Solar Development Potential on Contaminated Lands in Maryland

Analysis of contaminated sites across Maryland to determine their development potential for solar photovoltaic electricity generation

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October 11, 2018

Utility Scale Solar Energy Coalition
USSEC
of Maryland

Introduction & Background

Growing demand for solar farms in Maryland driven by:

- Climate/environmental concerns
- Jobs/tax revenue/economic development opportunities
- Landowner/farmer interest (increase/diversify income/)

Various factors drive solar to undeveloped parcels (ex. farm fields):

- Residential, commercial, & industrial real estate demand → land costs above what is viable for solar economics
- Environmental concerns & policy dissuade use of timbered land for solar

Challenges to solar development on farm parcels

- Over 90% of farm parcels not suitable for solar due to lack of transmission infrastructure/injection capacity
- Patchwork of conservation easements makes contiguous development challenging
- Viewshed/farmland preservation concerns
- Landowner interest required

Introduction & Background

Opportunity to Develop Solar on Contaminated Lands

- Obvious appeal as a target for solar due to lower value and limited alternative uses of contaminated sites
- Often fewer viewshed concerns due to compromised nature of sites

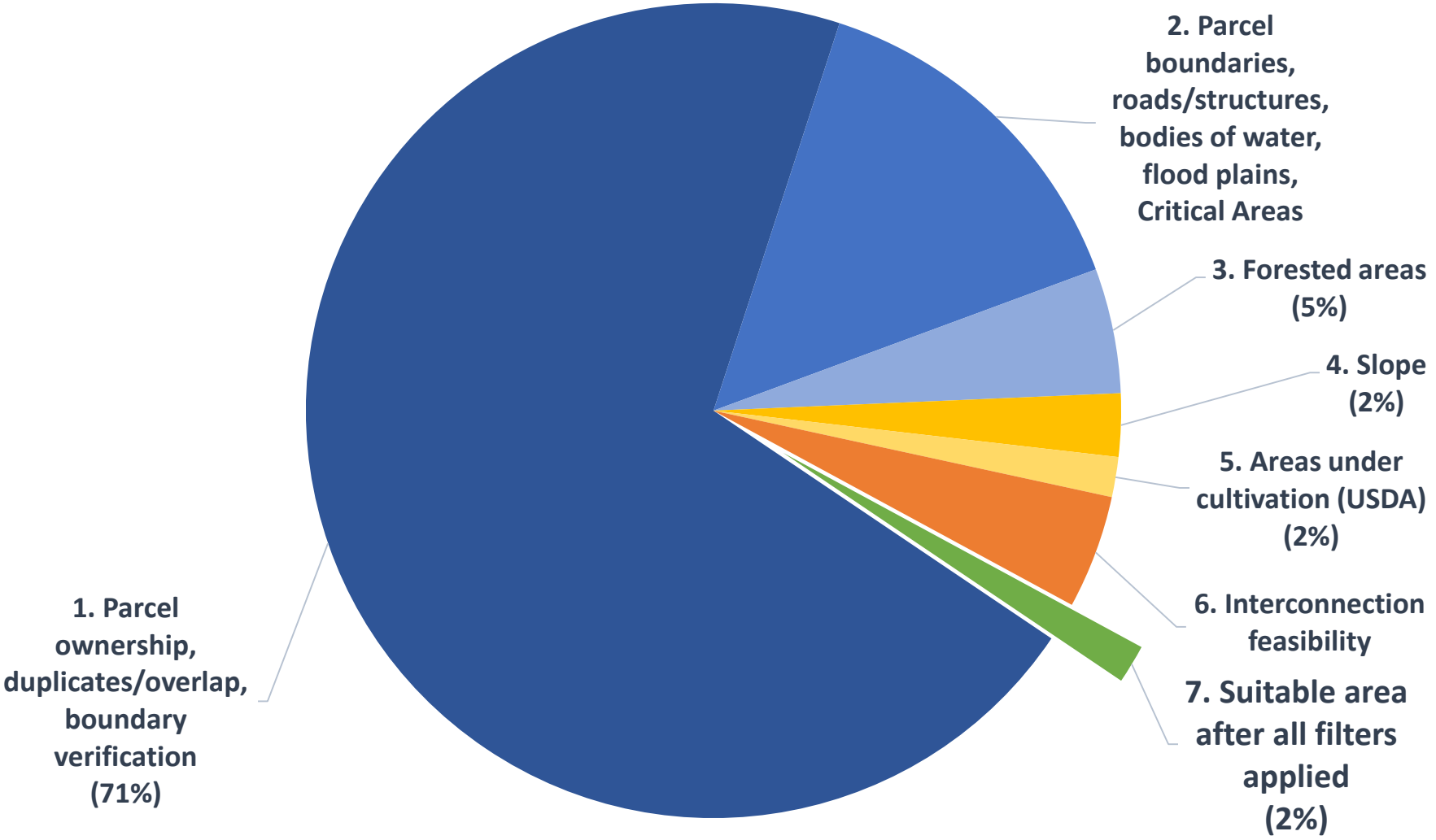
Challenges in Developing Solar on Contaminated Lands

- Build cost can be 2-3x vs. optimal non-contaminated site
  - Ex. HB 934 testimony by Montgomery County in 2018: "The goal of the bill is to allow a County to install larger solar energy projects on County-owned buildings and land. Without the benefits of net metering, many projects with a capacity greater than 2 MW are **not financially viable**."
- Financing risk can make such developments unfinanceable or even more costly
- Unlike planning for other land uses (ex. landfills, commercial zones, etc.), since power has to "fit" into the grid, determining where solar should be developed or whether solar can even fit in the grid in a particular area is a highly technical exercise and a moving target, a challenge for effective land use planning.

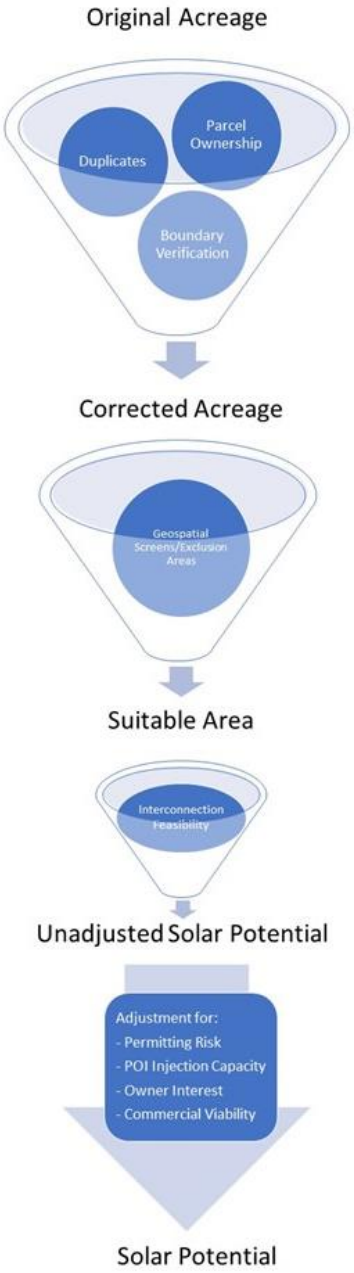
How Much Solar Can We Fit on MD Contaminated Lands?

- The answer to this question defines scale of opportunity & provides context for addressing challenges to developing solar on such lands.
- To answer this question, USSEC screened hundreds of sites:
- Source #1: EPA "Repowering America's Land Initiative" database
  - Over 80,000 sites nation-wide including landfills, Superfund sites, "Brownfields", RCRA sites)
  - Partnered with NREL to include renewable energy siting information
  - 337 sites in Maryland → 17,100 MW of solar capacity per database
- Source #2: MD DOE list of closed solid waste facilities
  - Address and contact information for 64 sites
- 401 total sites listed in the EPA and MDE databases in MD, of which 370 were unique sites (duplicates removed).

USSEC Contaminated Site Viability Screening: Acreage Reductions for Utility-Scale Projects



Methodology for Estimating Development Potential for Utility-Scale Solar Projects



Methodology for Estimating Development Potential for Small/Mid-Scale Solar Projects

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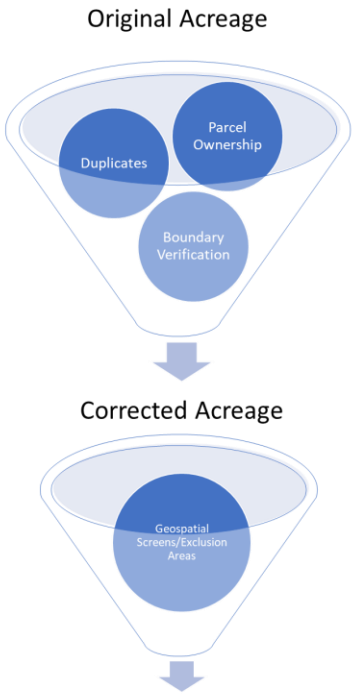
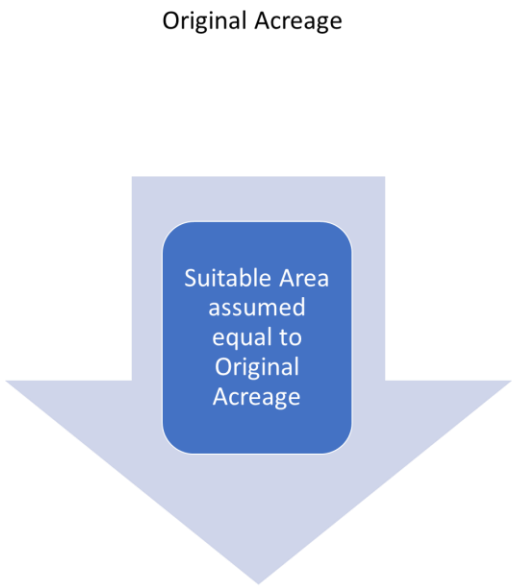
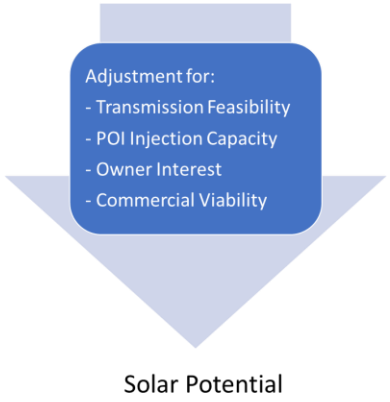
On sites 10 acres or larger

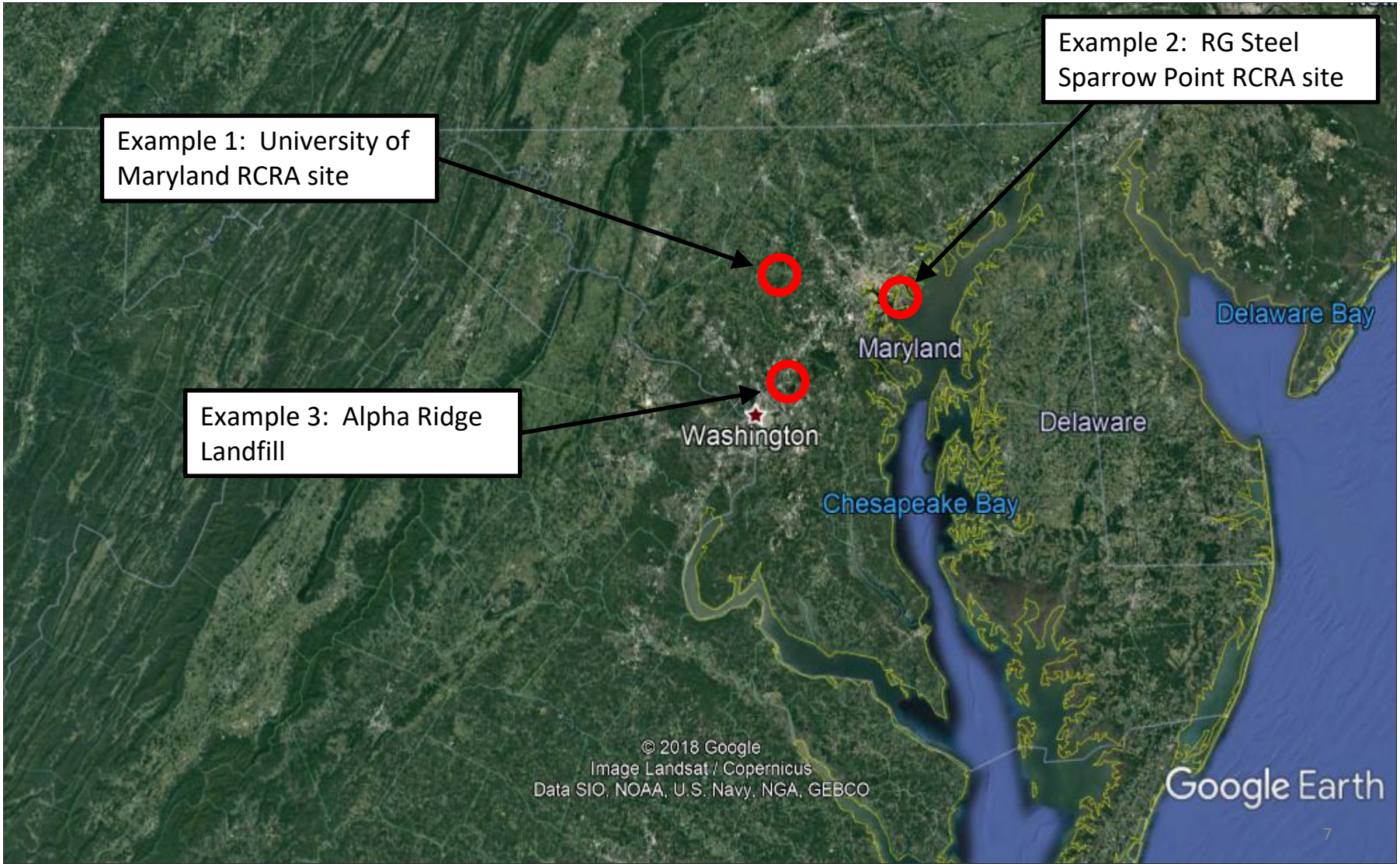


On sites under 10 acres



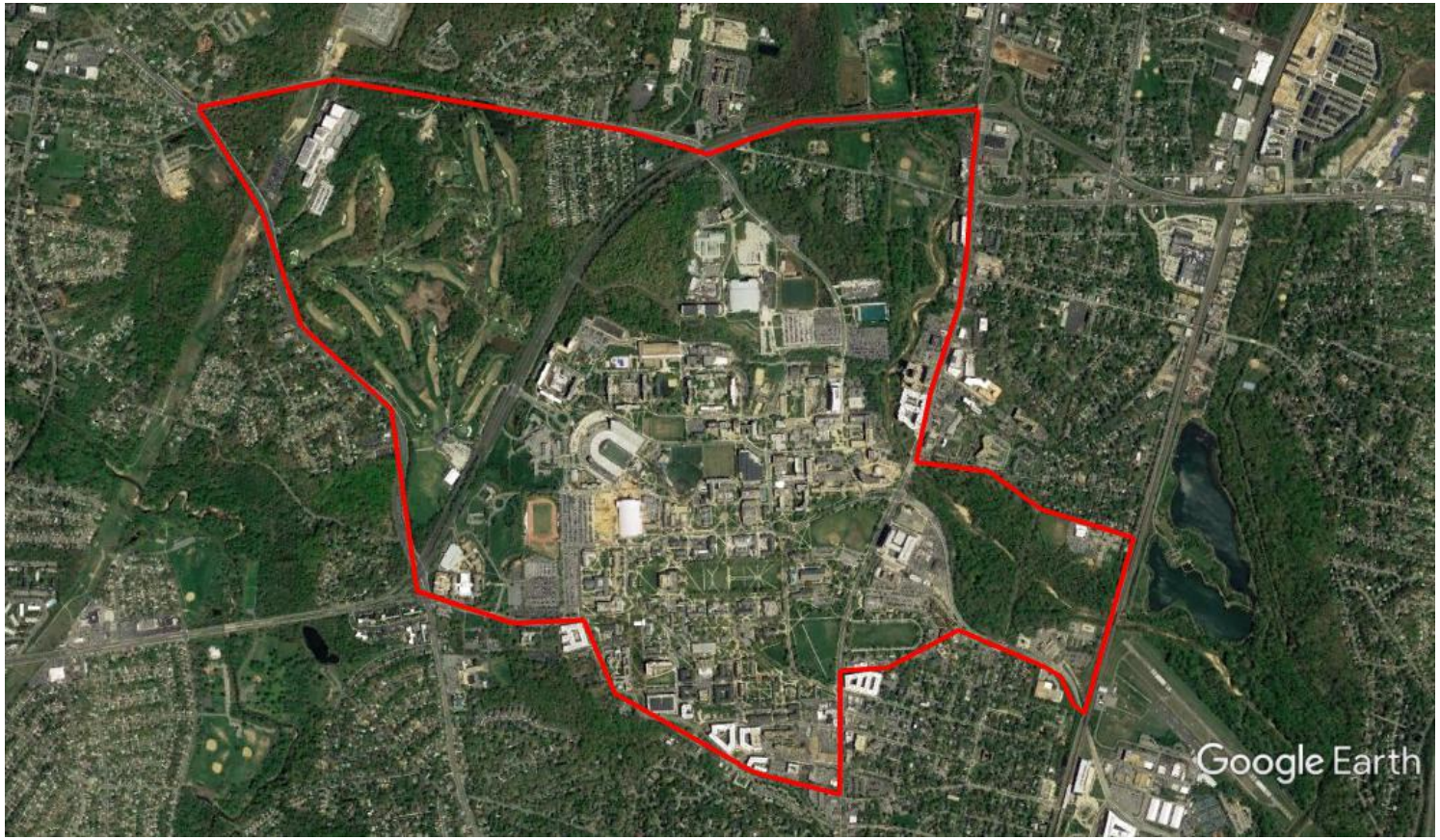


Examples of Site Screening Process



Example #1

University of Maryland – EPA RCRA Site (Ref. No. 928)



The EPA Repowering America's Land Initiative Database lists this site as 1,300 acres with the potential to host 216.7 MW of solar.

	Original Area (acres)	Corrected Area (acres)	Suitable Area (acres)	Unadjusted USS Potential (MW)
EPA	**1,300**			**216.7**
USSEC				

Example #1

University of Maryland – EPA RCRA Site (Ref. No. 928)

In the first screening step, USSEC researched the site and reason for its inclusion in the EPA database.

This step revealed that only 21 acres of this 1,300 acre site (a university campus) were associated with a RCRA.

The acreage was corrected accordingly.

	Original Area (acres)	Corrected Area (acres)	Suitable Area (acres)	Unadjusted USS Potential (MW)
EPA	**1,300**			**216.7**
USSEC		**21**		

Example #1

University of Maryland – EPA RCRA Site (Ref. No. 928)

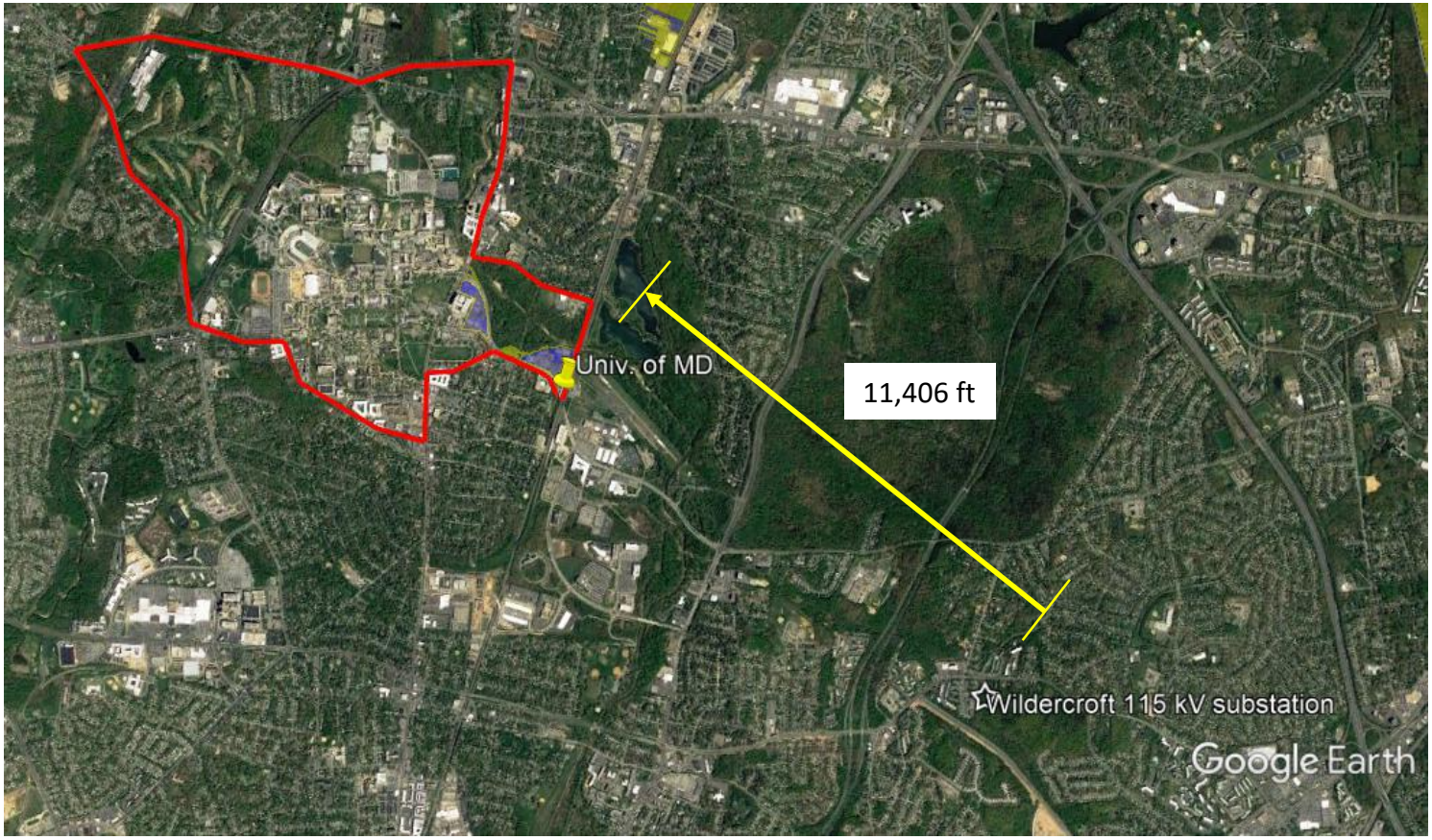
In the second screening step, the corrected acreage was screened for a host of site constraints including parcel boundaries, roads, structures, streams & wetlands, forested areas, Critical Areas, and slope > 10%.

This step resulted in suitable acreage of 7 acres.

	Original Area (acres)	Corrected Area (acres)	Suitable Area (acres)	Unadjusted USS Potential (MW)
EPA	**1,300**			**216.7**
USSEC		**21**	**7.0**	

Example #1

University of Maryland – EPA RCRA Site (Ref. No. 928)



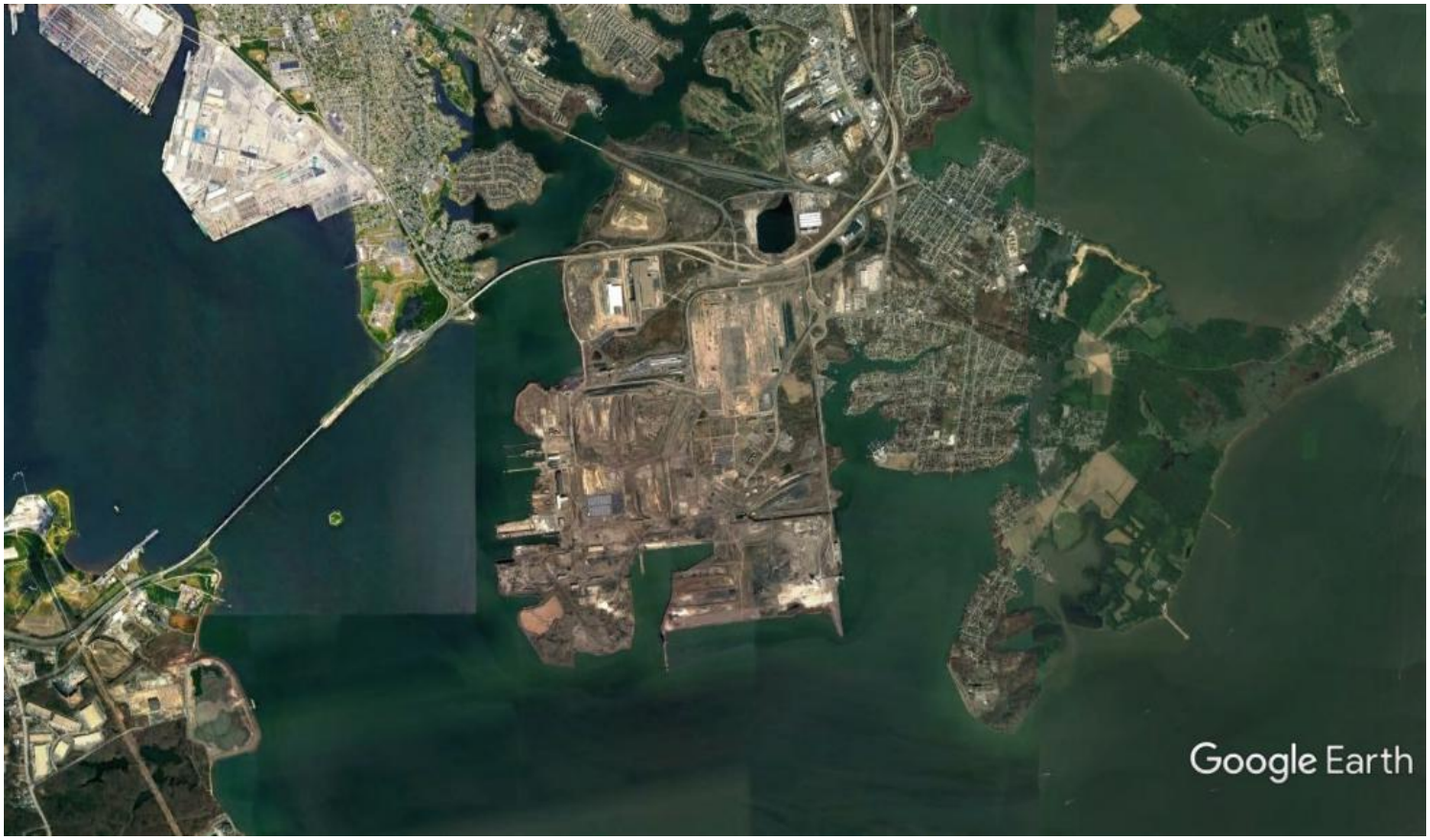
	Original Area (acres)	Corrected Area (acres)	Suitable Area (acres)	Unadjusted USS Potential (MW)
EPA	**1,300**			**216.7**
USSEC		**21**	**7.0**	**0**

In the final screen, the suitable acreage is subjected to a transmission screen to determine viability (voltage & distance) to the nearest substation or transmission line. This final step indicated that this site is not suitable for large utility-scale solar development.

However, the 7 suitable acres were included in the estimated capacity for small and medium-sized projects.

Example #2

RG Steel Sparrow Point – EPA RCRA Site (Ref. No. 942)



The EPA Repowering America's Land Initiative Database lists this site as 3,100 acres with the potential to host 383 MW of solar.

	Original Area (acres)	Corrected Area (acres)	Suitable Area (acres)	Unadjusted USS Solar Potential (MW)
EPA	3,100			383

Example #2

RG Steel Sparrow Point – EPA RCRA Site (Ref. No. 942)

In the first screening step, USSEC researched the site and reason for its inclusion in the EPA database.

This step corrected the site acreage from 3,100 to 2,362 acres.

	Original Area (acres)	Corrected Area (acres)	Suitable Area (acres)	Unadjusted USS Potential (MW)
EPA	**3,100**			**383**
USSEC		**2,362**		

Example #2

RG Steel Sparrow Point – EPA RCRA Site (Ref. No. 942)

In the second screening step, the corrected acreage was screened for a host of site constraints including parcel boundaries, roads, structures, streams & wetlands, forested areas, Critical Areas, and slope > 10%.

This step resulted in suitable acreage of 916 acres.

	Original Area (acres)	Corrected Area (acres)	Suitable Area (acres)	Unadjusted USS Potential (MW)
EPA	**3,100**			**383**
USSEC		**2,362**	**916**	

Example #2

RG Steel Sparrow Point – EPA RCRA Site (Ref. No. 942)

	Original Area (acres)	Corrected Area (acres)	Suitable Area (acres)	Unadjusted USS Potential (MW)
EPA	**3,100**			**383**
USSEC		**2,362**	**916**	**152.7**

In the final screen, the suitable acreage is subjected to a transmission screen to determine viability (voltage & distance) to the nearest substation or transmission line. This final step indicated that this site has transmission infrastructure at the appropriate voltage to accommodate a utility-scale solar project of 152.7 MWac (assuming 6 acres/MWac net of all setbacks)

Example #3

Alpha Ridge Landfill – EPA Landfill Site (Ref. No. 4817)

The EPA Repowering America's Land Initiative Database lists this site as 590 acres with the potential to host 98.3 MW of solar.

	Original Area (acres)	Corrected Area (acres)	Suitable Area (acres)	Unadjusted USS Potential (MW)
EPA	590			98.3
USSEC				

Example #3

Alpha Ridge Landfill – EPA Landfill Site (Ref. No. 4817)

In the first screening step, USSEC researched the site and reason for its inclusion in the EPA database.

This step revealed the landfill to contain only 487 acres.

The acreage was corrected accordingly.

	Original Area (acres)	Corrected Area (acres)	Suitable Area (acres)	Unadjusted USS Potential (MW)
EPA	**590**			**98.3**
USSEC		**487**		

Example #3

Alpha Ridge Landfill – EPA Landfill Site (Ref. No. 4817)

	Original Area (acres)	Corrected Area (acres)	Suitable Area (acres)	Unadjusted USS Potential (MW)
EPA	590			98.3
USSEC		487	68	

In the second screening step, the corrected acreage was screened for a host of site constraints including parcel boundaries, roads, structures, streams & wetlands, forested areas, Critical Areas, and slope > 10%.

This step resulted in suitable acreage of 203 acres, but USSEC's research indicates that only 68 of those acres are closed and capped and therefore suitable for solar.

Example #3

Alpha Ridge Landfill – EPA Landfill Site (Ref. No. 4817)

	Original Area (acres)	Corrected Area (acres)	Suitable Area (acres)	Unadjusted USS Potential (MW)
EPA	**590**			**98.3**
USSEC		**487**	**68**	**0**

In the final screen, the suitable acreage is subjected to a transmission screen to determine viability (voltage & distance) to the nearest substation or transmission line. This final step indicated that this site is not suitable for large utility-scale solar development.

However, the 68 suitable acres were included in the estimated capacity for small and medium-sized projects.

What about land cost, landowner interest, etc?

USSEC's screening efforts identify suitable acreage, but numerous other factors limit development viability:

- Transmission & distribution injection capacity (i.e. room on the grid)
- Landowner willingness to participate
- Commercial viability (high build & financing costs, land prices, etc.)
- Other standard development risk elements (permitting, environmental, title, subsurface, etc.)

Given uncertainty in overlap of these variables, USSEC applied a range of assumed "success rates" of 20% to 40% to determine a reasonably expected range of actual potential for solar development.

This is likely an optimistic range of viability, since each of the listed risk factors alone represent significant obstacles to viability across sites.

Results

Utility-Scale and Small and Medium-Scale Projects

	Size Tier (based on suitable acreage)	No. of sites	Suitable Area (acres)	Avg. Size of Suitable Area per Site (acres)	Net Solar Potential Before Risk Adjustment (MW)	Assumed Average Nameplate Capacity (MW)	Risk Adjustment for Injection Capacity, Owner Interest, and Commercial Viability		Estimated Solar Development Potential (MW)	
							Low	High	Low	High
Utility-Scale Projects	Sites 120 acres or larger	15	4,309	287.3	~370	N/A	20.0%	40%	74	148
Medium-Scale Projects	Sites 20 acres or larger	53	3,401	64.2	~530	10	20.0%	40%	106	212
	Sites between 10 and 20 acres	24	334	13.9	~48	2.0	20.0%	40%	9.6	19.2
Small-Scale Projects	Sites under 10 acres	239	855	3.6	~120	0.5	20.0%	40%	24	48
Total									**214**	**427**

Conclusions & Recommendations

- The opportunity to develop solar on contaminated sites in Maryland appears to be limited to a range of ~200 to ~400 MW across the state. In context, a 14.5% solar carveout represents ~5000 MW of solar capacity.
- Policies designed to incentivize solar development on these sites must address challenges with commercial viability of such developments.
- Land use planning that does not allow for flexible siting that recognizes uncertainty around transmission injection capacity and landowner interest is unlikely to achieve the desired outcome of directing the siting of solar development.

Questions & Discussion

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Note: The full report describing USSEC's analysis of solar development potential on Maryland's contaminated sites, along with the underlying database, assumptions, and GIS layers produced as part of this analysis will be posted on USSEC's website (www.mdsolarcoalition.com) and made available to the public in order to advance collective understanding of these issues. For an advance copy of the report and associated data, please send a request by email to info@mdsolarcoalition.com

ADDITIONAL SLIDES

MWdc vs. MWac

- Solar facilities are often described in terms of the total MW of solar installed.
- Important to understand whether reference to MW is a MWdc or Mdac
- DC stands for direct current. This is the amount of MW that comes out of the panels
- AC stands for alternating current. This is the amount of MW injected into the grid
- Solar arrays are typically built with a larger dc size with inverters that manage and reduce the maximum output to the grid.
- The typical dc-ac ratio is between 1.2x and 1.6x. For example, projects in Maryland's Community Solar program are capped at 2 MWac, but they're often sized at around 2.6 MWdc
- Most solar farms typically require around 10 acres per MWac due to the need for various setbacks (ex. neighbors, property lines, shading, etc.)

Methodology

Utility-Scale Projects

Interconnection Feasibility Criteria

	Substations		Transmission Lines	
Rating (kV)	Min. Project Nameplate Capacity (MW)	Max. Distance between project and POI (miles)	Min. Project Nameplate Capacity (MW)	Max. Distance between project and POI (miles)
69	20	1	30	1
115, 138	50	2	80	2
230	100	2	150	2
345	150	2	250	2
500	250	2	400	2