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# Somersworth Landfill Renewable Energy Reuse Assessment

## Somersworth (NH) City Council

## April 7, 2014

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# Overview

- Study Purpose
- Site History
- Site Suitability Analysis
- Project Development Scenarios
- Remedy Considerations for Solar Project
- Analysis Summary
- Next Steps
- Questions

# Study Purpose

- Assess potential opportunities to locate a utility-scale solar photovoltaic (PV) generation facility at the Somersworth Landfill site.
- Evaluate the potential financial impact of various project development scenarios for a solar project at the Somersworth Landfill site.
- Help City of Somersworth further screen and prioritize potential solar project opportunities at site.

# Site History/Remedy Implementation

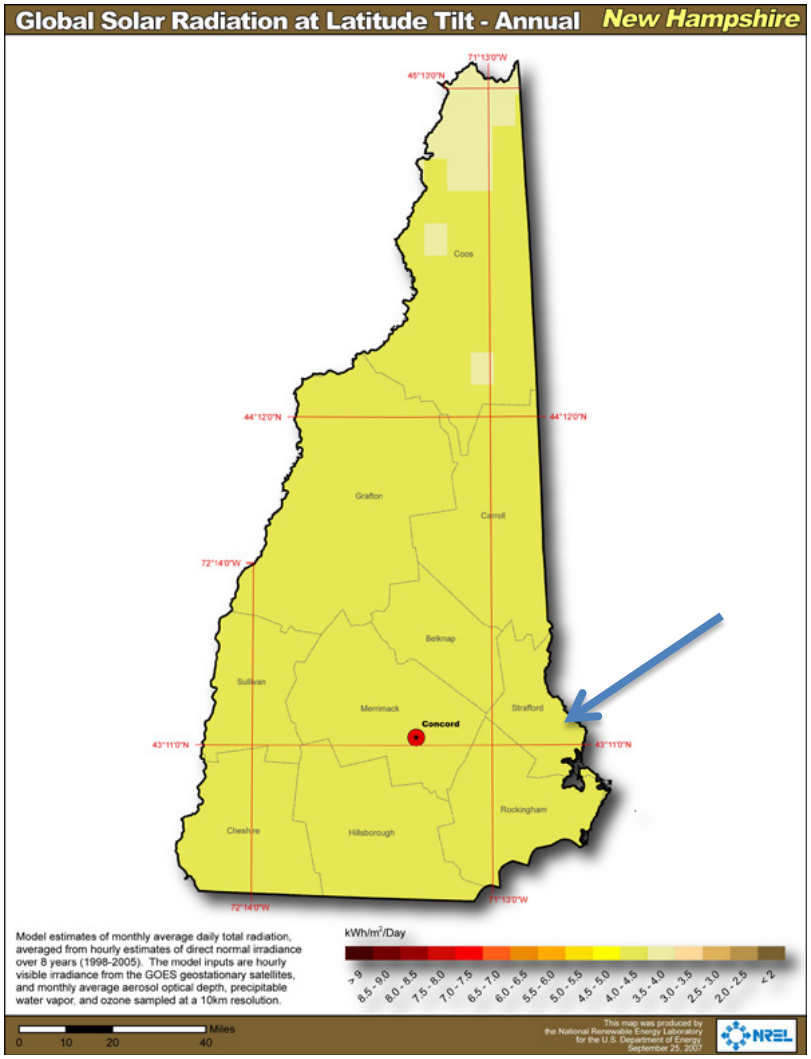
| Activity | Date | Status |
|---|---|---|
| Site Listed on National Priorities List | September 1983 | Final listing on NPL |
| Record of Decision Signed (ROD) | June 1994 | Installation of a chemical treatment wall and placement of permeable landfill cover (PLC) over entire site to allow infiltration of water to flush contamination toward wall. |
| Consent Decree | March 1996 | Defendants (i.e., General Electric Company and the City of Somersworth) agreed to perform Remedial Design/Remedial Action for the selected remedy; other PRPs agreed to help finance cleanup. |
| Ground Water Management Zone Established | January 2000 | City of Somersworth promulgates a "Groundwater Protection District" which prohibits the pumping of ground water from any well, trench, sump or other structure for residential, irrigation, agricultural or industrial purpose |
| On Site Construction Activities | July 2000 – June 2001 | Installation of the permeable reactive barrier completed in September 2000. Placement of a permeable cover over the landfill finalized during summer of 2001 |
| Passive Gas Collection Trench Installed | December 2003 | After soil investigations discovered methane migrating off-site towards nearby residences, trench installed to intercept and vent gas |

# Site Suitability: Solar Resource

Solar resource availability

- The viability of a solar project depends on a location's solar resource.

- New Hampshire, and the Somersworth area, have a good but not great solar resource (4-5 kWh/ $m^2$/day).



# Site Suitability: Remedy Components

*Remedy Components*

- Landfill Boundary
- Permeable Cover
- City Landfill Cap
- Barrier Trench System
- Infiltration/Treatment/ Reinjection System
- Monitoring Wells

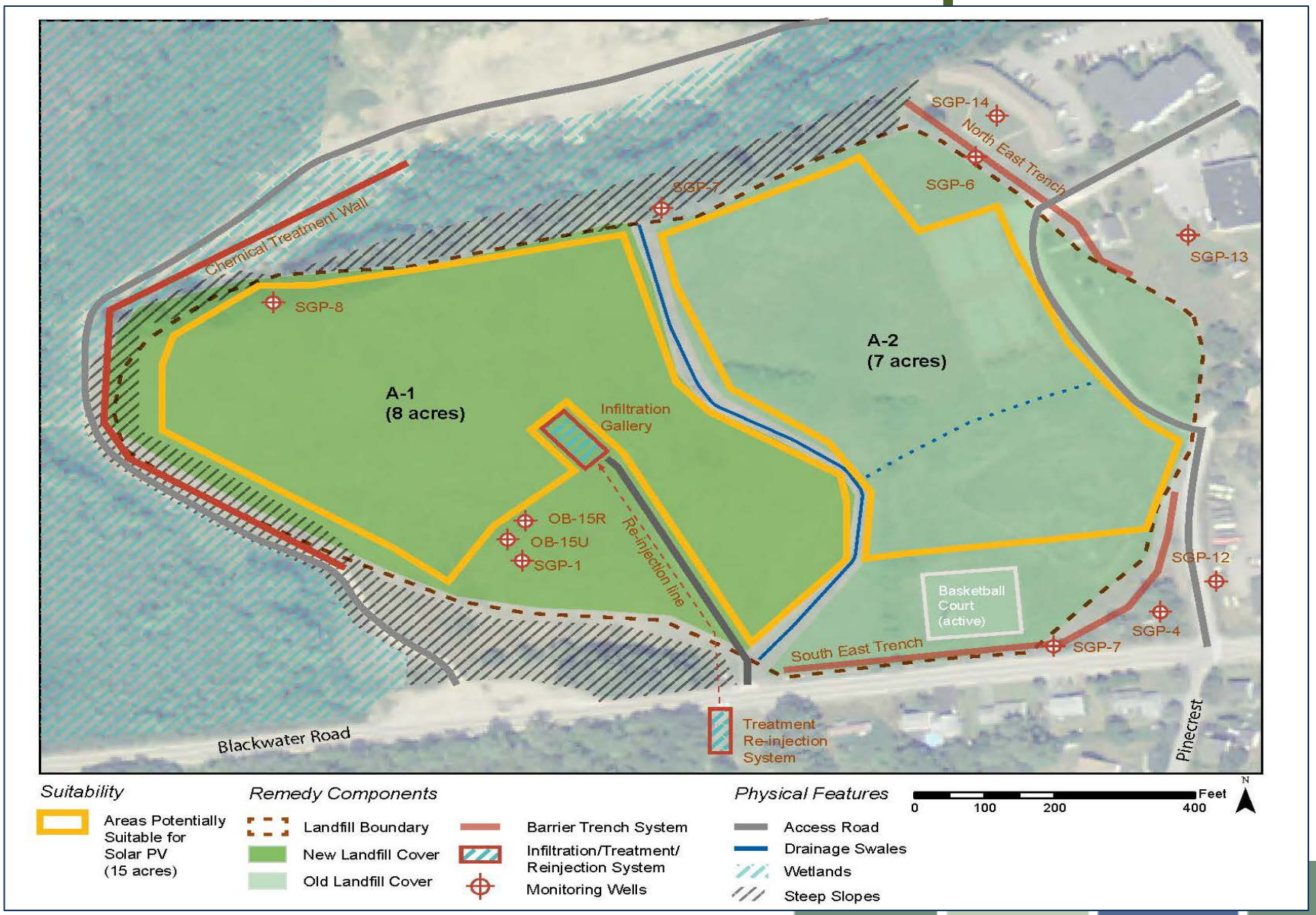
*Physical Features*

- Access Road
- Drainage Swales
- Wetlands
- Steep Slopes

0 100 200 400 Feet

N

# Areas Suitable For Solar Development



# Solar System Size and Cost Estimates

| Reuse Zone | Estimated Available Acreage | Estimated Size | Estimated Output | Installed Costs | Annual O&M Costs |
|---|---|---|---|---|---|
| Zone A-1 | 8 | 1.6 – 2.1 MW | 1,750 – 2,450 MWh | $5.6 M- $8.4 M | $32 k – 42 k |
| Zone A-2 | 7 | 1.5 – 2 MW | 1,650 – 2,350 MWh | $5.2 M- $8 M | $28 k – 40 k |
| | | | | | |
| Combined Totals | 15 | 3.1 – 4.1 MW | 3,400– 4,800 MWh | $10.8 M- $16.4 M | $60 k – 82 k |

**Assumptions:**
System Costs: $3.50 - $4.00/Watt installed
(assumes some additional site prep costs to accommodate project needing to be 100% surficial; no incentives included)
O&M Costs: $20/kW/year
Costs are installed costs and do not include any potential incentives/rebates

Area needed: 3.5 - 5 acres / MW of AC nameplate capacity (maximum rated output of system)
MWh=1000 kilowatthours (kWh)

Output estimate calculated with based on average crystalline silicon PV system

# Project Development / Ownership Scenarios

| Scenario | Summary |
|---|---|
| Direct Ownership | • A public entity owns and operates a PV system.<br>• Project financing through general obligation bond, a stand-alone bond, bank financing, grants, city revenue or a combination. |
| Land Lease | • Project developer responsible for all aspects of project development and maintenance.<br>• Developer negotiates a land lease with the host municipality. |
| Group Net Metering | • A public entity leases land for project and participates in a group net metering agreement with a group host (i.e., a developer).<br>• Public entity receives a billing credit/rebate on the monthly electricity bill for a period of time (20 years). |

# Evaluation of Potential Financial Impacts

- Preliminary assessment of the annual output and potential revenue impacts of a hypothetical solar project located at the Somersworth Landfill.

- First-order approximation of a project's potential financial impacts for the City under a variety of assumptions.

- Assessment looked at two potential scenarios:
  - Land Lease
  - Group Net Metering (SB98)

# Development Scenario Financial Impact Comparison

- Potential 20-year financial impact to the City of two project approaches.
- 1 MW project covering ~ 6 acres of landfill
- Possible to bundle land lease and group net metering

| | Land Lease ($5,000/acre) | Group Net Metering Rebate $0.03/kWh | Bundled |
|---|---|---|---|
| **Year 1 Revenue** | $30,000 | $38,400 | $68,400 |
| **20-year Impact (constant dollars)** | $600,000 | $732,590 | $1,332,590 |
| **20-year Impact (NPV dollars)** | $361,170 | $419,770 | $870,940 |

# Financial Impact Comparison - Land Lease

- Financial impact of land lease – using entire landfill area

| | Annual Base Rent | 20-Year Estimate (constant dollars) | 20-Year Estimate (net present value) |
|---|---|---|---|
| Acres | 15 | 15 | 15 |
| | | | |
| $350/acre | $5,250 | $105,000 | $59,512 |
| $500/acre | $7,500 | $150,000 | $85,017 |
| $1,000/acre | $15,000 | $300,000 | $170,034 |
| $1,500/acre | $22,500 | $450,000 | $255,051 |
| $2,500/acre | $37,500 | $750,000 | $425,085 |
| $5,000/acre | $75,000 | $1,500,000 | $850,170 |

# Remedy Considerations for Solar Project

- Accommodate long term cleanup objectives (infiltration, stormwater management)
  - No excavation or regrading of PLC cap
  - Maintain infiltration function of PLC
  - Compatibility with Institutional Controls

- Site Security
  - Accommodate any requirements to protect equipment and prevent unauthorized entry (e.g., installing fencing)

- Stormwater management
  - Consider interaction between solar project design, stormwater impacts and ground water cleanup goals and timelines
  - Mitigate potential erosion impacts

# Remedy Considerations for Solar Project

- Cover management
  - Site preparation and construction can add temporary and permanent loads to landfill cover
  - Ensure vegetative cover compatible with increased shading expected due to presence of solar arrays

- Solar array anchoring systems
  - Any solar projects needs to avoid ground penetrations in PLC area
    - Ballast-weighted mounting methods rely on weight of solar system to anchor system on surface of landfill
  - Ensure deadweight loading of solar arrays and mounts is compatible with weight bearing capacity of PLC cover

# Analysis Findings

- Landfill presents unique opportunity to accommodate a large solar project in a state with few large projects.
- Suitable areas of the site could support a solar project up to 3 to 4 MW in size.
- May be benefit to phasing a project starting with old landfill area.
- Modest state incentives and the inability of the City to take advantage of federal tax-based incentives likely limit direct ownership opportunities.

# Proposed Next Steps

- Clarify any construction limitations of the PLC area (e.g., weight bearing capacity of cap).
- Identify a project development structure most well-suited to or preferred by City.
- Pursue a more detailed technical engineering and feasibility study of a potential project.

# Questions?

- RE Assessment Contact Information

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# Additional Resources

# Solar PV Anchoring Options

Ballasted anchoring system
(Meadowlands, NJ)

*Source: SunDurance Energy LLC*

Slab foundation
(Boulder, CO)

*Source: NREL*

# Solar PV Anchoring Options

Driven piles
(Indianapolis, IN)

*Source: Hanwha Q Cells*

Pour in place foundation
(Newport, DE)

*Source: Dupont*

# Accommodating Landfill Infrastructure (Easthampton, MA)

- Layout of 2.1 MW PV system designed to accommodate existing landfill infrastructure components

# RE Incentives

- State Policies/Incentives
  - Renewable Portfolio Standard
    - Utilities (excluding municipal electric companies) generate 23.8% of total electricity output from renewable sources by 2025.
      - Utility compliance through purchase of renewable energy certificates (RECs)
      - Includes a specific carve out of 0.3% generation from solar power installed after January 1, 2006
      - NH participated in ISO-New England and New England Power Pool REC program
  - Rebates
    - Commercial & Industrial Solar Rebate Program run by State Public Utilities Commission ("PUC")
    - $0.80/W for new systems
    - 100 kW maximum system size

# RE Incentives

- State Policies/Incentives (cont'd)
  - Commercial & Industrial Renewable Energy Grants (PUC)
    - Applies to renewable-energy projects installed at commercial, industrial, public, non-profit, municipal; or school facilities
    - Minimum $100,000, no maximum
    - $1.8 million program budget for 2013
    - Projects eligible to apply for a PUC rebate are not eligible for funding under grant program
  - Group Net Metering
    - State requires all utilities selling electricity in the state to offer net metering to customers who own or operate systems up to 1 MW in capacity that generate electricity using solar.
    - Net excess generation (NEG) is either carried forward indefinitely to the customer's next bill as a kilowatt-hour (kWh) credit.
    - Customers with NEG at the end of an annual period may receive payment for NEG at the utility's avoided-cost rate.