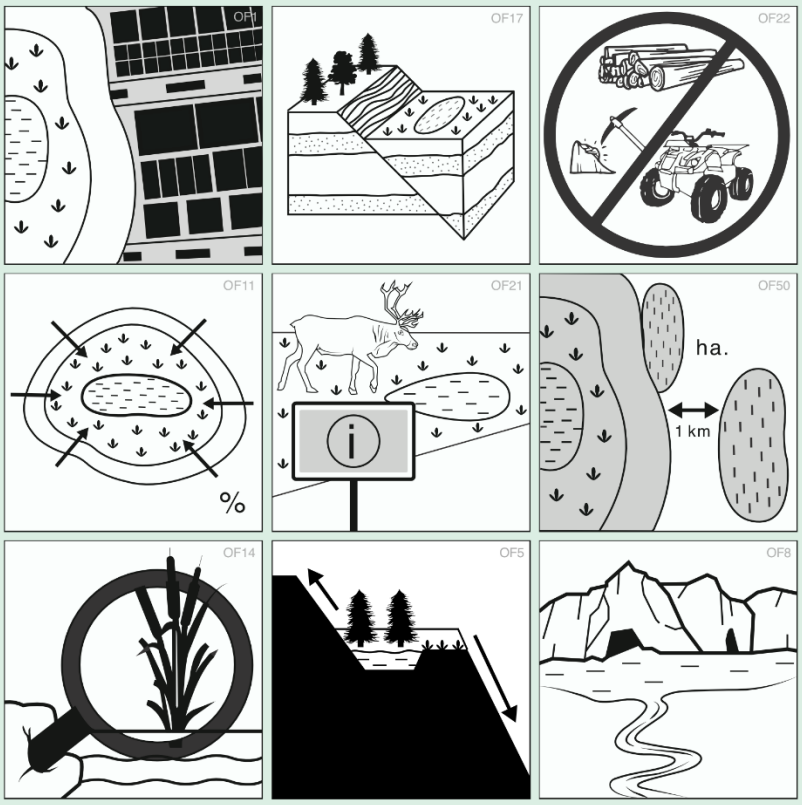
WETLANDS ECOSYSTEM SERVICES PROTOCOL

WESP-BC



Desktop Assessment

Non-Tidal Wetlands

Prepared by the B.C. Wildlife Federation, March 2026

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1 INTRODUCTION

This guide is a technical resource designed to support the Desktop Assessment component of the Wetland Ecosystem Service Protocol (WESP-BC). Before beginning this component, users should be familiar with the WESP-BC Manual and have completed the WESP-BC Field Assessment, including the final validation of the Assessment Area (AA) and Contributing Area (CA).

The Desktop Assessment requires interpreting satellite imagery and provincial spatial datasets to answer 44 key questions. While this guide references publicly available province-wide datasets, users are encouraged to utilize higher-quality local data or superior imagery where available. Local knowledge and field notes should also be available while completing this assessment.

All datasets mentioned are intended as reference resources; final responses should be based on the most suitable answer using professional judgment. Observations made during the field component including defined boundaries, land use observations, field notes, and interpretation of recent imagery must be prioritized over spatial datasets, which may be outdated or contain inaccuracies.

This guide provides step-by-step instructions to assist users when deciding between multiple options. However, it is designed with the following principles in mind:

- Proportional Effort: In many cases, not all analysis steps listed here will be necessary. For most sites, answers will clearly fall into the lowest or highest categories, and exact calculations of area or percent cover may not be required.
- Oversight: The process encourages manual oversight of every question to mitigate issues arising from mapping inaccuracies or limited data.
- Optimization: Users are encouraged to pursue opportunities for automation, provided that the integrity of the "best available data" is maintained.

All final responses must be entered into the current WESP-BC Desktop Assessment Survey123 form for each site. Once the desktop questions are submitted, the .csv outputs from both the Field and Desktop Assessments are used within the WESPR tool to calculate the final function and benefit scores.

1.1 DATA PREPERATIONS

To make the Desktop Assessment as efficient as possible there are some analysis should be done first. The datasets created in these analysis should be retained and accompany the other data collected and packaged with WESP-BC results. To simplify dataset naming it is recommended to save all layers within one folder with the suggested standardized naming.

1.1.1 NECESSARY MAPPING FROM FIELD ASSESSMENT

Prior to beginning these questions, review the data collected specifically for your site, and ideally have polygons delineated that were confirmed in the field for areas including:

- **AA that has been field verified**

  This is the polygon that has been verified in the field. There are detailed instructions on determining the AA in the WESP-BC Manual.

- **Contributing area (watershed)**

  The contributing area (watershed) is the portion of land that drains surface water into a common outlet (i.e., Assessment Area). It is defined by topographical features (e.g., ridges and hills) and flow direction, which may extend many kilometers upslope. Only areas that actually drain into the wetland are included and areas that flow into disconnected streams or basins are excluded. There are detailed instructions for determining the AA in the WESP-BC Manual

- **Streams observed in the field**

  Any streams that were observed in the field or are visible in imagery may be useful to map in order to quickly determine length which will be required for some questions

- **Open water observed in the field**

  Any open water areas that were observed in the field assessment or are known to occur should be included if they are not mapped in available datasets, as the area will need to be calculated for some questions

Accessing provincial datasets

Many questions in this assessment require review of provincially available datasets. These layers can be accessed in a variety of ways including downloading using the script on GitHub, or viewed online using iMap or downloaded individually from the BC Data Catalogue for additional information on reviewing provincially available datasets (Appendix A: 3).

Optimizing Layer Visualization

Prior to beginning analysis it may be advantageous to make each layer partially transparent in order to consider multiple layers at once. To optimize the mapping experience, it may be advantageous to strategically arranging the order of relevant layers (Appendix A: 2).

2 ACQUIRING SPATIAL DATA

To complete the analysis described in this guide, multiple publicly available datasets are required and summarized in Table 2.1. These datasets may not all be necessary for every site, or may be replaced by higher-quality locally available data, but are

suggested as a starting point. The package available on GitHub contains an up-to-date list of which of these layers can be obtained using the package. This package can be run by a beginner in RStudio and only requires the AA to be input as a .gpkg file. The package then identifies the Watershed Assessment Unit and a 10km buffer as the Area of Interest, for which all layers available are downloaded to a single folder. Other options for viewing and downloading the required spatial datasets are described in Appendix A.

Table 2.1. Required Datasets for Desktop Analysis

Dataset Name	Question Relevance
Aerial Imagery for the site and surrounding area *not available as part of preparing spatial data package	All
Land Cover Mapping *not currently available as part of preparing spatial data package	OF 34, 35, 36, 37
BC Wildfire Fire Perimeters – Historical (Government of British Columbia, 2025b)	OF 15
BC Cumulative Effects Framework - Human Disturbance (Government of British Columbia, 2023a)	OF 31, 32, 41
BC Cumulative Effects Framework – Integrated Roads – 2025 (Government of British Columbia, 2025a)	OF 2, 9, 30, 42
BC Historical Fish Distribution – Points (50,000) (Government of British Columbia, 2006)	OF 20
Conservation Lands (Government of British Columbia, 2025c)	OF 21, 22
Critical Habitat for Federally-Listed Species at Risk - Posted (Government of British Columbia, 2024a)	OF 21
Designated Lands (GitHub File)	OF 21, 22
Digital Road Atlas (DRA) – Master Partially – Attributed Roads (Government of British Columbia, 2025d)	OF 2 (if applicable), 12, 30, 31, 42
Ecoprovinces - Ecoregion Ecosystem Classification of British Columbia (Government of British Columbia, 2004)	OF 44
Freshwater Atlas – Lakes (Government of British Columbia, 2008b)	OF 3, 18, 19
Freshwater Atlas – Rivers (Government of British Columbia, 2025e)	OF 6, *9*
Freshwater Atlas – Stream Directions (Government of British Columbia, 2023b)	OF 6, 8, 9, 10, 11
Freshwater Atlas – Glaciers (Government of British Columbia, 2008a)	OF 8
Freshwater Atlas – Stream Network (Government of British Columbia, 2024b)	OF 6, 8, 9, 10, 11
Freshwater Atlas – Watershed Groups (Government of British Columbia, 2008c)	OF 5, 6, 9
Freshwater Atlas – Watershed Boundaries (Government of British Columbia, 2025f)	OF 11

Freshwater Atlas – Wetlands (Government of British Columbia, 2025g)	OF 19, 43
Geology Faults (*Government* of British Columbia, 2018)	OF 17
Municipalities - Legally Defined Administrative Areas of BC (Government of British Columbia, 2016)	OF 1
NGO Conservation Areas – Fee Simple (Government of British Columbia, 2024c)	OF 22
Reconnaissance Karst Potential Mapping (Government of British Columbia, 2002)	OF 16
Species and Ecosystems at Risk - Publicly Available Occurrences - CDC (Government of British Columbia, 2025i)	OF 21, 22, 24
TANTALIS – Wildlife Management Areas (Government of British Columbia, 2025k)	OF 21, 22, 24
TANTALIS – Conservancy Areas (Government of British Columbia, 2025j)	OF 21, 22
Ungulate Winter Range – Approved (Government of British Columbia, 2025l)	OF 21
VRI – 2024 – Forest Vegetation Composite Polygons (Government of British Columbia, 2024d)	OF 28, 29, 38, 39, 40
VRI – Relational Data Dictionary (Government of British Columbia, 2019)	OF 28, 29, 38, 39, 40
Old Growth Technical Advisory Panel (TAP) – Old Forests *not available as part of preparing spatial data package	OF 33
Wildlife Species Inventory – Incidental Observations –Publicly Available (Government of British Columbia, 2025o)	OF 24
Wildlife Species Inventory – Survey Observations - Publicly Available (Government of British Columbia, 2025n)	OF 24
Wildlife Species Inventory – Telemetry Points – Publicly Available (Government of British Columbia, 2025p)	OF 24
Wildlife Habitat Features – Incidental Observations – Publicly Available (Government of British Columbia, 2025m)	OF 24
Wildlife Habitat Features – Survey Observations – Publicly Available (Government of British Columbia, 2025n)	OF 24
Secured Species at Risk Observations from Conservation Data Center (data request required)	OF 24

2.1 GEOGRAPHIC INFORMATION SYSTEM (GIS) SOFTWARES

The majority of office questions in this manual require the use of GIS. A variety of different software can be used to complete this analysis. In this guide ArcGIS Pro 3.6 has primarily been used. Some of the foundational skills to use the software have been described in **Error! Reference source not found.**. The GIS instructions included in this guide assume some a basic working knowledge of GIS and utilizing tools such as buffers, erasing features, clipping features, calculating geometry, summarizing statistics, selecting intersecting features etc. Optimizing layer appearances, utilizing a variety of basemaps and other navigational tools may be useful to navigate the abundance of layers

2.1.1 DATA PREPARATION

To streamline the Desktop Assessment, certain preparatory steps should be done ahead of time to make the workflow more efficient and allow for the series of

questions to be completed quickly. It is suggested to follow naming conventions described in Table 4.1, to ensure that the relevant layer can be found when following steps in this document. Some datasets are described as being optional, such as lakes clipped to 2km would not be necessary if there are no lakes within the 2km buffer. These datasets are optional as they may not apply to all situations. Generally, if any of the datasets in Table 4.1 are necessary to answer the question for the site of interest, then they should accompany the site data in a geodatabase.

Table 2.2 Necessary Dataset Analysis for Desktop Assessment

Dataset Name	Description	Relevant Question
"AA"	Delineated Wetland or Assessment Area (AA), based on AA guidance in the WESP-BC Manual Attributes including area in Hectares (Ha)	All questions
"AA_OpenWater"	Open water observed in the field	
"Streams_field_verified"	Streams mapped based on recent imagery or field observations	
"Buffer_2km_excluding_AA"	2km buffer around the AA with the AA polygon excluded	OF 31, 32, 33
"Buffer_100m_excluding_AA"	100m buffer around the AA with excluding the wetland	OF 30
"Buffer_100m_including_AA"	100m buffer including the AA	OF 21,OF 36
"Buffer_1km"	1km buffer polygon around the AA	OF 34
"Buffer_2km"	2km buffer polygon around the AA	OF 18, 19, 37
"Buffer_5km"	5km buffer polygon around the AA	OF 34
"Buffer_10km"	10km buffer polygon around the AA	OF 4
"Lakes_clipped_2km"	All mapped lakes clipped to a 2km buffer Hectares field calculated	OF 18, 19
"Wetlands_clipped_2km "	Portions of mapped wetlands inside the 2 km buffer of the AA Hectares field calculated	OF 19
"Wetland_100m_Buffer"	Wetlands within 100m buffer	OF 12
"CA_polygon"	Manually digitized polygon representing the full contributing area	OF 11
"CA_excluding_AA"	Contributing area polygon where AA is removed	OF 11
"Disturbed_WAU"	Disturbance within the WAU boundary	OF 41
"WAU"	Watershed Assessment Unit (WAU) that wetland falls within	OF 12, 41, 42, 43
"Forests_within2km"	Forests within 2km buffer	OF 33

"AA_Landcover"	Land cover features clipped to the AA	OF 35
"Landcover_1km"	Land cover within 1km buffer	OF 34
"Landcover_5km"	Land cover within 1km buffer	OF 34
"Landcover_AA_100m"	Landcover within 100m including AA	OF 36
"Mature_OldGrowth_within2km"	Mature or old growth forests within 2km buffer	OF 33
"Roads_WAU"	Roads with the WAU boundary	Of 42
"HumanDisturbance_2km"	Human disturbance layer clipped to within 2km	OF 32
"AllRoads_100m"	All roads within 100m buffer of the AA	OF 30
"AA_DesignatedOverlap"	Portion of the AA intersecting designated conservation/ecological lands	OF 21

Contributing Area Excluding The AA

1. Modify the Contributing Area (CA) polygon that wasmappe verified in the field:
   i. Go to **Edit** > **Create Features** > **Polygon** template.
   ii. Trace the CA boundary starting from the wetland outlet, following contours, terrain, contours, and stream flow direction.
   iii. Save the polygon (e.g., *CA_polygon*).
2. Erase the AA from the CA polygon:
   i. *see* 11
   ii. Save CA without AA as "*CA_excluding_AA*".
3. Calculate AA area:
   i. Open the **Attribute Table** for both *AA_polygon* and *CA_excluding_AA*.
   ii. Confirm the *Shape_Area* field (units: m^2).
   iii. If necessary, add a new field (e.g., *Area_ha*) and calculate hectare by dividing the *Shape_Area* by 10,000.

2.2 BUFFERS

Buffers for AA should be created for multiple distances:

a. < 100 m "*Buffer_100m"*
b. 100 - 500 m "*Buffer_500m"*
c. 0.5 - 1 km "*Buffer_1km*"
d. 1 - 5 km *"Buffer_5km*
e. > 5 km *"Buffer_larger_than_5km"*
f. 10 km *"Buffer_10km"*

NOTE: Refer to Appendix-A for buffer tool instructions.

Buffers may be useful to determine presence or absence of specific features within a certain distance. In some cases, buffers may also useful to clip other datasets in order to calculate areas or determine percentage coverage.

Buffer 2km Excluding AA

Modify the 2km buffer and remove the AA

1. Select and export "*Buffer_2km"* layer.
2. Remove the AA from the buffer (*see* 11) and save it as "*2km_buffer_excluding_AA*".

Buffer 100m Including AA

1. Create a 100 m buffer around the AA (save as "*Buffer_100m*").
2. Merge AA and buffer into a single extent:
    i. Use the **Union (Analysis)** or **Merge (Data Management)** tool.
    ii. **Input Features** = AA_polygon and Buffer_100m.
    iii. Save as "*Buffer_100m_including_AA*".

Buffer 100m Excluding AA

1. Select and export "*Buffer_100m*" layer.
2. Remove the wetland from the buffer using the Erase tool (*see* 11).
    i. Save as "*Buffer_100_NoWetland*"
3. Select intersecting roads by adding the DRA – Master Partially – Attributed Roads layer.
4. Use *Buffer_100_NoWetland* to select intersecting roads.

Lakes Within 2km

The steps to create this layer can be replicated to create other layers that may apply only within specific buffers.

1. Modify the lakes layer if there are other lakes not mapped but are known to exist based on local knowledge, other datasets, or imagery interpretation
2. Clip lakes to the 2 km buffer (Analysis > Clip): Go to Analysis tab > Tools > search for Clip.
    ii. Input Features = Lakes (Freshwater Atlas).
    iii. Clip Features = "Buffer_2km".
    i. Output Feature Class = "Lakes_clipped_2km".
    Calculate lake areas using Calculate Geometry (Appendix A):
    i. Save as "Lakes_clipped_2km".

3 DESKTOP ASSESSMENT SURVEY

3.1 HOW TO INTERPRET QUESTION GUIDANCE

Each Desktop Assessment question described below includes recommended datasets, analysis process, and in some cases additional guidance to consider when answering each question. The description for each question may not include every component, but generally follows a similar structure:

OF# THE QUESTION TITLE THAT CORRESPONDS TO THE SURVEY123 QUESTION AND OTHER WESP RESOURCES

Relevant Layers

- *Links to layers that may be beneficial to consider*
- *Aerial Imagery – may also be listed if key to consider*

"Exact question as described on the Survey123 form"

NOTE: additional hints or helpful information may be included in a note. This is typically also included in the Survey123 form.

Question options including specification of answer format (select one, select multiple, integer, decimal etc.):

- Options or text data
- Formatted to match Survey123 form options

1. Specific steps to complete analysis will be included,
   a. These steps may include links to specific appendix resources.
2. If the answer is obvious from reviewing datasets and imagery these steps may not be required to complete for all sites

3.1.1 OF 1: DISTANCE TO COMMUNITY

Relevant Layers:

- *Assessment Area (AA)*
- *Aerial Imagery*
- *Municipalities - Legally Defined Administrative Areas of BC*

"The distance from the AA's edge to the nearest settlement (>5 residences per square km) or legally recognized municipality or community is:"

NOTES:

- Settlements can include clusters of homes, small communities, municipalities, or reserves. Use your judgment based on visible infrastructure and settlement patterns.
- Use the most recent imagery to visually inspect the area. Apply buffers or the measure tool to determine the distance to the nearest residential area.

Select one of the following:

- < 100 m
- 101 - 500 m
- 500 m - 1 km
- 1.01 - 5 km
- > 5.01 km

3.1.2 OF 2: DISTANCE TO FREQUENTLY TRAVELLED ROAD

Relevant Layers

- *BC Cumulative Effects Framework – Integrated Roads – 2025*
- *Digital Road Atlas (DRA) – Master Partially – Attributed Roads*
- *Aerial Imagery*

"The distance from the AA center to the nearest road with an average daytime traffic rate of > 1 vehicle/ minute is:"

NOTE: Only consider paved roads, confirm with aerial imagery or the Digital Road Atlas for road classification. **DO NOT** include trails, ATV routes, or unmaintained roads.

Select one of the following:

- < 10 m
- 11 - 25 m
- 26 - 50 m
- 51 - 100 m
- 101 - 500 m
- > 501 m

3. Add the relevant layers.
4. Adjust the symbology for clarity.
5. Measure the distance from the center of the AA to the nearest main paved road, or use the buffers to visually determine distance to the nearest road.

3.1.3 OF 3: DISTANCE TO PONDED WATER

Relevant Layers:

- *Aerial Imagery*
- *Freshwater Atlas – Lakes*

"The distance from the AA edge to the closest (but separate) body of fresh water (wetland, pond, or lake) that is ponded all or most of the year:"

NOTES:

- This method is for determining the distance from the AA to the nearest ponded freshwater feature (not rivers/streams).
- Focus on separate ponded features that do not appear to be part of the same continuous wetland.
- "Abutting" means directly touching without a 100+ m upland or infrastructure gap.
- You may count ponded areas obscured by vegetation if imagery, seasonal differences, or persistent saturation indicators suggest they are present.

Select one of the following:

- <100 m, and not separated by any width of paved roads, bare ground, or impervious surface.
- <100 m, but completely separated by those features.
- 101 m-1 km, and not separated.
- 101 m-1 km, but separated by those features.
- 1.05-5 km, and not separated.
- 1.05-5 km, but separated by those features.
- None of the above (the closest patches or corridors that are large, are more than 5 km away).

1. Add the Freshwater Atlas – Lakes layer.
2. Identify the AA and use the imagery basemap to visually locate nearby ponded water.
3. Measure from the edge of the AA to the nearest ponded feature:
    i. If separated by **roads, bare ground, or impervious surfaces wider than 100 m**, treat that body of water as being separate from the AA.

3.1.4 OF 4: DISTANCE TO LAKES

Relevant Layers:

- *Aerial Imagery*
- *Freshwater Atlas – Lakes*

"The distance from the AA edge to the closest (but separate) ponded water body larger than 8 hectares during most of a normal year is:"

NOTES:

- Ensure the lake is within the 10 km buffer (lakes smaller than 8 ha should be excluded).

- For islands, use only the island containing the AA, not all islands included in the watershed polygon.
- DO NOT use rivers/flowing water to define watershed boundaries; always use mapped watershed polygons.

Select one of the following:

- <100 m
- 101 m-1 km
- 1.01-5 km
- 5.01-10 km
- >10.01 km

1. Consider "*Buffer_10km*"**.**
2. Identify the AA and use the imagery basemap to visually locate the largest (*larger than 8 ha*) nearby ponded water.
3. Measure from the edge of your AA to the largest nearby ponded water.

3.1.5 OF 5: RELATIVE ELEVATIONS IN WATERSHED

Relevant Layers:

- *Elevation data (Topographic map sufficient)*
- *Freshwater Atlas – Watershed Groups*

1. If field GPS elevations are not available, add a **Topographic** basemap (*see* **Error! Reference source not found.**)
2. Identify the AA polygon:
   i. Use the **Explore Tool** (default cursor) or **Identify Tool**, click near the center of the polygon, and record the elevation (meters).
3. Add the Freshwater Atlas – Watershed Groups layer.
   i. Use the **Identify Tool**, click inside the AA polygon and record the watershed group name.
   ii. Examine available elevation data for the watershed group and determine the highest and lowest elevation for the watershed group. For South Coast Region:
      1. Lower Fraser is 2200m range
      2. Harrison River is 2250 m range
      3. Chilliwack River is 2400m range
4. Calculate relative elevation using the formula below:

$$\textbf{Relative Elevation} = \frac{\textbf{AA Elevation} - \textbf{Minimum Elevation}}{\textbf{Elevation Range of Watershed}}$$

- This calculation expresses the AA's elevation relative to its watershed: whether it lies near the bottom, middle, or top of the watershed.

3.1.6 OF 6: STREAM INTERSECT

Relevant Layers:

- *Aerial Imagery*
- *Freshwater Atlas – Watershed Groups*
- *Freshwater Atlas – Stream Directions – Points*
- *Freshwater Atlas – Stream Network – Lines, Edge Type*
- *Freshwater Atlas – Rivers*

"Do topographic maps or the Freshwater Atlas show a stream flowing out of the AA's wetland and into a downslope stream network, or does the AA abut a river and is probably flooded by the river periodically?"

NOTES:

- In the Freshwater Atlas – Stream Network, the following line types should be ignored unless field observations indicate otherwise:
  i. Flow Connector
  ii. Isolated Waterbody Skeleton
  iii. Underground Connector
  iv. Inferred Connector

Select one of the following:

- Yes
- No

1. Add the relevant layers.
2. To symbolize streams:
   i. In the **Contents pane**, right-click the layer (e.g., Stream Network) > **Symbology** > set **Primary Symbology** = **Unique Values**.
   ii. In the **Field** drop-down, select **EDGE_TYPE**.
   iii. **Add All Values** except for the above specified line types.
3. Visually inspect whether the AA polygon intersects with valid streams or rivers.
   i. Use aerial imagery and stream direction points to confirm flow direction.
4. Interpret results:
   i. If a clear stream flows out of the AA and connects to the downslope network → **Yes**.
   ii. If the AA abuts a river that can flood it periodically → **Yes**.
   iii. Otherwise → **No**.

3.1.7 OF 7: ASPECT

Relevant Layers:

- *Elevation or slope/aspect raster (e.g., RESULTS Openings Slope Aspect and Elevation)*
- *Topographic contours (e.g., TRIM Contour Lines)*

"The overland flow direction of most surface water (in streams, rivers, or runoff) that enters the AA is: N, NE, S, SE, E SE, W, NW, or flat"

NOTE: If flow direction is unclear or diffuse, consider the *mean aspect* of the surrounding watershed.

Select one of the following:

- Northward (N, NE), north-facing contributing area
- Southward (S, SW), south-facing contributing area
- Other (E, SE, W, NW), or no detectable uphill slope or input channel (flat)

1. Add the AA polygon and an elevation or slope/aspect raster.
    i. For easier interpretation, add a **Hillshade** or **Aspect** raster (e.g., *BC DEM Hillshade*).
    ii. Alternatively, use the **Topographic** basemap (*see* **Error! Reference source not found.**).
2. Assess the surrounding terrain:
    i. Identify the dominant slope direction draining into the AA.
    ii. Look for elevation patterns, flow channels, or upslope contributing areas.
    iii. Use **contour lines** to confirm slope gradients in upland areas.
3. Determine dominant flow direction entering the AA:
    i. Consider slope, stream direction, and landform orientation.
    ii. If no clear slope or channel exists, treat the AA as "Flat".
4. Select the best category:
    i. If flow originates from a **north-facing slope** (flowing south), choose **Southward (S, SW)**.
    ii. If flow originates from a **south-facing slope** (flowing north), choose **Northward (N, NE)**.
    iii. If flow comes mainly from **E**, **SE**, **W**, **NW**, or terrain is flat, choose **Other**.

3.1.8 OF 8: GLACIER INFLUENCE

Relevant Layers:

- *Freshwater Atlas – Stream Directions*
- *Freshwater Atlas – Stream Network*
- *Freshwater Atlas – Glaciers*
- *Glaciers*

"Select first true choice"

- No glacier capable of contributing surface flow to the AA is present upstream. If a glacier is present, there is no surface connection to the AA.

- Glacier connected by streams to the AA is present upstream, but clarity or temperature of the AA's surface water is seldom or never affected (because it is too distant from glacier).
- Glacier connected by streams to the AA is present upstream and the clarity or temperature of the AA's surface water is regularly affected.

NOTE: Consider whether the AA is in a glacial-headed watershed (*high influence*) or is located downstream of a glacial-headed watershed (*low influence*).

1. Add the relevant layers.
2. To check upstream of the AA, zoom to the AA polygon and pan upstream within the watershed.
    i. Identify any mapped glaciers in the watershed.
    ii. Use the *stream network* and *stream direction points* to confirm if a surface water connection exists between the glacier and the AA.
3. Interpret results:
    i. If **no glacier** is upstream or no surface connection exists, select **Option 1**.
    ii. If a glacier is connected by streams but is **too distant** to affect water clarity or temperature**,** select **Option 2**.
    iii. If a glacier is connected by streams and regularly influences AA water clarity/temperature, select **Option 3**.

3.1.9 OF 9: FLOODABLE INFRASTRUCTURE

Relevant Layers:

- *Aerial Imagery*
- *Freshwater Atlas – Rivers*
- *Freshwater Atlas – Stream Network*
- *Freshwater Atlas – Stream Directions*
- *BC Cumulative Effects Framework – Integrated Roads – 2025*
- *Freshwater Atlas – Watershed Groups*

“Is there infrastructure that is at risk of flooding within 5 km of the wetland?”
NOTES:

- **Do NOT** include agricultural fields, gravel pits, or other mined lands unless clearly built-up with public infrastructure.
- Infrastructure is considered “vulnerable” if:
    - It has experienced flood damage in the past 100 years without protection,
    - It lies within a mapped 100-year floodplain, or
    - It is in an alluvial floodplain and less than 3 m above the expected annual high water (e.g., bankfull stage).

- Define "floodable infrastructure" as features lying downstream or downslope within the same watershed. Consider whether upstream wetlands contribute to flood risk; if none are relevant, record as "none.".
- The "watershed" refers to the "Freshwater Atlas Watershed Groups".
- Consider temporary damming effects from ice jams that could occur downstream in the vicinity of the AA.

"Select first true choice"

- Within 1 km: Infrastructure vulnerable to river flooding is present downstream or downslope within 1 km of the AA and in the same watershed.
- Within 5 km: Infrastructure vulnerable to river flooding is present downstream or downslope within 5 km of the AA in the same watershed.
- >5 km: Infrastructure vulnerable to river flooding is present downstream or downslope at a farther distance but within the same watershed.
- None: No infrastructure vulnerable to river flooding is present downstream or downslope in the AA's watershed.
  1. Consider "*Buffer_5km*" (Appendix-A).
  2. Use the **Measure Tool** to identify infrastructure within the buffer that is:
     i. Close to stream channels or rivers flowing downstream or out of the AA.
     ii. Located on the floodplain or visibly near channels within low-lying areas.
  3. Look for indicators of potentially flood-vulnerable infrastructure, including:
     - Buildings
     - Bridges
     - Actively used roads
     - Pipelines

3.1.10 OF 10: INTERNAL FLOW DISTANCE

Relevant Layers:

- *Aerial Imagery*
- *Freshwater Atlas – Stream Directions*
- *Freshwater Atlas – Stream Network*

"How long is the stream that is intersecting the wetland?"

NOTES:

- This measurement represents the internal flow path through the AA.
- A valid flow path requires both an inlet and outlet (natural or mapped).
- Where a mapped stream intersects the AA, measure only the channel length within the AA boundary.
- Exclude short tributaries or inflows that do not continue through the wetland.

Select one of the following:

- < 10 m
- 11-50 m
- 51-100m
- 101m-1 km
- 1.01-2km
- > 2.01 km, or the wetland lacks an inlet and/or outlet

Identify inlets and outlets, if any, from topographic maps (use elevations to determine which are inlets and which are outlets) and augment with field inspection. Estimate distance along the length of the **largest stream channel** passing from inlet to outlet. If no channel is visible, estimate the straight-line distance between the highest and lowest point within the AA.

1. Add the relevant layers:
    i. Add the **stream network layer prepared in OF 6** (with invalid EDGE_TYPE values removed).
    ii. Add aerial imagery for visual confirmation.
2. Identify inlets and outlets by using **stream directions** and **elevation/contours** to determine inflow vs. outflow points.
3. Open the **Measure Tool** (*see* 8) to trace the **channel path** from inlet to outlet within the AA boundary, clicking along bends to capture curvature.
    i. If mapped streams differ from visible/field-observed channels, use the observed channel.
4. If multiple streams exist, measure each candidate segment, and record **the longest measure length** as the internal flow distance.
5. If no mapped stream is present, use **elevation data/contour lines** to estimate the straight-line distance between the highest and lowest points within the AA.
6. Record the results length in **meters** and select the correct category.

3.1.11 OF 11: WETLAND AS A % OF ITS CONTRIBUTING AREA (CATCHMENT)

Relevant Layers:

- *Aerial Imagery*
- *Freshwater Atlas – Stream Directions*
- *Freshwater Atlas – Stream Network*
- *Freshwater Atlas – Watershed Boundaries*

"**What percentage of the catchment area does the wetland take up?**"

NOTES:

- Identifying the contributing area (CA) of the AA's wetland is the part of the watershed that potentially drains toward and feeds into the AA, which may

extend upslope for many kilometers. Exclude any areas that flow into streams not connected to the AA.

- If needed, use aerial imagery, stream data, and field observations to refine the CA boundary. Then, calculate the wetland's % of its CA by dividing the wetland area (excluding the AA itself) by the CA (minus the wetland).
- The CA should reflect the actual hydrological inputs to the wetland. Adjust the default watershed polygon using topographic or stream data if needed.
- When calculating area, include ponded water that abuts the wetland as part of the wetland area.
- In flat headwater areas or isolated basins, the wetland may be larger than its effective catchment.

Select one of the following:

- <1%, *or contributing area is unknown due to stormwater pipes that collect water from an indeterminate area*
- 1.1-10%
- 10.1-100%
- >100.1% *(wetland is larger than its contributing area (e.g., headwater wetland with flat surrounding terrain and no inlet, or entirely isolated by dikes, or a raised bog).* **Skip to OF 13**.

1. Delineate and prepare the Contributing Area (CA) (*see* Data Prep, Section ?.)
   i. Trace and save the *CA_polygon*.
   ii. Erase the AA from the CA (*see* 11).
   iii. Save as "*CA_excluding_AA*".
2. Check and calculate areas:
   i. Confirm area fields for both **AA_polygon** and **CA_excluding_AA** (m^2 or hectares).
   i. If needed, calculate hectares (Shape_Area ÷ 10,000).
3. Calculate wetland % of CA:
   i. Use formula below:

$$Wetland\ \%\ of\ CA = \frac{AA\ Area}{CA\_excluding\_AA}$$

   ii. Record results as a percentage and select the appropriate category.

3.1.12 OF 12: UNVEGETATED SURFACE IN THE WETLAND'S WAU:

- *Aerial Imagery*
- *Digital Road Atlas (DRA) – Master Partially – Attributed Roads*

"The proportion of the WAU comprised of buildings, roads, parking lots, other pavement, or bare soil at the time of peak annual runoff is about:"

NOTE: Calculate the total area of unvegetated or impervious surfaces (e.g., buildings, pavement, bare ground) within the Watershed Assessment Unit (WAU) (100 m buffer), then estimate the proportion this represents of the buffer area.

Select one of the following:

- <10%
- 10.1-25%
- >25.1%

1. Consider the layer "*Wetland_100m_Buffer*".
    i. Symbolize with transparent fill and a visible outline (*see* 2).
2. Scan the buffer for unvegetated/impervious surfaces by using aerial imagery.
    i. Look for paved roads, parking lots, rooftops, bare soil, gravel, or rocky outcrops.
    ii. Exclude temporary features (e.g., cutblocks).
3. Use the Digital Road Atlas (DRA) layer to confirm paved and developed road segments.
4. Visually estimate % of buffer covered by impervious/unvegetated surfaces while considering the options.
    i. If difficult to judge visually, use the **Measure tool** or digitized polygons around built-up areas to calculate.
5. Record and select the appropriate category.

3.1.13 OF 13: CONSERVATION INVESTMENT

- No layers required. This question relies on local information and research on of the site.

"The AA is within or abuts a wetland on which public or private organizational funds were spent to preserve, create, restore, or enhance the wetland. If unsure, ask the property owner."

NOTES:

- No mapping analysis is required for this question.
- If not already known, contact the landowner or local authority to determine whether conservation, restoration, or enhancement funds were invested in the wetland.

Select one of the following:

- Yes
- No

3.1.14 OF 14: SUSTAINED SCIENTIFIC USE

- No layers required. This question relies on local information.

"Has there been sustained scientific use of the wetland?"

NOTES:

- No GIS mapping is required for this question.
- Consider whether the AA has been monitored for more than 2 years (plants, animals, or water), with data available to the public and not tied to regulatory requirements. Also, check if the AA is part of a designated benchmark, reference, or status-trends monitoring area. If the wetland is within a park or conservation area, do a quick search to confirm whether monitoring or research has been conducted.

Select one of the following:

- Yes
- No

3.1.15 OF 15: BURNED

Relevant layers:

- BC Wildfire Fire Perimeters – Historical

Has any part of the Assessment Area (AA) burned since 2010?

NOTE: The 100 m distance accounts for fire effects that may extend slightly beyond the mapped perimeter.

Select one of the following:

- Yes
- No

1. Add the layer and ensure the AA polygon is visible.
2. Visually inspect whether a fire perimeter overlaps the AA or extends within **100 m** of the boundary.
    i. If needed, check the **burn year** attribute to confirm whether the fire occurred within the last **25 years**.

3.1.16 OF 16: KARST GEOLOGY

Relevant Layer:

- *Karst Potential*

"The AA's wetland is within a geologic unit having a significant karst (limestone, calcium carbonate) component."

- Visual confirmation from local experts or detailed geological mapping is recommended where karst presence is suspected.
- "Other information" may include advice of qualified geologists or other maps of local geology.

Select one of the following:

- Yes

- No

1. Add the Karst Potential layer.
2. Arrange layers so the karst layer is displayed above the AA polygon.
3. Check if the AA overlaps areas classified as **High (H)** or **Medium (M)** karst intensity.
4. If no karst layer is available:
   i. Use regional geology layers or maps showing limestone-rich Paleozoic/Mesozoic formations.

3.1.17 OF 17: GEOLOGIC FAULTS

Relevant Layer:

- *Geology Faults*

"The AA's wetland abuts or is intersected by a geologic fault."

Select one of the following:

- Yes
- No

1. Add the Geology Faults layer.
2. Overlay with the AA:
   i. Ensure both the wetland (AA) and the fault line layer are visible.
   ii. Arrange layers so the fault line layer is displayed above the AA polygon.
   iii. Visually inspect whether any fault lines cross or touch the AA boundary
3. If difficult to determine by visual inspection (such as on very large sites) then consider using the intersect tool (Appendix A: 9).

3.1.18 OF 18: LAKES WITHIN 2 KM

Relevant Layers:

- *Aerial Imagery*
- *Freshwater Atlas – Lakes*

"Considering Freshwater Atlas-Lakes, consider the 2km buffer. Based on visual estimation or measurement, the percentage of that circle occupied by lakes is:"

NOTES

- Focus only on permanent open-water lakes.
- Exclude wetlands, ephemeral ponds, and seasonal water bodies unless clearly mapped as lakes for this question (these other areas are considered in **OF 19**).

Select one of the following:

- <2%
- 2.1-7%
- 8-17%
- 18-34%
- >34.1%

1. Consider the Lakes layer
2. Calculate the total buffer area:
   i. In the Attribute Table of *Buffer_2km*, add a field (e.g., *Buffer_Ha*).
   ii. Use **Calculate Geometry** to populate the buffer area in hectares (*see* 10).
3. Calculate the total buffer area using the formula below:

$$Lake\ \%\ of\ Buffer = \frac{Total\ Lake\ Area}{Total\ Buffer\ Area}\ X\ 100$$

3.1.19 OF 19: WETLANDS AND LAKES WITHIN 2 KM

Relevant Layers:

- *Freshwater Atlas – Lakes*
- *Freshwater Atlas – Wetlands*

"Also load this layer: Base Maps> Freshwater Atlas> Wetlands. Based on visual estimation, the percentage of that circle occupied by wetlands AND lakes combined is:"

NOTES:

- You can union the lakes and wetlands layers before measuring, then calculate the combined area in a single step.
- Consider permanent open water as well as mapped wetland areas within the buffer.
- This value should be larger than the value of **OF 18** which only considered lakes within 2km.

Select one of the following:

- <2%
- 2.1-7%
- 8-17%
- 18-34%
- >34.1%

1. Consider the dataset created in **OF 18**.
   i. Visually inspect if there are any lakes or wetlands within the 2km buffer.
   ii. If it is difficult to determine the precise area coverage of these features, then follow steps 2-5 to determine the areas.

2. Clip wetland layers to buffer boundary (*see* 12)
    i. ii. Save as "*Wetlands_clipped_2km*".
3. Calculate total areas using **Calculate Geometry** (*see* 10).
4. Use the formula below to answer the question: $Wetland + Lake\ \%\ of\ Buffer = \frac{Lake\ Area + Wetland\ Area}{Buffer\ Area}\ X\ 100$

3.1.20 OF 20: FISH OCCURRENCE

Relevant Layers:

- *BC Historical Fish Distribution – Points (50,000)*

The following iMapBC layer is required:

- *Fish Wildlife and Plant Species > All Fish Points*

"Score all the conditions below that are true based on your own observations, information from agency biologists, or this iMapBC layer: Fish Wildlife and Plant Species> All Fish Points (use the Identify tool and click on the points to see the species reported)."

NOTES:

- Watershed connectivity and proximity determine the appropriate score option (within AA, within 8 km, or in connected parts of the watershed).
- Only wild, not stocked fish should be considered.

Select all that are true:

- Chinook are present in AA
- Chinook in connected parts of same watershed within 8 km
- Chinook in other connected parts of the same watershed
- Chum are present in AA
- Chum are in connected parts of same watershed within 8 km
- Chum are in other connected parts of the same watershed
- Coho/Silver are present in AA
- Coho/Silver are in connected parts of same watershed within 8 km
- Coho/Silver are in other connected parts of the same watershed.
- None of the above, but other fish species are likely present in AA. Or a stream connects the AA to other waters and is not known to be fishless.
- Is known or likely to be fishless (e.g., too small, dry, and/or not accessible even temporarily, and not stocked).

3.1.21 OF 21: ECOLOGICAL DESIGNATION

Relevant Layers:

- *BC Parks, Ecological Reserves, and Protected Areas*
- *Conservation Lands*
- *Critical Habitat for Federally-Listed Species at Risk – Posted*
- *Designated Lands*

- *Species and Ecosystems at Risk - Publicly Available Occurrences - CDC*
- *Ungulate Winter Range – Approved*
- *TANTALIS – Conservancy Areas*
- *TANTALIS – Wildlife Management Areas*

"Is the AA within or abuts a public or private area designated by government (public or First Nations), Nature Conservancy, or a conservation land trust for its heightened ecological importance?"

NOTES:

- Ecological designations may include areas with legal protection, management restrictions, or recognized ecological value.
- Designations vary by jurisdiction; confirm data sources are current before analysis.

Select one of the following:

- Yes
- No

1. Add the relevant layers.
2. Consider "*Buffer_100m*".
3. Use **Intersect** to compare "*Buffer_100m*" with the designated lands layer (*see* 9) and save it as "*AA_DesignatedOverlap*"
4. Review the designation:
   i. Open the **Attribute Table** of *"AA_DesignatedOverlap''.*
   ii. Locate the field indicating **designation type** (e.g., park, ecological reserve).
   iii. Confirm whether the wetland lies **within** or **abuts** a designated ecological area.

3.1.22 OF 22: PROTECTION FROM INTENSIVE USES

Relevant Layers:

- *Designated Lands*
- *Conservation Lands*
- *NGO Conservation Areas – Fee Simple*
- *BC Parks, Ecological Reserves, and Protected Areas*
- *Species and Ecosystems at Risk - Publicly Available Occurrences - CDC*
- *TANTALIS – Wildlife Management Areas*
- *TANTALIS – Conservancy Areas*

"Are new timber harvest, roads, mineral extraction, and intensive summer recreation (e.g., off-road vehicles) permanently prohibited from the AA?"
NOTE: Consider any lands that contribute to conservation, such as those with legal protection, management restrictions, or excluded activities (e.g., PPA, other protected areas). If such designations occur in or directly adjacent to the wetland, record them here.
Select one of the following:

- Yes
- No

3.1.23 OF 23: BGC PROTECTION PERCENTAGE

The following iMapBC layer is required:

- *Forest Grasslands and Wetlands > Percent BGC Subzone Variant Protected*

"Consider the percentage of the wetland's biogeoclimatic subzone variant that is Protected: Forest Grasslands and Wetlands > Percent BGC Subzone Variant Protected. That percentage is:"

NOTES:

- Assign the AA to the BGC subzone variant covering the largest portion of the wetland.
- The dataset reports the percentage of the entire BGC subzone variant that is provincially protected.
- This value reflects protection at the provincial scale, not local conditions around your AA.

Select one of the following:

- 0-1%
- 1.1-4%
- 4.1-8%
- 8.1-12%
- 12.1-20%
- > 20.1%

1. Use **Select Layer by Location** to select BGC polygons that intersect the AA:
    i. Open the **Attribute Table** of selected features.
    ii. If multiple subzones overlap, determine which subzone covers the **largest** portion of the AA.
2. Use **Calculate Geometry** if needed to measure overlap areas.
3. Determine the protection percentage:

i. In the Attribute Table of the dominant BGC polygon, locate the field reporting the **percent protected** value, record the value, and select the appropriate category.

3.1.24 OF 24: SPECIES OF CONSERVATION CONCERN

Relevant Layers:

- *Species and Ecosystems at Risk - Publicly Available Occurrences - CDC*
- *Wildlife Species Inventory – Incidental Observations – Publicly Available*
- *Wildlife Species Inventory – Survey Observations – Publicly Available*
- *Wildlife Species Inventory - Telemetry Points – Publicly Available*
- *Wildlife Habitat Features – Incidental Observations – Publicly Available*
- *Wildlife Habitat Features – Survey Observations – Publicly Available*

"Are there species of conservation concern (in the list below) that have been observed within a 500m buffer of the AA?"

NOTES:

To identify species of concern near your wetland:

- **Consult Experts:** Regional biologists, First Nations knowledge holders, and agency staff.
- **Check Public Databases:**
  - Use the BC Species and Ecosystems Explorer to identify *Red/Blue-listed and SARA species*.
  - BC Conservation Data Centre (CDC)
  - eBird.org (bird records)
  - iNaturalist.org (citizen-science observations)
- **Request Restricted Data (if your project is eligible):** Submit wetland polygon(s) with a 500m buffer specified to the BC Conservation Data Centre to cdcdata@gov.bc.ca for masked/proprietary CDC records.
- Consult the BC Species & Ecosystems Explorer for the current conservation status of each species that has occurrences within or nearby your wetland. Red, Blue, and SARA listed species should be considered as of conservation concern for this question.

Select all the species of conservation concern that have been observed within a 500m buffer of the AA :

- Any **plant species** or **community** of conservation concern.
- Any **amphibian** listed as being of conservation concern
- Either of these **waterbird** species of conservation concern: American Bittern, Eared Grebe.

- **Raptor or wetland songbird** species of conservation concern: Broad-winged Hawk, Swainson's Hawk, Northern Goshawk, Peregrine Falcon, Prairie Falcon, Long-billed Curlew, Western Screech-owl, Short-eared Owl, Black Swift, Olive-sided Flycatcher, Barn Swallow, Cape May Warbler, and/or Rusty Blackbird.
- **Caribou**

1. Use the **Explore** or **Identify** tool to obtain latitude/longitude coordinates.
2. Copy these coordinates for use in species databases.
3. Review species records in available project-specific wildlife observation, **eBird**, **iNaturalist**, and any other available and relevant sources such as municipality datasets etc.
4. Confirm species presence, conservation status, and habitat context based on available data.

3.1.25 OF 25: LOCAL MOISTURE DEFICIT

"In the next column, enter the CMD value (Annual) for the raster cell containing this wetland."

Using the online ClimateBC. Map Viewer find the approximate location of your wetland on the map. Select "Normal_1991-2020" in the "Historical" drop-down menu.

3.1.26 OF 26: DEGREE DAYS INDEX

"Enter the DD>5 value (Annual) for the raster cell containing this wetland."

Using the online ClimateBC. Map Viewer find the approximate location of your wetland on the map. Select "Normal_1991-2020" in the "Historical" drop-down menu.

3.1.27 OF 27: LOCAL SOLAR INPUT

"Enter the sum of *RAD_sp* and *RAD_sm* values (Seasonal) for the raster cell containing this wetland."

3.1.28 OF 28: SITE INDEX (SOIL NUTRIENTS)

Relevant Layer:

- *VRI – 2024 – Forest Vegetation Composite Polygons*

"Enter the Site Index for the raster cell containing this wetland. If VRI contains no data for this attribute at AA's location, leave blank. "

NOTES: Use the mean SI if working with a wetland that spans multiple cells. If the site index is unavailable or the value is "NaN", leave this question blank.

Select one of the following:

- <6.3%
- 6.4 - 9.5%
- 9.6 - 13.3%
- 13.4 - 18.5%

- >18.6%

3.1.29 OF 29: TOPOGRAPHIC POSITION

Relevant Layer:

- *VRI – 2024 – Forest Vegetation Composite Polygons*

"Enterthe *Site_Position_Meso* code (C, D, F, L, M, T, or U) for the raster cell containing this wetland. If VRI contains no data for this attribute at the AA's location, leave the next cell blank."

NOTES: Use the provincial landform data to assign the appropriate slope position for the Assessment Area (AA). Landform codes include:

- **D** = Depression (Valley, Local Valley in Plain)
- **F** = Flat (Plains)
- **L** = Lower slope
- **M** = Middle slope (Gentle Slopes, Steep Slopes)
- **U** = Upper slope (Hilltop in Valley, Headwaters)
- **T** = Toe slope
- **C** = Crest (Ridges and Peaks, Local Ridge in Plain)

If no **T** (Toe slope) or **L** (Lower slope) code is present for the AA, use the most applicable available code based on inspection of terrain.

3.1.30 OF 30: ROAD DENSITY WITHIN AA'S BUFFER

Relevant Layer:

- *Digital Road Atlas (DRA) – Master Partially – Attributed Roads*
- *BC Cumulative Effects Framework – Integrated Roads – 2025*

"Considering a buffer of 100 m from the AA's edge, identify visible roads and mapped roads in the Digital Road Atlas. The length (km) of all roads within that buffer, divided by the buffer's area, is:"

NOTES:

- Include **All** road types (paved, unpaved, resource) within the buffer. Exclude the wetland area itself from calculations to avoid skewed density values.
- If the road layer is in meters, convert units to kilometers before calculating density.

Select one of the following:

- < 0.12 km/km^2
- 0.13-0.30 km/km^2
- > 0.31 km/km^2

1. Consider the "*Buffer_100m_NoWetland*" layer
2. Select intersecting roads:
   i. Add the Integrated Roads layer.

ii. Use **Select Layer by Location** with "*Buffer_100m_NoWetland*" (Spatial Relationship = Intersect).

3. Export and calculate road length:
   i. Export the selected roads as *"AllRoads_100m"*.
   ii. In the **Attribute Table**, ensure the length field is in kilometers (*see* 10).
   iii. Sum the total road length (*see* 0).
4. Open the **Attribute Table** of "*Buffer_100m_NoWetland"*
   i. Confirm area in km^2.
5. Calculate road density using the formula below:

$$Road\ Density = \frac{Total\ Road\ Length\ (Km)}{Buffer\ Area\ (Km2)}$$

3.1.31 OF 31: ROAD DENSITY WITHIN 2 KM OF THE AA

Relevant Layer:

- Digital Road Atlas (DRA) – Master Partially – Attributed Roads
- BC Cumulative Effects Framework – Human Disturbance – 2023

"Consider the 2 km buffer from the AA. The length (km) of all roads within that buffer, divided by the buffer's area, is:"

Select one of the following:

- < 0.12 km/km2
- 0.13-0.30 km/km2
- > 0.31 km/km2

1. Consider the "*2km_buffer_excluding_AA*"
2. Follow the same remaining steps as **OF 30** to calculate total road length, buffer area, and road density.

3.1.32 OF 32: INTACTNESS OF LANDSCAPE WITHIN 2 KM

Relevant Layer:

- *BC Cumulative Effects Framework – Human Disturbance – 2023*

"Within that 2-km buffer, the percentage that is Natural/Semi-Natural is:"

Select one of the following:

- <5%
- 5.1-30%
- 30.1-60%
- 60.1-90%
- >90.1%

1. Consider the *"2km_buffer_excluding_AA"*.
2. Extract disturbance features within the buffer by using **Clip** or **Select Layer by Location** and save as "*HumanDisturbance_2km*"
3. Reclassify land cover into two categories:

i. **Intact** (Natural/Semi-Natural): forest, wetland, grassland, etc.
ii. **Not Intact** (Disturbed): urban, agriculture, clearcuts, etc.

4. Calculate intact percentage following step 4 of **OF 30**.

3.1.33 OF 33: MATURE & OLD GROWTH FOREST WITHIN 2 KM

Relevant Layers:

- *Old Growth Technical Advisory Panel (TAP) – Old Forests*

"Within that 2-km buffer, the percentage of area mapped as Old Growth or Mature is:"

NOTE:

- The percentage is relative to total forested area within the 2 km buffer, not total land area.

Select one of the following:

- <5%
- 5.1-30%
- 30.1-60%
- 60.1-90%
- >90.1%

1. Consider "*Buffer-2km*" layer.
2. Select for Mature and Old Growth classes:
   i. Open the **Attribute Table** of the forest layer.
   ii. Open **Select by Attributes** to select features where the *class = Mature* OR *class = Old*.
3. Extract forest features within buffer by **Clipping** the layer to "*2km_buffer_excluding_AA*" (*see* 12).
   i. Save as "*Forests_within2km*".
4. Clip the selected Mature + Old Growth subset the same way.
   i. Save as "*Mature_OldGrowth_within2km*".
5. Use Calculate Geometry to find total hectares for "*Forests_within2km*".
   i. Repeat for "*Mature_OldGrowth_within2km*".
6. Determine the percentage using the formula below:

$$Mature + Old\ Growth\ \% = \frac{Mature + Old\ Growth\ Forest\ Area}{Total\ Forest\ Area}\ X\ 100$$

3.1.34 OF 34: LAND COVER TYPE UNIQUENESS

Relevant Layers:

- *BC Land Cover (if available)*
- *VRI attribute bclcs_level_5*
- *Sentinel Land Cover*

"Do any of the land cover types that are present in the AA comprise <1% of the land cover in the surrounding 1km or 5km buffers?"

NOTE: Using best available land cover classification and aerial image interpretation to assess landscape diversity within 1 km and 5 km buffers around the wetland. Overlay the AA layer with each buffer and identify 'unique' land cover types present in each to determine if some of the land cover types within the wetland are rare compared to the surrounding areas.

Landcover types should consider the following categories:

· Barren Land
· Coniferous Forest
· Cropland
· Deciduous Forest
· Estuary
· Grassland
· Mixed Forest
· Shrub Land
· Snow and Ice
· Urban and Built-up
· Fresh Water
· Marine Water
· Wetland
· Riparian Layers
  o Includes Coniferous Forest, Deciduous Forest, Mixed Forest, Grassland and Shrubland that overlaps with the Riparian Zone.
· Intertidal and Subtidal
· Herbaceous shrub

Select all that apply:

- Yes, at least one landcover type within the AA comprises <1% of the area within the 1 km buffer of the AA (and outside of the AA)
- Yes, at least one landcover type within the AA comprises <1% of the area within 5 km of the AA (and outside of the AA)
- Neither of the above

1. Determine the land cover types that are within the AA. (eg. Deciduous, coniferous, barren, open water etc.)
2. Consider "*Buffer_1km*" and "*Buffer_5km*" and if any of the land cover types that occur within the AA are rare (<1% coverage) within the buffers.

i. If you can tell that none of the land cover types within the AA are rare in the buffers, then you can select c) and not continue any further.

3. To determine the percentage of the buffer covered by any rare land cover types, use **Intersect** with the best available landcover data and each buffer (*see* 9).
   i. Save the land cover layers as "*Landcover_1km*", "*Landcover_5km*"
4. Calculate land cover proportions using **Calculate Geometry** (*see* 10):
   i. Divide each type's area by the total buffer area.
   ii. Identify any types where coverage is **<1%**.

   NOTE: In cases where available land cover mapping is inaccurate, defer to observed land cover types based on the most recent available imagery.

3.1.35 OF 35: MAXIMUM DOMINANCE OF A LAND COVER TYPE

Relevant Layer:

- *BC Land Cover (if available)*
- *VRI attribute bclcs_level_5*
- *Sentinel Land Cover*

"Identify the most extensive land cover type within the AA and calculate all the AA's vegetation that it comprises."

1. Select the AA and **Clip** the land cover (*see* 12) and save as "*AA_Landcover*".
2. Calculate areas by class using **Calculate Geometry** (*see* 10) and save as "*Area_ha*".
3. Summarize areas (*see* 0).
4. Identify the dominant land cover type with the largest total area within the AA.
   i. Divide the area of the dominant land cover type by the **total AA land cover area**.
5. Calculate proportions and enter the result as a decimal with a maximum value of 1.

   NOTE: If there's only one type of land cover in the AA, such as coniferous, the answer would be 1. If the wetland is made up of 60% grassland and 40% mixed forest, then the answer would be 0.6.

3.1.36 OF 36: NUMBER OF LAND COVER TYPES IN THE AA AND 100 M BUFFER

Relevant Layer:

- *BC Land Cover (if available)*
- *VRI attribute bclcs_level_5*
- *Sentinel Land Cover*

"The number of different land cover types mapped within the AA, plus all land cover types within 100 m of its edge is:"

NOTE: Use the land cover classification to identify distinct types present within the AA and its 100 m buffer. Each unique class counts once, regardless of area.
NOTE: In cases where available land cover mapping is inaccurate, defer to observed land cover types based on the most recent available imagery.

Select one of the following:

- 1
- 2
- 3 or 4
- >4

1. Consider the "*Buffer_100m_including_AA*" layer.
2. **Clip** the land cover layer to the "*Buffer_100m_including_AA"* layer (*see* 12) and save as "*Landcover_AA_100m*".
3. Identify unique classes by using the **Attribute Table** and reviewing the **Classification** field.
    i. If unclear, run Summary Statistics (*see* 0).
4. Count the number of unique land cover types present and select the appropriate category.

3.1.37 OF 37: NUMBER OF LAND COVER TYPES WITHIN 2 KM

Relevant Layer:

- *BC Land Cover (if available)*
- *VRI attribute bclcs_level_5*
- *Sentinel Land Cover*
- Aerial imagery

"The sum of the number of different land cover types mapped within the AA plus all types within the 2 km buffer is:"

NOTE: Use the land cover classification to identify distinct types present within the AA and its 2 km buffer. Each unique class counts once, regardless of area.
NOTE: In cases where available land cover mapping is inaccurate, defer to observed land cover types based on the most recent available imagery.

Select one of the following:

- <4
- 4 or 5
- 6 or 7
- 8 to 11
- >11

1. Consider the "Buffer_2km" layer.

2. Clip the land cover layer to the combined AA + 2 km buffer extent (*see* step 3 **OF 19** and section **0**).
3. Follow the same steps used in **OF 36** to identify unique land cover types and determine the final count.

3.1.38 OF 38: DECIDUOUS LAND COVER WITHIN THE AA AND 100 M BUFFER

Relevant Layer:

- *VRI - 2024 - Forest Vegetation Composite Polygons*

"The percentage of the deciduous land cover type within the AA plus 100 m from its edge, as compiled from the land cover layer, is:"

NOTE: In cases where available land cover mapping is inaccurate, defer to observed land cover types based on the most recent available imagery.

Select one of the following:

- <6%
- 6-20%
- 21-39%
- 40-66%
- >66%

1. Consider the "*Landcover_AA_100m" layer.*
2. Open the **Attribute Table** and consider the attribute bclcs_level_4, which indicates the type of vegetation.
    i. Under bclcs_level_4 values of "TB" (tree-broadleaf) should be considered for this question
3. Calculate areas using the **Calculate Geometry** (*see* 10) to find the area of deciduous polygons (ha).
4. Use the formula below:

$$Deciduous\ \% = \frac{Total\ Deciduous\ Area}{Total\ AA + 100m\ Buffer\ Area}\ X\ 100$$

3.1.39 OF 39: CLOSED CONIFEROUS LAND COVER WITHIN THE AA AND 100 M BUFFER

Relevant Layer:

- *VRI - 2024 - Forest Vegetation Composite Polygons*

"The proportion of the coniferous land cover type within the AA plus 100 m from its edge, as compiled from the land cover layer, is:"

NOTE: In cases where available land cover mapping is inaccurate, defer to observed land cover types based on the most recent available imagery.

Select one of the following:

- <20%
- 20.1-47%
- 48-69%

- 70-90%
- >90.1%

NOTE: For **OF 39**, follow the same process as **OF 38**, but filter for closed coniferous stands instead of deciduous types (bclcs_level_4 = "TC").

3.1.40 OF 40: NON-TREE VEGETATION WITHIN THE AA AND 100 M BUFFER

Relevant Layer:

- *VRI - 2024 - Forest Vegetation Composite Polygons*

"The percentage of the land cover that is non-tree, within the AA plus 100 m from its edge, as compiled from the land cover layer, is:"

NOTE: In cases where available land cover mapping is inaccurate, defer to observed land cover types based on the most recent available imagery.

Select one of the following:

- <9%
- 9.1-24%
- 25-44%
- 45-74%
- >74.1%

NOTE: For **OF 40** follow the same process as **OF 38,** but filter non-tree vegetation instead of deciduous types.

3.1.41 OF 41: DISTURBED AREA PERCENTAGE IN THE WAU

Relevant Layer:

- *BC Cumulative Effects Framework – Human Disturbance – 2023*

"As a percentage of the WAU, the Disturbed area (GIS layer provided) comprises:"

NOTE: This measure reflects disturbance proportion across the full WAU, not just within the AA.

Select one of the following:

- <10%
- 10.1-20%
- 20.1-30%
- 30.1-40%
- >40.1%

1. Clip the layer to the WAU boundary (*see* step 3 of **OF 19**) and save as "*Disturbed_WAU*".

2. Open the **Attribute Table** of "*Disturbed-WAU*" to calculate the total lengths (km).
3. Disturbance is typically coded as **1 = Not disturbed** and **2 = Disturbed**.
    i. Filter for "**Disturbed (2)**" values only.
4. Use **Calculate Geometry** to measure the disturbed area in hectares and **sum** these values for the total disturbed area (*see* 10, 0).
5. Use the formula below:

$$Disturbed\ \%\ (WAU) = \frac{Total\ Disturbed\ Area}{Total\ WAU\ Area}\ X\ 100$$

3.1.42 OF 42: ROAD DENSITY IN THE WAU

Relevant Layer:

- *BC Cumulative Effects Framework – Integrated Roads – 2025*
- *Digital Road Atlas (DRA) – Master Partially – Attributed Roads*

"Intersect the WAU with the Digital Road Atlas. The length (km) of all roads within that WAU, divided by the WAU's area, is:"

NOTE: Include all road types present in the Integrated Roads layer (paved, unpaved, and resource roads).

Select one of the following:

- <0.4 km/km2
- 0.5-1.2 km/km2
- > 1.3 km/km2

1. Clip the layer to the WAU boundary (*see* Step 3 of **OF 19**) and save as "*Roads_WAU*".
2. Open the **Attribute Table** to calculate the total road length (*see* step 3 of **OF 30**).
    i. Sum the total length (*see* 0).
3. Use the "Road density" formula and choose the appropriate category.
    i. Confirm the WAU area in km^2 (Appendix A:10)

3.1.43 OF 43: WETLAND DENSITY IN THE WAU

Relevant Layer:

- *Freshwater Atlas – Wetlands*
- *Any additional local wetland mapping (if available)*

"The summed area of all wetlands in the wetland's WAU, divided by the WAU's area, is:"

Select one of the following:

- <0.03
- 0.03-0.04

- 0.05-0.07
- 0.08-0.13
- >0.13

NOTE: Follow the same process as **OF 42**, but instead of summing road length, calculate the total wetland area within the WAU and divide by the WAU's total area to determine the proportion.

3.1.44 OF 44: ECOPROVINCE

Relevant Layer:

- Ecoprovinces - Ecoregion Ecosystem Classification of British Columbia

"The AA's ecoprovince is:"

Select from the following:

- Boreal Plains (BP)
- Central Interior (CI)
- Coast & Mountains (CM)
- Georgia Depression (GD)
- Northern Boreal Mountains (NBM)
- Southern Interior (SI)
- Southern Interior Mountains (SIM)
- Sub-Boreal Interior (SBI)
- Taiga Plains (TP)

1. Identify the AA's exoprovince:
    i. Use **Select Layer by Location** and intersect (*see* 9)
2. Confirm ecoprovince classification:
    i. Open the **Attribute Table** of the selected polygon.
    ii. Locate the **Ecoprovince name/code** field.
3. Select the matching option from the list above.

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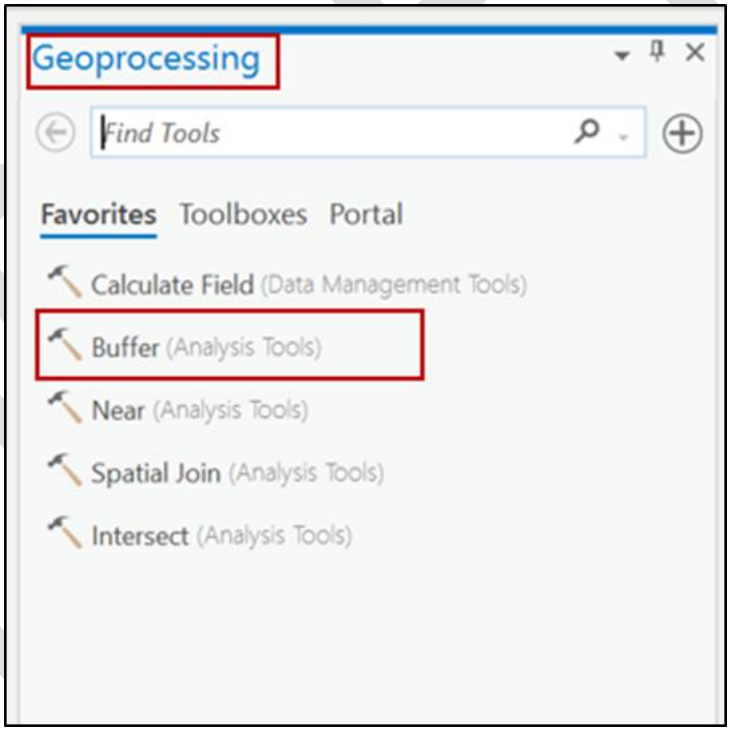
APPENDIX-A.COMMON GIS TOOLS

1 CREATING A BUFFER

Buffers are used to define an area within a specified distance around features.

1. Open the **Buffer Tool** (Go to **Analysis** > **Tools** > **Buffer**).
2. Set **Input Features**:
   i. Choose the feature layer you want to buffer (e.g., *CA_Polygon*, *AA_of_Interest*)
3. Specify buffer **Distance**:
   ii. Enter the distance (e.g., *2000 Meters*).
   iii. Choose the correct unit (meters, kilometers, etc.).
4. Choose **Dissolve** Option (If needed):
   i. **ALL:** merges overlapping buffers into one area.
   ii. **NONE**: keeps each feature's buffer separate.
5. Save as "*Bufefr_2km*".
6. Click **Run**.

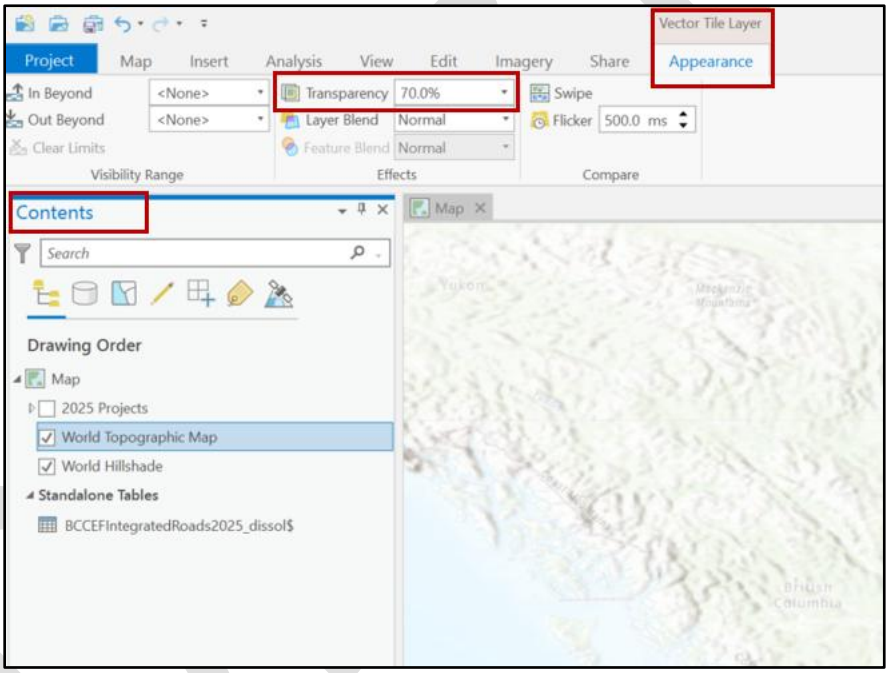


TIP: Adjust layer transparency (*see* 2) for instruction on how to overlap the buffer with other layers.

2 OPTIMIZING LAYER TRANSPARENCY

Transparency allows you to see multiple layers at once by making one layer partially see-through. This is useful when comparing overlapping datasets.

4. Select the layer of interest in the **Contents Pane**.
5. Open the **Appearance** tab (Go to the **Feature Layer** > **Appearance** on the ribbon).
6. Adjust Transparency:
    i. Use the **Transparency** slider to set the desired level (i.e., 70%)
3. Arrange order of layers in the **Contents Pane** to ensure your transparent layer is above the reference layers.



3 ADDING DATASETS TO MAP

1. Go to the **Map** tab > click **Add Data** > choose **Data from ArcGIS Online**.
2. In the search bar, enter the dataset name (i.e., "Freshwater Atlas Lakes")
3. Look for authoritative sources (e.g., from @gov.bc.ca).
4. Click the desired dataset > click **Add**.
5. The layer is added to your map and appears in the **Contents pane**.

4 ACCESSING SPATIAL DATA USING WESPR PACKAGE

The WESPR GitHub includes instructions on how to prepare spatial data and use a package that obtains the majority of the datasets from the BC data package. This package shows if there are no layers within your relevant search area, and eases the burden of viewing each dataset separately.

5 EXPORTING DATA FROM IMAPBC

1. Go to iMapBC.
2. Use **Add Provincial Layers** in the **Data Sources** tab to find and check off the layers you need.
3. Click the **Export** tab.
4. Select **Provincial Layer Download**.
5. In the download service panel, select the layers you want (toggle on/off), choose area of interest (extent), select output format (e.g. Shapefile preferred) and coordinate system.
6. Enter your email if required, agree to terms, then **Submit Order**.
7. Wait for a link with the download; unzip/import into ArcGIS Pro.

6 USING THE BC DATA CATALOGUE

1. Go to BC Data Catalogue
2. Search for the dataset name or topic (i.e., "Freshwater Atlas Wetlands").
3. Use filters like *Format = Shapefile* or *geodata* to narrow results.
4. Download the data and unzip if needed.
5. In ArcGIS Pro, go to **Map** > **Add Data** > browse to the extracted shapefile or layer package.

7 ADDING BASEMAPS

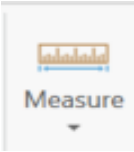
Basemaps provide background context for your data. ArcGIS Pro includes built-in basemaps such as Topographic, Imagery, Streets, and more.

1. Open the Basemap gallery and click **Basemap**.

2. From the gallery, choose the desired basemap (e.g., Topographic, Imagery, Streets).
3. To manage visibility, you can toggle the basemap on/off in the **Contents pane**.

8 MEASURE DISTANCES

The **Measure Tool** allows you to calculate distances directly on the map. This isuseful for estimating travel paths or validating buffer distances.

1. Go to **Map** and click the 

.
2. Choose measurement type by selection the Distance option.
3. If needed, set the desired units (e.g., meters, kilometers) from the drop-down list.
4. **Measure distance:**
   i. Click once on the map to set the starting point.
   ii. Click again to set the end point.
   iii. The distance is displayed in the Measure window.
5. To finish the measurement, double-click to the end of the measurement.

9 INTERSECT FEATURES

The **Intersect Tool** combines two or more layers and keeps only the areas where they overlap. This is useful when you need to find features that share the same space (e.g., wetlands within a buffer, roads crossing a watershed).

1. Open the **Intersect Tool** (Go to **Analysis** > **Tools** > **Intersect**).
2. To set the **Input Features**, select two or more layers you want to intersect (e.g., *Wetlands_2km* and *Buffer_2km*).
3. In the tool options, set the desired output type (e.g., Point, Line, Polygon).
4. Save the results with a clear name (e.g., Clipped_*Wetlands_ 2km*).
5. Click **Run**.

10 CALCULATE GEOMETRY

The **Calculate Geometry** function allows you to populate a field with geometric properties of features, such as area, length, or coordinates. This is useful for reporting results (e.g., hectares of wetlands, length of streams).

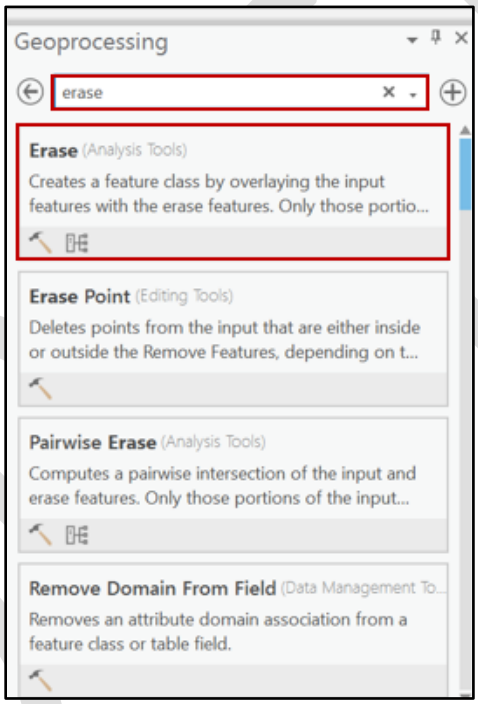
1. Right-click the layer of interest in the **Contents Pane** and select **Attribute Table**.
2. If needed, add a new field by selecting **Add Field**.
   i. Name the field clearly (e.g., *Area_ha*, *Length_km*).
   ii. Set **Data Type** = **Double** to store decimal values.
   iii. Click save to add the field data.

3. Open the **Calculate Geometry** by clicking the new field heading.
4. Choose the desired geometry property (e.g., Area, Length, X/Y Coordinates).
5. Click **Run**.

11 ERASE FEATURES

The **Erase tool** removes portions of one layer that overlap another layer. The output contains only the parts of the input features that do **not** overlap the erase features. This is useful when you want to exclude areas (e.g., subtracting wetlands from a contributing area).

1. Open the Erase Tool (Go to **Analysis** > **Tools** > **Erase**).
2. To set **Input Features**, choose the layer that you want to clip (keep parts outside the erase area).
3. Choose the layer that will be removed from the input (e.g., *AA_polygon*).
4. Save the results with a clear name (e.g., *CA_excluding_AA*).
5. Click Run.



12 CLIP FEATURES

The **Clip Tool** trims features to the boundary of another layer. The output contains only the portions of the input features that fall **inside** the clip features. This is useful for restricting data to an area of interest (e.g., clipping streams to a watershed).

1. Open the Clip Tool (Go to **Analysis** > **Tools** > **Clip**).
2. To set **Input Features**, select the layer you want to trim.
3. To set **Clip Features**, choose the boundary layer thar defines the area of interest (e.g., *AA_boundary*).
4. Save the results with a clear name (e.g., *Streams_within_watershed*).
5. Click **Run**.

13 SUMMARY STATISTICS

The **Summary Statistics** tool calculates totals, averages, and other statistics for one or more fields in a dataset, grouped by an attribute (e.g., land cover type).

1. Open the tool and search for **Summary Statistics**.
2. Set inputs:
   i. **Input Table** = the dataset you want to summarize (e.g., "*AA_Landcover"*).
   ii. **Output Table** = choose a name and save location (e.g., "*AA_Landcover_Summary"*).
3. Choose fields and statistics:
   i. Under *Statistics Fields*, select the numeric field you want to summarize (e.g., *Area_ha*).
   ii. Choose a statistic type (e.g., *Sum*, *Mean*, *Minimum*, *Maximum*).
   iii. You can add multiple fields or multiple statistics if needed.
4. If you want results broken down by category (e.g., land cover type), add the relevant field under *Case Field*.
   i. If no Case Field is set, results will be calculated for the entire table.