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# PILOT PROJECT: Integrating Framework Themes into the High Resolution National Hydrography Database

COOPERATIVE AGREEMENT NO. G09AC00274

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## Introduction:

GIS applications of many different disciplines have a recurring need for a few themes of data. Framework, defined by the Federal Geographic Data Committee, is “a collaborative community based effort in which these commonly needed data themes are developed, maintained, and integrated by public and private organizations within a geographic area”.<sup>i</sup> These framework themes represent the best available data for an area. Framework is one of the key building blocks and forms the data backbone of the National Spatial Data Infrastructure (NSDI) which is a means to assemble geographic data nationwide to serve a variety of users.<sup>ii</sup> Table 1 lists the seven federally recognized framework themes.

Theme Name	Federal Lead Agency
Geodetic Control	National Geodetic Survey
Cadastral	Bureau of Land Management
Administrative Units	U.S. Census Bureau
Orthoimagery	U.S. Geological Survey
Elevation	U.S. Geological Survey
Hydrography	U.S. Geological Survey
Transportation	Department of Transportation

Source: <http://www.fgdc.gov/framework>

Idaho has expanded on the federal framework themes by recognizing 40 datasets grouped into 14 themes (Table 2). Technical Working Groups (TWG) to facilitate planning and development of the elements of each framework theme and dataset have been formed for many of the Idaho Framework Themes.

Theme Name	Theme Name
Cadastral & Geodetic Control (TWG)	Hazards
Government Units(TWG)	Energy & Utilities
Elevation (TWG)	Bioscience
Hydrography (TWG)	Climate
Imagery (TWG)	Geosciences
Transportation (TWG)	Public Safety (TWG)
Land Use/Land Cover (TWG)	Reference

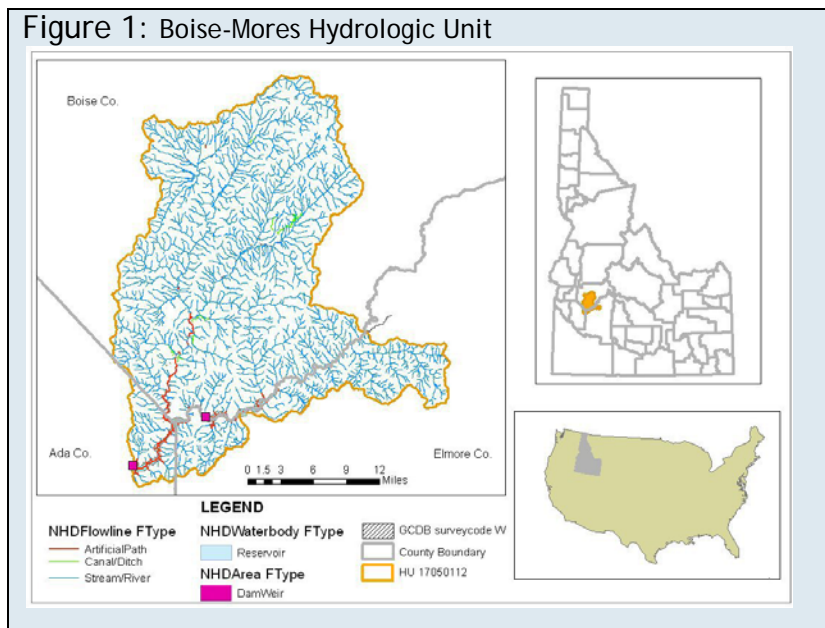
(TWG) indicates that there is an active Technical Working Group  
Source: <http://gis.idaho.gov/portal/framework/index.htm>

Hydrography is one of many framework layers. The National Hydrography Dataset (NHD) is the surface water component of the National Map and the hydrography

framework layer for Idaho. The Idaho Department of Water Resources (IDWR) as the Idaho Data Steward is actively updating the NHD with data from local sources but work is just beginning in Idaho to integrate the NHD with other framework layers. The purpose of this grant was to explore the relationships among the framework themes in Idaho focusing on one pilot Hydrologic Unit. IDWR chose Hydrologic Unit 1705112 (Boise-Mores) as the area for this pilot study. The Boise-Mores hydrologic unit had not been updated by the NHD steward and would therefore provide a “blank slate” for framework dataset comparison.

Area of Analysis - Hydrologic Unit (HU) 17050112 Boise-Mores:

The Boise-Mores HU is approximately 400,000 acres located in Southwestern Idaho. The HU’s primary waterways are the Boise River and Mores Creek. The majority of the HU is contained within Boise County with southern most parts of the HU within Ada and Elmore Counties (Figure 1). The Boise River serves as the Boise/Elmore County boundary. The Boise River runs through the Boise-Mores HU from the confluence of the North Fork and Middle Fork of the Boise River downstream and along the historical Boise River channel to approximately the historical confluence of the Boise River and Mores Creek. The Ada/Elmore County Boundary is the center of the south half of township 3N Range 04E in the HU. The Ada/Boise County boundary begins at the historical confluence of Mores Creek and the Boise River and extends approximately northwest to the southeast corner of township 06N01E. The confluence of the three county boundaries is currently impounded by Lucky Peak Reservoir.



Lucky Peak Reservoir is one of two major reservoirs in HU 17050112. Lucky Peak Dam is approximately 10 miles upstream on the Boise River from the City of Boise. The dam is a rolled earth-filled dam 340 ft. high and 1700 ft. long. It was originally built in the 1950's primarily for irrigation storage. In the 1980's, a powerhouse was added for hydroelectric power generation. The lake, when full, is 12 miles long. It has 45 miles of shoreline and 3,019 acres of surface area. The lake provides a total storage capacity of 306,000 acre-feet at elevation 3060.<sup>iii</sup>

Arrowrock Dam is approximately 20 miles upstream from the City of Boise and 10 miles upstream of Lucky Peak Dam on the Boise River. Arrowrock Reservoir has 3,100 acres of surface area and provides a maximum storage capacity of 300,850 acre-feet. It is formed behind a concrete arch dam 350 ft. high and 1150 ft. long. It was completed in the 1915 primarily for irrigation storage. Hydroelectric power generation is a secondary purpose.<sup>iv</sup>

The Boise-Mores HU vegetation is mainly consists of evergreen forest with some sagebrush dominated shrubland in the southern portion of the HU primarily around the reservoirs. There is minimal large scale agriculture and no organized Irrigation Companies. The largest city in the HU is Idaho City with a 2000 Census population of 458. The only other town within the HU with a documented 2000 Census population is Placerville with a population of 60. Only about 20% of HU is privately owned. The primary landowner in the HU is the U.S. Forest Service.

#### *Boise-Mores HU in relation to other HU in the State of Idaho*

The Boise-Mores HU is one of the smaller HU's in Idaho. The mean area of an Idaho HU is 823412 acres. HU 17050112 is similar to 15% to 20% of the HU in Idaho. The most similar HU's to the Boise-Mores HU are in Central and Northeastern Idaho. These HU are characterized by significant portions of the HU being owned by the U.S. Forest Service, with populations less than 5% of the total state population, and where the primary industries are or were historically forest products and mining.

#### **The Integration Process:**

##### Summary of Framework Vertical Integration Survey

In order to help identify which framework datasets are interdependent with hydrography, a survey was sent to the twenty-four framework leads and coordinators for the Idaho Framework Datasets. The survey respondents were asked to identify other framework datasets that have a relationship with the dataset they represent. The relationships were defined as:

- 1) Fundamental: The dataset cannot be completed until either before or after a different dataset is finished.
- 2) Impacting: The characteristics of the dataset indicate or are indicated by the characteristics of another.
- 3) Interdependent With: The dataset must align with another dataset in order to be useful.

To view the complete survey, see Appendix A.1.

Individuals responsible for sixteen of the framework datasets responded. Three of the framework datasets had multiple respondents as both the framework coordinator and framework lead may have completed the survey for a particular dataset. Responses for 32% of the framework datasets were obtained.

Framework Dataset	# Responses
Structures (Address Points)	2
Parcels	2
Geology	2
Water Features/Hydrography	1
Volcanic Hazards	1
True Color Imagery	1
Landslides	1
Land Cover	1
Indices (Reference)	1
Emergency Services Zones	1
Earthquakes and Active Faults	1
County Boundary	1
Cadastral Reference	1

Respondents representing County boundary, Imagery, and Geology datasets indicated that their datasets showed interdependency with hydrography. The County Boundary respondent indicated that hydrography had an impact on the development of the dataset along with a primary interdependency. The Imagery and Geology respondents indicated that their layers have interdependency with hydrography but did not consider it the most important.

To view a copy of the survey, please see [Appendix A.1](#).

For a summary of the survey results by respondent, please see [Appendix A.2](#).

## Comparison of Framework Datasets with NHD Hydrography

### *a. Cadastral & Geodetic Control*

#### i. Geodetic Control:

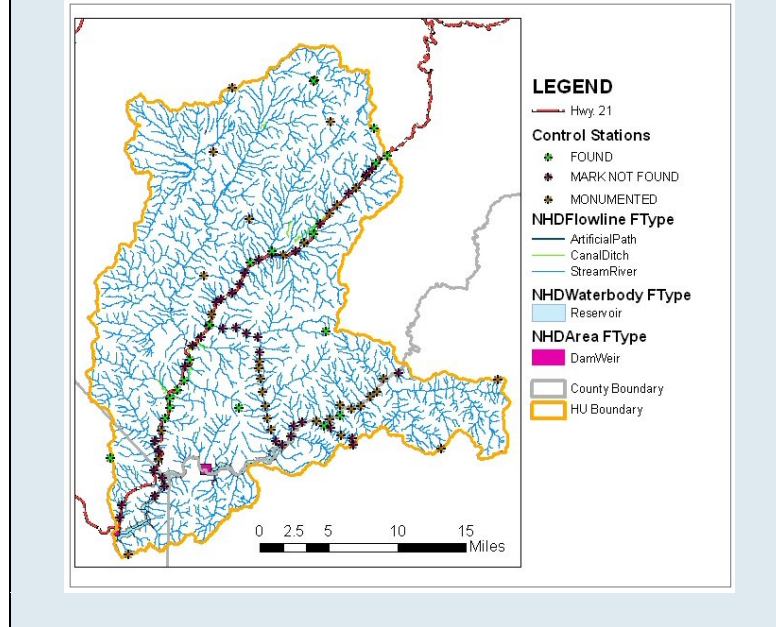
Responses from Geodetic Control regarding hydrography were not received in this Framework Vertical Integration Survey therefore a dataset from the National Geodetic Survey (NGS) was used. The NGS is listed as the federal lead for the Geodetic Control framework layer. The NGS manages the national coordinate system, the National Spatial Reference System (NSRS). Geodetic positional coordinates from survey control stations are a primary component of the NSRS. Survey control stations with publishable NGS datasheets are available for download from NGS.<sup>v</sup>

Ninety-nine survey control stations were identified in HU 71050112 (Figure 2). Thirty-five stations have not been visited since their monumentation in the 1930s - 1950s and forty of the stations were not located when last visited. Only twenty-four stations have been located since the 1950's. Of the 18 stations located in the last 40 years, most are along either the existing or historical State Highway 21. One station, PID = 0Z0741, is described as being on a boulder near a concrete gauge house but it is not directly on the structure.

Although there are no survey control stations associated with hydrologic features in HU 17050112, there may be survey control stations on dams and gauging stations in areas other than HU 17050112. For example, PID= NU1723 has an azimuth mark described as being set in the southwest corner of the retaining wall of the Oakley Dam. This mark is about 0.3 miles northwest of the actual station mark which is flush with the ground.

There does not appear to be an easily identifiable way to link geodetic control and the NHD in Idaho. Survey Control Station descriptions may reference a hydrologic feature when describing how to navigate to a station but they are not near or along hydrologic features in general. Hydrography is a dataset that has inherent change in it, both horizontal and vertical. Effective survey control stations must be placed in areas that are static over time. Placing survey control stations as event themes along a hydrologic network does not provide added value to the NHD in Idaho as these stations do not impact the characteristics of water along the network.

Figure 2: Geodetic Control in HU 17050112



ii. Cadastral:

The Framework Vertical Integration Survey respondent representing Cadastral Reference indicated that the most current and accurate dataset available for Idaho is the Bureau of Land Management (BLM) Geographic Coordinate Database (GCDB).<sup>vi</sup> The Bureau of Land Management (BLM) cadastral survey program is responsible for the official boundary surveys for all federal agencies in the U.S.<sup>vii</sup> The GCDB is a collection of geographic information representing the Public Land Survey System (PLSS) and some Non-PLSS surveys of the United States. The GCDB grid is computed from BLM survey records, local survey records and geodetic control information.<sup>viii</sup> Over 80% of state of Idaho is covered by GCDB to the quarter-quarter section (QQ) level. GCDB has not been developed (generally) in the sparsely populated mountainous central portion of Idaho.

The GCDB PLSS land description area (ladesc) layer contains the attribute sursys which is defined as the survey system type of the parcel. A sursys value of W indicates water, fresh or salt. A query of the GCDB polygons for sursys equals W often results in a representation of river meanders that existed at the time of survey. In the GCDB within Idaho, these surveys were often conducted in the late 1800's to early 1900's. Therefore survey information may not be useful in describing the current path of waterways but could indicate historic river courses.



The NHD contains the NHDArea feature class which has Fcodes that denote Submerged Stream (Fcode = 46100). A submerged stream is defined as a 2D river course inundated by an impounded water body. There are two major reservoirs in HU 17050112 that impound the Boise River. The GCDB can indicate the original locations of submerged streams. Currently, there are no features in the NHD feature class Submerged Stream for HU 17050112 although the submerged streams are indicated on the 1:24,000 USGS topographic maps in this HU.

The GCDB could be especially useful in areas where the 1:24,000 USGS topographic maps do not indicate the locations of submerged streams, 2D features could be added to the NHD by matching the GCDB surveyed water feature (sursys = W) with an Fcode representing submerged streams. The artificial path through the NHD Flowline through the reservoirs could be modified to coincide with the centerline of the GCDB surveyed water feature (sursys = W), rather than the center of the NHD Waterbody, to indicate the location of the submerged stream.

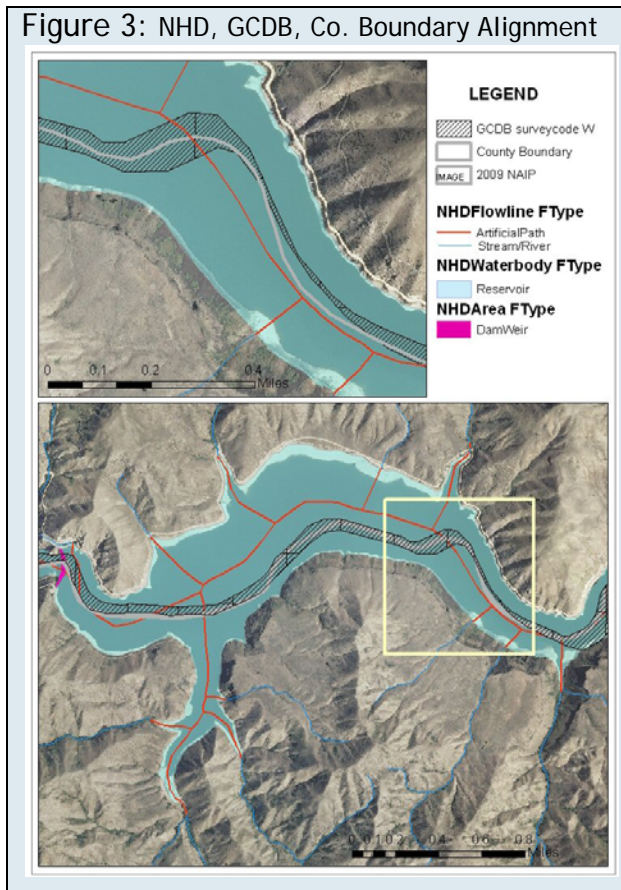


Figure 3 represents a portion of the pool of Arrowrock Reservoir. The original survey of the highlighted area was conducted in 1902, and resurveyed in 1943.<sup>ix</sup> The county line represented in the figure follows the submerged stream indicated on the 1:24,000 USGS topographic maps (survey year 1969).

The GCDB surveyed water feature (sursys = W) does not exactly follow the submerge stream indicated on the 1:24,000 USGS topographic maps. When both features exist, a procedure determining which will take precedence must be developed.

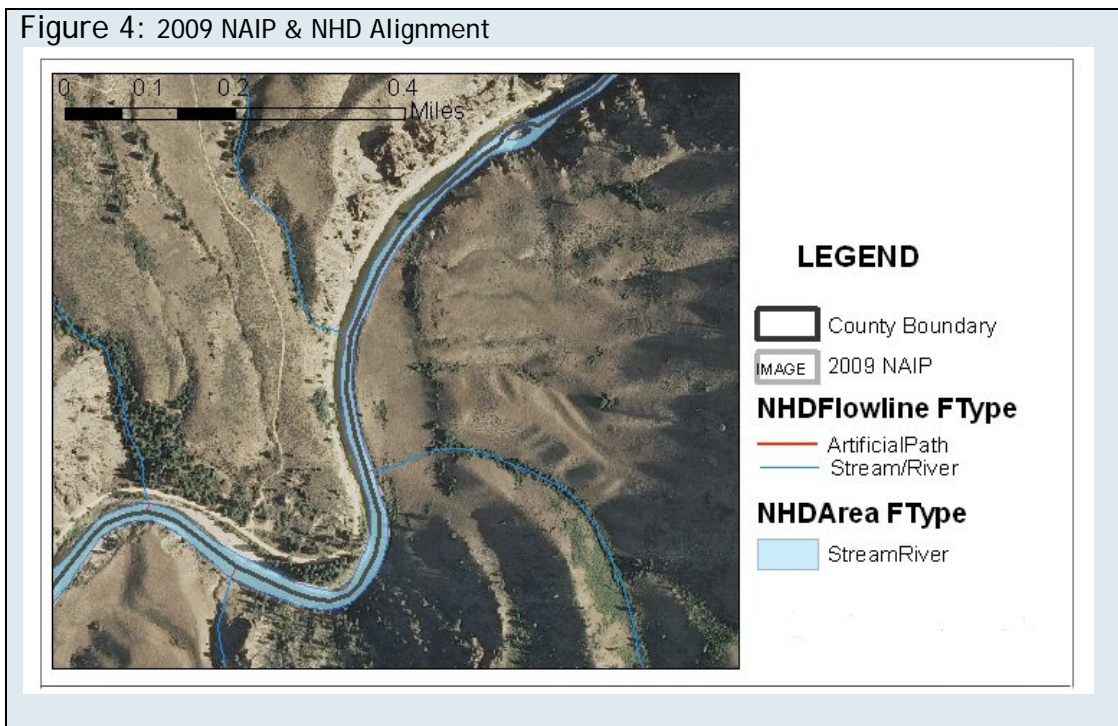
*b. Government Units:*

The Framework Vertical Integration Survey respondent representing Government Units indicated that the most current and accurate dataset available for Idaho that represents government units statewide is the BLM GCDB. The GCDB and government unit boundaries are not directly correlated because the GCDB does not maintain features or attributes to indicate a government or administrative boundary although many boundaries are legally described using the Public Land Survey System. The survey respondent also indicated that Hydrography was an interdependent framework dataset with Government Units. This relationship exists because the descriptions of many Idaho county boundaries and a portion of the Idaho western state boundary are based on the location of waterways. For example: the eastern Boise County boundary ends at the headwaters of the North Fork of the Boise River. Idaho Code 13-110 describes the Southern Boundary as "Thence down the center of the channel of the North Fork of the Boise River and the main Boise River to the place of beginning". The county boundary GIS layer used for this report was the GU\_CountyOrEquivalent dataset downloaded from the National Map.<sup>x</sup> The metadata for this dataset indicates that the 2009 TIGER/Line CENSUS Data was the source for the layer.

The primary government unit in HU 17050112 is the county boundary. The Boise River serves as the Boise/Elmore County boundary and runs through the HU from the confluence of the North Fork and Middle Fork of the River to approximately the confluence of the Boise River and Mores Creek. A downstream portion of the county boundary is inundated by Arrowrock and Lucky Peak Reservoirs. Approximately 10 river miles upstream from Arrowrock Reservoir to the confluence of the North Fork and Middle Fork is not inundated.

The current county boundary from the National Map does not follow either the NHD artificial path through the reservoirs or adhere to the GCDB water feature (sursys = W) (See Figure 3). Also, it does not appear to follow the county boundary illustrated on the USGS topographic map through the reservoirs (NHD Waterbodies). For the 10 river miles of the boundary not inundated (NHD Area), the county boundary from the National Map is in alignment with the NHD Flowlines (Figure 4).

Where the legal description of a boundary is dependent on hydrography, care should be taken to make sure features line up vertically. The GCDB may more accurately reflect the original locations of submerged streams and serve as a better representation of the county boundary, than the centerline of the NHD Waterbody features. Unfortunately, although the NHD Flowlines, the NHD Area, and the National Map County Boundary are aligned with each other, none align with the 2009 NAIP imagery.



*c. Imagery*

The Framework Vertical Integration Survey respondent representing Imagery indicated that the most current/accurate dataset available for Idaho is the

National Agriculture Imagery Program (NAIP) imagery. This imagery was flown statewide in 2009 with 4 bands for display in true color and Color Infrared (CIR). The horizontal accuracy is 1 meter ground sample distance at the absolute accuracy specification as stated by NAIP<sup>xi</sup>. Compressed County Mosaics CCMs of imagery are available for free download through the USDA Geospatial Data Gateway or purchased through the USDA Aerial Photography Field Office APFO Customer Service Section.<sup>xii</sup>

IDWR has previously updated NHD Flowlines with input from local agencies using the 2004 NAIP imagery as reference layer. Subsequent updates will be done using the most recent NAIP imagery, which currently is our 2009 layer. On visual inspection, there are discrepancies between the 2009 NAIP imagery and the current NHD (Figure 4). Many things can affect the alignment of the NHD with current imagery including the source and date of the NHD data and the amount change such as agriculture and/or urbanization that has occurred since the NHD was acquired. Photorevision of NHD based on imagery can be difficult in areas of high relief or dense vegetation. Based on the experience of the Idaho NHD Technical Point of Contact, a HU can take from 3 to 6 months to photorevise the NHD to reflect current imagery.

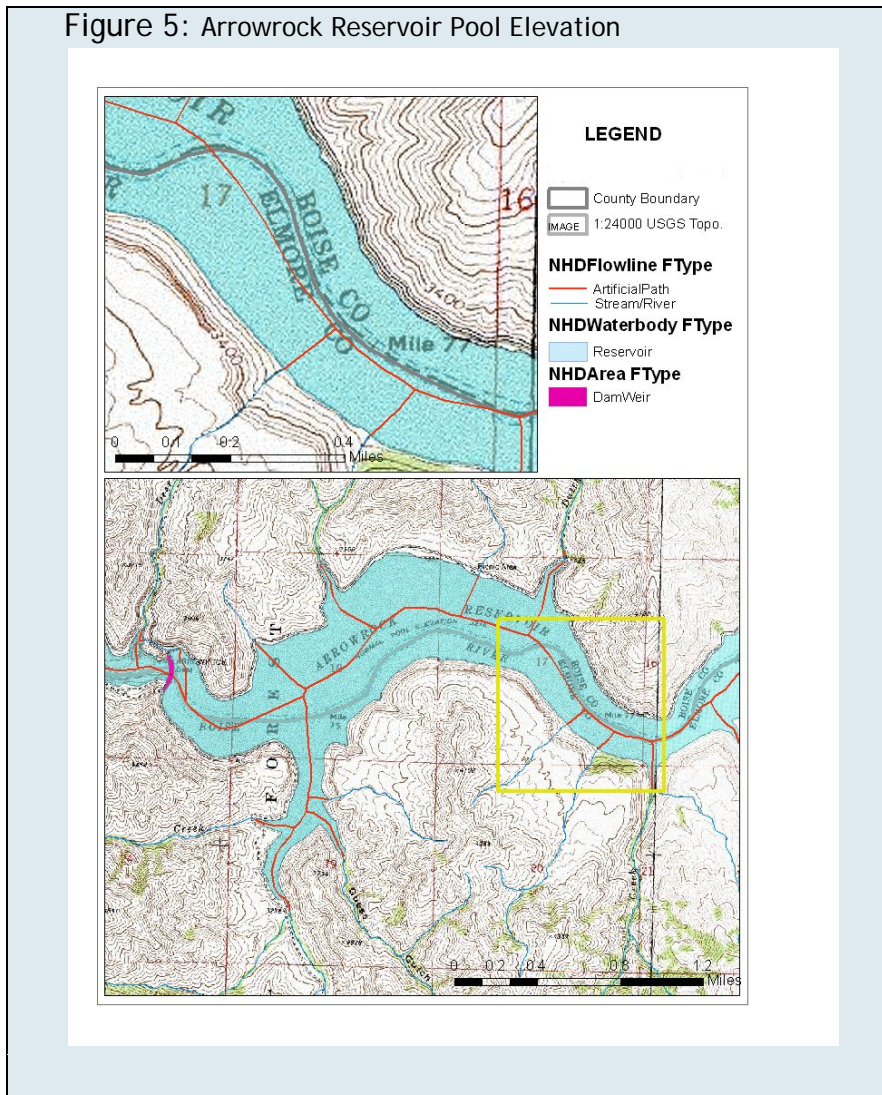
Because the 2009 imagery contained the Color InfraRed (CIR) band, using a Normalized Difference Vegetation Index (NDVI) classification to identify water was considered. This method was not recommended, because the CIR band of NAIP imagery was not derived from a true red-band sensor, but from a Bayer-type filter CCD, typical of many digital aerial camera systems. For this reason, it is difficult to use NDVI from NAIP to determine water. Additionally, the output values are typically very different from NDVI derived from Quickbird, SPOT, or Landsat. Therefore, it would be just as effective to conduct a visual inspection of the hydrography and the imagery to determine alignment verses using a NAIP derived NDVI.

#### *d. Elevation*

Elevation was not represented in the Framework Vertical Integration Survey. The National Elevation Dataset - 10 meter (NED) for Idaho is the most accurate statewide dataset available. It is available for download from the Idaho Interactive Numeric & Spatial Information Data Engine (Inside Idaho).<sup>xiii</sup> LIDAR has been flown for many projects areas within Idaho, unfortunately none of these project areas are within HU 17050112.

In GIS, z-values represent elevation values. Many of the NHD feature classes are z-enabled, including NHD Flowline, NHD Line, NHD Point, NHD Waterbody, and NHD Area. The z values for these feature classes do not appear to have been calculated at this time. Elevation attributes were identified for the NHD feature classes NHD Waterbody and NHD Area.

Only two features in the HU have an elevation value populated, the pools of the two reservoirs. This value is tied to the FCode and different FCodes represent different pool elevations. The FCode for these two features is 39009 (Lake/Pond, Average Water Elevation). The Elevation attribute value for Lucky Peak Reservoir equals 932.7 meters (3060.039 feet) and Arrowrock Reservoir equals 980.2 meters (3215.879 feet).



Elevation (z-values) for the vertices of the two NHD Waterbodies in HU 17050112 that contained elevation attribute values were calculated based on the NED using several ArcGIS tools.<sup>xiv</sup>

Table 4: NED Calculated Values		
Vertices:	Lucky Peak	Arrowrock
Count	4496	3164
Minimum	3053.138 ft.	3183.739 ft.
Maximum	3112.838 ft.	3251.871 ft.
Mean	3068.278 ft.	3224.006 ft.
# Vertices +/- 40 ft. of Attribute Elevation	11	0

Because very few (0.2 %) of the vertices were outside of the tolerance for a scale of 1:24,000, there is very strong correlation between the NED and the two features in the NHD with elevation values.

*e. Transportation*

Responses regarding interaction between transportation and hydrography were not reflected in the Framework Vertical Integration Survey. Idaho does have an active Technical Working Group that is focusing on centerline/address range data in response to E911 and for pavement management. The result of this group’s effort is a GIS road centerline layer available at Inside Idaho.<sup>xv</sup> This layer is updated weekly from Idaho source data stewards across the state if new data is made available. Data from 43 of the 44 counties is present in this dataset. Density of the spatial and attribute information will vary by source.

An intersect of the roads dataset with the NHD hydrography would result in two primary outcomes; a transportation crossing, representing a culvert or bridge location, or an intersection resulting from the misalignment of either the road centerline and or the hydrography. (Figures 6) Either result is useful as transportation crossings impact the hydrologic network, especially in times of flooding. Alignment information can also help prioritize NHD update areas. Using several GIS analysis tools in ArcGIS,<sup>xvi</sup> locations of intersection were determined for the NHD Flowline data for HU 17050112. The result was 684 point locations of intersection. A visual inspection comparing the hydrography and road centerlines with the 2009 NAIP imagery showed that 63% of the intersections were transportation crossings while 37% were alignment errors.

Figure 6: Intersections of Hydrography and Transportation

Transportation Crossing: Intersections are 2 bridges.



Hydrography Misalignment: Hydrography actually follows southwestern side of the road.



Bridges are a type of transportation crossing and can be represented in the NHD as an FType of an NHD Line or an NHD Area feature. Bridges are not currently represented in the Idaho GIS road centerline layer. The National Bridge Inventory is part of the National Transportation Atlas Database.<sup>xvii</sup> Twenty-five bridges from this database were identified in HU 17050112. Only 24 bridges were used as one was located in the pool of Lucky Peak Reservoir. Three additional bridges were identified in the Idaho Transportation Department (ITD)<sup>xviii</sup> and locations were provided to IDWR.

The twenty-seven bridges identified have locations in the ITD database within 50 meters of a NHD Flowline and Road Centerline intersection, fourteen are within 10 meters. These locations could potentially be used to populate the NHD Line feature attributes, FType = Bridge.

Additional bridges exist in HU 17050112 but are not in the databases provided. There are 4 locations where roads intersect either NHD Area or NHD Waterbody features in HU 17050112 but are not included either of the bridge databases provided. After visually inspecting these locations on the 2009 NAIP imagery, these locations appear to be bridges. If it is assumed that a bridge is more likely to be present on a perennial stream than an intermittent one and the intermittent/perennial stream classifications in the NHD are accurate, then there are an additional 182 possible bridges in this HU that are not included in the bridge database. Verifying which of these locations is a bridge versus some other type of structure, such as a culvert, may require field work.

Alignment errors are often the result of datasets being built independently. Both the hydrography dataset and the roads centerline data may be accurate to a 1:24,000 scale to ground, but not in relation to each other. This is often an issue during spatial analysis. Field work would be needed to align the features in these datasets. Another source of alignment issues is the date of development and update of the dataset. Road construction also affects hydrography as the stream course may be altered as the road is built. If the hydrography has not been updated since road development, alignment errors can occur.

*f. Hazards - Flood Dataset*

Four of the Six Idaho Framework Hazard datasets (Landslides, Avalanches, Earthquake/Active Faults, and Volcanic Hazards) were represented in the Framework Vertical Integration Survey. Survey respondents representing hazard datasets did not indicate a dependency on hydrography. Flood, the hazard most directly associated with hydrography was not represented in the survey responses. Therefore, a representative from IDWR's floodplain management unit was approached.

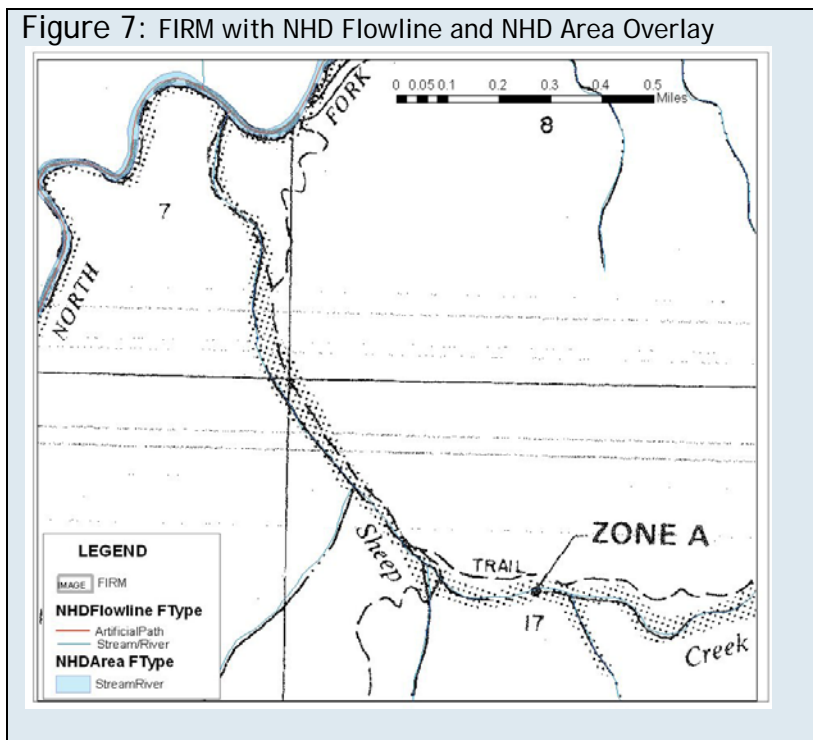
Flood Information Rate Maps (FIRMS) and Digital Flood Insurance Rate Maps (DFIRMS) are used to regulate floodplain development by communities enrolled in the National Flood Insurance Program. Currently 168 cities and counties use these maps to display flood hazard areas and to regulate building and other



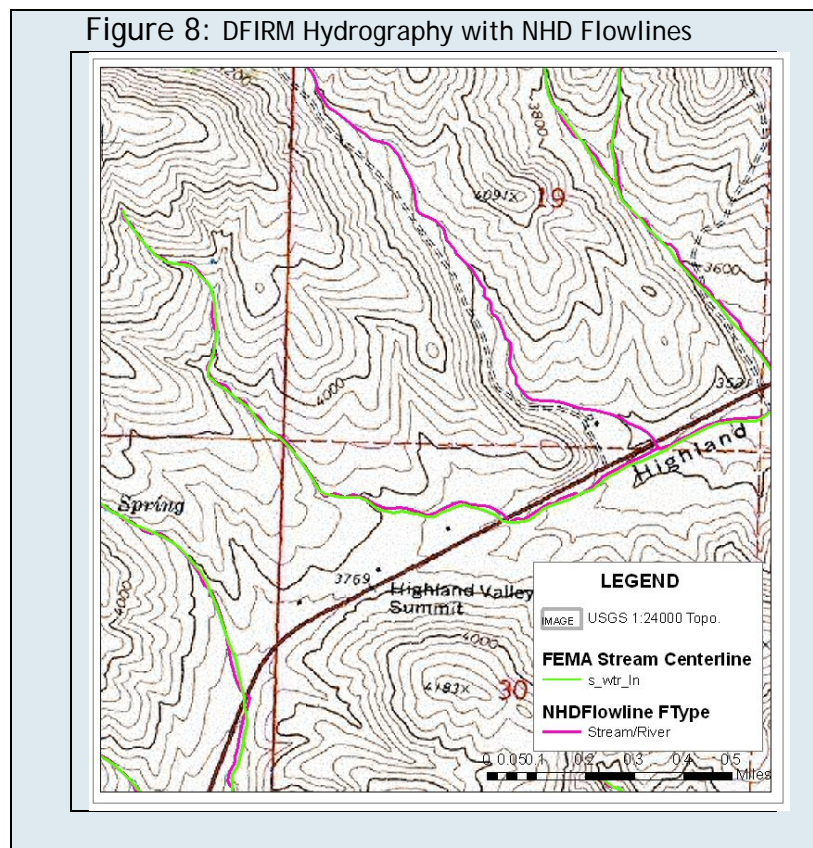
development in flood hazard zones. DFIRMS are the product of FEMA's paper to digital transition program. DFIRMS have been produced by FEMA for 10 of Idaho's 44 counties. The maps are county wide and include cities within mapped flood hazard areas. FIRMs and DFIRMS are available for order from the Federal Emergency Management Agency (FEMA).<sup>xix</sup>

On a FIRM, a flood zone designated as Zone A depicts the horizontal extent that a 1% annual chance flood event is predicted to inundate. An engineering study has not been done for Zone A areas so depth of flooding is not described. This definition could be condensed to "an area of land subject to flooding". FType 40307 is defined as an area of Land Subject to Flooding, Inundation Status Not Controlled.

For HU 17050112, Ada County is the only county that has DFIRM data, and that subset comprises about 5% of the HU 17050112. The Boise and Elmore county portion of the basin is a standard FIRM. Populating the Inundation Area feature class based on DFIRMS could be done if an NHD/FEMA agreement was obtained. Populating the feature class from FIRMS would require significant time digitizing from scanned paper maps. An example of the NHD overlay on a scanned FIRM is illustrated in Figure 7.



Flowline updates in the NHD could be used as base map data for DFIRM creation as long as all FEMA base map specifications are met. DFIRMs do include a surface water feature dataset (s\_wtr\_ln) and a surface water area feature dataset (s\_wtr\_ar). The main purpose of these datasets is to provide a cartographic depiction of the surface water features for visual interpretation of the FEMA mapping data.<sup>xx</sup> The Ada County DFIRM stream centerline dataset does not align with the NHD or the 1975 1:24000 USGS topographic map used in Figure 8. The Ada County DFIRM did not contain a s\_wtr\_ar feature dataset. If the DFIRMs were based on NHD Flowline data, alignment would occur until an update was made to the NHD. Additionally, changes reflected in the NHD could be coordinated with DFIRM revisions hence facilitating integration.



FIRM to DFIRM priorities are based on flood risk to population. Idaho has a fairly low population per square mile when compared nationally. According to the FEMA Digital Flood Mapping Products, Requirements, DFIRM Base Map Specifications:

“Base map data supplied by communities or other non-Federal sources (e.g., State agencies, regional agencies) that meet FEMA criteria are the first choice for DFIRM production.”<sup>xxi</sup>

In areas where DFIRM’s have yet to be produced, improved NHD can serve as updated base map data.

There are several other features included in the DFIRM database that may be incorporated into the NHD or be used to populate DFIRMs if available.

Table 5: Subset of DFIRM features that potentially correspond to NHD features.

DFIRM feature	DFIRM Table	NHD FCODE
Culvert	S_gen_structure	42814
Dam	S_gen_structure	34300
Levee	S_gen_structure	56800

None of the DFIRM features that correspond to NHD features, except canal/ditch, were present in HU 17050112.

### Creation of Event Themes for Selected Framework Layers

Most of the identified integration pathways identified involve the creation of NHD features based on other datasets rather than creating events. There are several features maintained in other framework layers that correspond to currently defined NHD feature types. Creating features is preferred over creating events because event creation inherently alters the position of a source feature. Because positioning is changed, the features are no longer in alignment. One identified exception is bridge features.

Creating Bridges as point events is preferred over adding them to the NHD Line or NHD Area feature classes because not all bridge location span an NHD Area or NHD Waterbody feature. In HU 17050112, seven of the twenty-seven bridges (26%) identified by the Idaho Transportation Department span an NHD Area or NHD Waterbody feature. The other 20 span 1D features. The locations of the 208 bridge/road intersections on intermittent streams can also be useful as they are often locations of flow constriction especially during high water events. These structures would not be defined as a bridge and often span 1D features but can be represented as point events. Point events representing bridges and other transportation crossings incorporated into the NHD can be created using the HEM tools.

## Conclusions:

### Issues and Challenges

One major challenge for integrating the NHD with other framework datasets is identifying what datasets are being used by the GIS communities as the framework layer. Many framework technical working groups in Idaho are still establishing standards and creating a statewide dataset. Because many framework layers do not have a definitive dataset or have multiple datasets, there can be more than one candidate. For example, the National Map has one county boundary dataset based on Census Data and the Idaho Interactive Numeric & Spatial Information Data Engine has another county boundary dataset based on the USGS 1:24000 topographic maps. Different datasets will produce different results.

In Idaho, the NHD seems to be a more fully developed framework dataset, due to state and federal involvement and funding, compared to the majority of datasets. As Idaho and national framework layers are developed and mature, integration issues may be easier to identify. Many of Idaho's framework committees are working on data acquisition and creation, hence working with more immature datasets, and that may be a reason why so few responded to the survey.

Another challenge is identifying how to integrate the data and the degree of integration. Many framework datasets seem to have a limited relationship beyond a purely spatial one. For example, geodetic control and hydrography have no interdependency or impact on each other. Their fundamental dependency is their spatial relationship to each other.

In datasets where a relationship is identified, integration with the NHD can occur either through the creation of events or the population or alteration of existing NHD features. Identifying what should be events versus what should be a feature can be challenging as there are conflicting definitions in the NHD. For example, Dam and Gauging Station are both a Point Event Type and FTypes of the NHD Point Feature Class. These conflicts will need to be resolved. Additionally, the domains for the Event Features Classes in the NHD are limited if defined at all. There are no currently defined Event Types for NHD Line or NHD Area. These domains need to be better described and defined in order to facilitate integration.

Additionally, if the features are populated with other framework datasets in mind, a procedure must be established to coordinate updates between datasets. A procedure must address the initial integration and how changes would be coordinated between framework datasets when edits are made. Based on the results of this investigation, the procedure should minimally address the following issues:

- 1) Comparison of FType definitions: How will the FType definitions between the two datasets be compared to determine if they are truly compatible or should other FTypes be created?
- 2) Changes in source data composition: For example, synthetic hydrography versus field collection.
- 3) Changes in source data scale: If the source data is improved from 1:24,000 to 1:5000, how will the NHD data stewards be notified?
- 4) Conflict Resolution: The procedure will also need to address who will resolve conflicts between different datasets that cover a similar area.
- 5) Layer precedence: Which framework layer will take precedence especially if there is more than two datasets being integrated? For example, will updates be derived from imagery framework or from elevation framework data?

#### Resources required to apply integration to all the HU in the State

Currently, the Idaho NHD Steward is updating the NHD Flowline information based on the 2009 NAIP Imagery and input from local sources. Based on previous pilot projects, a HU may take as long as a year to update depending on the size, the amount of change, and the number of partners in the HU. During this process, adjustments based on the current Road Centerline dataset can also be made if they are within the tolerances for adjusting the NHD. Conflicts between the two datasets will need to be addressed by the Transportation and Hydrography Technical Working Groups.

As other datasets become more mature and integration becomes possible, additional resources will be required.

#### Needed Updates to this HU

During this process, several NHD Areas were identified that are not present in the current NHD. Also identified were areas where the NHD flowlines are not in alignment with the 2009 NAIP imagery. Adjustments to the NHD identified through this process have been submitted to the Idaho NHD Steward for future incorporation into the NHD.

#### **Acknowledgements:**

Thank you to Wilma Robertson and the Office of the Geographic Information Officer for providing the Vertical Integration Survey. Thank you to the framework leads that answered the survey.

## Appendix:

### A. Survey Documents:

1. Survey:  
[http://www.idwr.idaho.gov/GeographicInfo/NHD/Projects/PDF/Vert\\_Survey.pdf](http://www.idwr.idaho.gov/GeographicInfo/NHD/Projects/PDF/Vert_Survey.pdf)
2. Survey Compiled by Respondent:  
<http://www.idwr.idaho.gov/GeographicInfo/NHD/Projects/PDF/VertCompiledSummary.pdf>

### B. Expanded Figures:

[http://www.idwr.idaho.gov/GeographicInfo/NHD/Projects/PDF/Vert\\_Expanded\\_Figures.pdf](http://www.idwr.idaho.gov/GeographicInfo/NHD/Projects/PDF/Vert_Expanded_Figures.pdf)

## End Notes:

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<sup>i</sup> <http://www.fgdc.gov/framework>

<sup>ii</sup> Referenced from: <http://www.fgdc.gov/framework>

<sup>iii</sup> Referenced from: [http://en.wikipedia.org/wiki/Lucky\\_Peak\\_Dam](http://en.wikipedia.org/wiki/Lucky_Peak_Dam) & [http://www.nww.usace.army.mil/corpsoutdoors/siteMenu.asp?lake\\_id=107](http://www.nww.usace.army.mil/corpsoutdoors/siteMenu.asp?lake_id=107)

<sup>iv</sup> Referenced from: [http://en.wikipedia.org/wiki/Arrowrock\\_Dam](http://en.wikipedia.org/wiki/Arrowrock_Dam) & [http://npdp.stanford.edu/DamDirectory/aDamDetail.jsp?npdp\\_id=ID00280](http://npdp.stanford.edu/DamDirectory/aDamDetail.jsp?npdp_id=ID00280)

<sup>v</sup> Download at <http://www.ngs.noaa.gov/cgi-bin/datasheet.prl>

<sup>vi</sup> Download at [http://www.geocommunicator.gov/GeoComm/Isis\\_home/home/index.shtm](http://www.geocommunicator.gov/GeoComm/Isis_home/home/index.shtm)

<sup>vii</sup> [http://www.geocommunicator.gov/GeoComm/Isis\\_home/home/index.shtm](http://www.geocommunicator.gov/GeoComm/Isis_home/home/index.shtm)

<sup>viii</sup> <http://www.blm.gov/wo/st/en/prog/more/qcdb.html>

<sup>ix</sup> <http://www.gloreCORDS.blm.gov/>

<sup>x</sup> <http://nationalmap.gov/>

<sup>xi</sup> [http://www.fsa.usda.gov/Internet/FSA\\_File/naip\\_2009\\_info\\_final.pdf](http://www.fsa.usda.gov/Internet/FSA_File/naip_2009_info_final.pdf)

<sup>xii</sup> <http://datagateway.nrcs.usda.gov/>

<sup>xiii</sup> [www.insideidaho.org](http://www.insideidaho.org)

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<sup>xiv</sup> ArcToolbox Tools: Feature Vertices to Point, Interpolate Shape, Add XY Coordinates

<sup>xv</sup>

[http://beta.insideidaho.org/webapps/search/path\\_search.aspx?path=G:\data\anonymous\igdc\roads\\_id\\_igdc.shp.xml](http://beta.insideidaho.org/webapps/search/path_search.aspx?path=G:\data\anonymous\igdc\roads_id_igdc.shp.xml)

<sup>xvi</sup> ArcToolbox Tools: Buffer, Dissolve, Intersect, Multipart to Single Part, Feature to Point

<sup>xvii</sup> [http://www.bts.gov/publications/national\\_transportation\\_atlas\\_database/2010/](http://www.bts.gov/publications/national_transportation_atlas_database/2010/)

<sup>xviii</sup> <http://itd.idaho.gov/>

<sup>xix</sup> <http://msc.fema.gov>

<sup>xx</sup> Guidelines and Specifications for Flood Hazard Mapping Partners, Appendix L p. L-345; <http://www.fema.gov/library/viewRecord.do?id=2206>

<sup>xxi</sup> [http://www.fema.gov/plan/prevent/fhm/dfm\\_dfhm.shtm](http://www.fema.gov/plan/prevent/fhm/dfm_dfhm.shtm)

## Appendix B

### Expanded Figures



Figure 1: Boise-Mores Hydrologic Unit

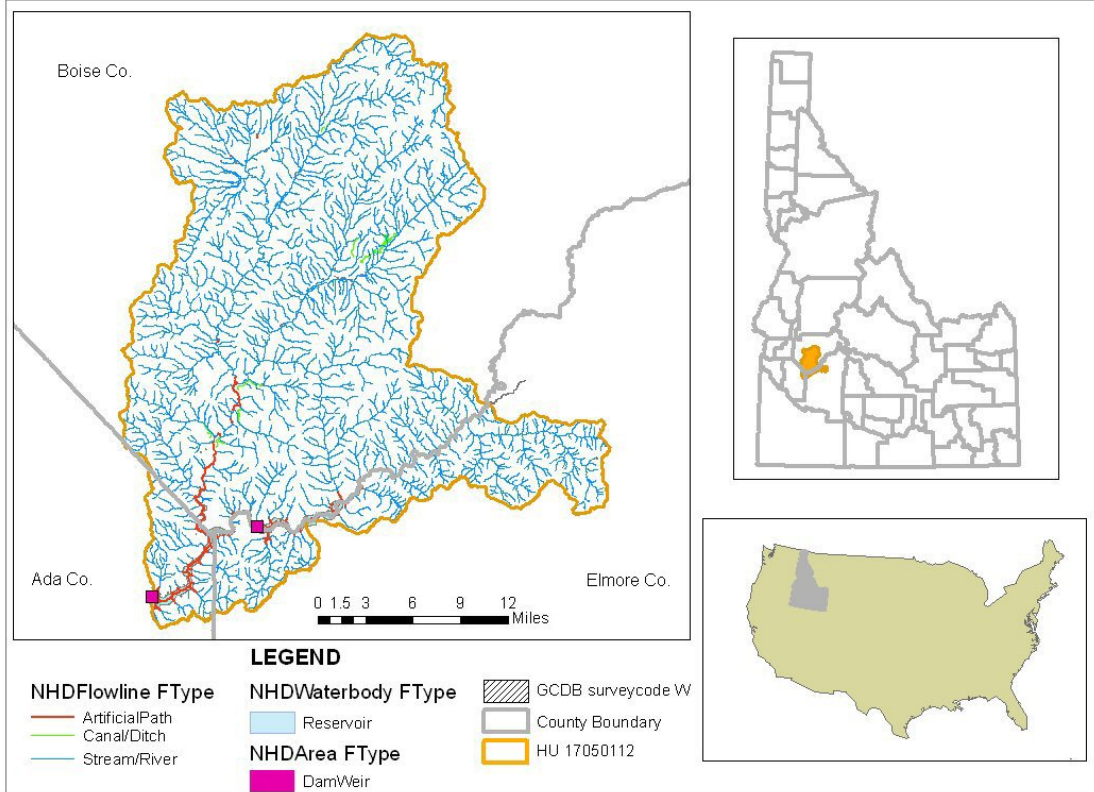


Figure 2: Geodetic Control in HU 17050112

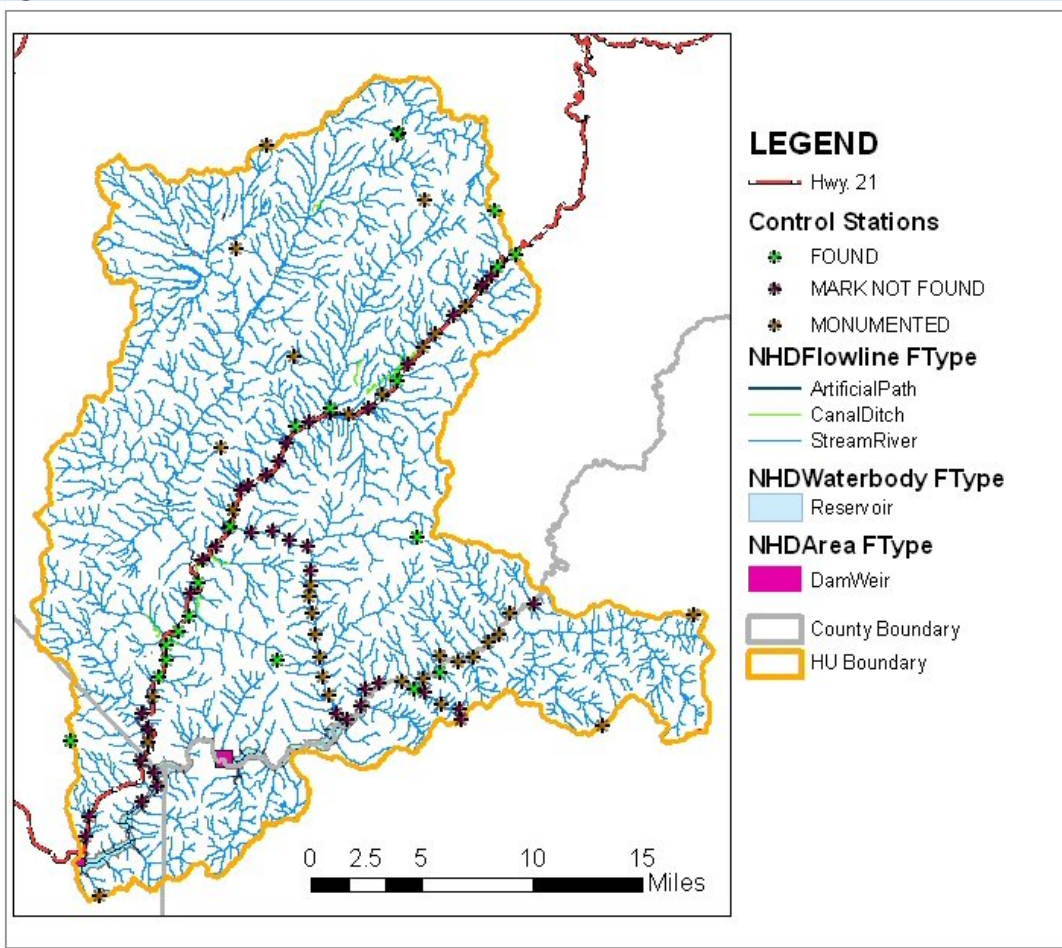


Figure 3: NHD, GCDB, Co. Boundary Alignment

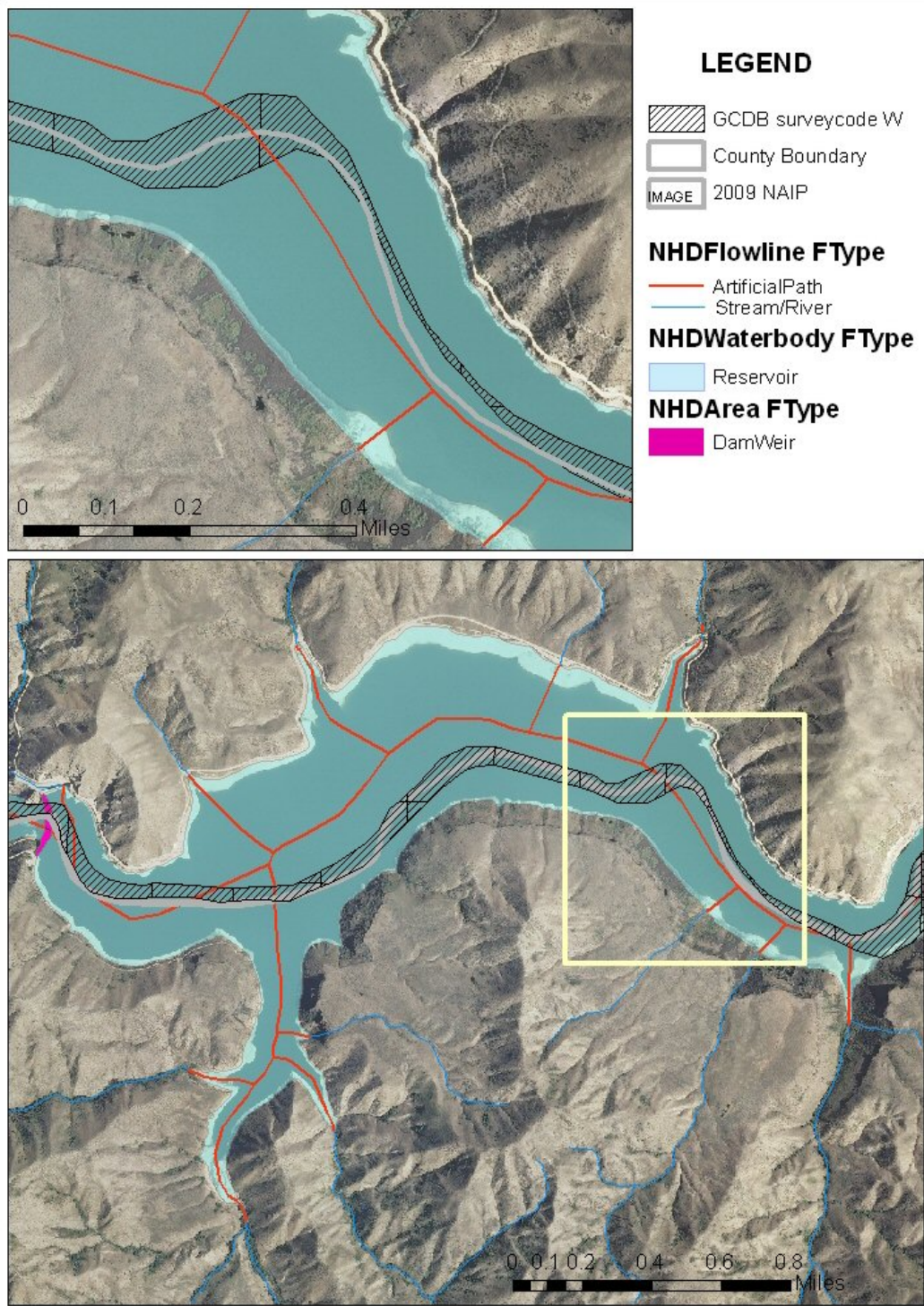



Figure 4: 2009 NAIP & NHD Alignment





**LEGEND**

 County Boundary

 2009 NAIP

**NHDFlowline FType**

 ArtificialPath

 Stream/River

**NHDArea FType**


 StreamRiver

Figure 5: Arrowrock Reservoir Pool Elevation

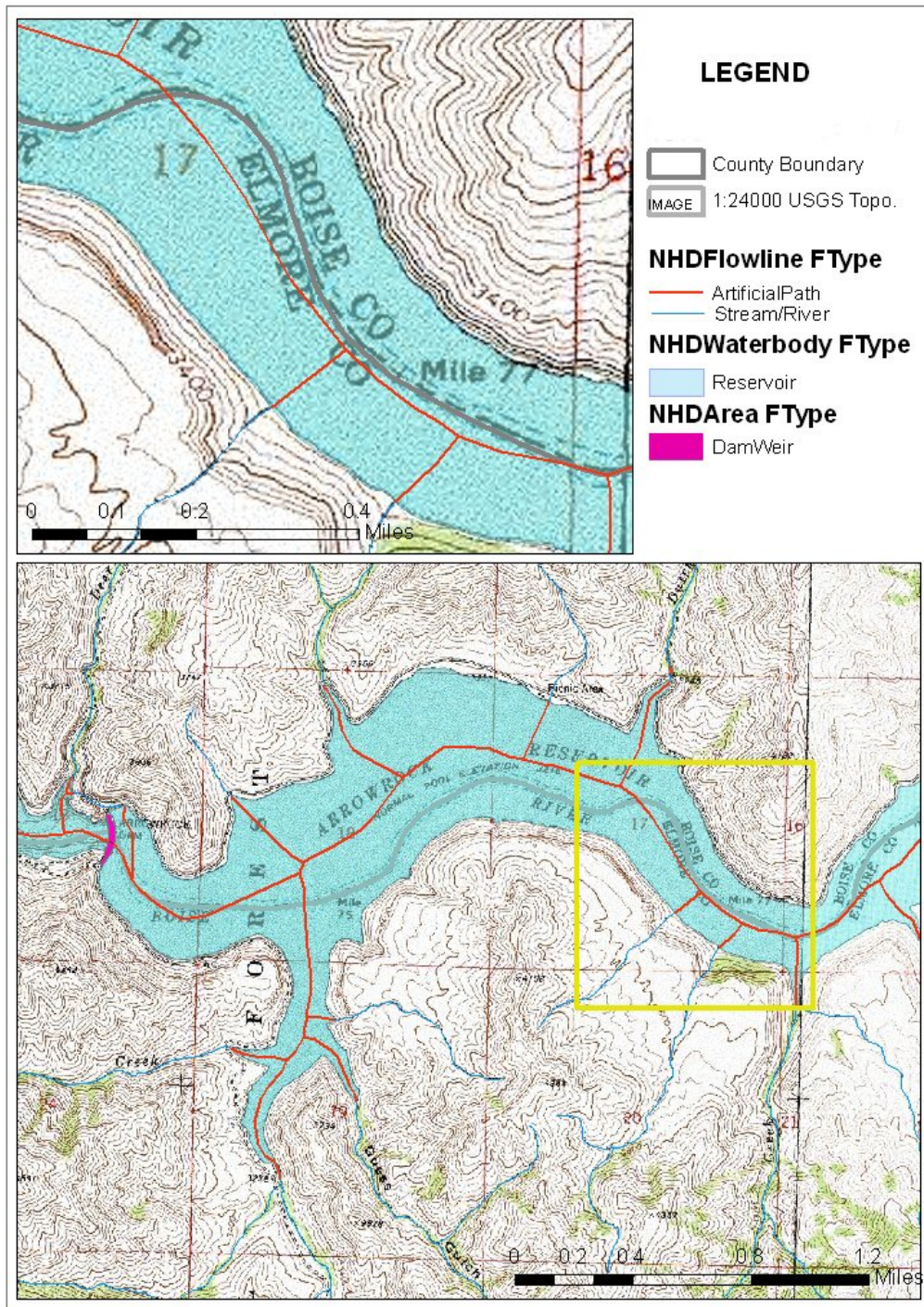


Figure 6: Intersections of Hydrography and Transportation

Transportation Crossing: Intersections are 2 bridges.



Hydrography Misalignment: Hydrography actually follows southwestern side of the road.



Figure 7: FIRM with NHD Flowline and NHD Area Overlay

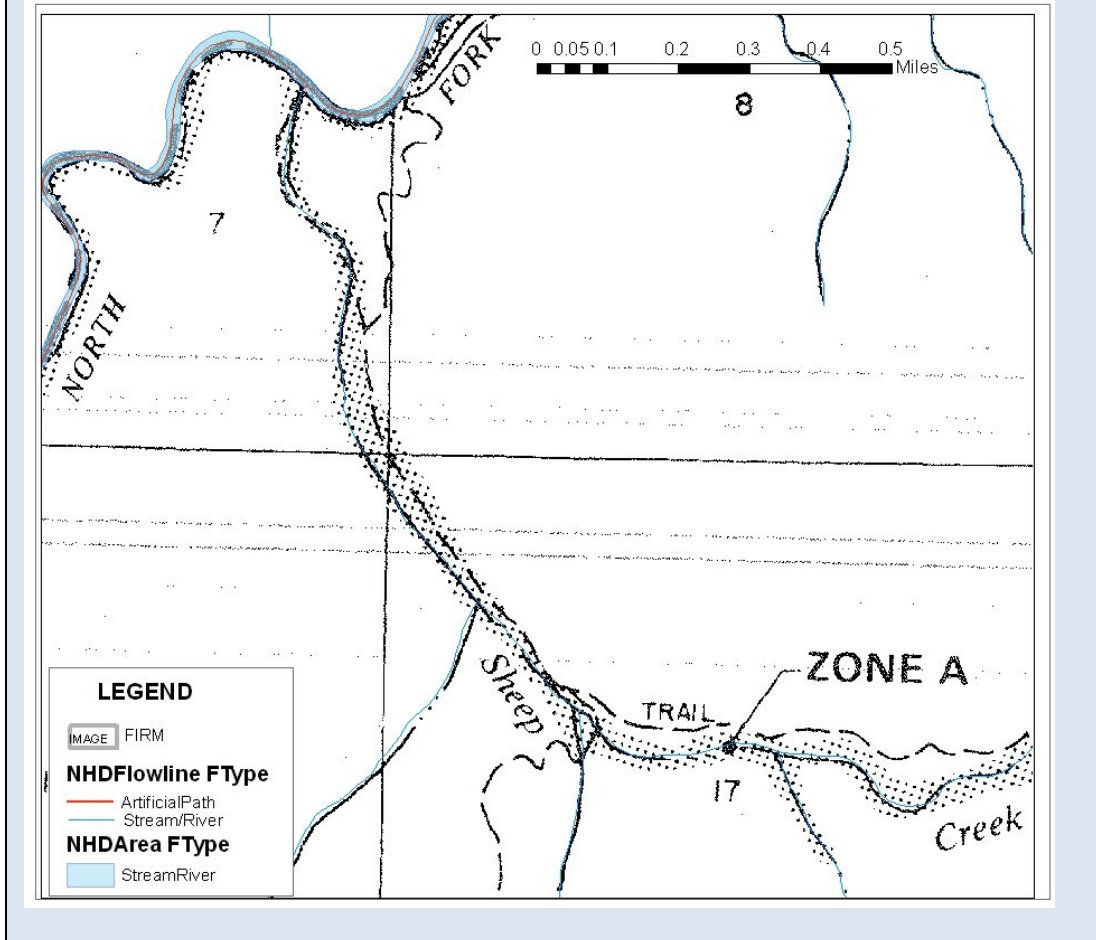


Figure 8: DFIRM Hydrography with NHD Flowlines

