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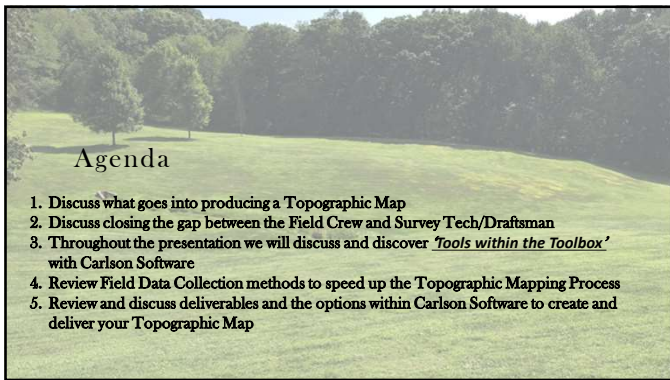
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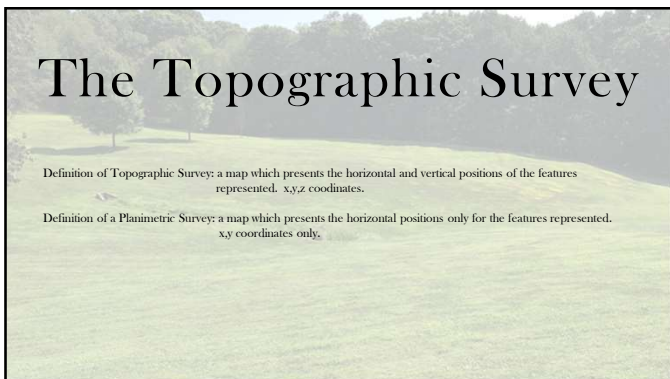
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# The Topographic Survey

- The Topographic Survey is a compilation of field data brought into a CAD platform.
- Key personnel are the Party Chief and the Survey Tech/Draftsman.
- Party Chief is the eyes of the project.
- Survey Tech is the artist who puts the data in planimetric format electronically or on paper.
- Communication between the 2 is essential for a good product.

How is your survey department managed?  
 Do you have project kickoff meetings?  
 Who attends these meetings?  
 Does the Survey Tech ask questions?  
 Does the Party Chief review the final survey?

Communication is the key!

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**Communication:**

**How well do you convey what you expect from your field crew?**

**How well do you interpret those instruction?**

**Scenario:**

**You're wife asks you to make a fire pit in the back yard so you all can sit around the fire and toast marshmallows.**

**What kind of fire pit would you make?**

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**Communication:**

**This is a functional option.**

**Ring of stones to contain the fire**

**It's in the back yard**

**You even collected limbs from around the yard**



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**Communication:**

**This is what she was envisioning!**



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**Communication:**

**Did she give bad instructions or did you not interpret the instructions correctly.**



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# The Topographic Survey

Working parts or "elements" of a topographic survey:

**Ground shots:** elevation on ground surfaces.  
elevation of hard surface

**Breaklines:** 3 dimensional lines that help define the topography such as top & bottom of bank; centerline of ditch; top & bottom of retaining walls; top, bottom & back of curb; gutter lines; centerline or crown of road;

**Feature locations:** edge or outline of a physical feature that may or may not be a breakline, such as edge of pavement, sidewalk, buildings, utility poles, fences.

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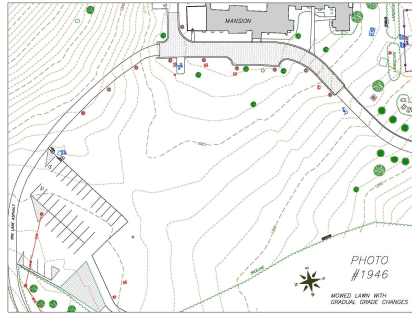
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### Topographic Survey

**Definitions:**

Contour: an imaginary line on the ground, all points of which are at the same elevation.

Contour interval: the difference in elevations between adjacent contours on a map.




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### Topography Examples: Gradual Grade Changes

- No breaklines
- 50' grid of ground shots would suffice.




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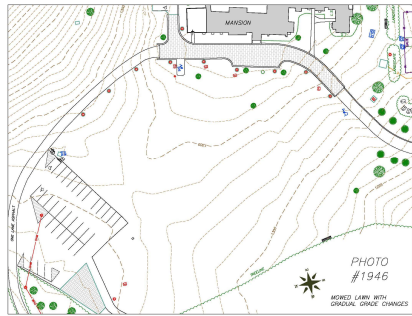
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### Topography Examples: Gradual Grade Changes

- Determine Contour interval: Interval depends on how steep the terrain is and the scale of your map.
- 1' contour interval, index contours every 5'
- 2' contour interval, index contours every 10'
- 20' contour interval, index contours every 100'
- No breaklines needed in this example




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**Topography Examples: Gradual Grade Changes**

- No breaklines
- 50' grid of ground shots would suffice.
- Locate abnormalities in the terrain:
  - Depressions
  - Mounds
  - Naturally occurring drainage
- Practice sheet

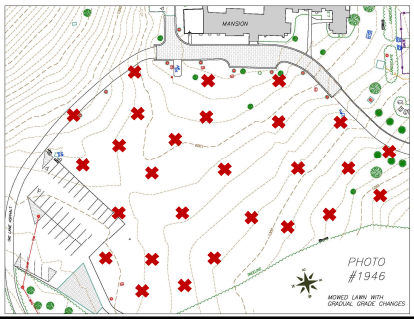


PHOTO #1946  
MARKED LINES WITH GRADUAL GRADE CHANGES

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**Topography Examples: Distinct Grade Changes**

- Breaklines along Top & bottom of banks
- Supplement with ground shots



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**Topography Examples: Distinct Grade Changes**

- Breaklines along Top & bottom of banks
- Supplement with ground shots



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**Topography Examples: Distinct Grade Changes**

- Breaklines along Top & bottom of banks
- Supplement with ground shots

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**Topography Examples: Distinct Grade Changes**

- Breaklines along Top & bottom of banks
- Supplement with ground shots

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**Topography - Creating Contours History...**

- Point Plot via Hand with a Light Table or Point Plot via Printer
- Hand Drawn Contours – Interpretive
- Can Be Creative to *Get the Job Done*
- Easy To Modify as Needed

- With the introduction of CAD and Land Surveying Software Pkg's-Allowed Drafters and Surveyors to Create 'their' Topographic Survey Map...

**Carlson**

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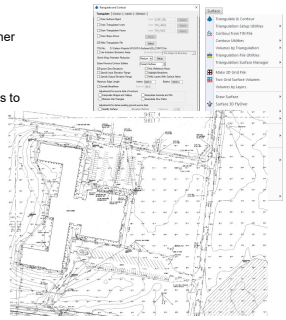
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### Topography - Creating Contours History...

- CAD Software – Creating DTM, TIN or DEM... along with other new surface formats
  - Various data sources – Not just from the field with traditional Topographic Collection Methods
  - Software needs to be flexible with settings and output options to create contours
  - Easy To Modify as Needed
- 
- Allowed Drafters and Surveyors to Create *'their'* Topographic Survey Map...



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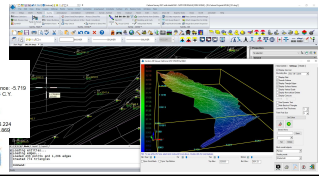
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### Topography - Creating Contours with Software

- Points or Points and Break-Lines (aka. Fault Lines)
  - 3D Break Lines
  - 3D Points
  - *Fun Fact...* Carlson Points Can be also 2D Points w/Elevation Labels
- Ability to Create Multiple Topographic Contour Map Styles for Output
- Electronic Surface Model File Creations → Send to others easily...
- Use the surface file types for... Volume Calculations, Profiles and other functions within *your* software package



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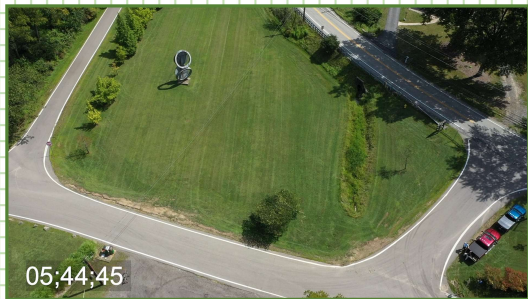
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### Project #1: Topographic Survey at Hartwood Acres



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Project #1: Obtain permission for drone flight



**URBAN TERRAIN**  
4000 TOWNSHIP ROAD, SUITE 200  
WILKESBARRE, PA 18702  
910.283.8282

August 18, 2022

**ALLEGHENY COUNTY PERMS**  
501 COLON TOWNSHIP  
501 COLON AVENUE  
WILKESBARRE, PA 18702

John W. Clewley, Deputy Director of Public Works

Re: Request permission to fly drone video at Horseshoe Acres for educational purposes.

Dear Mr. Clewley:

I am writing to request an Unmanned Aircraft System (UAS) for the Pennsylvania Society of Land Surveyors (PSLS) that will be approved by the 2022 Legislative Session. Our proposal includes a letter of approval from the Pennsylvania Society of Land Surveyors, a letter of approval from the Pennsylvania Department of Transportation, a letter of approval from the Pennsylvania Department of Environmental Protection, and a letter of approval from the Pennsylvania Department of Agriculture.

I currently have the Horseshoe Road address in Horseshoe Acres for the proposed subject garden. The site is located on the east side of the road, south of the intersection with the road, and is currently zoned R-1. The site is currently zoned R-1, which allows for residential use, including the use of a drone. The site is currently zoned R-1, which allows for residential use, including the use of a drone. The site is currently zoned R-1, which allows for residential use, including the use of a drone.

I appreciate your cooperation and the fact that you are willing to help me with this project. I will provide you with all of the information you need to complete this project. I will provide you with all of the information you need to complete this project. I will provide you with all of the information you need to complete this project.

Sincerely,  
*Cheryl Hopkins*  
Cheryl Hopkins  
Owner, UASD Terrain LLC  
Allegheny County  
Pennsylvania Society of Land Surveyors

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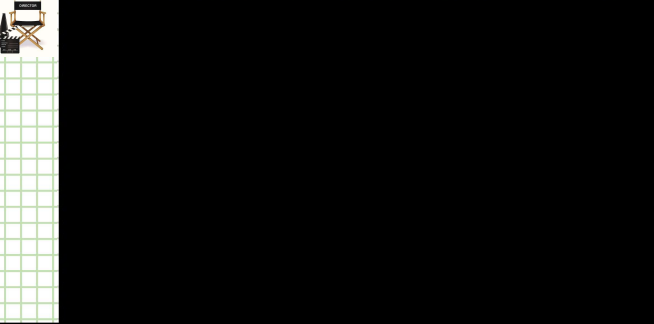
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Project #1: Drone Video #6



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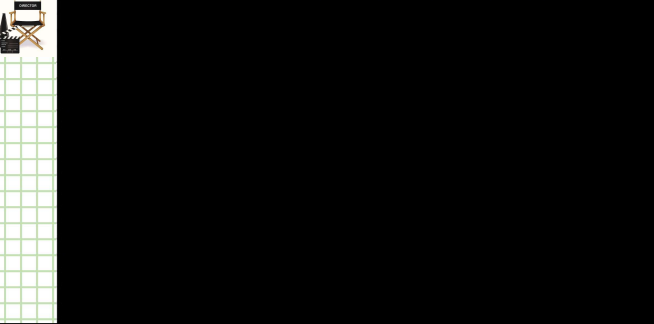
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Project #1: Drone Video #7



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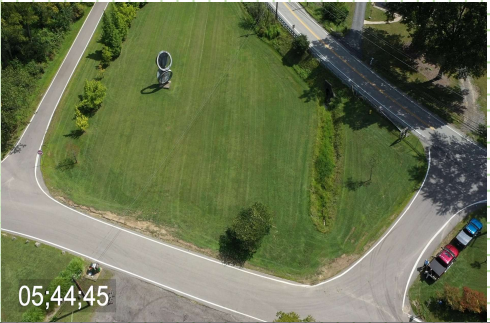
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**Project #1: Parts of the Topography**

- Paved State Road
- Paved access Roads
- Ditch or Swale
- Headwall
- Gradual grade open field



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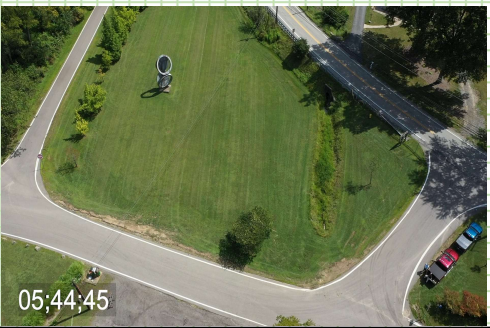
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**Project #1: Parts of the Topography**

- Paved State Road
  - Edge of pavement
  - Centerline of crown
  - Edge of shoulder
  - Top of bank
  - Bottom of bank
- Paved access Roads
  - Edge of pavement
  - Top of bank
  - Bottom of bank
- Ditch or Swale
  - Top of bank
  - Bottom of bank
  - Flowline
- Headwall
  - Top of wall
  - Bottom of wall
  - Invert of pipe



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**Project #1: A State Road**

- Paved State Road
  - Edge of pavement
  - Centerline of crown
  - Edge of traveled cartway
  - Edge of shoulder
  - Top of bank
  - Bottom of bank
- Non-topographic features
  - Guide rail
  - Sign
  - Utility poles

Carry elevations of all features, you may or may not use the elevation in your surface.

Be consistent with shots or note that elevation is not to be used to create the surface. (0.00 or -9999)



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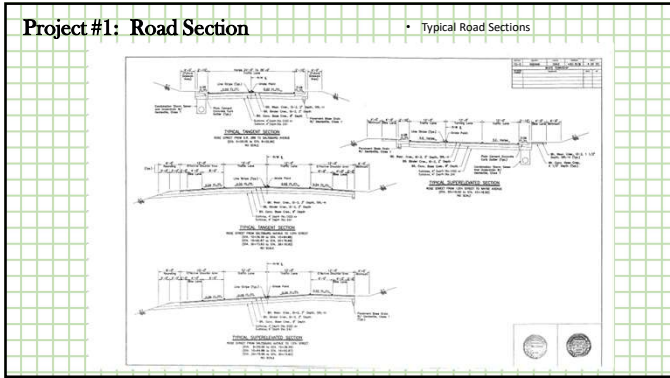
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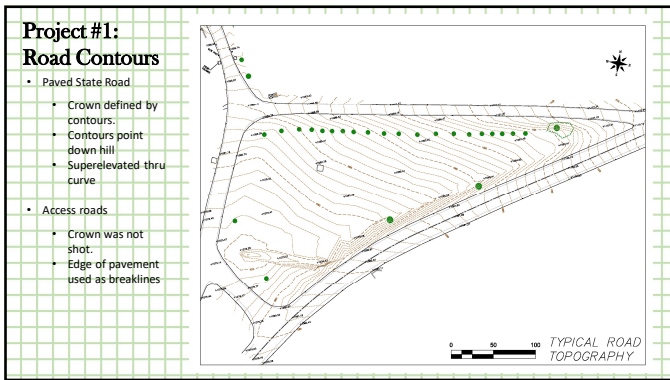
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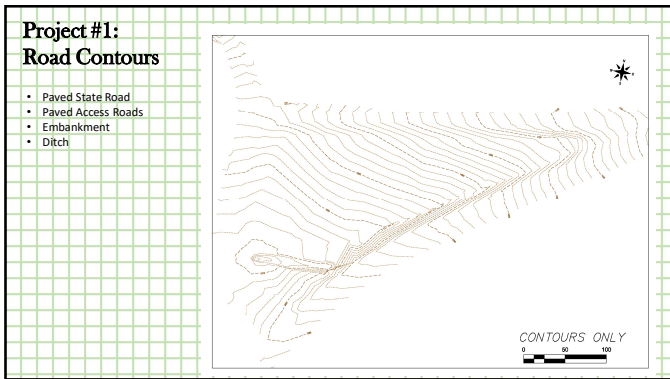
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**Example: City Street**

- Crown
- Curb
- Sidewalk

• Shots:

- Sidewalk edges
- Back of Curb
- Top of Curb
- Bottom of Curb
- Gutter line
- Crown
- Ground shots

CITY STREET CONTOURS WITH DECIMED CROWN  
0 20 40

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**Project #1: A Trapezoidal Ditch**

- Parts of a ditch
  - Top of Bank
  - Bottom of Bank
  - Flow line
- Man-made features
  - Headwall
  - Pipes & inverts

Look for small pipes draining into the ditch.  
Take shots cross section style when feasible.

09:00:38

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**Project #1: A Trapezoidal Ditch**      • Sections

**TYPICAL CHANNEL SECTION**  
(STA 11+50.00 to STA 20+00.00)  
NO SCALE

\*LOCATE THE FLOWLINE WHICH IS NOT ALWAYS IN THE CENTER OF THE DITCH.

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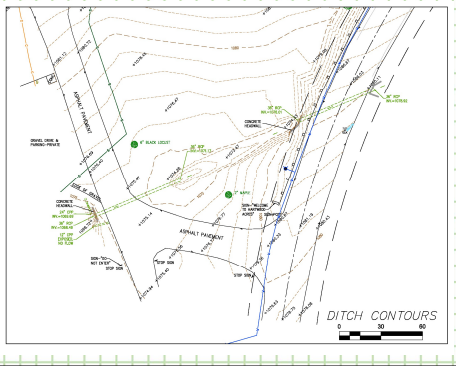
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**Project #1:  
Trapezoidal Ditch**

- Contours define banks
- Verify inverts
- Spot elevations



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**Project #1: A Trapezoidal Ditch**

- Parts of a ditch
  - Top of Bank
  - Bottom of Bank
  - Flow line
- Man-made features
  - Pipes & inverts

Note pipe size and material.

Use a topo foot to ensure you're getting true elevations.



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**Project #1: Headwall**

- Parts of a headwall
  - Top of wall
  - Bottom of Wall
  - Pipes & inverts

Note pipe size and material.



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### Project #1: Complex Headwall

- Parts of a headwall
  - Top of wall
  - Bottom of Wall
  - Pipes & inverts

Isolate the breaklines  
Use specific codes



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### Wall vs. Retaining wall



- Retaining wall is holding back earth
  - Contours run up a retaining wall
- Wall is for privacy, safety or decorative.
  - Run contours under wall. Label height of wall

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### Unique Features

- Steps & sidewalk elevated
- Shot as a wall
- Breakline along bottom of wall/steps
- Edge of sidewalk as breakline



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**Project #2: Sink Hole**

Topographic Survey of old cobblestone street to repair a sinkhole and design stormwater improvements.



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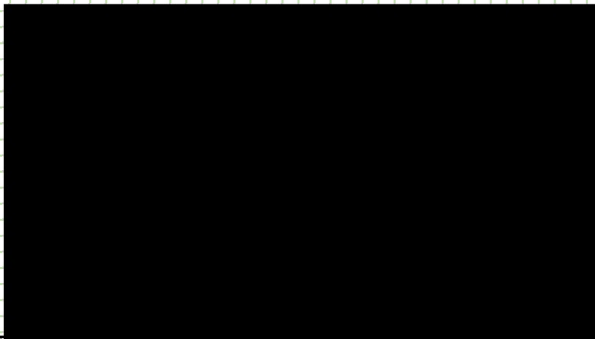
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**Project #2:** Drone Video #1



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**Project #2: Sink Hole**

- The real star of the show is the street itself.
- Water under the road is pushing up the brick



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### Project #2: Cobble Stone Street

Parts of the Topo

- Ground Spot
- Edge of Sidewalk
- Ground Spot (if needed)
- Top back of curb
- Top of curb
- Bottom of curb/Gutter line
- Edge of Concrete/Brick
- Centerline (not well defined)



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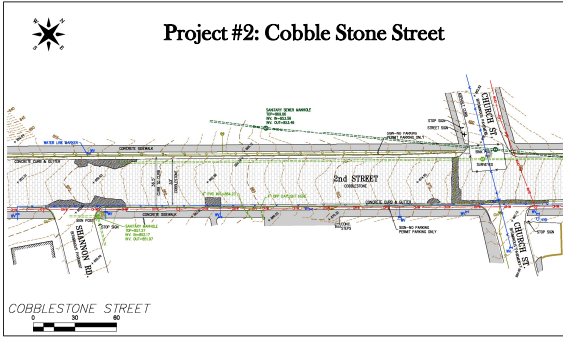
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### Project #2: Cobble Stone Street



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### Random Projects



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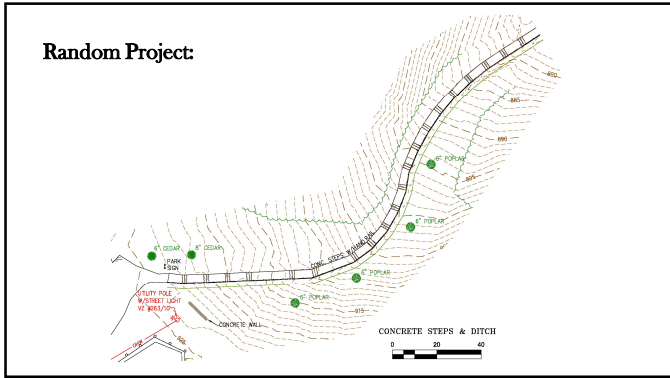
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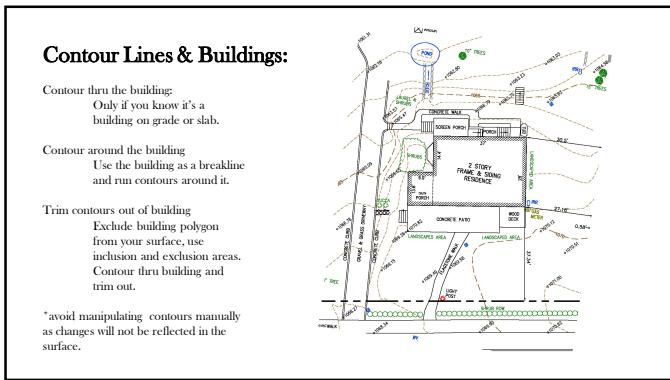
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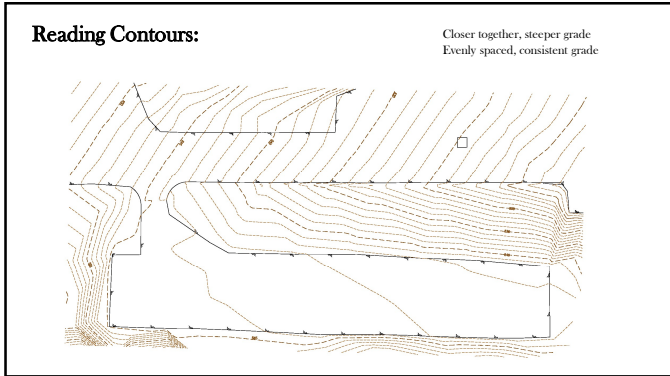
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**Reading Contours: Hill**

GS-Ground shot  
TB-Top of Bank  
BB-Bottom of Bank

\*practice sheet

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**Know what you're looking at:**

When ordering topography from a third party, be sure you're getting a quality product. Ask if they have a licensed land surveyor or photogrammetrist on staff.

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**Know what you're looking at:**

When ordering topography from a third party, be sure you're getting a quality product. Ask if they have a licensed land surveyor or photogrammetrist on staff.

Contoured to roof of building.

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### Interpolation

Fill in the gaps between grades.

Difference in elevations divided by distance between points = elevation difference per foot.

Measure distance for next spot elevation, multiply by edpf.

Add or subtract elevation depending on grade.

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### Topography – When You’re Ready...! – Let’s Take a Look

- Creating Surfaces with Topo Points
- Creating Surfaces and Contours with Break Lines

- Evaluate and Analyze TIN/DTM Creation with
  - 3D Viewer(s) Tools
  - Profile(s)
- Editing Surfaces and Contour Tools to... 'Create your Map'
- Surface to Surface Volume Calculations...
- Output and Export Options for various types of deliverables from Carlson SW

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