

| 10-Year Plan—<br>Prioritized Mapping<br>Area | Activity (*blue indicates<br>cooperative work between<br>Coalition states)  | 2010-<br>2012 | 2012-<br>2015 | 2015-<br>2020 | Societal Issues   | Glacial Terrane/Deposit<br>Characteristics  |
|--|---|---------------|---------------|---------------|---|---|
| <b>Illinois</b>                              |   |               |               |               |   |   |
| 1. Lake County                               | 3-D glacial geologic mapping.   | X             |               |               | Numerous groundwater-resource and contamination issues; conflicting land uses; interaction of land and water use (rapid development) with wetlands and L. Michigan shoreline.   | Moraine belts and till plains; ice stagnation features; mainly Wisconsin Episode glacial deposits overlie Illinois Episode and possibly older deposits; 100-300' drift thickness.   |
| 2. McHenry County                            | 3-D glacial geologic mapping.   | X             | X             |               | Numerous groundwater-resource and contamination issues; conflicting land uses; interaction of land and water use (rapid development) with wetlands and agriculture.   | Moraine belts and till plains; Wisconsin Episode glacial deposits overlie Illinois Episode and possibly older deposits; 100-400' drift thickness.   |
| 3. Will County                               | 3-D glacial geologic mapping.   |               | X             |               | Numerous groundwater-resource and contamination issues; conflicting land uses; interaction of land and water use with wetlands, agriculture, and quarrying.   | Moraine belt and meltwater drainageways underlain by deposits of the last Wisconsin Episode events. Landscaped incised by numerous channels, some of which extend to bedrock. <25-150' drift thickness.                                   |
| 4. Lake Calumet - Cook<br>County             | 3-D glacial geologic mapping.<br>Establish “digital data library” from thousands of historical borings.<br>Determine material’s engineering properties and potential for transmitting contaminants. |               | X             |               | Economic development, brownfield mitigation, environmental protection, and natural area establishment.  | Large tracts of filled and made land. Dominated by lake plains and beaches of ancestral Lake Michigan and associated lake sediment. Lake Michigan shoreline intensely modified; 50-100' drift thickness.                                  |
| 5. South Chicago - Cook<br>County            | 3-D glacial geologic mapping.<br>Determine material’s engineering properties and potential for transmitting contaminants.   |               | X             | X             | Economic development, environmental protection, and remediation/redevelopment.  | Large tracts of filled and made land. Dominated by lake plains and beaches of ancestral Lake Michigan and associated lake sediment. Patches of moraine rise from the surrounding lake plain; 25-125' drift thickness.                     |
| 6. Mahomet Valley - eastern<br>portion       | 3-D glacial geologic mapping.   |               |               | X             | Mahomet Aquifer receives water from bedrock and overlying glacial deposits; overlying aquifers may be contaminated from agricultural chemicals; aquifer properties and boundaries need detailed delineation for modeling. | Buried valley/moraine belt/till plain; regional pre-Illinois Episode aquifer is beneath thick deposits from multiple glaciations; shallow and restricted Illinois Episode aquifers overlie the Mahomet Aquifer; 200-350' drift thickness. |

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| 7. Mahomet Valley - central portion   | 3-D glacial geologic mapping.   |   |   | X | Same as above.  | Same as above.  |
|   | 8. Development and use of Visualization Laboratory to visualize 3-D relationships among glacial deposits. Laboratory use by ISGS and Coalition partners.  | X | X | X |   | N.A.  |
| <b>Indiana</b>  |   |   |   |   |   |   |
| 1. Northeastern Indiana, including Allen County; new project mapping areas representing targeted glacial land systems | 3-D glacial geologic mapping at regional, intermediate, and micro-scales. Includes coring, logging, sediment analysis, dating.  | X | X | X | Sediment stratigraphy, architecture, and properties in 3-D provide the basis for evaluating geologic and groundwater resources.   | Several glacial land system types including typical ice-lobe and complex, inter-ice-lobe systems; variable drift thickness. |
| 2. Northeastern Indiana   | Development of till depositional model. Coop with Illinois GS, Ohio GS.   | X | X |   |   | Fine-grained till deposits of Huron, Erie and Lake Michigan Lobes; 50-150' thickness.                                       |
| 3. Several counties in Indiana  | Shallow geophysics in principal types of midwest glacial land systems. Coop with Illinois GS, Michigan GS, Ohio GS.   | X | X |   |   | Huron-Erie, Erie, and Saginaw Lobe land systems; variable drift thickness.  |
|   | 4. Sediment laboratory expansion. Develop rapid particle size analysis capability. Automate high-resolution analysis of sediment cores for magnetic susceptibility, p-wave velocity, resistivity, imaging, etc.). Coop with Illinois GS, Ohio GS. | X | X |   | Quantitative textural and physical property data are fundamental to 3-D sediment modeling, geology-geophysics linkage, and deriving applied sediment characteristics. Increased speed of sediment cores analysis facilitates greater data coverage. | N.A.  |
| 5. Northeastern Indiana, including Allen County; new project mapping areas representing targeted glacial land systems | 3-D geologic modeling to (1) integrate mapping products and data collection, and (2) visualize and derive applied products such as aquifer productivity and vulnerability, aggregate resource, and land drainage maps.                            | X | X | X | Products will be directly useful for resolving resource utilization issues such as groundwater availability and pollution, aggregate mining, and land drainage capability.  | Several land system-aquifer types including typical ice-lobe and complex, inter-ice-lobe areas; variable drift thickness.   |

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| 6. Allen County, Marion County, and new mapping project areas | Outreach in support of 3-D surficial geology mapping, modeling, and derivative products. Includes analysis of current issues, IGS and non-IGS Web site layers with Coalition products, press releases, IGS client newsletters, and public presentations. | X | X |   | Focused, targeted outreach documenting Coalition products and how they should be used is vital to solving resource management issues, thereby demonstrating the value of the Coalition. | Same as above.                                      |
| 7. Michindoh Aquifer (if funded)                              | 3-D glacial geologic mapping. Coop with Ohio GS and Michigan GS.   |   | X | X | Complex and sensitive aquifer and sand and gravel resources area.   | Till-dominated settings; 100->300' drift thickness. |

## Michigan

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| 1. Barry County                  | 3-D glacial geologic mapping.                                   | X |   |   | Includes development corridor; agriculture sand and gravel resource issues.   | Interlobate area between Saginaw Lobe and Lake Michigan Lobe; 150-300' drift thickness.             |
| 2. Calhoun County                | 3-D glacial geologic mapping.                                   | X | X |   | Includes development corridor between Battle Creek and Kalamazoo; agriculture, extractive, and industrial issues.   | Saginaw Lobe Terrain, areas of thin drift, drumlins; 0-300' drift thickness.                        |
| 3. Allegan County                | 3-D glacial geologic mapping.                                   |   |   | X | Includes development corridor; agriculture issues.  | Lake Michigan Lobe deposits; eastern side contains Saginaw Lobe deposits; 150-250' drift thickness. |
| 4. Michindoh Aquifer (if funded) | 3-D glacial geologic mapping. Coop with Ohio GS and Indiana GS. |   | X | X | Complex and sensitive aquifer and sand and gravel resources area.   | Till-dominated settings; 100->300' drift thickness.   |
| 5. Clinton County (southern)     | 3-D glacial geologic mapping.                                   |   |   | X | High population growth; sand and gravel resource issues; surface water issues.  | Saginaw Lobe recessional moraines with outwash channels between them; 120' average drift thickness. |
| 6. Monroe County                 | 3-D glacial geologic mapping.                                   |   |   | X | Karst region, nonexistent aquifer in areas, limestone quarry dewatering, development corridor, poor water quality.  | Huron-Erie Lobe; moraines, and lake plain; 0-70' drift thickness.                                   |
| 7. Eastern Upper Peninsula       | Karst feature mapping.  |   |   | X | Karst region, mapping; products will be directly useful for resolving resource utilization issues such as groundwater availability and pollution, and aggregate mining. | Lake Superior Lobe; 0-200' drift thickness.   |

## Minnesota

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|  | 1. Stratigraphic nomenclature development. | X |  |  |  |  |
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| 2. Priority counties (see map); determined by state/ local participation | 2. Surficial and subsurface glacial mapping. | X | X | X | Focus on mapping glacial aquifers and the nature of their connections to the land surface and surface water features.  | Variable drift thickness.   |
| <b>New York</b>  |  |   |   |   |  |   |
| 1. Onondaga County   | 3-D glacial geologic mapping.                | X |   |   | Numerous groundwater resource and contamination issues; conflicting land uses; interaction of land and water use (rapid development) with wetlands; Onondaga Lake. Geologic hazards associated with landslides.  | Through valleys with drumlinized terrains composed of till. Large complex meltwater channel systems tying proto Great Lakes into Finger Lake Valleys. Wisconsin Episode sediments overlie Devonian Shales and Limestones. Glacial stratigraphy poorly defined; 0-800'+ drift thickness.   |
| 2. Ulster County   | 3-D glacial geologic mapping.                |   | X |   | Water resource issues with NYC water supply; conflicting land use. Rapid development and economic development issues associated with water resources. Geologic hazards, flooding, landslides, and water quality.   | Established fluvial systems within a glaciated mountainous terrain formerly occupied by extensive, deep proglacial lake systems. Extensive till and lacustrine facies. Poor age control although suspected Wisconsin Episode drift over Devonian sandstones; 0-400' drift thickness.  |
| 3. Albany County   | 3-D glacial geologic mapping.                |   |   | X | Numerous water-resource issues including contamination from landfills and industrial settings. Prevalent landslides in high population centers (geologic hazards).   | Extensive sand dune fields 10-75' thick, derived from delta sediments. Thick glaciolacustrine sediments deposited in proglacial lake basins. Poor age control; little consensus on ice marginal positions; 0-300' drift thickness.  |
| 4. Cayuga County   | 3-D glacial geologic mapping.                |   | X |   | Numerous water-resource issues centered around the Montezuma Wetlands Complex. Competing land use between agriculture, wetlands along Interstate highway corridor. Complex stratigraphy and aquifers impacting surface water, groundwater, and ecologic communities. | Drumlinized till plains grading into Finger Lake troughs. Till on upland surface interbedded with lacustrine sediments deposited in large proglacial lake systems. Multiple ice marginal positions in region in association with eskers & tunnel channels. Large wetlands developed on floors of former lake basins. Poor age control on deposits; 30-300' drift thickness. |

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| 5. Seneca County                        | 3-D glacial geologic mapping.  |   | X |   | Numerous water-resource issues centered around the Montezuma Wetlands Complex. Complex stratigraphy and aquifers impacting surface water, groundwater, and ecologic communities. Coastal erosion on the shore of Lake Ontario. | Same as above.  |
| 6. Wayne County                         | 3-D glacial geologic mapping.  |   | X | X | Numerous water-resource issues centered around the Montezuma Wetlands Complex. Complex stratigraphy and aquifers affecting surface water, groundwater, and ecologic communities. Coastal erosion on the shore of Lake Ontario. | Drumlinized till plains grading into Finger Lake troughs. Till on upland surface interbedded with lacustrine sediments deposited in large proglacial lake systems. Multiple ice marginal positions in region in association with eskers and tunnel channels. Poor age control on deposits; 30-300' drift thickness. |
| <b>Ohio</b>                             |  |   |   |   |  |   |
| 1. Clark County - and elsewhere in Ohio | Karst mapping.   | X |   |   | Important geohazards with groundwater contamination, construction problems, flooding, and road maintenance issues.   | Typically, thin upland, ground moraine areas with thin drift. Karst features have been found with as much as 40' of overlying drift, 0-40' drift thickness.   |
|   | 2. Continuation of development of till stratigraphic model. Coop with Indiana GS, Illinois GS.   | X |   |   | Till stratigraphic models will be valuable for correlating and better understanding of units and depositional patterns. Models will be crucial for future detailed mapping and modeling projects.                              | Various till-dominated settings (Erie Lobe land systems); variable drift thickness.   |
|   | 3. Development of various derivative maps to tie in with STATEMAP stack maps and surficial mapping of 30x60 minute quadrangles.          | X | X |   | Derivative maps will include sand and gravel resources, thick fine-grained drift suitable for waste disposal, and thin drift areas suitable for quarrying underlying bedrock.  | Various settings targeted towards the specific type of derivative map; variable drift thickness, reflects a very critical component of these maps   |
|   | 4. Continued development of shallow seismic capabilities and engineering properties/seismic database. Coop with Illinois GS, Indiana GS. |   | X | X | Shallow seismic studies will help provide data that can be applied to mapping, stratigraphic, engineering, earth quake properties, etc. Valuable in exploration for resources and in delineating geohazards.                   | Various settings depending upon the particular project, tie in with STATEMAP projects; drift thickness typically limited to about 100-150'. Refined techniques or equipment might extend this maximum depth.  |

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|  | 5. Obtain Giddings or shallow geo-probe to assist with stratigraphic sampling or contracting the same.  |   | X | X | Drilling program will greatly aid in developing the till stratigraphic model, obtaining samples for same, provide control points for seismic studies, obtain engineering samples, etc. Will also aid in mapping complex and problematic areas for STATEMAP projects.  | Same as above. Drift thickness assumed limited to <100' unless drilling can be contracted in the future.  |
|  | 6. Reactivate sedimentation laboratory to do analyses on samples to support till stratigraphic and soils geochemistry. Coop with Indiana GS.  |   | X | X | Provide laboratory to help aid projects listed above. Provide lithologic and engineering properties that would provide useful data for a host of activities including aggregate and ground water exploration, earthquake loss prediction, engineering risks, and delineating geohazards. Soils geochemistry would be slanted towards elements of interest, particularly arsenic, selenium, etc. | Same as above.  |
|  | 7. View completed surficial geology and related derivative maps and determine areas that would support and benefit from detailed studies/maps/models utilizing and testing of stratigraphic models. | X | X |   | View areas with complex or unresolved geologic properties. Tie studies into known geologically problematic areas. Assist with doing site-specific studies that are required to support other government agencies as needed.   | Various settings, depends upon particular project needs; variable drift thickness, however drift thickness is a key component of such maps.                                     |
| 8. Michindoh Aquifer (if funded); coop with Indiana GS and Michigan GS |   |   |   |   | Complex and sensitive aquifer and sand and gravel resources area.   | Till-dominated settings; 100->300' drift thickness.   |
| <b>Pennsylvania</b>  |   |   |   |   |   |   |
|  | 1. Determine locations of water wells in PaGWIS (water well database).  | X |   |   | Groundwater-resource protection in rapidly developing municipal-industrial areas. Surficial and bedrock geologic mapping.   | Moraine belts and till plains; ice stagnation features; mainly Wisconsin Episode glacial deposits overlie Illinois Episode and possibly older deposits; 0-400' drift thickness. |
|  | 2. Complete compilation of critical water well data entry into PaGWIS.  | X | X |   | Same as above.  | Same as above.  |
| 3. Northwestern PA   | 3. Bedrock topographic and drift thickness mapping.   | X | X | X | Aid/restrict location of municipal and industrial infrastructure to protect limited groundwater resources. Base for future surficial and bedrock geologic mapping.  | Same as above.  |

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| 4. Erie Bluffs State Park   | 3-D glacial geologic mapping. | X |   |   | Groundwater-resource protection. Monitor bluff stability for new Erie Bluffs State Park development. Identify unsuitable foundation areas (lacustrine deposit consolidation). | Lacustrine deposits and till. Beach ridges and moraines; 0-300' drift thickness.                           |
| 5. New Castle South 7.5' Quad                                     | 3-D glacial geologic mapping. | X |   |   | Economic development in the area of Toll Road 60. Brownfield redevelopment near New Castle.   | Moraine and ice-stagnation features; 0-100' drift thickness.   |
| 6. Warren County (western)  | 3-D glacial geologic mapping. |   | X | X | Prepare suitability maps for anticipated economic development, construction-resource availability, and groundwater-resource protection.                                       | Moraine. Ice stagnation features. Thick valley fills. Unknown drift thickness, but estimated at 0 – 200'+. |
| <b>Wisconsin</b>  |                               |   |   |   |   |  |
| 1. Grant County (STATEMAP project supported by GLGMC)             |                               | X |   |   | Flooding susceptibility; groundwater resources and contamination; use of wetlands and agricultural land.  | Periglacial, proglacial, and glacial (pre-Illinoian glaciation); loess dominated; drift thickness 30-300'. |
| 2. Lower Wisconsin River Valley                                   |                               |   | X | X | Same as above.  | Same as above.   |
| <b>USGS</b>   |                               |   |   |   |   |  |
| 1. Livingston, Oakland, and Washtenaw Counties - South Lyon Quad  | Coop with Michigan GS.        | X |   |   | High population region; groundwater issues; sand and gravel extraction issues.  | Huron-Erie and Saginaw interlobate area with surficial and buried outwash; drift thickness 125-250'.       |
| 2. Manistee and Wexford Counties - Wellston NE and Wellston Quads |                               | X |   |   | Refining sand resources in Manistee National Forest. Competing interests between recreation and resource extraction.  | Deltaic sand region between Lake Michigan Lobe moraines; drift thickness 300-800'.                         |
| 3. Wexford County -Harrietta, Mesick, and Mesick NE Quads         |                               |   | X | X | Same as above.  | Same as above.   |
| 4. Leelanau County  |                               |   | X |   | County map compilation.   | Lake Michigan Lobe deposits; drift thickness 50-250'.  |
| 5. Livingston County Coop with Michigan GS                        |                               | X | X |   | County map compilation.   | Huron-Erie, Saginaw Lobes and interlobate areas with associated outwash; drift thickness 50-300'.          |
| 6. Benzie County - Frankfort Quad                                 |                               |   |   | X | Sleeping Bear National Lakeshore; popular recreation area.  | Sand dunes, Lake Michigan Lobe moraines, and outwash; drift thickness 100-200'.                            |