Associating Linear and Point events with NHDPlus Version 1 Catchments
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This document assumes a basic understanding of NHDPlus and linear/point events tied to the NHDPlus NHDFlowline linear referencing system. Additional information about these topics is available at

ftp://ftp.horizon-systems.com/NHDPlus/documentation/NHDPLUS_UserGuide.pdf
ftp://ftp.horizon-systems.com/NHDPlus/exercises/NHDPlus-Exercise2-LinkingDatatoNHD.pdf

NHDPlus V1 contains a circa 2006 snapshot of the medium resolution National Hydrography Dataset (NHD). The NHD stream network is represented by a set of linear features stored in the NHDFlowline feature class. Each feature in NHDFlowline has a unique "common identifier" known as a ComID. Because, over time, ComIDs are not stable identifiers, the ComID is not considered a suitable route identifier for linear referencing. Therefore, each NHDFlowline feature is also assigned a Reachcode. The Reachcode is very stable and, once assigned, Reachcodes are only retired if the on-ground hydrography changes or errors are found in the NHD that requires Reachcodes to change. When Reachcodes change, the changes are tracked in an NHD reach cross reference table.

The NHD linear referencing system is composed of routes defined by the nationally unique set of Reachcodes. Measurements are assigned to each route (i.e. each Reachcode) beginning with 0 at the bottom of a reach and ending with 100 at the top of a reach. A given Reachcode may be assigned to one or more NHDFlowline features. Figure 1 illustrates an NHD Reachcode assignment to multiple flowlines. The small numbers on the left are ComIDs and 06010104000016 is the Reachcode of the reach highlighted in yellow.
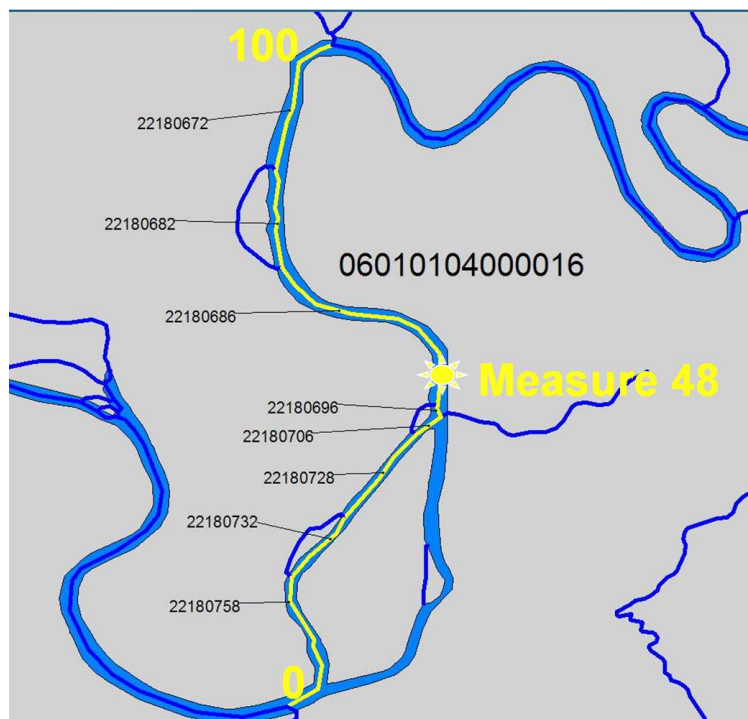

Figure 1

Using Reachcodes and measures, entities (or information) may be tied to locations along the NHDPlus stream network using the NHDFlowline features. NHDPlus Linear Events consist of a Reachcode, from-measure and to-measure, while NHDPlus Point Events consist of a Reachcode and measure. Figure 2 shows linear and point events.
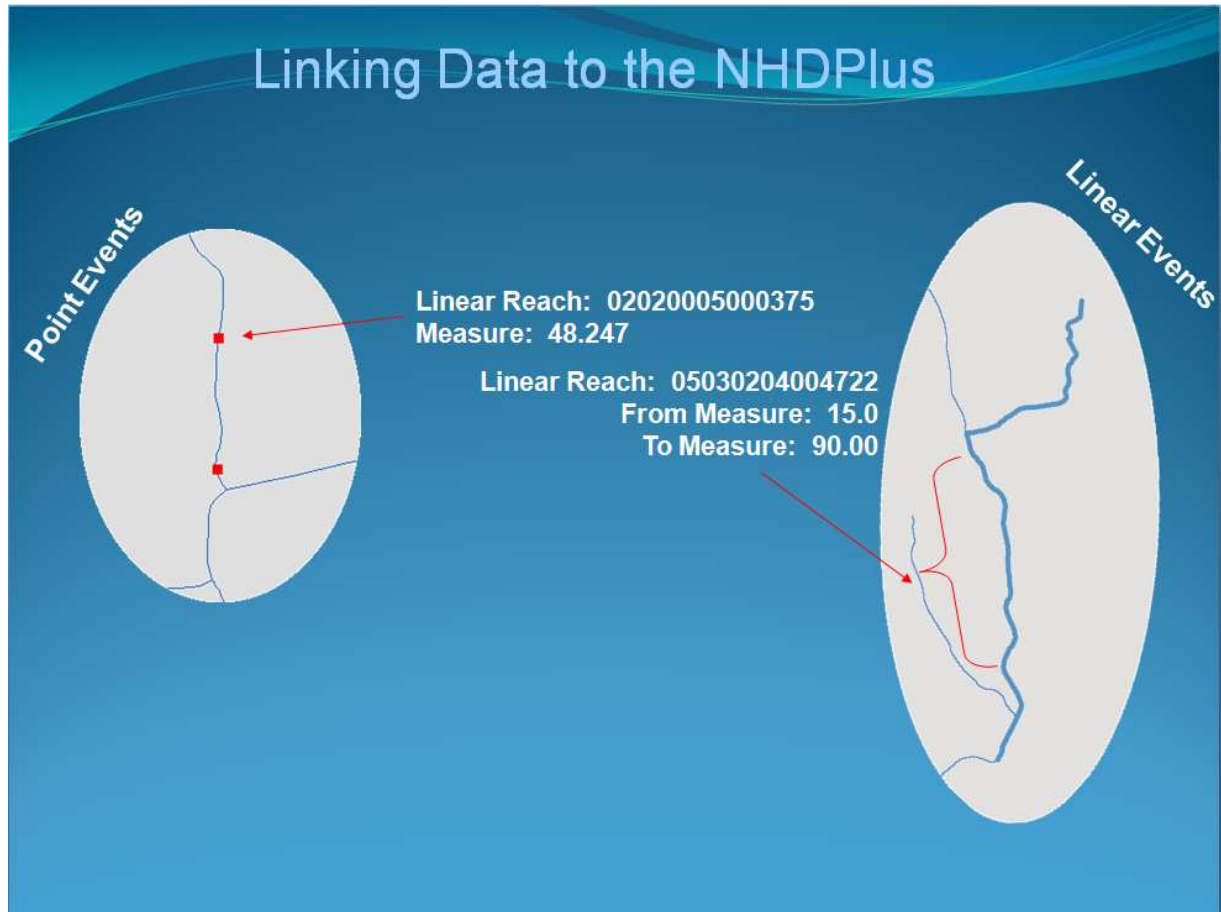

Figure 2

NHDPlus catchments have a 0/1-to-1 relationship with NHDFlowlines.   The relationship is defined through the NHDFlowline ComID. The vast majority of NHDFlowline features have one and only one catchment and the remaining NHDFlowline features have no catchments. The relationship between catchments and flowlines is maintained through the flowline ComIDs. Each catchment ComID is equal to a unique NHDFlowline feature's ComID. More information about NHDPlus catchments is available in:

ftp://ftp.horizon-systems.com/NHDPlus/documentation/NHDPLUS_UserGuide.pdf

Sometimes it is useful to associate linear and point events to NHDPlus catchments. The many-to-1 relationship between NHDFlowline features and Reachcodes and the 0/1-to-1 relationship between NHDPlus catchments and NHDFlowline features complicate the process of linking linear and point events to catchments. This can be accomplished in several ways. The preferred method is described here.

Step 1. Download the Events2Catchments NHDPlus data extension from:

http://www.horizon-systems.com/NHDPlus/download.php#Linking%20NHDPlus%20Linear%20&%20Point%20Events%20to%20NHDPlus%20Catchments%20-%20Instructions%20and%20Data

Step 2. Uncompress the downloaded data.   The Events2Catchments file geodatabase contains: (1) CatchmentSP feature class which is a national set of smoothed NHDPlus catchments and (2) ComID_Measures table which contains the measures (m-values) of the top (upstream) and bottom (downstream) endpoints of each feature in NHDPlus V1 NHDFlowline.

Step 3. For a point event table, find the ComID for the point as follows:

Assumption: event table (called Event) contains EventID, Reachcode, and Meas

Add FlowlineComID Long Integer(9) to Event.

Set Event.FlowlineComID = ComID_Measures.ComID
    where Event.Reachcode = ComID_Measures.Reachcode and Event.Meas >= ComID_Measures.BotMeas and Event.Meas <= ComID_Measures.TopMeas

Step 4. For a linear event table, find the ComID for the line using the following logic:

Assumption: event table contains EventID, Reachcode, FromMeas and ToMeas

Assumption: event table contains a record for each NHDPlus V1 NHDFlowline on which the event occurs. In other words, Event contains no multi-flowline event records.

Assumption: event table was created with the convention that FromMeas <= ToMeas

Add FlowlineComID Long Integer(9) to Event.

Event.FlowlineComID = ComID_Measures.ComID
    where Event.Reachcode = ComID_Measures.Reachcode and Event.FromMeas >= ComID_Measures.BotMeas and Event.ToMeas <= ComID_Measures.TopMeas

Step 5. After step 3 or 4, the vast majority of events will be associated with a ComID that has an NHDPlus Catchment. However, there will be events associated with ComIDs that do not have catchments. For example, ComIDs with NHDFlowline.Flowdir = "Uninitialized", do not have NHDPlus V1 catchments and ComIDs that are very short flowlines (generally less than 50m), may not have NHDPlus V1 catchments. To assign catchments to the events with ComIDs that have no catchment, find all Event.FlowlineComID's that do not have a Catchment as follows:

Select Event.FlowlineComID where Event.FlowlineComID is not in CatchmentSP.ComID

Step 6. For all Events selected in step 5, spatially intersect the Events with CatchmentSP.

For each linear event, if the event is assigned to more than one catchment (a highly likely occurrence), develop rules, based on the type of event and indexing technique, to decide which of the multiple catchment assignments to keep. For example, a rule might be keeping the catchment holding the longest portion of the event.

For each point event, if the event is assigned to more than one catchment (i.e. the point event lies exactly on a boundary between catchments), an arbitrary choice can be made to assign just one of the catchments to the event.