

ELEVATION DERIVED HYDROGRAPHY

Building a consistent hydrography dataset from lidar and ifSAR

NV5 GEOSPATIAL

Introduction

NV5 Geospatial is working with the US Geological Survey (USGS) on creating and improving workflow processes designed to generate more consistent, accurate, and efficient Elevation-derived Hydrography (EDH) from either lidar or radar data. We are a fully engaged technical partner supporting the USGS vision for EDH.

Hydrography data is critical to federal, state and local government management of water resources. The increasing availability of broad-area and state-wide lidar offers the opportunity to create hydrography datasets that are current, comprehensive, and highly accurate. USGS has developed standards that guide hydrography data nationwide with their National Hydrography Dataset (NHD) and Watershed Boundary Dataset (WBD).

Extraction of hydrography from lidar conceptually appears to be a straightforward process. However, the reality is anything but. NV5 Geospatial believes it is critical that the hydrography community unite around a national standard, while at the same time recognizing the need for minor modifications to accommodate local conditions and requirements.

NV5 Geospatial Approach and Tool Development

We have been working to develop local resolution EDH networks through creation of proprietary processes. Specifically, we:

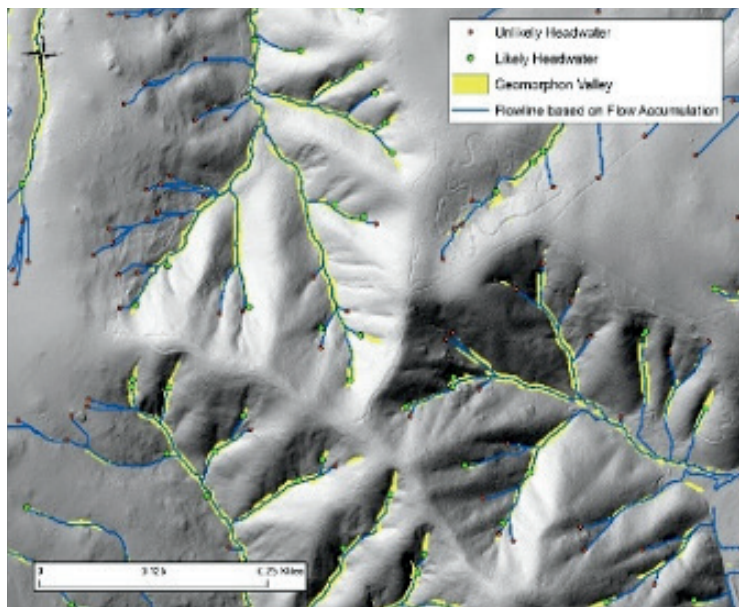
- Developed a multi-environment process integrating multiple approaches to derive flowlines and hydrologic networks.
- Work with local experts to refine landscape-specific parameters for refinement and attribution of flowlines.
- Use a combination of flow direction and accumulation routines along with direct detection of landscape channelization through geomorphon analysis*.

These two methods (flow accumulation and geomorphons) work in tandem to support derivation of systematically objective and reproducible EDH networks. NV5 Geospatial has utilized these two approaches to optimize the process for hydro-enforcement of false obstructions in the DEM, ensure topologically connected line work, identify commission errors where no surface flow exists, and more accurately estimate headwater initiation in upper reaches. Additionally, to support stakeholder review, NV5 Geospatial has developed a distributed rapid evaluation process that allows remote analysts and local experts to easily review and edit data.

**In collaboration with University of Maryland, Baltimore County (UMBC)*

NV5G Edge

- Leader in Elevation Derived Hydrography (EDH)
- Participated in USGS EDH pilot watersheds
- Developing EDH for Alaska from IfSAR
- Developed the first NHD and WBD dataset from lidar that incorporated storm-water systems
- Actively supporting partnerships between local, state and federal agencies to promote EDH
- Advocate for USGS standards in EDH community



ELEVATION DERIVED HYDROGRAPHY

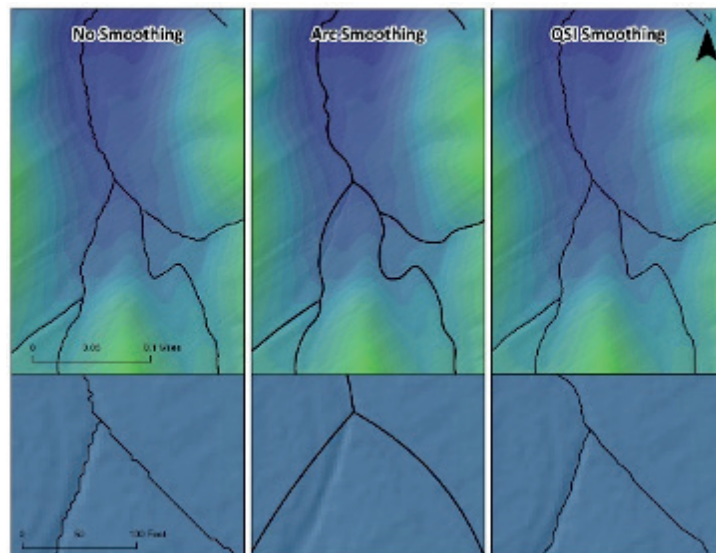
Building a consistent hydrography dataset from lidar and ifSAR

NV5 GEOSPATIAL

Further Refinement of EDH

Once flow lines have been delineated, our proprietary tools are applied to:

- Create artificial flow paths through polygonal representations of water bodies and large rivers.
- Link the flow lines, artificial flow paths, waterbodies, culverts and pipes to create a complete network that has topologically consistent flow direction and downstream elevation.
- Smooth the entire network to remove rasterization artifacts and reduce vertex density while preserving both accuracy and continuity within specified tolerances.
- Support landscape specific determination of key issues including (a) stream initiation points, and (b) stream periodicity.
- Attribute lines and polygons in the network through conflation of existing data and data derived from the landscape analysis.



Datasets then go through USGS specific pre-conflation and once approved, full conflation into the NHD or WBD. NV5 Geospatial works with leading conflation experts to ensure the data meets USGS's expectations and is approved for upload to the national databases.

Through the development of a high-resolution EDH network for Washington DC, the integration of the subsurface sewer network posed challenges for the standard NHD and WBD databases. QSI worked with USGS and DC to identify data structure limitations and develop a solution to reconcile incompatible components. It is interesting to note that for the Washington DC project more HUC16s were developed than there are HUC10s in the WBD east of the Mississippi River.

NV5 Geospatial Experience

We offer unique, nationwide capabilities and expertise for the development of EDH. Our team has worked closely with the USGS Hydrography team on both the National Hydrography Dataset (NHD) and the Watershed Boundary Dataset (WBD). This collaboration, in conjunction with our deep understanding of client needs and creative approach to solution development, has enabled us to develop new concepts and processes that support the increased complexity of local

resolution EDH, meet specific needs of end users, and contribute to the next generation of the NHD and WBD.

NV5 Geospatial works side-by-side with our clients to balance their specific requirements with the USGS standards so that whatever investment is made in the development of EDH, it will progress the larger goal of a consistent nationwide network. NV5 Geospatial will work with you to help develop your EDH plan and ensure that it meets your program's long term needs the first time.

Sample of EDH Experience

Project Name	Client	Area (sq. mi)
Elevation-Hydro Pilot Project (5 watersheds)	USGS	808
Washington DC EDH Project	DOEE DC	270
Alaska EDH from IfSAR	USGS	16,800
Forest Management Hydrography Data	Various	1,350
Marin County EDH	Golden Gate Conservancy	457
BLM Onsite Hydro-delineation Services	BLM	NA
Metlakatla Indian Community	MIC	135