

**APPENDIX G: COMPUTER MODEL STUDY 2:
Alternate Range Orientations at the 2 Proposed Range Sites
Typical and Busy Day Scenarios
10 ft., 20 ft., and 30 ft. tall berms**

Computer model study 2 was conducted for each of the 2 proposed range sites, Site 1: Marquette County Road Commission and Site 2: Sands West.

1. There are two sets of models constructed, a “typical day” scenario and a “busy day” scenario.
 - a. The typical day scenario has one shooter on the 300 yard range firing a .223 rifle; one shooter on the 40 yard range firing a 12 gauge shotgun and one shooter on the 25 yard range firing a 0.40 caliber handgun in the same one second time period.
 - b. The busy day scenario has 1 shooter on the 50 yard range, 200 yard range and on the 300 yard range firing a .223 rifle, one shooter on the 40 yard range firing a 12 gauge shotgun and 2 shooters on the 25 yard range firing 0.40 caliber handguns.
2. Weather conditions were modeled as downwind with 1 to 11 mph wind with a temperature of 50°F and 80% R.H.
3. The direction of fire in the base range design was changed for each of the 2 proposed sites.
4. Three berm heights of 10 ft. tall, 20 ft. tall and 30 ft. tall were modeled for the “typical day” and “busy day” scenarios at each site.
5. The alternate direction of fire was to the north-northwest for Site 1: MCRC; to the northwest and to the southwest for Site 2: Sands West.
6. The sound levels are shown on the noise contour maps as LA eq in dBA.

The “typical day” scenario for each range and orientation had lower scores than the corresponding “busy day” scenario. The Site 1: County Road Commission base range design with the 10 ft. berm had less impacts on surrounding properties as ranked by the linear pressure and dB scores than the ranges at the other site. The two alternate range orientations of the base range design at Site 2: Sands West had greater impacts on surrounding properties as ranked by the linear pressure and dB scores.

The north-northwest orientation was scored as having less impacts on surrounding properties than the north orientation at Site 1: County Road Commission with the base range design with the 10 ft. tall berm for the “typical day” and “busy day” scenarios. The southwest orientation for the range at Site 2: Sands West had significantly more impact on surrounding properties than the north and the northwest orientation of the base range design with the 10 ft. tall berm for the “typical” and “busy” day scenario at this location.

When berm heights of 20 ft. and 30 ft. are added to the rankings of the 2 sites and the alternate directions of fire, Site 1: County Road Commission oriented to the north and oriented to the north-northwest with 30 ft. tall berms is ranked as having the least impact on surrounding properties for both the “typical” and “busy” day scenarios. Site 2: Sands West oriented to the northwest with a 20 ft. tall berm is ranked seventh with fewer impacts than the base range design with the 10 ft. tall berms at Site 1: County Road Commission. For any given range site and direction of fire, the configurations with the 20 ft. and 30 ft. tall berms had lower impacts than the configurations with the 10 ft. tall berms at each site. The approximate cost increase to build the range with a 20 ft. tall berm compared to a 10 ft. tall berm was \$233,900. The approximate cost increase to build the range with a 30 ft. tall berm compared to a 10 ft. tall berm was \$670,900.

Table G-1. Summary table of rating points for each scenario tested in Experiment 2.

BUSY DAY 6 SHOOTERS 10 FT BERM				
Site	DOF	LIN PRES	dB	PTS
SITE 1: MCRC	NNW	927	80	308
SITE 1: MCRC	N	1,235	81	364
SITE 2: Sands	NW	1,590	82	825
SITE 2: Sands	N	2,519	84	940
SITE 2: Sands	SW	4,816	87	1184
TYPICAL DAY 3 SHOOTERS 10 FT BERM				
Site	DOF	LIN PRES	dB	PTS
SITE 1: MCRC	NNW	439	76	371
SITE 1: MCRC	N	458	77	395
SITE 2: Sands	NW	767	79	911
SITE 2: Sands	N	1,111	80	1004
SITE 2: Sands	SW	2,049	83	831

Table G-2. List of points for each range site, berm height and orientation.

BUSY DAY 6 SHOOTERS					
Site	DOF	Berm Height	Lin Press	dB	PTS
SITE 1: MCRC	N	30 FT.	442	76	274
SITE 1: MCRC	NNW	30 FT.	562	77	302
SITE 1: MCRC	N	20 FT.	850	79	298
SITE 1: MCRC	NNW	20 FT.	926	80	306
SITE 1: MCRC	NNW	10 FT.	927	80	308
SITE 2: Sands	NW	30 FT.	1,188	81	783
SITE 1: MCRC	N	10 FT.	1,235	81	364
SITE 2: Sands	NW	20 FT.	1,483	82	817
SITE 2: Sands	NW	10 FT.	1,590	82	825
SITE 2: Sands	N	30 FT.	2,058	83	909
SITE 2: Sands	N	20 FT.	2,415	84	1149
SITE 2: Sands	N	10 FT.	2,519	84	940
SITE 2: Sands	SW	30 FT.	2,963	85	1162
SITE 2: Sands	SW	20 FT.	4,359	86	1177
SITE 2: Sands	SW	10 FT.	4,816	87	1184
TYPICAL DAY 3 SHOOTERS					
Site	DOF	Berm Height	Lin Press	dB	PTS
SITE 1: MCRC	NNW	30 FT.	238	74	351
SITE 1: MCRC	N	30 FT.	277	74	313
SITE 1: MCRC	NNW	20 FT.	334	75	340
SITE 1: MCRC	N	20 FT.	359	76	354
SITE 1: MCRC	NNW	10 FT.	439	76	371
SITE 1: MCRC	N	10 FT.	458	77	395
SITE 2: Sands	NW	30 FT.	507	77	847
SITE 2: Sands	NW	20 FT.	706	78	901
SITE 2: Sands	NW	10 FT.	767	79	911
SITE 2: Sands	N	30 FT.	809	79	958
SITE 2: Sands	N	20 FT.	989	80	992
SITE 2: Sands	N	10 FT.	1,111	80	1004
SITE 2: Sands	SW	30 FT.	1,454	82	1028
SITE 2: Sands	SW	20 FT.	1,947	83	826
SITE 2: Sands	SW	10 FT.	2,049	83	831



MARQUETTE CRC MODEL G-1

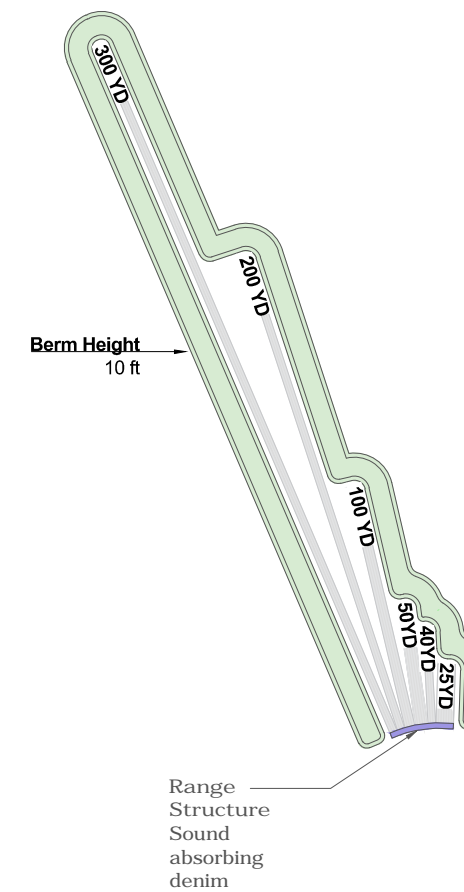
10 ft. Tall Berms | Alternate Orientation

Typical Day:
Shooters within 1 second:
1 Rifle
1 Shotgun
1 Handgun

D.O.F. NNW

Wind: 1 to 11 mph downward

50°F and 80% R.H.





MARQUETTE CRC
MODEL G-2

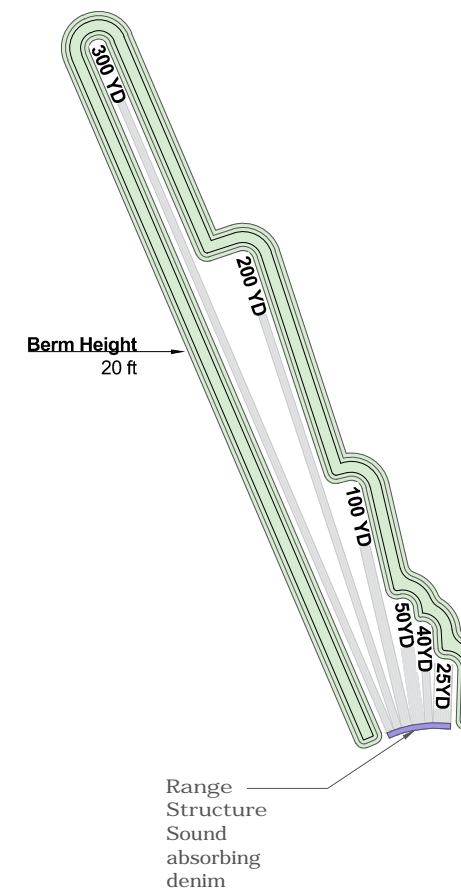
20 ft. Tall Berms | Alternate Orientation

Typical Day:
 Shooters within 1 second:
 1 Rifle
 1 Shotgun
 1 Handgun

D.O.F. NNW

Wind: 1 to 11 mph downward

50°F and 80% R.H.





MARQUETTE CRC
MODEL G-3

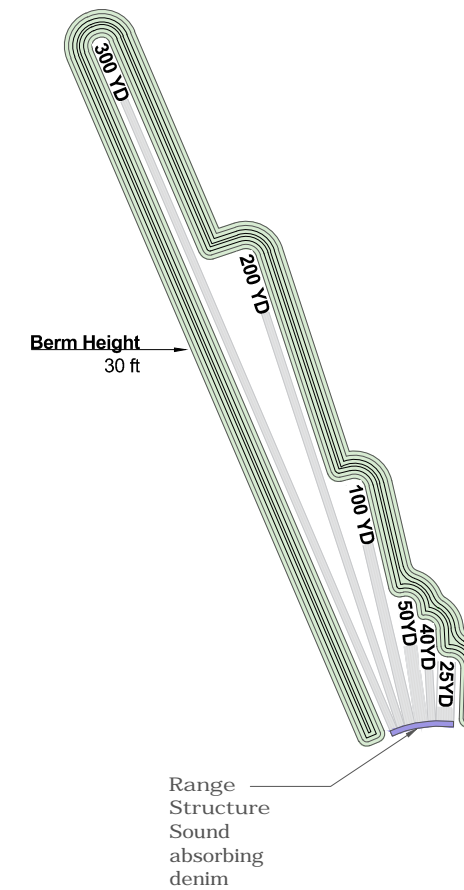
30 ft. Tall Berms | Alternate Orientation

Typical Day:
 Shooters within 1 second:
 1 Rifle
 1 Shotgun
 1 Handgun

D.O.F. NNW

Wind: 1 to 11 mph downward

50°F and 80% R.H.





MARQUETTE CRC
MODEL G-4

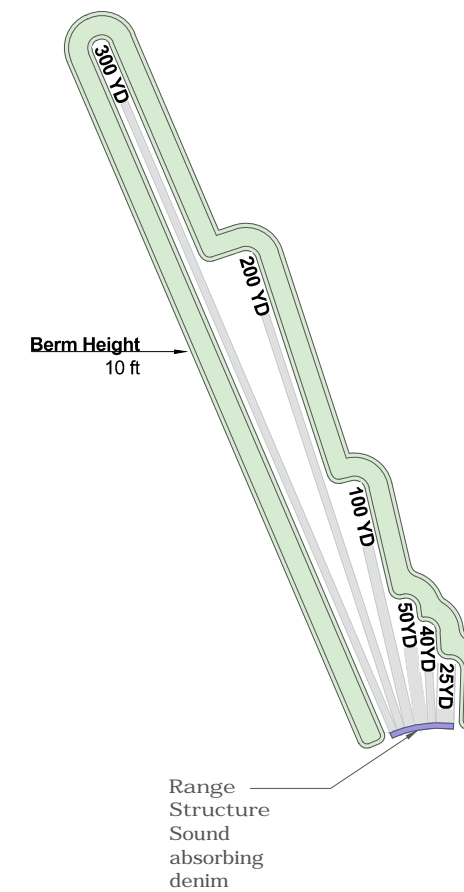
10 ft. Tall Berms | Alternate Orientation

Busy Day:
Shooters within 1 second:
3 Rifles
1 Shotgun
2 Handguns

D.O.F. NNW

Wind: 1 to 11 mph downward

50°F and 80% R.H.





MARQUETTE CRC
MODEL G-5

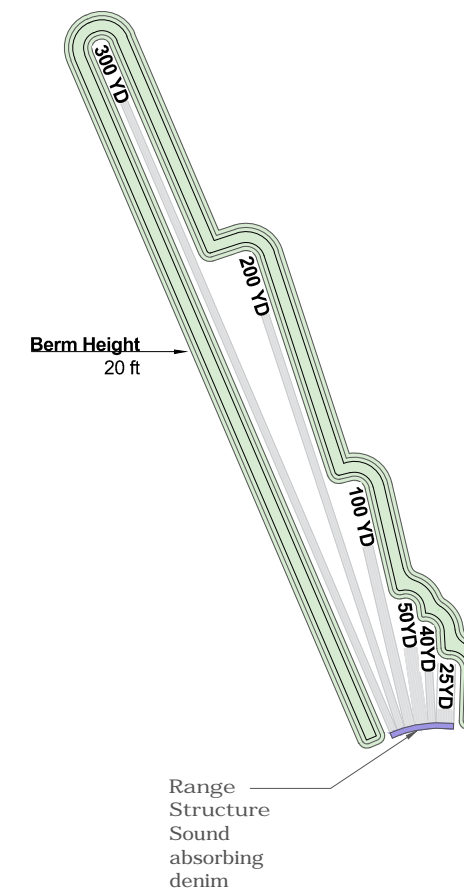
20 ft. Tall Berms | Alternate Orientation

Busy Day:
 Shooters within 1 second:
 3 Rifles
 1 Shotgun
 2 Handguns

D.O.F. NNW

Wind: 1 to 11 mph downward

50°F and 80% R.H.





MARQUETTE CRC
MODEL G-6

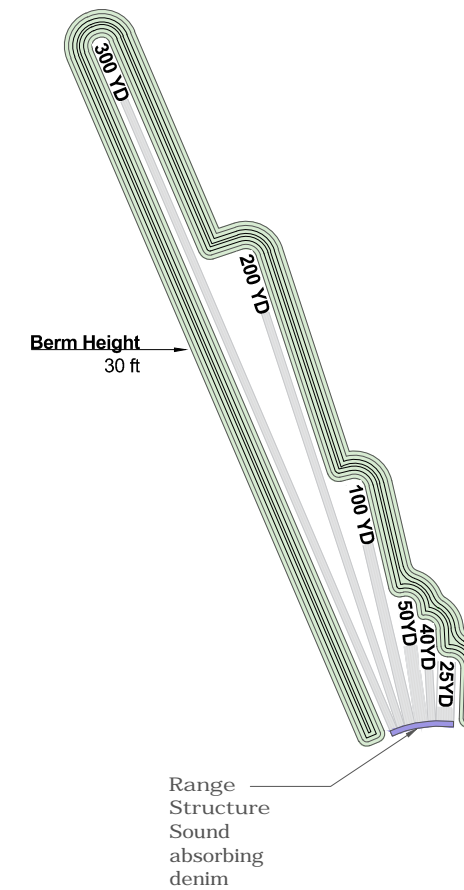
30 ft. Tall Berms | Alternate Orientation

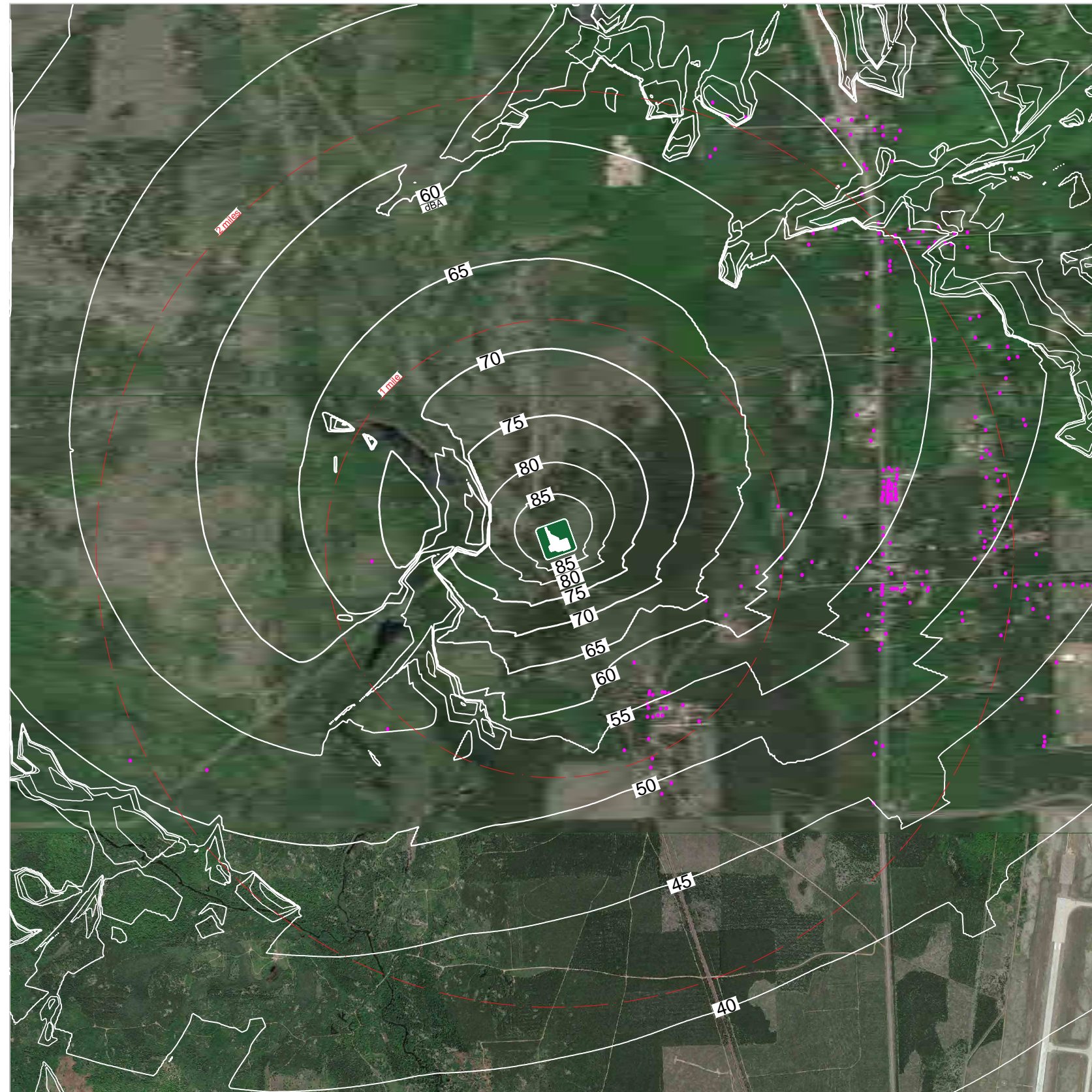
Busy Day:
Shooters within 1 second:
3 Rifles
1 Shotgun
2 Handguns

D.O.F. NNW

Wind: 1 to 11 mph downward

50°F and 80% R.H.





SANDS
MODEL G-7

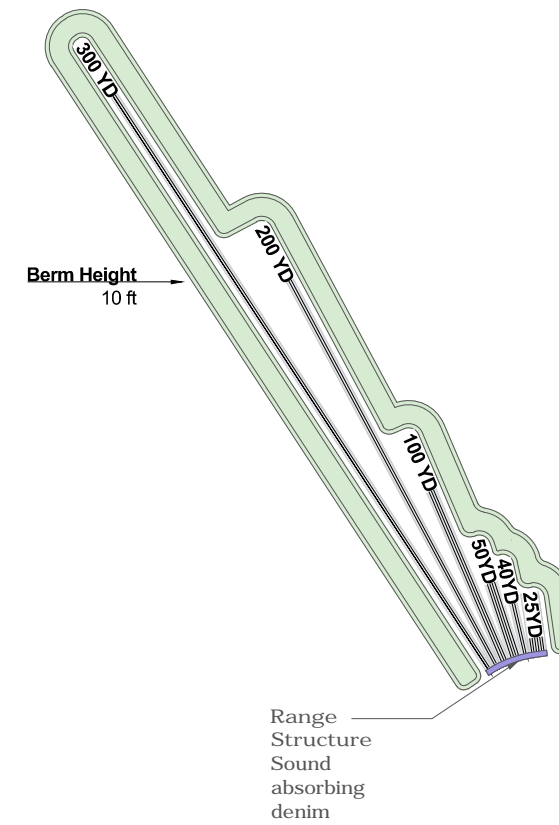
10 ft. Tall Berms | Alternate Orientation

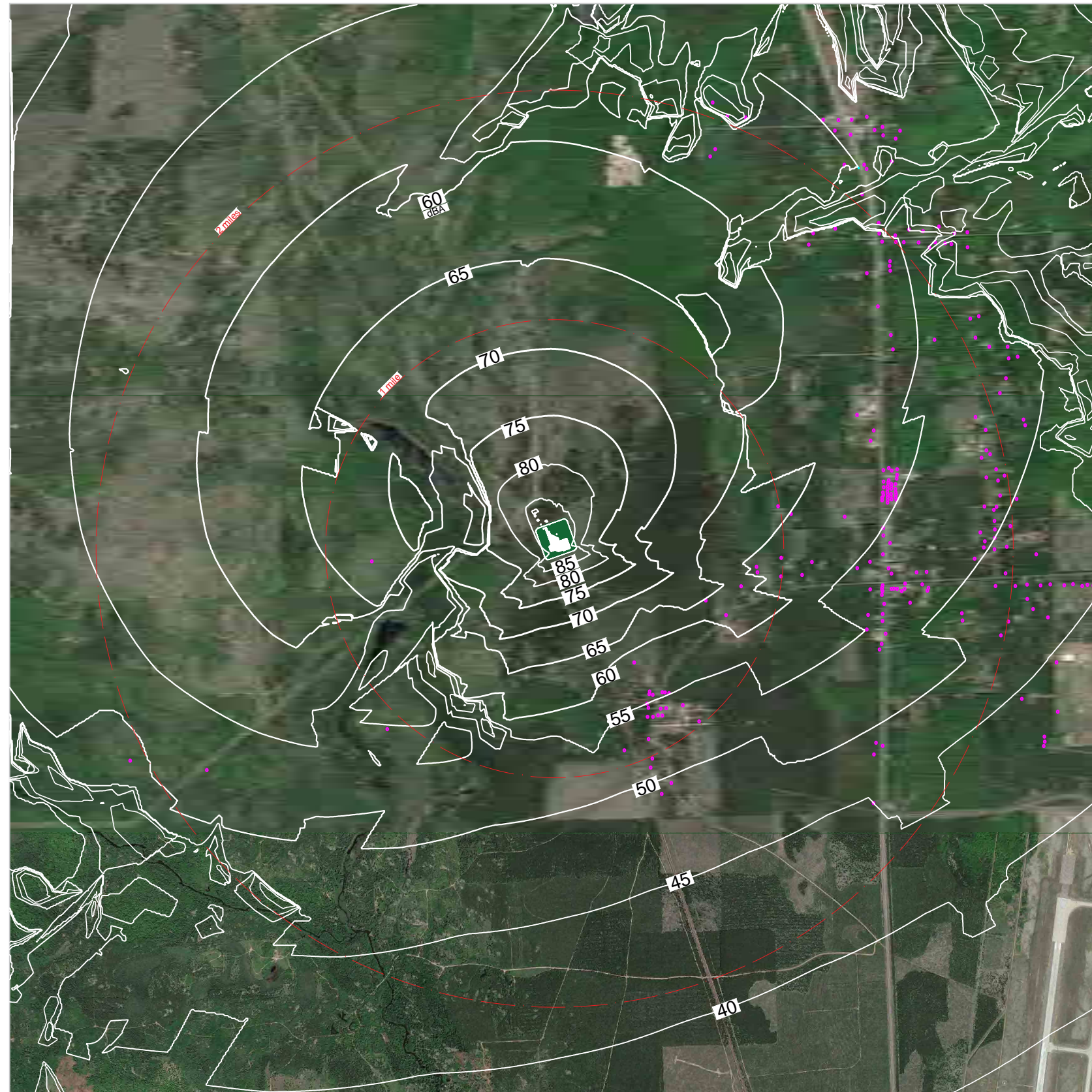
Typical Day:
Shooters within 1 second:
1 Rifle
1 Shotgun
1 Handgun

D.O.F. NW

Wind: 1 to 11 mph downward

50°F and 80% R.H.





SANDS
MODEL G-8

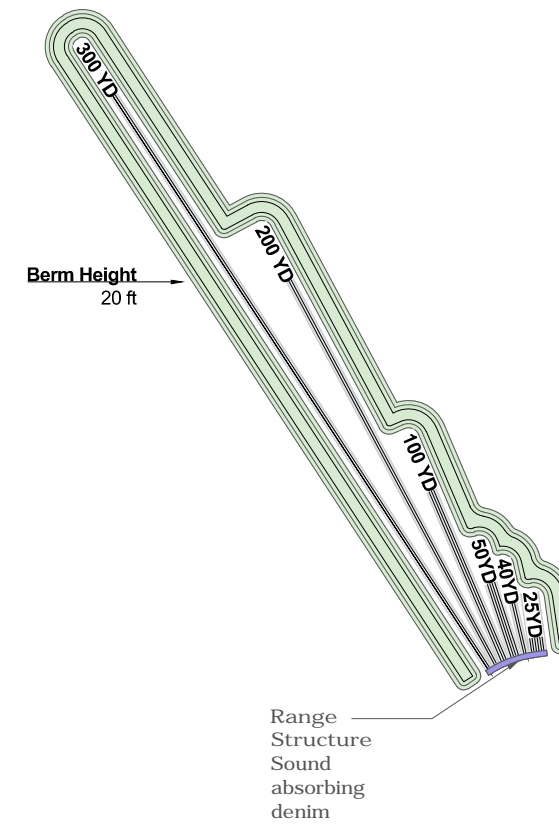
20 ft. Tall Berms | Alternate Orientation

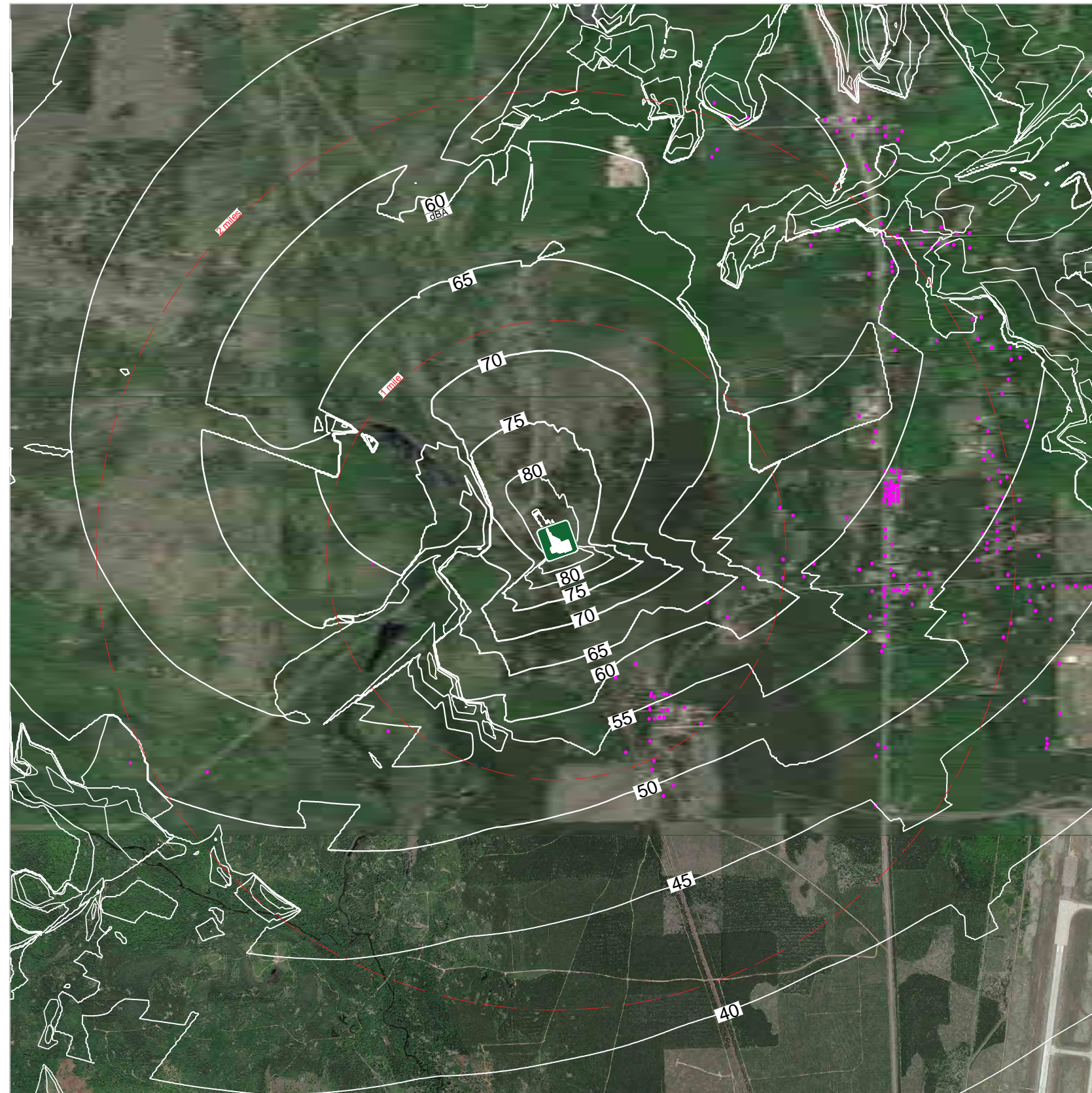
Typical Day:
Shooters within 1 second:
1 Rifle
1 Shotgun
1 Handgun

D.O.F. NW

Wind: 1 to 11 mph downward

50°F and 80% R.H.





SANDS
MODEL G-9

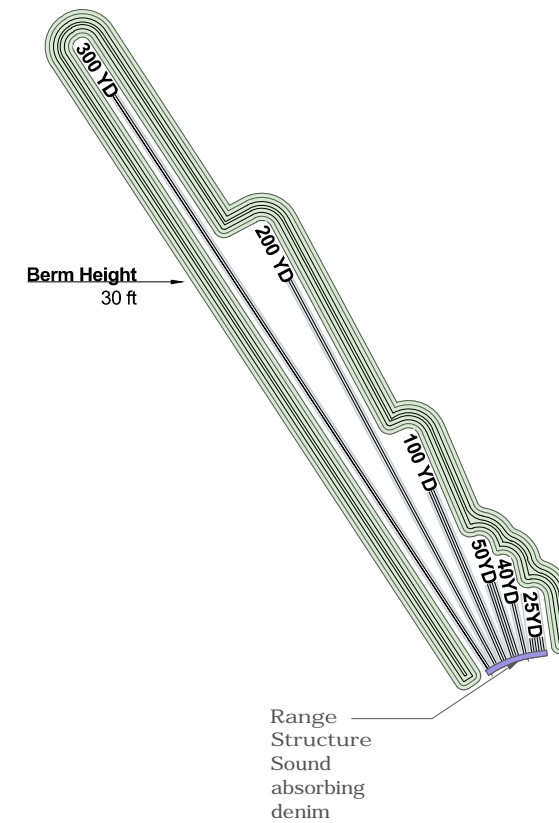
30 ft. Tall Berms | Alternate Orientation

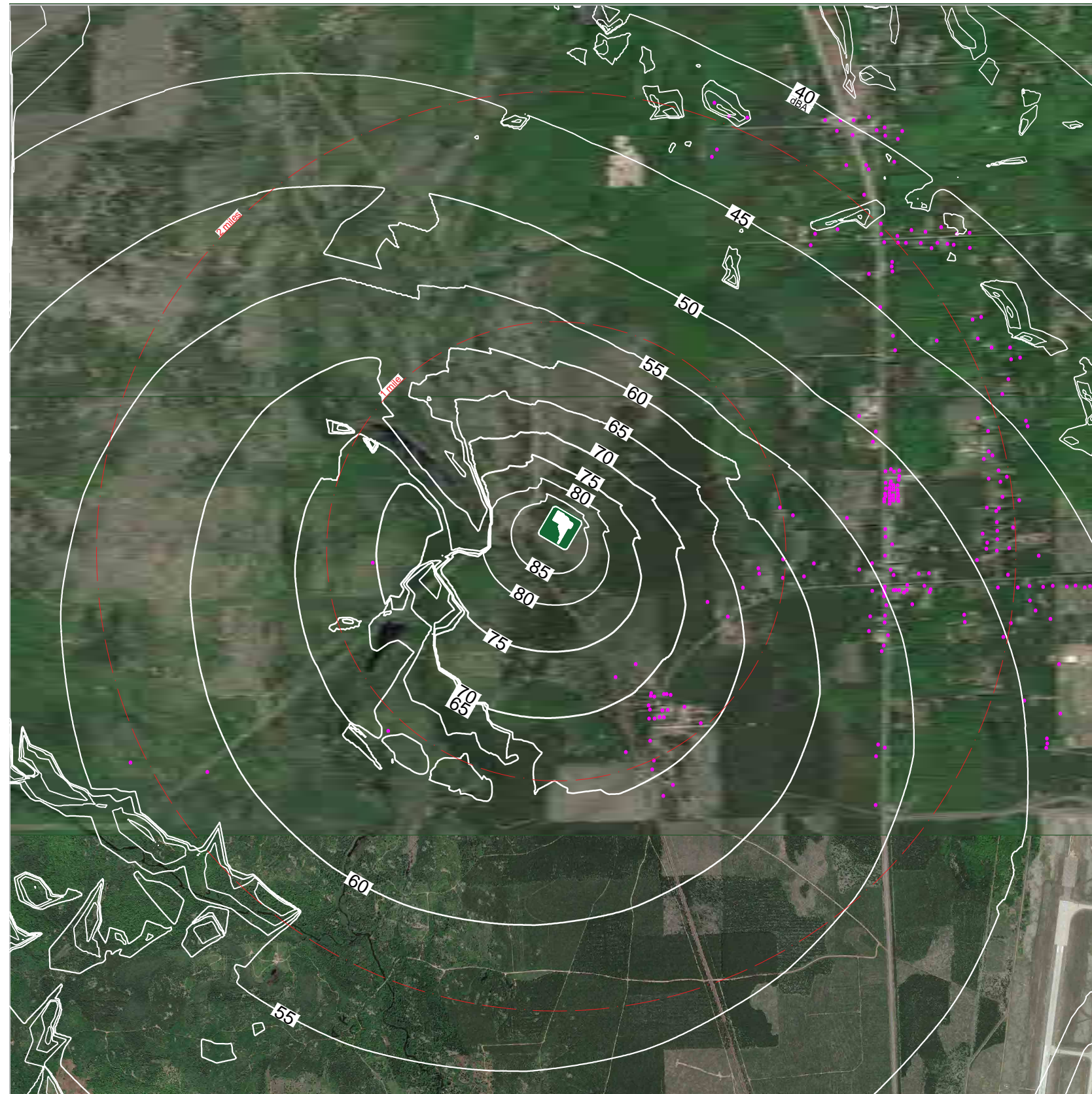
Typical Day:
 Shooters within 1 second:
 1 Rifle
 1 Shotgun
 1 Handgun

D.O.F. NW

Wind: 1 to 11 mph downward

50°F and 80% R.H.





SANDS
MODEL G-10

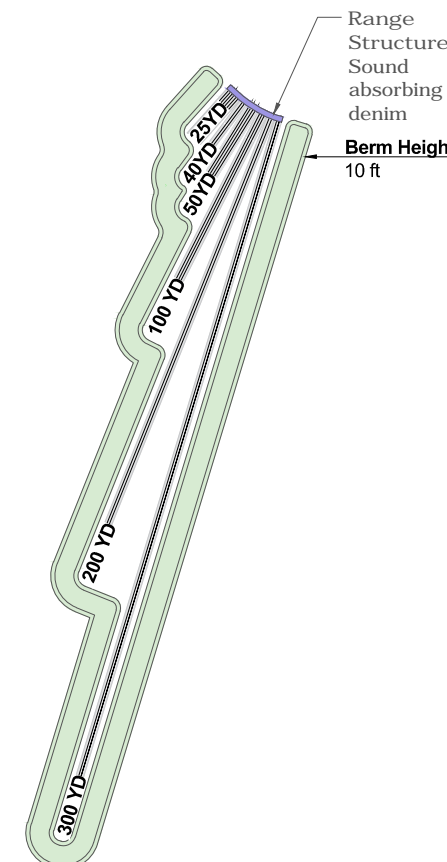
10 ft. Tall Berms | Alternate Orientation

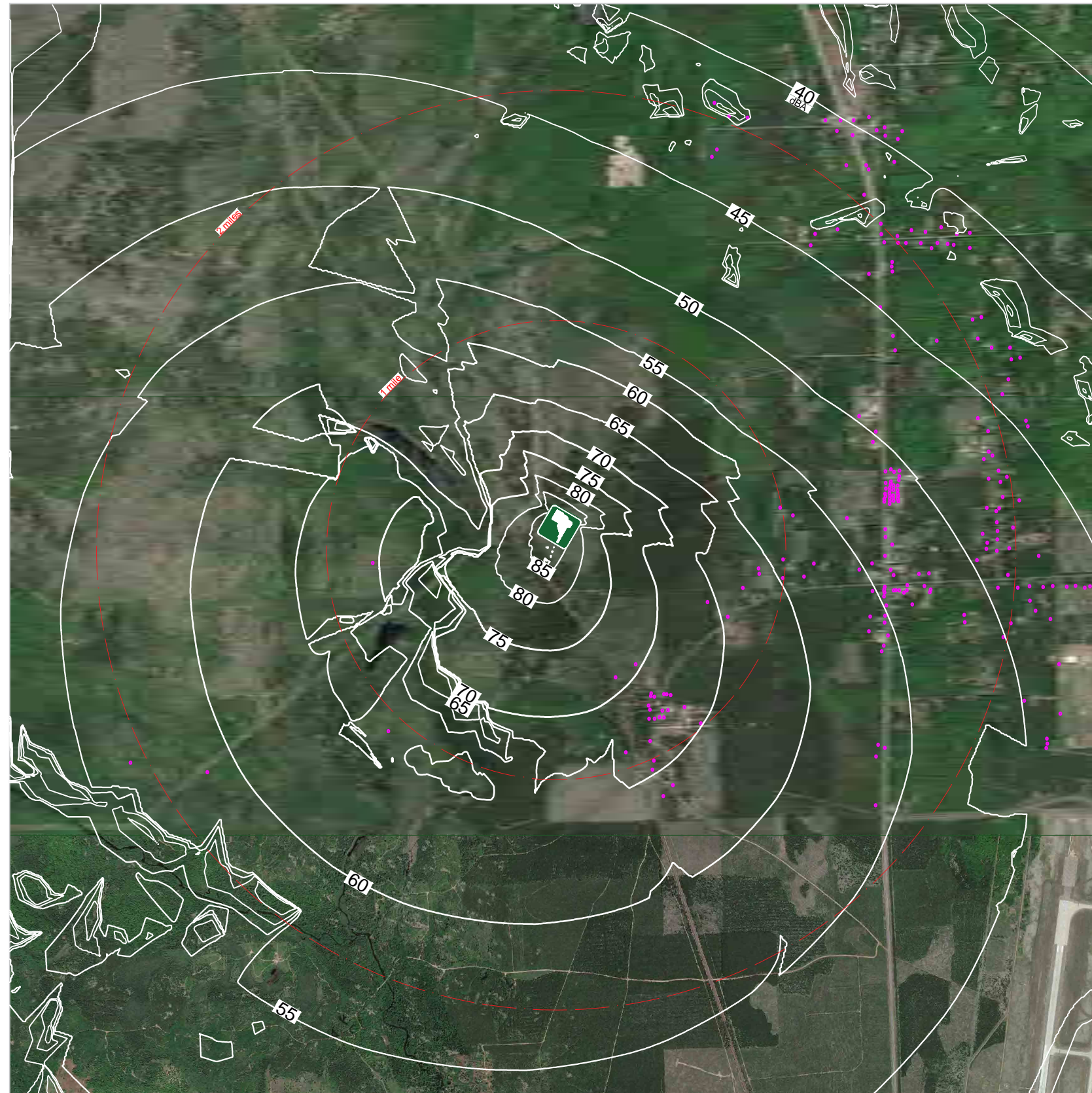
Typical Day:
Shooters within 1 second:
1 Rifle
1 Shotgun
1 Handgun

D.O.F. SW

Wind: 1 to 11 mph downward

50°F and 80% R.H.





SANDS
MODEL G-11

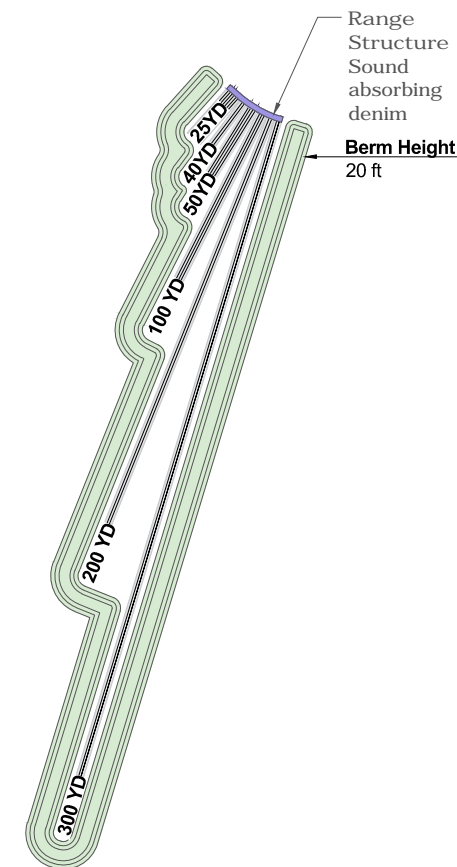
20 ft. Tall Berms | Alternate Orientation

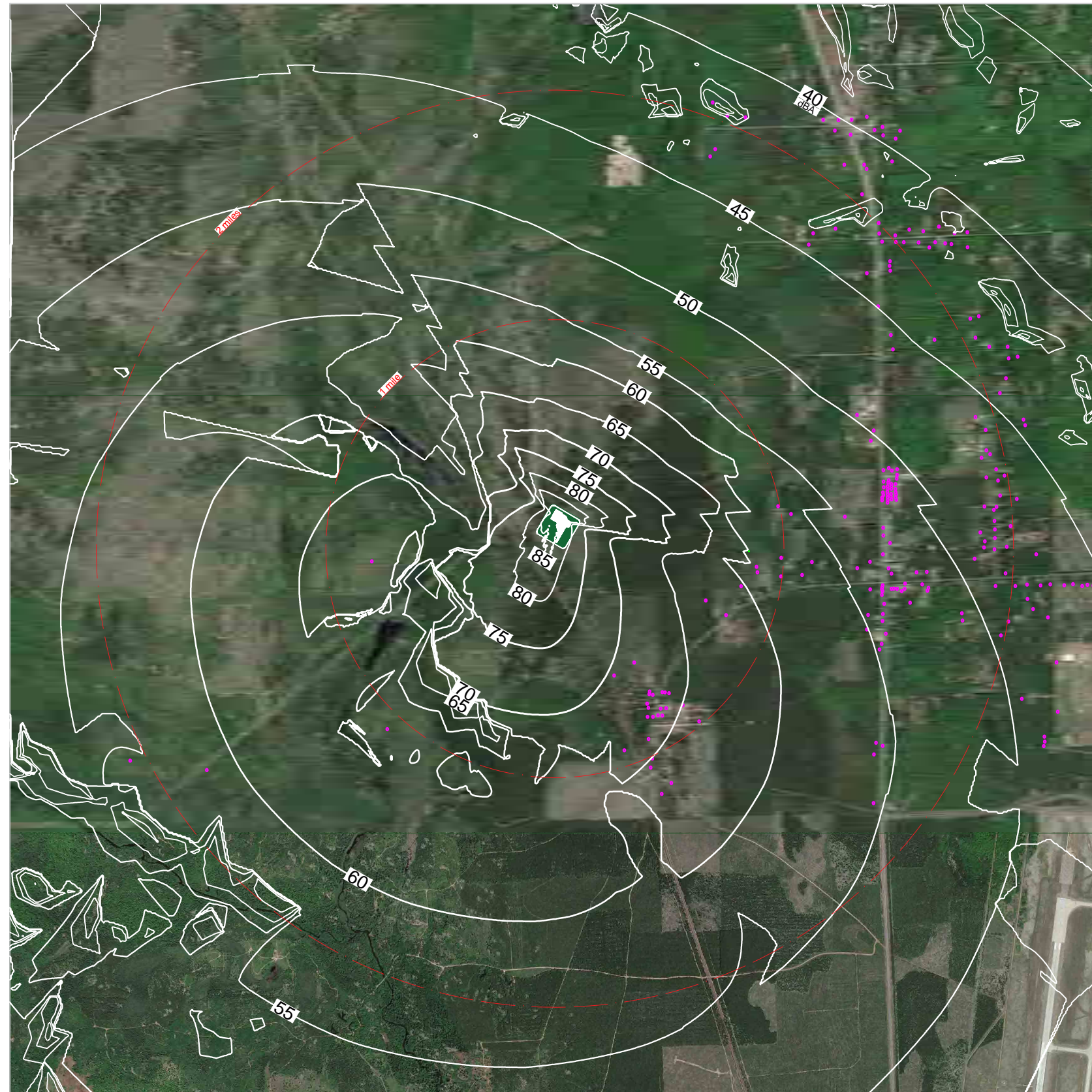
Typical Day:
Shooters within 1 second:
1 Rifle
1 Shotgun
1 Handgun

D.O.F. SW

Wind: 1 to 11 mph downward

50°F and 80% R.H





SANDS
MODEL G-12

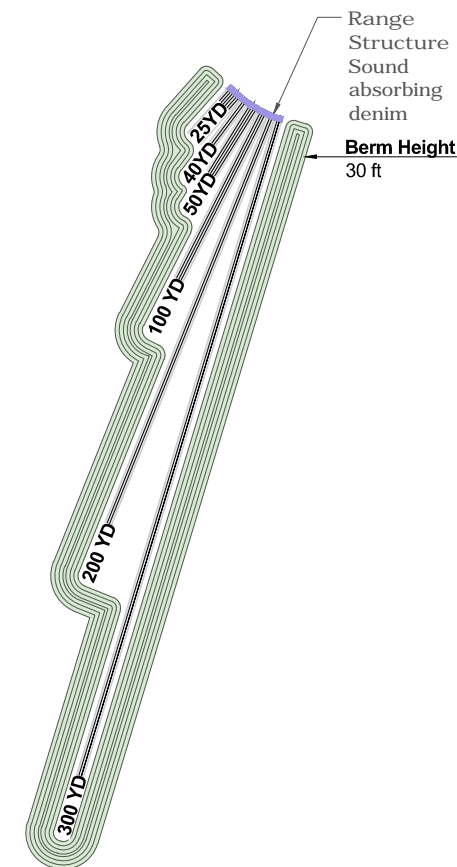
30 ft. Tall Berms | Alternate Orientation

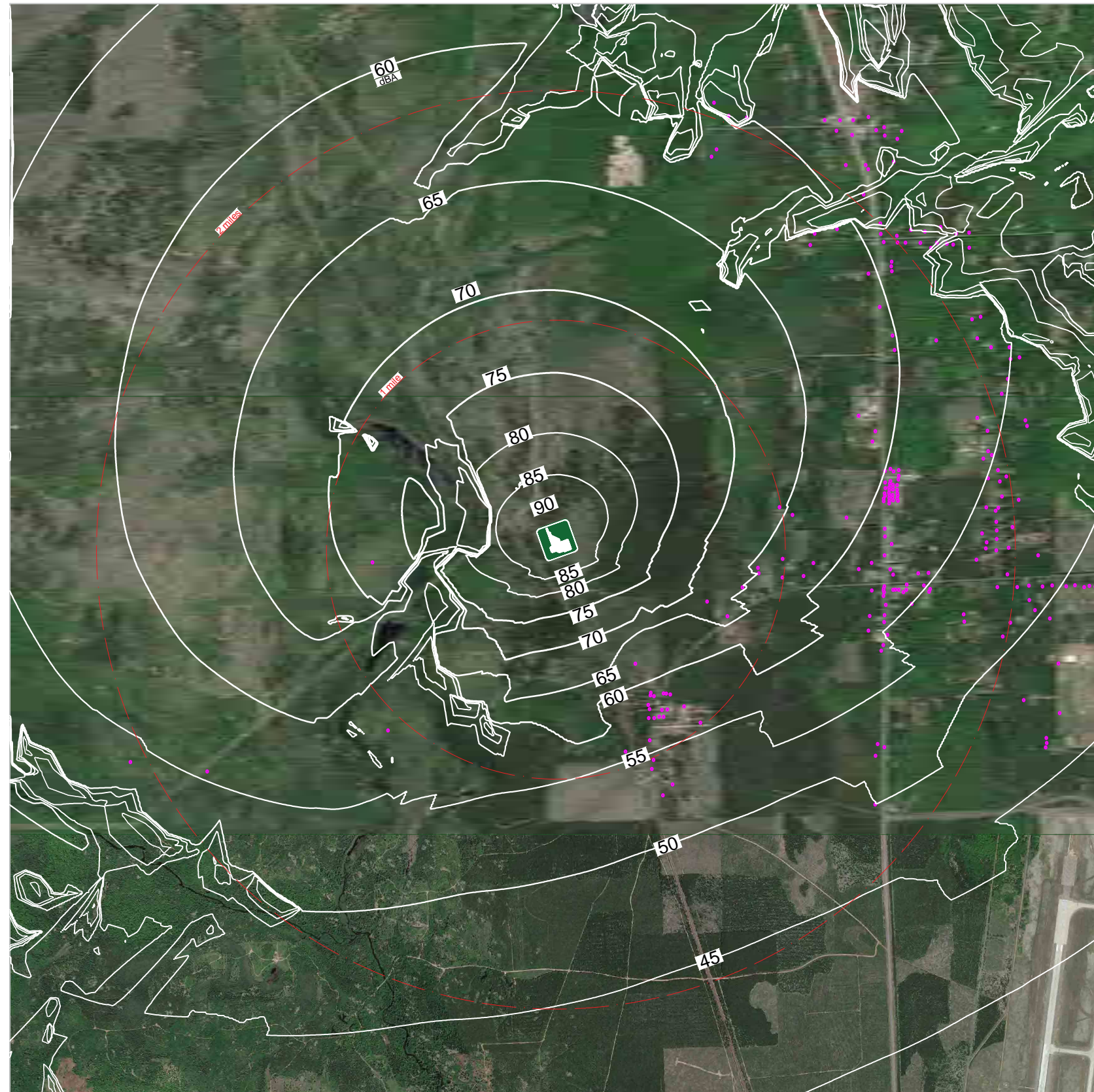
Typical Day:
Shooters within 1 second:
1 Rifle
1 Shotgun
1 Handgun

D.O.F. SW

Wind: 1 to 11 mph downward

50°F and 80% R.H





SANDS
MODEL G-13

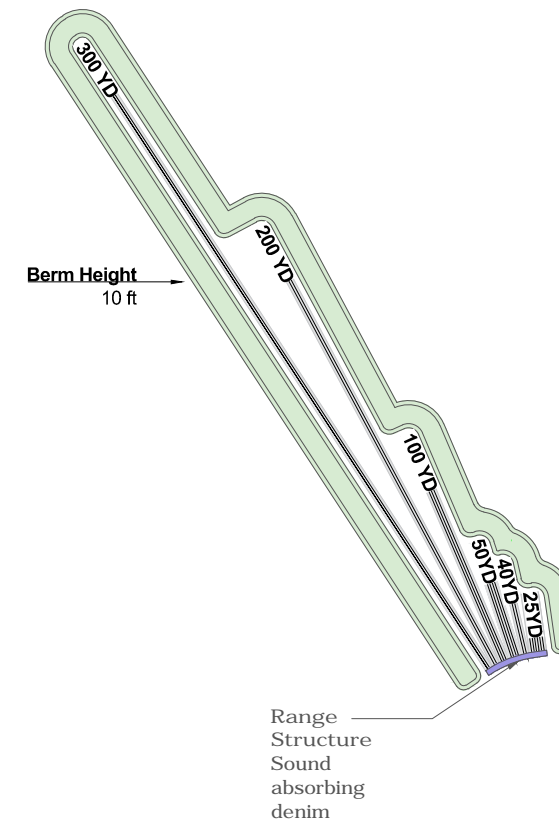
10 ft. Tall Berms | Alternate Orientation

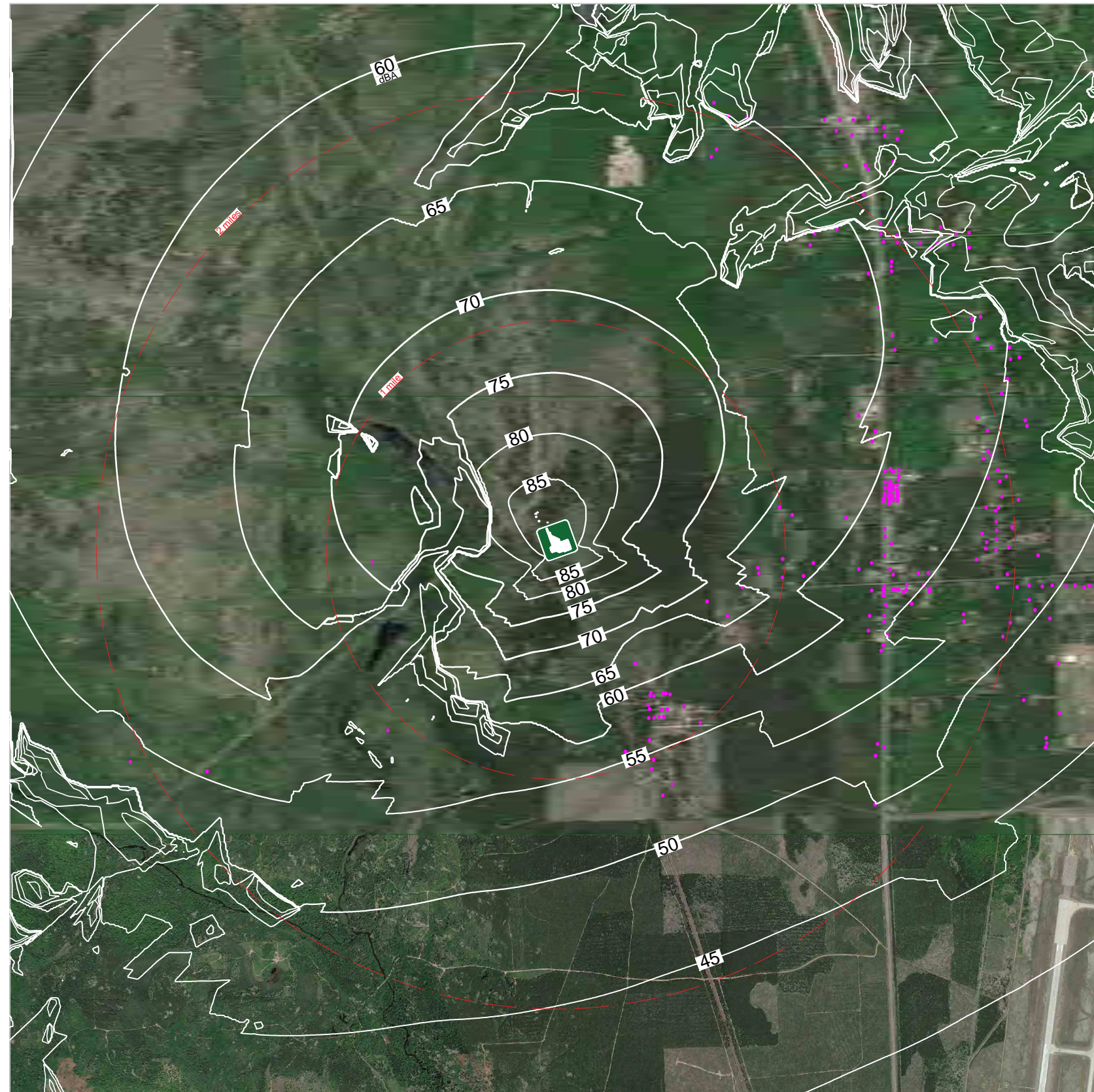
Busy Day:
 Shooters within 1 second:
 3 Rifles
 1 Shotgun
 2 Handguns

D.O.F. NW

Wind: 1 to 11 mph downward

50°F and 80% R.H.





SANDS
MODEL G-14

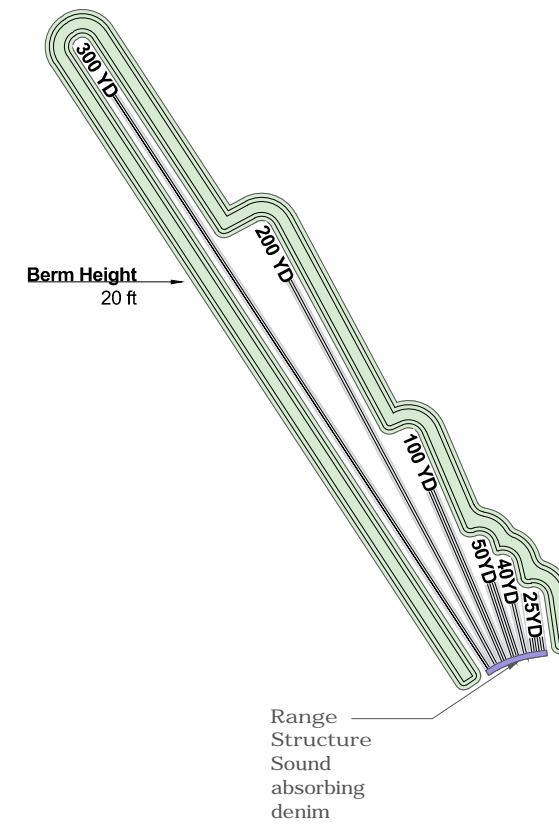
20 ft. Tall Berms | Alternate Orientation

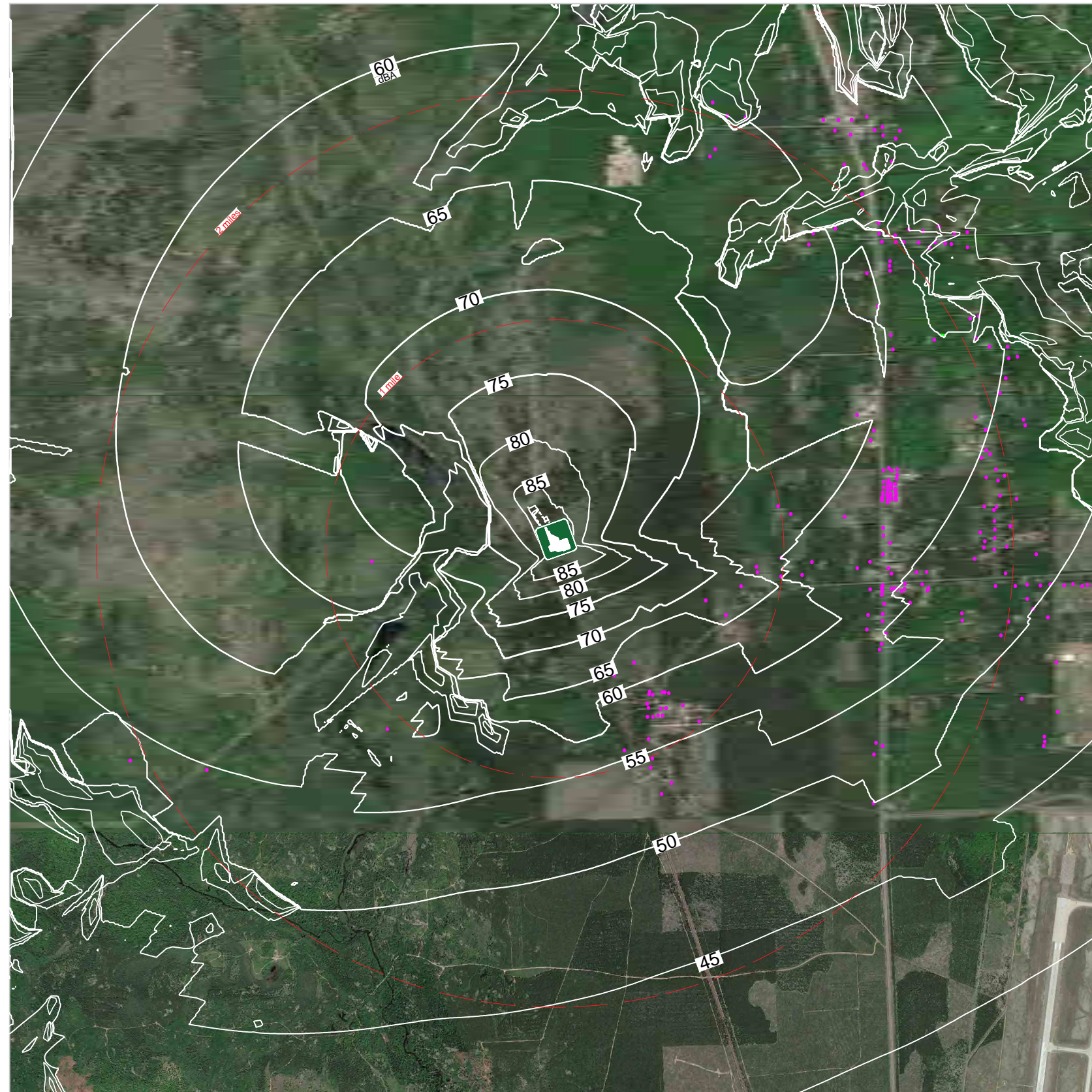
Busy Day:
Shooters within 1 second:
3 Rifles
1 Shotgun
2 Handguns

D.O.F. NW

Wind: 1 to 11 mph downward

50°F and 80% R.H.





SANDS
MODEL G-15

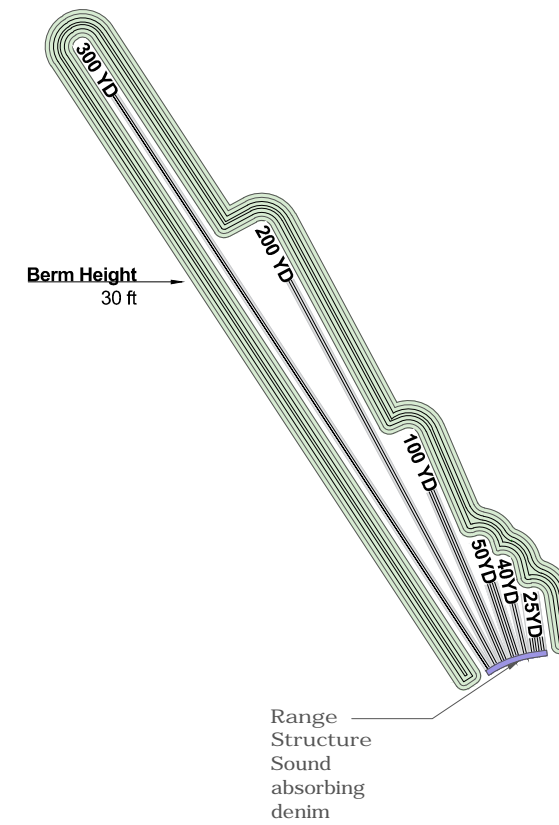
30 ft. Tall Berms | Alternate Orientation

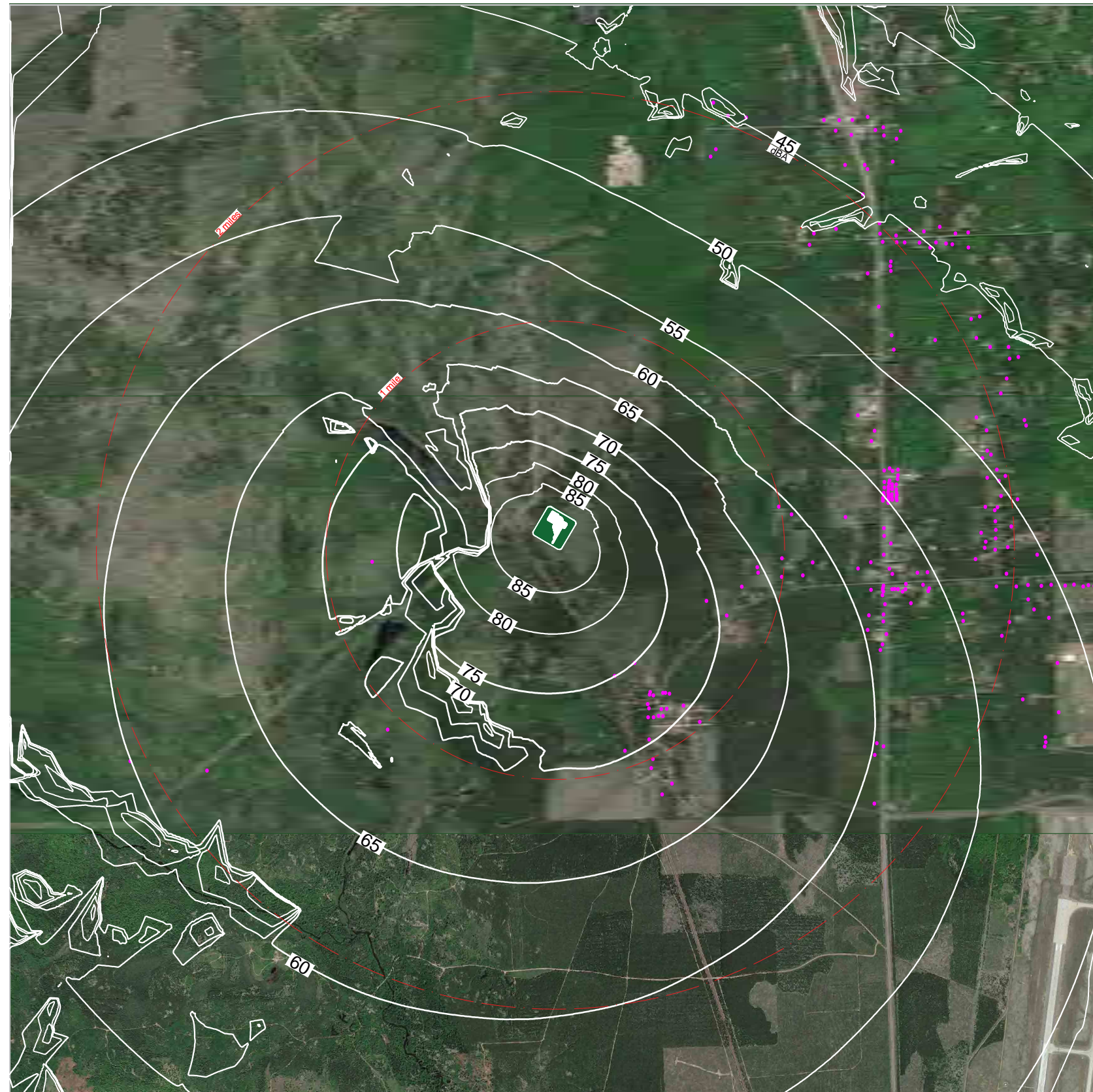
Busy Day:
 Shooters within 1 second:
 3 Rifles
 1 Shotgun
 2 Handguns

D.O.F. NW

Wind: 1 to 11 mph downward

50°F and 80% R.H.





SANDS
MODEL G-16

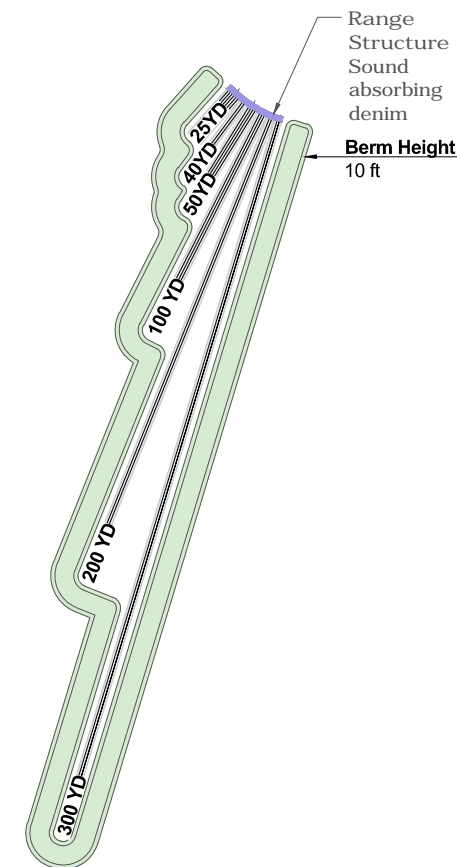
10 ft. Tall Berms | Alternate Orientation

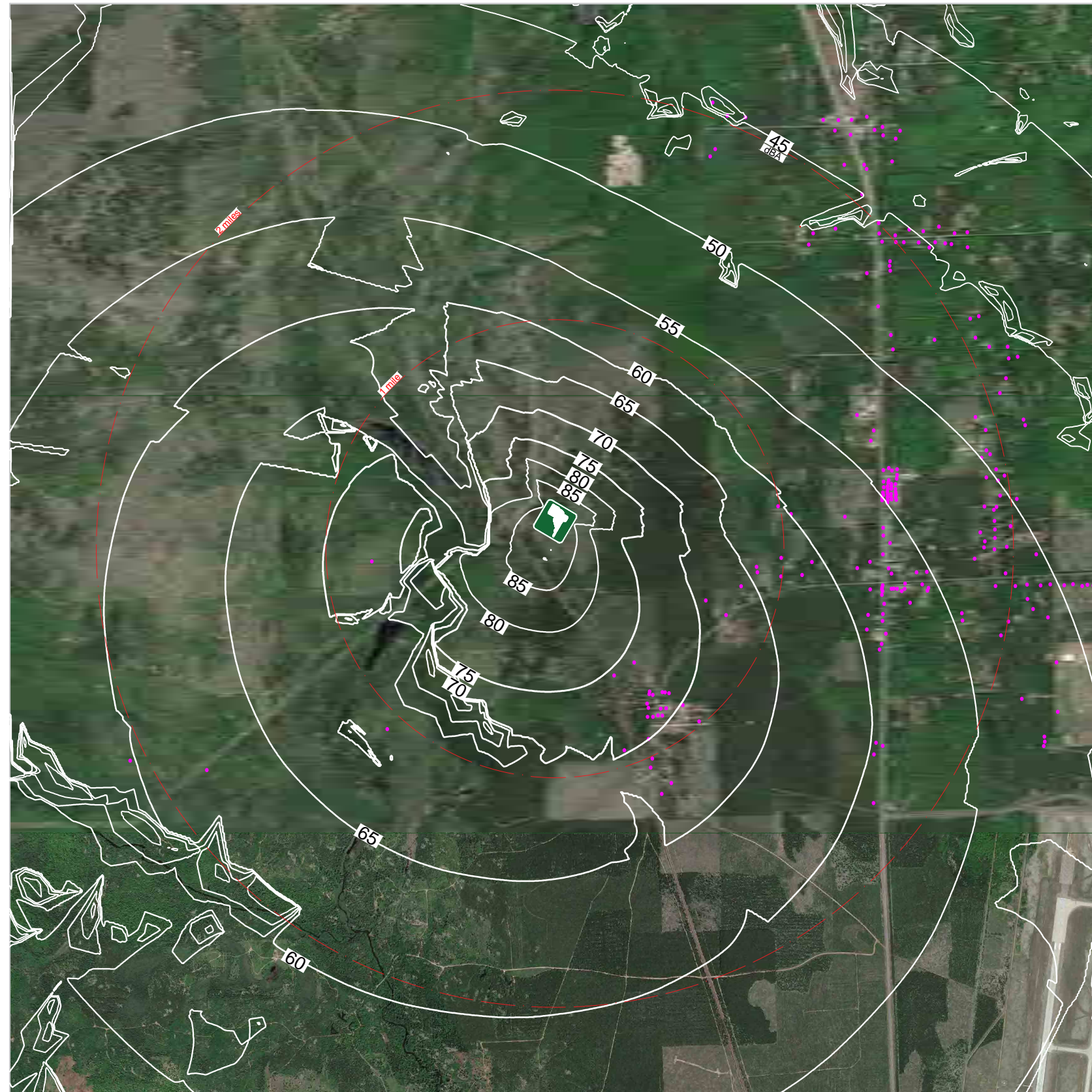
Busy Day:
Shooters within 1 second:
3 Rifles
1 Shotgun
2 Handguns

D.O.F. SW

Wind: 1 to 11 mph downward

50°F and 80% R.H.





SANDS
MODEL G-17

20 ft. Tall Berms | Alternate Orientation

Busy Day:
Shooters within 1 second:
3 Rifles
1 Shotgun
2 Handguns

D.O.F. SW

Wind: 1 to 11 mph downward

50°F and 80% R.H

