MSDI Elevation and Hydrography Working Groups: Data Quality Improvement Matrix

May 1, 2025

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Meeting Agenda

- Welcome & Introductions
- Overview of Assessing MSDI Framework Data Quality and Improvement
- Elevation Working Group
  - Elevation Theme Updates
  - Review Data Improvement Matrix
  - Discussion
- Hydrography Working Group
  - Hydrography Theme Updates
  - Review Data Improvement Matrix
  - Discussion
- Wrap up, next steps

Introductions

-Name, organization, and a favorite mountain, valley, or water-

Overview of Assessing MSDI Framework Data

- MSL's *GIS Coordination Strategic Plan* (FY2023-2027)
  - Prioritized four Business Plans
- Goal 4: Business Plan to Improve Geospatial Data Value
  - "Improve the collection, maintenance, and dissemination of authoritative geospatial information, aiding the creation of better policies, more informed decisions, and providing value to Montana."
  - Objective 3:
    - "Assess datasets and data themes using the data quality measures"
  - Objective 4:
    - "Determine actions needed to improve the value of the selected datasets and data themes"
  - Objective 5:
    - "Generalize the findings in Objective 4 to a program of data quality improvement"

Assessing MSDI Framework Data Quality

- **Data quality measures**:
  - **Timeliness**: an assessment of the data's update cycles, and temporality to internal and external deadlines and reporting needs
    - **Update Frequency**: an aspect of "Timeliness", specified in this assessment because it is usually an explicit part of data management workflows
    - **Archive Frequency**: an aspect of "Timeliness", specified in this assessment because it is usually an explicit part of data management workflows
  - **Accuracy/Precision**: a measure of the spatial accuracy of the data. Is the accuracy stated? Does is match end user's needs?
  - **Consistency**: a measure of the similarities and differences between data stored in multiple datasets or databases
  - **Completeness**: a measure of how comprehensive the information in a dataset is. Are required or priority fields populated?
  - **Integrity**: as assessment of whether the data's structure, schema and maintenance workflows meet end users needs
  - **Relevance**: an assessment of the accessibility and availability of the data required to inform business systems and answer business questions

For each measure, consider *current practices, short-term needs, and long-term needs.*

Overview of Assessing MSDI Framework Data

Data Theme (italic) and dataset	Completeness	Precision	Spatial Accuracy	Integrity	Timeliness
MSDI Elevation (multiple datasets)					
Lidar point cloud - Current practices	Incomlete statewide with gaps in coverage. Primary focus to date has been on ground points, with most other points being "unclassified"	Lidar precision is measured as repeatability (i.e, how similar are the measurements where flight paths overlap). Relative vertical accuracy (repeatability) is 2.2 inches.	Mimimum of 2 lidar points per sq mete r (QL2). Lidar Specification is 4" vertical accuracy in nonvegetated areas. Horizonal accuracy is around 8 inches.	3DEP was adopted in the State Lidar Plan, 2019. Not all MT data is 3DEP, however. Thorough metadata in xml format is available for each product. More recent projects, since 2018, include a final report. The metadata and reports are readily available online through the Montana Lidar Inventory. Documentation of	currently have a data collected in until 2023. . Sta (e.g., DNRC) have one-year. Ideal w turnaround afte would be impro
Lidar point cloud - Near-term Needs	Lidar point cloud is available statewide. Future lidar acquisitions include expanding point cloud classification, e.g., buildings and vegetation (low, medium, high).	no changes expected	A mimimum of 2 lidar points per sq meter (QL2) and 4" vertical accuracy in nonvegetated areas is achieved statewide. Some QL1 (8 pts per sq meter) is available.	national specifications is achieved. All recent projects (since 2018) include similar metadata and final reports. Montana data are submitted to the USGS 3DEP, corrections are made, and the data are incorporate into the National Map. Older projects will continue to be avaialble but will be flagged as not meeting current specifications. Known issues with	Much quicker tu the event of an e geohazard). Imp time for project availability from months. Have a preliminary data Montana Statew
Lidar point cloud - Long-term Needs	A more complete point cloud classification statewide is desired. Point clouds have minimal unclassified points.	Relative vertical accuracy (repeatability) may improve as technolgy advances	A minimum of QL1 (8 pts per sq meter) is achieved statewide. Vertical accuracy may also improve as technology advances.	Montana continues to follow national standards. As new standards are proposed, they are reviewed by the Montana Elevation Working Group. Future lidar acquisitions are completed under the USGS GPSC (contracting mechanism), whenever possible.	Ideal would be 1 after flight. This data for experie review and proc

MSDI Elevation Working Group

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MSDI Elevation is a statewide, raster representation at 10-meter resolution. The Theme will soon be comprised of high-resolution (1-meter), high-accuracy elevation derived from LiDAR.

The MSDI Elevation Working Group is open to anyone interested. Thanks for joining.

Elevation Theme Updates

- Lidar is available for ~85-90% of the state
  - Mosaics of five core products are available for each project: bare-earth DEM, hillshade, DSM, canopy height model, and intensity
  - Anticipate statewide lidar being complete and available in early 2026
- Repeat acquisitions are underway for some counties (thanks USGS!)
- New Montana Lidar Inventory app released, April 2025
  - https://msl.mt.gov/gis/lidarinventory (*old app with link to new app on first page*)
    - New acquisition status dashboard
    - Lidar images/posters
    - New help and lidar 101
    - Improved tools (swipe, selection, add data, elevation profile, and printing)
- Continue to work through QC/corrections with USGS to include lidar collected by the State (thanks DNRC!) in The National Map

Review Data Improvement Matrix

Elevation, What's Working

- Completeness, almost there! Will have statewide baseline dataset soon.
- Business Relevance, business use is well-documented. Seeing use across Montana, multiple sectors, many different applications, novice to expert.
- Consistency and Integrity, solid because of national standards through the USGS 3DEP and using GPSC (contracting mechanism)
- Accuracy – Quality Level 2 lidar (2 ppsm) with ~4-inch vertical and 8-inch horizontal accuracy is meeting most MT needs. A statewide, 1-meter resolution DEM will be impressive.

Review Data Improvement Matrix

Elevation: What Could be Improved?

- Consistency/Completeness
  - Point cloud classification is largely focused on bare-earth. A more complete point cloud classification is desired (e.g., for buildings, vegetation, and more consistent DSM creation)
  - Deliverables vary across projects (contours, building footprints, hydro-enforcement)
- Timeliness
  - Ideally, the turnaround time from acquisition to delivery (2 years) would be shortened. Preliminary data release to partners has helped. Short-term goal may be <18 months.
  - Clarity in communications with partners about delivery dates
- Spatial Accuracy/Precision
  - Some MT uses are needing Quality Level 1 lidar (8 ppsm), such as vegetation structure and feature/edge detection. Long-term goal (requirement?) for future acquisitions may be statewide QL1 and 0.5 meter DEMs.
- Update Frequency
  - Goal is an approximate 5 to 8 year update cycle (12-20% new per year). Some areas will need more frequent updates, such as waterways; some will need less, such as uplands. Need to develop acquisition plan or map dividing the state into 5 to 8 acquisition regions, plus high-change areas.
  - Need to be able to respond quickly after an event (e.g., events like 2022 Yellowstone floods)
  - Acquisition planning unit needs to transition from county-based to watershed-based (*see MSDI Hydrography*)

Elevation (lidar) Discussion

- **Feedback: What's Working & What could be Improved**
  - Questions, Suggestions, Comments
    - What would make MSDI Elevation more valuable/relevant to your work?
    - What are you excited/hopeful about with statewide lidar? Now or in the future.
    - What keeps you from using MSDI Elevation more? What are the limitations?
- Elevation – Next Steps
  - Send out matrix for review
  - Working Group feedback will go into the final Data Quality Matrix
  - Approval by the MGIA Council in May
  - Data Improvement Plans will be developed later this year
  - Working Group to meet again this summer/fall to review plans

Next step:

Generalize the data quality matrix into an Elevation Data Improvement Plan

ELEVATION (Lidar and Related Products)

Increasing Data Value through Data Quality Matrix

THEME: Elevation (Lidar, Contour, Digital Elevation Model, Digital Terrain Model, Digital Terrain Model, related derived products)		
DATA VALUE and QUALITY OVERALL GOALS: Five year goals: Process (and plan) in place to generate a complete statewide coverage every 5 to 8 years, with more frequent updates (see Timeliness) in areas of dynamic change (floodplains, landslides, large burn areas, development areas). Have clarity in communications with partners about delivery dates. Any future lidar data is collected at QL1 (8 points per sq. m). Ideal goals: Entire state is covered by QL1 data, replacing areas of current QL2 data. Turnaround time is less than one year from acquisition to publication. Complete statewide point cloud classification, including buildings and vegetation. A pool of funding is available for Lidar updates, shortening the elapsed time from identifying a need for data, funding data acquisition, and acquiring the data. Core products – DSM, bare earth DEM, hydro-flattening, hydro-enforcement, certified contours, fully classified point cloud, canopy height, hillshade – are available statewide, are created with consistent statewide methods, and are updated regularly as new data are acquired.		
Archiving and Retrieval Capabilities: One goal is to have 10-20% of statewide coverage archived and replaced by new data each year, achieving a 5-8 year statewide update cycle. A second goal is to have more sophisticated retrieval methods and provide storage and self-retrieval of datasets from projects and statewide data.		
Outcome	*Action*	*Progress Assessment*
Current: User can retrieve a version of any project dataset (not necessarily authoritative) as it existed for the month and year collected	Continue current approach to archiving (annual). Original collections are available as projects.	In place
Near-term: User can retrieve authoritative data for any given month		
Near-term: Statewide tiling scheme and delivery system that is not project-based	Devise a tiling scheme and automated / semi-automated production process for statewide	

Hydrography Working Group

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MSDI Hydrography maps the watercourses of Montana, including rivers, streams, lakes, canals, springs, catchments, and more. The Theme is in the early beginnings of transitioning from the National Hydrography Dataset (NHD) to elevation-derived hydrography through the USGS 3D Hydrography Program (3DHP).

The MSDI Hydrography Working Group is open to anyone interested. Thanks for joining.

Hydrography Theme Updates

- The National Hydrography Dataset has been retired
  - Final snapshot available, December 2023. There will be no more changes/edits.
- The Watershed Boundary Dataset has been retired
  - Final snapshot available, January 2025. There will be no more changes/edits.
- Transitioning to elevation-derived hydrography through the USGS 3D Hydrography Program (3DHP)
  - 3DHP all web service is available through the USGS. NHD features loaded into the 3DHP model. Think of this as a skeleton.
- Released Montana 3DHP Planning Dashboard
  - 15 HU10s are underway (thanks USFS)
- Coordination efforts are underway in the Gallatin and possibly Milk (Blaine County)
  - Would like to submit an application to the USGS Data Collaboration Announcement (DCA) in September. **Seeking partners and funding!**
  - Developing a 1-pager handout for 3DHP and its benefits for Montana.

Review Data Improvement Matrix

Hydrography: What's Working

- Completeness - At the 1:24,000 scale, the NHD has been useful for decades.
- Integrity - The NHD's structure, schema, and maintenance workflows are well developed. National standards, rules, and tools ensure compliance.
- Timeliness - The NHD may be updated as needed for relatively small areas. Ad hoc, local edits are supported.

Review Data Improvement Matrix

Hydrography: What Could be Improved? (slide 1 of 2)

- Timeliness – A comprehensive, statewide update is out of reach given current MSL staffing and resources (estimated to take over 20 years)

- Consistency - The NHD is inconsistent statewide (resolution varies, density varies, age varies). Some subbasins are mapped at higher resolution and with more detail than others. Some features are digitized using recent imagery, while other features remain largely untouched since the original paper topographic map (1960s-70s) to digital transfer.

Review Data Improvement Matrix

Hydrography: What Could be Improved? (slide 2 of 2)

- Business Relevance - Hinderances to the adoption of "one Montana hydrography" include the need for: higher-resolution (local) features, especially canals; a whole stream identifier attribute; local names (non-GNIS); better representation of flow permanence (perennial, intermittent, ephemeral); improved mapping of multi-channels and braiding; harmonization with Canada at the border; simplified networking and linked-data capabilities, including tools to do so; stream order; generalizing and simplifying for cartographic products; the need for a more stable version (less active editing and publication).
- Archive Frequency - Ideal archive would document river channel movement (e.g., have an accurate channel centerline depiction for every 5-8 years or more frequent after flooding events)
- Other
  - What headaches will the transition period from NHD to 3DHP cause?
  - What add-on features/tables will need to be managed by Montana?
  - 3DHP includes more detailed and finer delineation of catchments than the current Watershed Boundary Dataset (e.g., smaller than HU12).
  - Recommend combining MSDI Hydrography and MSDI Hydrologic Units into a single Theme.

Hydrography Discussion

- **Feedback: What's Working & What could be Improved**
  - Questions, Suggestions, Comments
    - What would make MSDI Hydrography more valuable/relevant to your work?
    - What are you excited/hopeful about with Hydrography? now or in the future.
    - What keeps you from using MSDI Hydrography more? What are the limitations?
- Hydrography – Next Steps
  - Send out matrix for review
  - Working Group feedback will go into the final Data Quality Matrix
  - Approval by the MGIA Council in May
  - Quality Improvement Plans will be developed later this year
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Thank you for attending.

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