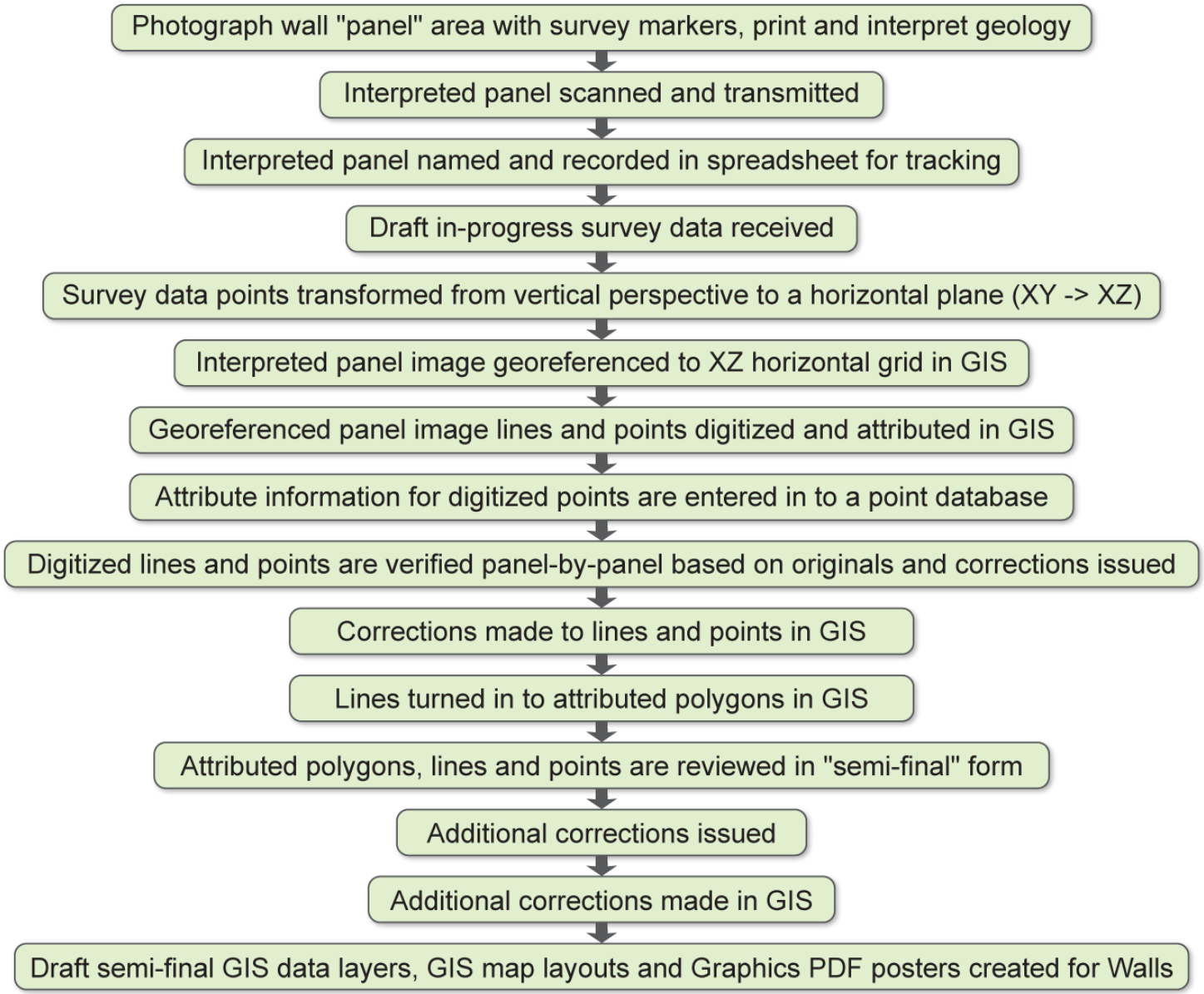
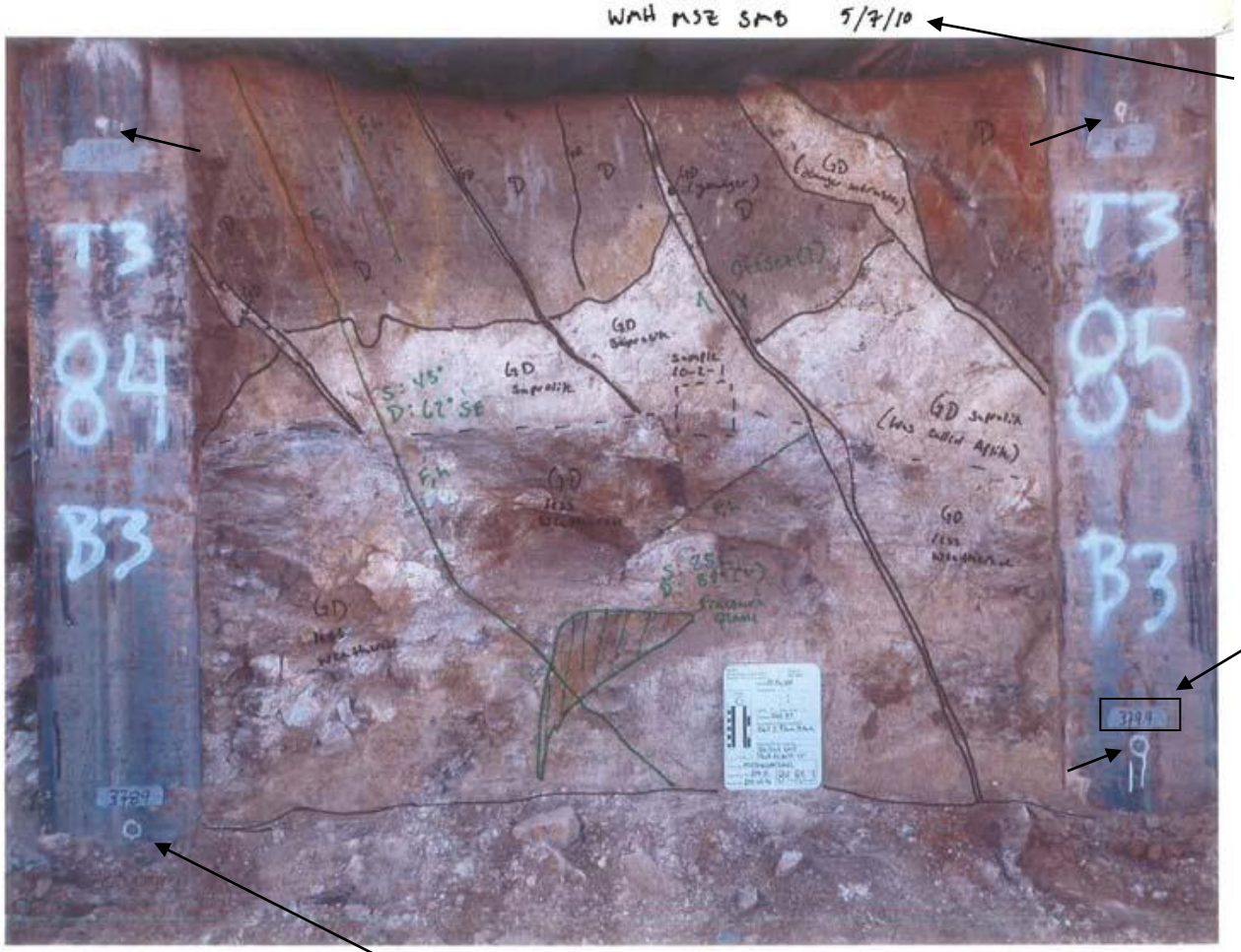
Excavation Wall Mapping Process



	sq. ft mapped	geo panels	GIS polygons	GIS lines	GIS points
East Wall	7,940	229	1,779	6,431	227
North Wall	16,050	457	2,473	6,992	307
Northeast Wall	8,800	220	1,665	4,064	186
West Wall	4,000	104	1,766	2,447	36
Northwest Wall	3,040	84	284	632	37
Southeast Wall	5,600	152	1,457	4,122	104
Southwest Wall	240	6	206	243	6
	45,670	1,252	9,630	24,931	903

1. Geologists photograph wall "panel" area, interpret geology on printed 8.5x11 page in the field



initials of field geologists and date panel was interpreted

hand written label listing elevation, used to double check registration points generated from transformed spreadsheet values

84_3.jpg

survey marker point

2. Interpreted 8.5x11 panel ("annotated photograph") is scanned to Adobe PDF and transmitted to WLA GIS Analyst
3. JPEG image extracted from PDF file, and named `<left pile #>_<tier #>.jpg`

VCS Unit 2 East Wall										
Piles 69 -> 101										
Panel ID	Interpreted	Verified	Corrected	Correction Required	Panel ID	Interpreted	Verified	Corrected	Correction Required	Panel ID
84_1		SMB 1/21/11		no changes	**85_1**		SMB 1/21/11	JH 3/15/11	del 'diffuse contact', Aplite poly to Gdf	**86_1**
84_2	MSZ 4/05/10	SMB 1/21/11	JH 3/15/11	del blue line center; del dashed lines subparallel to the fracture...	**85_2**	MSZ 4/05/10	SMB 1/21/11	JH 3/15/11	continue contact to 86_2	**86_2**
84_3	WMH SMB MSZ 5/07/10	SMB 3/17/11	JH 3/20/11	5, del dashed square around 'sample', add indicated StrikeDip label w/ measurements	**85_3**	WMH SMB MSZ 5/07/10	SMB 3/17/11	JH 3/20/11	add indicated offset labels w/ offdist (x2), del dashed 'clay rich' poly, del tiny contact separating LG dike, dikes veins filled w/ white clay (c, v or v,c), digitize fracture on left	**86_3**
84_4	MSZ WMH 5/19/10	SMB 3/17/11	JH 3/20/11	5, add indicated SS labels w/ measurements (x4), change Gd to Gdf	**85_4**	MSZ WMH 5/20/10	SMB 3/17/11	JH 3/20/11	5, add indicated offset SS labels w/ measurements (x2), change 'clay seem' bottom right to Gd vein, clay seam at top left to LG vein	**86_4**
84_5	JHC WMH 6/03/10	SMB 3/17/11	JH 3/20/11	5, add indicated offset and SS labels w/ measurements (x2)	**85_5**	JHC WMH 6/03/10	SMB 3/17/11	JH 3/20/11	5, add indicated offset labels w/ offdist (x2), change indicated 'clay seem' to LG veins, change clay seam on right to fracture	**86_5**
84_6	JHC WMH 6/28/10	SMB 3/17/11	JH 3/20/11	5, add indicated SS labels w/ measurements (x2)	**85_6**	JHC WMH 6/28/10	SMB 3/17/11	JH 3/20/11	2,3 add indicated SS label w/ measurement, snap fracture to clay seam top right - all are fracture	**86_6**
global change 5: dashed lines around weathered rock, 'diffuse contact', 'banding' and 'exfoliation' to separate .shp L_Type = SWC (not to included on final map)										
global change 3: add missing redlines, move to separate .shp (Altered Lineation, could be renamed Joints)										

4. JPEG file names recorded in Excel and columns added for;

"Interpreted" = initials of geologist(s) who interpreted the panel and when the interpretation was done

"Verified" = initials of geologist(s) who verified the GIS digitized-attributed lines overlaid on the georeferenced panel images "Corrected" = initials of the WLA GIS Analyst who made the correction and when the correction was made

"Correction Required" = a brief summary of the edit(s), if any

5. In-progress draft survey data, in the form of Excel spreadsheets of XYZ coordinates, received from Glenn & Associates

6. Survey data transformed by the WLA GIS Analyst to create a vertically oriented plane; true distance along the X axis originating at 0 and distance along the Y axis from the difference in Z (elevation) values

7. WLA GIS Analyst georeferences each JPEG panel using the four survey marker points using the transformed vertically oriented grid of survey points

8. WLA GIS Analyst(s) digitize and attribute lines and points from the georeferenced JPEG panel

L_Type = “Contact” or “Fracture” or “Vein”
Symbol = “dashed” or “solid”

9. WLA Geologist reviews digitized points for each digitized panel incorporating information recorded in the field on the panels and in field notes;

P_ID = Unique number for point, formatted as follows: <left pier #>_<lift #>_<point number>, for example: 008_5_2

P_Type = “Offset” or “Offset?” or “StrikeDip” or “SS”

Strike = Strike of fracture measured in field. Follow right hand rule

Dip = Dip of fracture measured in field

DipDir = Compass quadrant of dip direction

LinRake = Rake of any lineations on the face of the fracture. A rake of 90 is entered if the field notes or log report that the lineations are “on dip”

LinTrend = Trend of any lineations on the face of the fracture. This may be measured in the field or calculated from the strike, dip, and plunge

LinPlunge = Plunge of any lineations on the face of the fracture

LinDir = Compass quadrant of plunge direction

OffDist = Offset distance in centimeters. May be measured in field or from GIS. These are apparent offsets measured in the plane of the wall.

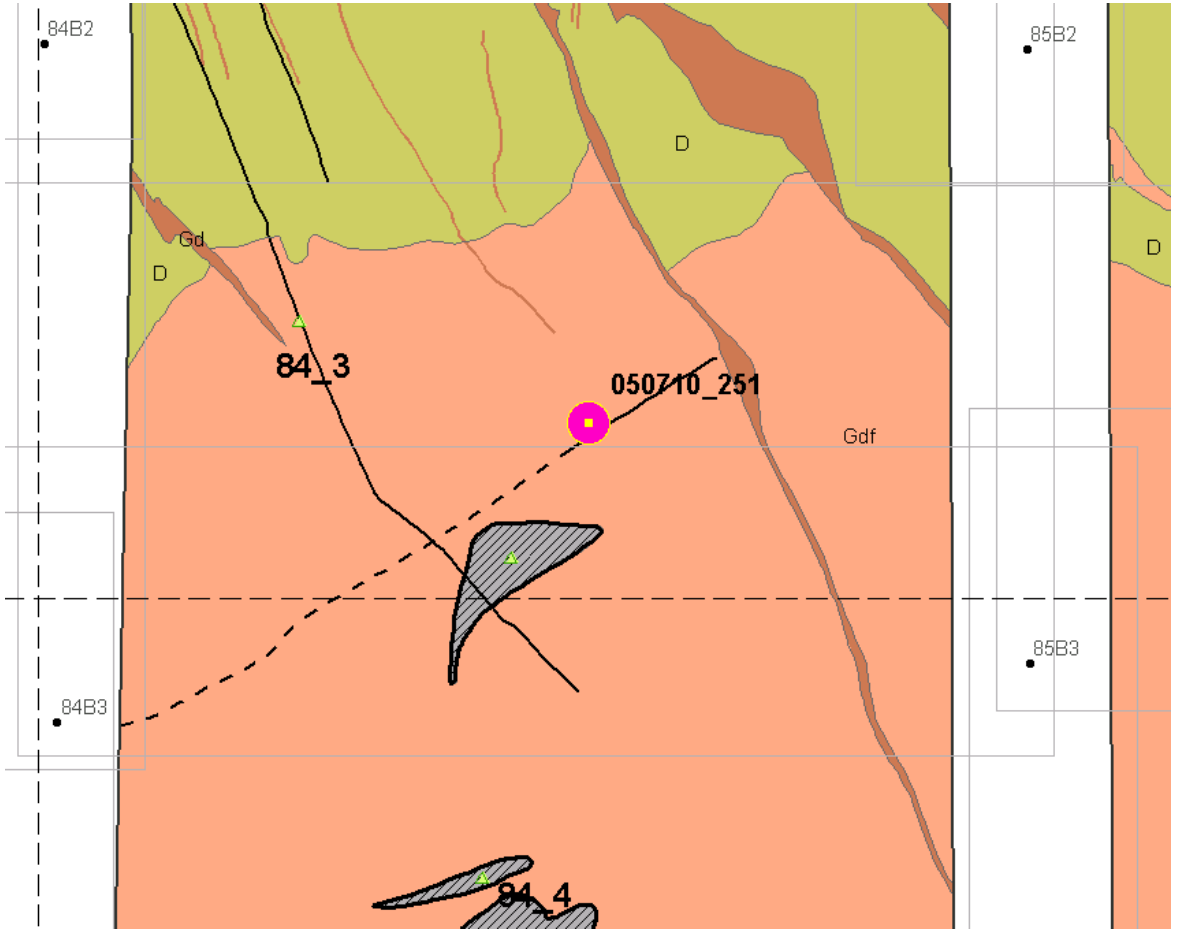
OffType = Sense of offset as seen in the wall. R=Right lateral L=Left lateral

GeoUnit = The youngest geologic unit that the fracture cuts or offsets. This unit may be along the fracture to either side, but within the panel.

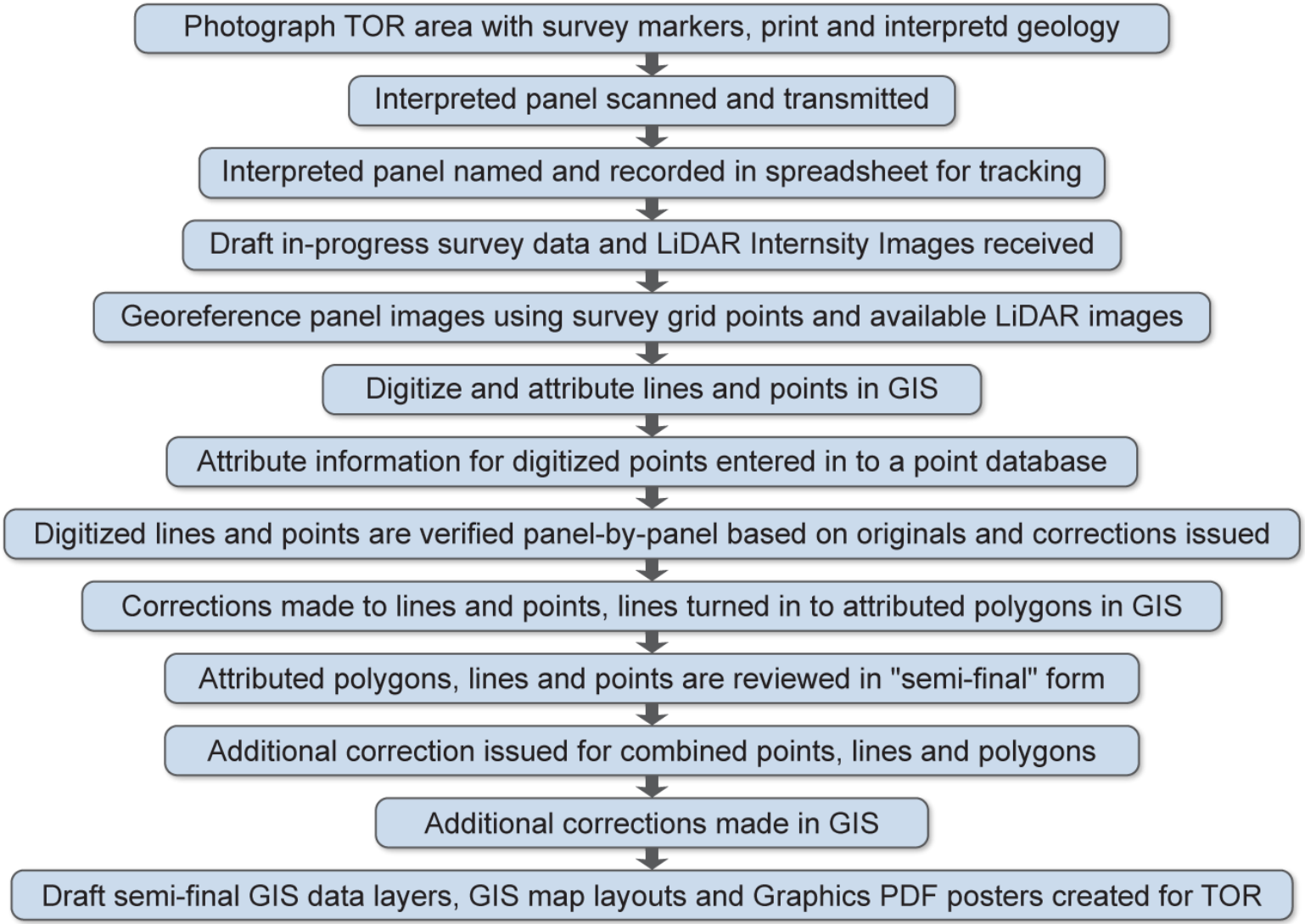
10. WLA GIS Analyst creates hardcopy for Geologists to edit and revise

11. WLA GIS Analyst makes required changes to the data based on hardcopy and other changes described in text and; a. adds summary of changes to the “Correction Required” field, b. updates the “Corrected” field for TRACKER .xls files

12. WLA GIS Analyst creates attributed polygons based on revised lines and hardcopy edit unit labels, refines the data and updates attributes for consistency

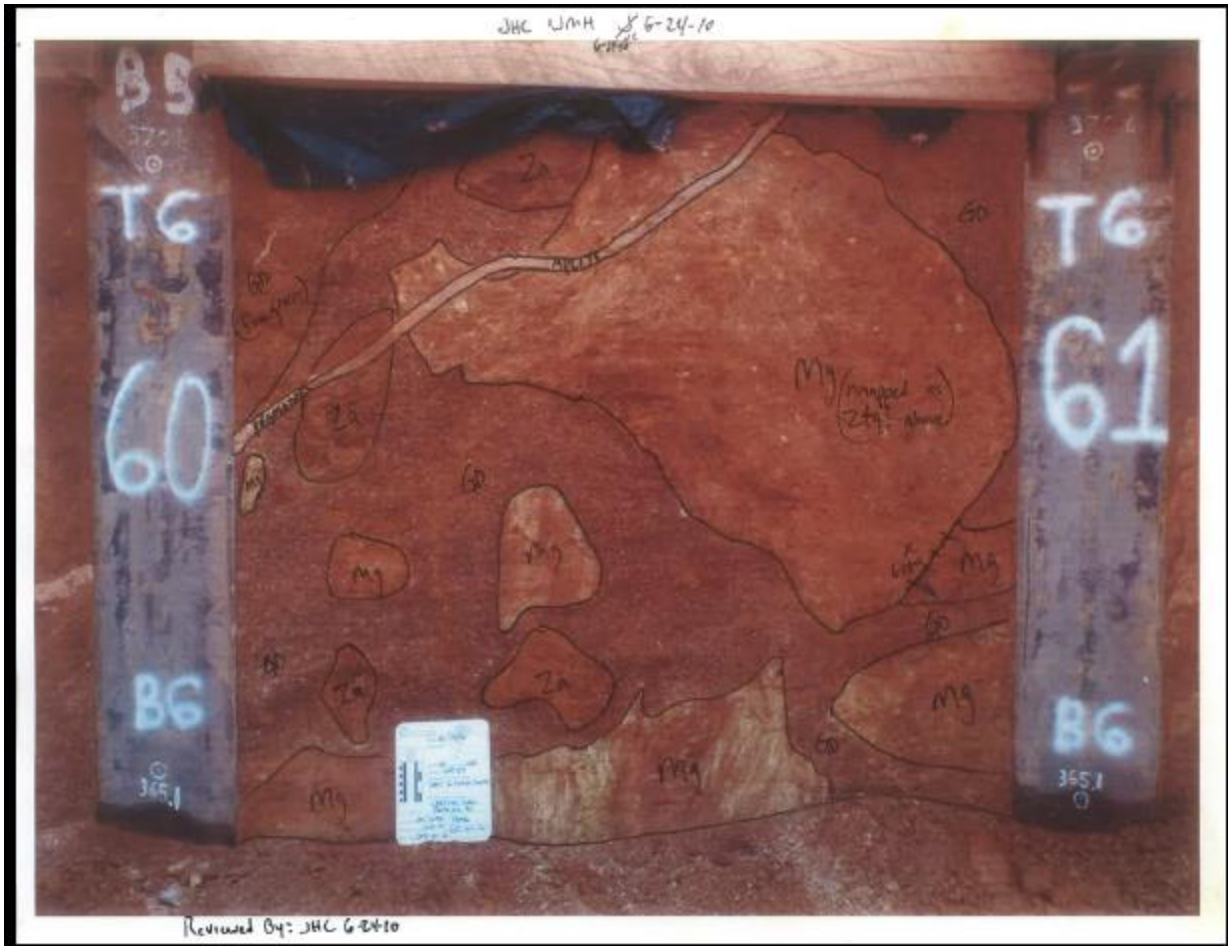


Pre-Blast Top of Rock (TOR) Mapping Process



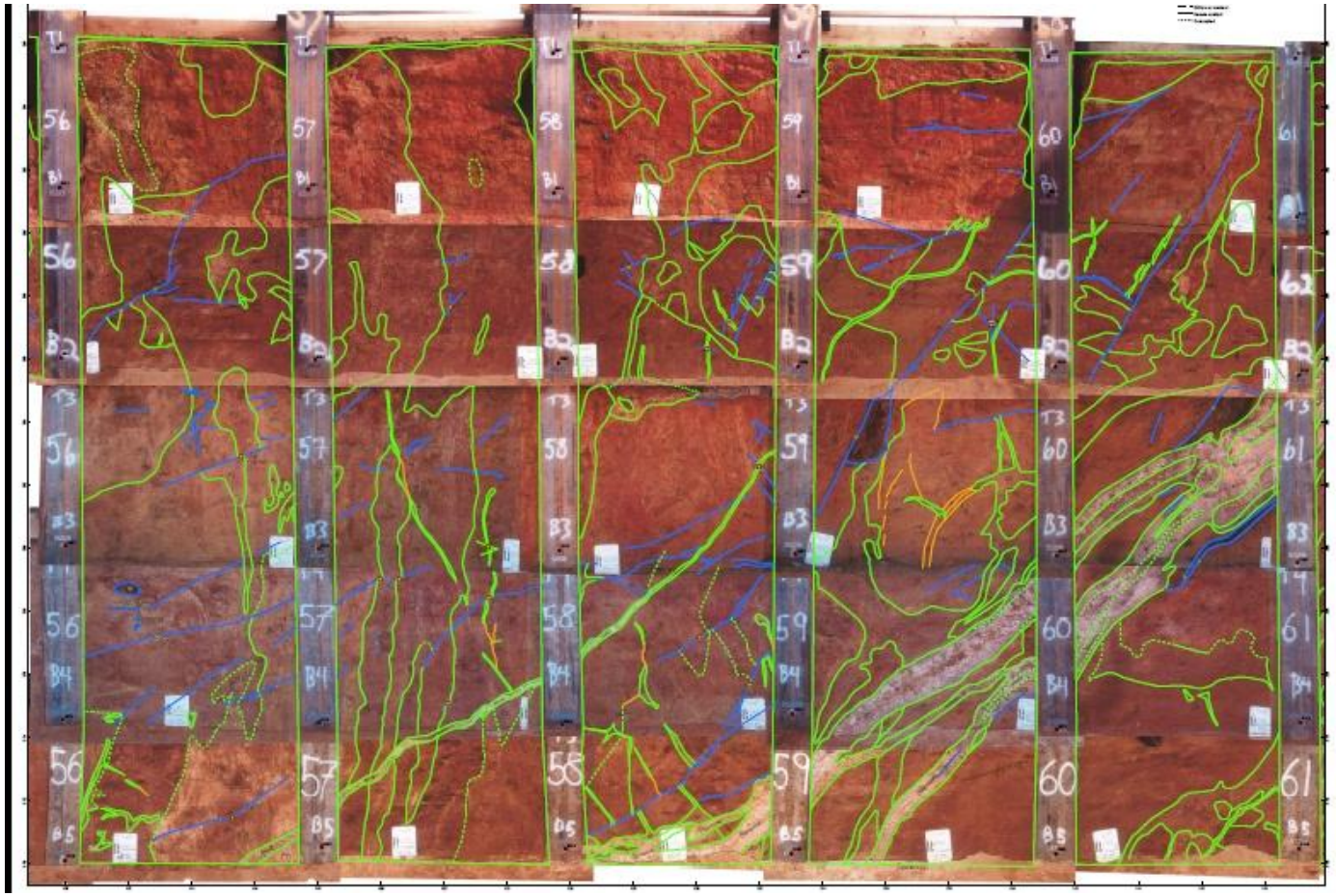
Mapping Workflow

- Photo Taken in Field
- Geologist annotates photo
- Annotated photo reviewed by geologist
- Annotated photo scanned to GIS



Mapping Workflow

- GIS digitizes, creates ‘review posters’
- Geologist reviews ‘poster’
- Revised by GIS, creates ‘map’
- Geologist reviews ‘map’



Keeping Track of Revisions

VCS Unit 2 West Wall Corrections

Piles 134 -> 155

Panel ID	Interpreted	Verfiied	Corrected	Correction Required
134_1	JMH/WMH 4/20/10	JC/WH SMB 1/26/11	JH 3/14/11	2
134_3	JHC/WMH 6/03/10	JC/WH SMB 1/26/11	JH 3/14/11	extend Gd poly to bottom corner 135_2 and Za in 135_3
135_1	JMH/WMH 4/20/10	JC/WH SMB 1/26/11	JH 3/14/11	del lower line
135_2	FS 4/23/10	JC/WH SMB 1/26/11	JH 3/14/11	2, use line in upper portion for Mg/GD contact
135_3	JHC/WMH 6/03/10	JC/WH SMB 1/26/11	JH 3/14/11	connect GD line to 135_4, change dashed to solid
135_4	JHC/WMH 6/29/10		JC/WH SMB 1/26/11	none