DIGITAL MAPPING TECHNIQUES 2025

The following was presented at DMT'25
May 18 - 21, 2025

The contents of this document are provisional

See Presentations and Proceedings
from the DMT Meetings (1997-2025)
http://ngmdb.usgs.gov/info/dmt/

Over the last 5 years, the Virginia mapping team has developed multiple help guides in an effort to make the creation of GeMS products more efficient, consistent, and collaborative within our department. This presentation focused on the GeMS Cheatsheet, a single shared document of internal standards and GeMS resources, and the Complete Glossary for GeMS, a document that allows our staff to add and review terms to a shared GeMS Glossary.

CREATING EFFICIENCY AND CONSISTENCY WITHIN GEMS PRODUCTS THROUGH HELP GUIDES AND SHARED WORKFLOWS

GMR GeMS Glossary and GeMS Cheatsheet

PRESENTED BY:

Holly Mangum
Geologist: Scientist II
Virginia Department of Energy: Geology and Mineral Resources Program

May 20th, 2025

VIRGINIA Energy

OVERVIEW

Over the last 5 years, the Virginia mapping team has developed multiple help guides in an effort to make the creation of GeMS products more efficient, consistent, and collaborative within our department. Two of our guidance documents will be highlighted in this talk: the Glossary for GeMS, a document that allows our staff to add and review terms to a shared GeMS Glossary, and the GeMS Cheatsheet, a single shared document of internal standards and GeMS resources.

Geology and Mineral Resources (GMR) & Applied Sciences and Natural Resources Staff

COMPLETE GLOSSARY FOR GEMS

A collaborative document for adding and reviewing glossary terminology

PROCESS

	A	B	C
1	**Steps**	**Process**	
2	1	A new term is added to the ForReview tab. Many of our definitions come from the AGI Glossary of Geology (https://glossary.americangeosciences.org/). We have a subscription to the online version of this catalog. If you would like to access it, please refer to Chrissi's email titled "Important Subscription: Glossary of Geology Online Database" from March 14th.	
3	2	Anyone in GMR can review and make notes about the term. If a note is made about the term, the person who added the term will need to review the notes and make necessary changes. Jennie will remind GMR personnel to review others terms as well as their own.	
4	3	Once two people have approved the term by adding their initials to the "Reviewer #1/#2 initials" column, the originator of the term needs to put their initials in the "Confirmation from original creator that term is ready for CompleteGlossary" column to indicate that it is ready to be moved to the main glossary.	
5	4	Jennie will move the term to the "CompleteGlossary" tab and preserve it in the "Archive of ForReview" tab.	
6	5	If it is decided that a term is not needed after two reviews, Jennie will mark it as 'N' in the first column and it will be moved to the "Archive of ForReview" tab.	
7	6	The "CompleteGlossary" tab will occassinally be updated on the GMR website: https://www.energy.virginia.gov/geology/Mapping.shtml	
8			
9	**Tabs**	**Tabs Explaination**	**Who can edit this**
10	CompleteGlossary	This is the GMR source glossary of approved terms that can be pulled from to create a project glossary. These terms have been reviewed and created by GMR personnel.	Jennie and Holly
11	ForReview	This is where GMR personnel can add new terms to be reviewed. Each term will need to be reviewed by at least two people before it can be moved to the source glossary.	Anyone can add a term and/or review a term in this tab. Only Holly or Jennie can move a term from this tab to any other tab.
12	Archive of ForReview	This is a collection of all terms from the "ForReview" tab. Terms that have been approved and dis-approved exist here as a reference.	Jennie and Holly
13	Common FGDC Symbols	This is a reference list of FGDC terms and the symbols that should be used for them in a project geodatabase.	Anyone
14	GlossaryCitation	Citation for the "CompleteGlossary" tab document	No editing needed
15			
16			
17			
18			
19			
20			

CompleteGlossary | Process | ForReview | Archive of ForReview | Common FGDC Symbols | GlossaryCitation

This document has 6 tabs, starting with the “Process” tab that explains to the user how the document is intended to be used and what each tab contains.

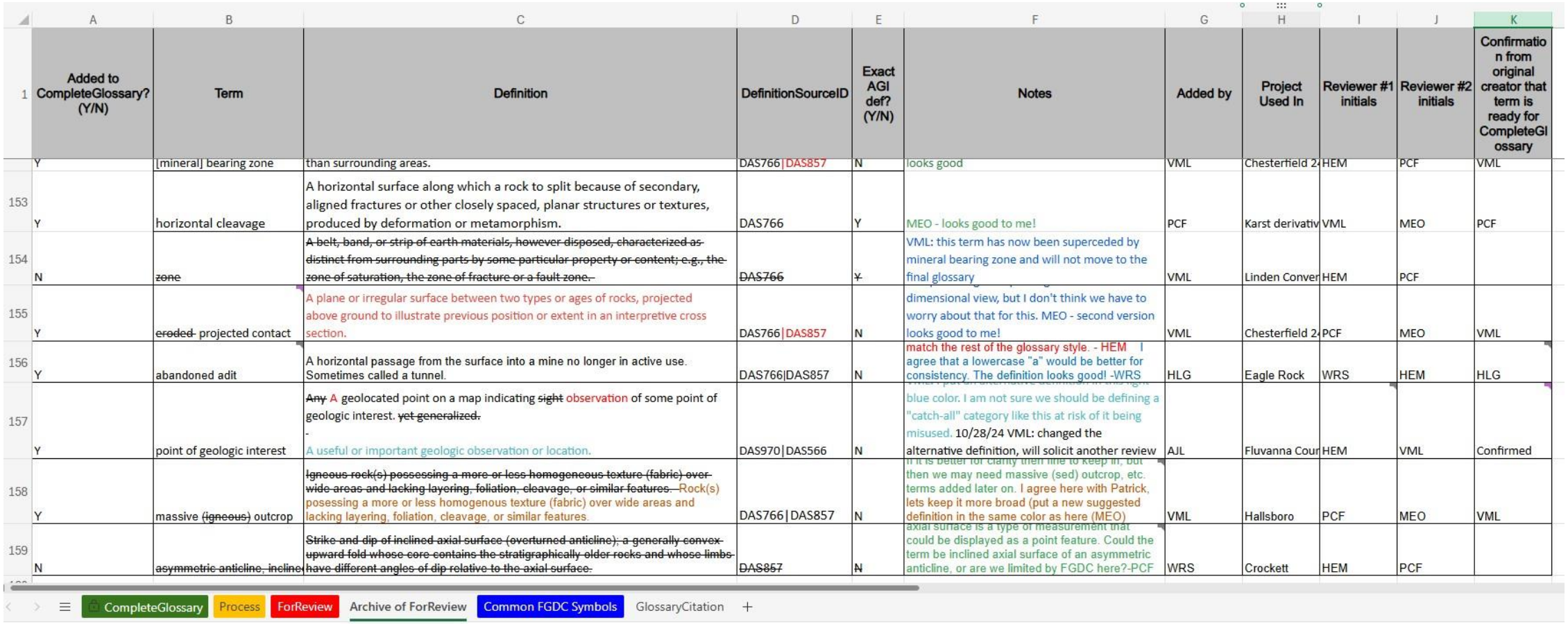
FOR REVIEW

	A	B	C	D	E	F	G	H	I	J	K
1	Added to Complete Glossary? (Y/N)	Term	Definition	DefinitionSourceID	Exact AGI def? (Y/N)	Notes	Added by	Project Used In	Reviewer #1 initials	Reviewer #2 initials	Confirmation from original creator that term is ready for CompleteGlossary
2		vertical anticline	A vertical fold, whose plunge is vertical or near-vertical, and whose core contains the stratigraphically older rocks.	DAS766|DAS857	N	Introducing this term to handle a legacy vertical anticline I have on Dabneys. Any thoughts on the one word edit to the AGI definition of glossary would be helpful! MEO - looks good to me, Katie!; PCF: ~~does this mean the axial surface is vertical or near-vertical? To me it sounds like it is kinda like an upright anticline?~~ Might be helpful to add something about axial surface (and/or plunge if necessary); I see it means the fold hinge is vertical --> https://www.sciencedirect.com/science/article/abs/pii/S0016787864800237?via%3Dihub (I am actually not using this on Dabneys anymore, and this definition does not represent what I intended...?) VML: Keeping this one and vertical syncline in this tab until the term re-emerges later	KEL	Dabneys	MEO	PCF	
3		vertical syncline	A vertical fold, whose plunge is vertical or near-vertical, and whose core contains the stratigraphically younger rocks.	DAS766|DAS857	N		PCF				
4		elevation tick	A location on the y-axis of a cross sectional diagram, typically labelled with a number indicating the relative elevation above or below sea level at that point.	DAS857	N	HLG: This definition sounds good to me, and is consistent with our other defintions that talk about the cross sectional diagram.	VML	Dutch Gap Convers	HLG	HEM	
5											
6											
7											
8											
9											
10											
11											
12											
13											

CompleteGlossary | Process | ForReview | Archive of ForReview | Common FGDC Symbols | GlossaryCitation

The “ForReview” tab is editable by all users. It is where new glossary terms can be proposed and reviewed at any time by our staff. Terms are removed from this tab once they have been accepted.

ARCHIVE



	A	B	C	D	E	F	G	H	I	J	K
1	Added to CompleteGlossary? (Y/N)	Term	Definition	DefinitionSourceID	Exact AGI def? (Y/N)	Notes	Added by	Project Used In	Reviewer #1 initials	Reviewer #2 initials	Confirmation from original creator that term is ready for CompleteGlossary
	Y	[mineral] bearing zone	than surrounding areas.	DAS766|DAS857	N	looks good	VML	Chesterfield 2	HEM	PCF	VML
153	Y	horizontal cleavage	A horizontal surface along which a rock to split because of secondary, aligned fractures or other closely spaced, planar structures or textures, produced by deformation or metamorphism.	DAS766	Y	MEO - looks good to me!	PCF	Karst derivativ	VML	MEO	PCF
154	N	~~zone~~	~~A belt, band, or strip of earth materials, however disposed, characterized as distinct from surrounding parts by some particular property or content; e.g., the zone of saturation, the zone of fracture or a fault zone.~~	~~DAS766~~	~~Y~~	VML: this term has now been superceded by mineral bearing zone and will not move to the final glossary	VML	Linden Conver	HEM	PCF	
155	Y	~~eroded~~ projected contact	A plane or irregular surface between two types or ages of rocks, projected above ground to illustrate previous position or extent in an interpretive cross section.	DAS766|DAS857	N	dimensional view, but I don't think we have to worry about that for this. MEO - second version looks good to me!	VML	Chesterfield 2	PCF	MEO	VML
156	Y	abandoned adit	A horizontal passage from the surface into a mine no longer in active use. Sometimes called a tunnel.	DAS766|DAS857	N	match the rest of the glossary style. - HEM I agree that a lowercase "a" would be better for consistency. The definition looks good! -WRS	HLG	Eagle Rock	WRS	HEM	HLG
157	Y	point of geologic interest	~~Any~~ A geolocated point on a map indicating ~~sight~~ observation of some point of geologic interest. ~~yet generalized.~~ - A useful or important geologic observation or location.	DAS970|DAS566	N	blue color. I am not sure we should be defining a "catch-all" category like this at risk of it being misused. 10/28/24 VML: changed the alternative definition, will solicit another review	AJL	Fluvanna Cour	HEM	VML	Confirmed
158	Y	massive ~~(igneous)~~ outcrop	~~Igneous rock(s) possessing a more or less homogeneous texture (fabric) over wide areas and lacking layering, foliation, cleavage, or similar features.~~ Rock(s) posessing a more or less homogenous texture (fabric) over wide areas and lacking layering, foliation, cleavage, or similar features.	DAS766|DAS857	N	then we may need massive (sed) outcrop, etc. terms added later on. I agree here with Patrick, lets keep it more broad (put a new suggested definition in the same color as here (MEO)	VML	Hallsboro	PCF	MEO	VML
159	N	~~asymmetric anticline, incline~~	~~Strike and dip of inclined axial surface (overturned anticline); a generally convex-upward fold whose core contains the stratigraphically older rocks and whose limbs have different angles of dip relative to the axial surface.~~	~~DAS857~~	~~N~~	could be displayed as a point feature. Could the term be inclined axial surface of an asymmetric anticline, or are we limited by FGDC here?-PCF	WRS	Crockett	HEM	PCF	

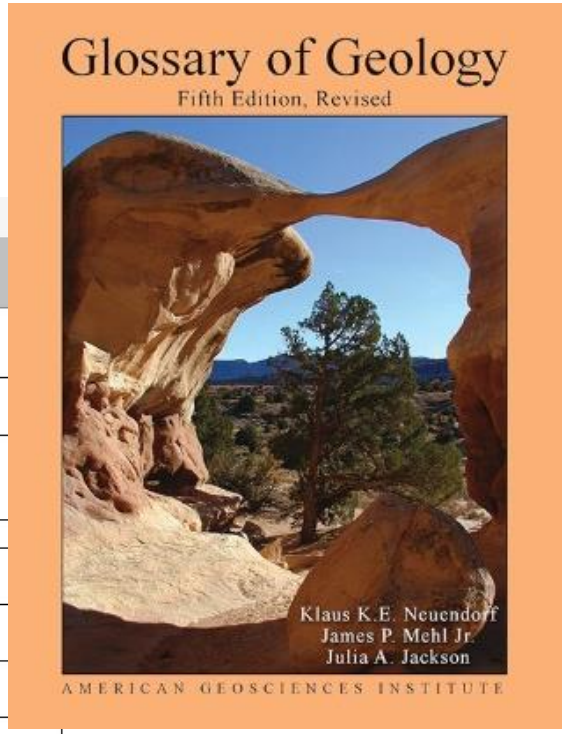
CompleteGlossary | Process | ForReview | Archive of ForReview | Common FGDC Symbols | GlossaryCitation

The "Archive of ForReview" tab is an archive that serves as a reference for all the terms that have been accepted and rejected, along with the original discussion about the term.

COMPLETE GLOSSARY

	A	B	C	D	E
1	Term	Definition	DefinitionSourceID	Exact AGI def? (Y/N)	Notes
2	abandoned adit	A horizontal passage from the surface into a mine no longer in active use. Sometimes called a tunnel.	DAS766|DAS857	N	
3	abandoned pit	A previously excavated area where earth material (sand, gravel, etc.) was taken to be used for fill at another location.	DAS766|DAS857	N	
4	abandoned quarry	Remnants of open workings. Previously the site of industrial or commercial extraction of aggregate, slate, and other resources no longer in active use. Condition is circumstantial and varies by location.	DAS766|DAS857	N	
5	adit	A horizontal passage from the surface into a mine. Sometimes called a tunnel.	DAS766	Y	
6	anticline	A fold, generally convex upward, whose core contains the stratigraphically older rocks.	DAS766	Y	
7	antiform	A fold, generally convex upward, where stratigraphic order of folded layers is unknown or poorly constrained.	DAS766|DAS857	N	
8	asymmetric anticline	A generally convex upward fold whose core contains the stratigraphically older rocks and whose limbs have different angles of dip relative to the axial surface.	DAS766|DAS857	N	
9	asymmetric fold	(a) A fold whose axial surface is not perpendicular to the enveloping surface. (b) A fold whose limbs have different angles of dip relative to the axial surface.	DAS766	Y	
10	axial plane	A planar surface that connects the hinge lines of the strata in a fold.	DAS766|DAS857	N	
11	axial surface	A surface that connects the hinge lines of the strata in a fold.	DAS766	Y	
12	borehole	A circular hole made by drilling; esp. a deep hole of small diameter, such as an oil well or a water well.	DAS766	Y	
13	breccia	A coarse-grained clastic rock, composed of angular broken rock fragments held together by a mineral cement or in a fine-grained matrix; it differs from conglomerate in that the fragments have sharp edges and unworn corners. Breccia may originate as a result of sedimentary processes such as talus accumulation (sedimentary breccia); igneous processes, esp. explosive (igneous breccia, volcanic breccia); disturbance during sedimentation (intraclastic breccia); collapse of rock material (solution breccia, collapse breccia); or tectonic processes (fault breccia)	DAS766	Y	

CompleteGlossary | Process | ForReview | Archive of ForReview | Common FGDC Symbols | GlossaryCitation

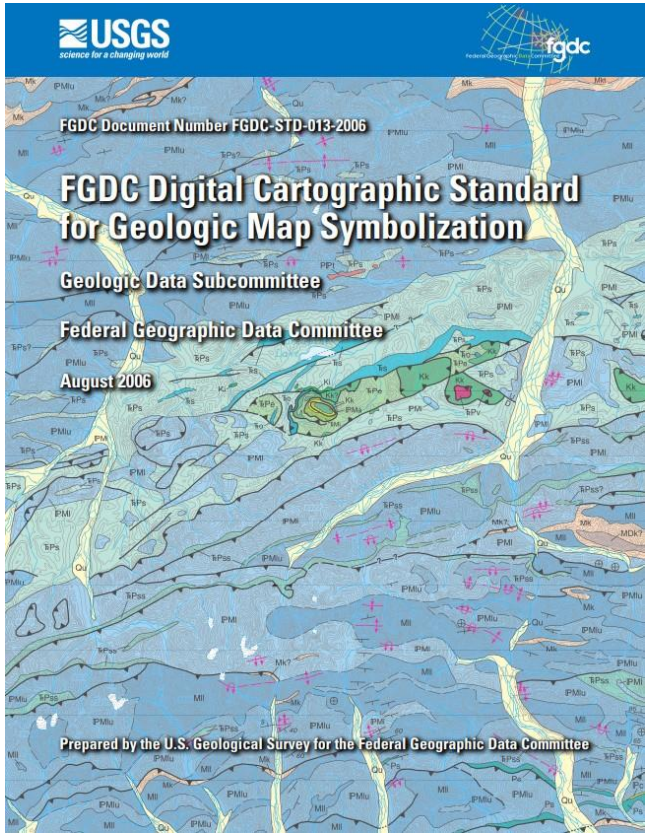


This is the final working glossary that our staff can copy terms from for their map databases.

COMMON FGDC SYMBOLS

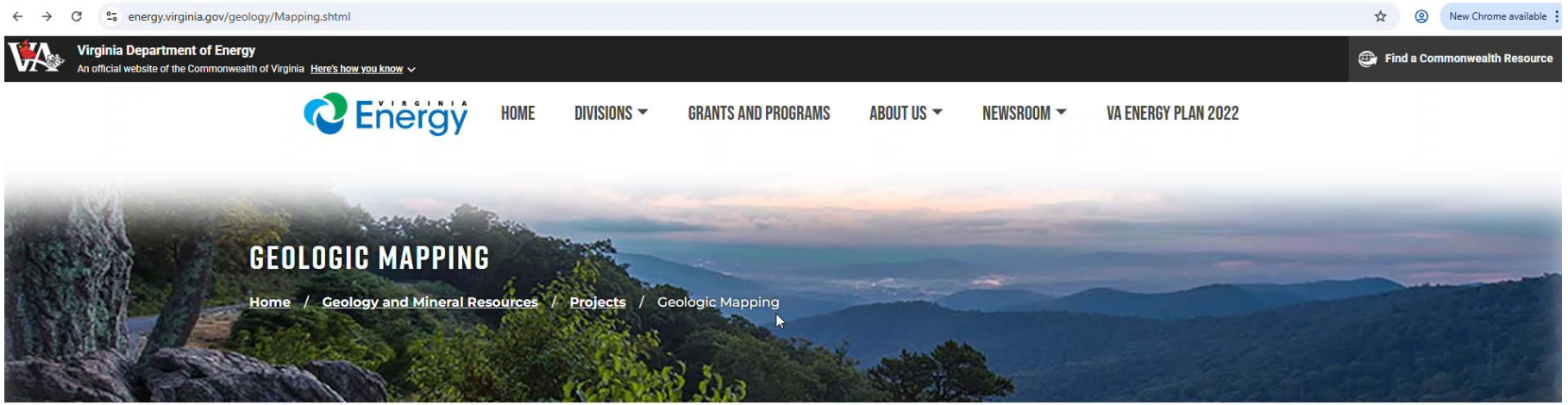
	A	B	C	D
1		Add ' in front of number to keep leading zero		
2	**Term**	**FGDC Symbol**	**Notes**	**DASID** (optional)
3	abandoned quarry	19.03.05		DAS753
4	adit	19.03.12		DAS753
5	borehole	19.05.07	includes geology sheets	VDOT Boreholes (STd in DataSources field): DAS768 VDOT Geology Sheets (vdot in DataSources field): DAS769 GMR Borehole Database: DAS826
6	compositional layering	08.02.03		
7	contact	01.01.01 (certain), 01.01.03 (approximate), 01.01.07 (concealed)		
8	crenulation cleavage	09.133		
9	cross section line	31.10		
10	dike	19.01.12 (point), 01.03.01 (line)	Belongs in MapUnitLines	
11	fault	02.01.01 (certain), 02.01.03 (approximate), 02.01.07 (concealed)	generic fault	
12	gas well	19.05.051		DAS753
13	gneissic banding	08.03.47 (inclined), 08.03.48 (vertical), 08.03.46 (horizontal)		
14	horizontal bedding	06.01		
15	inclined bedding	06.02		
16	inclined cleavage	07.02		
17	inclined dike or vein	01.04.01	Belongs in OrientationPoints feature class. Does not seem to work properly from the FGDC style file - TSG	
18	inclined fold hinge of small, minor anticline	09.105		
19	inclined fold hinge of small, minor syncline	09.113		
20	inclined foliation	08.03.02 and 08.02.03		
21	inclined foliation - gneissic	08.03.02		
22			Simplify to gneissic banding for 100K. Can also be used for "Strike and dip of	

CompleteGlossary | Process | ForReview | Archive of ForReview | Common FGDC Symbols | GlossaryCitation



This tab is included in the glossary spreadsheet because when staff are looking for a term to add to their map, they are often also going to need the symbology for that term.

GLOSSARY ON OUR WEBSITE



WHAT DO GEOLOGIC MAPS TELL US?

Geologic maps show the distribution of bedrock and unconsolidated sediments using colors, lines, and symbols. These maps contain an explanation that describes the composition, texture, and age of the rocks. Geologic maps may be accompanied by one or more geologic cross-sections, showing the bedrock relationships in the subsurface. The locations of important features such as folds and faults are also shown on geologic maps.

Geologic maps provide basic information for land development and conservation projects. Large projects (dams, roads, bridges, and buildings) require detailed geological analysis because of monetary, health, and safety concerns. Smaller projects, such as waste disposal systems and water wells also benefit from an understanding of the local geology. Geologic maps are also used for:

Evaluation of geologic hazards (landslides, earthquakes, land subsidence)
Planning transportation and utility routes
Site selection for public facilities (landfills, waste-treatment facilities, waste-disposal sites, schools)
Land-use planning and evaluation of land-use proposals
Regulatory decisions
Environmental assessment and protection planning (underground storage tanks, landfills, aquifer contamination)
Development and protection of groundwater

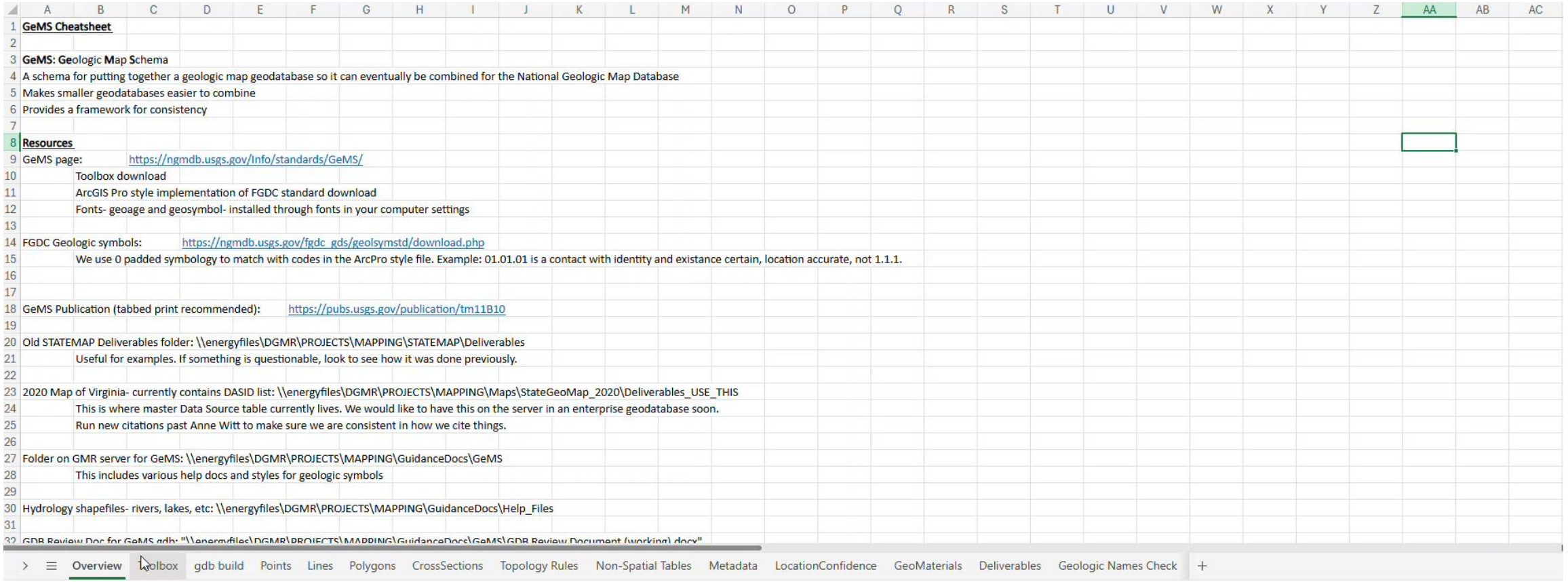
https://www.energy.virginia.gov/geology/Mapping.shtml

We provide a copy of our glossary on our Mapping page, excluding only the terms that come verbatim from AGI since we pay a subscription to access those terms.

GEMS CHEATSHEET

A single reference document of helpful GeMS links and internal GMR standards

REVIEW OF CHEATSHEET



GeMS Cheatsheet

GeMS: Geologic Map Schema
A schema for putting together a geologic map geodatabase so it can eventually be combined for the National Geologic Map Database
Makes smaller geodatabases easier to combine
Provides a framework for consistency

Resources
GeMS page: https://ngmdb.usgs.gov/Info/standards/GeMS/
- Toolbox download
- ArcGIS Pro style implementation of FGDC standard download
- Fonts- geoage and geosymbol- installed through fonts in your computer settings

FGDC Geologic symbols: https://ngmdb.usgs.gov/fgdc_gds/geolsymstd/download.php
- We use 0 padded symbology to match with codes in the ArcPro style file. Example: 01.01.01 is a contact with identity and existance certain, location accurate, not 1.1.1.

GeMS Publication (tabbed print recommended): https://pubs.usgs.gov/publication/tm11B10

Old STATEMAP Deliverables folder: \\energyfiles\DGMR\PROJECTS\MAPPING\STATEMAP\Deliverables
- Useful for examples. If something is questionable, look to see how it was done previously.

2020 Map of Virginia- currently contains DASID list: \\energyfiles\DGMR\PROJECTS\MAPPING\Maps\StateGeoMap_2020\Deliverables_USE_THIS
- This is where master Data Source table currently lives. We would like to have this on the server in an enterprise geodatabase soon.
- Run new citations past Anne Witt to make sure we are consistent in how we cite things.

Folder on GMR server for GeMS: \\energyfiles\DGMR\PROJECTS\MAPPING\GuidanceDocs\GeMS
- This includes various help docs and styles for geologic symbols

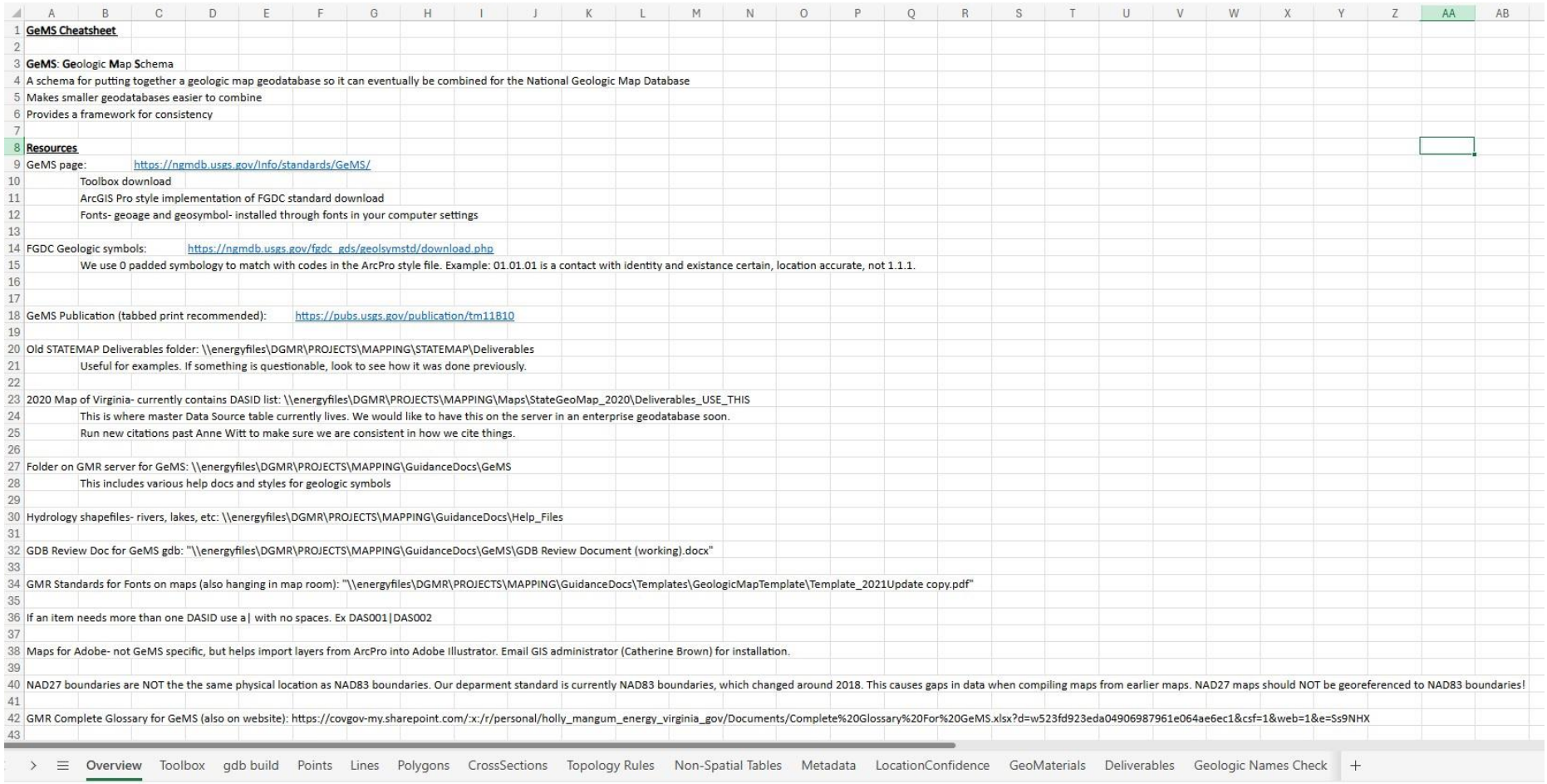
Hydrology shapefiles- rivers, lakes, etc: \\energyfiles\DGMR\PROJECTS\MAPPING\GuidanceDocs\Help_Files

GDB Review Doc for GeMS.gdb: "\\energyfiles\DGMR\PROJECTS\MAPPING\GuidanceDocs\GeMS\GDB Review Document (working).docx"

Overview | Toolbox | gdb build | Points | Lines | Polygons | CrossSections | Topology Rules | Non-Spatial Tables | Metadata | LocationConfidence | GeoMaterials | Deliverables | Geologic Names Check

This cheatsheet has 15 tabs containing tips, tricks, and links with information about creating a GeMS geodatabase based on USGS and internal GMR standards.

OVERVIEW



GeMS Cheatsheet

GeMS: **Ge**ologic **M**ap **S**chema
A schema for putting together a geologic map geodatabase so it can eventually be combined for the National Geologic Map Database
Makes smaller geodatabases easier to combine
Provides a framework for consistency

Resources
GeMS page: https://ngmdb.usgs.gov/Info/standards/GeMS/
Toolbox download
ArcGIS Pro style implementation of FGDC standard download
Fonts- geoage and geosymbol- installed through fonts in your computer settings

FGDC Geologic symbols: https://ngmdb.usgs.gov/fgdc_gds/geolsymstd/download.php
We use 0 padded symbology to match with codes in the ArcPro style file. Example: 01.01.01 is a contact with identity and existance certain, location accurate, not 1.1.1.

GeMS Publication (tabbed print recommended): https://pubs.usgs.gov/publication/tm11B10

Old STATEMAP Deliverables folder: \\energyfiles\DGMR\PROJECTS\MAPPING\STATEMAP\Deliverables
Useful for examples. If something is questionable, look to see how it was done previously.

2020 Map of Virginia- currently contains DASID list: \\energyfiles\DGMR\PROJECTS\MAPPING\Maps\StateGeoMap_2020\Deliverables_USE_THIS
This is where master Data Source table currently lives. We would like to have this on the server in an enterprise geodatabase soon.
Run new citations past Anne Witt to make sure we are consistent in how we cite things.

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This includes various help docs and styles for geologic symbols

Hydrology shapefiles- rivers, lakes, etc: \\energyfiles\DGMR\PROJECTS\MAPPING\GuidanceDocs\Help_Files

GDB Review Doc for GeMS gdb: "\\energyfiles\DGMR\PROJECTS\MAPPING\GuidanceDocs\GeMS\GDB Review Document (working).docx"

GMR Standards for Fonts on maps (also hanging in map room): "\\energyfiles\DGMR\PROJECTS\MAPPING\GuidanceDocs\Templates\GeologicMapTemplate\Template_2021Update copy.pdf"

If an item needs more than one DASID use a| with no spaces. Ex DAS001|DAS002

Maps for Adobe- not GeMS specific, but helps import layers from ArcPro into Adobe Illustrator. Email GIS administrator (Catherine Brown) for installation.

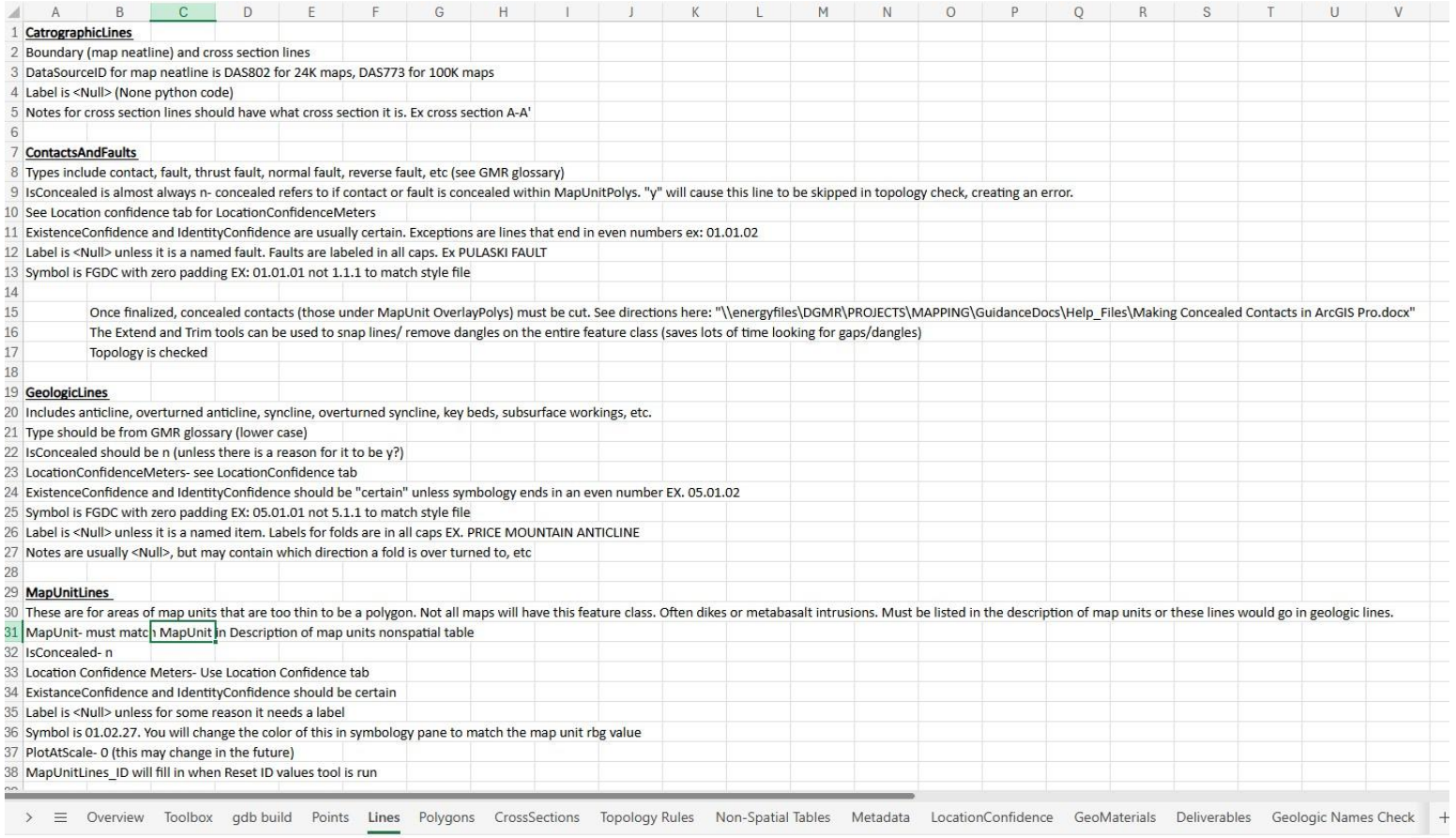
NAD27 boundaries are NOT the the same physical location as NAD83 boundaries. Our deparment standard is currently NAD83 boundaries, which changed around 2018. This causes gaps in data when compiling maps from earlier maps. NAD27 maps should NOT be georeferenced to NAD83 boundaries!

GMR Complete Glossary for GeMS (also on website): https://covgov-my.sharepoint.com/:x:/r/personal/holly_mangum_energy_virginia_gov/Documents/Complete%20Glossary%20For%20GeMS.xlsx?d=w523fd923eda04906987961e064ae6ec1&csf=1&web=1&e=Ss9NHX

Overview | Toolbox | gdb build | Points | Lines | Polygons | CrossSections | Topology Rules | Non-Spatial Tables | Metadata | LocationConfidence | GeoMaterials | Deliverables | Geologic Names Check

The “Overview” tab is extremely useful as a one stop shop for links to GeMS related resources and the location of commonly used datasets on our internal GMR server.

EXAMPLE OF A FEATURE TAB: LINES



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
1	**CatrographicLines**																					
2	Boundary (map neatline) and cross section lines																					
3	DataSourceID for map neatline is DAS802 for 24K maps, DAS773 for 100K maps																					
4	Label is <Null> (None python code)																					
5	Notes for cross section lines should have what cross section it is. Ex cross section A-A'																					
6																						
7	**ContactsAndFaults**																					
8	Types include contact, fault, thrust fault, normal fault, reverse fault, etc (see GMR glossary)																					
9	IsConcealed is almost always n- concealed refers to if contact or fault is concealed within MapUnitPolys. "y" will cause this line to be skipped in topology check, creating an error.																					
10	See Location confidence tab for LocationConfidenceMeters																					
11	ExistenceConfidence and IdentityConfidence are usually certain. Exceptions are lines that end in even numbers ex: 01.01.02																					
12	Label is <Null> unless it is a named fault. Faults are labeled in all caps. Ex PULASKI FAULT																					
13	Symbol is FGDC with zero padding EX: 01.01.01 not 1.1.1 to match style file																					
14																						
15		Once finalized, concealed contacts (those under MapUnit OverlayPolys) must be cut. See directions here: "\\energyfiles\DGMR\PROJECTS\MAPPING\GuidanceDocs\Help_Files\Making Concealed Contacts in ArcGIS Pro.docx"																				
16		The Extend and Trim tools can be used to snap lines/ remove dangles on the entire feature class (saves lots of time looking for gaps/dangles)																				
17		Topology is checked																				
18																						
19	**GeologicLines**																					
20	Includes anticline, overturned anticline, syncline, overturned syncline, key beds, subsurface workings, etc.																					
21	Type should be from GMR glossary (lower case)																					
22	IsConcealed should be n (unless there is a reason for it to be y?)																					
23	LocationConfidenceMeters- see LocationConfidence tab																					
24	ExistenceConfidence and IdentityConfidence should be "certain" unless symbology ends in an even number EX. 05.01.02																					
25	Symbol is FGDC with zero padding EX: 05.01.01 not 5.1.1 to match style file																					
26	Label is <Null> unless it is a named item. Labels for folds are in all caps EX. PRICE MOUNTAIN ANTICLINE																					
27	Notes are usually <Null>, but may contain which direction a fold is over turned to, etc																					
28																						
29	**MapUnitLines**																					
30	These are for areas of map units that are too thin to be a polygon. Not all maps will have this feature class. Often dikes or metabasalt intrusions. Must be listed in the description of map units or these lines would go in geologic lines.																					
31	MapUnit- must match MapUnit in Description of map units nonspatial table																					
32	IsConcealed- n																					
33	Location Confidence Meters- Use Location Confidence tab																					
34	ExistanceConfidence and IdentityConfidence should be certain																					
35	Label is <Null> unless for some reason it needs a label																					
36	Symbol is 01.02.27. You will change the color of this in symbology pane to match the map unit rbg value																					
37	PlotAtScale- 0 (this may change in the future)																					
38	MapUnitLines_ID will fill in when Reset ID values tool is run																					

Overview | Toolbox | gdb build | Points | Lines | Polygons | CrossSections | Topology Rules | Non-Spatial Tables | Metadata | LocationConfidence | GeoMaterials | Deliverables | Geologic Names Check

We have multiple tabs with information related to GeMS geodatabase features, such as points, lines, and polygons. Pictured is an example of the "Lines" tab, which parses out each individual line feature in a GeMS geodatabase and explains how each attribute should be filled out based on the USGS GeMS guidebook and internal GMR standards.

LOCATION CONFIDENCE SCALE GUIDE

	A	B	C
1		**Confidence (m)**	
2	**1:24,000-scale Maps**		
3	lines - certain and accurate (....01)	25	Appropriate for contacts that are exposed, constained by closely spaced field data or accurately located on LIDAR basemaps.
4	lines - certain and approximate (...03)	50	Appropriate for contacts that are approximately located on LIDAR basemaps.
5	lines - certain and approximate (...03)	100	Appropriate for contacts that are constrained by moderately spaced field data.
6	lines - certain and inferred (...05)	250	Appropriate for contacts that are constrained by widely spaced field data.
7	lines - covered (...07)	50	Appropriate for accurate contacts in areas that are covered by narrow surficial deposits.
8	lines - covered (...07)	100	Appropriate for approximate contacts in areas that are covered by narrow surficial deposits.
9	lines - covered (...07)	150	Appropriate for contacts in areas that are covered by intermediate width surficial deposits.
10	lines - covered (...07)	250	Appropriate for contacts in areas that are covered by wide surficial deposits.
11	points - certain and accurate	5	Appropriate for points located using GPS, LIDAR basemaps, or well-rectified digital orthophotographs.
12	points - certain and approximate	25	Appropriate for points digitized from 7.5-minute topographic maps
13	**1:100,000-scale Maps**		
14	contacts and faults - certain and approximate	100	Appropriate for most contacts digitized from 1:100,000-scale or better mapping and constrained by moderately spaced field data or approximately located on LIDAR basemaps.
15	lines - certain and inferred	250	Appropriate for contacts not constrained by moderately spaced field data, not approximately located on LIDAR basemaps, or obscured by wider surficial deposits.
16	orientation points (gps)	5	Appropriate for points located using GPS, LIDAR basemaps, or well-rectified digital orthophotographs.
17	orientation points (plotted on topo)	25	Appropriate for points digitized from 7.5-minute topographic maps
18	orientation points (plotted on topo)	100	Appropriate for points digitized from 30 x 60-minute topographic maps
19	**1:250000-scale Maps**		
20	contacts and faults	250	Appropriate for most contacts digitized from 1:1250,000-scale or better mapping.
21	**Cross Sections**		
22	contacts and faults	250	Appropriate for most contacts and faults in cross sections
23			
24			
25			
26	** Note that contact lines accuracy and certainty correspond to they FGDC symbol code. This should also match in the fields of the object.		
27	*** Most maps prior to 2017 did NOT use LiDAR		
28	****Some older datasets have 10M confidence for some points. Our current standards override those (usually becomes 5).		
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Overview | Toolbox | gdb build | Points | Lines | Polygons | CrossSections | Topology Rules | Non-Spatial Tables | Metadata | **LocationConfidence** | GeoMaterials | Deliverables | Geologic Names Check | +

When working on multiple maps at different scales, it can be easy to misattribute the LocationConfidence for point and line features. Having this single chart of common features and their confidence meters makes it easier for our staff to fill out their feature attributes and makes the review process overall more efficient.

REFERENCES

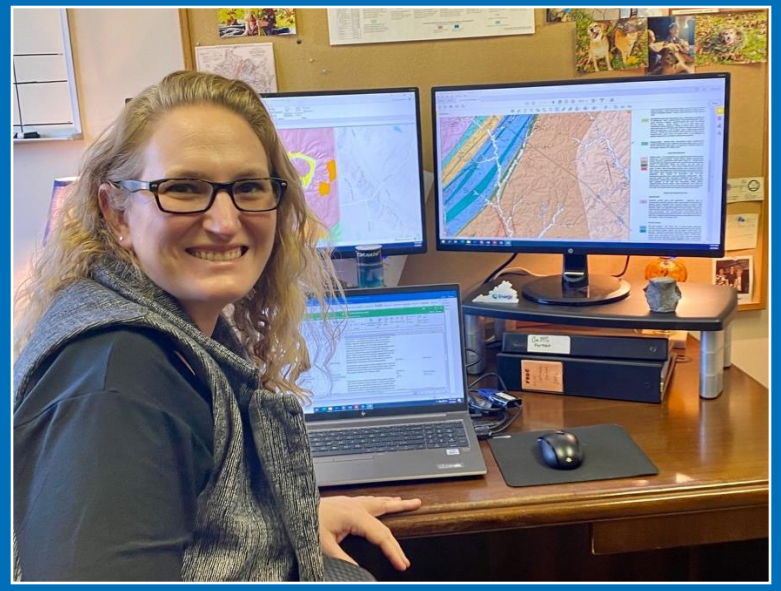
Federal Geographic Data Committee [prepared for the Federal Geographic Data Committee by the U.S. Geological Survey], 2006, FGDC Digital Cartographic Standard for Geologic Map Symbolization: Reston, VA, Federal Geographic Data Committee Document Number FGDC-STD-013-2006, 290 p., 2 plates.

Neuendorf, K.K.E., Mehl, J.P., and Jackson, J.A. (eds), 2011, Glossary of Geology, 5th edition (revised), American Geological Institute, 800 p.

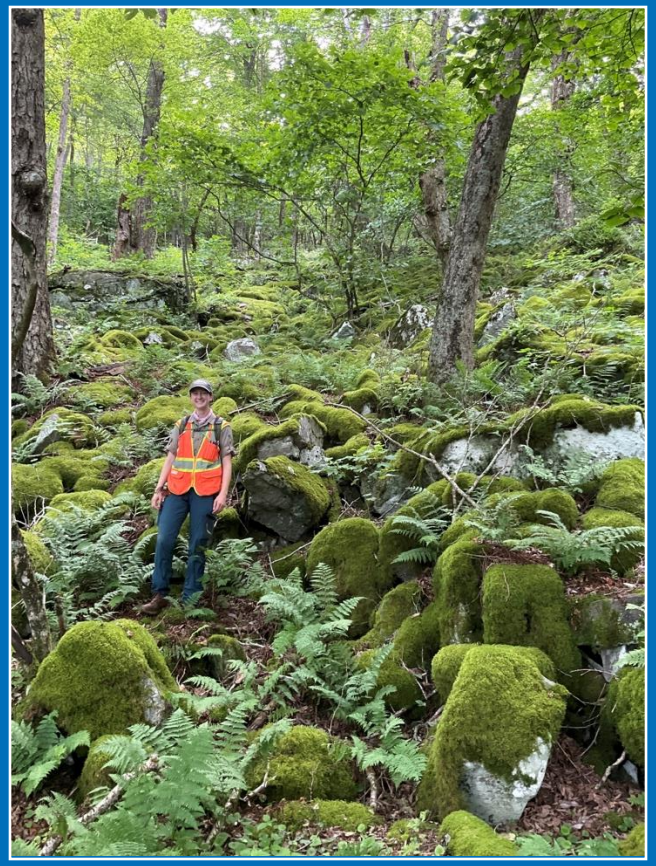
U.S. Geological Survey National Cooperative Geologic Mapping Program, 2020, GeMS (Geologic Map Schema)—A standard format for the digital publication of geologic maps: U.S. Geological Survey Techniques and Methods, book 11, chap. B10, 74 p.

Witt, A.C., Heller, M.J., Occhi, M.E., Spears, D.B., Lang, K.E., Berquist, C.R. Jr., and Prince, P.S., editors, 2021, Statewide Geologic Map Database of Virginia: Virginia Department of Energy, Geology and Mineral Resources Program, Open-file report 2021-12, scale 1:250,000.

THANK YOU.



Catherine Brown digitizing a geologic map in ArcPro



Holly Mangum mapping colluvium on Walker Mountain for the geologic map of the Rural Retreat 24K Quadrangle

CONTACT THE PRESENTERS:

Holly Mangum
Geologist: Scientist II
Virginia Department of Energy
(434)-951-6364
holly.mangum@energy.virginia.gov

Catherine Brown
Information Technology Specialist II
Virginia Department of Energy
(540)-480-1369
catherine.brown@energy.virginia.gov
**Designed GeMS Cheatsheet*

May 20th, 2025

VIRGINIA Energy