## Annual Technical Report

# F14AC00227 Identifying and Prioritizing Barriers through Stream Mapping in the Mat-Su Borough

**Agreement Number:** F14AC00227
**Agreement Name:** *Identifying and Prioritizing Barriers through Stream Mapping in the Mat-Su Borough*
**Award Term:** 1/1/14-12/31/15
**Project Applicant Contact**:
Jim DePasquale
The Nature Conservancy
715 L Street Suite 100
Anchorage, AK 99501
jdepasquale@tnc.org
DUNS: 072656630

**Technical Progress Report**

**Introduction:**

The purpose of this report is to identify progress on an ongoing, multi-agency effort to update the USGS National Hydrographic Database (NHD) and the Alaska Hydrographic Database (AK Hydro) in the Mat-Su basin. Specifically, this report focuses on work accomplished under USFWS agreement *F14AC00227 Identifying and Prioritizing Barriers through Stream Mapping in the Mat-Su Borough.* Through this agreement, TNC has allocated USFWS funds supporting two key project phases in the Mat-Su hydrographic mapping program; systematic validation of elevation-derived flowlines through field observations and desktop analyses as well as conflation of validated stream geometry to the USGS NHD and the Alaska Hydrographic Database.

Two contractors were chosen to complete the tasks outlined in this agreement; St. Mary's University of Minnesota Geospatial Services Group (SMUMN) was engaged to conduct the systematic validation of elevation-derived flowlines and subsequent conflation to the NHD, and the Palmer Soil and Water Conservation District (PSWCD) was engaged to conduct field observations of modeled streams to support the validation process and assignation of stream classifications of intermittent, perennial and ephemeral. The following identifies progress for each of the tasks listed in this agreement.

**Task List and Progress**

**1. Create digital elevation model and stream/drainage lines within the area of interest**

***100% complete.*** A Mat-Su basin-wide (~25,000 square mile), five meter resolution DEM was created by merging elevation data from the Mat-Su LiDAR and Statewide Digital Mapping projects (*Figure 1*). The basin-wide DEM was subsequently hydro-conditioned and hydro-enforced to ensure that modeled flows across the digital landscape accurately reflect ground conditions. Hydro enforcement and conditioning was assisted by refining geometry and positioning of the ADF&G Culvert Database. ADF&G culvert locations were compared against recent, high-resolution Mat-Su aerial photography and elevation data and edited to a) more accurately describe the location of each culvert and b) more accurately describe the geometry of each culvert. Once ADF&G culvert data were modified, each culvert was "burned" into the underlying DEM to ensure that modeled flow is as accurate as possible (See Appendix A for further information).

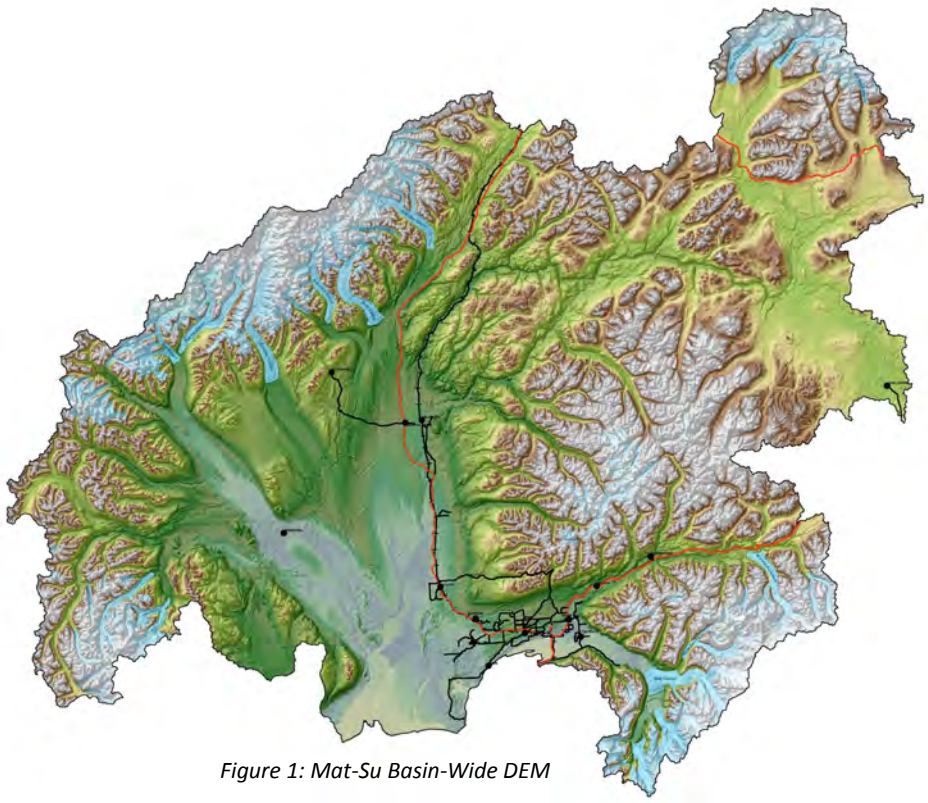


*Figure 1: Mat-Su Basin-Wide DEM*

Next, a preliminary draft of a Mat-Su basin-wide synthetic model of drainage lines was developed *(Figure 2).* The synthetic stream model presents over 100,000 lineal miles of streams in the Mat-Su basin. The modeled drainage lines were developed in a custom FORTRAN application by TerrainWorks, Inc. It should be noted that Mat-Su local experts and agency staff agree that the code and processing capability provided by TerrainWorks resulted in a flow model which is superior in accuracy to flowlines produced by commercial off the shelf modeling applications. As NHD Updates occur throughout Alaska following the availability of new elevation data from the Statewide Digital Mapping Initiative, we recommend this method of modeling elevation derived streams in the future.

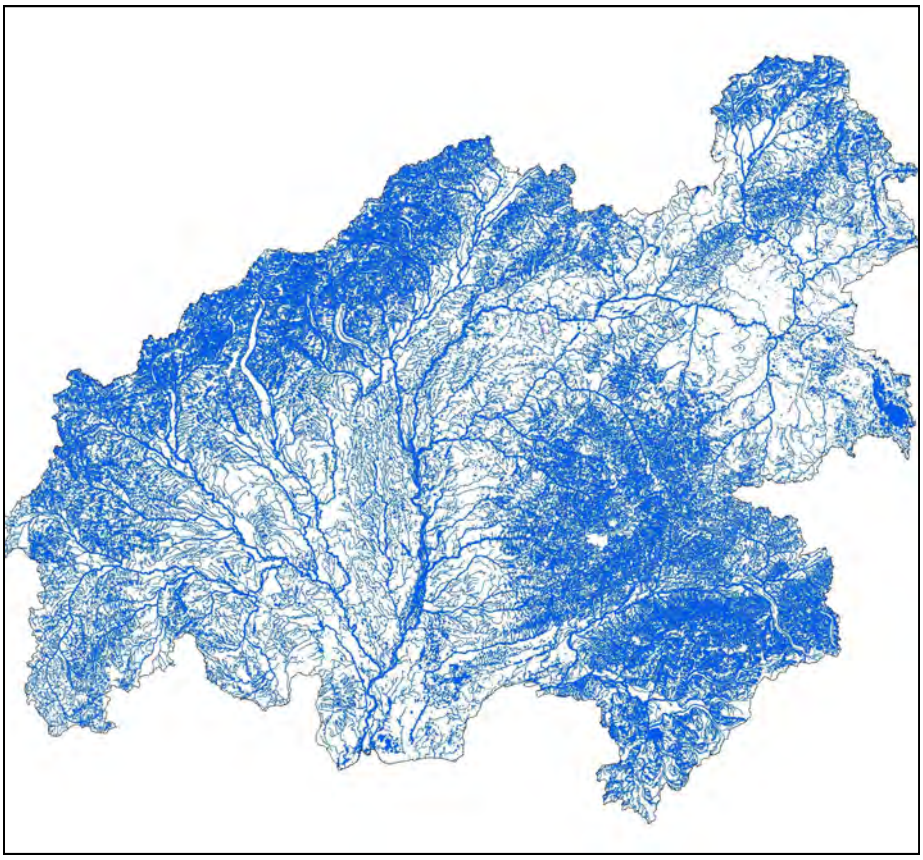


*Figure 2: Mat-Su basin-Wide Synthetic Drainage Lines*

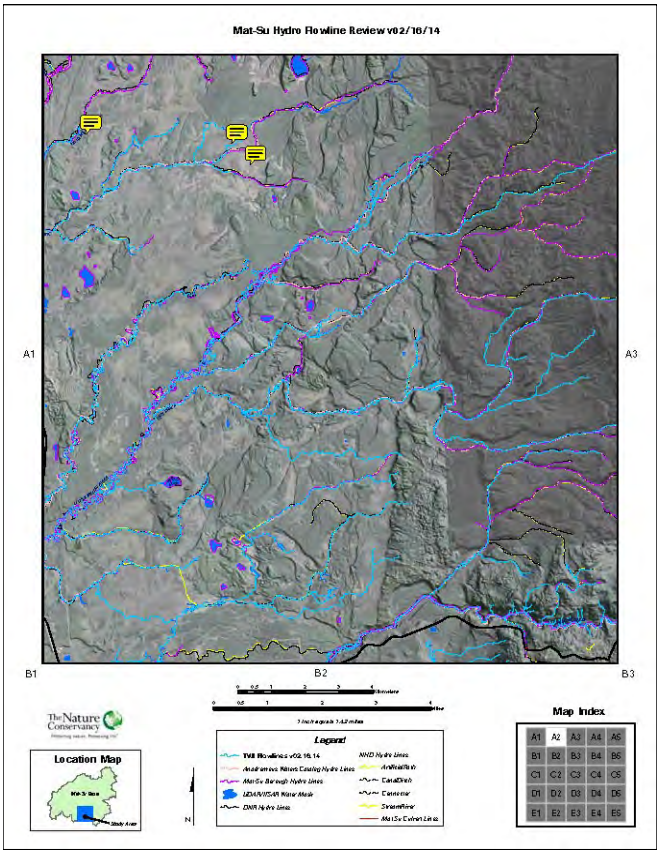



*Figure 3: Data Used For Expert Review of Synthetic Stream Model*

**2. Compare new stream lines to existing stream lines for accuracy and calibrate model**

***100% Complete.*** Before the modeled drainage lines were considered ready for validation and conflation tasks, three iterations of the model were developed which were successively reviewed by a group of local experts familiar with Mat-Su hydrologic systems. During each iteration, local experts were provided with existing hydrographic data sets as well as high resolution aerial photography and topographic relief which were used as a comparison to the newly modeled drainage lines *(Figure 3).* Experts were invited to comment on situations where the model appeared to accurately place drainage lines and where the model needed improvement. After the third iteration of the model, it was agreed that model parameters were calibrated to the best of our ability and systematic validation of the model was initiated.

**3. Perform quality control and assurance on the new stream lines by verifying with imagery stream locations, identify drainage vs. perennial streams, ensure topology and connectivity are consistent, create standard attributes and ensure streamlines conform to AK Hydro data model and NHD data model**
***Pilot Project Area: 100% Complete. Outlying Areas: Ongoing.***

On July 1, 2014, SMUMN initiated a systematic validation of newly modeled Mat-Su stream lines, including review of the geometric configuration and the spatial accuracy of the derived line work using reference spatial datasets available for the Mat-Su basin including: SDMI SPOT 5, LiDAR, LiDAR collected reflectance imagery, Mat-Su LiDAR mission high resolution aerial imagery, IfSAR ORI and IfSAR DTM. The horizontal accuracy of the spatial datasets produced by this validation process meets the National Map Accuracy Standard (NMAS) of +/- 12 meters for 1:24,000 scale map data. Stream classifications "intermittent", "perennial" and "ephemeral" and validated initiation points are assigned to modeled hydrography throughout the project area based on conclusions, parameters and rules drawn from field validation exercises conducted by project staff and partnering organizations during the summer of 2014.

Once stream geometry is validated, SMUMN applies a series of QAQC, topological and database schema checks to ensure the data are prepared for the AK Hydro Database as well as applying the USGS NHD Edit Tools to ensure errorless conflation to the USGS National Hydrographic Database.

**4. Perform targeted field verification during summer months**
***100% Complete.*** On July 1, 2014, the Palmer Soil and Water Conservation District (PSWCD) began field verification of modeled stream lines which progressed through the summer months of 2014. Field operations required that PSWCD staff navigate to stream locations previously identified by SMUMN (Figure 4) and make field observations in order to accurately assign stream initiation points as well as to collect data elements which guide the SMUMN team in the assignation of stream classifications intermittent, perennial and ephemeral. Further, during the week of July 18, 2014, staff from SMUMN joined PSWCD and TNC staff for one week of field observations. This week included one day of rotary wing, aerial reconnaissance in which data for 24 locations not approachable on the ground was collected by SMUMN staff.

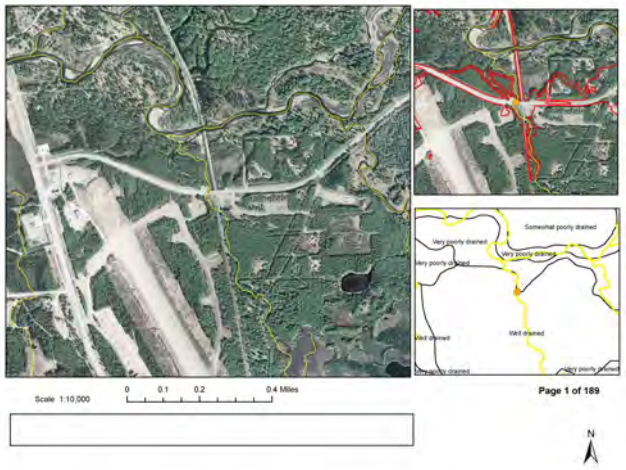



*Figure 4: Field map Used for Stream Validation*

**5. Conflate the new stream layer to the USGS NHD**
***Pilot Project Area: 100% Complete. Outlying Areas: Ongoing.*** The pilot project area has been successfully conflated to the NHD without error. Outlying areas will be conflated to the NHD over the next several months. It should be noted that the accuracy and resolution of the validated stream geometry is high enough to warrant a global replacement of existing NHD stream geometry throughout the entire Mat-Su basin, rather than retain existing stream geometry.

**6. ID areas of potential new barriers**

***50% Complete (pending final validation of modeled streams).*** To identify potential new barriers a GIS model was developed which considered the following three gradient criteria for fish passage barriers:

i) 1200 foot stream segments exceeding 8% gradient for salmon
ii) 500 foot stream segments exceeding 16% for cutthroat trout
iii) Waterfall barriers: 4 meters relief over a 10 meter stream segment

Because the stream network produced by the Mat-Su NHD Update was predicated on high resolution elevation data, we have a unique opportunity to model barriers to fish passage at the base resolution of the collateral datasets used to derive the streams themselves. The modeled streams are built upon a nodal framework where "nodes" are represented by the center of the DEM cell meeting the flow accumulation threshold for stream initiation. Eventually, stream nodes become vertices and are combined to form linear segments, or reaches. However, nodes can be also used to identify gradient thresholds at the highest resolution possible, which is 5 meters (the resolution of the DEM used to model the streams).

Currently, the barrier criteria have been applied to the basin-wide stream model. The result is a point feature class where points meeting barrier criteria are grouped by each of the three criteria. However, in order to avoid "false positive" barriers, TNC recommends waiting until the entire Mat-Su basin has been through the validation process so as to ensure that the barrier model is not performed on streams which are pruned or otherwise modified through the validation process. Validation of stream geometry (exclusive of conflation tasks) should be complete by September, 2015. Further, a geoprocessing tool in the NetMap GIS application, developed by TerrainWorks, Inc., was developed which incorporates each of the three barrier criteria so that this exercise may be repeated in the future or applied to other locations.

**7. Create excel sheet of ADFG barrier numbers and calculated upstream miles per ADFG/FWS methodology**

*0 % Complete (pending final validation of modeled streams):* This task has been assigned to the Palmer Soil and Water Conservation District and will be completed once the modeled stream geometry has passed the validation process. Computing upstream lineal miles using the validated streams will ensure accurate mileage values.

**8. Perform at least two outreach events for the MatSu Salmon Partnership and MatSu Borough to inform the public and agencies of the new streams**

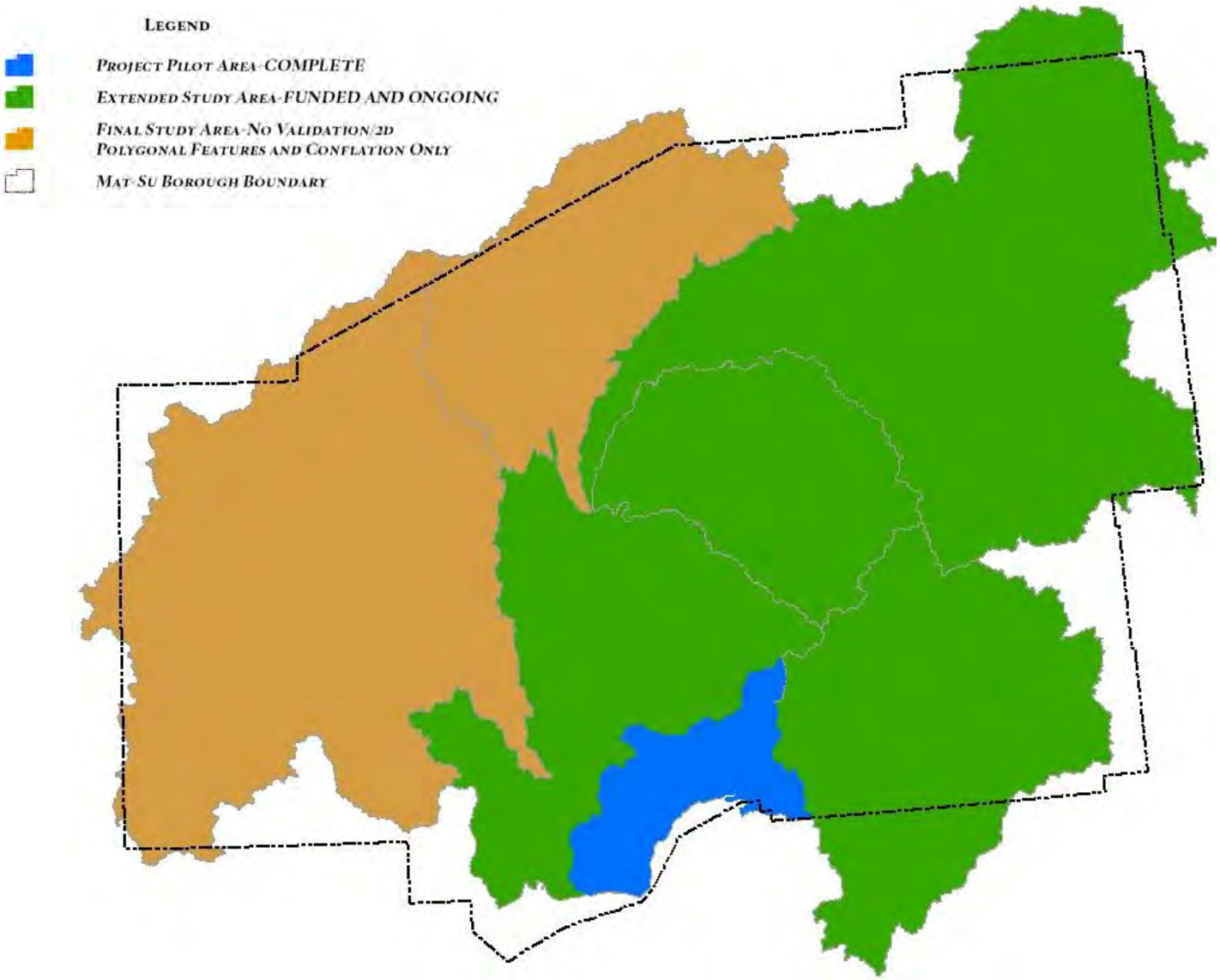
***100% Complete.*** During the duration of this agreement, a total of nine outreach events have been conducted to inform the public and agencies of this work. Two of these were specifically funded through this agreement and identified by asterisks below.

**A. October 22, 2014:** TNC, TerrainWorks and ADF&G sponsored and hosted a NetMap workshop using the new Mat-Su data at the University of Alaska Southeast GIS Lab in Juneau following the 2014 Alaska AFS/AWRA Conference.
**B. October 30, 2014:** TNC Spatial Ecologist Jim DePasquale presented the NHD Update to several members of EPA Region 10 Staff.
**C. November 17, 2014:** TNC Spatial Ecologist Jim DePasquale presented the NHD Update to the Mat-Su Borough GIS Division and the Mat-Su Borough Chief Information Officer
**D. *November 18, 2014:** Contractor St. Mary's University of Minnesota Geospatial Working Group presents on the Mat-Su NHD Update to the 2014 Mat-Su Fish Habitat Partnership Science Symposium (presentation session).
**E. November 18, 2014:** Contractor TerrainWorks, Inc. presents on the Mat-Su NHD Update to the 2014 Mat-Su Fish Habitat Partnership Science Symposium (presentation session).
**F. *November 18, 2014:** Contractor Palmer Soil and Water Conservation District presents on the Mat-Su NHD Update to the 2014 Mat-Su Fish Habitat Partnership Science Symposium (poster session).
**G. November 20, 2014:** TNC, TerrainWorks and ADF&G sponsored and hosted a NetMap workshop using the new Mat-Su data at the Alaska Pacific University GIS Lab in Anchorage following the 2014 Mat-Su FHP Science Symposium.
**H. January 22, 2015:** TNC Marketing Specialist Dustin Solberg authored a news article on the Mat-Su NHD Update; as of this report we are working with the Anchorage Daily News with hopes of publishing the article this spring.
**I. February 17, 2015:** Contractor St. Mary's University of Minnesota Geospatial Working Group presents on the Mat-Su NHD Update and other Alaska NHD updates to the Alaska Surveying and Mapping Conference.

**Progress Map**

The following map demonstrates validation and conflation progress for the time period 07/01/14 to the present. TNC initially engaged St. Mary's University of Minnesota to perform validation and conflation tasks on a pilot area comprised of three, USGS HUC 10 polygons and covering the Mat-Su Borough "Core Planning Area". This pilot area is represented in blue in the graphic below and was chosen as a proof of concept, allowing SMUMN to accurately determine a budget and schedule to perform validation tasks on surrounding areas of the basin and to refine technical workflows for the validation and conflation tasks. All Validation and conflation tasks for the pilot area were completed in November, 2014.

Since then, an extended study area (in green below) was identified and SMUMN is progressing with validation and conflation of the extended study area on schedule using funds made available through this agreement. An area in the western region of the Mat-Su basin consisting of USGS 8-digit HUC's for the Yentna and Chulitna basins is being reserved as the "final study area". As of 03.15.15, the Final Study Area faced a $50,000 budget shortfall: $30,000 for validation tasks and $20,000 for QA/QC of 2d polygonal features and conflation to the NHD and AK Hydro programs. TNC has agreed to contribute funding in the amount of $20,000 in order to ensure the 2d polygonal features are captured and reviewed for quality control as well as ensuring network topologies of the 1d synthetic stream network and conflation to the NHD and AK hydro programs. In the meantime, TNC and partnering organizations will continue to seek funding to ensure the final study area is validated.



**Conclusions and Future Recommendations**

Recent availability of high resolution elevation data in Alaska through the Statewide Digital Mapping Initiative as well as local LiDAR projects creates an opportunity to revolutionize mapping and analysis of Alaska freshwater resources. The process of modeling elevation-derived flow networks and subsequent validation of modeled streams through expert review, field observations and desktop analyses provides an accurate and cost efficient path to populate or update high resolution state and federal hydrographic mapping programs. Furthermore, by modeling elevation derived streams, we create a hydrologic network which is implicitly tied to the terrain; this is not the case for much of the nationwide NHD which causes an abundance of costly mapping problems and lowers the analytic potential of the data. The stream-to-landscape relationship in the Mat-Su NHD update creates prospects for several derivative mapping projects, two of which are already under consideration; populating the first USGS/EPA NHDPLus database of its kind in Alaska, and mapping of the Mat-Su Active River Area, or topographical floodplain.

*NHDPLus*

NHDPLus is a database managed by the USGS and EPA consisting of high resolution NHD, the USGS Watershed Boundary Database, hydro-conditioned DEMs and a suite of value added datasets and models. The vision behind NHDPlus is the development of "integrated hydrography": to ensure that hydrography and digital elevation models are derived from the same high resolution source, such as LiDAR or IfSAR, and to provide analytic capabilities which allow users to concurrently analyze characteristics of both hydrography and its corresponding terrestrial drainage area, or catchment. A network of users, including TNC, the Alaska Hydrography Technical Working Group, the Kenai Watershed Forum and Horizon Systems are currently collaborating to produce an NHDPlus pilot project in the Mat-Su. Funded through a multi-state National Fish Habitat Partnership grant, the Mat-Su NHDPLus pilot project shares the same geographic area as the Mat-Su NHD update pilot project. Once the NHDPLus pilot project is complete, sponsoring organizations will work to fund NHDPlus throughout the entire Mat-Su basin. In the meantime, TNC is preparing three additional NHDPLus "modules" which are thematic groups of data and business tables coupled with the basic NHDPLus framework to extend NHDPLus analytic capabilities and decision support. The modules are; salmon habitat, economic geography of Mat-Su salmon and Mat-Su land use/human activities.

*Active River Area*

The Mat-Su basin experiences periodic flooding events which have resulted in loss of human life and property. Further, Mat-Su riparian wetlands and flood prone areas which provide essential flood regulating services, water quality services and salmon habitat have not been mapped, making it difficult for Mat-Su planners and developers to design projects which avoid conversion of high value riparian wetlands. Building on the components of the Mat-Su NHD update and NHDPLus, TNC and partnering organizations are assembling a project plan to initiate an Active River Area mapping project in the Mat-Su basin. Active River Area is a concept developed by TNC scientists which uses high resolution terrain and highly accurate hydrography to simulate the extent of floodplains, meander belts, terraces, material contribution areas and riparian wetlands. Active River Areas include both the river channels and the drainage areas necessary to accommodate the physical and ecological processes associated with the river system. In other words, the Active River Area represents the geography required for the river to function in ways necessary for it to function and provide services to natural systems and human communities.

Mapping of Active River Areas has provided communities, planners, regulators, conservationists and agency staff with a planning tool supporting a wide range of decisions such as erosion and flood management, water quality, infrastructure, transportation and zoning.

## Appendix A: DEM Conditioning Using Modified ADF&G Culvert Locations

Conditioning DEM's such that modeled hydrologic flows best represent ground conditions (and thus decrease validation labor costs) is an integral component of elevation-derived stream modeling. Without hydro-conditioned elevation data, modeled flowlines will require laborious editing and significantly increase validation and conflation costs.

DEM's for the Mat-SU NHD Update were hydro conditioned in the following manner:

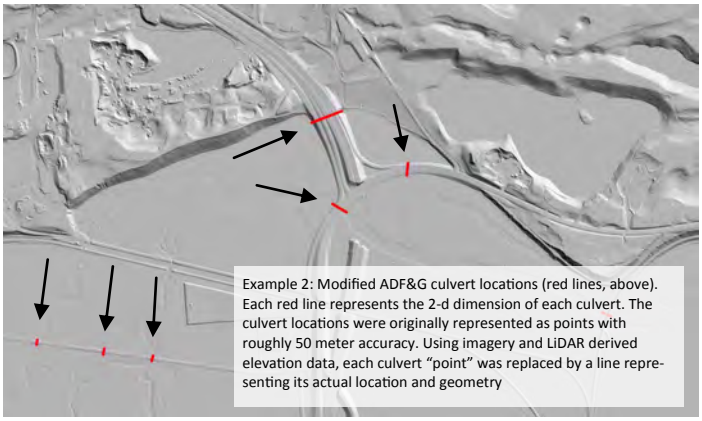
**Hydro Breaklines:** Elevation data from the Mat-Su LiDAR and SDMI projects were hydro flattened as a project deliverable. Hydro flattening requires that all lakes and streams meeting a minimum mapping area are hand-traced with closed polylines, or breaklines. Eventually, raw elevation data in water bodies are removed and replaced with synthetic elevations interpolated from vertices composing the hydro breaklines. The synthetic elevations are monotonic, they gradually decrease downstream.

**Bridges:** The Mat-Su LiDAR project encompasses the populated areas and road network of the Mat-Su basin. As a component of the Mat-Su LiDAR project, all major bridges spanning rivers were removed from the DEM's.

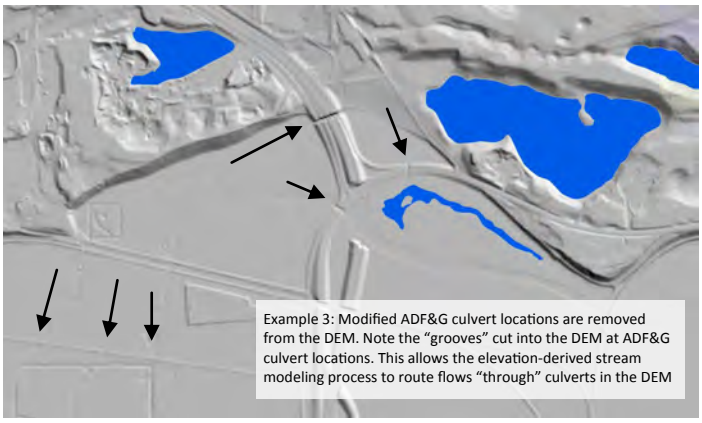
**Culverts:** Once ADF&G culvert locations were modified to best reflect their location and geometry (2-d dimensions), TWI, Inc., used custom FORTRAN code to remove a "notch" in the DEM at each culvert location. This allows flow to accumulate in culvert locations and ultimately results in the accurate placement of modeled flowlines.

**Final, Hydro-Conditioned DEM:** Once the DEM is fully hydro conditioned, it is the process of modeling elevation-derived flowlines, or synthetic streams, can begin. The custom FORTRAN code written by TWI, Inc. for modeling flowlines identifies flow direction and flow accumulation for each DEM cell and "builds" a flow network of lines which are placed on DEM channels where streams are likeliest to exist. This makes the validation process considerably simpler, and less expensive, as fewer modeled lines require pruning and editing. Further, by implicitly tying culvert locations to the flow network, we will be able to accurately conduct analyses on flows through specific culverts such as upstream aggregation of lineal stream miles. This can help agencies prioritize culverts for replacement and fish passage considerations.

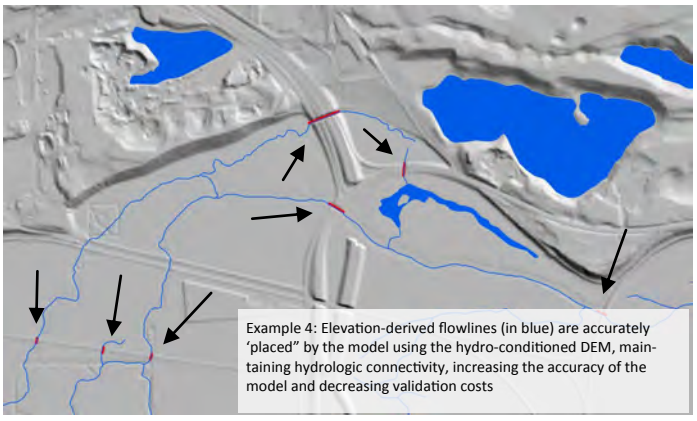
Example 1: Aerial Photo of Parks/Glenn Highway Interchange. There are multiple culverts in this area.



Example 2: Modified ADF&G culvert locations (red lines, above). Each red line represents the 2-d dimension of each culvert. The culvert locations were originally represented as points with roughly 50 meter accuracy. Using imagery and LiDAR derived elevation data, each culvert "point" was replaced by a line representing its actual location and geometry



Example 3: Modified ADF&G culvert locations are removed from the DEM. Note the "grooves" cut into the DEM at ADF&G culvert locations. This allows the elevation-derived stream modeling process to route flows "through" culverts in the DEM



Example 4: Elevation-derived flowlines (in blue) are accurately 'placed" by the model using the hydro-conditioned DEM, maintaining hydrologic connectivity, increasing the accuracy of the model and decreasing validation costs

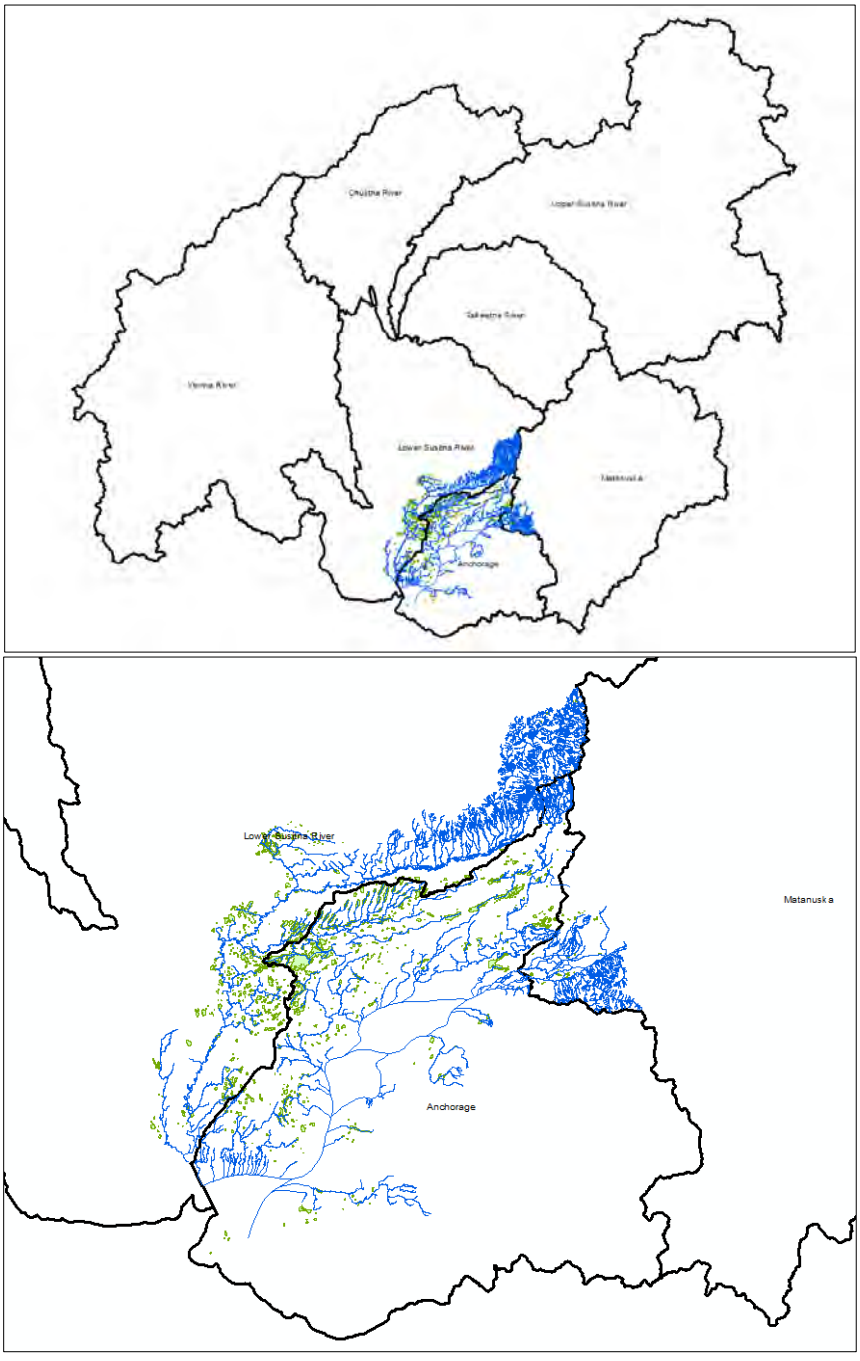
## Appendix B: Contracting Organization Progress Reports

Contracting organizations funded through this agreement are required to periodically report their progress to TNC. Following are three progress reports; one submitted by the PSWCD after the summer, 2014 field season and two from SMUMN which identify progress on validation and conflation tasks.

As of this report, both organizations have been on schedule and met or exceeded expectations for all tasks in this agreement. In particular, Andy Robertson, Jeffrey Knopf and the team at SMUMN have been uniquely professional and capable. They have determined intelligent, cost-efficient solutions to many complex problems and clearly have broad experience in mapping Alaska's freshwater resources. TNC recommends that SMUMN continue to play a strong role in mapping Alaska's freshwater resources in the future.

**Matanuska Susitna Watershed Progress Report: March 1, 2015**

In the summer of 2014 SMUMN began work on the validation of hydrologic features for the Mat-Su watershed. The Mat-Su watershed covers six 8 digit hydrologic unit codes (HUCs) or HUC8's and part of a seventh (Anchorage) in the southern portion of the study area.

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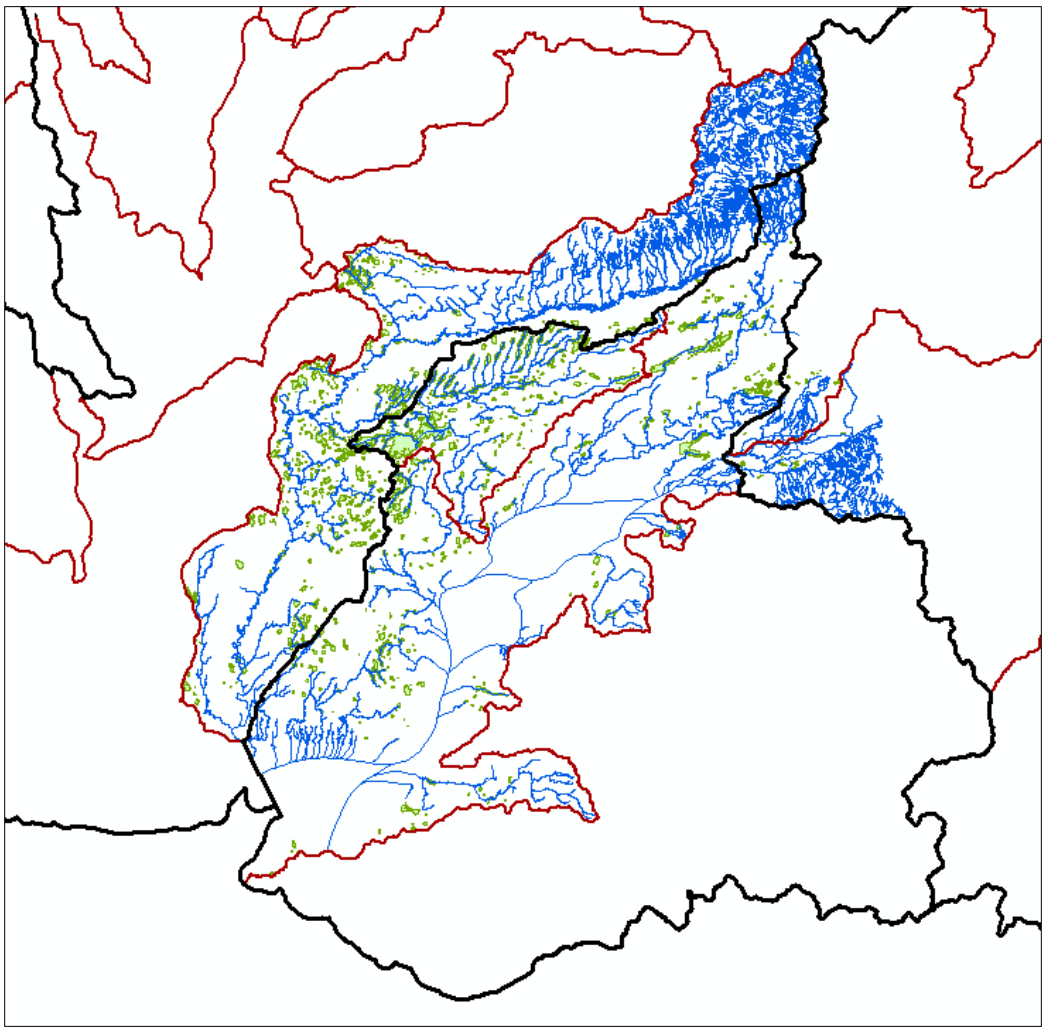
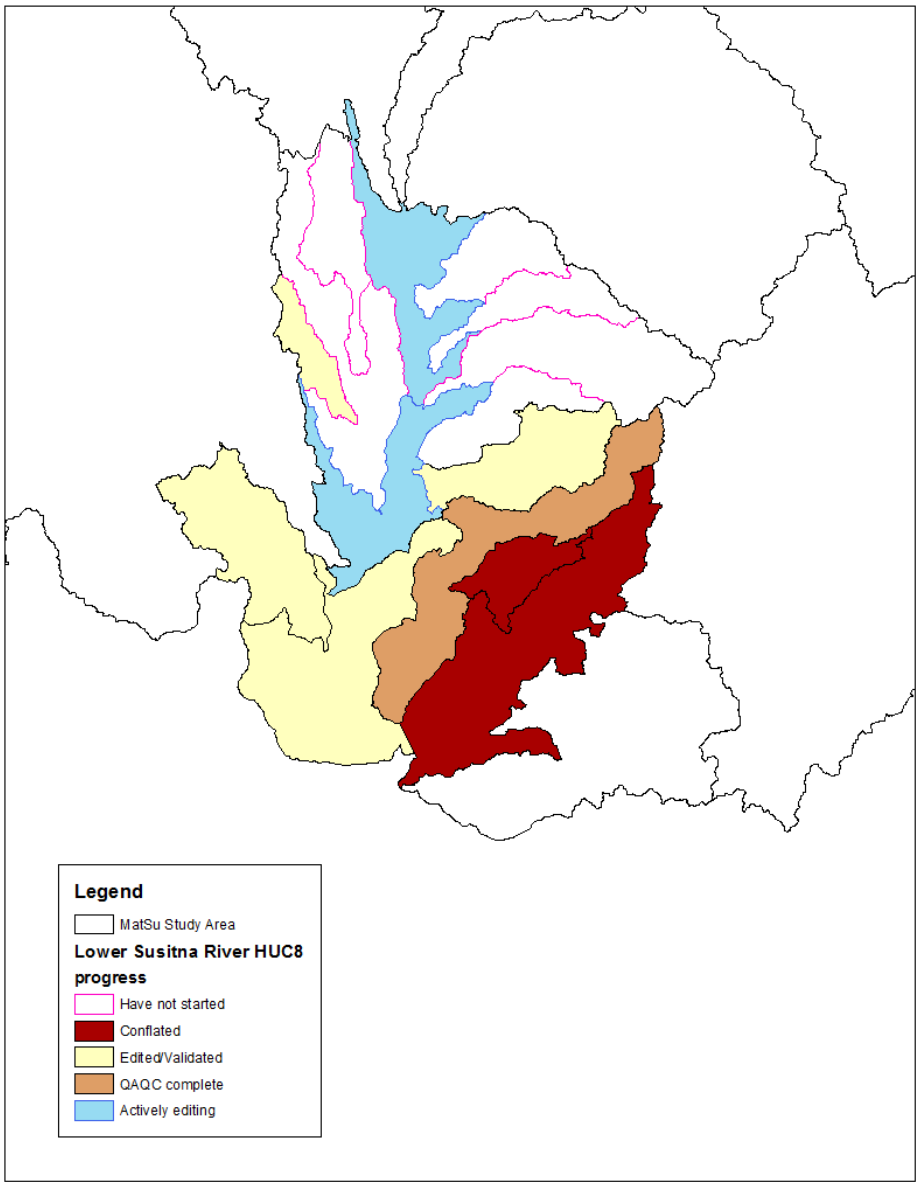
The pilot project for this large endeavor was the mapping of three 10 digit HUCs or HUC10's. They were comprised of roughly 9,000 features with approximately 2,000 miles of linear network.



Because the USGS conflate tools works best on a HUC8 sized area, the data was split into parts to coincide with the HUC8 boundaries. In the case of the pilot project the HUC8, Anchorage, contained two of the HUC10's (Fish Creek and City of Anchorage-Frontal Cook Inlet referred to as Goose Bay) validated in the pilot process. The third HUC10 (Little Susitna River) was part of the Lower Susitna River HUC8 and will be conflated with the group of HUC10's within the Lower Susitna River.

After the pilot project area was completed SMUMN discussed with TNC as to where to continue with validation. It was determined that we would follow the Susitna River north through the Lower Susitna River HUC8.

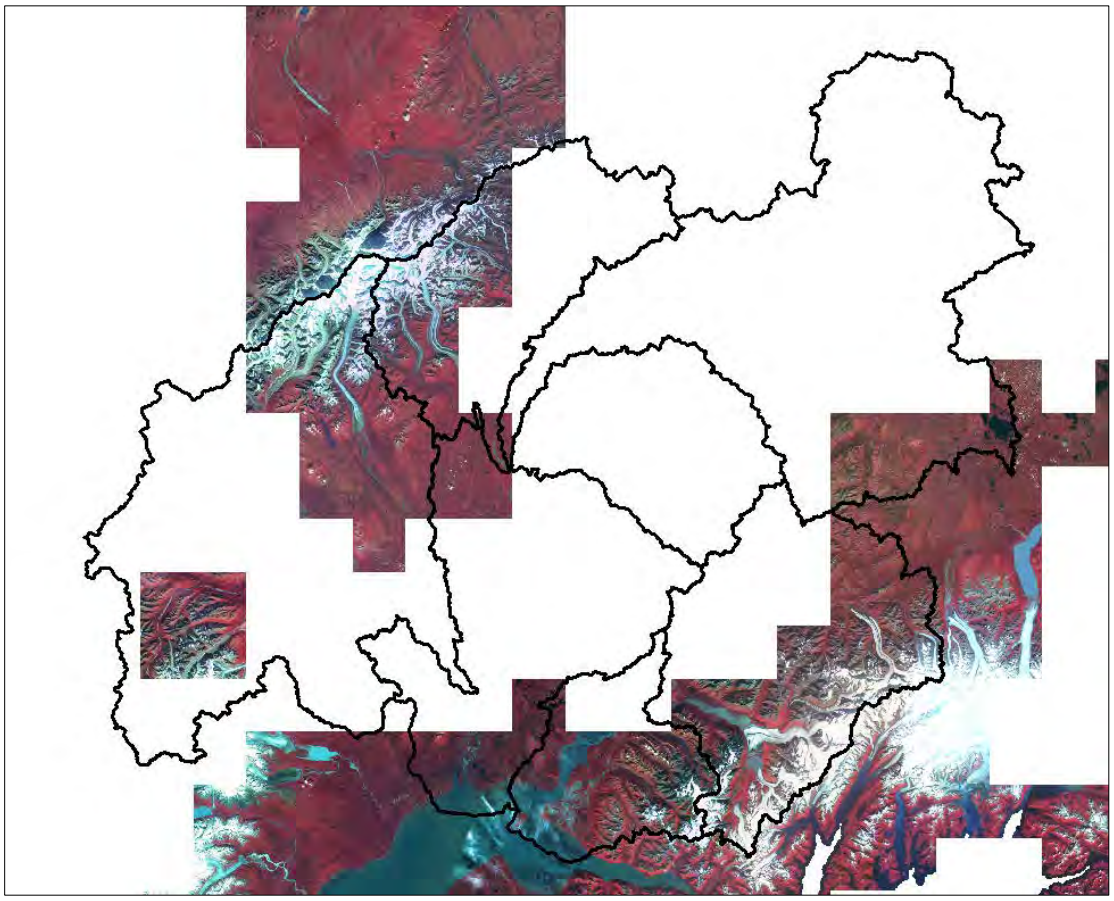
The progress of validation to date is shown in the following map.



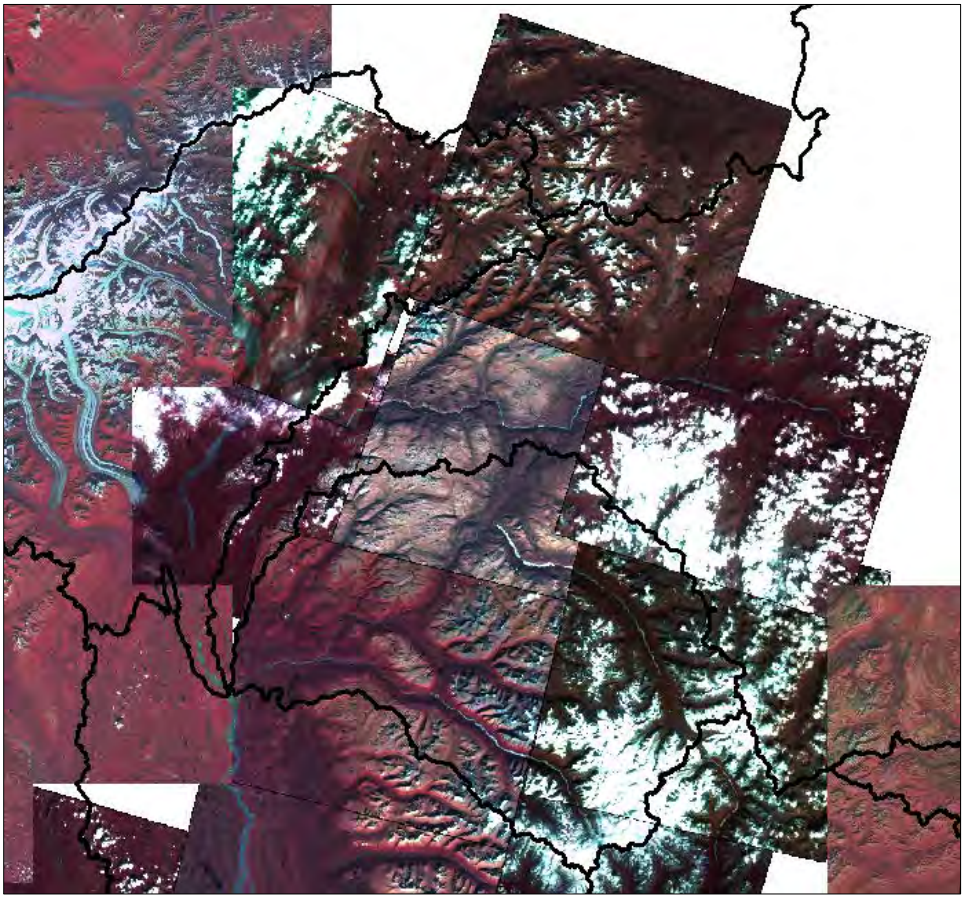

The dark red HUC10s are conflated and part of the master database. QAQC (quality assessment/quality control) completed means that the validation has been finished and ran through the quality control processes and are ready for the conflate process as soon as the remainder of the HUC10's are completed for the Lower Susitna River HUC8. Validated geodatabases have the features edited and ready for QAQC. Actively editing refers to a HUC10 that has been assigned and is being validated by an editor.

As high resolution imagery and digital elevation models were only acquired for a portion of the watershed, we have to use alternative sources of base imagery and collateral elevation data. It was agreed upon to use the SPOT 5 imagery and the IfSAR elevation data being collected for the

State of Alaska. The problem we encountered is that the SPOT 5 imagery is not completely processed for all parts of the State.



In those areas missing base imagery SMUMN aquired the raw (original) SPOT 5 scenes from Geogrpahic Information Network of Alaska (GINA) and orthorectified them using the staellite derived GPS files and IfSAR elevation models. This process was done for both the multi-spectral and panchromatic images in order to create pan-sharpened images that we could use as a collateral reference. Currently we have 12 pan-sharpended images and are working on others as the estimated time line for completion of SPOT 5 in the Mat-Su watershed is not known.



As we progress though this project our intention is to conflate completely validated and QAQC’ed HUC8’s versus waiting until the end of the validation process.

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**TNC Contract Number:**
**AKFO-070114a-JD**

# Systematic Validation and Quality Control of Digital Hydrography in the Mat-Su Basin

***Status Report 06/26/14 – 08/31/14***

- **Project(s) Title:** Systematic Validation and Quality Control of Digital Hydrography in the Mat-Su Basin
  - **Contract #:** AKFO-070114a-JD

- **Contractor:** Saint Mary's University of Minnesota, GeoSpatial Services
  - **Administrative Lead:** Andrew Robertson, Associate Director
    - email: aroberts@smumn.edu
  - **Project Manager:** Jeffrey Knopf, Senior GIS Analyst
    - email: jcknop01@smumn.edu
  - **IT Support:** Barb Featherly, GIS Application Developer
    - email: bxfeat05@smumn.edu
  - **QA/QC Specialist:** David Rokus, GIS Analyst
    - email: ddroku04@smumn.edu

- **Project Area (if applicable):** The Matanuska-Susitna Basin is a large, 25,500 square mile watershed area in south-central Alaska. The basin is approximately the combined size of Vermont, New Hampshire and Massachusetts (see attached map). In the fall of 2013, The Nature Conservancy initiated a hydrographic mapping and analysis program in the Mat-Su basin using newly available data to map all lakes, rivers and streams to a level of quality and technical specification suitable for ingestion into the USGS National Hydrographic Database. By meeting federal standards, this mapping program is freely available for use by government agencies, private and public organizations to support decisions which affect Mat-Su freshwater resources.
  - **Project Extent to be Mapped:** 16.3 M acres, +/- 25,500 square miles
  - **Website:**http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/alaska/placesweprotect/matanuska-susitna-basin.xml
  - **Other Project Area Comments:**

- **Websites**
  - **Contractor Website:** http://www.geospatialservices.org/

- **Agency**
  **Website:** http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/alaska/index.htm

- **Accomplishments Narrative**
  - **Administrative:** Administrative duties during this period of the contract were focused on: developing a comprehensive scope of work for the various aspects of the project; preparing a contract for delivery of services; interacting with project partners to secure commitments for project support and funding; and; finalizing field logistics for a week long data validation field trip to the Mat-Su Basin in mid-July, 2014. Additional activities included: assigning project responsibilities; ensuring that project activities were being completed on time and within budget; preparation of the draft interim reports; and, reconciling project expense.

    Numerous discussions and conferences calls were arranged during the period covered by this report in order to define the scope of work, validate mapping procedures, review sample hydrography data, assemble collateral spatial layers for incorporation in the mapping protocols and prepare for upcoming project milestones. Specific decisions during this period included:
    - Collateral data to be used in support of hydrography validation will include: SDMI IfSAR elevation data (DTM, DSM and ORI); SDMI SPOT5 spectral imagery; Mat-Su LiDAR based DSM and DTM; Derived Hillshade; Contours; Soils; Mat-Su LiDAR reflectance imagery; Mat-Su LiDAR mission spectral imagery; any existing Mat-Su basin stream, lake and culvert datasets; existing 2D break line data from IfSAR and LiDAR data collection processes; current AWC data from Alaska Fish and Game; PSWCD-USFWS Centerline Data; Reach possible flow; DNR Hydro; existing Mat-Su Basin wetland data (NWI, Gracz).
    - Attempts will be made classify single line streams into the following categories: perennial, intermittent and ephemeral. It was determined through the field validation exercise that most, if not all, streams in the basin are characterized by intermittent and perennial flow due to rainfall and snowmelt amounts. As a result, the ephemeral categorization will be reserved for the very limited number of streams that can truly be established to have ephemeral flow.

  - **Data and Geodatabases:** Primary and collateral data layers were provided to GSS via hard drive delivery from TNC in early July 2014. These datasets were loaded on servers at Saint Mary's University and prepped for future project activities.

- **Field Validation:** The week of July 14-18 SMU staff were in Alaska conducting fieldwork with the Palmer Soil and Water Conservation District personnel. We split our efforts to examine areas of high terrain, flat wetlands, and urbanization to get an understanding of the terrain and the validity of the flow network. Although the main focus at this point is the Goose Bay watershed, field work was conducted in a variety of locations. The team also had the opportunity to do some helicopter work. This trip originated from Talkeetna airport. Field sites were entered in the GPS to navigate from site to site. While in the field SMU used maps to document what was occurring at the field sites.

- **Goose Bay Trial:** The maps and knowledge gained in the field are being used to validate, edit and add to the linear network in the Goose Bay watershed. Many of the edits to the linears are done, approximately 90%. SMU has sent additional field points to the PSWCD to verify questions that came up while editing. At this time we are waiting for feedback on those areas. In the meantime SMU is working on the field reports.

- **Challenges, Lessons Learned, Opportunities for Improvement:** In general, the derived flowlines represent a reasonably accurate depiction of the surface hydrology. In some cases surface flow is over-represented and in others valid streams have been missed. We have seen some anomalies in the flow network as it corresponds to the elevation data. This was somewhat expected in the flat areas, however, it is being seen in elevated areas and along river corridors. In one example below (Attachment 3) the yellow arrow points to a valid flowline that was not captured. In addition, we have found numerous locations where the derived hydrography does not follow slope breaks in the contours derived from the composite digital elevation model (DEM). These specific issues will be reviewed in an upcoming conference call with TNC once edits to the Goose Bay trial watershed are complete.

- **Maps (screen capture, link, or attach graphics (jpg preferred)**
  - **Project Study Area and Field Photos:**
    - See attached graphics below

- **Outreach**
  - **Presentations:** An overview of the project was included in a webinar presentation to Association of State Wetland Managers Wetland Mapping Consortium on 06/25/14.

- **Budget**
  - **Current budget allocated for the project:** $31,475.00

- **Expenditures as of 07/31/2014**
  - **Federal Expenditures Invoiced:** $18,497.69
  - **Match Expenditures Invoiced:** $0.00
  - **Accumulated Time to Invoice:** +/- $10,000.00
- **Budget Remaining as of 01/31/2014**
  - **Federal Expenditures:** $31,030.02
  - **Match Expenditures:** $0.00
- **FTE's employed working on the project:** 3
- **Payments Received from NMED**
  - $18,497.69 **Date:** TBD
- **Other Budget Comments and Forecast**
  - Next invoice anticipated for 08/31/2014

- **Final Comments/Suggestions:** The Mat-Su hydrographic mapping program consists of two phases; a modeling phase and a validation phase. The modeling phase employs newly-available LiDAR and IfSAR elevation data to create an elevation-derived, synthetic network of hydrologic flowlines, or streams, in the Mat-Su basin. The validation phase consists of a third party, independent photogrammetric review of modeled streams coupled with field observations which ensure that modeled streams best reflect actual ground conditions. Once validated through these processes, the Mat-Su stream network will be conflated to the USGS NHD and AK Hydro data schema following USGS specifications for 1:24,000 scale mapping.

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**TNC Contract Number:**
**AKFO-070114a-JD**

**Attachment 1:**
**Project Study Area Map**

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**Attachment 2:**
**Field Trip Photo Samples**

**Attachment 3:**
**Challenges**

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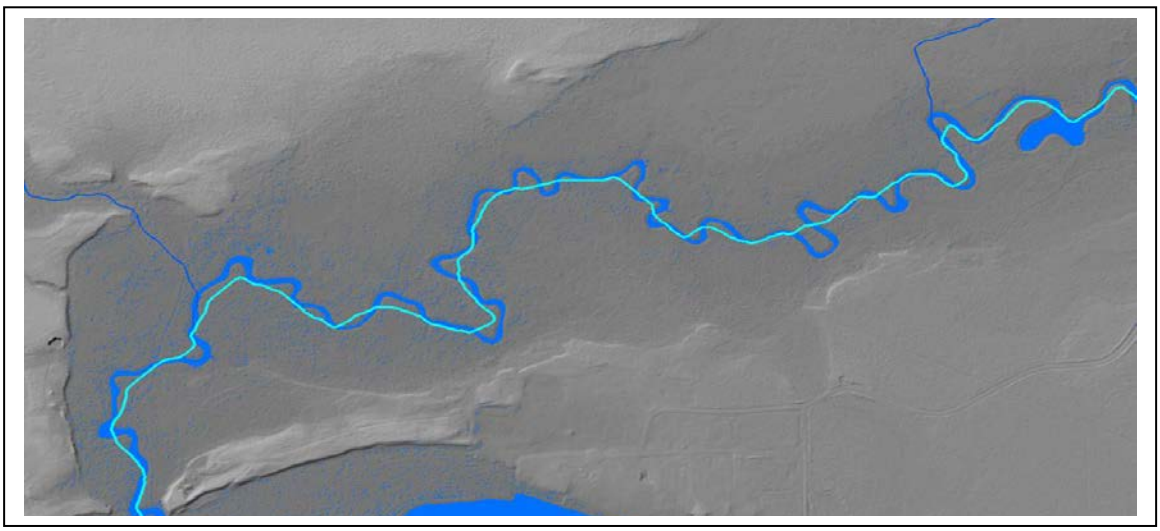

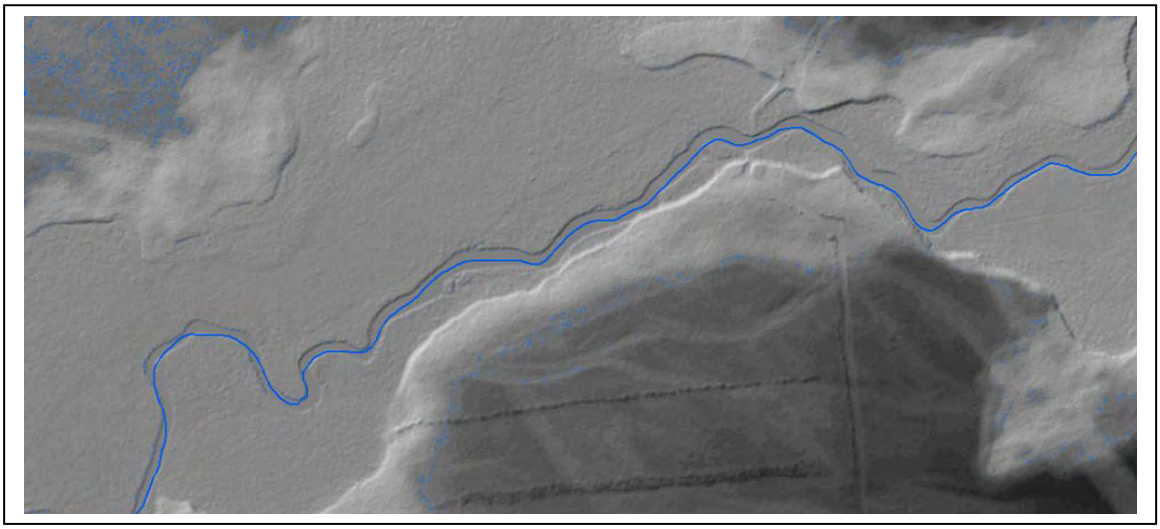

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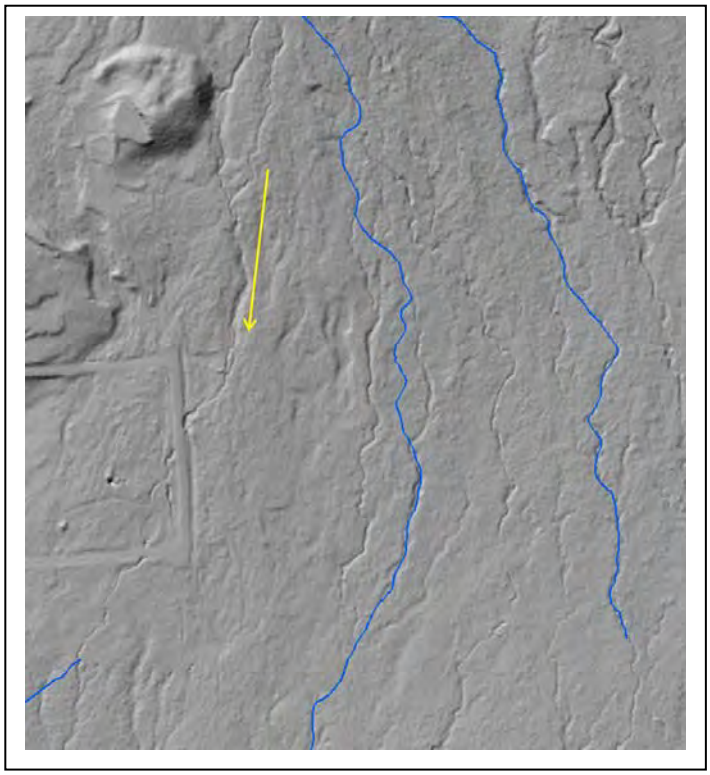

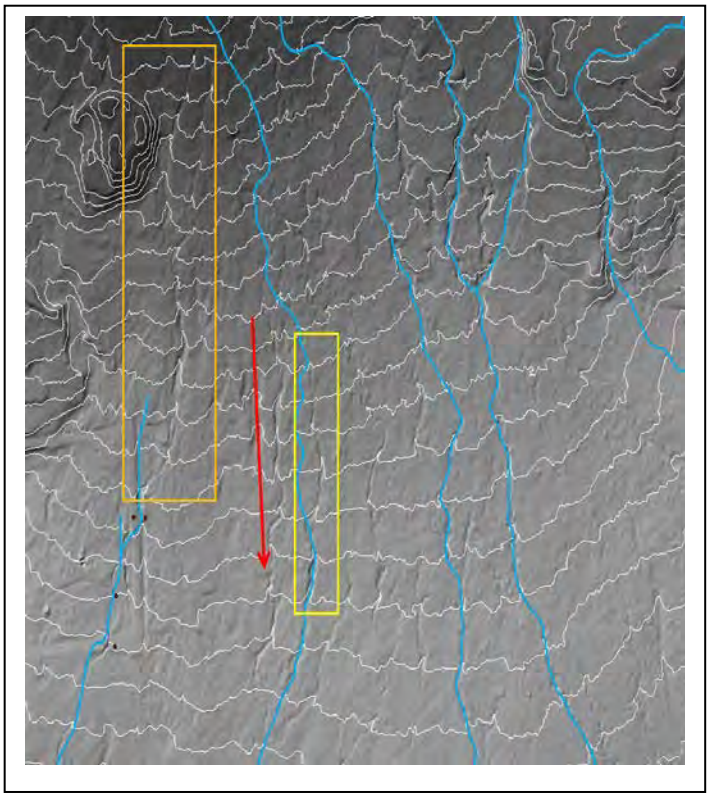

**GEOSPATIAL SERVICES • SAINT MARY'S UNIVERSITY OF MINNESOTA**
360 Vila Street • Box 7 • Winona, MN 55987-2440 USA • 507-457-8746 • Fax 507-457-6604 • www.geospatialservices.org

**Palmer Soil & Water Conservation District**
**101 W. Arctic Ave. Suite D. Palmer Alaska 99645**
**Phone: (907) 745-1441 • Fax: (907) 745-1443**

**Date:** August 29th, 2014
**Reporting Period:** 7/1/14 – 8/29/14 Project Update
**Project Title:** 2014 Matanuska-Susitna Basin Hydrographic Mapping Program: Field Validation of Elevation-Derived Streams and Fish Passage Barriers

The PSWCD MAT-Su Hydro Mapping field crew (Primarily Gooseberry Peter and Rachel Bobka) has surveyed modeled streams across the valley, from Hatcher's Pass to Pt. MacKenzie and from the Chugach Range to Meadow Lakes. The total number of data points (wetted streams necessitating measurements) recorded thus far is 49 (Figure 1). In addition to the GPS data taken, the field crew has hand drawn recorded observations, notes and hydrographic data on the GIS maps where appropriate. Particularly, observations and notes have been hand recorded directly onto the aerial imagery maps to express the absence of recordable data (non-existent culverts and stream channels) and to capture/illustrate information beyond that recorded in the data forms on the GPS unit (stream direction if different than modeled, cultural impacts and anecdotal information).

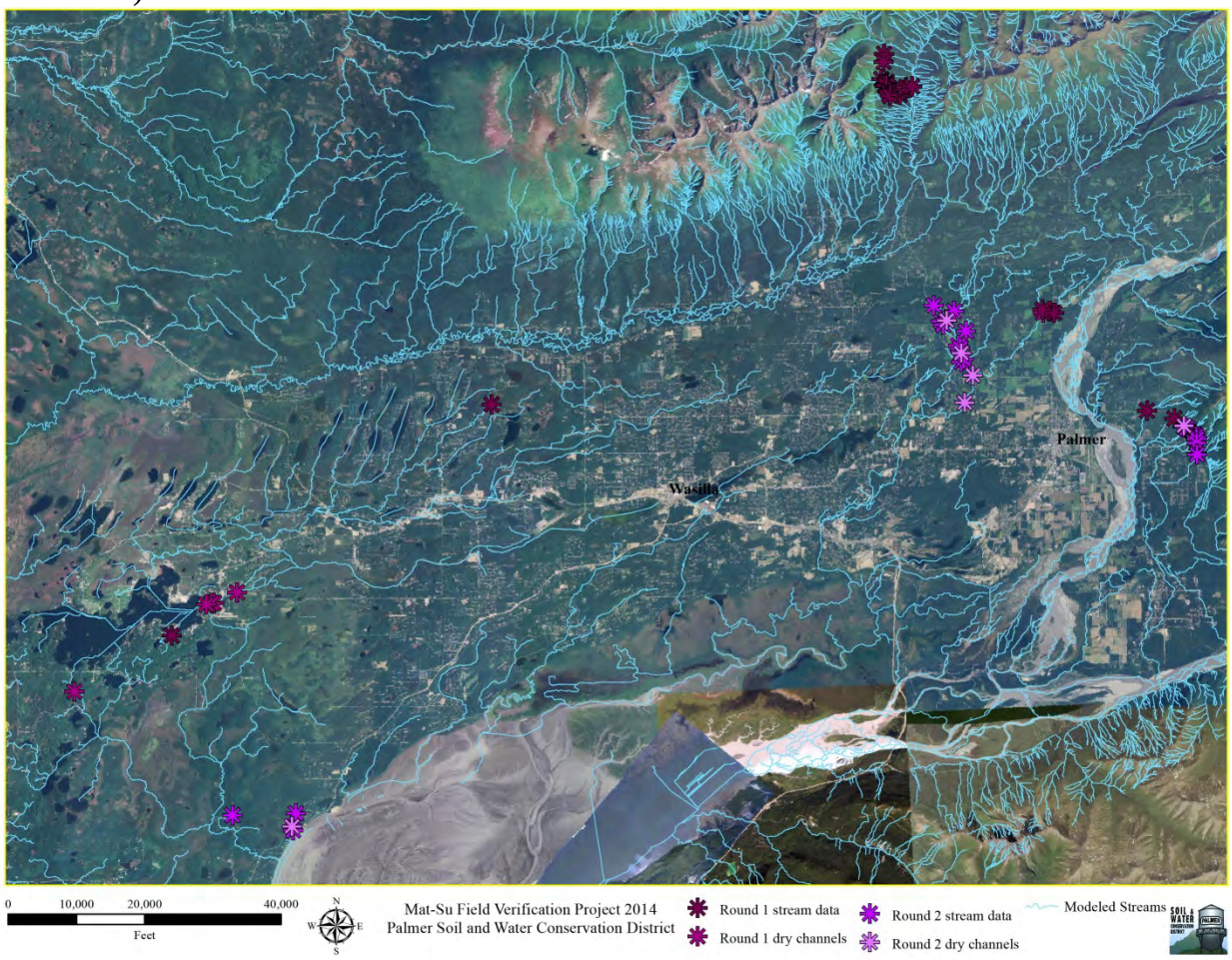


Figure 1. Overview of data points collected as of 8/29/2014

The PSWCD field crew is currently up-to-date with the survey points assigned by the St. Mary's University team. We have been prioritizing surveys that do not require landowner notification or access permission, and are nearly finished with that list. We have also been in the process of contacting landowners to secure permission for survey sites as needed. Thus far, we are only

waiting on landowner permission to access the ridge on the East side of the Little Su as the level of the river has risen too high to permit crossing to access the ridge via public lands. We have contacted the landowner at the southern base of the ridge to secure permission to cross her property and gain the ridge via a land route. As we hear from landowners (or not), we will advise regarding which surveys may be delayed or impossible pending landowner permission.

The model continues to present interesting challenges to verification! As noted by the St. Mary's team when they were out in the field earlier this summer with the PSWCD field crew, the model can place streams where there are none, and miss streams that are exist. It has also proven capable of deriving the accurate stream channel location and flow direction in spite of significant cultural impacts to an area. The nature of the Mat-Su hydrology also presents its own challenges in the form of streams that originate from and terminate in subsurface flow in low relief areas, the presence of countless relict channels, etc. We haven't found any water flowing uphill but we are still looking.

While conducting field surveys, the PSWCD crew has encountered "old timer" local property owners who have been able to provide invaluable anecdotal information regarding historic stream conditions, salmon runs and cultural impacts to the hydrography at several survey sites. This information has been recorded on the maps and shared with the Alaska Department of Fish and Game as appropriate. The PSWCD crew has also recorded invasive plant species and riparian restoration opportunities where encountered during stream mapping surveys, and hope to pursue these findings with funding organizations in the future.


Figure 2. Example of some field points given to field crew to identify

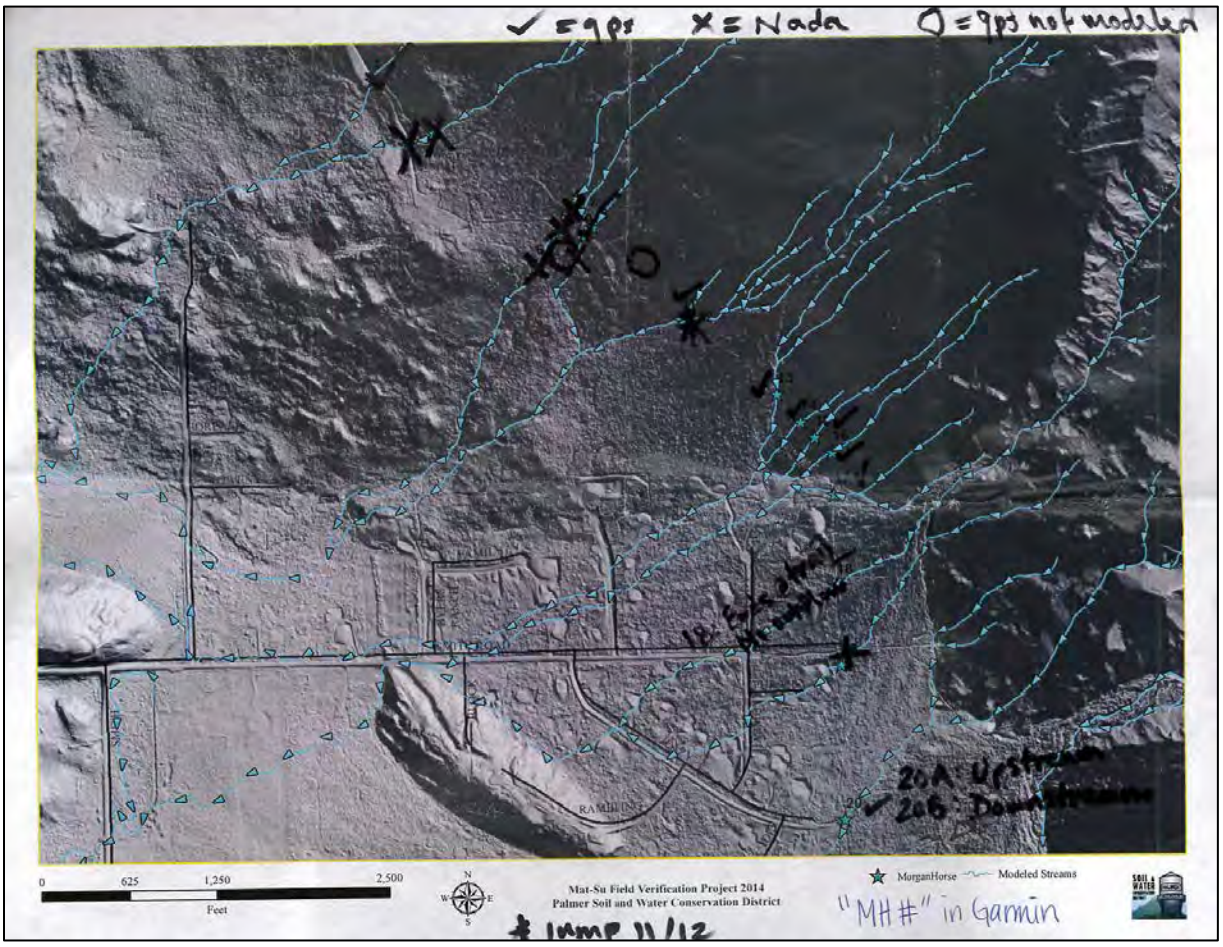

Figure 3. Example of notations from field crew on field maps