23 JANUARY 2026

Toward an Interactive Future for Explosives Safety Siting in Master Planning

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ACKNOWLEDGEMENTS

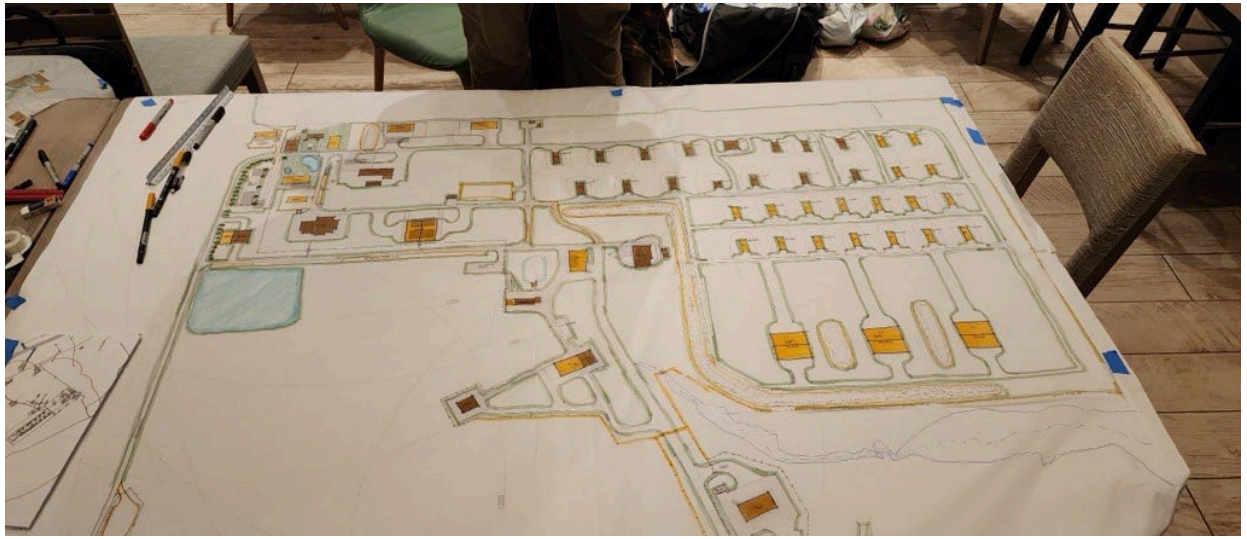
The authors would like to thank Thornton Tomasetti’s internal research and development team for their continued focus and backing of innovations across all industries.

AGENDA

1. **Master Planning and Current Methodologies**
2. Computational Design
3. BOOM

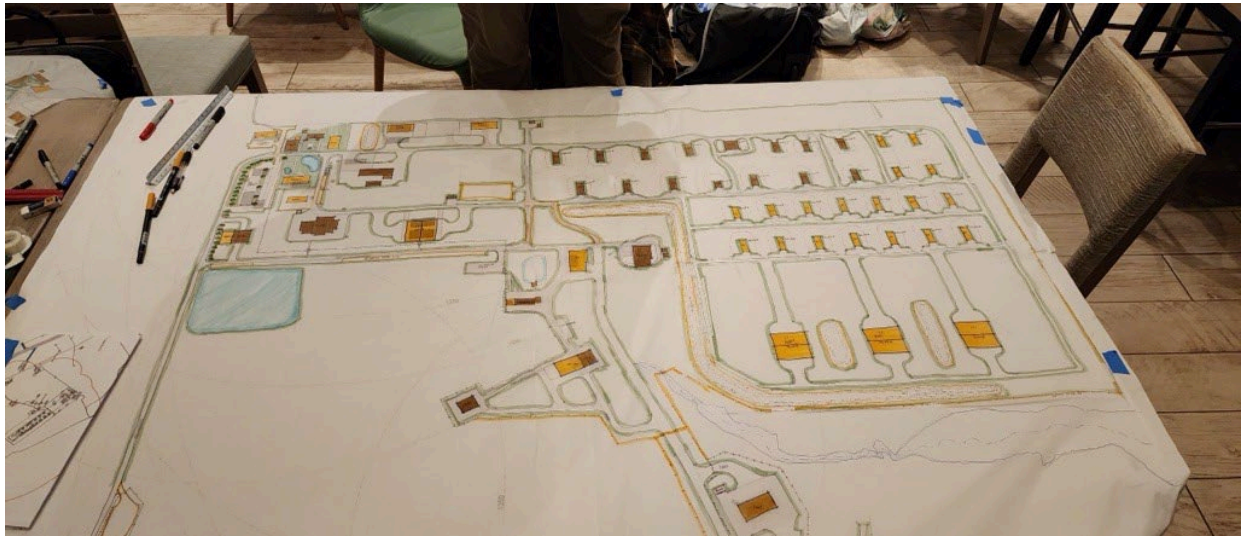
MASTER PLANNING

- Collaborative, **in-person** session with various installation members
- Master planning sessions typically conducted over **one** week
- Initial set of interviews typically conducted virtually prior to charrette
- Explosives Safety incorporated into:
    - District Development Plan
    - Installation Development Plan
    - DD1391 Validation Program



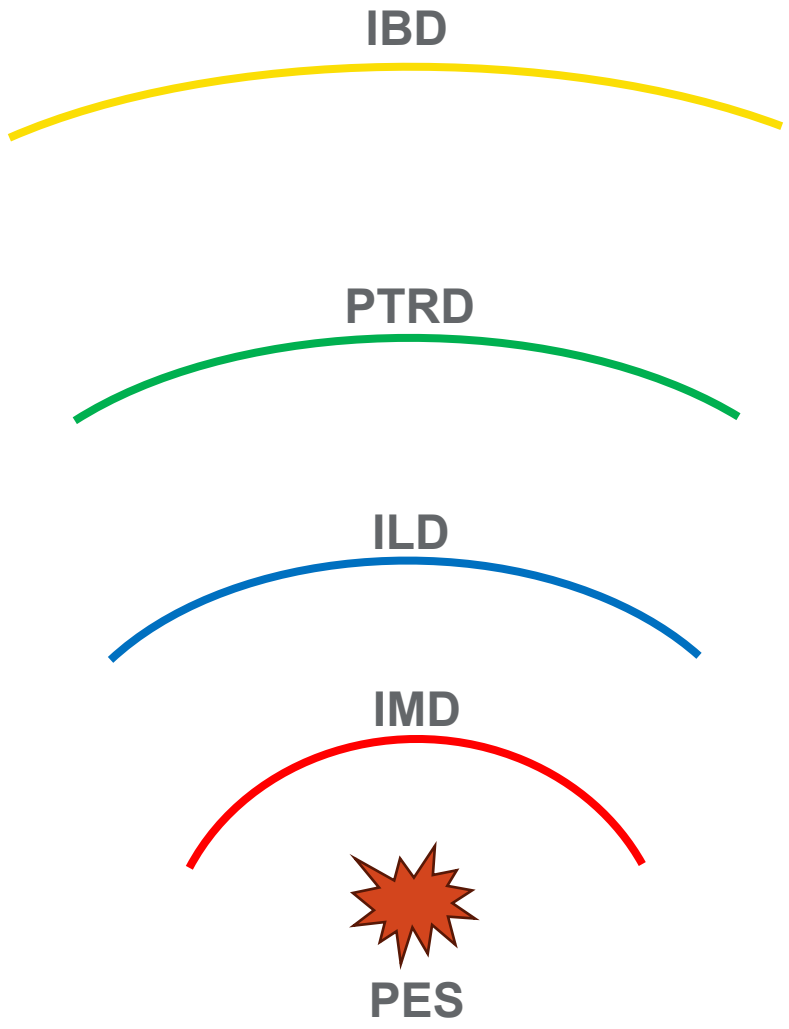
MASTER PLANNING

- **Monday** inbrief and site visit
  - Receive existing site info
  - Stakeholder interviews
  - Obtain existing NEW
- **Wednesday** mid-week review
  - Deficiency mapping
  - Design options
- **Friday** out-brief with master plan



QUANTITY DISTANCES

- Multiple quantity distances for each PES
- QD arcs calculated based on…
  - Net explosive weight
  - Magazine type
  - Orientation
  - Barricaded or unbarricaded



MASTER PLANNING

- **Iterative** design process
- Discussion, calculation, drafting
- Complex spreadsheets **reduce potential for collaboration**
- Calculation and drafting of QD arcs performed **separately**
- Cyclical as design evolves
- **Looking for better ways of addressing this workflow**

Type	ID	NEW (lb)						HFD (ft)	IBD (ft)			PTRD (ft)			Barricaded ILD (ft)			Unbarricaded ILD (ft)			ECM IMD (ft)					AGM IMD (ft)	
		1.1	1.2.1	1.2.2	1.2.3	1.3	1.4	All Sides	Front	Side	Rear	Front	Side	Rear	Front	Side	Rear	Front	Side	Rear	Side-Side	Rear-Rear	Front-Back	Front-Side	Front-Front	Barricaded	Unbarricaded
																					1.25	1.25	2	2.75	6	6	11
ECM	1043	50,000	35000	100000	100000	100000	CAP	1250	1289	1289	1250	774	774	750	368	258	221	663	589	442	46	46	74	101	221	--	--
AGM	1048	2,050	700	138417	100000	142119	CAP	1250	1250	1250	1250	750	750	750	114	114	114	229	229	229	--	--	--	--	--	82	149
ECM	1055	75,000	35000	100000	100000	100000	CAP	1250	1476	1476	1250	886	886	750	422	295	253	759	675	506	55	55	88	121	263	--	--
AGM	1058	200	480	50000	100000	100000	CAP	927	927	927	927	556	556	556	53	53	53	105	105	105	--	--	--	--	--	35	64
AGM	1061	1,520	496	20000	20000	100000	CAP	1250	1250	1250	1250	750	750	750	103	103	103	207	207	207	--	--	--	--	--	73	133
AGM	1062	9,750	0	20000	20000	73000	CAP	1250	1250	1250	1250	750	750	750	192	192	192	385	385	385	--	--	--	--	--	122	224
AGM	1064	1,068	0	38000	50000	73000	CAP	1250	1250	1250	1250	750	750	750	92	92	92	184	184	184	--	--	--	--	--	65	118
AGM	1065	67	652	50000	50000	100000	CAP	624	624	624	624	375	375	375	37	37	37	73	73	73	--	--	--	--	--	#N/A	#N/A
Pad	1069	5,804	3103	20000	50000	50000	3001	1250	1250	1250	1250	750	750	750	162	162	162	323	323	323	--	--	--	--	--	109	199
ECM	1087 B1	2,097	1063	20000	20000	160000	CAP	1250	1250	1250	1250	750	750	750	128	90	77	230	205	154	17	17	27	38	82	--	--
ECM	1087 B2	2,097	917	20000	20000	128000	CAP	1250	1250	1250	1250	750	750	750	128	90	77	230	205	154	17	17	27	38	82	--	--
ECM	1087 B3	2,097	800	20000	20000	61000	CAP	1250	1250	1250	1250	750	750	750	128	90	77	230	205	154	17	17	27	38	82	--	--
ECM	1087 B4	1,728	795	20000	20000	22000	CAP	1250	1250	1250	1250	750	750	750	120	84	72	216	192	144	15	15	24	33	73	--	--
ECM	1087 B5	1,728	795	20000	20000	5700	CAP	1250	1250	1250	1250	750	750	750	120	84	72	216	192	144	15	15	24	33	73	--	--
AGM	1102	1,400	450	65000	100000	75000	CAP	1250	1250	1250	1250	750	750	750	101	101	101	201	201	201	--	--	--	--	--	65	118
ECM	1103	60,082	50000	50000	50000	500000	CAP	1250	1371	1371	1250	822	822	750	392	274	235	705	627	470	49	49	78	107	234	--	--
ECM	1105	47,881	50000	50000	50000	500000	CAP	1250	1271	1271	1250	763	763	750	363	254	218	654	581	436	43	43	68	93	204	--	--
Test Pit	13508	5						419	419	419	419	251	251	251	15	15	15	31	31	31	--	--	--	--	--	#N/A	#N/A
Safe Haven	SF	65000						1250	1608	1608	1608	965	965	965	362	362	362	724	724	724	--	--	--	--	--	234	429
AGM	1065 exs+exp	115						712	712	712	712	427	427	427	44	44	44	88	88	88	--	--	--	--	--	30	55
AGM	1102 exs+exp	1400						1250	1250	1250	1250	750	750	750	101	101	101	201	201	201	--	--	--	--	--	65	118
AGM	M1	2050						1250	1250	1250	1250	750	750	750	114	114	114	229	229	229	--	--	--	--	--	82	149
AGM	Ready Pad	225						973	973	973	973	584	584	584	55	55	55	109	109	109	--	--	--	--	--	38	69
AGM	AGM1	2500						1250	1250	1250	1250	750	750	750	122	122	122	244	244	244	--	--	--	--	--	82	149
ECM	1	75000						1250	1476	1625	1250	886	975	750	422	295	253	759	675	506	55	55	88	121	263	--	--
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ECM	3	75000						1250	1476	1805	1250	886	1083	750	422	295	253	759	675	506	55	55	88	121	263	--	--
ECM	4	75000						1250	1476	1895	1250	886	1137	750	422	295	253	759	675	506	55	55	88	121	263	--	--
ECM	5	75000						1250	1476	1970	1250	886	1182	750	422	295	253	759	675	506	55	55	88	121	263	--	--
ECM	6	75000						1250	1476	1880	1250	886	1128	750	422	295	253	759	675	506	55	55	88	121	263	--	--
ECM	7	75000						1250	1476	1790	1250	886	1074	750	422	295	253	759	675	506	55	55	88	121	263	--	--
ECM	8	75000						1250	1476	1700	1250	886	1020	750	422	295	253	759	675	506	55	55	88	121	263	--	--
ECM	9	75000						1250	1476	1610	1250	886	966	750	422	295	253	759	675	506	55	55	88	121	263	--	--
ECM	10	75000						1250	1476	1520	1250	886	912	750	422	295	253	759	675	506	55	55	88	121	263	--	--
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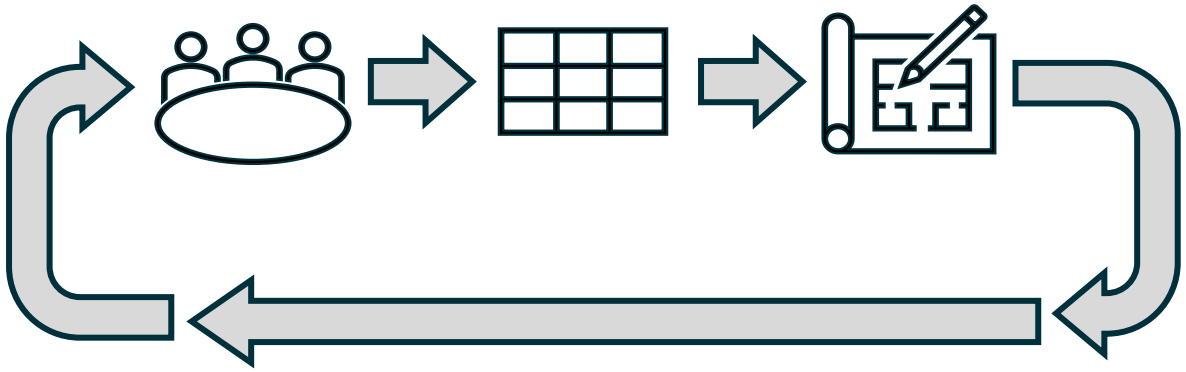

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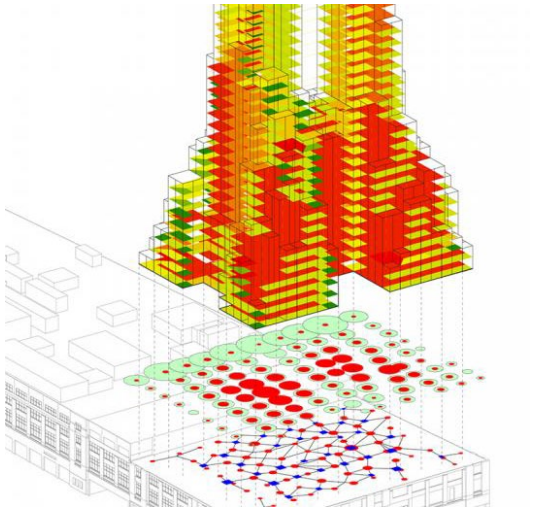
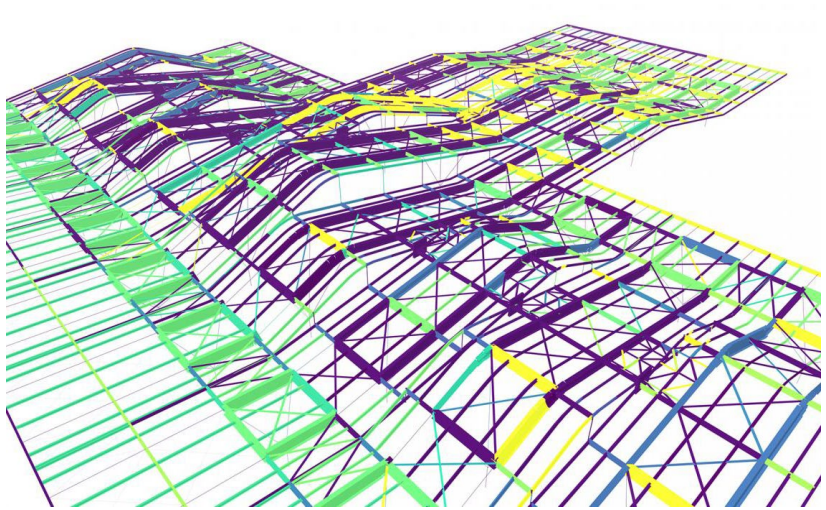
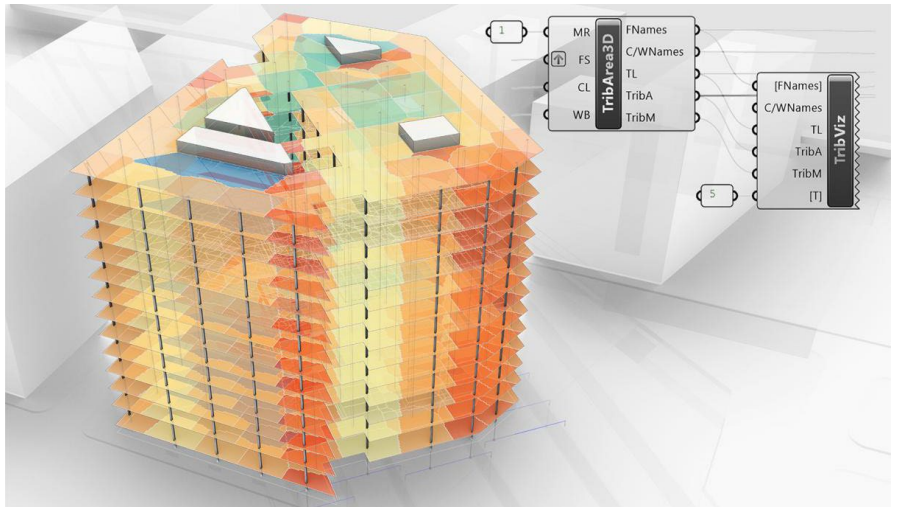
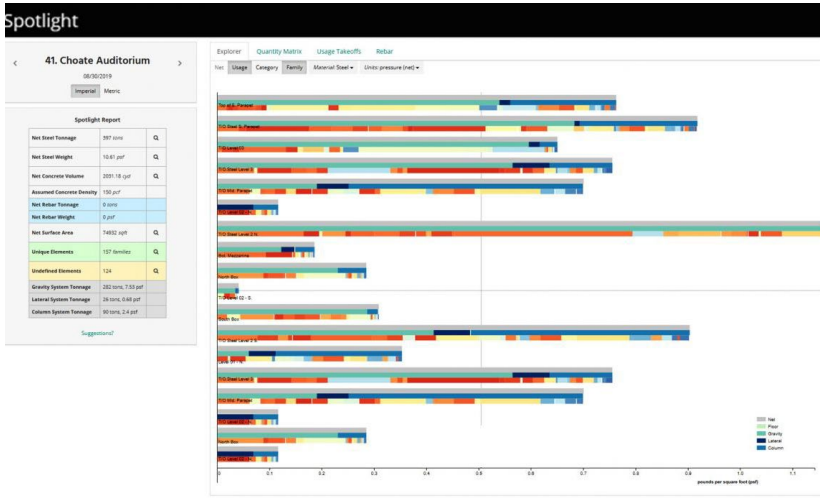
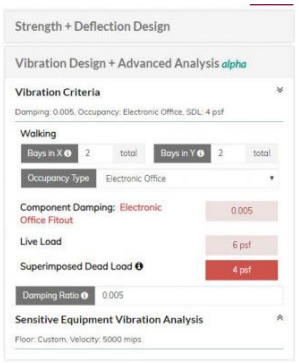
COMPUTATIONAL DESIGN

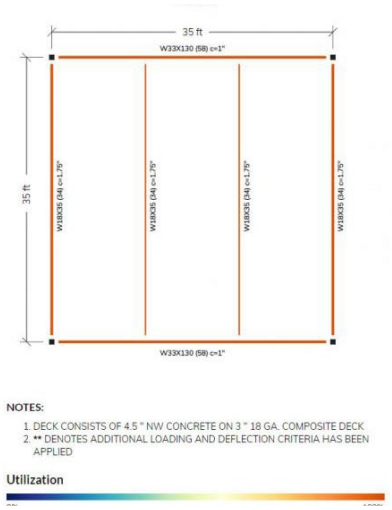


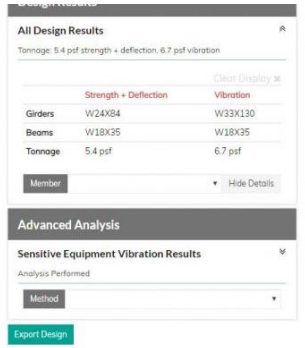


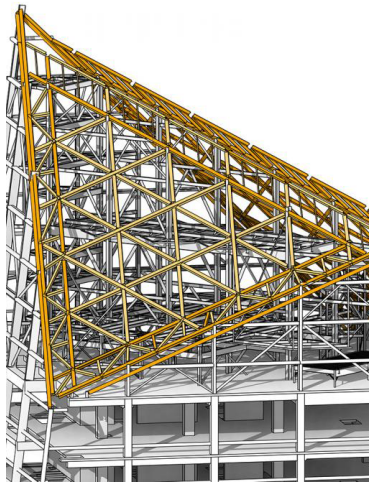






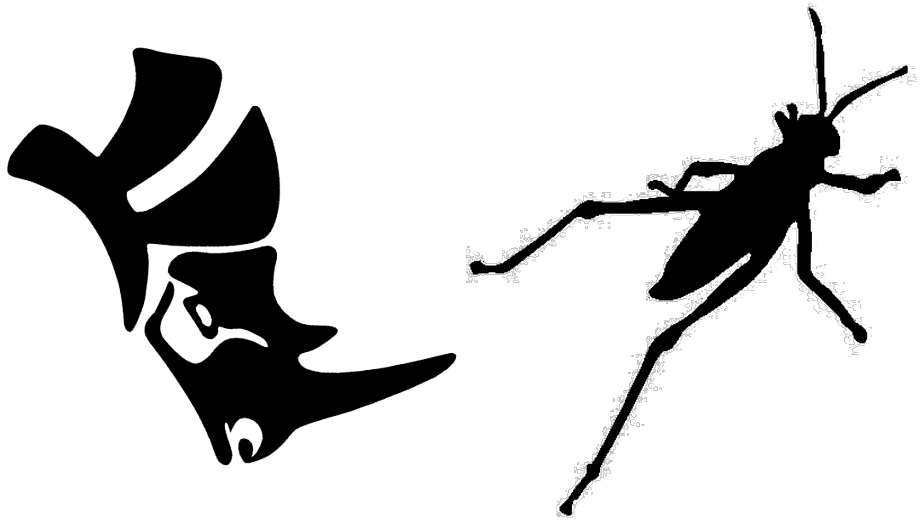






COMPUTATIONAL DESIGN

- Computational design brings together **design** and **computation**
- Merging **geometry** and **calculation**
- Development of workflows, tools often through visual programming
- Rhino and Grasshopper widely used across industries



AGENDA

1. Master Planning and Current Methodologies
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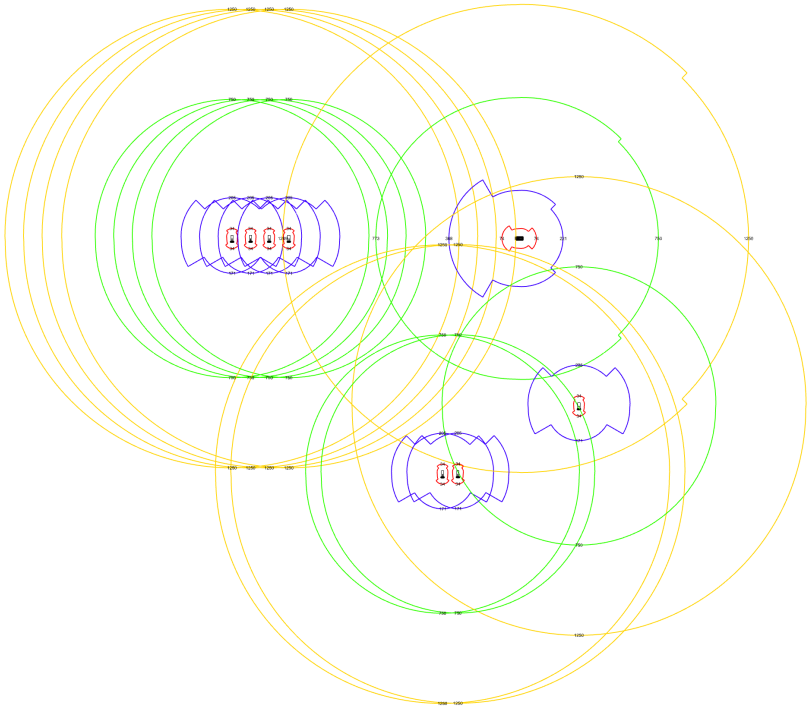
3. **BOOM**

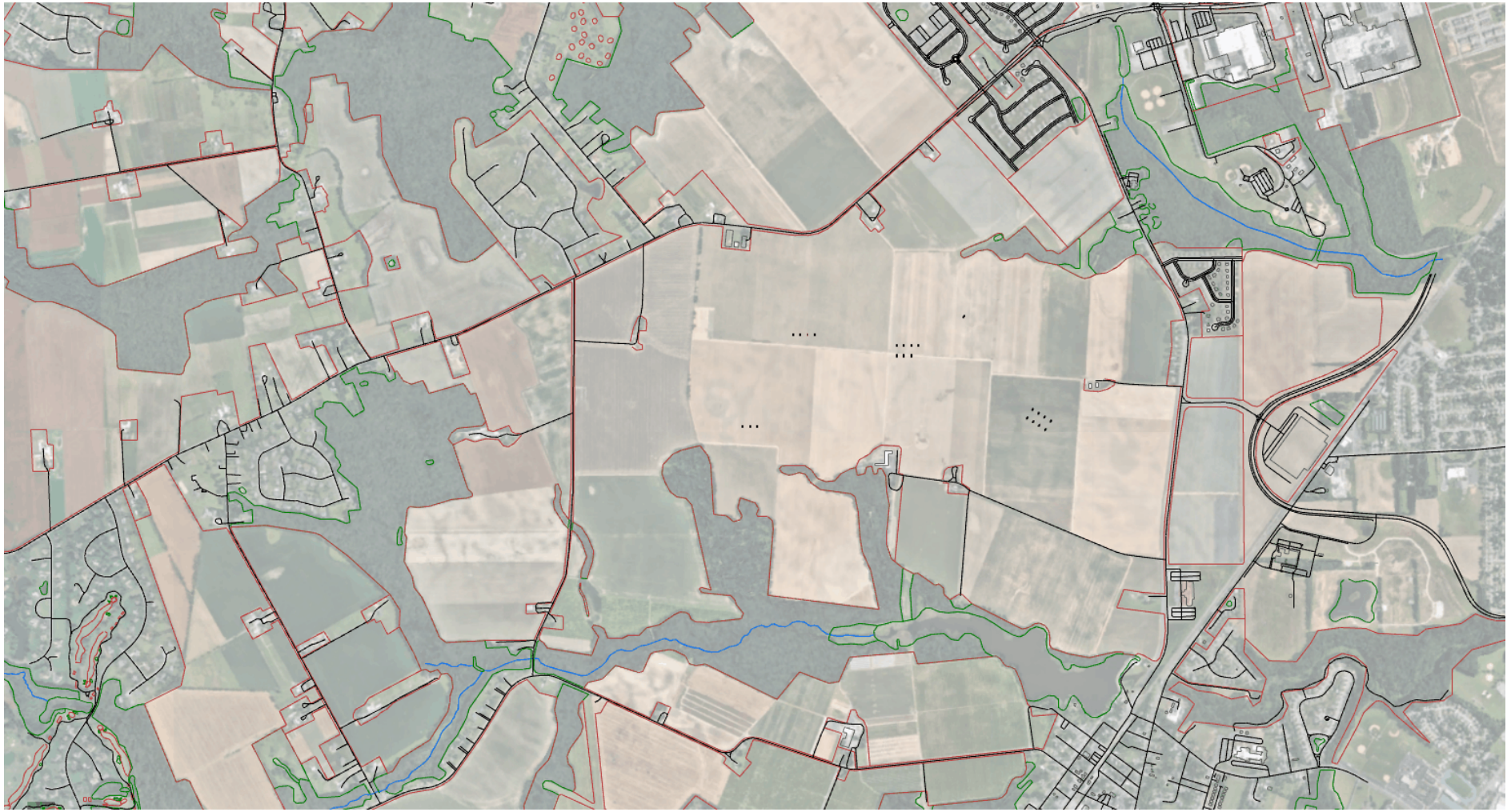
BLAST OPTIMIZATION AND OPERATIONS MAPPER

- TT internal development of Grasshopper tool
- Single source platform for instantaneous **calculation** and **plotting**
- Calculations and plotting performed **in context**



PRE-CHARETTE

PRE-CHARETTE



MONDAY


Top
Layers
Search
Layer
Material
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SITE
EXISTING
COA 1
COA 2
Properties: Viewport
Viewport
Title
Top
Width
1547
Height
890
Projection
Parallel
Display mode
Rendered
Locked
Camera
Lens Length (mm)
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Rotation
0.0
X Location
12748.602
Y Location
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Z Location
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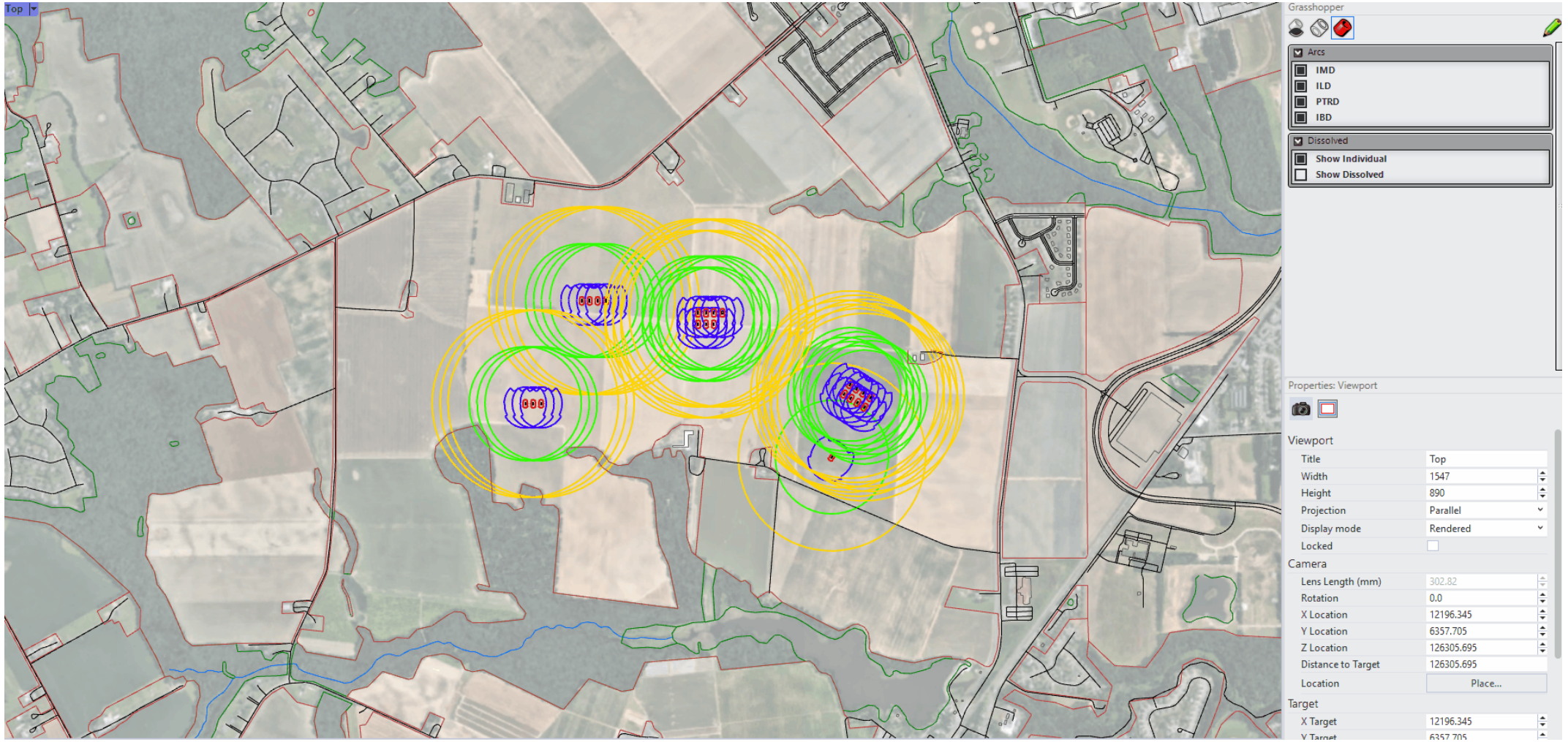
Distance to Target
126305.695
Location
Place...
Target
X Target
12748.602

TUESDAY


Top
Grasshopper
Arcs
IMD
ILD
PTRD
IBD
Dissolved
Show Individual
Show Dissolved
Properties: Viewport
Viewport
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Top
Width
1547
Height
890
Projection
Parallel
Display mode
Rendered
Locked
Camera
Lens Length (mm)
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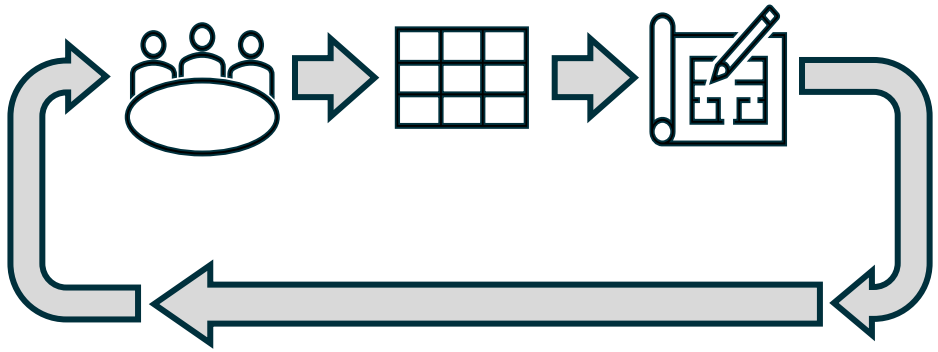
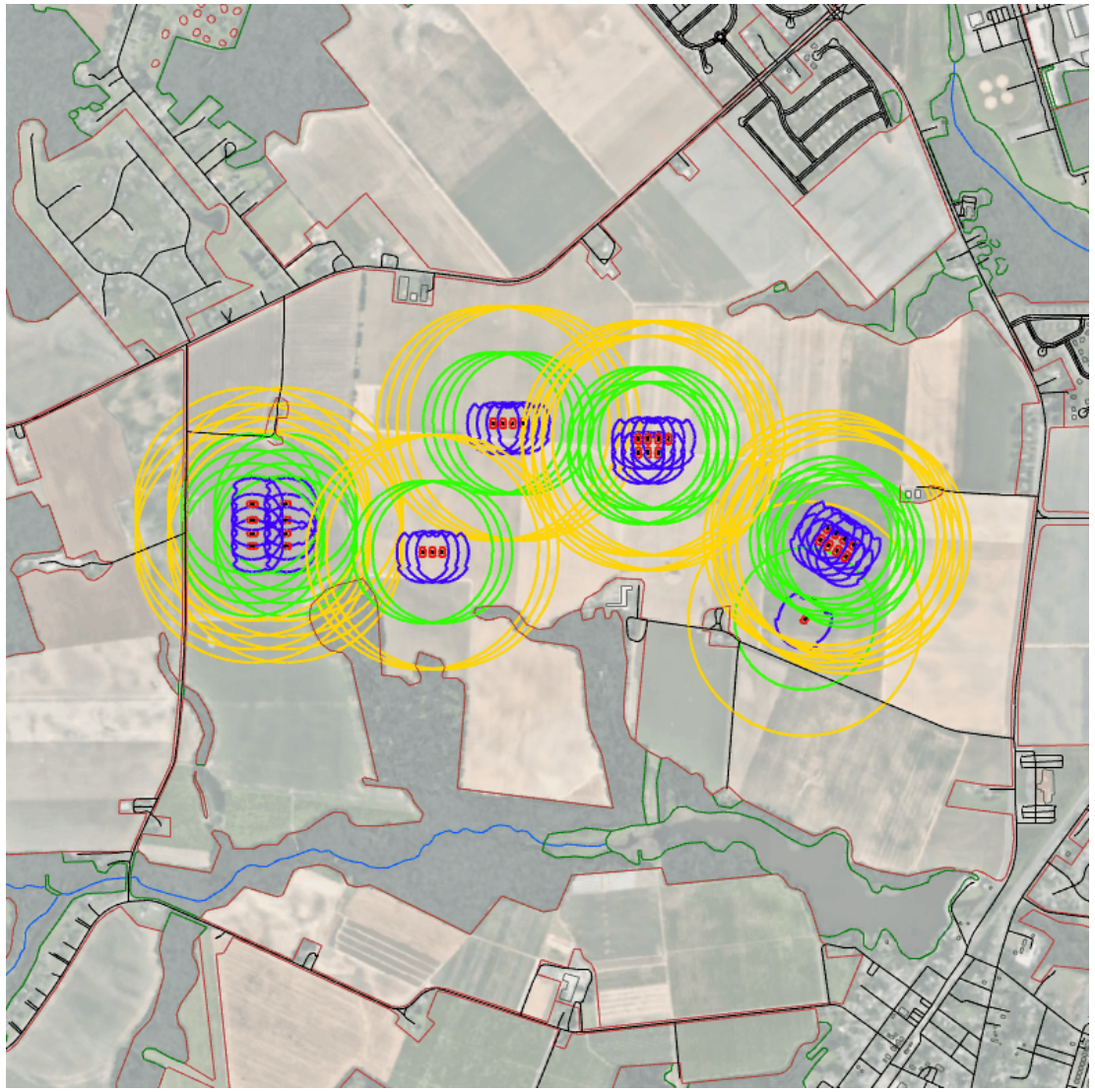
Rotation
0.0
X Location
12196.345
Y Location
6357.705
Z Location
126305.695
Distance to Target
126305.695
Location
Place...
Target
X Target
12196.345

WEDNESDAY

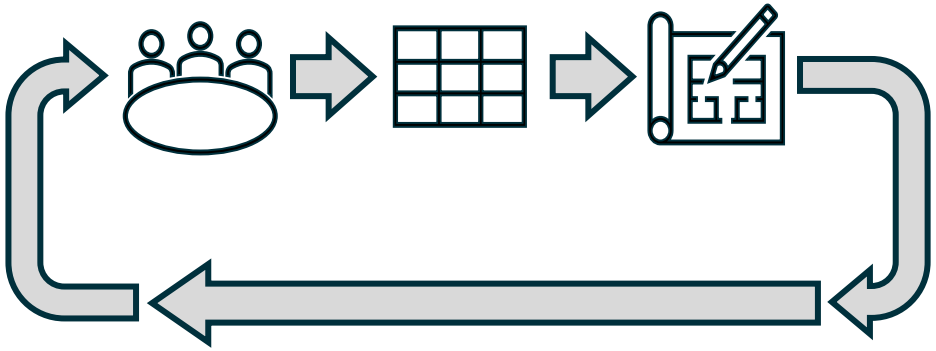
- Mid-week review of master plan
- Receive updates and changes from stakeholders
- Update master plan

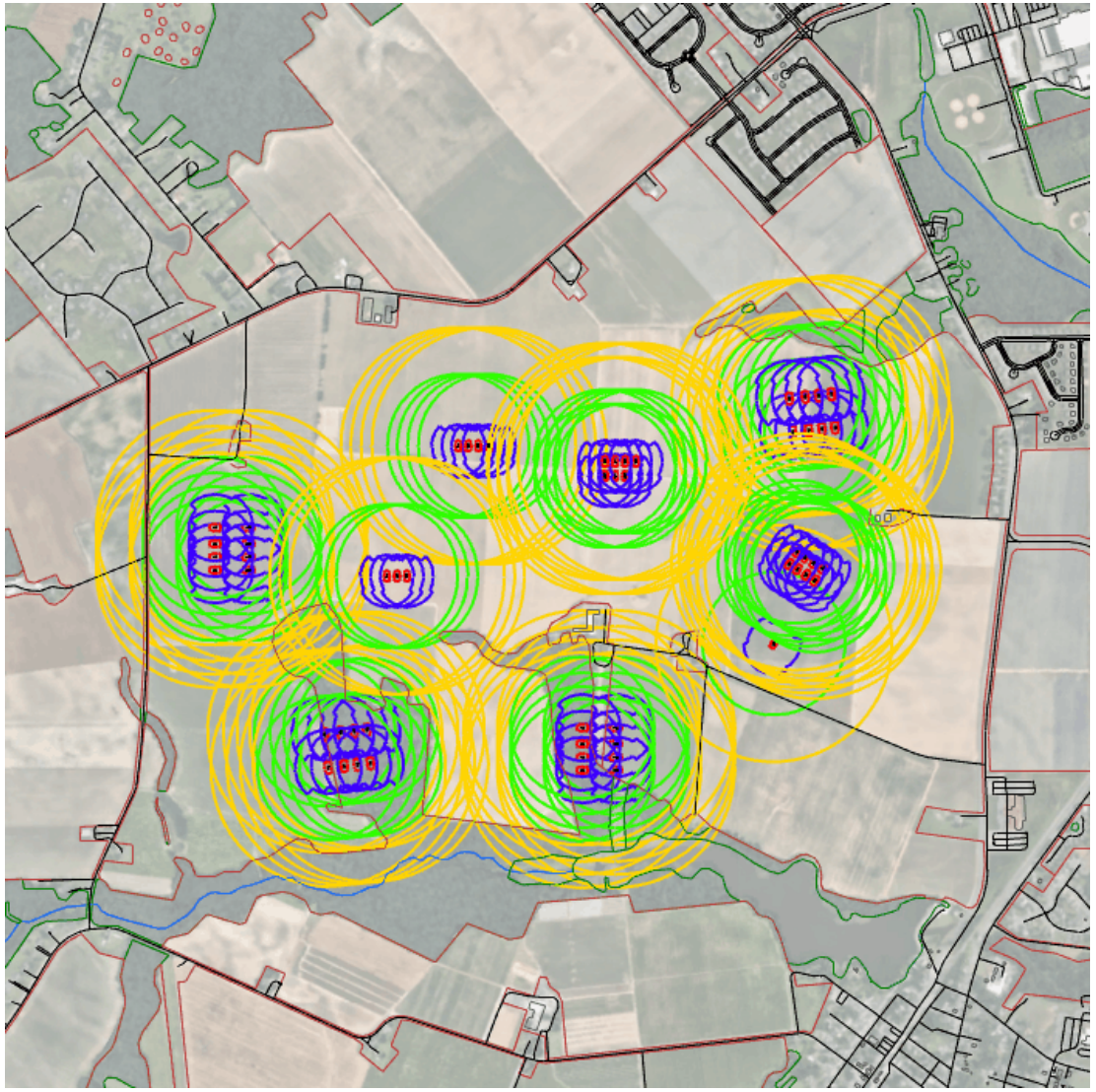




THURSDAY

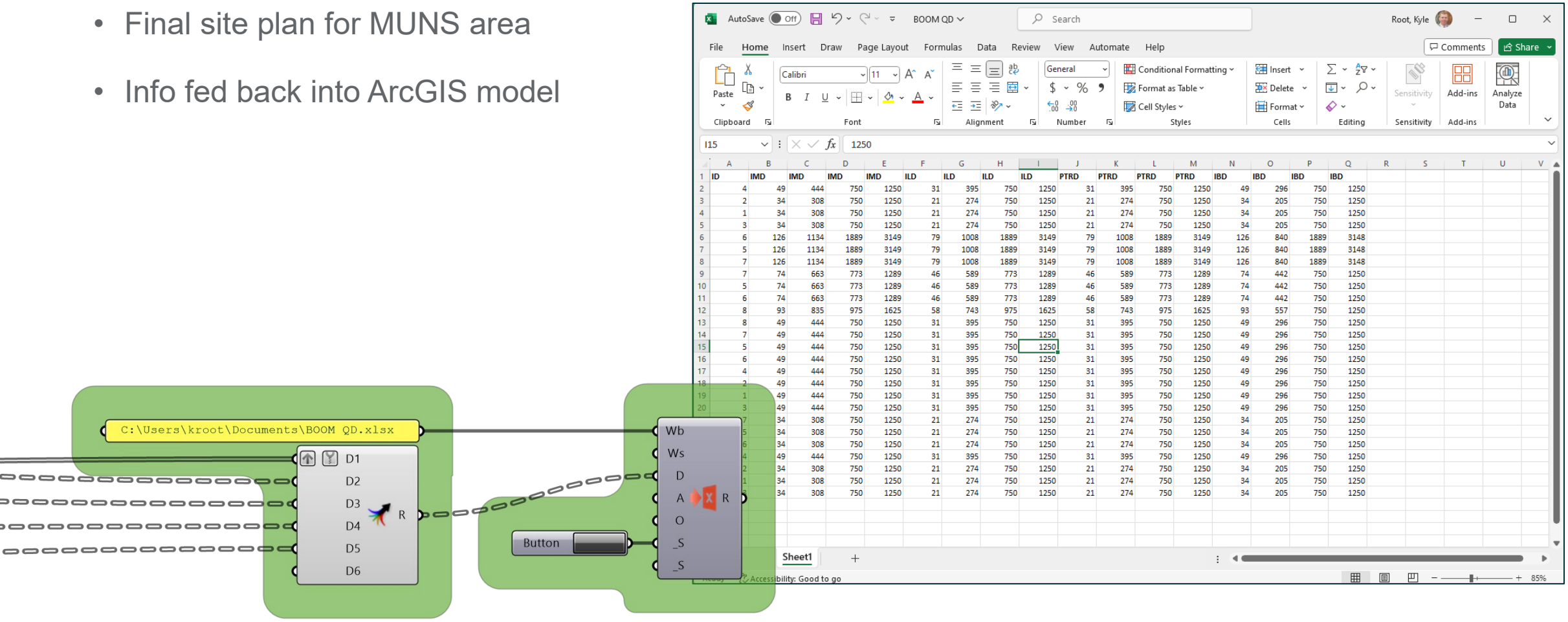
- Continue to refine master plan
- Updates to QD arcs **live** and **in context**





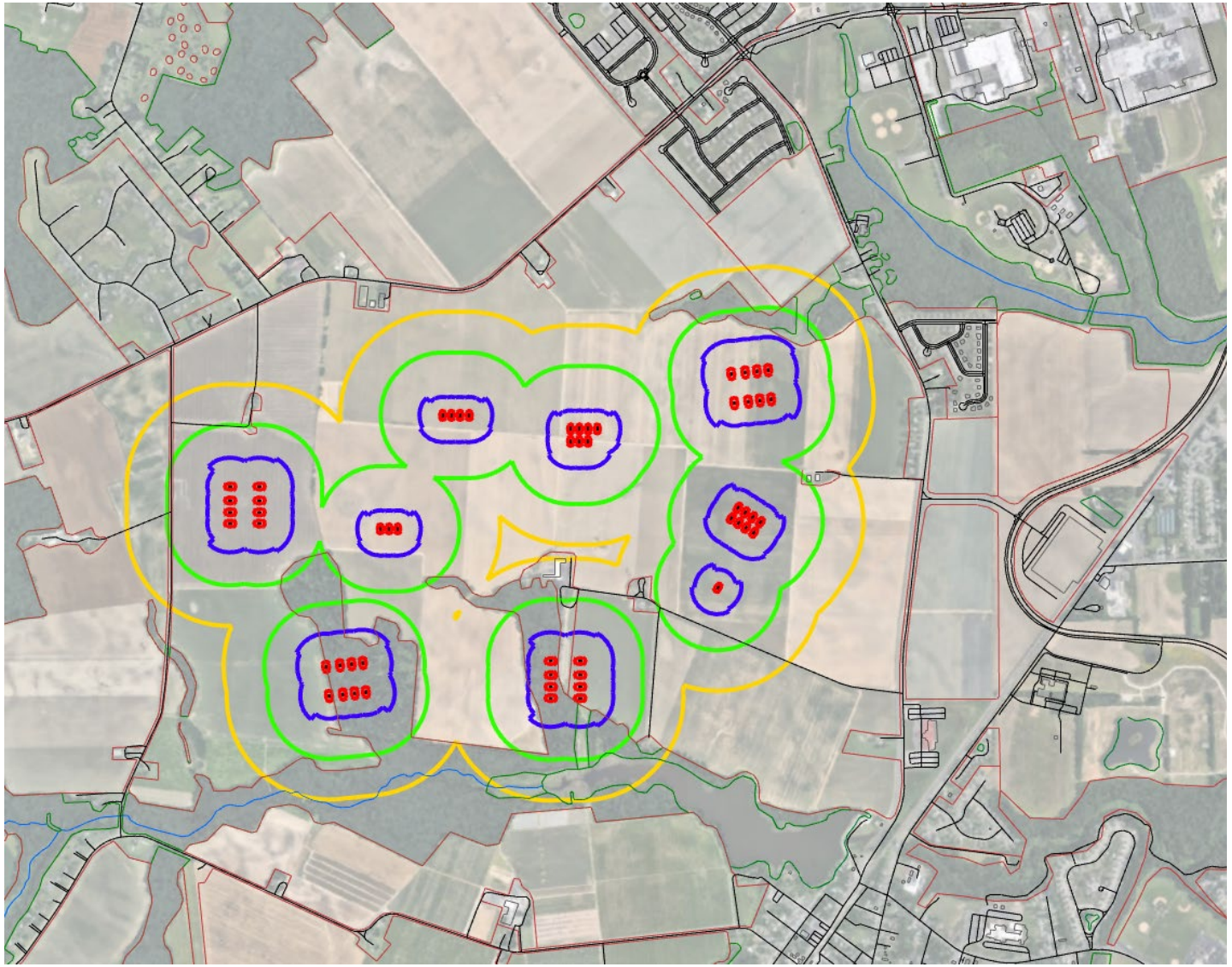
FRIDAY

- Final site plan for MUNS area
- Info fed back into ArcGIS model



POST-CHARETTE

- Base weapons safety officer can update ESS software for record keeping as projects are completed from master plan



CONCLUSION

- BOOM under continued internal development
- The collaborative working nature of the explosives safety engineer in master planning is shifting
- Cross industry collaboration could inform new ways of working
- Computational design tools excel in geometry and data processing

THANK YOU

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