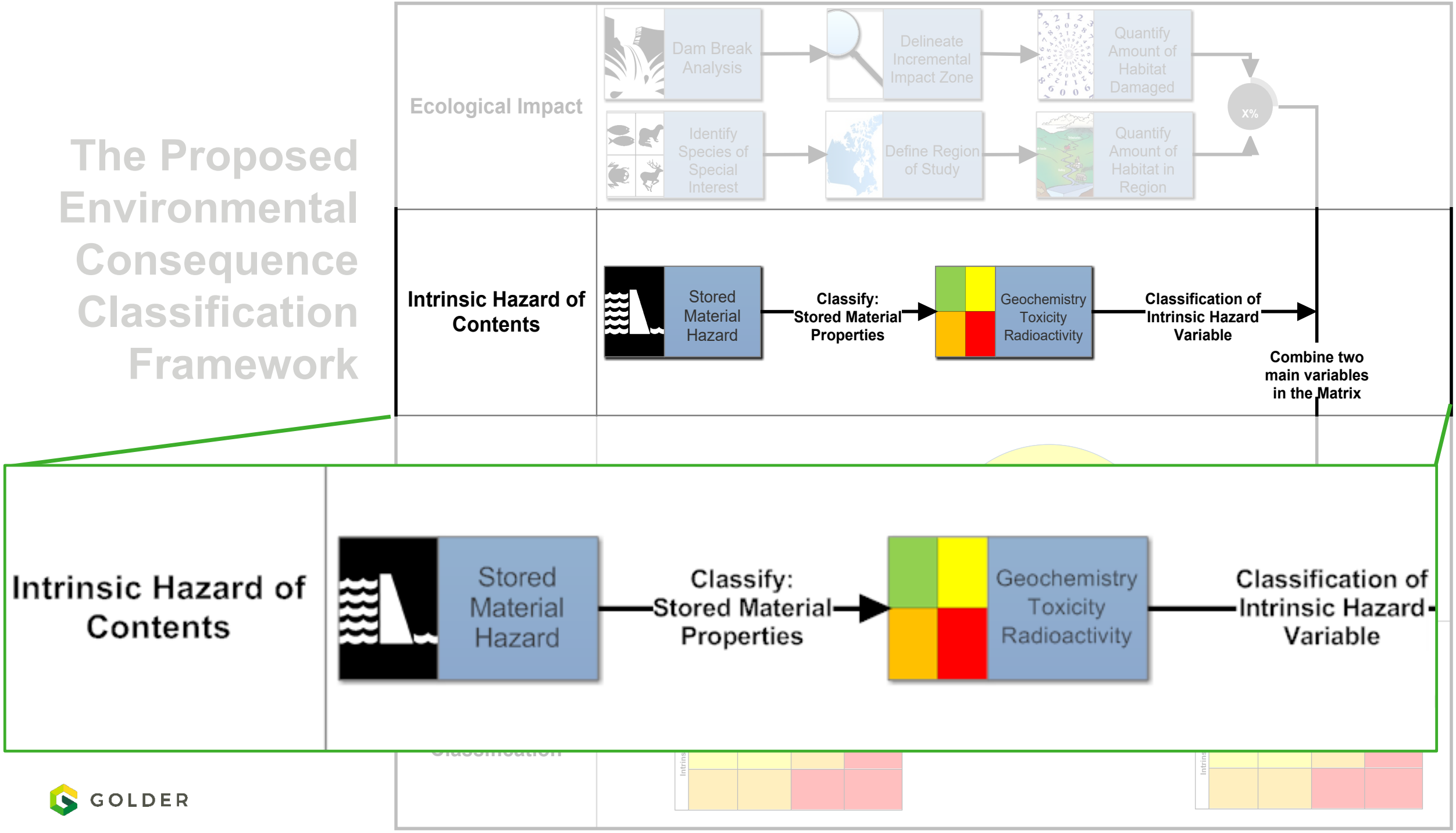
The Proposed Environmental Consequence Classification Framework



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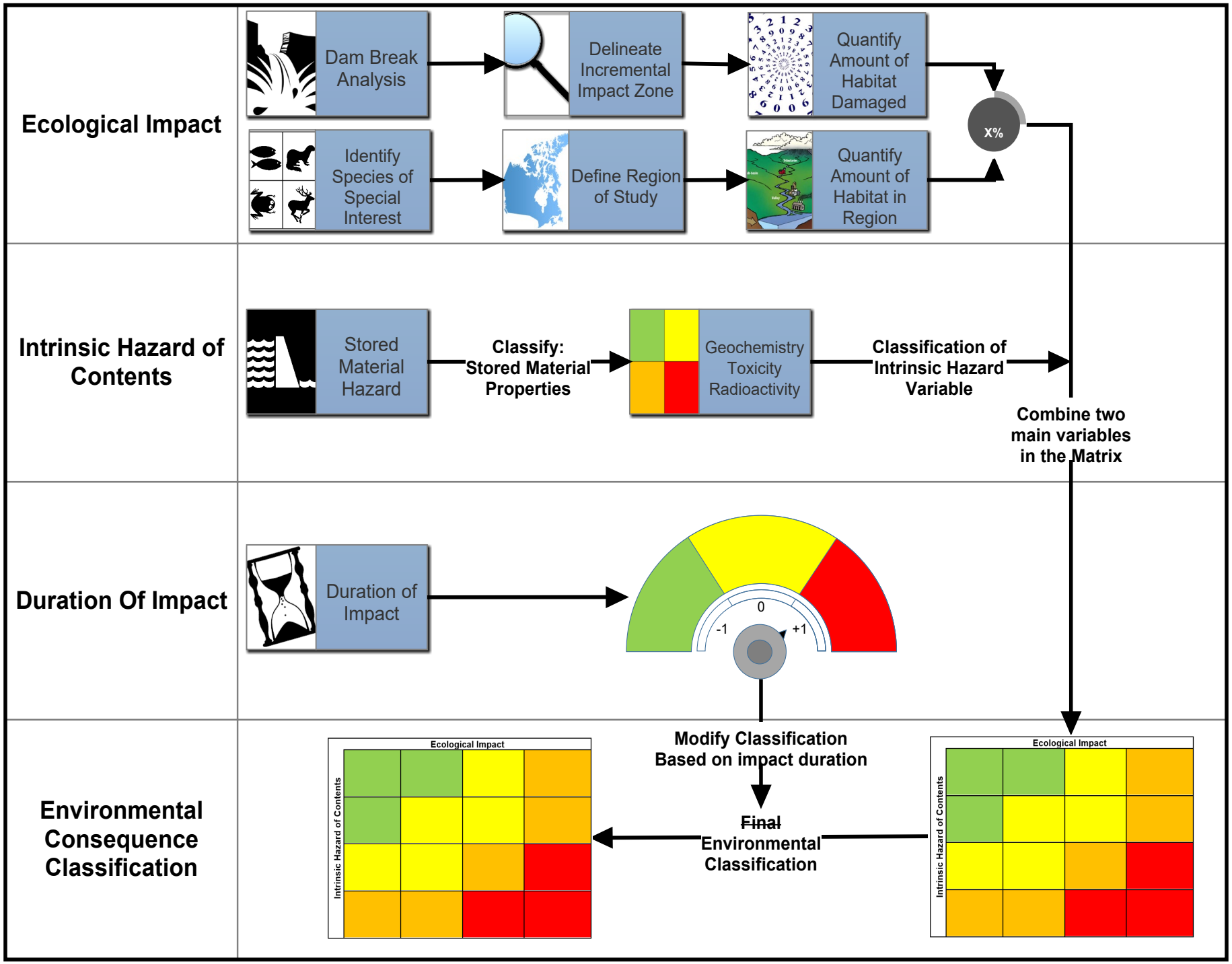
The Proposed Environmental Consequence Classification Framework



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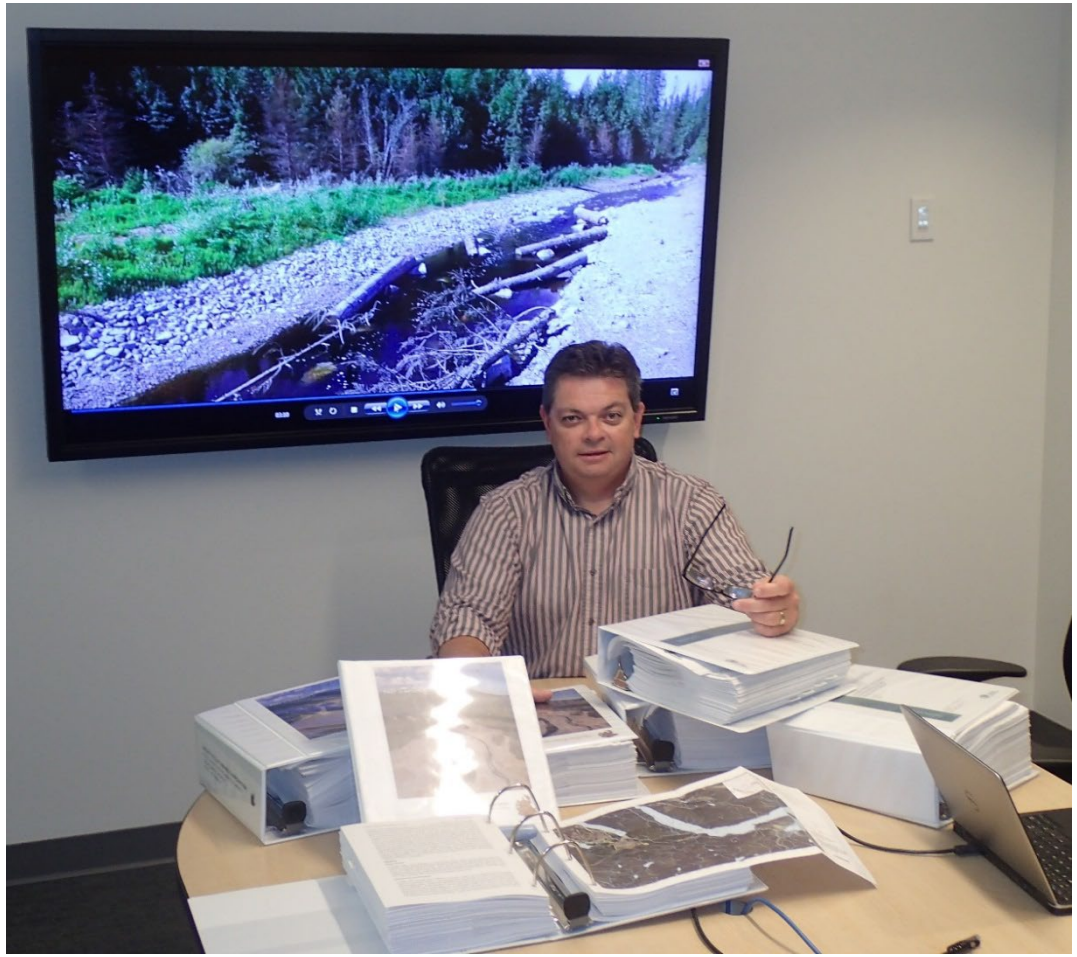
BETA TEST:

MOUNT POLLEY TAILINGS DAM FAILURE

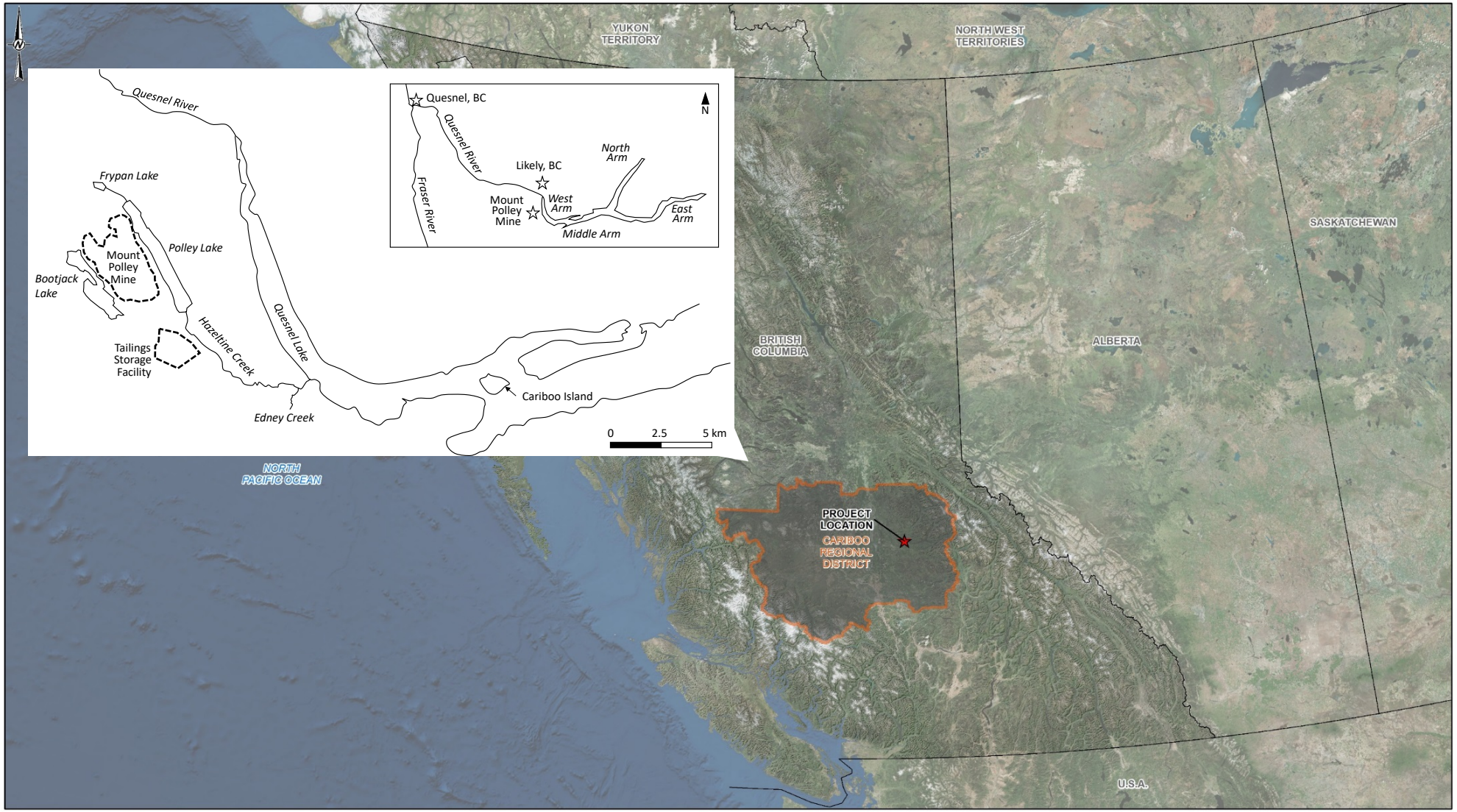
Good Candidate for a Beta Test

MOUNT POLLEY WAS A "POSITIVE CONTROL"



- Thousands of pages of detailed physical, biological, chemical and geochemical studies – openly available on Imperials Metals' website
- Countless Public Meetings, mail outs, progress videos
- Full transparency – data (including raw data) are on the internet

Mine Location



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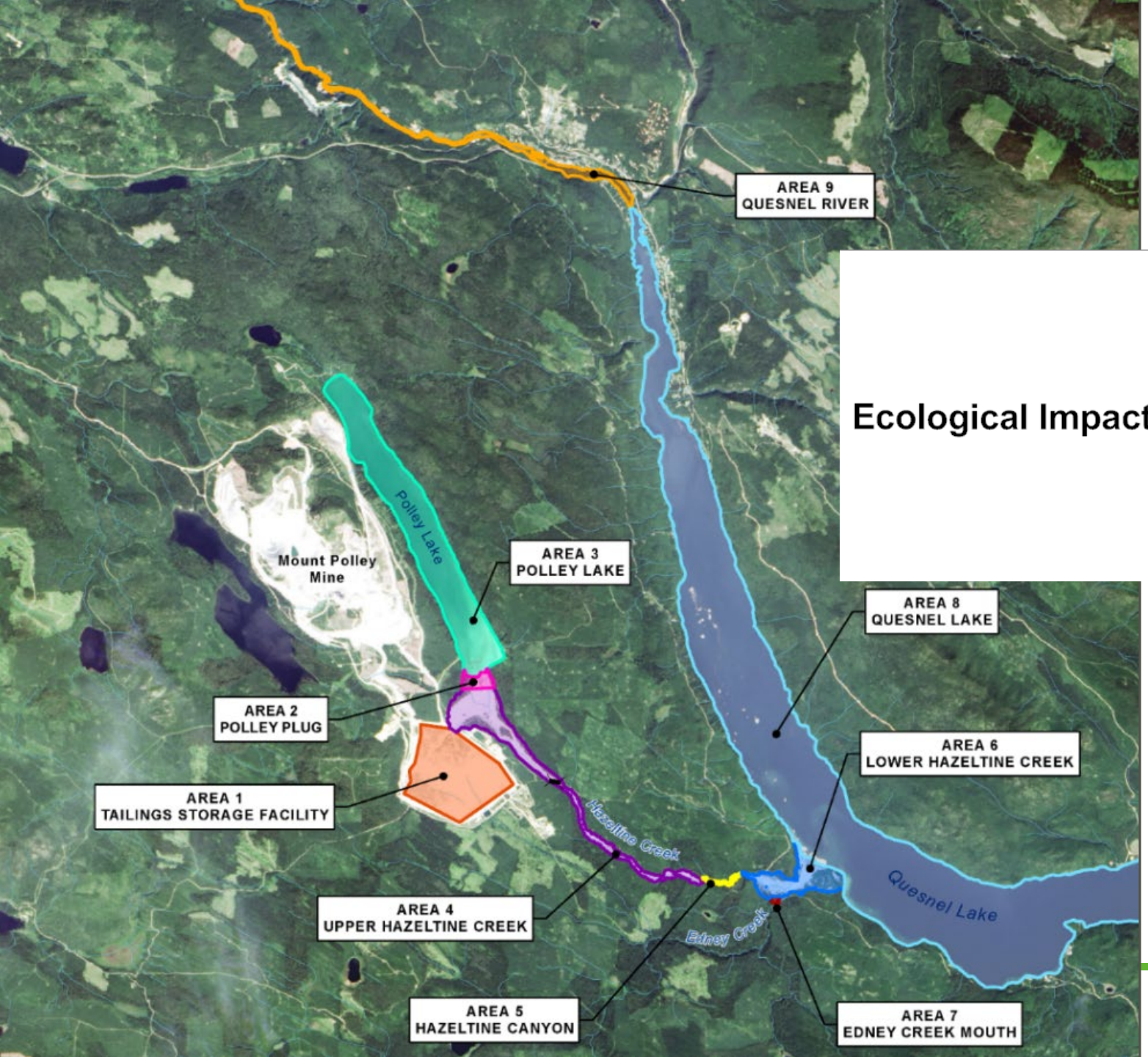
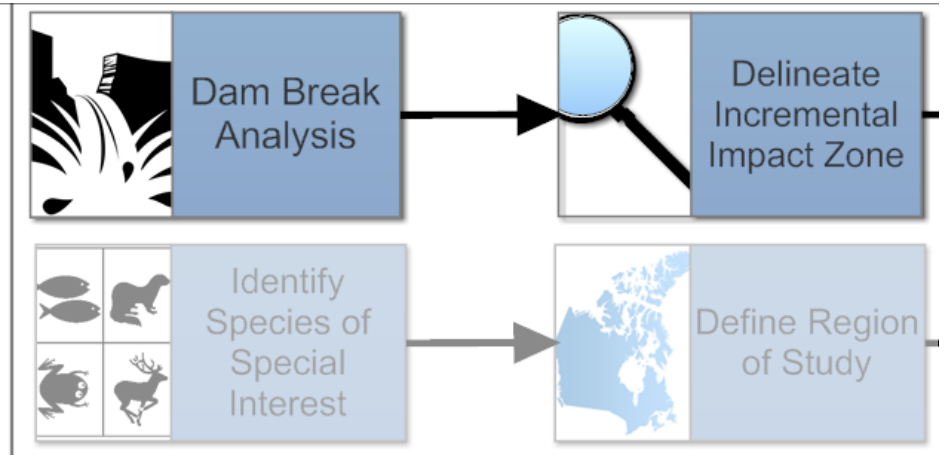
Inundation Map

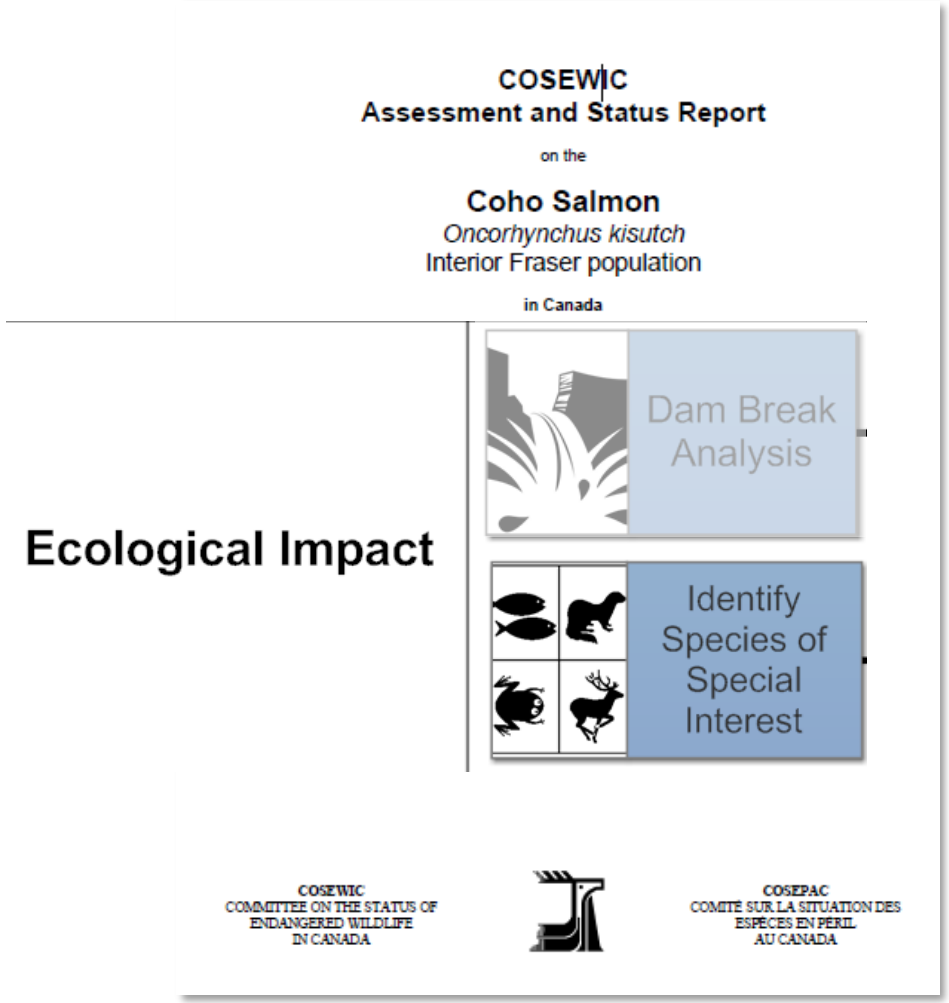
AS IT OCCURRED



Ecological Impact



Identifying Species of Special Concern

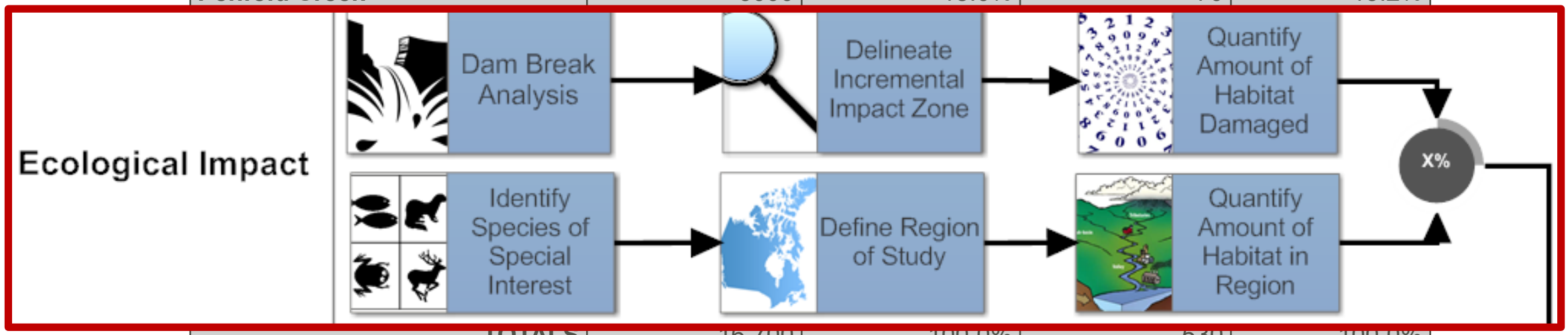


- Threatened race of Coho salmon
- Genetic structure of IFC: 5 distinct populations + subpopulations
- For Consequence Classification purposes, Quesnel Lake watershed is a suitable level of resolution as intermingling of that group would occur.
- Local habitat data available

Ecological Impacts

STREAM SURVEY RESULTS: INTERIOR FRASER COHO HABITAT SURVEY 2007

Stream Name	Habitat Amount		Spawning Adult Count	
	Length (m)	% total Length	No. of Adult Fish	% Total
Abbott Creek	900	5.4%	6	1.1%
Clearbrook Creek	350	2.1%	10	1.9%
Edney Creek	600	3.6%	12	2.3%
Hazeltine Creek	650	3.9%	4	0.8%
Mitchell River	6000	35.9%	88	16.6%
Penfold Creek	3000	18.0%	70	13.2%
TOTALS	16,700	100.0%	530	100.0%



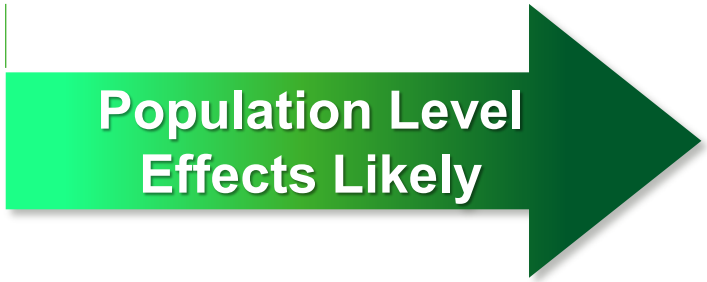
1. Ecological Impact

CLASSIFICATION OF THE ECOLOGICAL IMPACT VARIABLE

Of those creeks surveyed and containing IFC, **7.5%** of available IFC habitat was impacted by the breach

Therefore: Class B

Class A	Class B	Class C	Class D
< 5 % of species of special concern habitat in the defined study area.	5-20 % of species of special concern habitat in the defined study area.	20-50 % of species of special concern habitat in the defined study area.	> 50 % of species of special concern habitat in the defined study area.



IFC = Interior Fraser Coho

2. Intrinsic Hazard of Stored Material

CLASSIFICATION OF WHAT IS INSIDE THE DAM

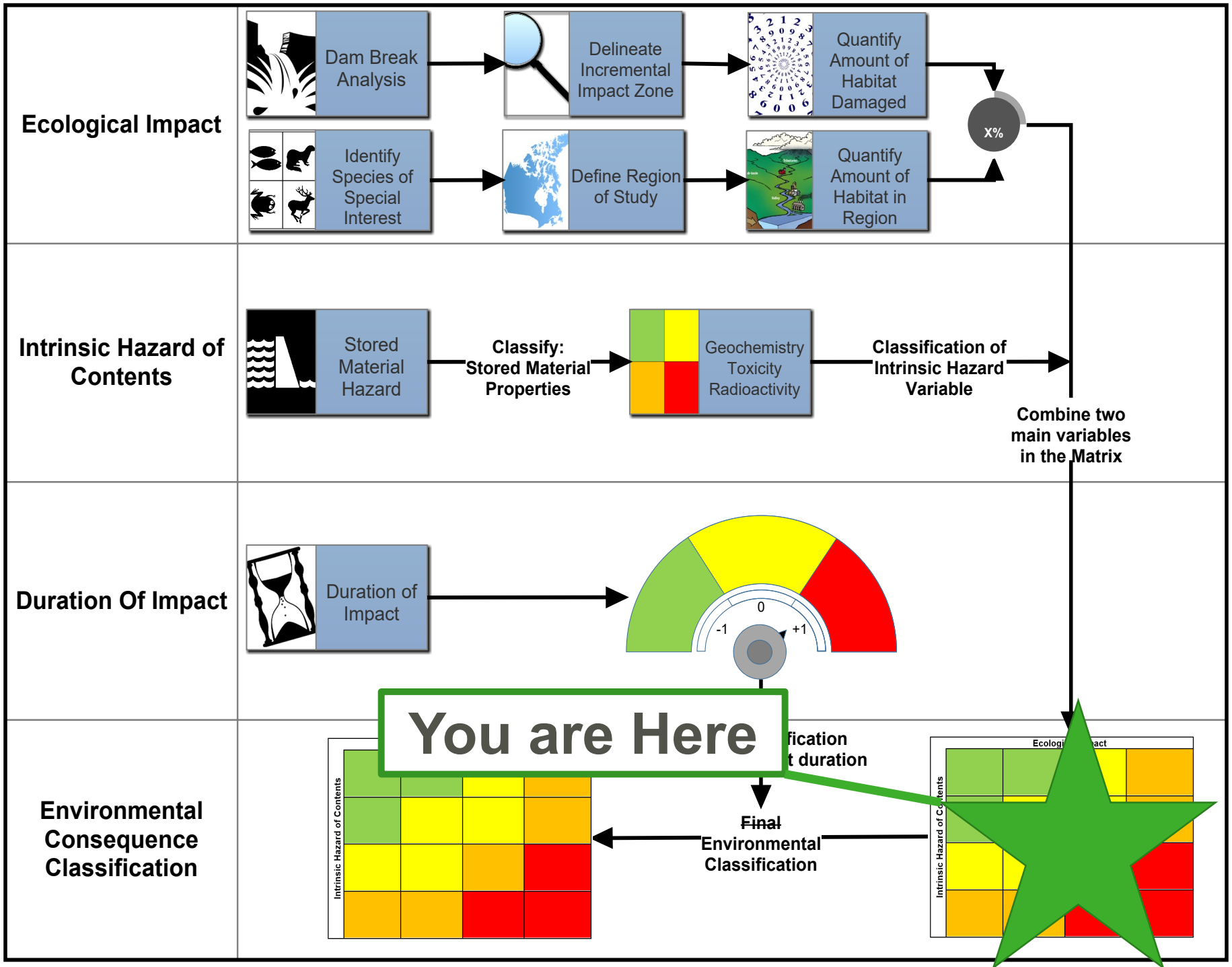
- Fluid and solids **were released** in failure
- Supernatant was regularly tested → **non-toxic**
- Tailings: non-acid generating, non-metal leaching
- **Therefore Class B**

	Class A	Class B	Class C	Class D
Release of liquid contents	Stored water /liquid transported outside the dam is non-acutely lethal	**Stored water /liquid transported outside the dam is non-acutely lethal.**	Stored water /liquid transported outside the dam is acutely lethal	Stored water /liquid transported outside the dam is acutely lethal
		AND/OR		
Release of solid contents	No solids are released	**Solids released not expected to leach metal(loid)s and/or produce acidity within the timeframe of reclamation activities**	Solids released have the potential to leach metal(loid)s and/or produce acidity within the timeframe of reclamation activities.	Solids released are expected to leach metal(loid)s and/or produce acidity

Classification Matrix – Mount Polley TSF Foundation Failure

Intrinsic Hazard of Stored Contents	Ecological Impact			
	CLASS A < 5% of species of special concern habitat in the defined study area	**CLASS B** 5-20% of species of special concern habitat in the defined study area	**CLASS C** 20-50% of species of special concern habitat in the defined study area	**CLASS D** >50% of species of special concern habitat in the defined study area
CLASS A transported water/liquid is non-acutely lethal and/or no solids are released	LOW	LOW	SIGNIFICANT	HIGH
CLASS B transported water/liquid is non-acutely lethal and/or solids released not expected to leach metal(loid)s and/or produce acidity within the timeframe of reclamation activities	LOW	SIGNIFICANT	SIGNIFICANT	HIGH
CLASS C transported water/liquid is acutely lethal and/or solids released have the potential to leach metal(loid)s and/or produce acidity within the timeframe of reclamation activities	SIGNIFICANT	SIGNIFICANT	HIGH	VERY HIGH
CLASS D transported water/liquid is acutely lethal and/or solids released are expected to leach metal(loid)s and/or produce acidity	HIGH	HIGH	VERY HIGH	VERY HIGH

The Proposed Environmental Consequence Classification Framework



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3. Duration of Impact

- Active soil and revegetation work
- Active stream restoration work (Edney habitat constructed, Hazeltine Habitat in progress)
- IFC found in rebuilt sections of Edney Creek (excluded from Hazeltine during construction)

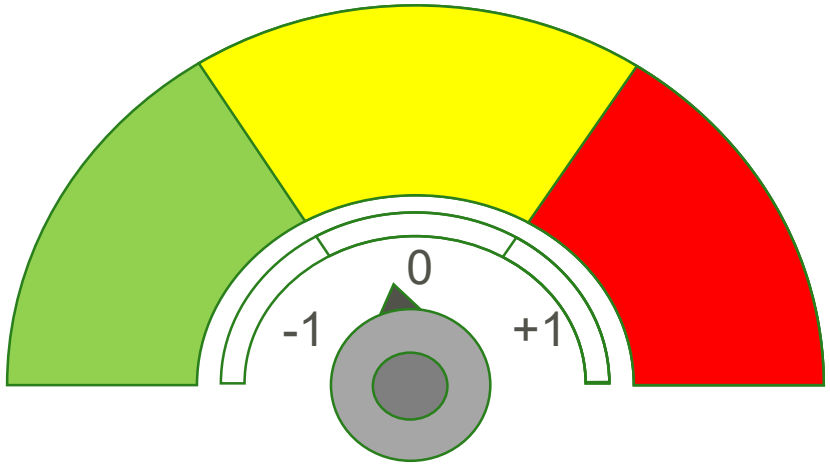
3. Duration of Impact

ENVIRONMENTAL CONSEQUENCE MODIFIER BASED ON ESTIMATED DURATION OF IMPACT

- Duration of impact estimated to be in range of 5 to 25 years

- **No Change to ECC**

Reduce ECC	No Change	Increase ECC
A return to acceptable restoration is feasible within a short (< 5 years) timeframe	A return to acceptable restoration is feasible within a moderate timeframe (5 to 25 years)	A return to acceptable restoration is unlikely within an extended timeframe (> 25 years).



Mount Polley Consequence Classification of “Significant”

REASONABLE?

Mount Polley

Meager Creek Slide

Goals for a new system

DID WE COME CLOSE?

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- Questions?
- Comments?
- Feedback?

…ARE WELCOME