TeraTrak R1

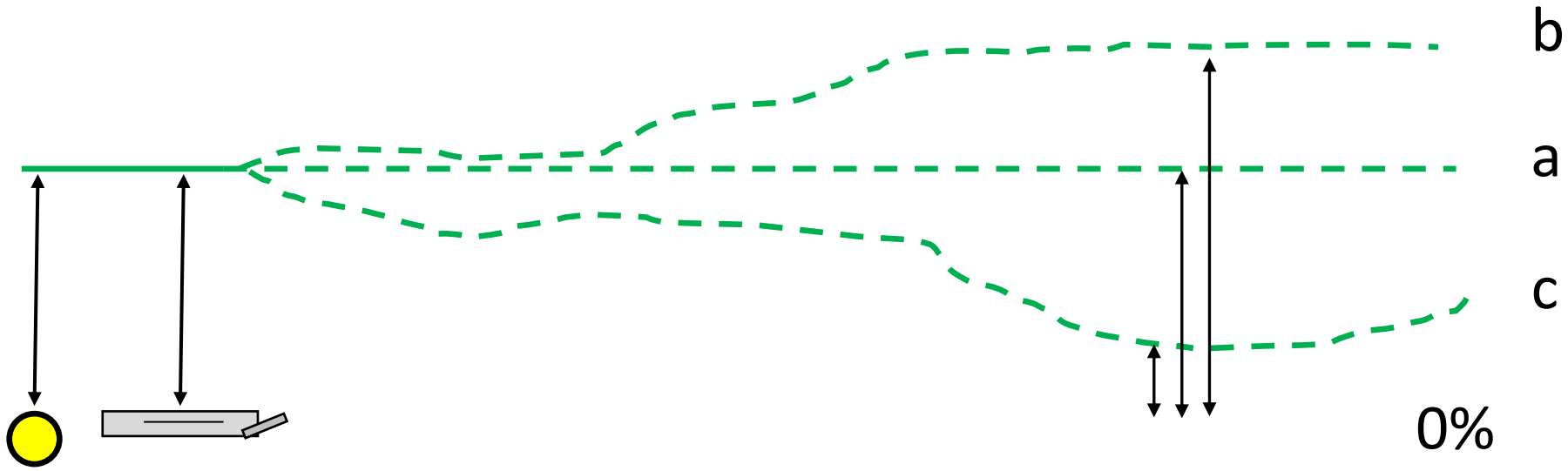
Reinventing the Measuring Wheel for HDD

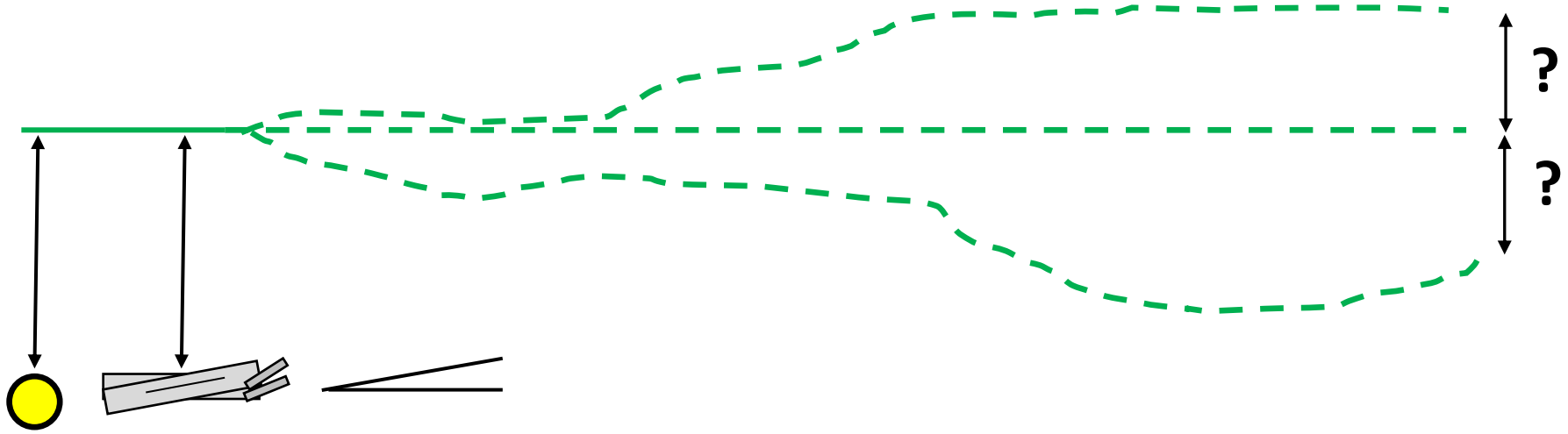
Siggi Finnsson

Digital Control Incorporated

What is depth?

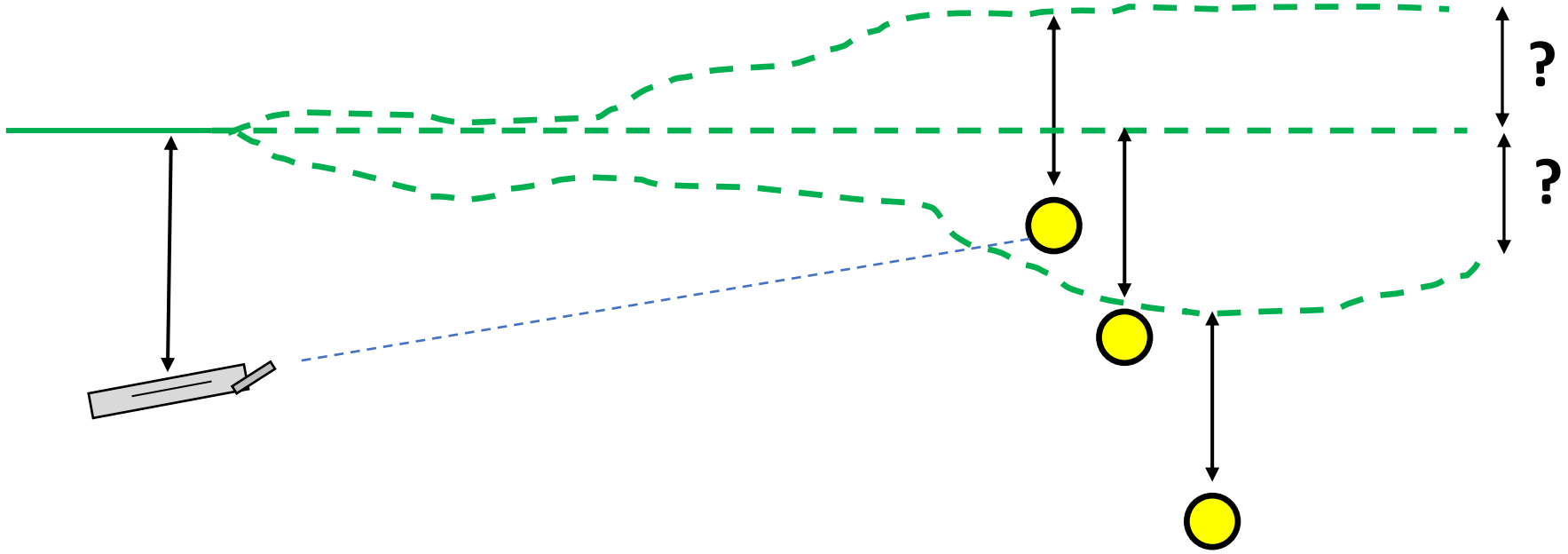
Depth is generally a measurement from some sort of a surface to a point of interest. In HDD, depth typically refers to the drill head, utilities or other points of interest along the way.





Depth is a function of the terrain.

This is obvious but does raise some questions.

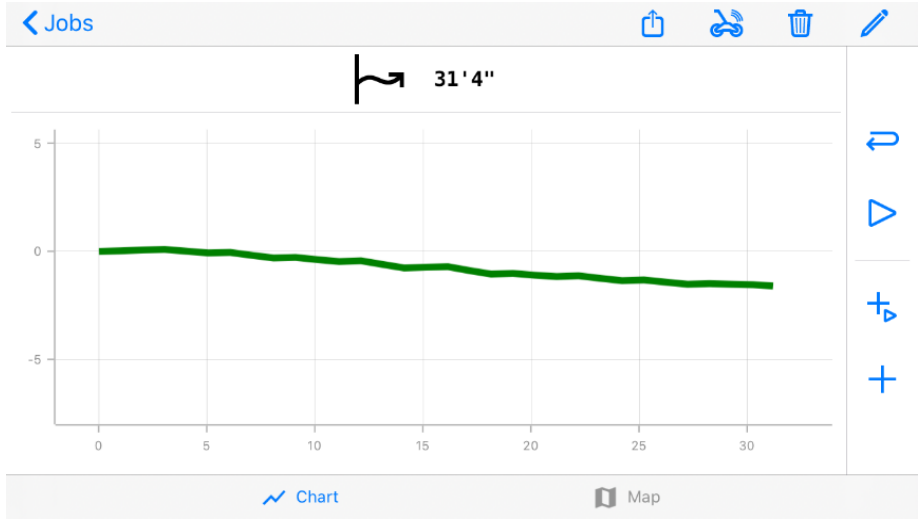


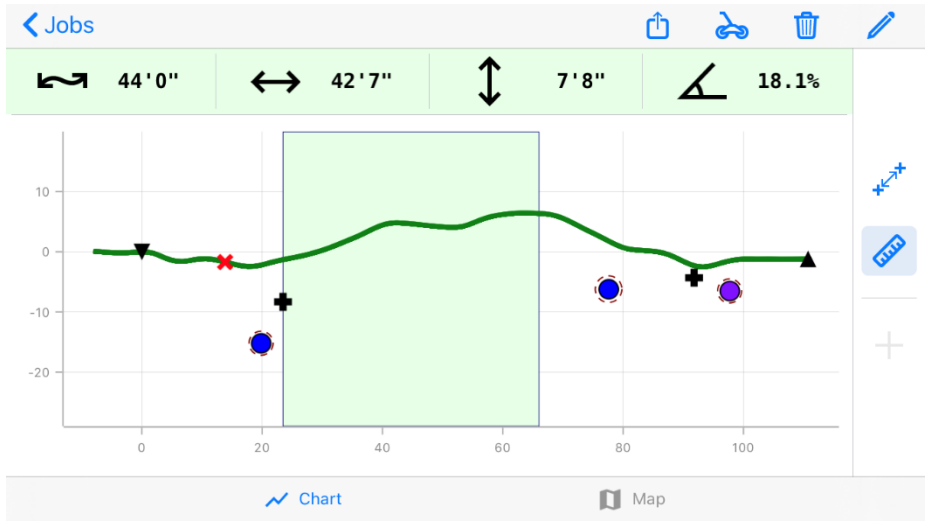
How does an HDD crew get accurate terrain or elevation information?

How do they make good steering decisions without terrain information?

How do they avoid things out front without knowing elevation changes?

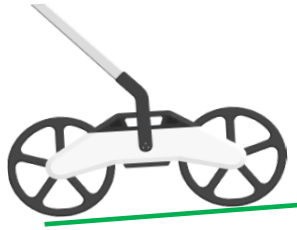
- The R1 is a real time terrain measuring device that can be used by anyone
- A continuous plot of the elevations in 1-foot increments is created in real time
- The elevation and distance data is streamed via Bluetooth to an iOS or Android application on a smart device
- Data from two paths, forward and return is averaged for the best solution
- A single path can be used for short (< 75 ft) drill calculations but this distance will be increased in later versions



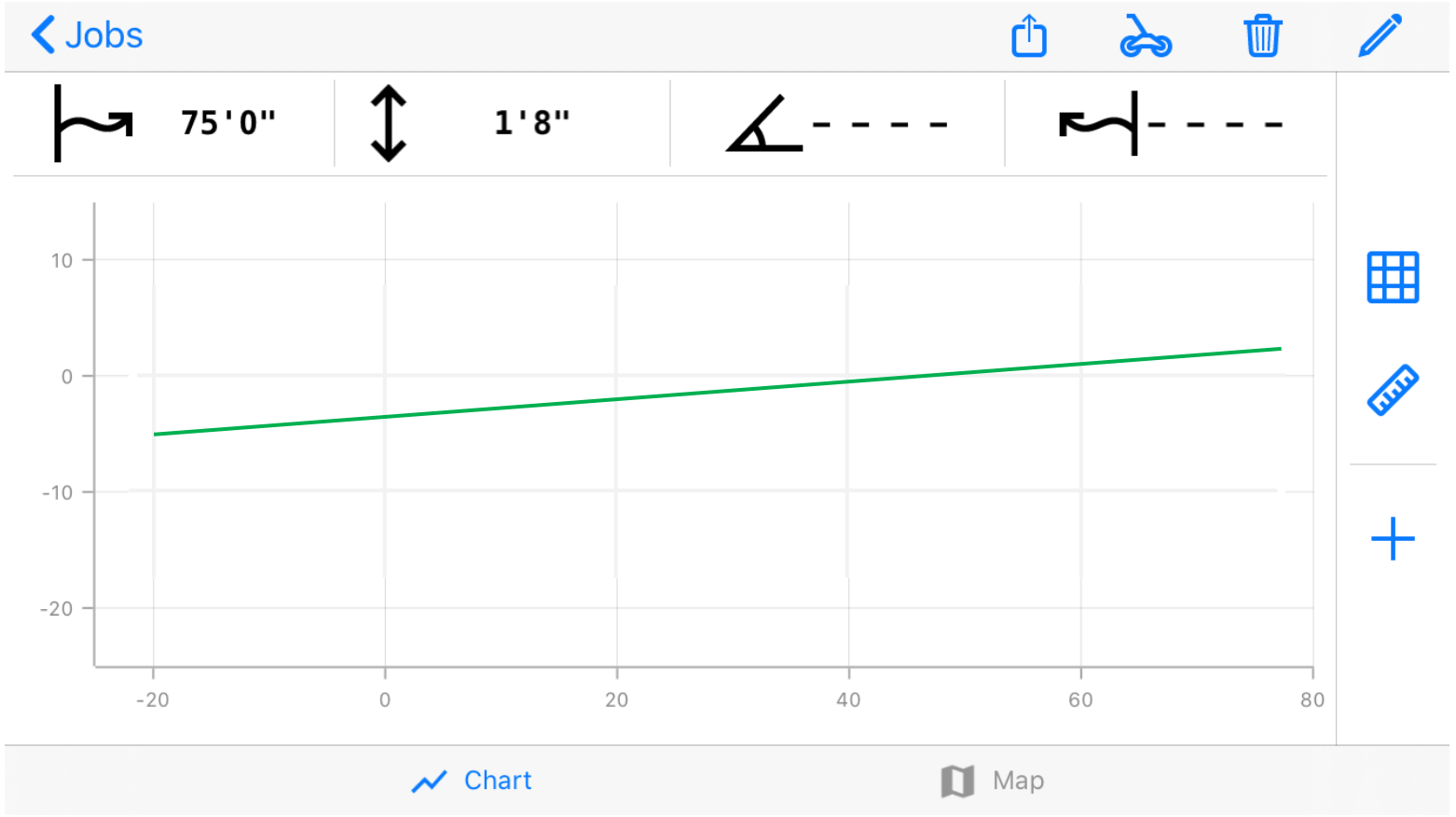


- As the R1 traverses the bore path, the terrain is plotted in real time
- Utilities being crossed as well as waypoints (desired targets for the bore) can be entered along the way
- Walking and entry of associated data for a 500 ft bore takes about 10 minutes
- Once all the data has been collected, various modes can answer questions related to the terrain and/or other data

How does it work?



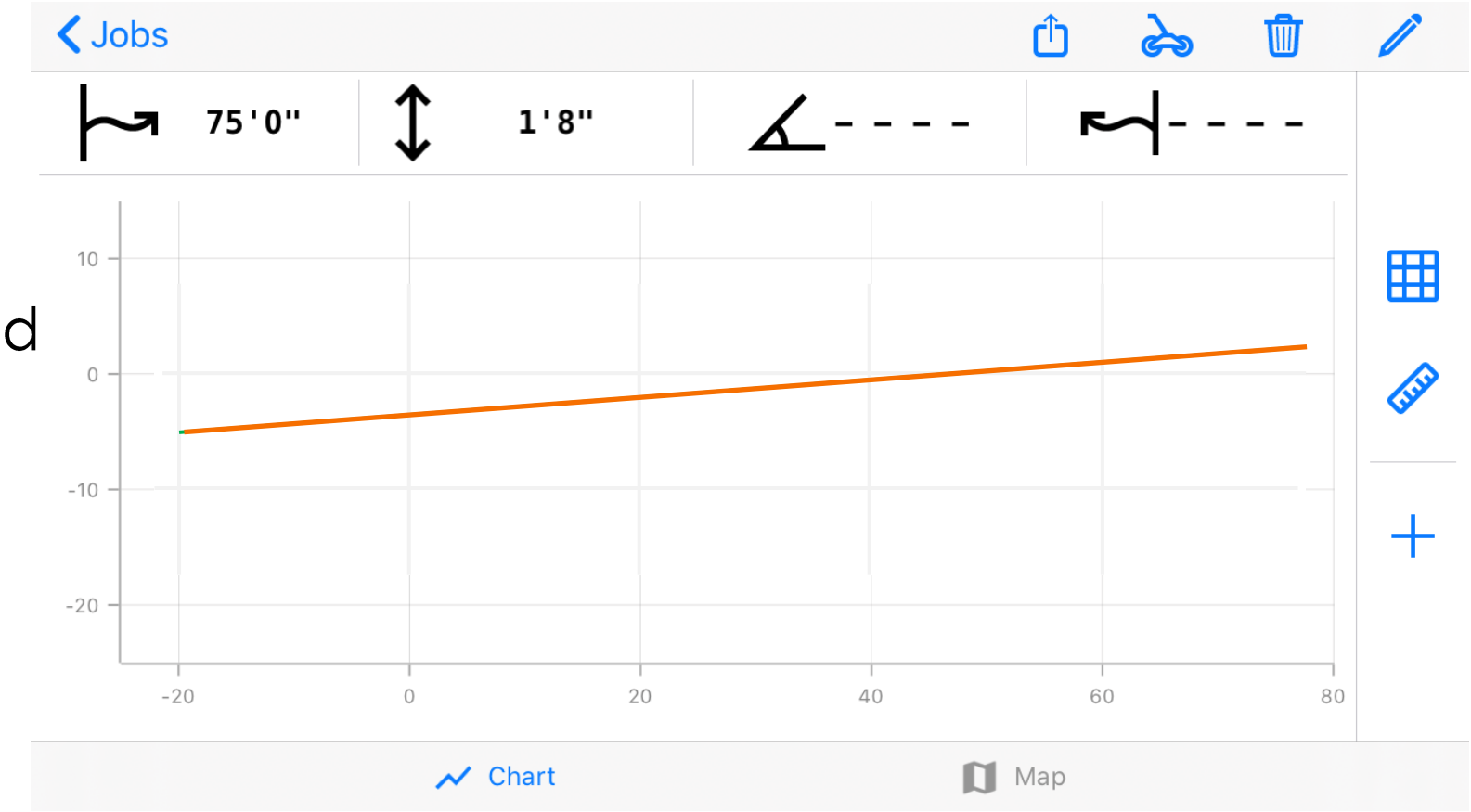
Forward Path

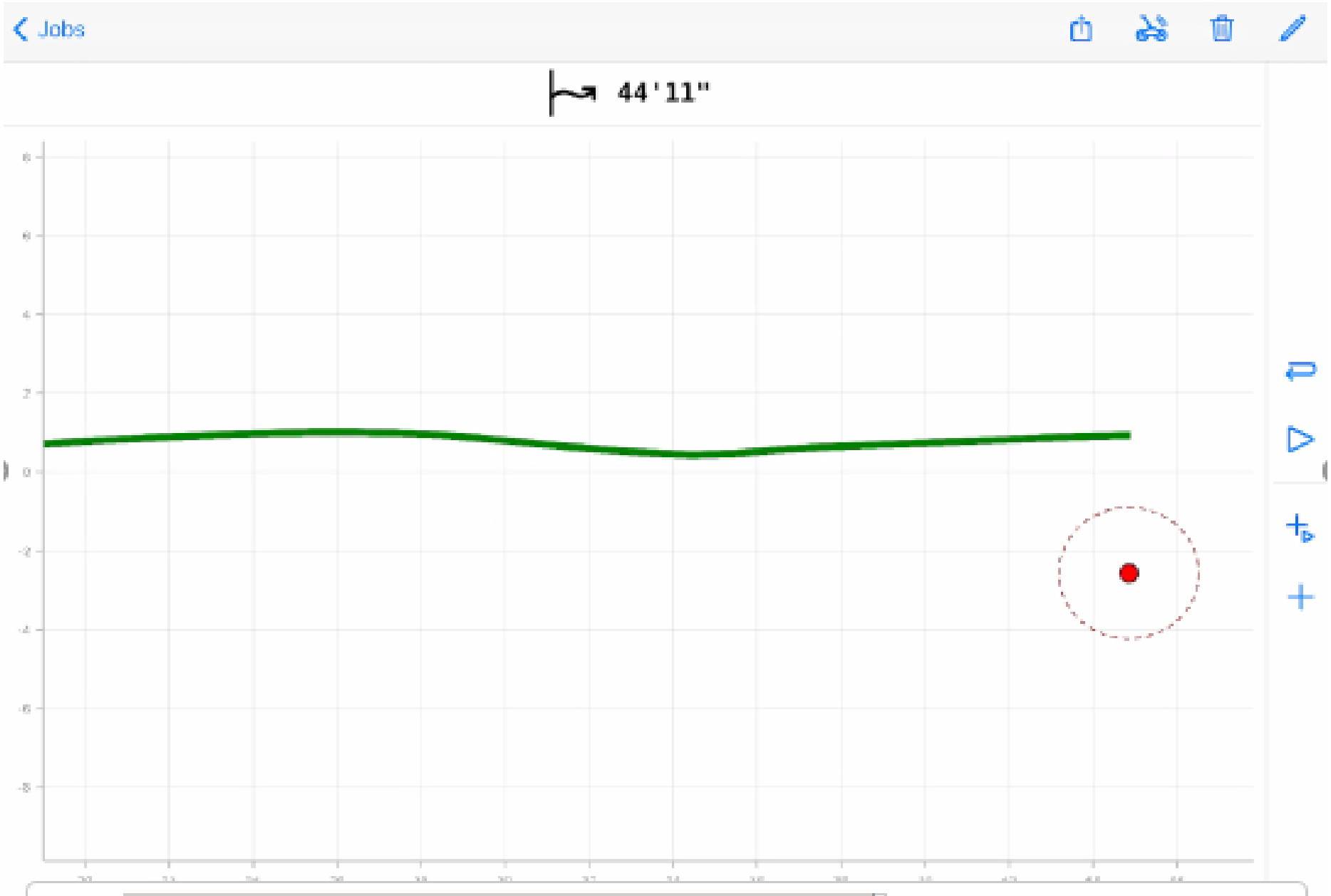


Return Path

The two paths are averaged for the best results.

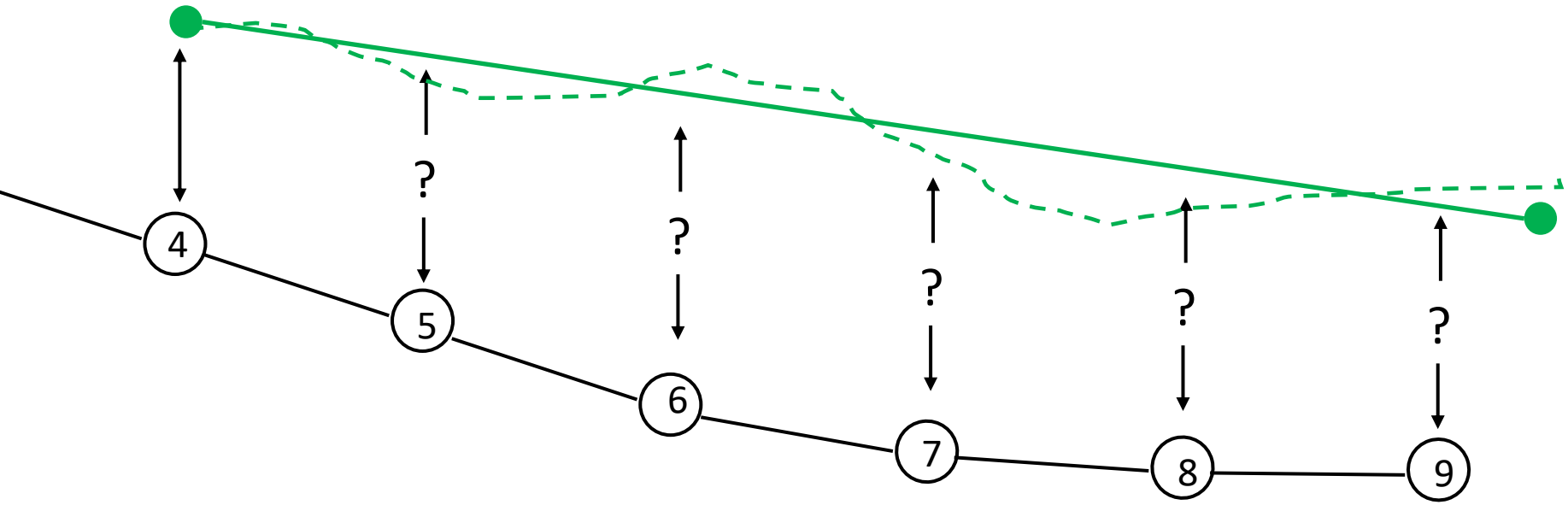
+/- 2 inches elevation over 500 feet




Jobs
44'11"

Continuous Terrain Data

Bore plans are typically communicated in terms of a rod number, a depth and a pitch

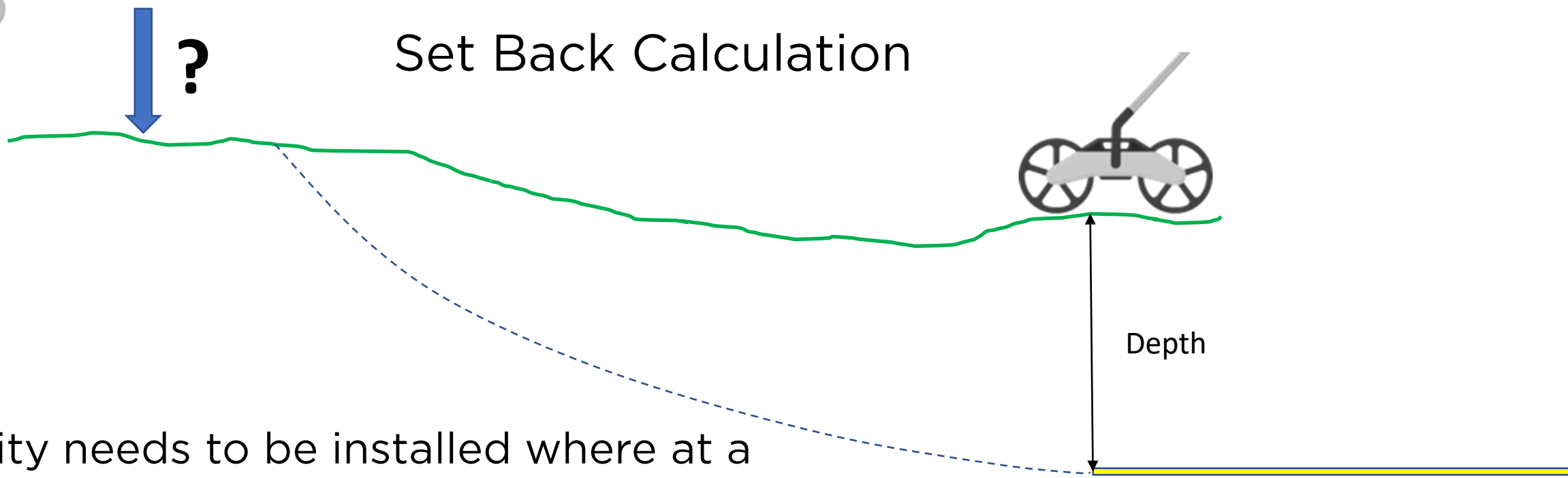


Rod 7	**4.5%**	**6’ 8 “**

Use Cases

- Two-point calculation (few rods calculation for less than 75 feet)
- Setback Calculator which can identify rig placement and create an entry plan (few rods for less than 75 feet)
- Information about the terrain during the pilot bore
- Terrain data gathering for planning in other applications

Set Back Calculation



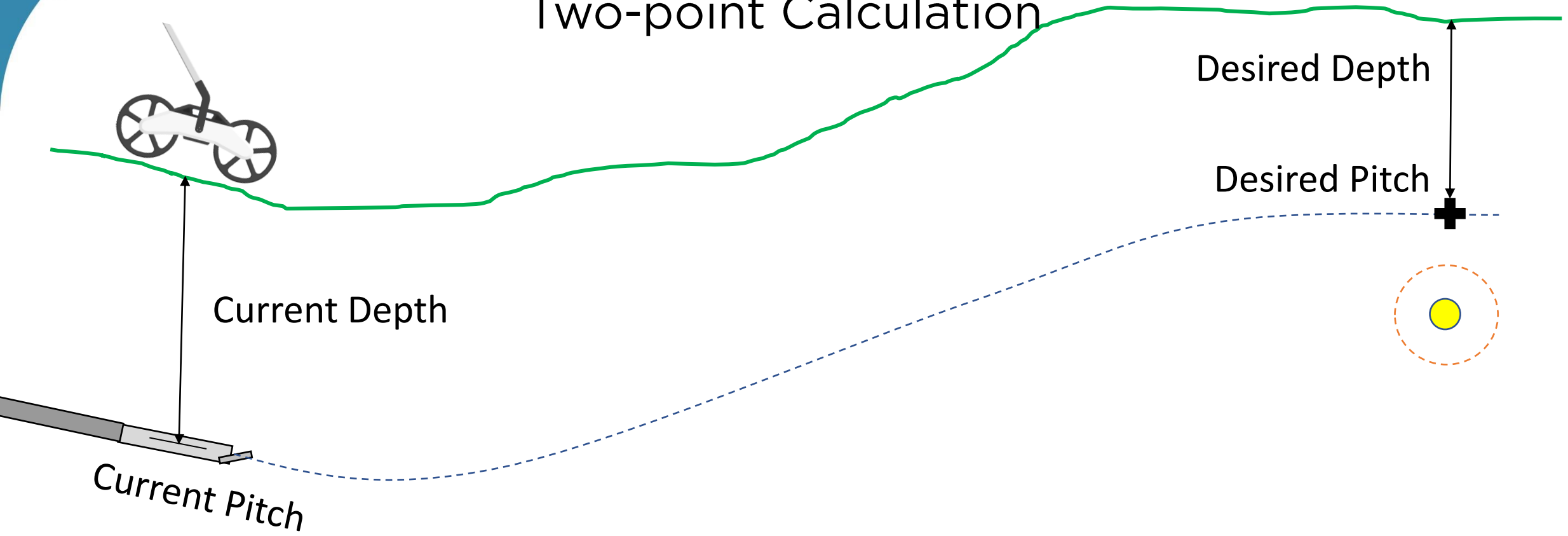
A utility needs to be installed where at a certain point it is at a given depth, for a tie in for example.

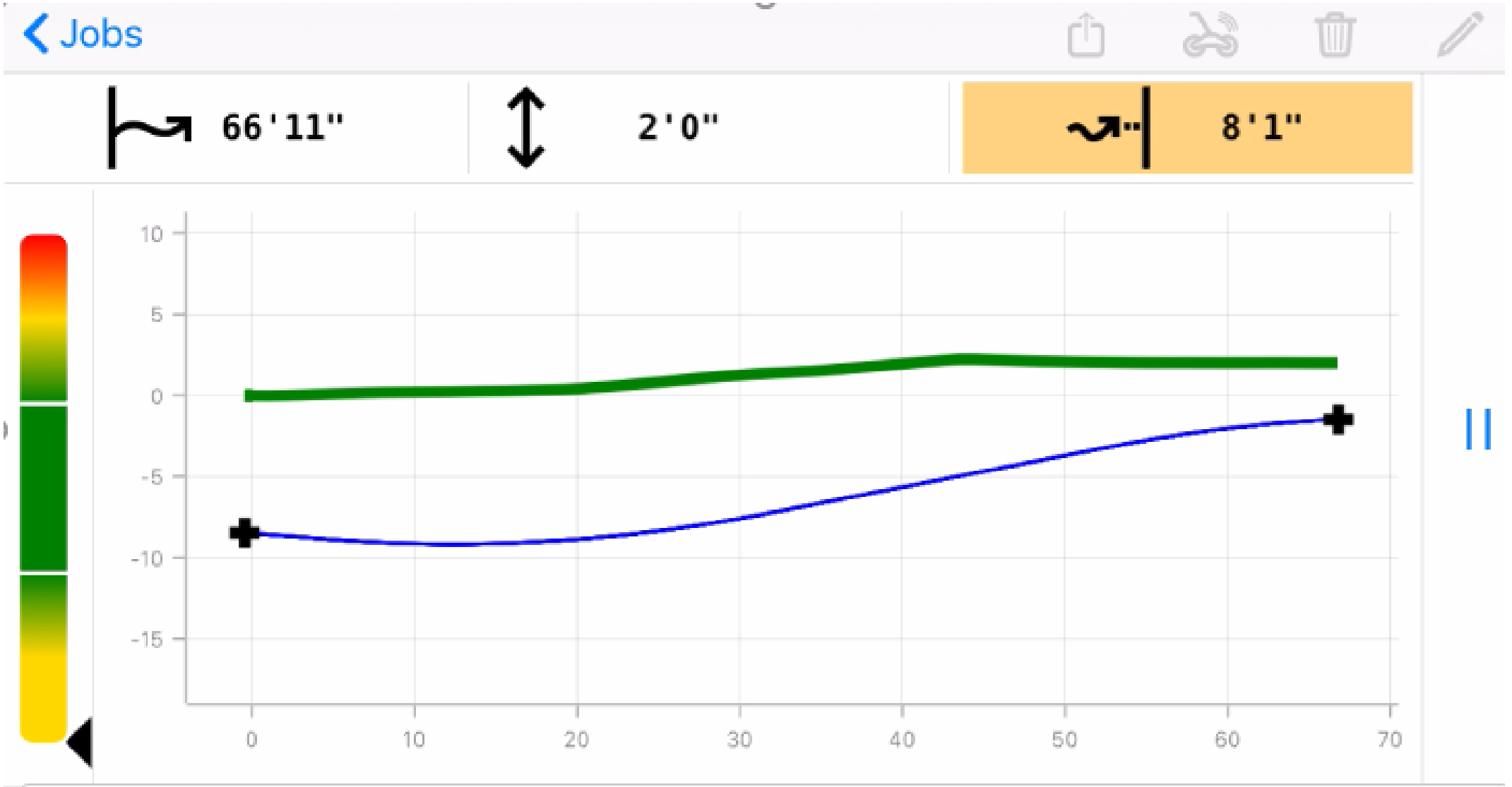
Where does the drill rig need to be set up to ensure that this is possible?

Once, that is determined, how do we get there?


Jobs
0'10"
44'2"
5
0
-5
-10
0
10
20
30
40
Chart
Map

Two-point Calculation




Jobs
66'11"
2'0"
8'1"
10
5
0
-5
-10
-15
0
10
20
30
40
50
60
70

Terrain information

Absent a traditional bore plan, there is a lot of details related to the terrain that various measurement modes provide.

This allows for the ability to determine, distances, elevation differences, slope of the ground, average pitch to name some.


Jobs
44.00'
42.55'
7.69'
18.1%
20
10
0
-10
-20
0
20
40
60
80
100


Jobs
32.00'
-1.37'
21.0%
90.62'
31.50'
87.34'
10
0
-10
-20
0
20
40
60
80
100
120
Waypoint
Chart
Map


Jobs
71.50'
68.38'
-0.94'
-1.4%
4.06'
5.9%
20
10
0
-10
-20
0
20
40
60
80
100
120
Chart
Map

Bore Planning in other applications

- The TeraTrak is designed to very easy to use
- It can be used by anyone on the crew
- It is fast and efficient
- All the pertinent data to plan a bore can be collected quickly
- In many cases can replace the need for surveying

Marker Information

Waypoints						
	24′ 0″	23′ 5″	-8′ 4″	7′ 0″	0.0%	
	95′ 6″	91′ 9″	-4′ 3″	2′ 0″	15.0%	

Utilities						
	20′ 3″	19′ 10″	-15′ 2″	13′ 0″	10.00″	1′ 7″
	101′ 7″	97′ 8″	-6′ 6″	5′ 0″	19.00″	1′ 2″

Flags				
1	14′ 2″	13′ 10″	-1′ 8″	
				Telephone pole

Terrain Information (Every 1 ft)

Type	Description	↝	↦	↕
		-8′ 0″	-8′ 0″	0′ 1″
		-7′ 0″	-7′ 0″	0′ 0″
		-6′ 0″	-6′ 0″	-0′ 1″
		-5′ 0″	-5′ 0″	-0′ 2″
		-4′ 0″	-4′ 0″	-0′ 2″
		-3′ 0″	-3′ 0″	-0′ 2″
		-2′ 0″	-2′ 0″	-0′ 1″
		-1′ 0″	-1′ 0″	-0′ 1″
Entry	▼	0′ 0″	0′ 0″	0′ 0″
		1′ 0″	1′ 0″	-0′ 1″
		2′ 0″	2′ 0″	-0′ 3″
		3′ 0″	2′ 11″	-0′ 7″
		4′ 0″	3′ 10″	-1′ 0″
		5′ 0″	4′ 9″	-1′ 4″
		6′ 0″	5′ 9″	-1′ 7″
		7′ 0″	6′ 9″	-1′ 7″
		8′ 0″	7′ 9″	-1′ 6″
		9′ 0″	8′ 9″	-1′ 4″
		10′ 0″	9′ 9″	-1′ 2″
		11′ 0″	10′ 9″	-1′ 2″
		12′ 0″	11′ 9″	-1′ 3″

23					
24	Topology Data	Identifier	Terrain Distance (ft)	Horizontal Distance (ft)	Elevation (ft)
25			-8	-7.99	0.09
26			-7	-6.99	0.02
27			-6	-5.99	-0.08
28			-5	-4.99	-0.13
29			-4	-3.99	-0.17
30			-3	-2.99	-0.17
31			-2	-2	-0.12
32			-1	-1	-0.05
33		Entry Point	0	0	0
34			1	1	-0.05
35			2	1.98	-0.25
36			3	2.91	-0.6
37			4	3.83	-1.01
38			5	4.77	-1.34
39			6	5.75	-1.55
40			7	6.75	-1.6
41			8	7.74	-1.49
42			9	8.72	-1.31
43			10	9.72	-1.17
44			11	10.71	-1.15
45			12	11.71	-1.25

Sample Standard Terrain (003)

Thank you!

Questions?

siggif@digital-control.com