

[illegible]

Differences in Methods

- Incorporated new satellite technology, and updated hardware and software.
- Procedures revised for clarity and ease of use.

Introduction

GNSS is the generic term for all global satellite systems used for positioning (e.g. GPS, Galileo, or GLONASS). GPS refers specifically to the United States' GNSS system, but is often used as a generic name for any GNSS. This SOP uses GPS in the generic sense.

The recreational-grade GPS receivers described in this SOP are useful for navigation during field work, but generally accurate to no better than 2-3 meters. The same coordinates will be used each year and all surveys will be accurate relative to each other. For higher precision locations with accuracy between 1 meter and 30 centimeters, refer to NGPN's Arrow 100 GNSS receiver SOP (Davis 2019).

This SOP gives only a general overview of the functions and use of these receivers. Refer to the owner's manual for each device for more detail on operation, capabilities, and maintenance.

Procedures

Setup and Calibration

Two weeks before field work, perform basic maintenance and calibration, and check the settings on each GPS receiver. This will allow time for repairs or more extensive maintenance if needed.

Put fresh batteries in the receiver – most handheld GPS receivers use two AA batteries. Alkaline, lithium, or NiMH batteries will all work well. Turn the receiver on and set the battery type setting to match (Main Menu – Setup – System).

Calibrate the receiver's internal compass if it has not been calibrated in the last two weeks. From the Main Menu, select Setup – Heading – Calibrate Compass and follow the on-screen directions.

Check the receiver's system settings to make sure they match NGPN's standard settings (menu paths shown are for Garmin GPSMAP receivers):

General settings (Main Menu – Setup – Settings)

- Satellite System: GPS + GLONASS (GPSMAP 64) or GPS + GALILEO (GPSMAP 66)¹
- WAAS/EGNOS: On (all models)

¹ The European Galileo GNSS constellation can give slightly higher location accuracy than the Russian GLONASS constellation, but is only supported on the newest receivers.

- Interface: Garmin Serial (all models)
- RINEX Logging: Off (GPSMAP 66 only)

Heading / compass settings (Main Menu – Setup – Heading)

- Display: Numeric Degrees
- North Reference: True
- Go To Line (Pointer): Bearing
- Compass: Auto

Position Format settings (Main Menu – Setup – Position Format)

- Position Format: hddd.ddddd (decimal degrees)
- Map Datum: NAD83
- Map Spheroid: GRS80

Time settings (Main Menu – Setup – Time)

- Time Format: 12-Hour
- Time Zone: Automatic

Units settings (Main Menu – Setup – Units)

- Distance and Speed or Speed/Distance: Metric
- Vertical Speed: Meters (m/min)
- Elevation / Depth: Meters
- Temperature: Fahrenheit
- Pressure: Millibars

Load Site Locations to Receiver

Use a USB cable to connect the GPS receiver to a computer, and transfer the planned site locations to the receiver. Recent Garmin GPSMAP receivers can read both GPX format and Google Earth KML/KMZ files – use whichever is more convenient.

You can also use the DNR GPS software package to transfer locations to the GPS receiver. If DNR GPS is not installed on your computer, the NGPN Data Manager or IT contact can help install it.

Connect the GPS receiver to the computer using a USB cable, and wait a minute for the computer to recognize it (it will appear under My Computer like a USB drive).

Start DNR GPS, and click the GPS menu and select Find GPS. The GPS receiver name will be listed in the upper left corner of the DNR GPS window once it has connected.

To load locations from a geodatabase, DNR GPS needs a pre-configured geodatabase connection. Open the Open from Database dialog by clicking the File menu, then Load From – Database. Create a connection by clicking the Add button, select the ESRI File Geodatabase (v10.x) type, and find the geodatabase with the site locations. Enter a Connection Name, test the connection, and select OK when connection is successful.

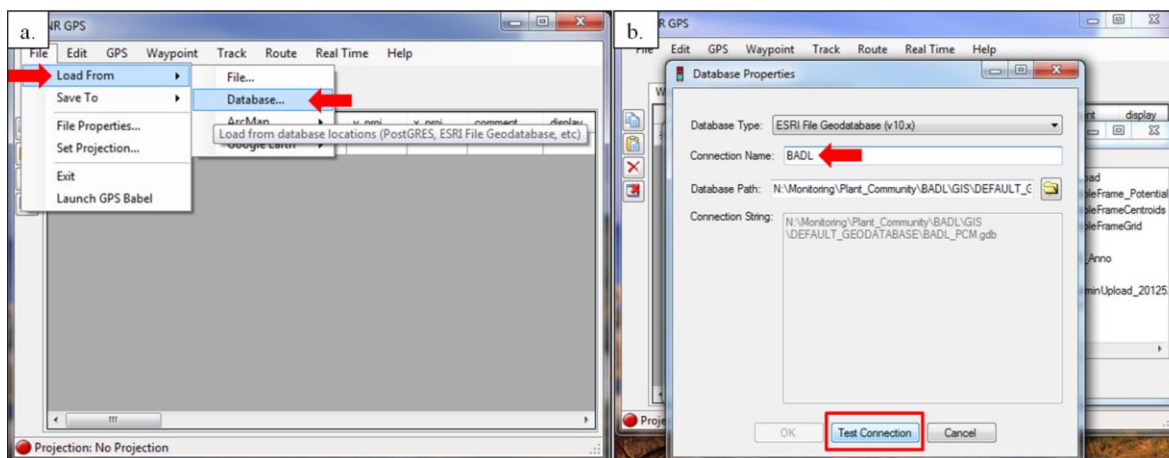


Figure 1. Screenshots showing how DNR GPS can a) access the database loading functions of DNR GPS, and b) set up a new geodatabase connection.

To use a geodatabase connection, click on the File menu, then select Load From - Database and select the geodatabase connection. Select the site location layers to load on the GPS receiver and click Add. When DNR GPS prompts you to Select IDENT Field, select the data field with the unique site ID and click OK.

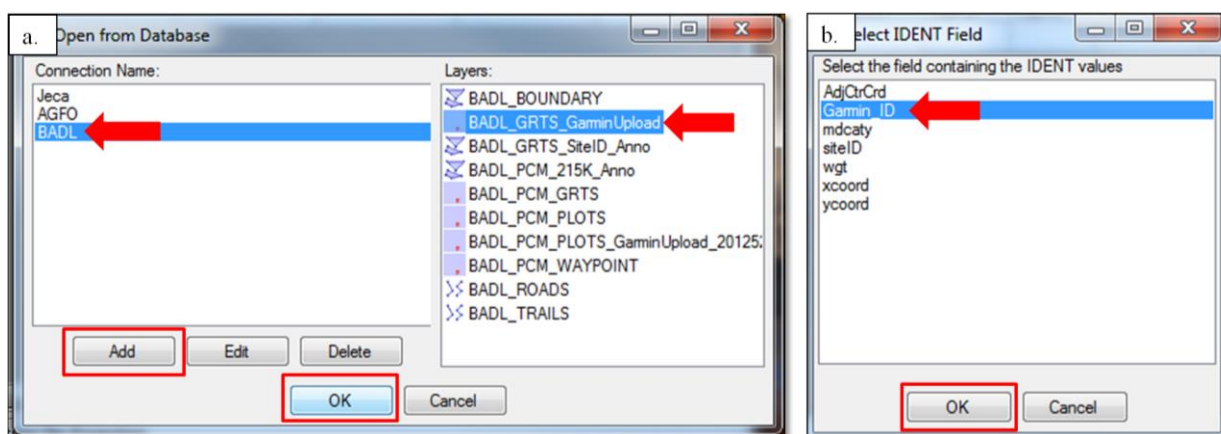


Figure 2. Screenshots of DNR GPS showing a) how to select a connection name and a locations layer, and b) how to choose a field from the database connection for the IDENT field.

Click the Waypoint menu and Upload to transfer the points to the GPS receiver.

Using a GPS Receiver in the Field

Finding Site Locations

When using Garmin GPS receivers, site locations and other points are called Waypoints. To find a location that has been loaded to or collected with a GPS receiver:

- Turn on the receiver and wait for it to get a fix.
- Press the **Find** button, use the 4-way rocker to select the **Waypoints** icon, and press the **Enter** button to open the Waypoints page.
- Select a waypoint by name using the 4-way rocker and press **Enter**. When the waypoint appears on the map, press **Enter** while **Go** is still selected.

Collecting a Location

To collect a waypoint (e.g. at a parking lot or sampling site):

- Press the **Mark** button on the GPS receiver.
- Use the four-way rocker to scroll to the waypoint name, press **Enter** and to start editing, and give it a meaningful name.
- If needed, use the rocker to select the symbol icon and press **Enter** to it.
- Select Done and press **Enter** when finished to save your edits.

Recording a Track Log

The GPS receiver can record a track log while moving – this feature varies by receiver, so check the manual for detail. You can use recorded tracks for mapping, navigation, or to retrace a route you took. For example, you could use it to retrace your route back to a vehicle from a sampling site.

On a Garmin GPSMAP 64-series receiver:

- Press **Menu** twice to open the Main Menu.
- Select the Setup icon, and press **Enter**. Select the Tracks icon and press **Enter**. Set the following settings:
 - Track Log: Records, Show On Map
 - Record Method: Auto
 - Interval: Normal
 - Auto Archive: When Full

On a Garmin GPSMAP 66-series receiver:

- Press **Menu** twice to open the Main Menu.
- Select the Setup icon, and press **Enter**. Select the Recording icon and press **Enter**. Select the Advanced Setup and press **Enter**. Set the following advanced settings:
 - Output Format: FIT and GPX
 - GPX Auto Archive: When Full
 - Trip Recording: Always
 - Recorded Data Reset: Activity and Trip
- Press the **Quit** button to return to the Recording menu and set the following:
 - Record Method: Auto
 - Interval: Normal
 - Auto Pause: Off
 - Auto Start: On

After Field Work

Copy any field data off the GPS receiver as soon as possible after returning from the field. If you will not be using the receiver again within the next week, remove the batteries for storage.

Download Data from GPS Receiver to Computer Using DNR GPS

Use a USB cable to connect the GPS receiver to a computer with DNR GPS, and start DNR GPS. Once the DNR GPS sees the receiver, click the Waypoint menu, then click Download to copy all waypoints on the GPS to the DNR GPS waypoint list. If there are tracks to download, click the GPS menu and select Download All. Save the data to an ESRI shapefile by clicking the File menu, then Save To – File. Change the Save as type to ESRI shapefile (3D) (*.shp).

Literature Cited

Davis, M.B. 2019. Using the Arrow 100 GPS Receiver. Northern Great Plains Network Standard Operation Procedure NPS/NGPN/SOP. National Park Service, Rapid City, South Dakota. Available at: <https://irma.nps.gov/DataStore/Reference/Profile/2260063>

Thornbrugh, D. J., I. W. Ashton, A. R. Jarding, J. S. Mills, and K. Paintner-Green. 2019. Protocol implementation plan for stream channel monitoring in the Northern Great Plains Network: narrative version 1.0. Natural Resource Report NPS/NGPN/NRR—2019/1918. National Park Service, Fort Collins, Colorado.

Wilson, S. K. and A. R. Jarding. 2016. Standard Operating Procedure, 62s Garmin GPS User Guide, Northern Great Plains I&M Network, Rapid City, South Dakota. Available at: <https://irma.nps.gov/DataStore/Reference/Profile/2259590>