

# Welcome to Edit Vector Data with *QGIS*

Questions to think about:

- What is your name?
- What program/department are you from?
- What brought you to the workshop today?
- What do you hope to get out the workshop?

With *QGIS* someone could:

- Create beautiful maps...

and/or

- Conduct spatial analysis...

QGIS has hundreds of tools and possibilities...

**This is an Introduction to *QGIS* with editing vector data**



# Edit Vector Data with *QGIS*



As per the instructions when you signed up:  
**QGIS downloaded on your computer?**



If not, please come back to the workshop another time!

# Territorial Acknowledgment

**We acknowledge and respect the ləkʷəŋən peoples on whose traditional territory the university stands and the Songhees, Esquimalt, and WSÁNEĆ peoples whose historical relationships with the land continue to this day.**



# Learning Objectives

- **Identify and navigate** key *QGIS* interface elements

(Layers panel, Menu bar, Map view)

- **Define** three types of vector data: **shapefile**, **GeoJSON**, **Geopackage**
- **Edit** attribute tables and vector data using QGIS tools



# Outcomes

Using *QGIS*, participants will:

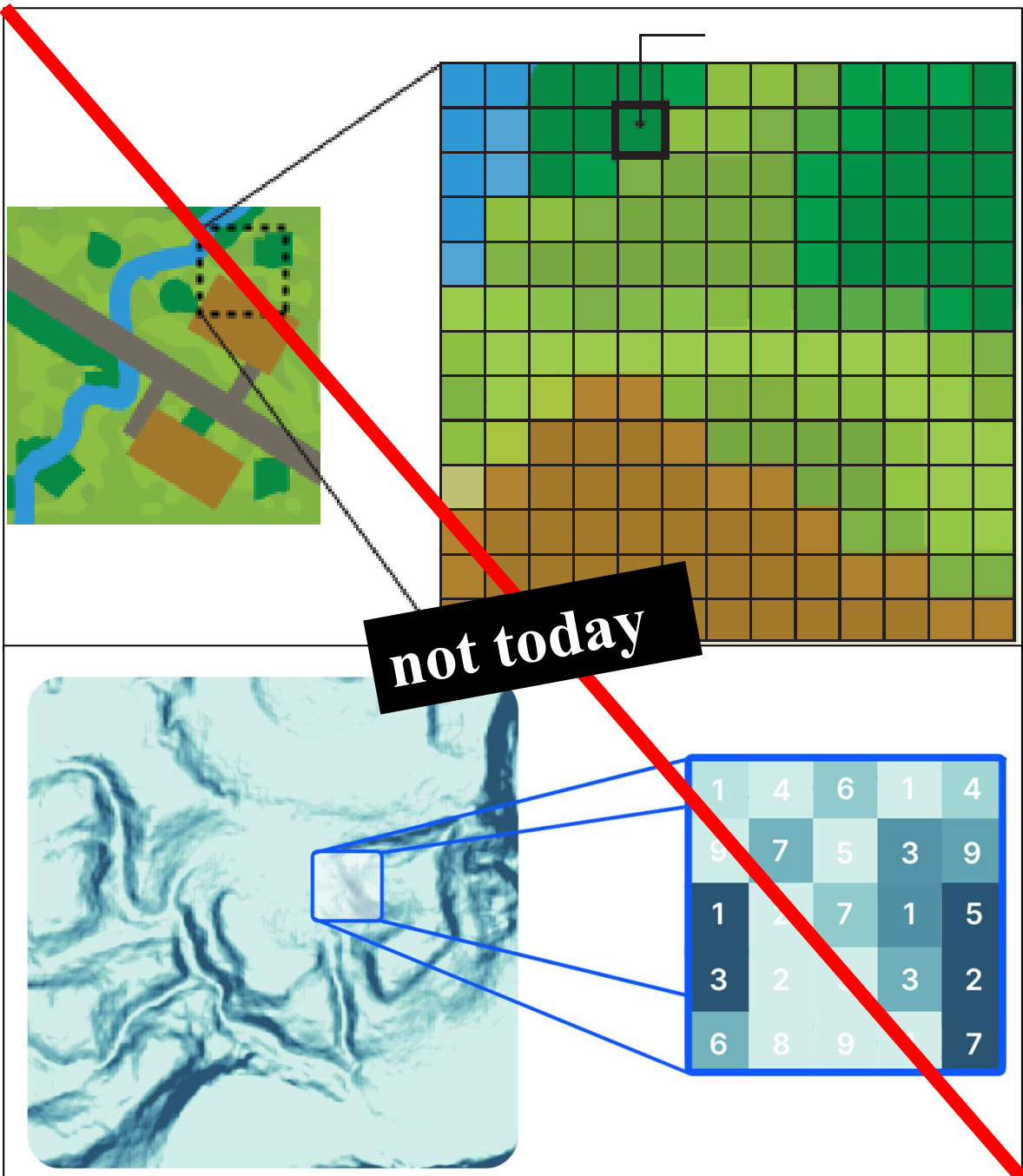
- Load and edit vector files
  - Shapefile, GeoJSON, geopackage
- Change **Symbology** of vector layers
- Edit vector layers using **digitizing**
- Edit vector layer **attribute tables**
- Package vector layers into a Geopackage (.gpkg)



# Geospatial Data: Two Types

## Raster

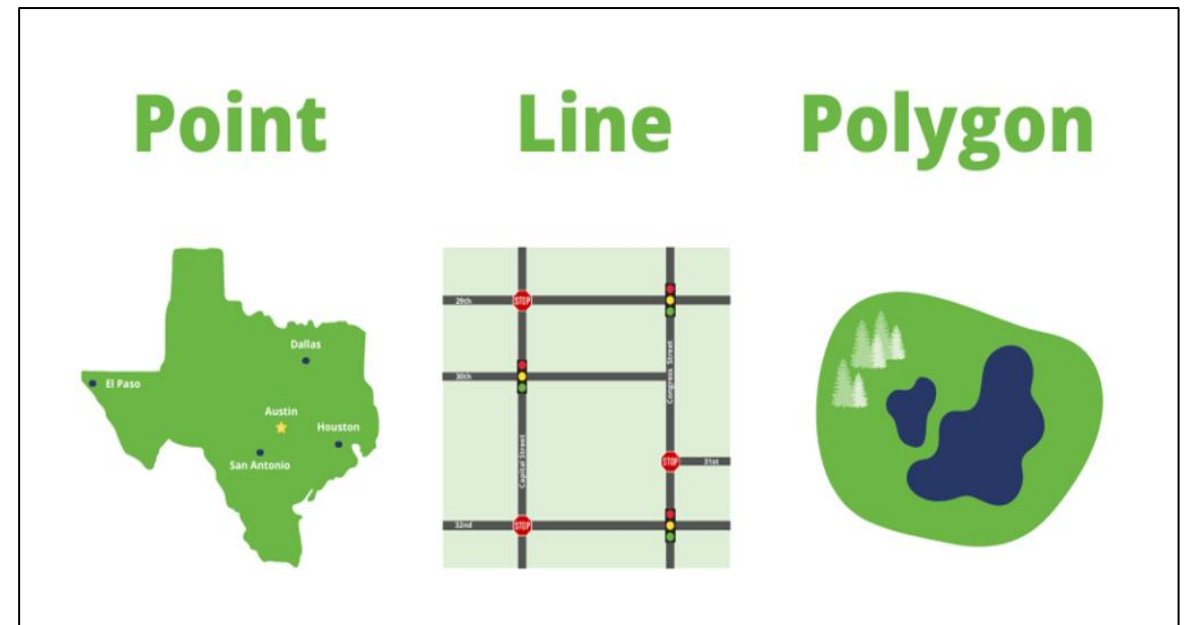
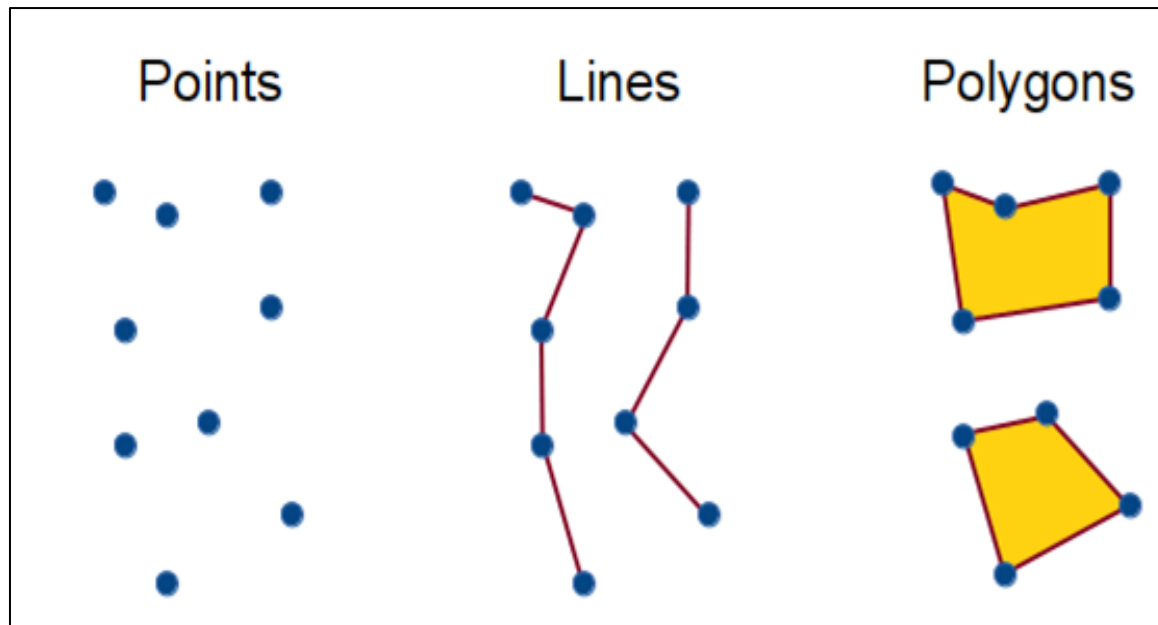
- Represents Earth's surface as a grid of pixels or cells
- Each cell has numeric value(s)



# Geospatial Data: Two Types

## Vector

- Represents geographic features as discrete geometric features (points, lines, polygons)
- Sometimes no accompanying data values



# Vector Features

Polygons  **Victoria**

- Area, perimeter

Lines  **Roads**

- Length, sometimes width

Points  **Points**

- No dimensions



A single layer in *QGIS* can only contain one kind of feature (point, line, or polygon)

# Vector files:

Most common

ESRI Shapefiles (\*.shp \*.SHP)

GMT ASCII Vectors (.gmt) (\*.gmt \*.GMT)

GPS eXchange Format [GPX] (\*.gpx \*.GPX)

GPSTrackMaker (\*.gtm \*.gtz \*.GTM \*.GTZ)

GeoJSON (\*.geojson \*.GEOJSON)

GeoJSON Newline Delimited JSON (\*.geojsonl \*.geojsons \*.nlgeojson \*.json \*.GEOJSONL \*.GEOJSONS \*.NLGEOJSON \*.JSON)

GeoPackage (\*.gpkg \*.GPKG)

GeoRSS (\*.xml \*.XML)

Geoconcept (\*.gxt \*.txt \*.GXT \*.TXT)

Geography Markup Language [GML] (\*.gml \*.GML)

Geomedia .mdb (\*.mdb \*.MDB)

Geospatial PDF (\*.pdf \*.PDF)

Hydrographic Transfer Format (\*.htf \*.HTF)

INTERLIS 1 (\*.itf \*.xml \*.ili \*.ITF \*.XML \*.ILI)

INTERLIS 2 (\*.xtf \*.xml \*.ili \*.XTF \*.XML \*.ILI)

Idrisi Vector (.vct) (\*.vct \*.VCT)

Keyhole Markup Language [KML] (\*.kml \*.kmz \*.KML \*.KMZ)

MBTiles (\*.mbtiles \*.MBTILES)

MS Excel format (\*.xls \*.XLS)

MS Office Open XML spreadsheet (\*.xlsx \*.XLSX)

Mapbox Vector Tiles (\*.mvt \*.mvt.gz \*.pbf \*.MVT \*.MVT.GZ \*.PBF)

Mapinfo File (\*.mif \*.tab \*.MIF \*.TAB)

Microstation DGN (\*.dgn \*.DGN)

NAS - ALKIS (\*.xml \*.XML)

Network Common Data Format (\*.nc \*.NC)

Open Document Spreadsheet (\*.ods \*.ODS)

OpenAir Special Use Airspace Format (\*.txt \*.TXT)

OpenJUMP JML (\*.jml \*.JML)

OpenStreetMap (\*.osm \*.pbf \*.OSM \*.PBF)

PCI Geomatics Database File (\*.pix \*.PIX)

50+ vector file types!

**Shapefiles (.shp)**

# Shapefile

ESRI Shapefiles (\*.shp \*.SHP)

GMT ASCII Vectors (.gmt) (\*.gmt \*.GMT)

**ESRI shapefiles must have:**

- .shx** shape index position, used for searching
- .shp** gives features their geometry
- .dbf** database file storing attribute data and object IDs
- .prj** for coordinate and projection system

Sometimes additional files

- .cpg** encoding applied to create the shapefile
- .sbn** optimizes spatial queries
- .sbx** speeds up loading times
- .xml** metadata associated with the shapefile



# Database Files (.dbf)

- Vector features can have **attribute information**
- The attribute information is contained in the .dbf
- Information is organized into tables

**Fields:** Each column is called a *field*  
each field describes a different attribute

	fid	OBJECTID	PERIMETER	MUNICIPALI	LA_NAME_RE
1	102	133	8777.24307	Esquimalt	Panhandle
2	101	111	9877.67695	Colwood	South Colwood
3	100	110	10232.60456	Oak Bay	South Oak Bay
4	99	109	8353.20166	Victoria	Fairfield

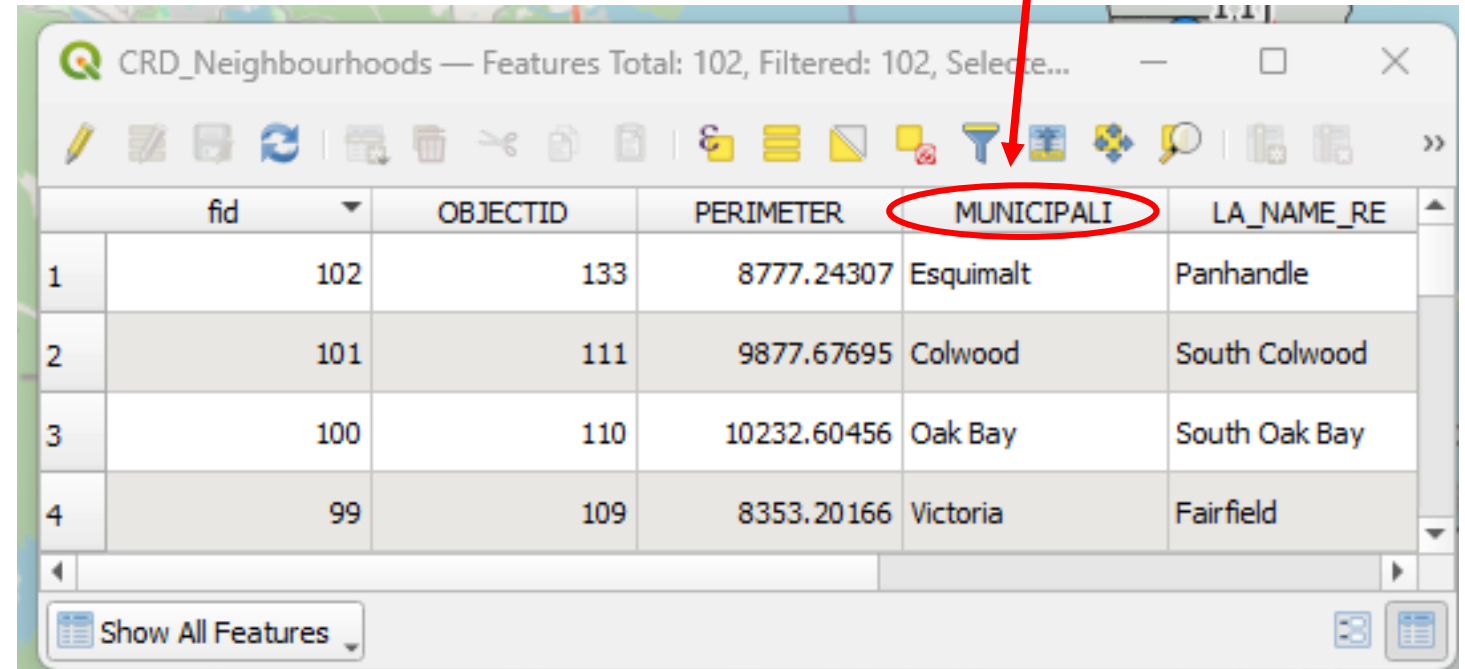
**Features:** Each row refers to a different feature on screen

# Database Files (.dbf) Limitations

## Column/Field names must follow these standards

- Maximum 10 characters
- Must begin with a 'letter'
- No dashes - or slashes /
- Underscores \_ ok

**NOTE:** "Municipality" field cuts off to 10 characters MUNICIPALI



The screenshot shows a table with the following columns: fid, OBJECTID, PERIMETER, MUNICIPALI, and LA\_NAME\_RE. The data rows are as follows:

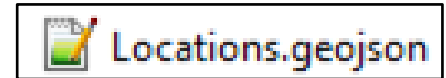
	fid	OBJECTID	PERIMETER	MUNICIPALI	LA_NAME_RE
1	102	133	8777.24307	Esquimalt	Panhandle
2	101	111	9877.67695	Colwood	South Colwood
3	100	110	10232.60456	Oak Bay	South Oak Bay
4	99	109	8353.20166	Victoria	Fairfield

**.dbf** can exist without geometric data (**.shp**) but are difficult to interpret without visual representation

**GeoJSON (.geojson)**

# GeoJSON

- Text-based format for geographic data
- Supports points, lines, and polygons
- Human-readable and editable in a text editor (e.g. *Notepad++* as below)
  - Can also edit directly in a GIS software (*QGIS*)



Point  
Coordinates



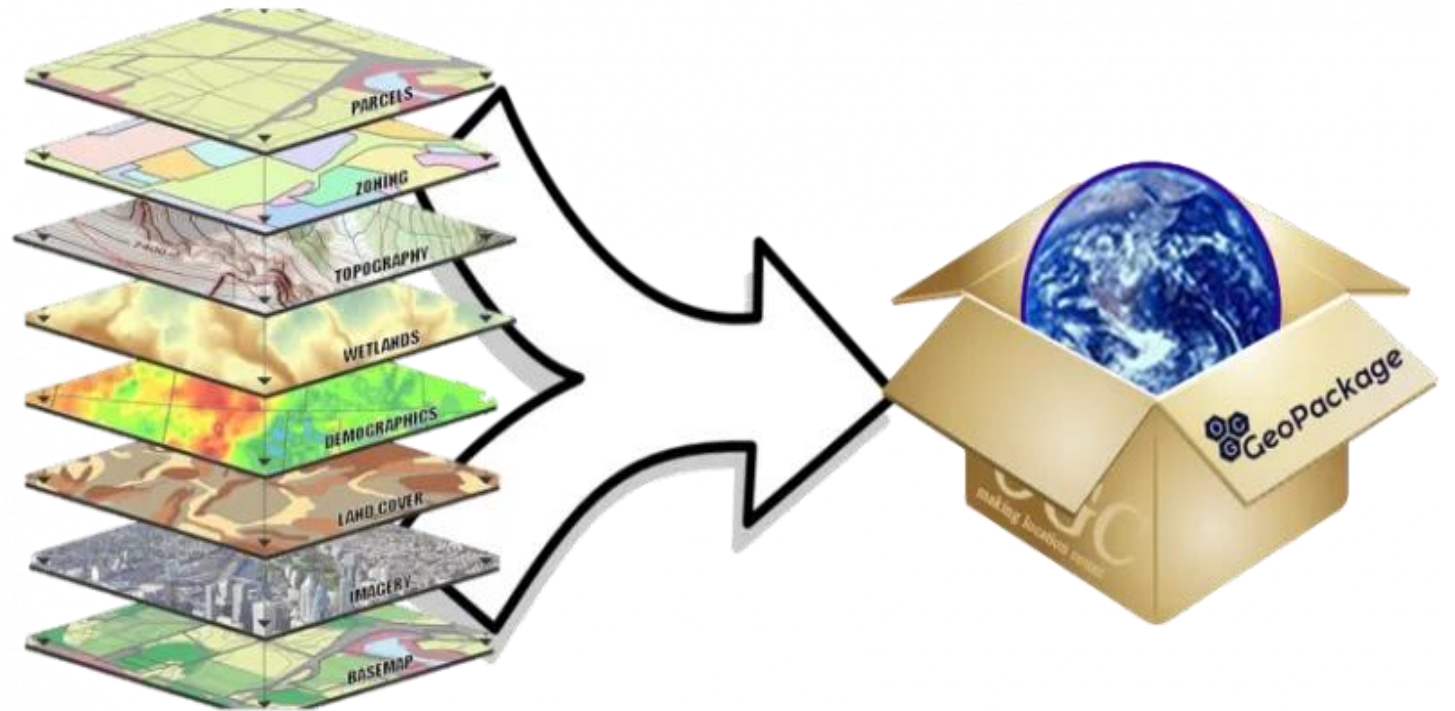
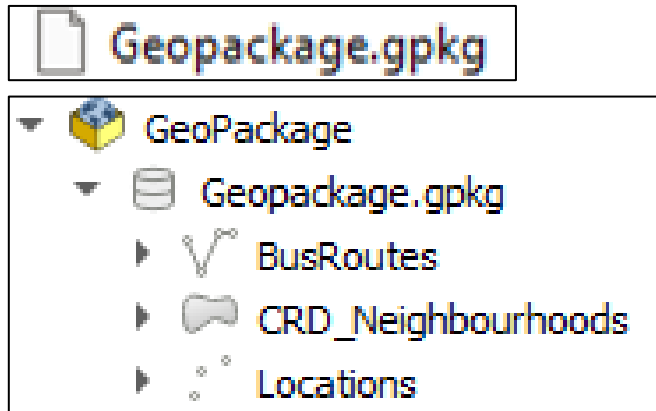
```
CA\Users\gabriellewade\OneDrive - University of Victoria\Desktop\Locations.geojson - Notepad++
File Edit Search View Encoding Language Settings Tools Macro Run Plugins Window ?
Locations.geojson Parks.geojson
1 {
2   "type": "FeatureCollection",
3   "name": "Locations",
4   "crs": { "type": "name", "properties": { "name": "urn:ogc:def:crs:EPSG::3157" } },
5   "features": [
6     { "type": "Feature", "properties": { "Name": "Your Location", "Latitude": null, "Longitude": null }, "geometry": null },
7     { "type": "Feature", "properties": { "Name": "YYJ", "Latitude": 48.65255013, "Longitude": -123.4297931 }, "geometry": { "type": "Point",
8       "coordinates": [ 468346.925805713166483, 5388921.096811008639634 ] } },
9     { "type": "Feature", "properties": { "Name": "Swartz Bay", "Latitude": 48.68812438, "Longitude": -123.4146051 }, "geometry": { "type": "Point",
10      "coordinates": [ 469487.00482679286506, 5392869.288799469359219 ] } },
11     { "type": "Feature", "properties": { "Name": "PKOLS", "Latitude": 48.49348443, "Longitude": -123.3422378 }, "geometry": { "type": "Point",
12      "coordinates": [ 474716.159818745218217, 5371207.259277308359742 ] } },
13     { "type": "Feature", "properties": { "Name": "Royal BC Museum", "Latitude": 48.42113463, "Longitude": -123.3673963 }, "geometry": { "type": "Point",
14      "coordinates": [ 472818.82447299733758, 5363173.876949505880475 ] } },
15     { "type": "Feature", "properties": { "Name": "Royal Jubilee Hospital", "Latitude": 48.43336085, "Longitude": -123.3275827 }, "geometry": { "type":
16      "Point", "coordinates": [ 475770.532241339213215, 5364575.082538747228682 ] } },
17     { "type": "Feature", "properties": { "Name": "UVIC Exchange", "Latitude": 48.4661241, "Longitude": -123.3088589 }, "geometry": { "type": "Point",
18      "coordinates": [ 477169.957331199198961, 5368155.529331269674003 ] } },
19     { "type": "Feature", "properties": { "Name": "Beacon Hill Park", "Latitude": 48.408105, "Longitude": -123.358701 }, "geometry": { "type": "Point",
20      "coordinates": [ 473455.374709020135924, 5361722.536787395365536 ] } },
21     { "type": "Feature", "properties": { "Name": "Hillside Centre", "Latitude": 48.44752084, "Longitude": -123.334211 }, "geometry": { "type": "Point",
22      "coordinates": [ 475286.879061449086294, 5366095.566013755276799 ] } },
23     { "type": "Feature", "properties": { "Name": "Victoria General", "Latitude": 48.46851697, "Longitude": -123.433163 }, "geometry": { "type": "Point",
24      "coordinates": [ 467982.795599248667713, 5368466.047575992532074 ] } },
25     { "type": "Feature", "properties": { "Name": "Costco", "Latitude": 48.45945001, "Longitude": -123.5020806 }, "geometry": { "type": "Point",
26      "coordinates": [ 462881.982760510407388, 5367489.339950951747596 ] } },
27     { "type": "Feature", "properties": { "Name": "Swan Lake", "Latitude": 48.46571279, "Longitude": -123.3738345 }, "geometry": { "type": "Point",
28      "coordinates": [ 472366.679330895422027, 5368131.230441669002175 ] } },
29     { "type": "Feature", "properties": { "Name": "Equimalt Park", "Latitude": 48.44578699, "Longitude": -123.4038815 }, "geometry": { "type": "Point",
30      "coordinates": [ 470133.876311512547545, 5365927.674945689737797 ] } },
31     { "type": "Feature", "properties": { "Name": "Elk/Beaver Lake", "Latitude": 48.52467723, "Longitude": -123.3920731 }, "geometry": { "type": "Point",
32      "coordinates": [ 471052.044112307543401, 5374692.177011045627296 ] } },
33     { "type": "Feature", "properties": { "Name": "Willows Beach", "Latitude": 48.43352245, "Longitude": -123.3040446 }, "geometry": { "type": "Point",
34      "coordinates": [ 477511.443523785448633, 5364530.287813624367118 ] } }
35   ]
36 }
```



**Geopackage (.gpkg)**

# Geopackage

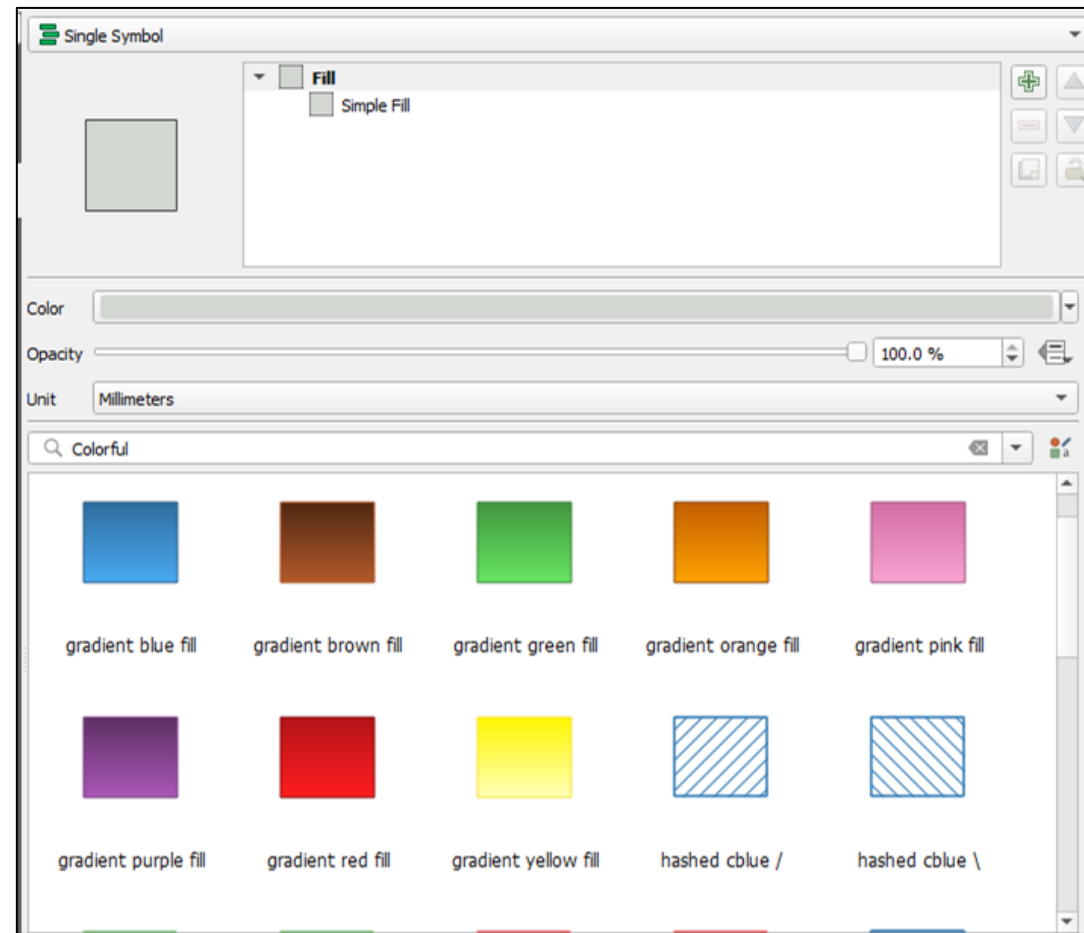
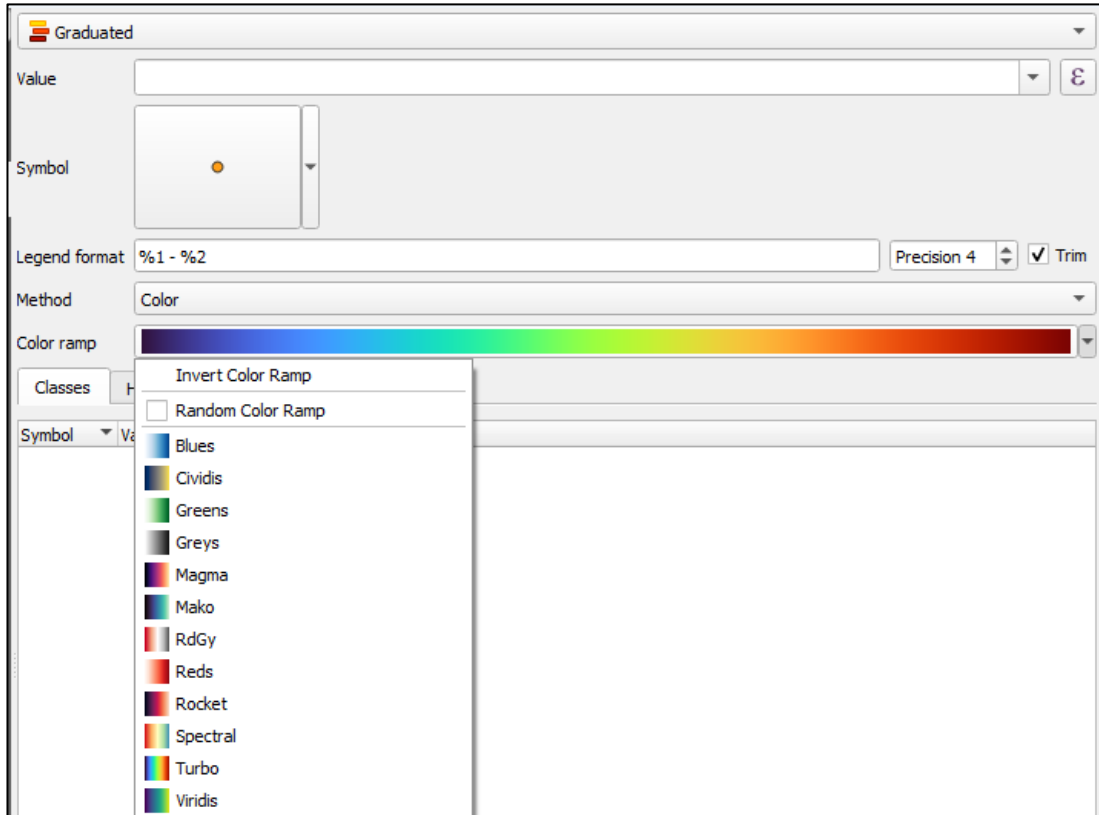
- File format that can hold multiple vector features (points, lines, polygons), tables, and rasters
  - All layers in one file (unlike shapefile; .shp, .dbf., .shx, etc.)
- Useful for large, complex datasets



<https://ocad.com/blog/2023/01/geopackage-import-in-ocad/>

# Change vector symbology

- Almost endless options...
  - Colour, transparency, shape, size
  - symbol, labels, schemes



# edit Vector data

- Can add and edit fields and features using the *Attribute Table* and *Field Calculator*

Fields

Features

	OBJECTID	PERIMETER	MUNICIPALI	AREA_HA
1	1	11463.16770	North Saanich	697.812
2	2	14437.25741	North Saanich	530.520
3	3	10838.44985	North Saanich	130.229
4	4	649.69038	North Saanich	1.881
5	5	7885.21741	North Saanich	81.932

Add Field

Name:

Type: 123 Integer (32 bit)

Provider type: integer

Length: 10

OK Cancel

CRD\_Neighbourhoods — Select by Expression

Expression Function Editor

feature geometry id

- Aggregates
- Arrays
- Color
- Conditionals
- Conversions
- Date and Time
- Fields and Val...
- Files and Paths
- Fuzzy Matching
- General

Feature: Airport

Preview:

Select Features Close

CRD\_Neighbourhoods — Field Calculator

Only update 0 selected features

Create a new field  Update existing field

Create virtual field

Output field name:

Output field type: 123 Integer (32 bit)

Output field length: 10 Precision: 3

Expression Function Editor

feature geometry id

- row\_number
- Aggregates
- Arrays
- Color
- Conditionals
- Conversions
- Date and Time
- Fields and Val...
- Files and Paths
- Fuzzy Matching

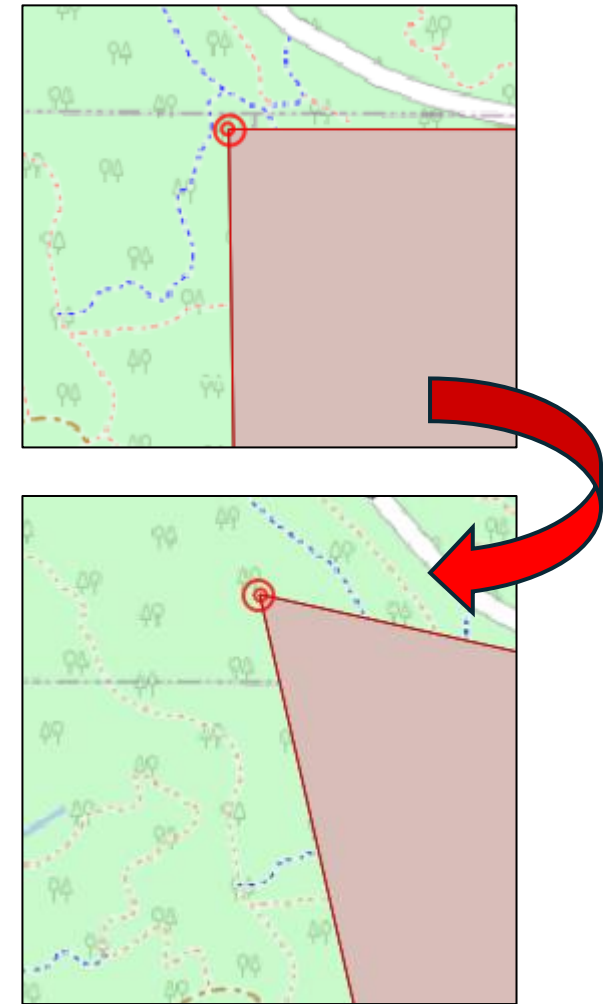
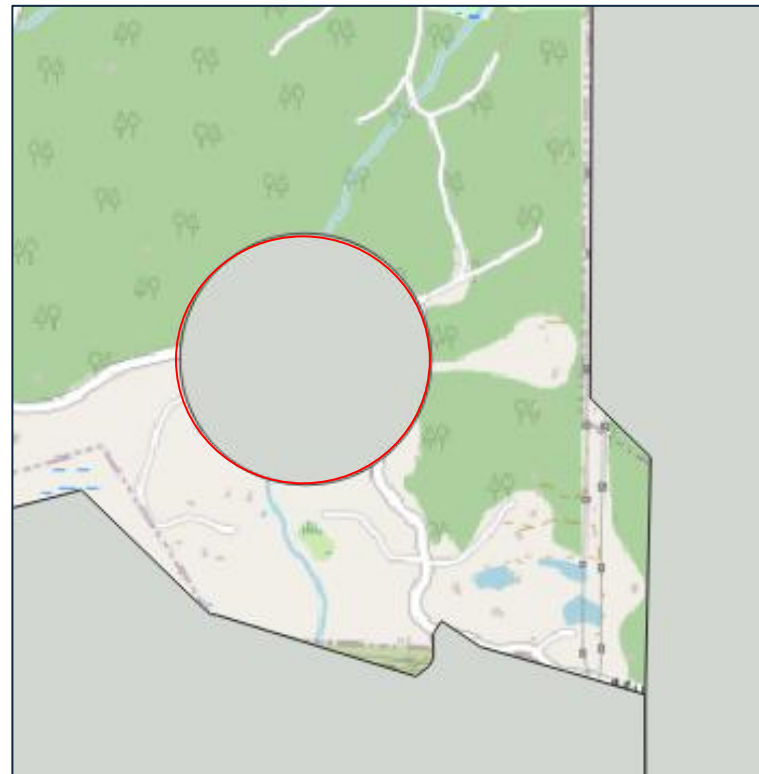
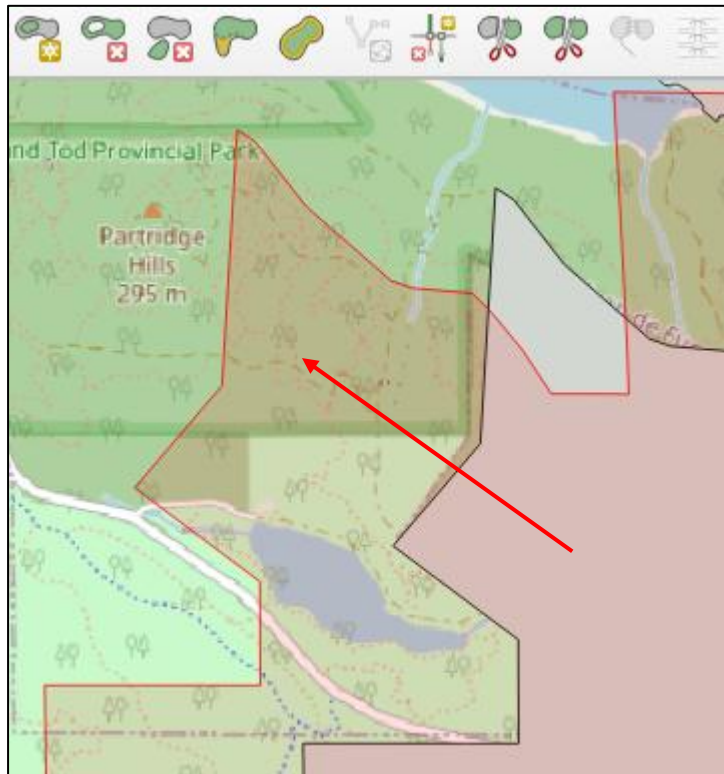
Feature: Airport

Preview:

OK Cancel Apply Help

# edit Vector data

- Can edit vector geometry directly – **digitizing**
  - Move feature, move vertices, add parts, delete parts, split features, etc.
  - Create new lines, points, polygons



**Could** do all types of edits (add and calculate fields, move/add/delete points, lines, polygons) for any vector file type (.shp, .geojson, .gpkg)...

**But** for this exercise will only do one type of edit on each vector file type

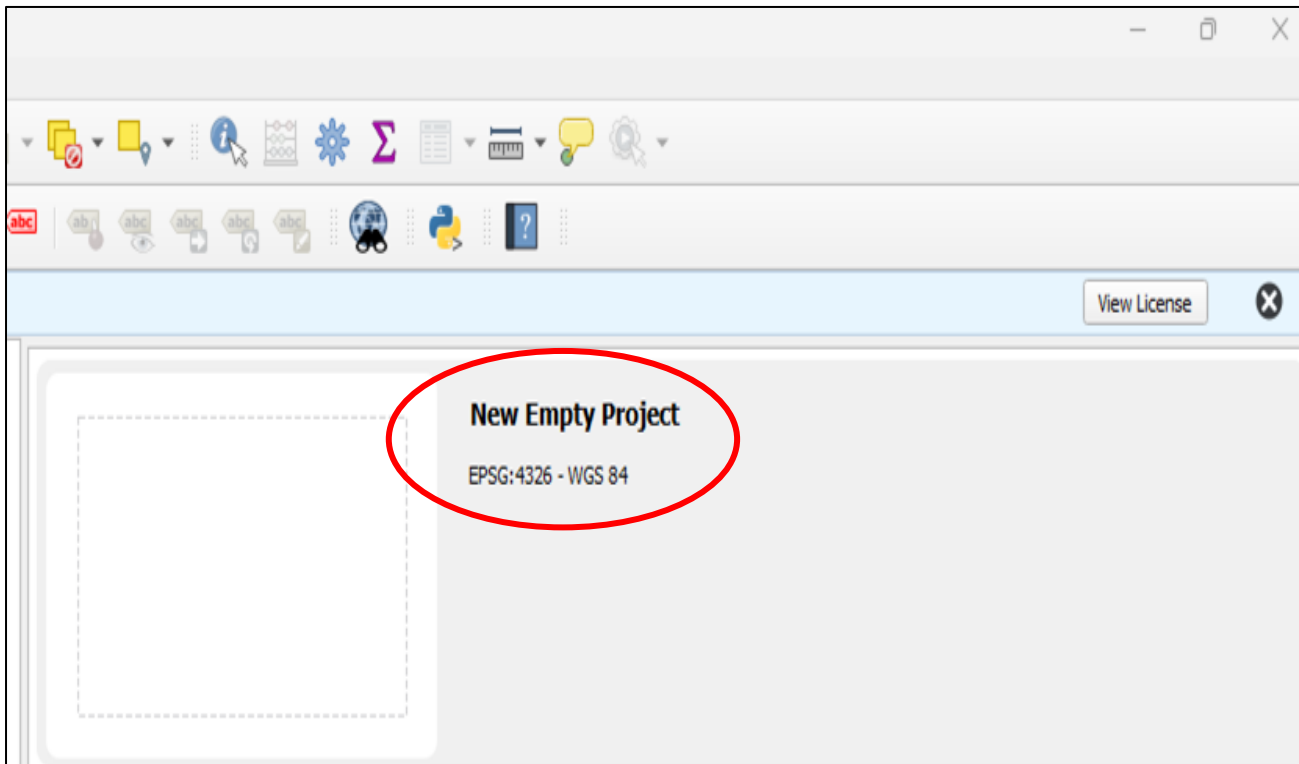
# Start *QGIS*

## Download workshop data

- Extract /unzip the .zip file
- Save it where you can find it...

## Open *QGIS* (your version may be different)

- Double click on *New Empty Project*



**Note:** New *QGIS* projects open with Geographic Coordinate System (GCS) **EPSG:4326**

# Understand QGIS interface



\*your interface may look different

Menu Bar

Toolbar

Layers Panel

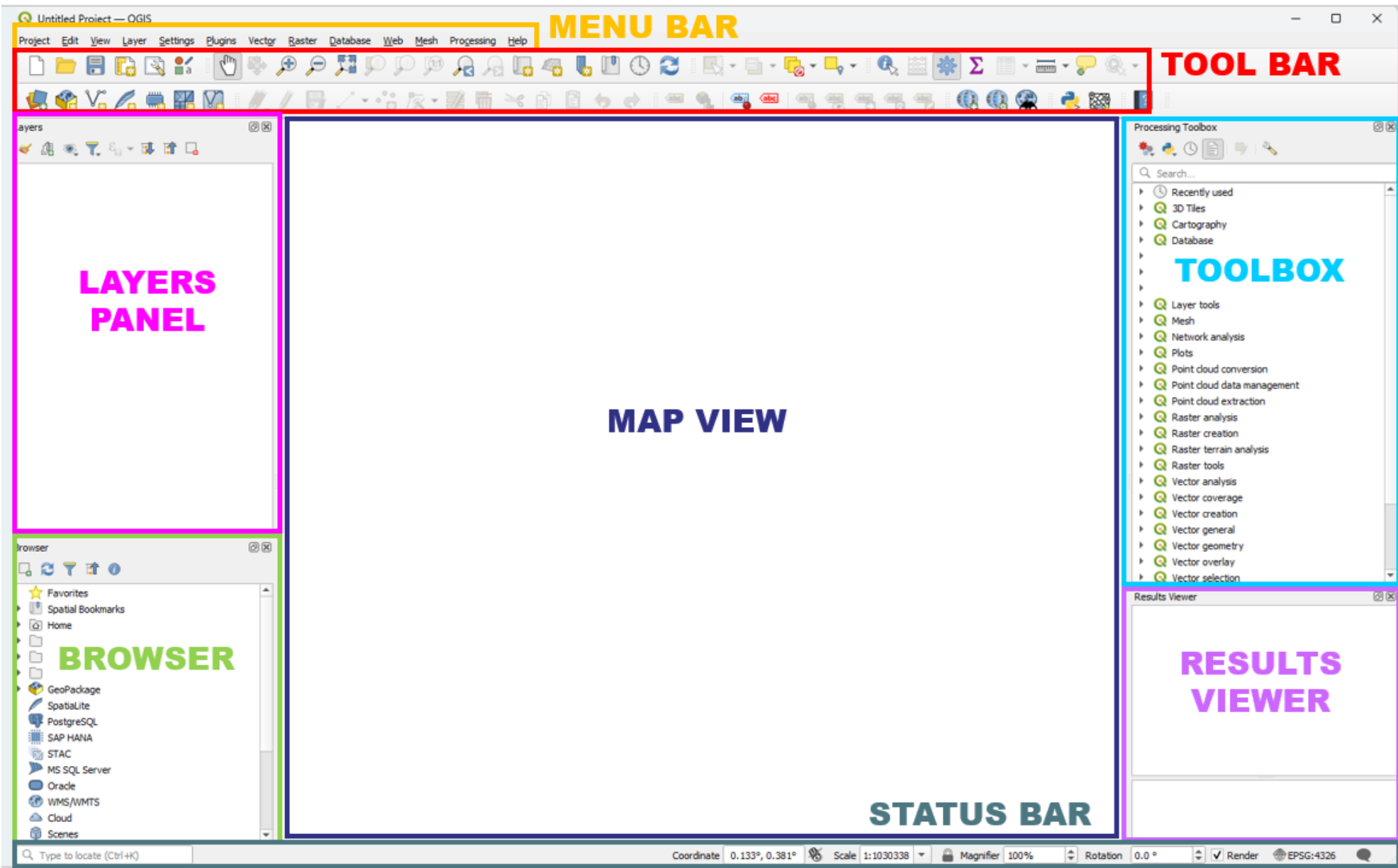
Map view

Browser

Toolbox

Status Bar

Results Viewer



# Understand *QGIS* interface

## Menu Bar:

Project Edit View Layer Settings Plugins Vector Raster Database Web Mesh HCMGIS Processing Help

Horizontal bar at the top providing access to various functions and tools

*(Project management, Edit, Plugins, Vector & Raster tools, etc.)*

## Toolbar:



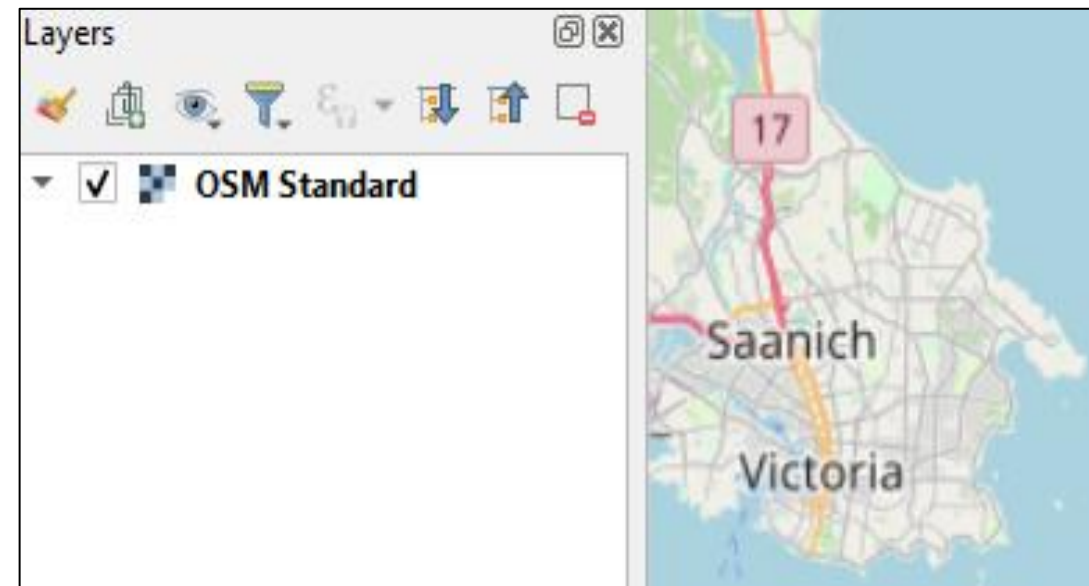
Contains icons for frequently used tools, such as Add Data, Pan, Zoom, Identify, etc.

Quick access to essential operations.

## Layers Panel:

**Displays** all active **Layers** in the project.

Allows users to organize, manage visibility and access properties of layers



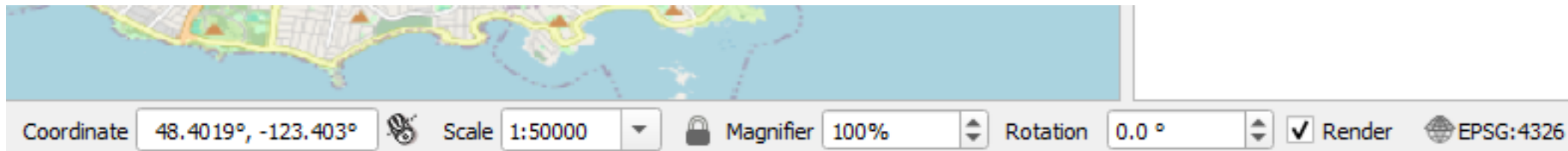
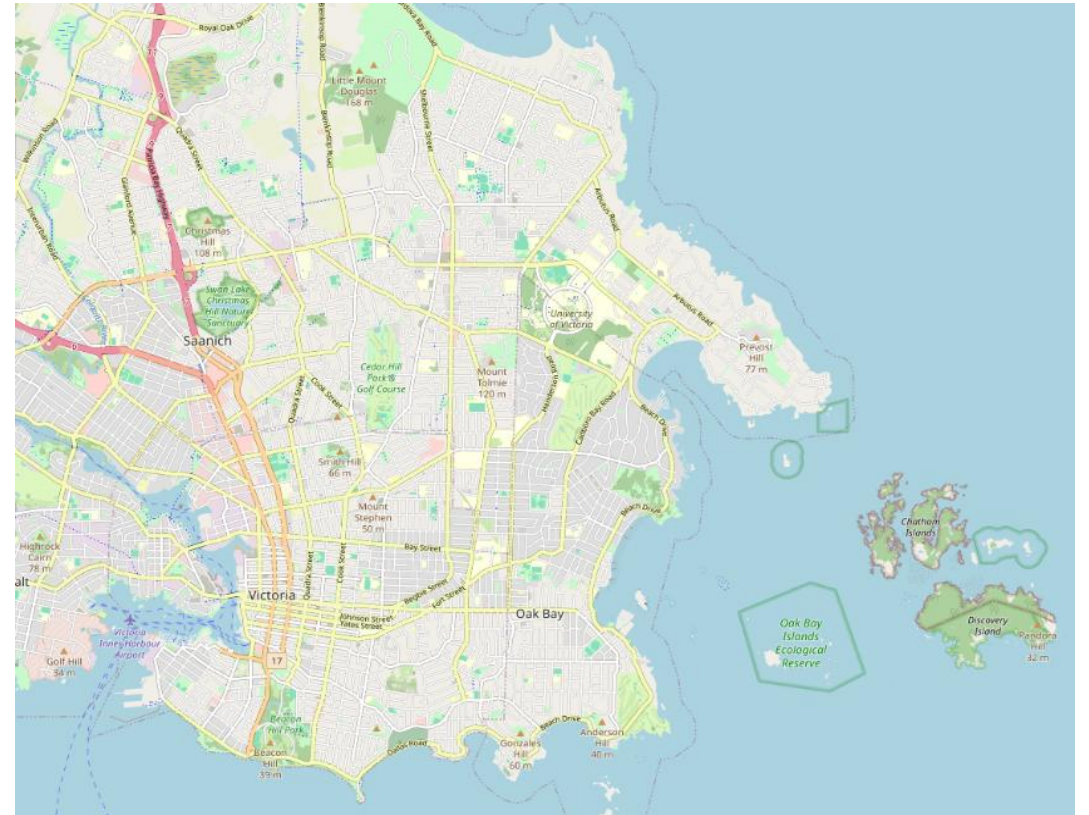
# Understand *QGIS* interface

## Map View:

The central area where spatial data is displayed. Interact with the map, visualize layers and analyze spatial relationships.

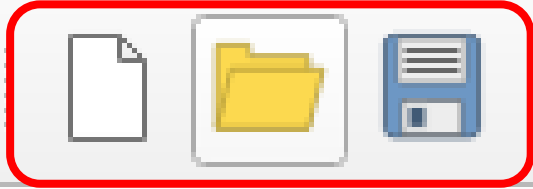
## Status Bar:

Located at the bottom, it provides information about current project: coordinate display, scale and CRS settings.

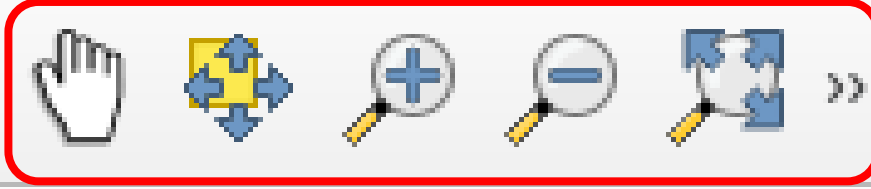


# Toolbar essentials

New project, open, and save



Pan



zoom

“zoom full”



Add data

Turn editing on/off



Add feature

# Advanced Digitizing Toolbar

- Some vector feature editing requires the **Advanced Digitizing Toolbar** – we will open this toolbar in the exercise



Move feature

Delete part



Proceed to **Workshop Exercise**

There are **Check-In** slides to **ask** for help  
(or **ask** sooner!)

# Resources going forward:



## QGIS – additional resources:

- QGIS Training Manual: [https://docs.qgis.org/3.40/en/docs/training\\_manual/index.html](https://docs.qgis.org/3.40/en/docs/training_manual/index.html)
- QGIS User Guide: [https://docs.qgis.org/3.40/en/docs/user\\_manual/index.html](https://docs.qgis.org/3.40/en/docs/user_manual/index.html)
- QGIS Tutorials & Tips: <https://www.qgistutorials.com/>

## Find data:

- GeoSpatial Data Guide: <http://libguides.uvic.ca/geospatialdata>

## Questions or problems:

- UVic Geospatial Librarian ([danielbm@uvic.ca](mailto:danielbm@uvic.ca)) or YCW Geospatial Intern ([gabriellewade@uvic.ca](mailto:gabriellewade@uvic.ca))

## UVic full semester GIS courses in the Department of Geography:

- GEOG222 – Intro to Maps and GIS
- GEOG328 – GIS Analysis



## GIS Skills and Mapping Micro-certificate

<https://continuingstudies.uvic.ca/science-and-the-environment/programs/gis-skills-and-mapping>