Progress report for: High-Resolution Hydrographic Mapping for parts of Lincoln and Minnehaha Counties using Lidar-Derived Digital Elevation Models

Reporting period: December 29, 2015 through March 23, 2016

Date submitted: March 23, 2016

Background: In December of 2014, the U.S. Geological Survey (USGS) began collaborating with five local and state agencies on a project for "high-resolution hydrographic mapping" within 3 adjacent 10-digit hydrologic units (HUs) located primarily within Lincoln and Minnehaha Counties. The five participating agencies include the cities of Harrisburg and Sioux Falls, Lincoln County, the East Dakota Water Development District, and the South Dakota Department of Transportation. Project activities are guided by a proposal/work plan dated December 12, 2014 that identifies four primary tasks to be addressed. An additional fifth task also will be addressed as a result of a successful grant application submitted by Lincoln County to the MidAmerica GIS Consortium (MAGIC), which now constitutes a seventh cooperating entity (inclusive of USGS). This task will consist of further subdividing all 12-digit HUs (nested within the 10-digit HUs) in the project area into 14-digit HUs and will be completed after the majority of other project activities have been completed.

Project implementation essentially started December 18, 2014, when East Dakota Water Development District (EDWDD) approved a cost-share assistance request from the city of Sioux Falls to partner with the other project cooperators. An important change from the initial proposal was to include a ground-truthing component (primarily an inventory of culverts and other relevant conveyance features), as noted on page 5 of the EDWDD December minutes (http://eastdakota.org/AM.html). This change is reflected in the modified project proposal (Phase 1, task 2), which now states that "USGS staff will coordinate with cooperating agencies and other interested parties for ground truthing of all preliminary data sets. The other agencies will have primary responsibility for ground truthing to levels of detail deemed necessary to meet their needs. USGS will then have primary responsibility for updating the preliminary flow direction and flow accumulation datasets, based on results of ground truthing." As such, an important initial activity has been to coordinate with the project (funding) cooperators and other potential stakeholders in developing and implementing efficient approaches for accomplishing this task. Activities associated with coordination efforts are noted in a following sub-heading that is separate from other major project activities.

Major project activities this reporting period:

The Global Selective Drainage Toolbox tool, built by Curtis Price, attempts to identify areas where culverts are likely to exist, but have not yet been hydroenforced. It begins with the elevation grid that already has known culverts and bridges "burned" in. The Global Selective Drainage tool has some processing parameters that can be adjusted by the user for customizing the criteria under which a culvert location will be "assumed" and a proposed drain line developed, that can in turn be burned in. One of the first steps the tool does is identify fill areas in the elevation model where water ponds. These fill areas may be natural lakes or wetland, or areas where water is artificially impounded by a roadbed because a culvert needs to be hydroenforced. The user can select area bracket values, so that very large fill areas (likely to be natural lakes) and very small fill areas can be filtered out. A second user-selected criteria is the distance between the pour point and the low point for a given fill area. In the scenario of an un-enforced culvert, the minimum point for the fill area will often be very near the upstream end of the culvert. The pour point for that fill area may be nearby if the low point in the crown of the road corresponds to the low point in the ditch, or the pour point may be some distance away if the un-enforced flow network has the water leaving the fill zone and flowing toward an adjacent, enforced culvert or bridge. Another user-selected criteria is the search distance, which is how far away from the

low point the tool will search in an attempt to locate the channel on the downstream side of the roadbed. A final criterion that can be set is the maximum number of iterations. This iterative approach is designed to be able to handle culverts with overlapping fill zones. Because the Blood Run hydrologic unit (1017020317) has area in MN and IA, where few culverts had been inventoried, it was selected for comparison testing of the user-selected criteria. After determining a tentatively optimal set of criterion, processing was then completed on the Ninemile Creek, Silver Creek, and Slip-Up Creek hydrologic units. The "assumed" culvert locations for Slip-Up Creek have not yet been evaluated, but 417 additional culverts have been identified so far from Blood Run, Ninemile Creek, and Silver Creek. A culvert was considered confirmed if one was visible in ESRI basemap imagery, or if a channel was visible on either side of the road at the assumed culvert location. Many additional assumed culvert locations may in fact have culverts, but these will need to be verified using pictometry or field visits. Processing of the remaining hydrologic units is underway.

Coordination activities:

A zipped folder of data layers from the Global Selective Drainage processing has been placed on ftp at ftp://ftpint.usgs.gov/pub/cr/sd/huron/HiResHydro/. Additional layers will be placed there as processing continues.