

ALASKA STATE PARKS

TRAIL MANAGEMENT HANDBOOK

MAY 2015

SECTION 5: TRAIL INVENTORY AND ASSESSMENT



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Section 5: Trail Inventory and Assessment

Since 2007 the Alaska State Parks Inventory and Assessment Project has mapped and assessed conditions of most trails throughout the Alaska State Park System. Mapping-grade *differential GPS* (DGPS) equipment has been used to collect the geographic alignment as well as the state of the trails and their related structures. The data continues to be used for map production and trail management.

Several products result from the Inventory and Assessment Project including the Alaska State Parks Trail Browser, state park unit overview maps, trail guides, as well as management maps on an as-needed basis. As trails are constructed and rerouted, State Parks trail data and maps will need to be continually updated.

Data collection involves using the *DGPS* (differential global positioning system) receiver to collect trail data. For those new to the process, there are a few tasks that should be completed beforehand. It is a good idea to take a GPS to GIS course if available. The first step is to read through the *Alaska State Parks Data Dictionary* (ASP_2010). The Data dictionary describes all of the attributes and values that can be collected by the *DGPS*, as well as associated definitions, and trail browser codes (see appendix B). Minimum Mapping Requirements is another document to read developed by DNR DMLW that outlines basic mapping guidelines (see appendix C).

The next step is to become familiar with the *DGPS* equipment. Alaska State Parks currently uses Trimble DGPS equipment with an external real-time beacon. Newer Trimble *DGPS* products can perform the necessary mapping tasks and need not be identical to the current equipment, but an external antenna should be used at all times; this helps the *DGPS* perform in forested areas. Real-time corrections obtained from the beacon within the antenna are helpful when relocating a feature previously mapped, but is not necessary during initial mapping; post-processing can be used to achieve similar results. To keep data consistent, the Trimble GPS Pathfinder software platform should be used with the ASP_2010 data dictionary.

5.1 Trail Data Collection in the Field

The current (as of 05/15/2012) *DGPS* configuration uses an external receiver carried within a backpack, with the antenna extending from a pole mounted to the backpack, with a hand-held data collector (see picture below). Charging batteries for both the receiver and data collector are required. Before heading to the field it is recommended to check settings of the device in the setup menu of Pathfinder (see appendix D for configurations).

There are several other items that are used the mapping process to be familiar with including the *clinometer*, compass, camera, tape measure, field book, and map. Make sure to research the area you are visiting beforehand. Other items not involved in the mapping process, but advisable to carry while mapping are a satellite phone (especially remote areas), a first aid kit, and bear spray.

The mapping process requires two people. The mapper (using the *DGPS*) is responsible for recording the trail data with the data collector. The mapping assistant determines and communicates trail grades (using the *clinometer*) and announces changing trail attributes to the mapper; other

duties include updating the field book, and taking photographs. For more information on using a clinometer see section 6.2. Notes are also taken in the field book before, during, and after mapping (see figure 5.1 below).

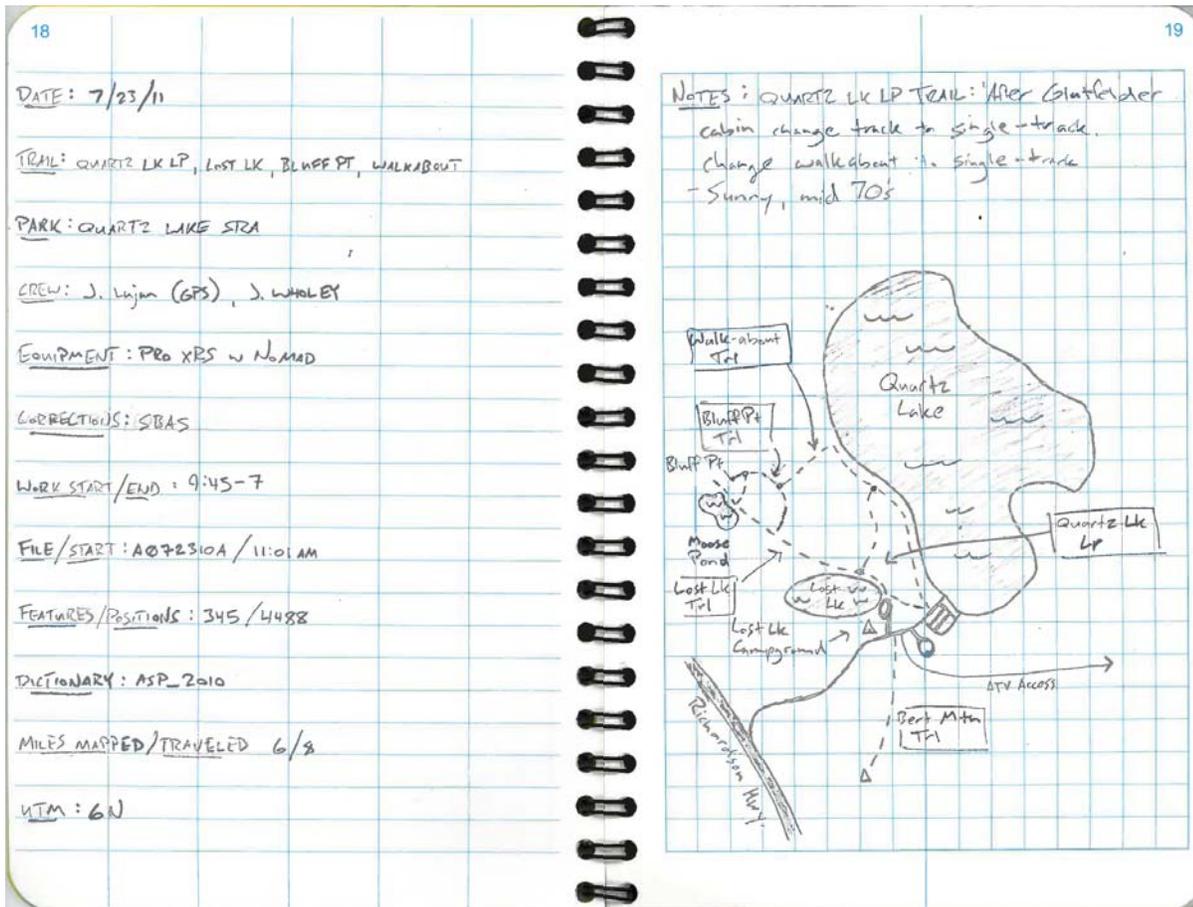


Figure 5.1 - Field Book Notes

The first few mapping trips should be for practice. The basic process goes as follows:

- 1) Begin field book template.
- 2) DGPS Equipment is assembled for data collection.
- 3) GPS Pathfinder Office is initialized.
- 4) Antenna height is measured and entered in data collector.
- 6) Begin new file.
- 7) Set time in camera.
- 8) Photograph the UTC time as the first photograph.
- 9) Collect point and polygon attributes near the trailhead.
- 10) Mapping assistant walks down trail 50 feet ahead of mapper while voicing trail attributes.
- 11) Continue mapping the trail; map point and polygon attributes when necessary.
- 12) When finished mapping, close the file and backup to flash memory.
- 13) Turn off GPS.
- 14) Carefully repack GPS equipment (either in plastic cases or within the backpack).
- 15) Update field book.

5.1.1 Data Collection Guidelines

- 1) For all point features not mentioned in the Minimum Mapping Requirements log for 10 seconds.
- 2) Collect data with the antenna level and close to the feature as possible.
- 3) As a general rule segment the trailway every 50 feet, but try to segment where the grade or conditions change.
- 4) Ensure the mapping assistant consistently walks about 50 feet ahead.
- 5) Keep GPS volume high enough to hear changes in satellites and data logging sounds.
- 6) Always use the external antenna.

5.1.2 Photo Points

- 1) GPS-Photo Link Software uses recorded time to tell photos apart. This requires the mapping team to wait at least 60 seconds between photo points.
- 2) The first photo of every mapping day must be of UTC time from the data collector. It is not necessary to collect a photo point with this photo, but wait at least 60 seconds after the UTC photo is taken to collect the first photo point.
- 3) After logging a photo point, take the photo immediately. If more than 15 seconds pass, it is best to delete the photo point, wait 60 seconds, and try again.
- 4) Try to take pictures with the sun at your back if possible. In low light situations hold camera with two hands and using a flash may be helpful. Some photos benefit from a sense of scale. A person or familiar object may give a photo a better perspective.
- 5) Refrain from taking photos that aren't photo points, because it makes geo-tagging the photos more difficult. If any photos are taken that aren't photo points record the subject matter and the time taken in the field book, to help avoid confusion.
- 6) It is good practice to upload photos to a computer after each field day.

.2 Trail Data Office Protocols

At the end of every field day it is advisable to upload files from the data collector to the program server using the GPS Pathfinder Office Data Transfer Utility. If out of the office, uploading data to the program laptop will suffice. If mapping in a remote location, backing data up to the data collector's flash drive may be the only option.

To keep projects organized, use a consistent folder structure and naming convention. Mapping documents (generally .mxd and .pdf files) should be given an obvious unique name and a date (remember not to add spaces). Example: "ChugachSP_Overview_01-02-12.mxd." See the folder structure used on the server in figure 5.2 below.

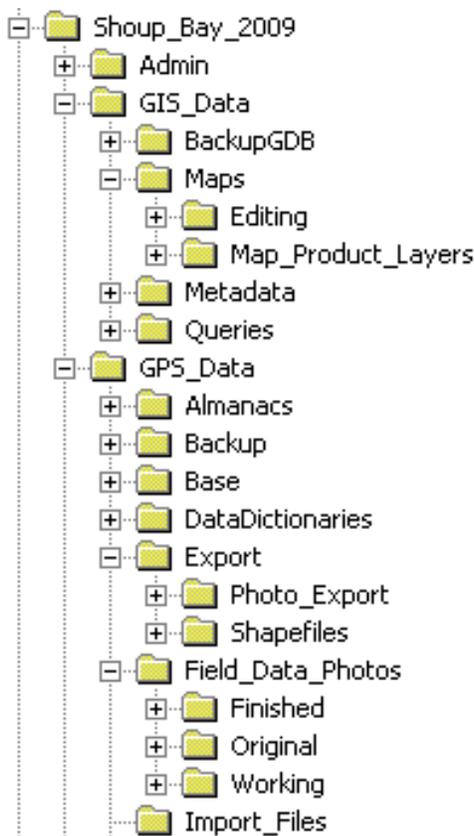


Figure 5.2 - Mapping Data Folder Structure

After uploading the data to the server it may be necessary to post-process with the Differential Correction Utility. If real-time corrections aren't received continuously through the mapping process, then post-processing should be performed.

Before using the Export Utility, look through all of the settings to make sure they match the desired export configuration. See appendix D for the proper export settings. These settings can all be saved when creating a new export configuration.

Photo points must be exported separate from the other attributes. One export should be only photo points; the other export should be the rest of the attributes.

The next step is editing the data. This involves three main tasks:

- 1) **Connect gaps between line segments.** Sometimes line segments are recorded by the GPS with gaps between them. In an edit session, these segments must be connected by adding a new vertex close to the gap and snap the endpoint to the next segment to close the gap in the trail. This requires zooming in closely to look for all gaps.
- 2) **Flip Lines.** The line segments must all be traveling the same direction to create elevation profiles for trail guides (discussed in section 5.3.3). If a trail was mapped entirely in the same direction the lines will all be aligned correctly. If one section of the trail is mapped E

to W, and another W to E (discouraged) then one section will have to be flipped (right click segment → flip lines) in an edit session.

3) **Edit attribute table errors.** There are a few common attribute table errors. If you realize you made an error in the field it is best to correct it then. If you have made an error over many segments (example: calling a trail the improper name over 50 segments) it may be easier to fix the error in an edit session. If you catch it and intend to fix it later make sure to record the date, time, and feature(s) to correct in the field book. Look carefully through the attribute tables for any obvious errors. Next, check that the trails are named correctly.

An easy way to do this is to highlight an entire trail in the attribute table and look at the map (with a base map loaded for reference) to make sure the proper trail name is denoted.

Some attributes need to agree with each other. The first two are **TRL_GRADE** and **SIDE_SLOPE**. It is not possible for the **TRL_GRADE** to be steeper than the **SIDE_SLOPE**. **DRAINAGE** also needs to agree with **DEGRADE**. For example **WELL DRAINED** does not agree with **MUDDY**.

Each attribute needs to have metadata that uses the Federal Geographic Data Committee (FGDC) standard FGDC-STD-001-1998. This is especially important when sharing trail data with other agencies. More information can be found here: <http://www.fgdc.gov/metadata/csdgm/>

5.2.1 GPS Photo Linking

(Screen shots from GeoSpatial Experts GPS-Photo Link software version 4.2.60)

GeoSpatial Experts GPS-Photo Link software is used to link attribute data to digital photos for the Alaska State Parks Trail Browser. These following steps make the GPS Photo Link process much easier. The photos are originally uploaded into the *Field_Data_Photos* → *Original* Folder. Next copy them into the *Field_Data_Photos* → *Working* Folder. Create folders within the *Working* folder based on the date and trail names in the following format: **2009-08-12_AprilBowl_GoldCordLake**. Within the *Working* folder create folders based on trail names to place the photos in.

The following steps will give you GPS linked photos with a consistent time stamp as show below. After opening GPS-Photo Link select *Camera Folder* as *Folder Source*. The *Camera Folder* will be the folder for one set of trail photos from one day. The root folder will be the *Map_Product Layers* → *Finished* folder; the output folder will be the identical folder structure within the finished folder. Select *No Action* for *Original Photo Action*. Use the exported **PhotoPt.shp** for each set of photo points, and set the Alaska time zone; use Lat/Lon and NAD 83. Use photo of GPS receiver for method of time synchronization. Use the following settings for time matching:

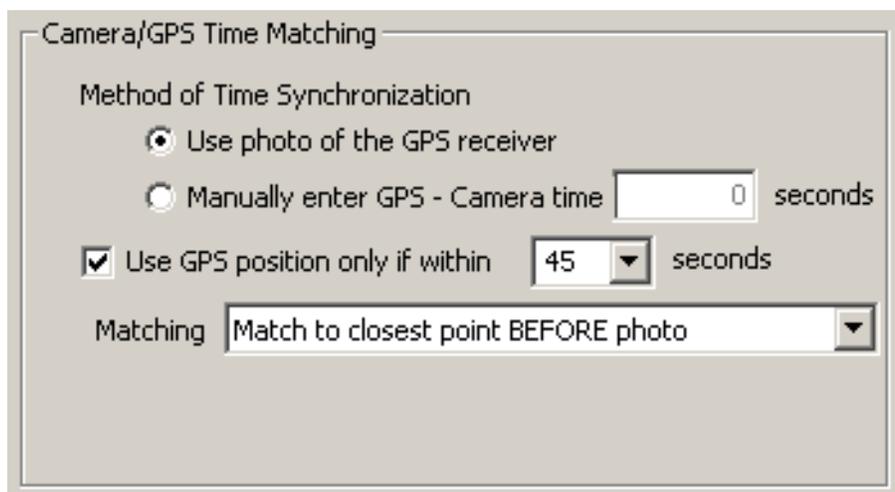


Figure 5.3 - Camera/GPS Time Matching

Wait at least 60 seconds between taking photos. The 45 second setting above will give a 15 second buffer if another photo point is accidentally recorded a few seconds early.

When you get to the *Time Offset Entry* window the *GPS time* will likely be different than the UTC time from the GPS data collector. The hour should be correct, but the minutes and/or seconds may not be. Change the *GPS time* to reflect the time on the data collector, and check the box to *Use this photo for time entry*. Keep in mind that you should match up the GPS and camera's clock before the *time entry photo* is taken.

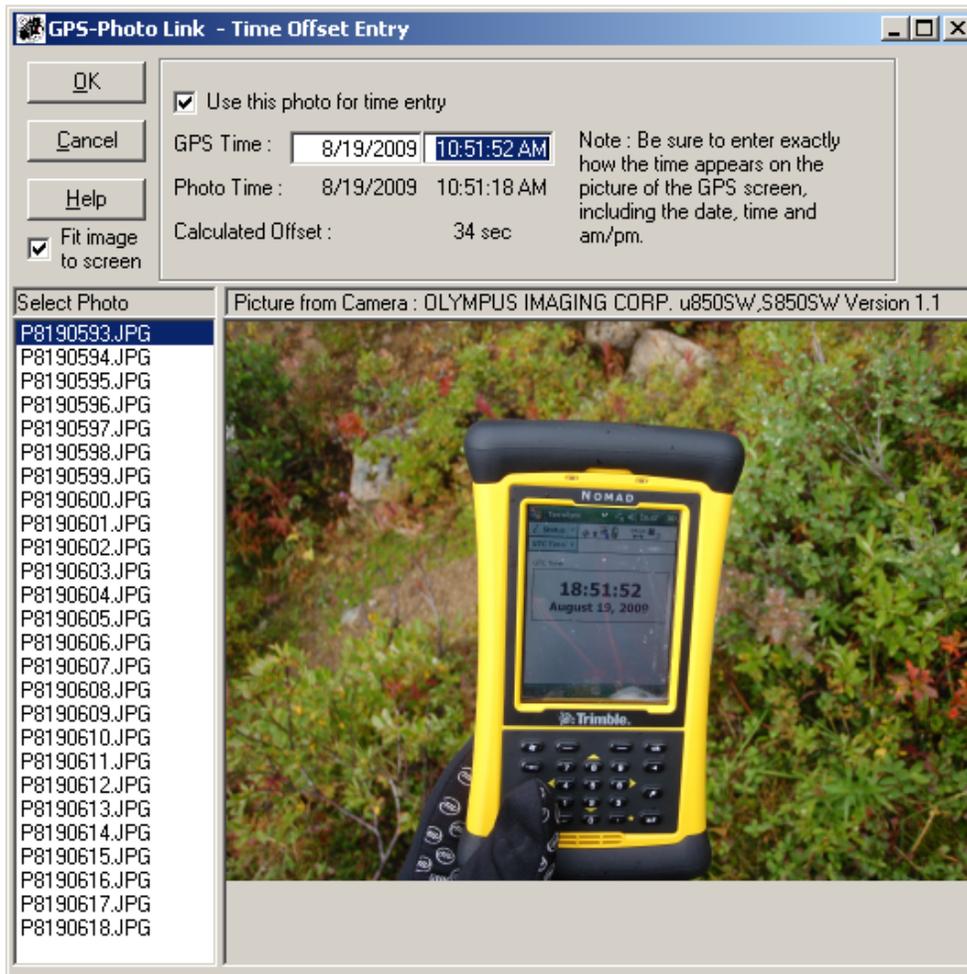


Figure 5.4 - Time Offset Entry

If the time isn't adjusted the photos may not be GPS linked; if so the *Lat* and *Lon* fields will not be filled in on the successive window. If those fields do show up, then you can fill in the *Title for All Photos* as park name, and *Sub-Title for All Photos* as trail name. As part of the file renaming process, enter the park's initials and trail name into *Photo Comment* in the following format: **HPMA_LaneBasin_**; the *Photo Comment* must be copied and pasted for each photo. If latitude and longitude fields don't show up for some photos, try shortening *Camera/GPS Time Matching* settings.

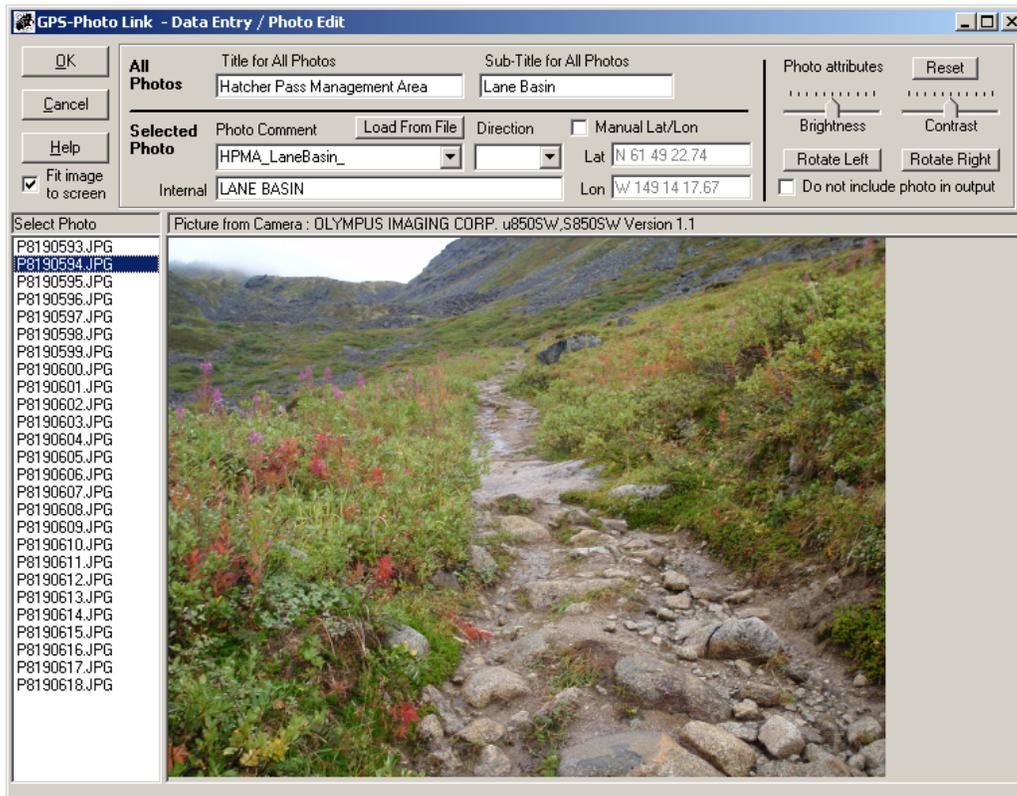


Figure 5.5 - Data Entry/Photo Editing

In the next window select *Watermarked Photo* and *ESRI Shape File* as *output formats*. Match the rest of the settings shown below.

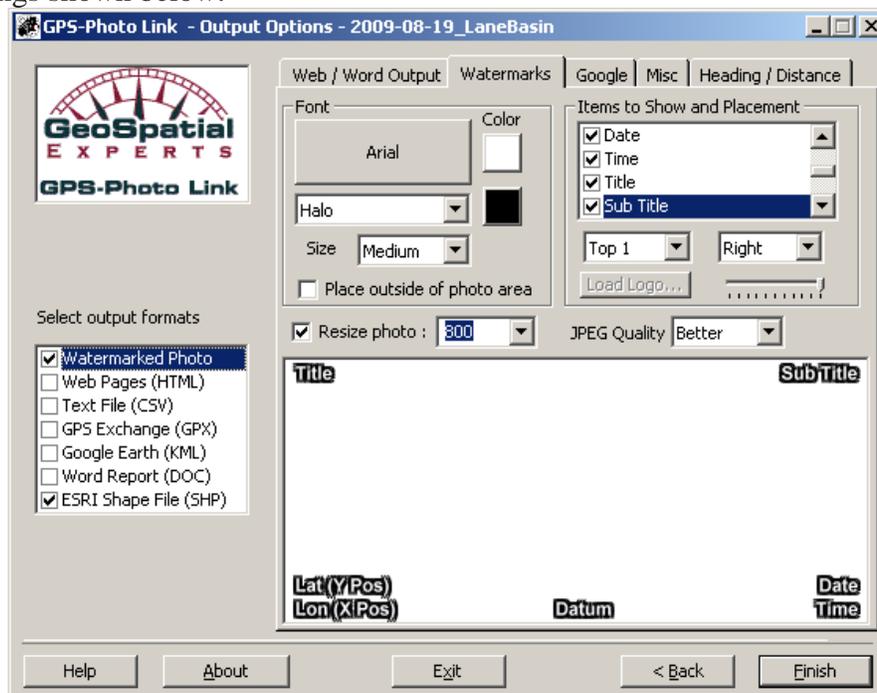


Figure 5.6 - Output Options



Figure 5.7 - Watermarked Photo

After processing all but one photo (the time entry photo) should have been photo linked. Within the newly created folder should be a thumbnail (...**small.jpg**) and a watermarked photo (...**tag.jpg**) for each picture, a track shapefile (**track.shp**), a picture shapefile (**picture.shp**), and **GPS-Photo Link.ini**. There is further processing before transfer to the Alaska State Trails Browser that is beyond the scope of this handbook. Further steps need to be discussed with the web developers.

5.2.2 Park Maps



Figure 5.8 - Denali State Park Overview Map (created with ESRI ArcMap 9.3.1)

Overview maps are made to depict trails and facilities in state park units and state park managed areas. These areas are where the trail systems have been mapped and assessed. These maps should be consistent with other park maps and conform to DNR DMLW's Minimum Mapping Requirements (see appendix C). The following settings and guidelines should be followed when creating or updating maps with ESRI ArcGIS software.

With all maps it is generally easiest to start with a completed map, save it as a new name, and alter it from there. Often maps share many elements so this can streamline the process. The .mxd files should be saved within the maps folder (ParkName_20XX→GIS_Data→Maps). When map layers are identified they must all be copied into the *map_product_layers* folder; linking to layers on the State of Alaska server can lead to dead links when files are inevitably moved.

It can be helpful to rename layers (before they are added to the map) to reflect clearly what they are. A map name, layer description, and date can be expressed for Lakes in the Nancy Lake Recreation Area as follows: **NLSRA_Lakes_01-01-12.shp**. The following layers are used in park maps, although others may be needed as well.

The larger park maps measure 36 by 48 inches in either portrait or landscape, the smaller park maps measure 18 by 24, and the trail guide maps (mentioned in following section) measure 8.5 by 11. Maps

should use North American Datum of 1983 (NAD83), the State Plane Coordinate System, and a Transverse Mercator Projection.

Maps should contain a key that identifies every symbol and geographic feature. There should also be contact information and a disclaimer explaining the map's purpose. Alaska State Parks and Department of Natural Resources logos should also be present. A scale bar, scale text, projection, coordinate system, datum, and a locator map or maps should also be on the map.

5.2.3 Map Layers and Symbology

Layers from Data Collection

These layers are features that come from DGPS data collection. All of these layers are used during editing; only some are needed for overview maps and trail guides; management maps may include any number of these features.

AquaProb, Anchor_P, Building_Ed, Building, Drainage_St, Hazard, Parking, Refer_Po, Restrict, Roads, Signs, Structur, Switchba, Trailway, Trl_Stru, and Water_Xi.

Contour Related Layers

These layers are discussed further below:

Contours, Contour Annotation, and Feature Outline Masks

Layers from Other Sources

These layers can come from a variety of sources. Check with the DNR DMLW GIS Coordinator to see which are available through the DNR GIS server.

Hillshade, Digital Elevation Model (DEM), Digital Raster Graphics (DRGs, scanned USGS quads), GIS Servers, Trails (ORV, snowmobile, non-motorized, water, routes), Roads, Park/Land Management Boundaries, Land Status, Private Property, Lakes, Rivers, Streams, Glaciers, Parking, Buildings, Restriction, Park Boundaries, Section Lines

There are several processing procedures used to make maps. They include digitizing, creating contours, and buffering park boundaries. Before starting any of the above procedures, the map's .mxd document should have at minimum the following layers: DEM, Hillshade, DRGs (for reference), glaciers (if applicable), and layers to digitize from (aerial/satellite imagery, GIS server, or DRGs).

Digitizing

Digitizing may be necessary if layers lack enough detail for the map's scale, or do not exist. Imagery, GIS servers, or DRGs can be used, but layers using imagery are generally the most accurate and current. The process is very straight forward. A new feature class (or shapefile) is created as either a point, polyline, or polygon in the *map_product_layers* folder. It is best to digitize in the data layout, but you can edit in the map layout also. Points can be used for towns and polylines can be used for streams. Polygons can be used for glaciers, lakes, rivers, wetlands,

buildings, etc. Zoom into the feature you want to digitize. Using the editing toolbar simply trace the feature. For larger polygons you may have to merge together many smaller polygons. Save often.

Buffering Park Boundaries

Create an extent polygon feature class (or shapefile) that encompasses the entire park boundary area. Use the erase tool to erase the park boundary polygon from the extent polygon. Now buffer the new polygon created with erase. A buffer of 1300 feet and 650 feet are needed. Both buffers should be “*outside only*.” The 1300 foot buffer (bottom) uses the color “Blue-Grey Dust,” and the 600 foot buffer (top) uses the color “Larkspur Blue.” Map settings are further discussed below.

Creating Contours

Clip the DEM so it is a little larger than the map size. Using the *Contour* tool, create 200 foot contours. Next use the *Smooth Line* tool to smooth out the contours. Then export the smoothed contours into a contours geodatabase. Next label the contours using the properties toolbar and “*convert labels to annotation*,” and add the expression below for labeling contours in thousand foot intervals using the *expression* box.

```
Function FindLabel ([CONTOUR]) if (([CONTOUR] = 1000) or ([CONTOUR] = 2000) or  
([CONTOUR] = 3000) or ([CONTOUR] = 4000) or ([CONTOUR] = 5000) or ([CONTOUR] =  
6000) or ([CONTOUR] = 7000)) then FindLabel = [CONTOUR]  
end if End Function
```

Next use the *Feature Outline Masks* tool to create a masking layer for the contour annotations. In *Advanced Drawing Options* mask the contour with the feature outline masks layer. Make the mask completely transparent. Both the annotation and feature outline masks layers are selectable and movable.

Features Properties, Labels, and Map Symbols

Map symbols and labels are usually added as the last step of map production. The contour labels can be adjusted during or after this process. The geographic features’ symbologies (color scheme) can be changed at any time.

Map symbols should be consistent with the rest of Alaska State Parks. They can be obtained from other maps or with the *Character Marker Bank* within the *Symbol Property Editor*. If importing symbols into ArcMap, Windows Metafiles (.emf) are most compatible. Every symbol on the map should be referenced in the map key.

Map features and labels are labeled with consistent fonts and colors, although font size varies with map scale and geographic significance. Here are some guidelines for text and labels.

Text

Map Title/Park Label: “Copperplate Gothic Bold” Bold Black 60/18

Map Key Labels: “Arial” 14 Bold Black

Disclaimer Text: “Times New Roman” Black 9

Labels

Trail Name: Calibri - Bold - Cherrywood Brown - 12
Park Facility Name: Arial - Bold - Black - 16
Street Name: Times New Roman - Bold - 14
Rivers/Streams/Lakes: Times New Roman - Bold - Italic - Lapis Lazuli - 16/12
Glacier Name: Times New Roman - Italic - Lapis Lazuli - 10
Mountain Summit Name: Bookman Old Style - Bold - Italic - Black - 10
Land Contour Labels: Times New Roman - Italic - Black - 9
Glacier Contour Labels: Times New Roman - Italic - Cretean Blue - 9

Geographic Features

Trail: Cherrywood Brown - 2
Railroad: Black - 2
Roads – Black 1/2
Lakes/Rivers: Yogo Blue (outline) - 0.4; Water Areas (fill)
Streams: Yogo Blue - 0.75
Wetlands: 420 Marsh - Leaf Green (fill) – no outline
Glaciers: Cropland - Moorea Blue (fill) – Transparency 60%
Glacier Outline: Moorea Blue - 1
Gravel Bars: Cropland – Gray 40% (foreground) – Gray 30% (background) – no outline
Moraines: Cropland – Burnt Umber (foreground) – 224, 214, 181 (background)

5.2.4 Trail Guides

Trail guides are created for frequently visited trails within Alaska State Parks. They provide park visitors with helpful information about the trail they are visiting. Trail guides are available to download and print from the Alaska State parks website. They have trail information on the first page and a map on the next.

The trail information page includes a trail description, allowable uses, distances, elevation gain, difficulty, safety precautions, park rules web link, elevation profile, trailhead access, and park contact information. Other information might also be useful such as water sources, campsites, and fishing opportunities.

The trail guides are created in Microsoft Publisher from either a horizontal or vertical template. The software has a straight forward graphic interface. Trail profile creation is discussed in the following section (Trail Profile Creation). Maps for the guides are created in the same way as the park overview maps except all maps measure 8.5 by 11 inches. Once the maps are completed in ArcMap, they should be exported to a high quality jpeg. The map should then be imported into Microsoft Publisher. Once all of the elements of the trail guide are added, it can be exported to a PDF. Before the trail guides are posted to the Alaska State Parks website, they should be reviewed interdepartmentally, and by park employees that manage the trails.

The fonts used for the trail guides are as follows:

Titles: Tempus Sans ITC - Bold - 114, 136, 66; 133, 33, 15 - 14/32
Narration: Segoe UI - Black - 8-10

Trail Profile Creation

In ArcMap/Catalog make a copy of the Trailway layer. In editing, merge all of the segments of the desired trail. Select the trail and click “create profile graph.” Right click the graph and select export as data in an excel format. Open the Microsoft Excel document. Paste the formulas “=CONVERT(A1,"m","mi")” in cell C1 and “=CONVERT(B1,"m","ft")” in cell D1. Drag both cells down to the bottom of the data. Select the two new columns. Insert a scatter plot and create an elevation graph with distance (miles) on the x-axis and elevation (feet) on the y-axis. Fonts and colors should match the trail guide (see example below). Copy and paste the elevation profile into the Trail Guide. If there are formatting issues, copy the profile to Microsoft Word first then into the Trail Guide.

Guide to



China Poot Lake Trail

in Kachemak Bay State Park

Trail Access: Halibut Cove Lagoon Trailhead; protected anchorage with mooring buoys and public dock

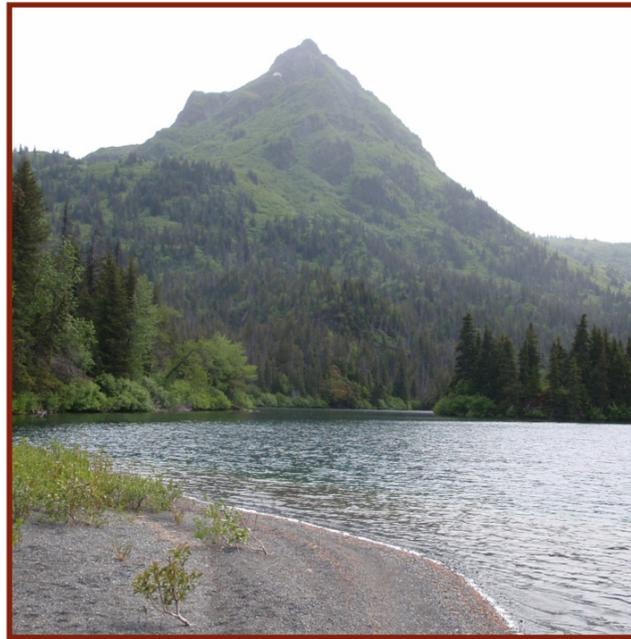
Allowable Uses: Hiking

Distance: 2.8 miles one way

Elevation Gain: 500 feet

Difficulty: Moderate; short, steep climbs

Hiking Time: 1.5 hours



Trail Description:

This popular trail climbs through the forest and over a low ridge, passing two small lakes where loons are common and blueberries are plentiful (August). The trail offers good views of Poot Peak and meanders through a cottonwood grove before arriving at China Poot Lake.

Park Access:

Kachemak Bay State Park is accessed via boat from the Homer Harbor. Local water taxis can provide transportation to most park trailheads.

Park Rules:

For a complete set of park rules visit:
<http://dnr.alaska.gov/parks/units/kbay/kbay.htm>

Camping:

Developed campsites at Halibut Cove Lagoon Trailhead, and at China Poot Lake Campsite. Public Use Cabin on China Poot Lake (reservations required (907) 269-8400).

Water Availability:

At trailhead; several small streams along trail; China Poot Lake; Moose Valley Creek.

Special Features:

China Poot Lake offers good fishing. Pleasant day hike from Halibut Cove Lagoon. Connects with many other trails in the area including Wosnesenski River, Coalition Loop, Moose Valley, and Poot Peak.

Alaska State Parks, Kenai Area Office
PO Box 1247
Soldotna, AK
(907) 262 - 5581



Figure 5.9 - Trail Guide - Trail Information Page (created with Microsoft Publisher 2007)

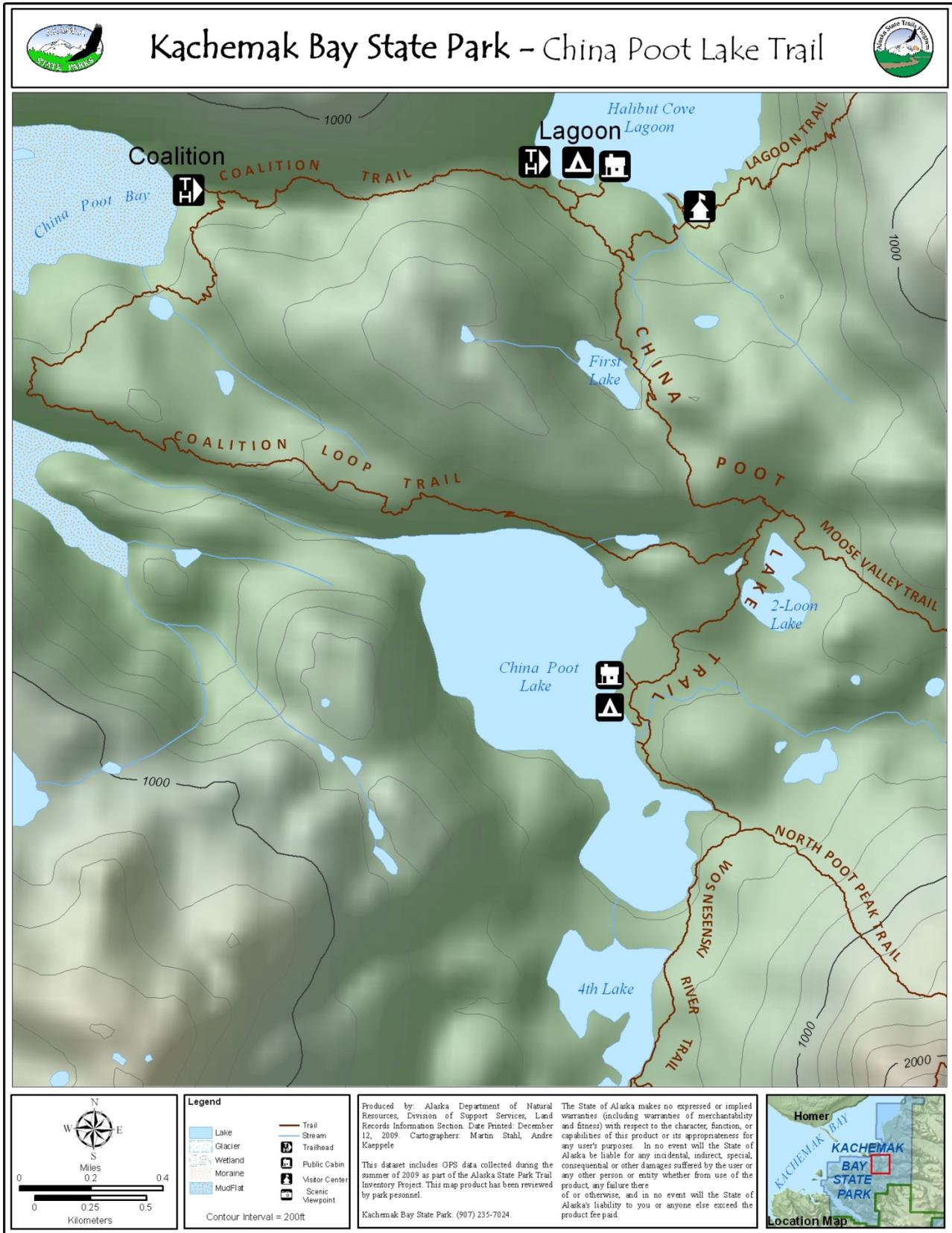


Figure 5.10 - Trail Guide - Map Page (created with Microsoft Publisher 2007)