

Snowmobile Trail Mapping

2018 NH TrailMasters Conference

Bill Gassman – Moultonboro Snowmobile Club

Electronic Copy at billgassman.com/trailmaster



Trail conditions and more at www.moultonborosnowmobileclub.org

Map created by Bill Gassman
2018 NH TrailMasters Conference
Moultonboro Snowmobile Club

Modern Mapping is Digitized

- Use GPS to identify tracks within 10 feet
- Store and edit digitized tracks in common file formats (ie; GPX and KML)
- Layer tracks onto maps, such as Google Earth
- Add text and graphics
- Share track files with others
 - Variety of third party online mapping services
 - State agencies



Agenda

- Trail Map Planning
- Business considerations
- Making the map
- Advanced topics
- Questions & Discussion



Snowmobile Mapping Choices

- Match map style with your customer
 - Size, folding and distribution format
 - Local business advertising
- Update frequency and accuracy
- Cost price and profits
- Easy to use in bad weather
- Degree of durability
- Re-use of digitized trails



Business Model

- Expenses

- Fixed costs
 - Tools
 - Map design service
- Volume based costs
 - Printing
 - Distribution
- Periodic Revisions

- Income

- Advertising
- Map sales



Two Year Map Example

Expenses:

- Design tools – On-hand
- Sales (ads and finished maps) - Volunteer
- Distribution - Volunteer
- Free samples & left-over – 100 maps
- Printing - \$1,575 for 700 maps
- TOTAL = \$1,575

Income:

- Map sales 450@\$7 and 150@\$3 = \$3875
- Advertising spaces 60@\$100=\$6000
- TOTAL = \$9875
- Profit: $\$9875 - \$1575 = \$8300$ / \$4150/year

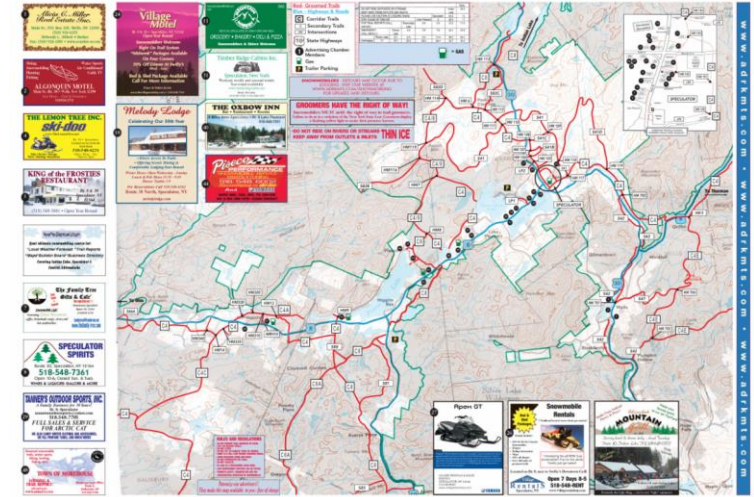
Advertising Sales

- Could be biggest source of income
- Assign sales manager
 - Create ad space order form with rates
 - Coordinate club members to solicit local businesses
 - Hint: visit in person and collect checks immediately
 - Hint #2: Pitch ad as a way to support the local snowmobile club
- Business cards make copy-ready ads – but may not fit your format
- Be willing/prepared to do graphics editing of ads
- Arrange ads roughly by category (food, lodging, real-estate, snowmobile dealers, etc.)
- Proof carefully – advertisers don't like errors!



Advertising

- How long will map last? Sell multi-year contract
 - Example: \$100/two years
 - If map lasts longer – no additional charge
- Lay out in unit format
 - Standard business card is 3.37"x2.125" or aspect ratio of Width = 1.586 X Length
 - Note: does not lay out well on standard paper sizes so you may choose differently
 - Calculate grid size, which determines number of spaces
 - Use back or around the front side
 - Double-sided printing costs more, but increases ad space
 - Leave space for map cover or club information
- Price by space – offer discounts for multiple ad-blocks
- Put advertiser legend on map, with number or name at location



Making the Map



Gerardus Mercator (1512-1594)



Global Positioning System (1980-today)

René Descartes (1596-1650)



How Long Does it Take?

- Quick and dirty 1-5 hours
 - Hand draw trails with free GPS editing tools
 - Print on home quality printer
 - Difficulty: moderately easy
- Professional quality map 8-100 hours
 - Import GPS tracks
 - Refine tracks for accuracy
 - Add labels, graphics and advertising
 - Use professional printer
 - Difficulty: moderately hard
- Mapping service
 - Give them what you have
 - Negotiate cost and work required
 - Look at sample work and check references
 - You still need to do some work



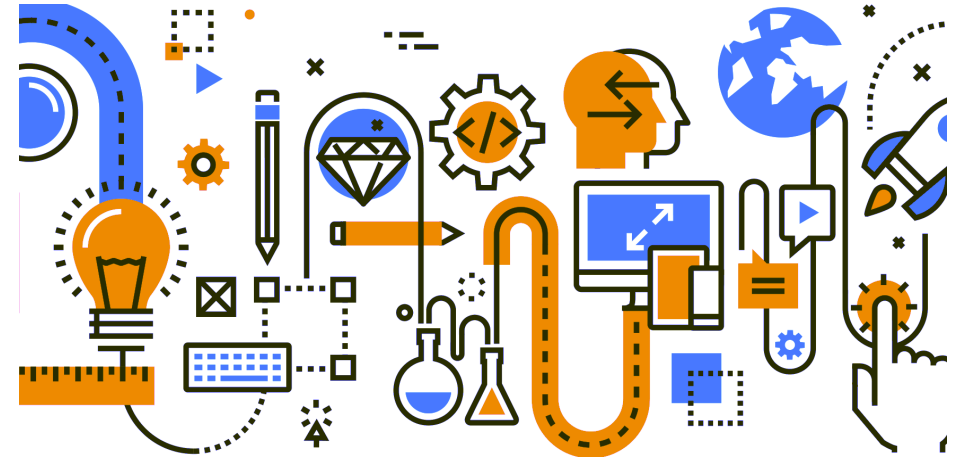
Quality Attributes

- Accurate and complete (trail locations, open/closed)
- Additional information (businesses, topology, points of interest)
- Clarity (good contrast in low light, big letters, simple to understand)
- Durable (how resistant to tear and water)
- Formats (hard copy & digital)
- Resolution (Precision)
- Drives customers to advertisers

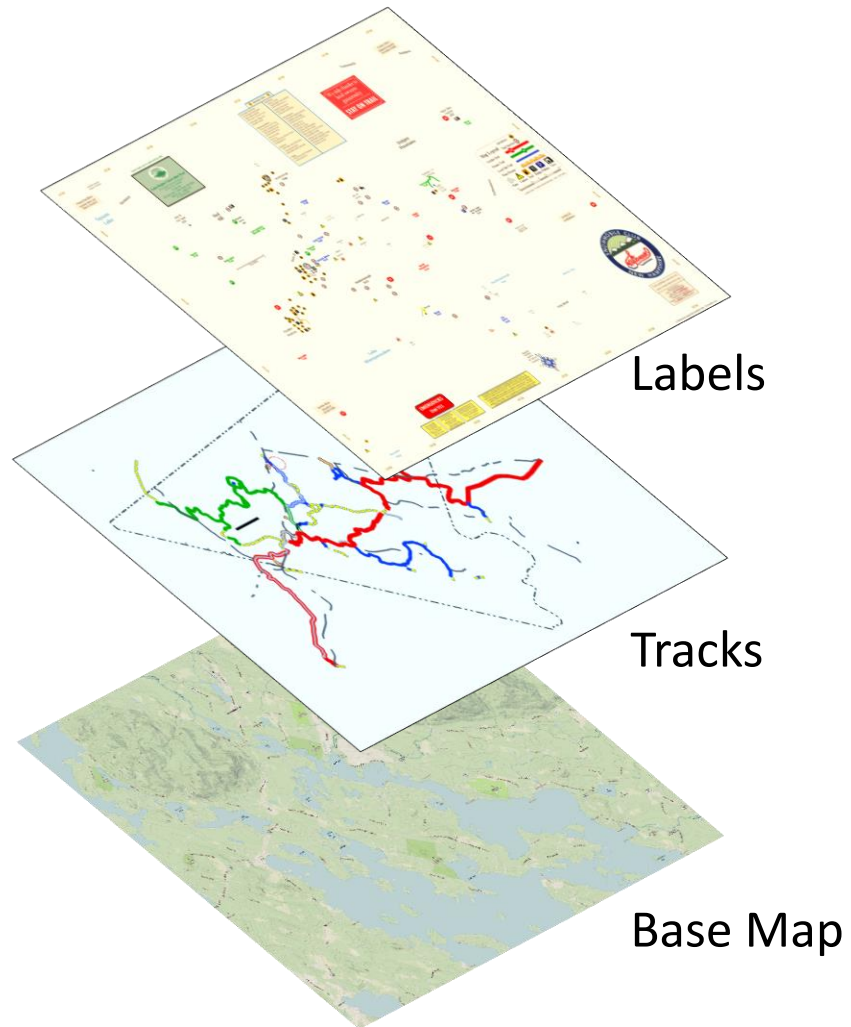


Map Making Workflow

1. Decide on business model
2. Digitize trails into tracks
3. Layer base map, tracks and labels
4. Add advertisements
5. Export to printable form (JPG, PDF)
6. Print
7. Distribute
8. Profit 😊



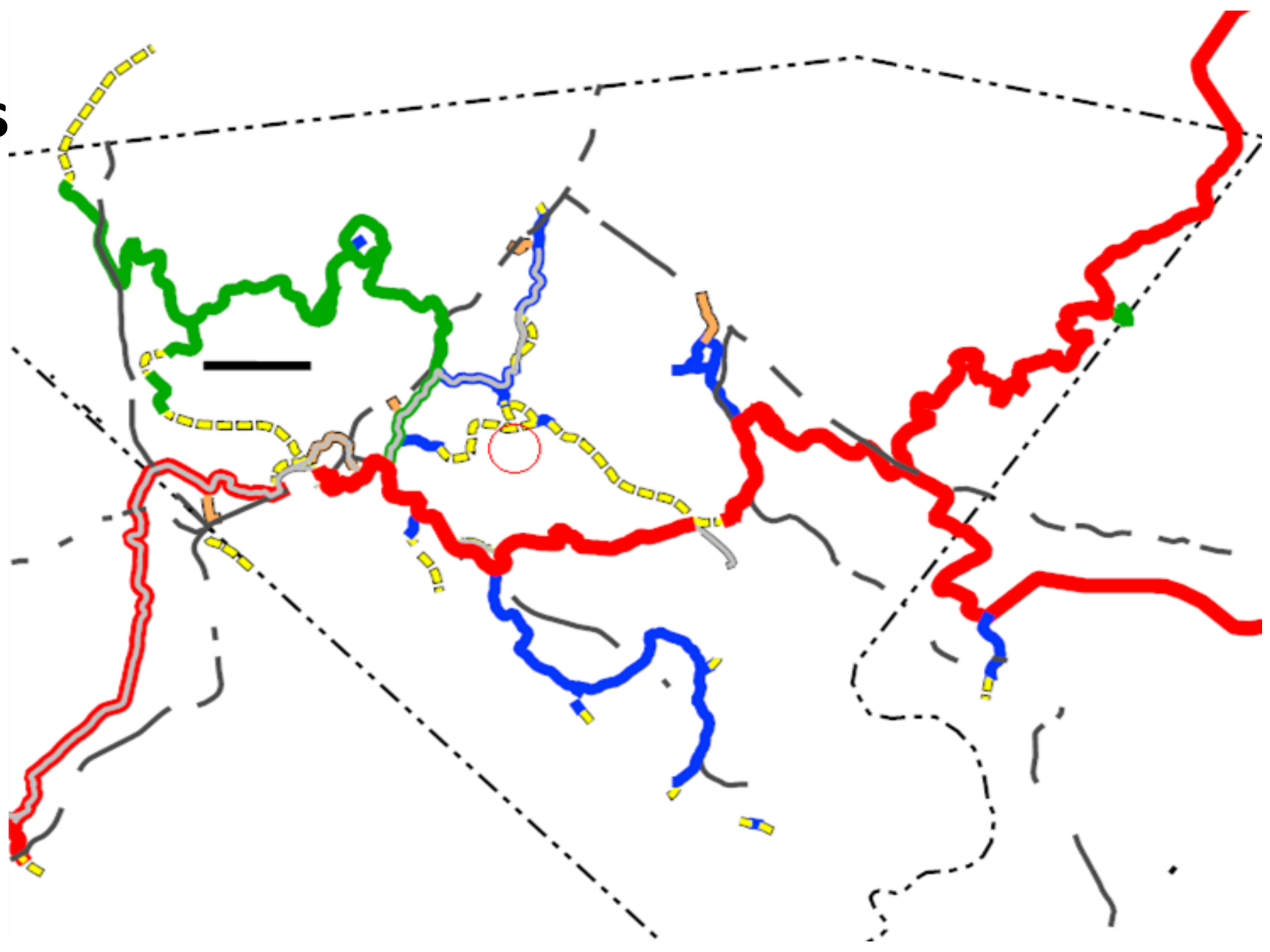
Map Layers



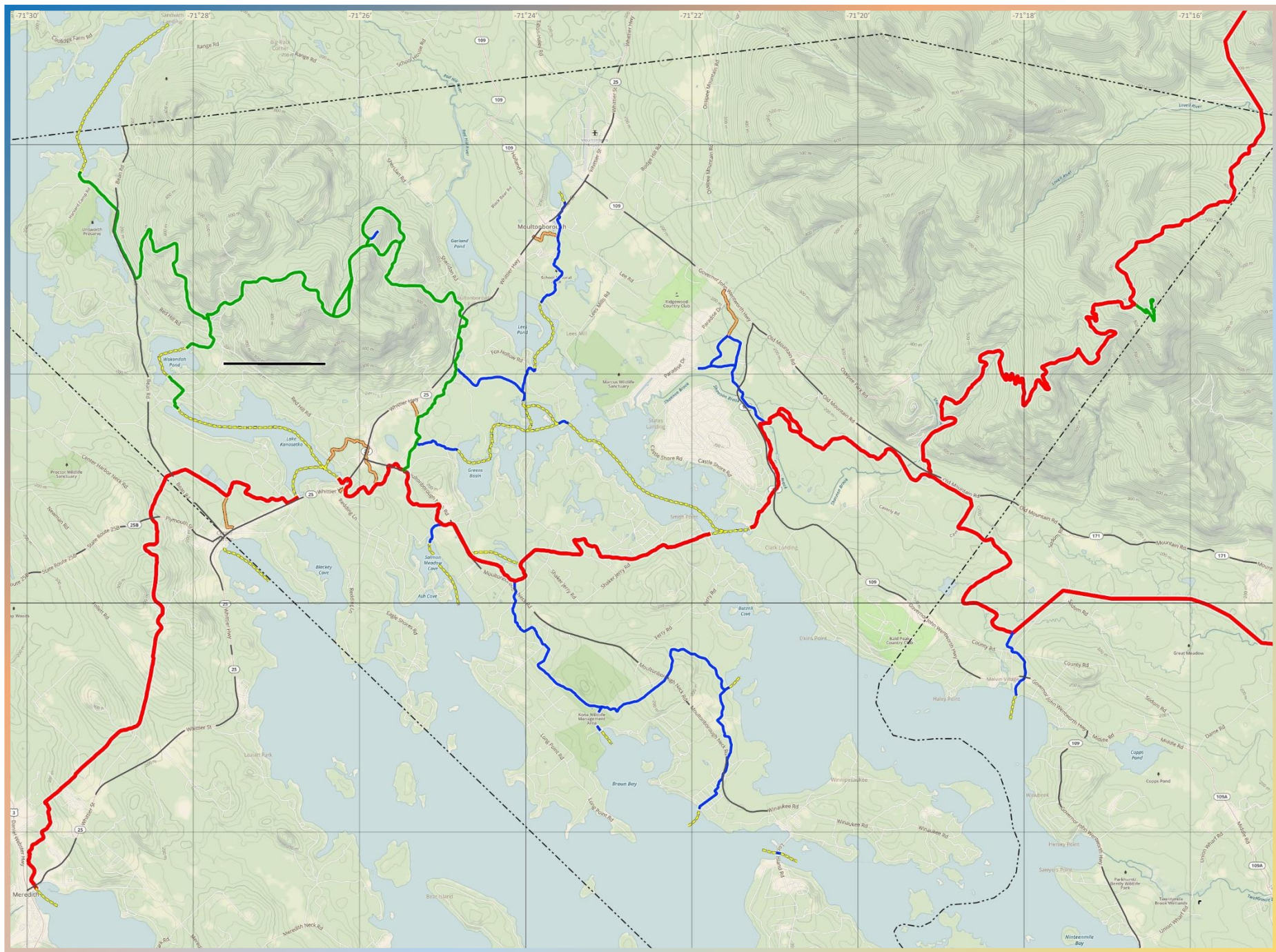
Base



Tracks



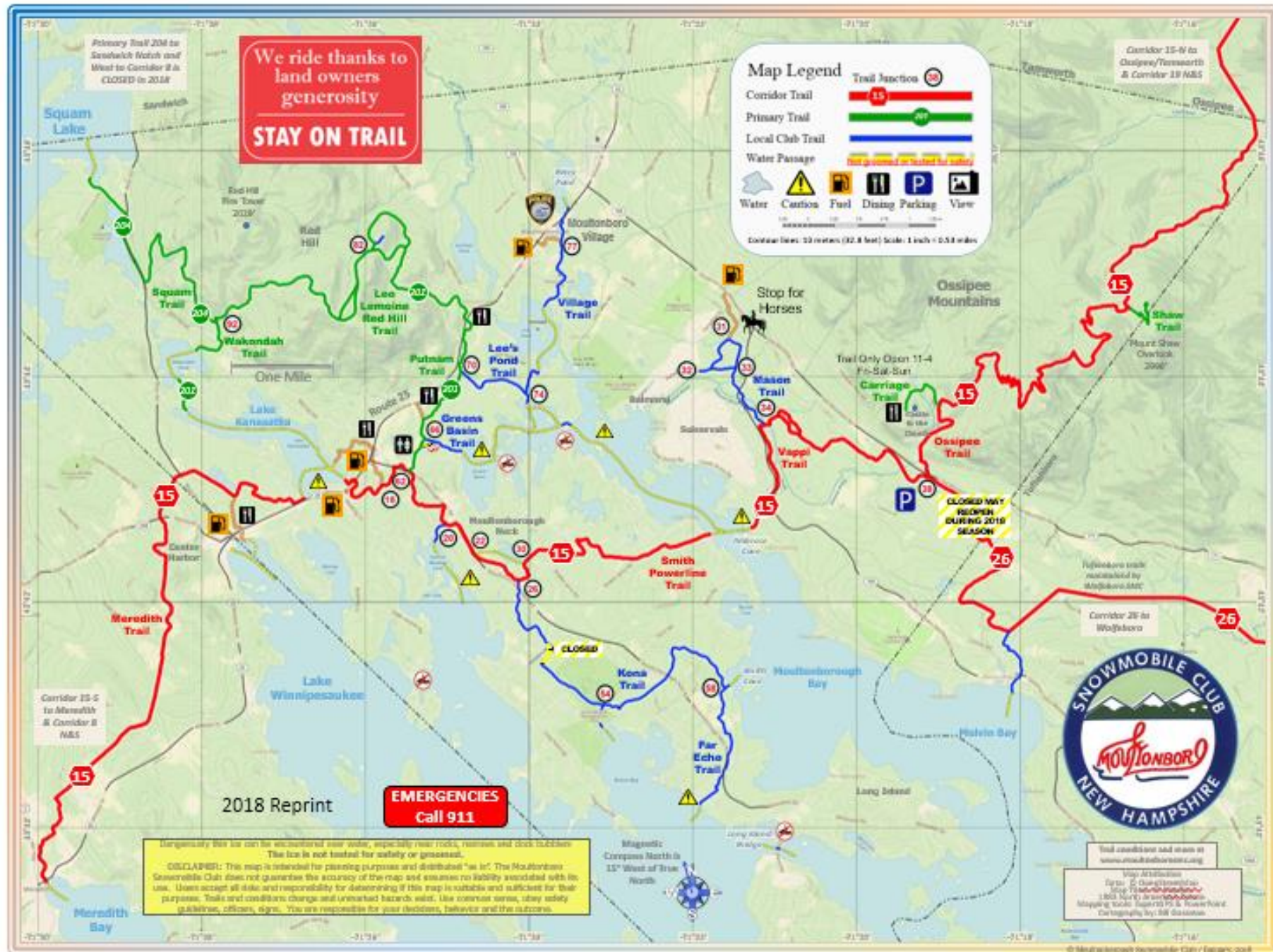
Base + Tracks



Labels

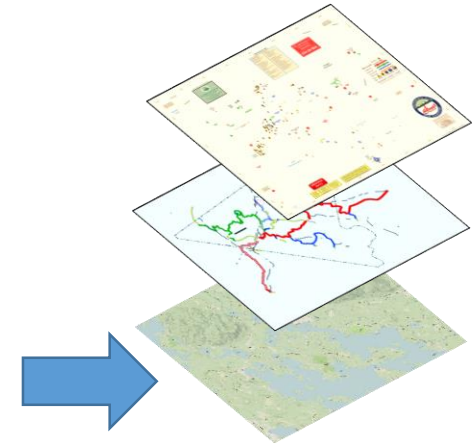


Final

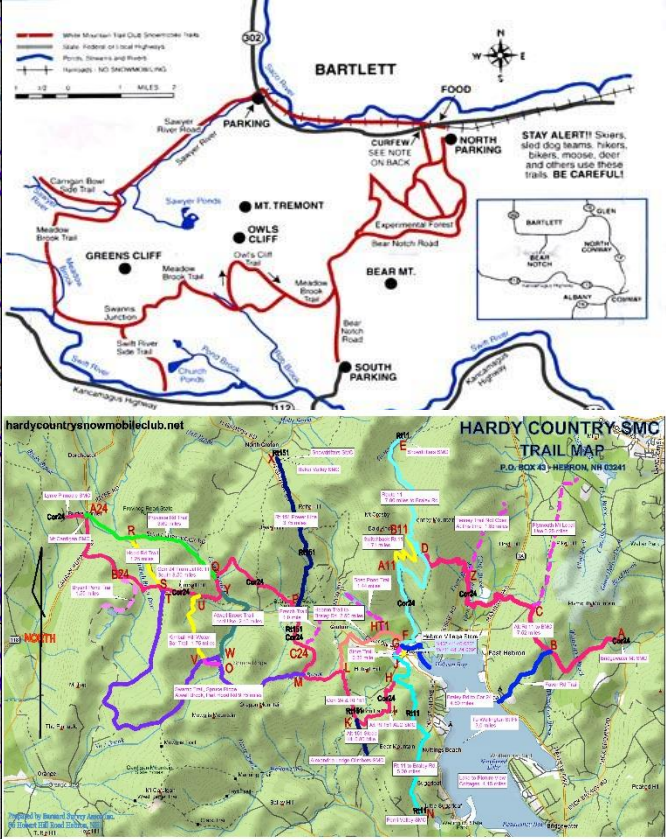
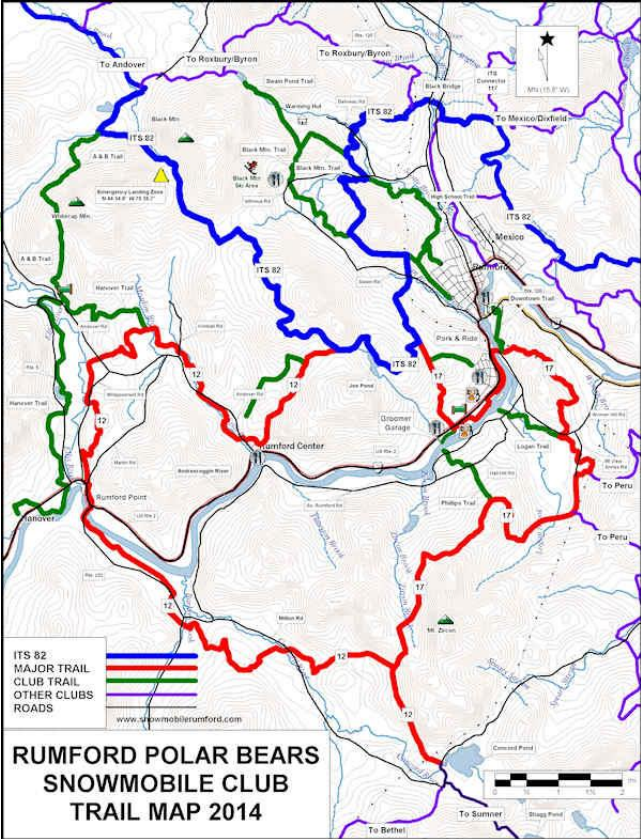


Base Map

- The foundation (canvas) of your trail map
- Many choices
 - Blank, photo, street-map, topological, satellite, etc
 - Hand drawn, free for public use, licensed for commercial use
 - Available for use with some GPS editing tools
- Commercial use requires attribution, permission and/or royalties
- Choice criteria
 - Focus (topology, street level, photographic)
 - Size and resolution (label text size, number of streets shown, how **fuzzy**)
 - Contrast (low contrast helps track and label layers show up well)
 - Clutter (complexity – is it overwhelming?)



Examples



Choice of Map Base Layers

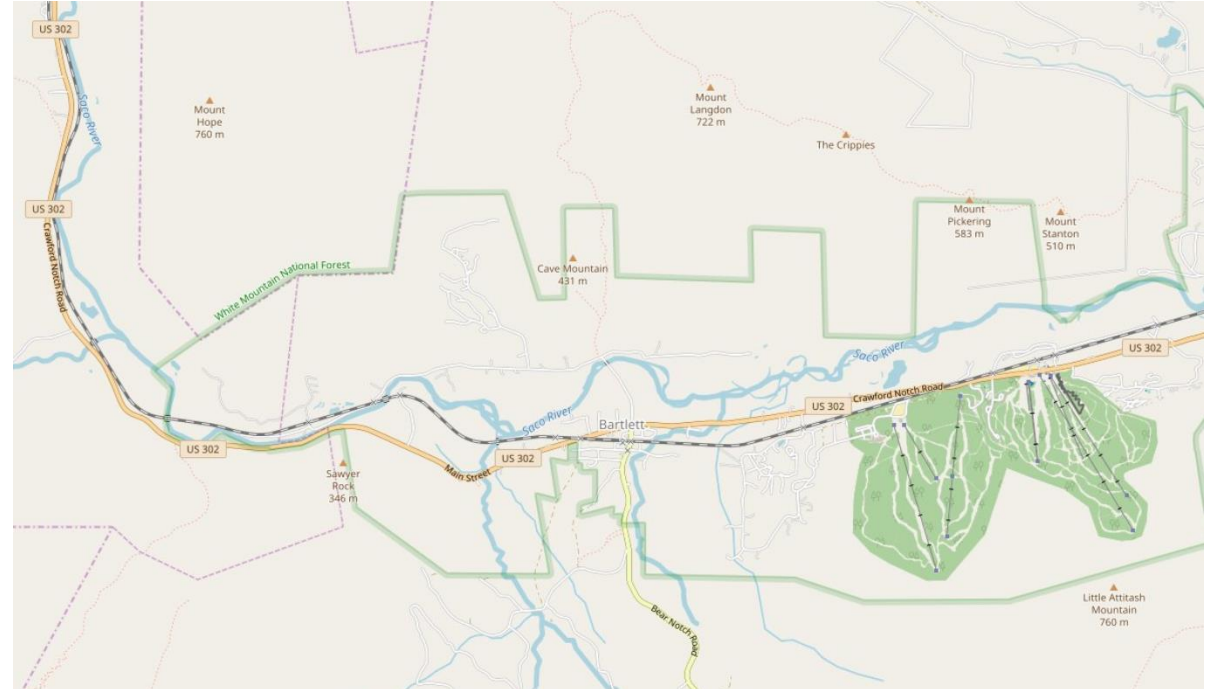
- Open Street Map (OSM)
 - Licensed by MapBox
- NH GranitView
- Google Map
- US Geological Survey
- NH Snowmobile Interactive Map (Jimapco/Topographics)



Open Street Map (OSM)



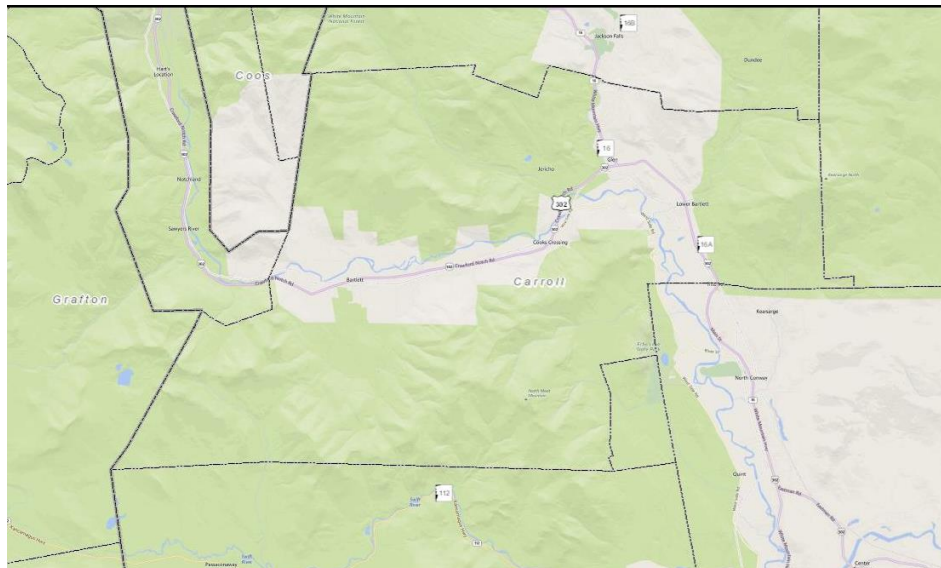
- Openstreetmap.org
- Licensed by MapBox
- To Download:
 - Position map, then “share”
 - Pick scale and image format
- Requires attribution
- Check license requirements
- Commercial reuse available with ExpertGPS editing tool



NH Granit



- <http://www.granit.unh.edu/> (GranitView)
- GIS clearing house for NH
- Supported by UNH
- Position map and use “export” function (to JPG/PNG/PDF, etc)



Thank you for your interest in NH GRANIT. No restrictions apply. Please feel free to use our resources for your mapping needs. We would certainly appreciate an acknowledgement on the map, but again, this is not a requirement.

Thanks again,
Chris
chris.phaneuf@unh.edu

*Chris Phaneuf
NH GRANIT
Earth Systems Research Center
Morse Hall, University of New Hampshire
Durham, NH 03824
(603)862-1214*

Google Maps & Earth

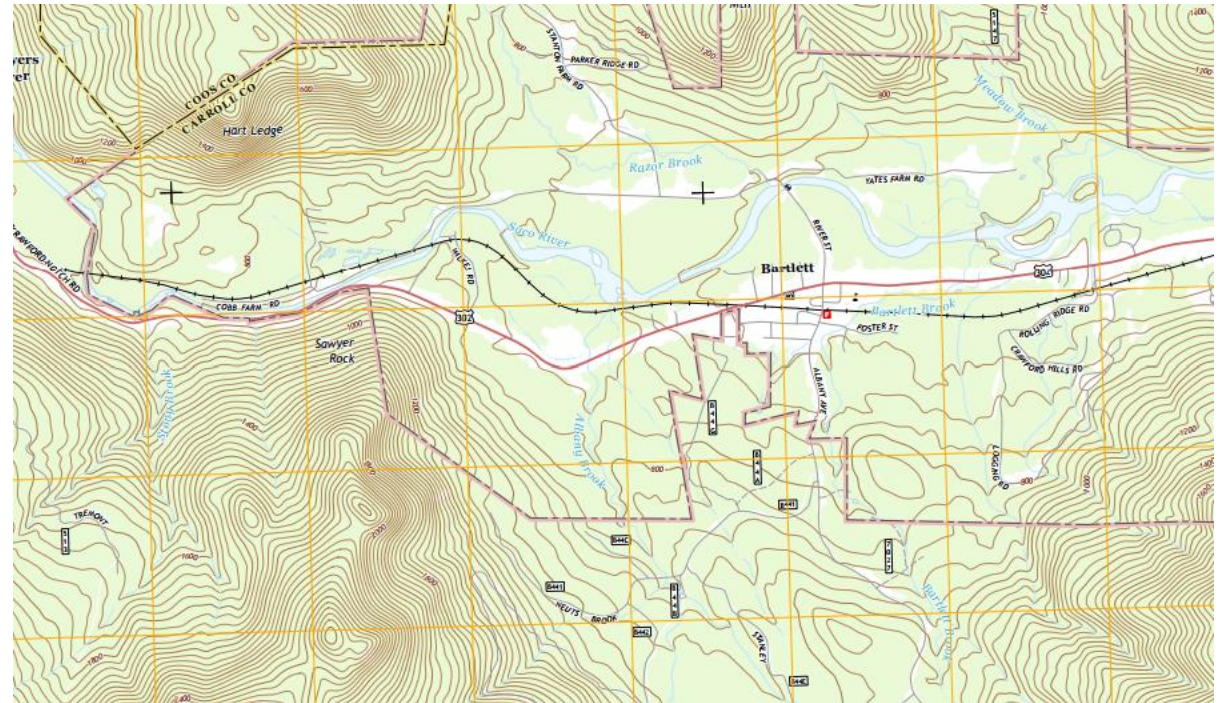
- Maps: Standard or satellite
- Earth: Satellite only
- Tools for drawing tracks
- Must “screen scrape” for image
- OK for live use on web site
- NOT for commercial use
 - Even for non-profits
 - Must be distributed free



US Geological Survey



- Viewer.nationalmap.gov
 - Find location
 - Select “find products”
 - Click on “results”
 - Choose “download”
 - Results are in PDF
 - Convert to JPG for graphics editing
 - May need multiple maps
 - Add attribution to your map
 - See https://www2.usgs.gov/visual-id/credit_usgs.html



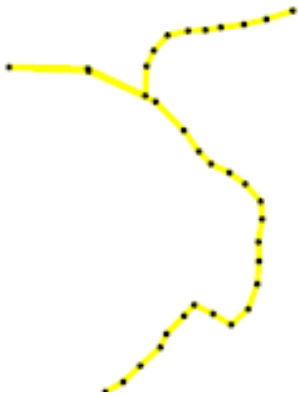
Jimapco/Topographics (NH State Map)



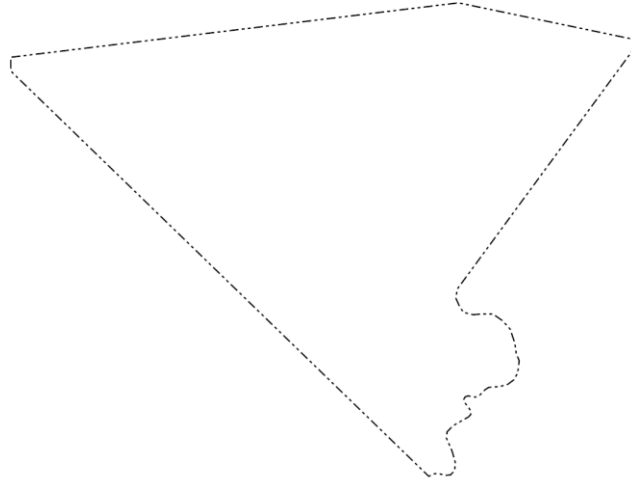
- Commercial map maker
- <http://www.jimapco.com/maproom/snowmobile/nh/>
- OK for screen-shots on web site – not commercially
- Offer service 18"x12" – Cost Example: Base fee \$825 for 500 maps (\$1.65 each) on standard paper
- Map includes all snowmobile trails, roads, lakes, streams and mountains with shaded relief and elevation contours.
- Info such as parking, clubhouse, scenic views, advertisers, etc.
- Printed map, and supports smartphones. See your current location on the map and more.
- Check references!



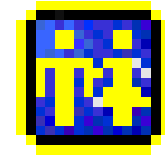
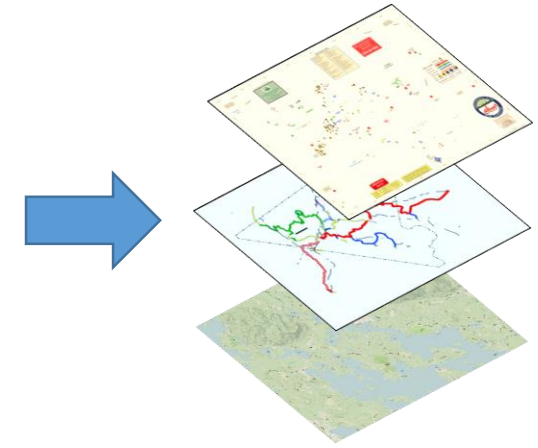
Tracks, Shapes and Waypoints



Track – series of coordinates



Shape – series of coordinates that enclose an area



Coordinates
43.72, -71.44

Waypoint – Single set of coordinates

- These are Geographical Information System (GIS) elements
- Attributes include label, distance, area, elevation, display style and more....
- A set of GIS elements may be layered on a base map

GPS/GIS data formats



GPX, or GPS Exchange Format, is an XML schema designed as a common GPS data format for software applications. It can be used to describe waypoints, tracks, and routes. The format is open and can be used without the need to pay license fees.

[GPS Exchange Format - Wikipedia](https://en.wikipedia.org/wiki/GPS_Exchange_Format)

https://en.wikipedia.org/wiki/GPS_Exchange_Format



Keyhole Markup Language

Keyhole Markup Language (KML) is an XML notation for expressing geographic annotation and visualization within Internet-based, two-dimensional maps and three-dimensional Earth browsers. KML was developed for use with Google Earth, which was originally named Keyhole Earth Viewer.

[Keyhole Markup Language - Wikipedia](https://en.wikipedia.org/wiki/Keyhole_Markup_Language)

https://en.wikipedia.org/wiki/Keyhole_Markup_Language



Note: other formats include NMEA or Magellan SD and .shp

Conversions – KML ↔ GPX

Converting Tool Criteria

- Online or install
- Download or “emailed”
- Free or pay
- Most work well

“Google” KML to GPX and pick one



Select conversion: KML to GPX ▼

Convert file: Choose File No file chosen

Options:

☒ Waypoints ☒ Tracks

☐ Zip Archive

Convert



Get started now!

Upload a GPS file: Choose File No file chosen

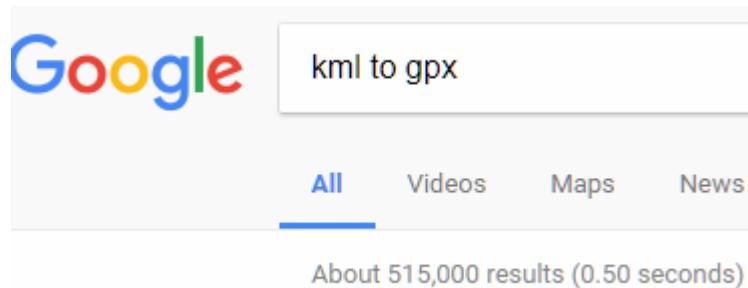
Choose an output format: Google Maps ▼

- Google Maps
- Google Earth
- PNG map
- JPEG map
- SVG drawing
- elevation profile
- GPX file
- plain text table

GPS Visualizer can read data from many sources including Google Maps, Google Earth, Dakota, Colorado, & Nüvi series (.xml/.hst/.tcx), Geocaching.com, Timex Trainer, TomTom (.gpx), and many others.

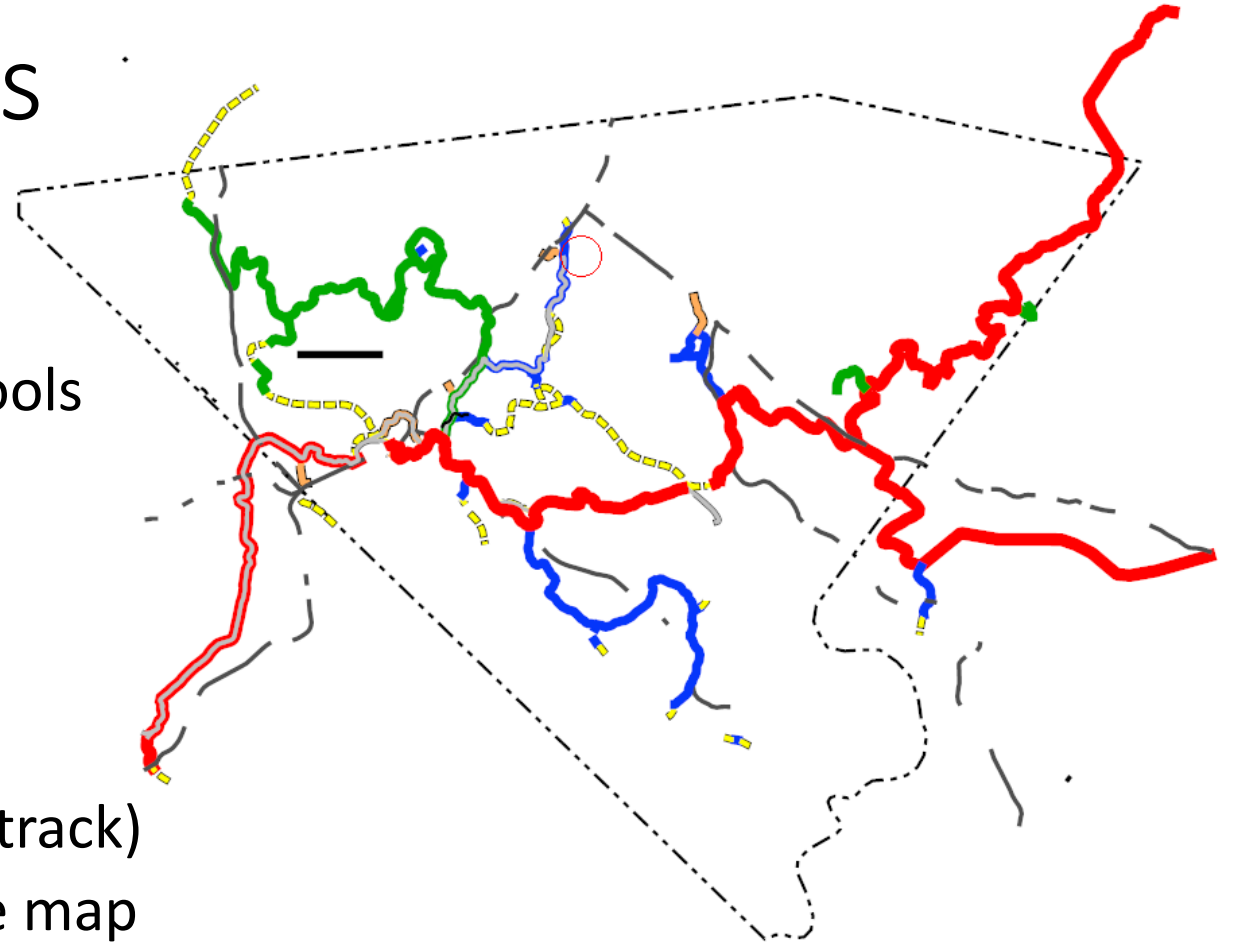
GPS Visualizer is based in Portland, Oregon.

Google Maps [1]



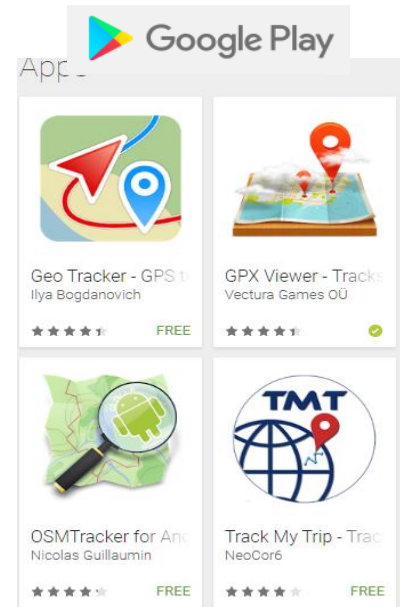
Capturing Digital Tracks

- Make GIS tracks for each trail
 - Manually create, use GPS editing tools
 - Use GPS tracking while on trails
 - Ask club members for their tracks
- Add optional GIS elements
 - Town boundaries (shape)
 - Measured Mile (a 1.0 mile straight track)
 - Important roads not visible on base map
 - Trail elements (bridges and stop signs)
 - Points of interest (may be better when added to label layer)



Using GPS to Capture Tracks

- Handheld GPS
- Smartphone app
 - Map-my-walk, OsmAnd and many more (most are sufficient)
- Accuracy improves when moving slowly
- Verify that you have good satellite reception
- Download or email series of tracks into file folder



FollowMee Mobile GPS Tracker



AllTrails - Hiking & Running



Map My Hike by Under Armour

GPS Track Editing Tools

- Feature considerations
 - Manually create or import tracks
 - Split, remove parts, edit segments
 - Join and convert tracks, smooth
 - Add names and descriptions
 - Add waypoints
 - Overlay tracks on various maps
 - Export maps and tracks to image
 - Online vs Offline
 - Base map licensing



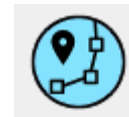
Install/Free



Install/\$75-\$250



Online/\$8-year

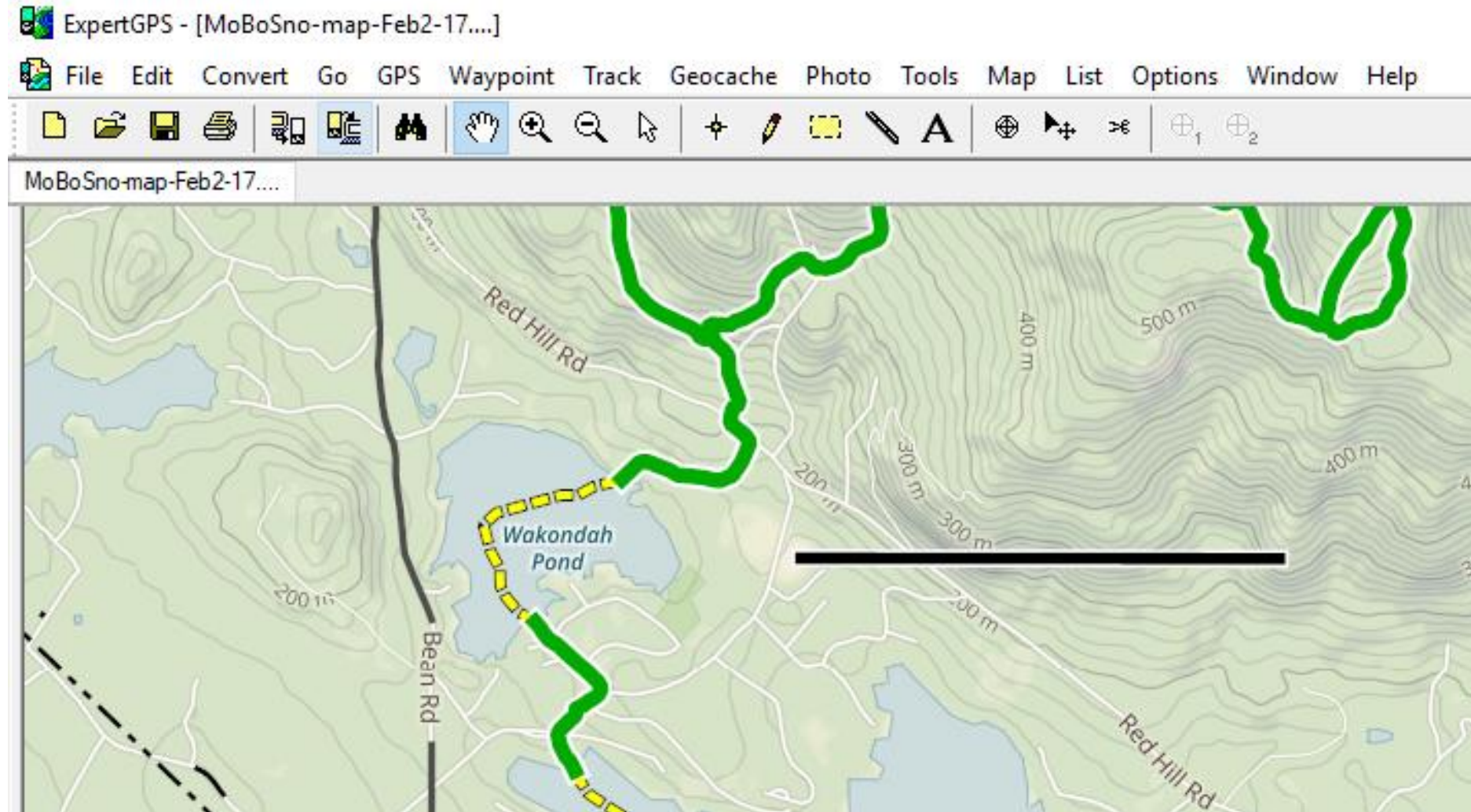


WTRACKS

<https://opoto.github.io/wtracks/>

Online/Free

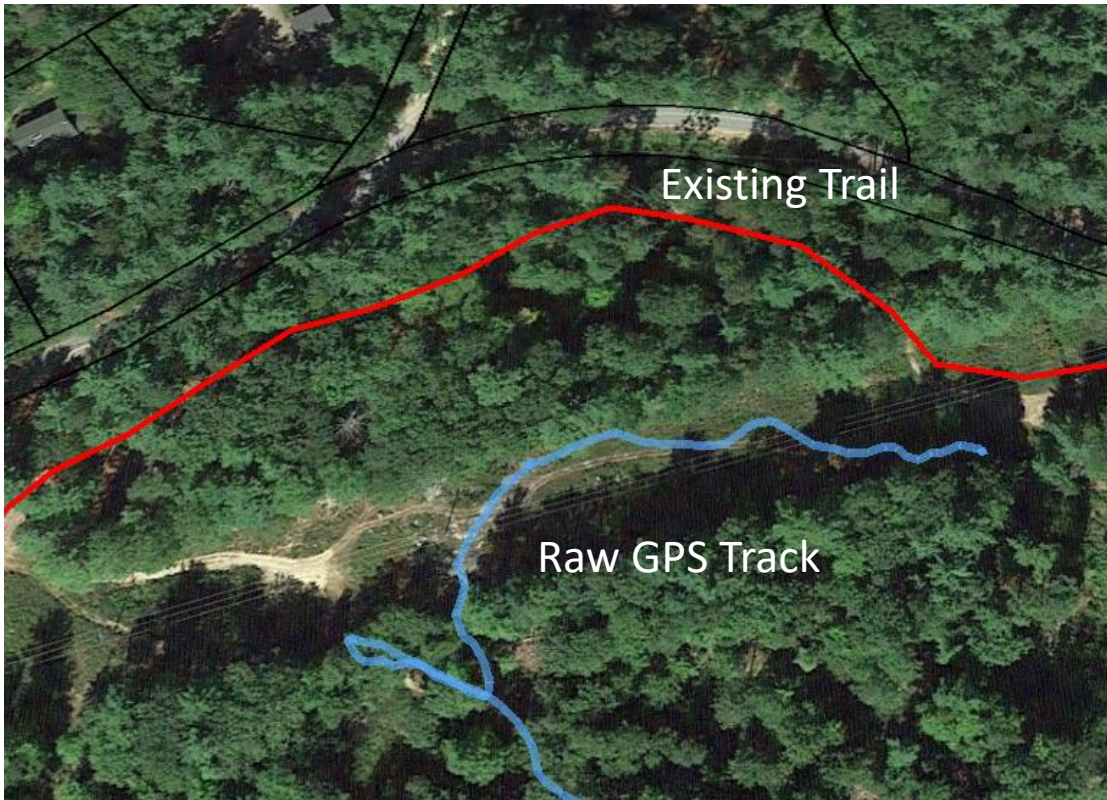
ExpertGPS Example



Adjusting Track

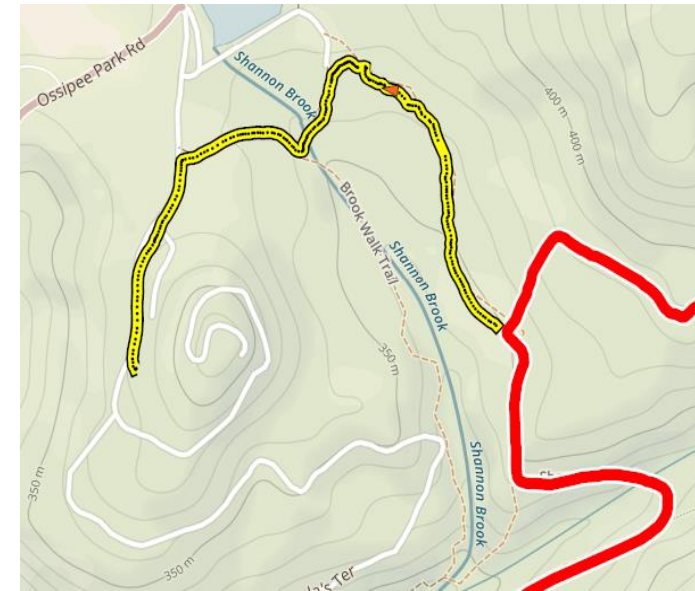
Example: Add new Trail to existing one

1. Use satellite base map or import GPX into Google Earth to view
2. Adjust track points to match “reality”
3. Save edited GPX track



Editing a Trail's Track

- Add trail name to track
- Color code for trail type (corridor, primary, local)
- Remove incorrect and redundant points to make line smooth
- Adjust point locations, especially curves
- Save trails in GPX or KML format



Edit Track

Type: Club Trail [New] [Delete]

Label on Map: Kona Trail [10 pt]

Name on GPS: KONA TRAIL

Description:

Stats: Area: 408.2 acres
Distance: 5.38 mi
Duration: 00:07:31
Ascent: 879.89 ft
Descent: 691.70 ft

Map Display Style (for all shapes of this type)

Kona Trail

Line: Solid [Blue] [Border]

Fill: None

Display navigation info: ☐ Distance ☐ Bearing ☐ Back Bearing

☐ Override color for this track only [OK] [Cancel]

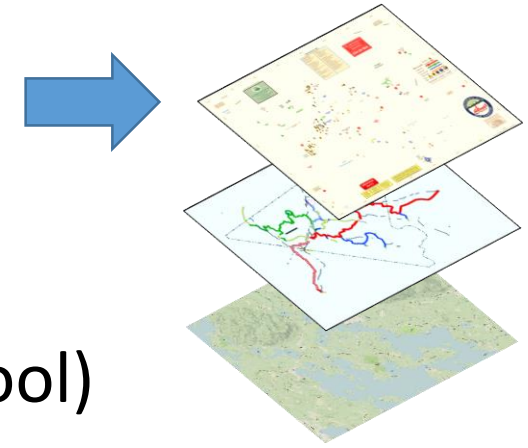
Exporting the Image

- If GPX editing tool supports it
 - Include base map of choice
 - Choose labels
 - Pick correct resolution (map labels readable)
 - Export to size of paper map (PNG or JPG)
- If GPX editing tool doesn't export image with tracks
 - Consolidate all tracks into one GPX file
 - Display track on a map choice of white screen using:
 - http://www.gpsvisualizer.com/map_input?form=jpg (disable labeling in advanced track options)

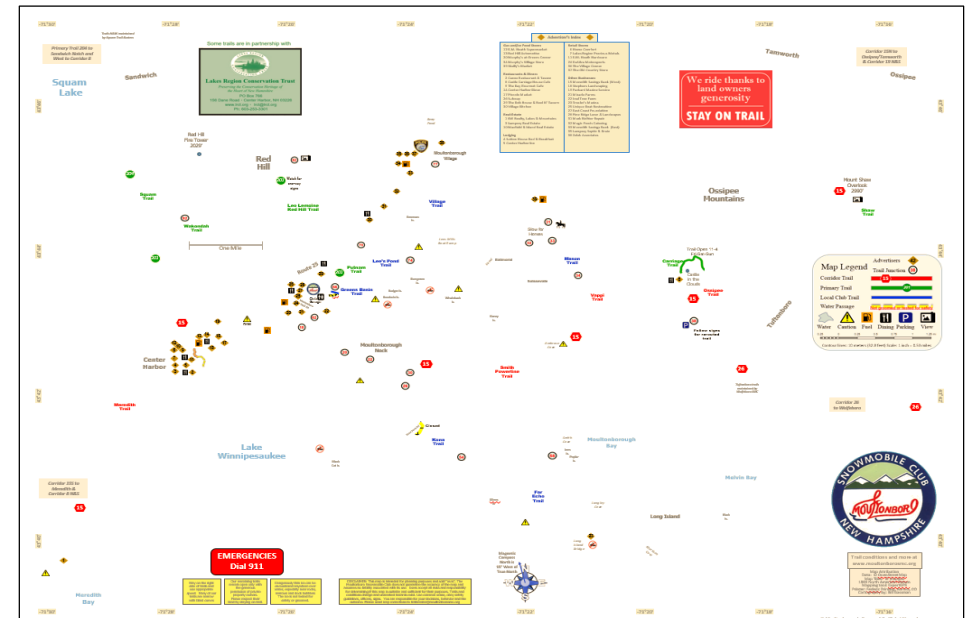


GPS Visualizer

Adding Labels



- Import base map with tracks (exported from GPX tool)
- Trail names and location markers (if any)
- Points of interest (lookout, cautions, fuel, food, police...)
- Acknowledgements (map maker, map source, printer...)
- Legend (distance scale, symbols guide)
- Edition (date, copyright)
- Whatever else looks good

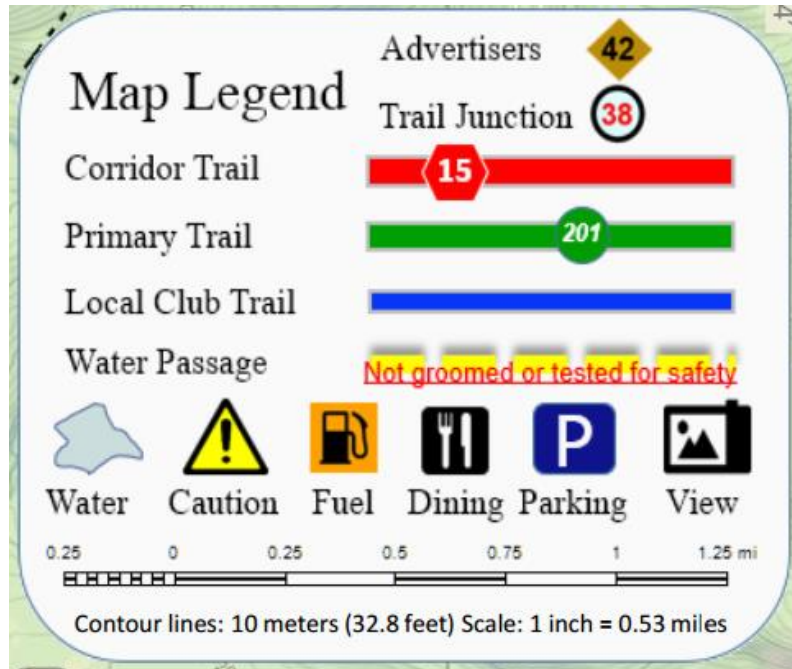


Tools for Labeling and Making Ready to Print

- Graphics editing
 - Microsoft PowerPoint
 - Google Slides
 - Apple Keynote
 - Adobe Photoshop
- Image Editing
 - Adobe Light Room
 - Google Picasa
 - Apple Photos

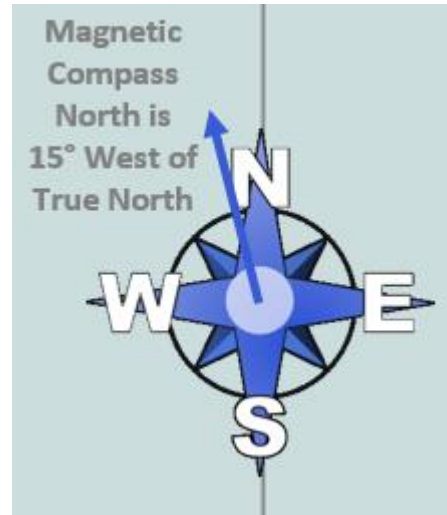


Map Aids and Legend



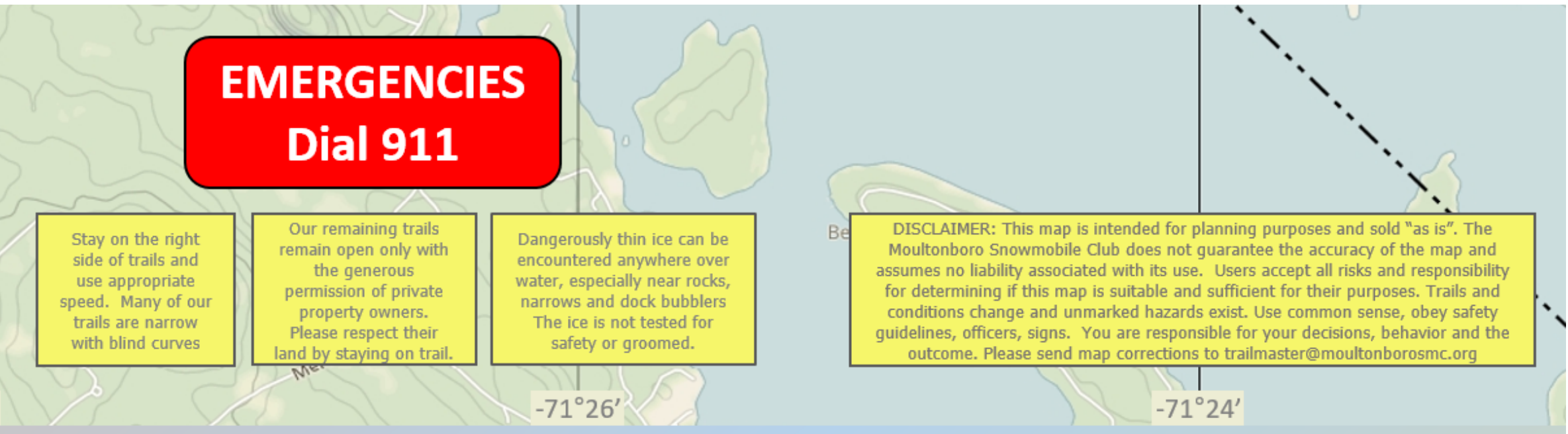
- Trail Colors
- Icons
- Distance measure

Attribution, Copyright and Other Information



Map Attribution
Data: © OpenStreetMap
Map Tiles: © MapBox
1983 North American Datum
Mapping tool: ExpertGPS
Printer: Federic Printing, Aurora, CO
Cartography by: Bill Gassman

Warnings and Disclaimers



EMERGENCIES Dial 911

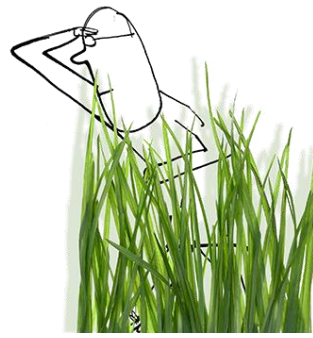
Stay on the right side of trails and use appropriate speed. Many of our trails are narrow with blind curves

Our remaining trails remain open only with the generous permission of private property owners. Please respect their land by staying on trail.

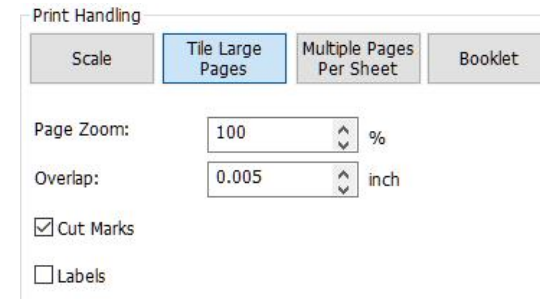
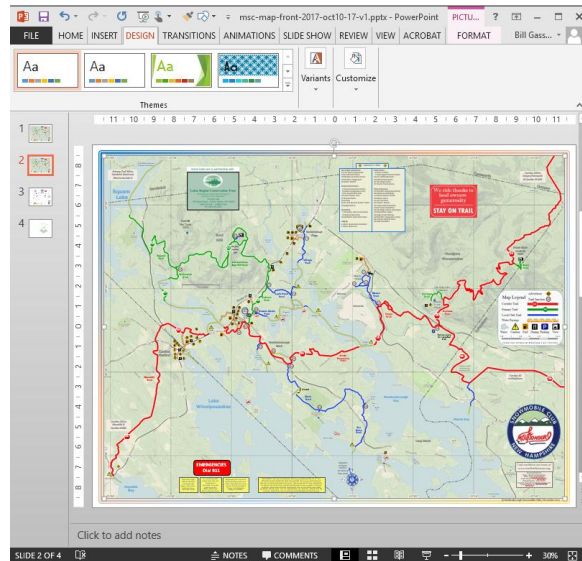
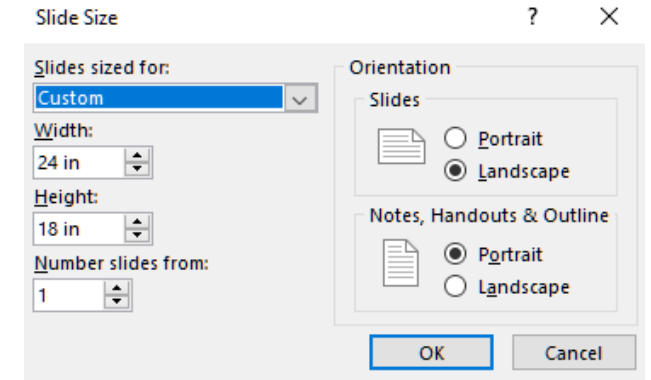
Dangerously thin ice can be encountered anywhere over water, especially near rocks, narrows and dock bubblers. The ice is not tested for safety or groomed.

DISCLAIMER: This map is intended for planning purposes and sold "as is". The Moultonboro Snowmobile Club does not guarantee the accuracy of the map and assumes no liability associated with its use. Users accept all risks and responsibility for determining if this map is suitable and sufficient for their purposes. Trails and conditions change and unmarked hazards exist. Use common sense, obey safety guidelines, officers, signs. You are responsible for your decisions, behavior and the outcome. Please send map corrections to trailmaster@moultonborosmc.org

PowerPoint Tricks



- Set slide design to custom size equal to map size
- During label tasks, add “fold lines” to your image and adjust your labels and ads to avoid the folds
- Print large drafts by saving to PDF, then using multi-page option to print pages that fit together to make full size mock-up.



PowerPoint High-Resolution

- Change export resolution from 96 (default) to 300 dpi
 - <https://support.microsoft.com/en-us/help/827745/how-to-change-the-export-resolution-of-a-powerpoint-slide>



Finishing Touches

- Add a border around the map
- Adjust contrast, color and other image attributes
- Get a second pair of eyes to proof your work
- Print out full version, ensuring the fold lines don't obscure anything
- Check that the folding exposes the title and back page as you expect



Advertising and Folding

Fan Folds



Front Cover

Second Fold

Back Cover
(prime spot!)

First Fold



Selecting a Printing Service

- Have an idea of specifications before talking with printers
 - Size, quantity, type of stock, color/B&W, one sided or two, folded, shipping?
- Color copiers are an option – but check size capability and cost per print
- Broker or printer direct
 - Get help if required to prepare print-ready copy
 - Ask what format to submit map. PDF most common.
- Stock choice
 - Regular paper or specialty (tear and water resistant)
 - Some local printers may not have specialty paper in stock
- Get proofs
 - Check color, alignment with folds, font rendering
 - Confirm schedule with printer





Printing Pricing

- Price depends on options (sides, color, stock, quality, shipping)
- Set up charges or hourly rate for preparation may apply
- Examples:
 - Kinkos/FedEx – \$0.09 to \$6.00/copy
 - Specialty Printer - \$2.00-\$4.00/copy
 - Other choices: library, town-hall, your home printer \$0.05-\$1.50/page

Example:

18"x24", tear-proof, color, 2 sided

Price: 800 copies -- \$1,760 (\$2.20/ea)

500 copies -- \$1,325 (\$2.65/ea)

300 copies -- \$954 (\$3.18/ea)

Add \$50 for shipping

8.5"x11", medium stock, color, 2 sided

Price: 200 copies - \$200 (\$1.00/ea)

Distribution

- ~~Sell with club registration~~
- Sell on web site
- Distribute through local merchants
- Provide free copies to state bureau of trails and town road agent
- Post thumbnail on-line to advertise
- Track your stock



Advanced Uses of Trail Mapping

- Sharing with third parties
- Rerouting trails
- Check property owner permissions



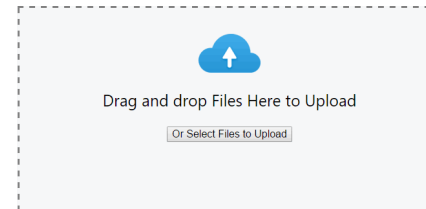
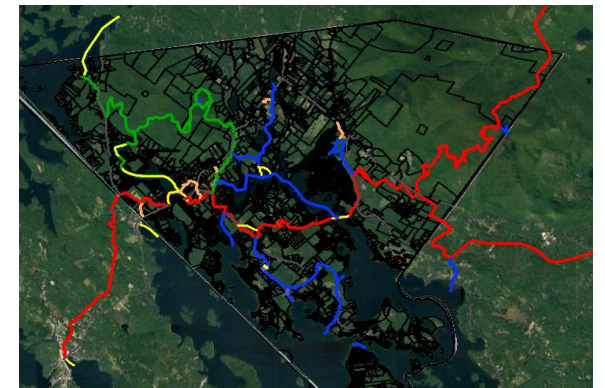
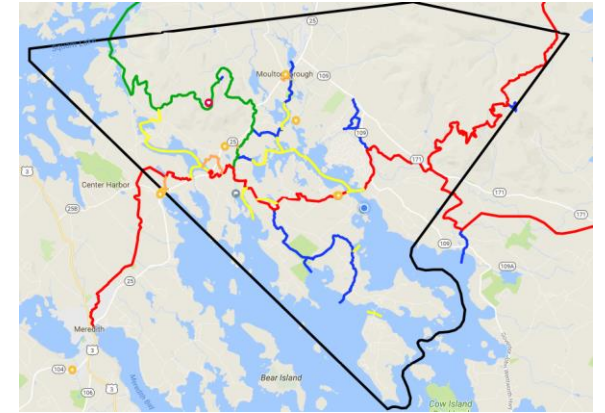
Third Party eMaps

- Online maps are becoming popular
- It may impact your map sales, but probably not by much.
- Polaris Ride Command www.ridecommand.polaris.com/en-us/home
- TrailHub www.trailhub.org
 - **Phone:** 802.489.7716
 - **Email:** trailchat@trailhub.org
 - Online app – nice, but expensive
- Backwoods GPS Trail www.backwoodsgpstrails.com/wp3/
 - CustomerService@backwoodsGPStrails.com
 - Off-line tool that runs in your GPS (no cell service required)
- GPS Trailmasters www.gpstrailmasters.com
 - info@gpstrailmasters.com
 - Runs in your Garmin GPS

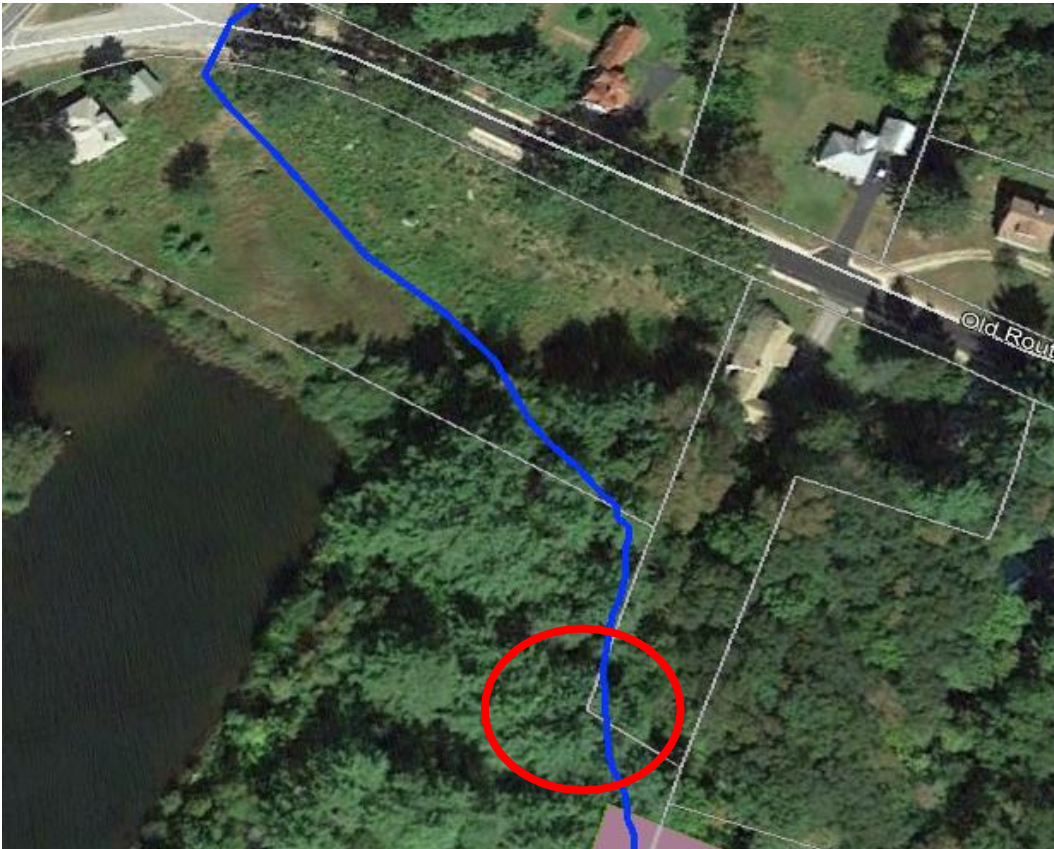


Add Your Trails to Google Maps & Earth

- Easy to view, share and combine with other layers
- Google Maps procedures
 - Use one GPX file with all trails
 - Select “Your Places and Maps” from upper left “three dash” icon
 - Scroll to bottom and select “Create Map”
 - Click on “import” and drag in KML or GPX file
 - Name and save. You can now share this with anyone
- Google Earth procedures
 - Select “Open”, under the “File” tab
 - Choose the correct format (kml or gpx) and import
 - Name and save in “my places”
 - Can regroup and save in KML format



Cool Uses: Property Line Analysis



- Acquire property line GIS shapes in KML or KMZ format
 - Some NH towns use AxisGIS (CAI Technologies)
 - Data fee example: \$250
 - Export from Town's GIS system
 - Import .SHP file into Google Earth

Trail Rerouting

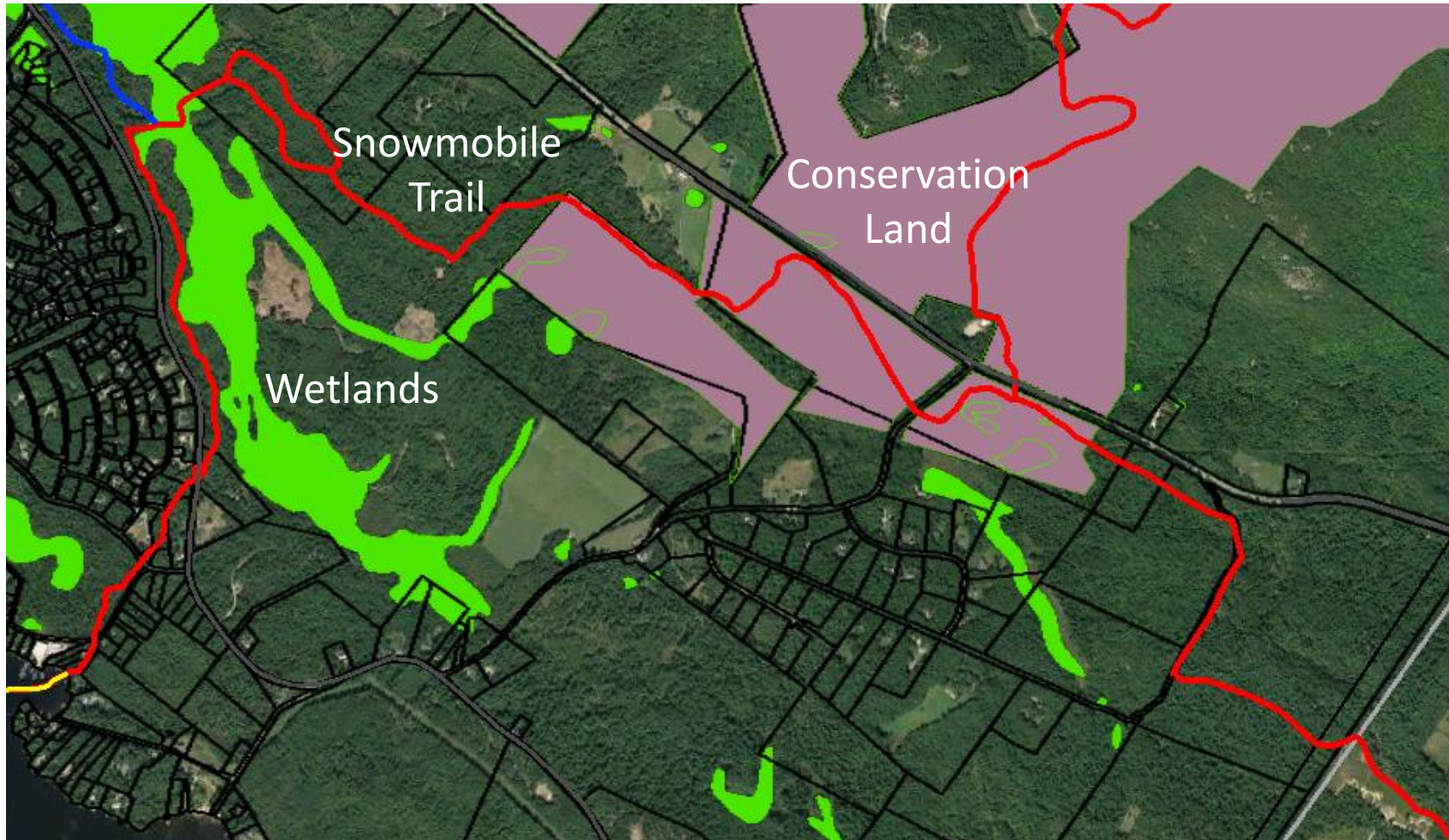
- See existing trails
- Locate property lines
- Learn land owner information
- See satellite view
- Draw alternatives



A satellite view of a property with a trail rerouting overlay. The trail is shown as a blue line with orange 'X' marks indicating rerouting points. A yellow line shows an alternative route. A data panel on the right provides detailed information about the property and the trail.

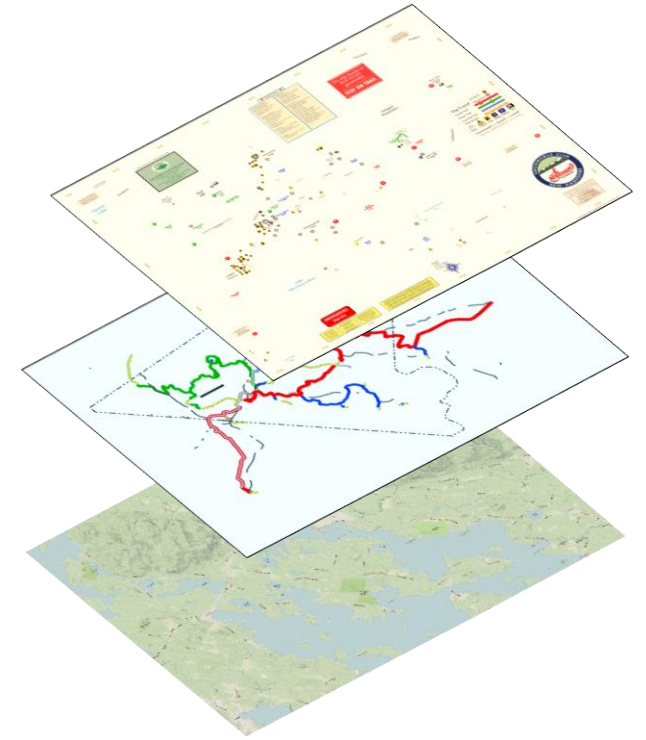
HOWARD CHRISTINE S	
FID	5319
AREA	269799.94822
PERIMETER	2339.692012
PARCEL_	5321
PARCEL_ID	40897
MAP_NUM	201
BLOCK	
LOT_NUM	9
BLDG_NUM	
FEATURE_ID	
PARCEL_NUM	201009000
FULL_NUM	201009000000
ID	1279
ParcelNumb	201009000
GisFullNum	201009000000
CamaFullNu	2010090000000000
Owner_Name	HOWARD CHRISTINE S
Location	50 MORRILL DRIVE
Street_Nam	MORRILL DRIVE
Street_Num	50
Street_N_1	50
Map	201
Map_Cut	
Block_1	
Block_Cut	
Lot	009
Lot_Cut	000
Unit	000
Unit_Cut	000
Total_Asse	167200
Total_As_1	179500
Total_As_2	73300
Total_As_3	252800
Total_As_4	174200
Total_As_5	78600

GIS Co-Occurrence Viewing

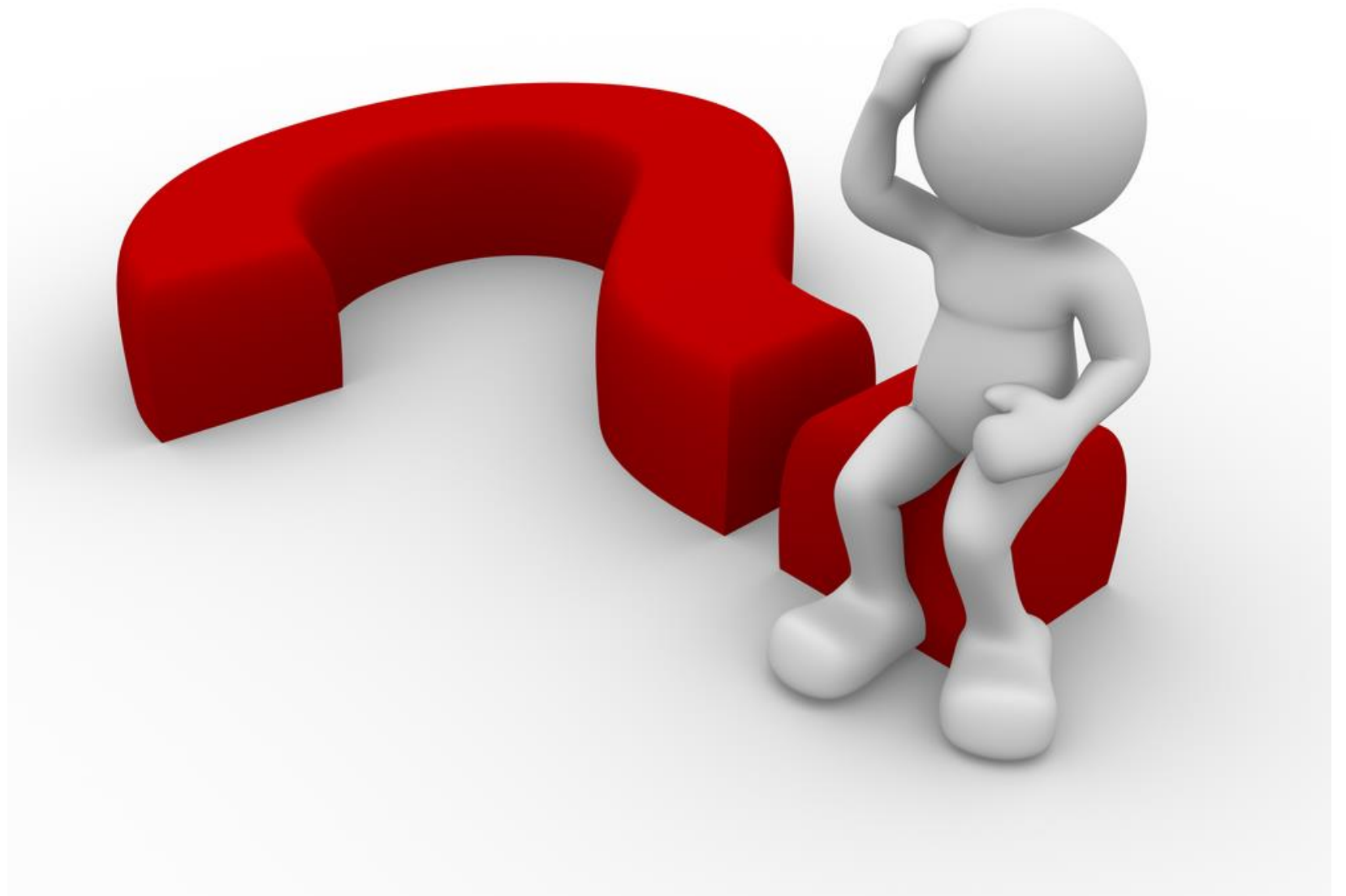


Workflow Summary

1. Plan: budget, size, quantity, paper quality and advertising
2. Add trail tracks to GPS editing tool
3. Export map and/or tracks to PNG/JPG format
4. Import map and tracks layer to graphics editor, like PowerPoint
5. Add labels
6. Export PowerPoint slide to PDF
7. Send PDF to printer
8. Distribute maps
9. Profit 😊



Questions



Snowmobile Trail Mapping

2018 NH TrailMasters Conference

Bill Gassman – Moultonboro Snowmobile Club

Electronic Copy at billgassman.com/trailmaster



Trail conditions and more at www.moultonborosnowmobileclub.org

Map created by Bill Gassman
2018 NH TrailMasters Conference
Moultonboro Snowmobile Club