



# Solar Street Lighting Highland Park Pathways to Power

Case Study and Financial Model Review

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# Notice

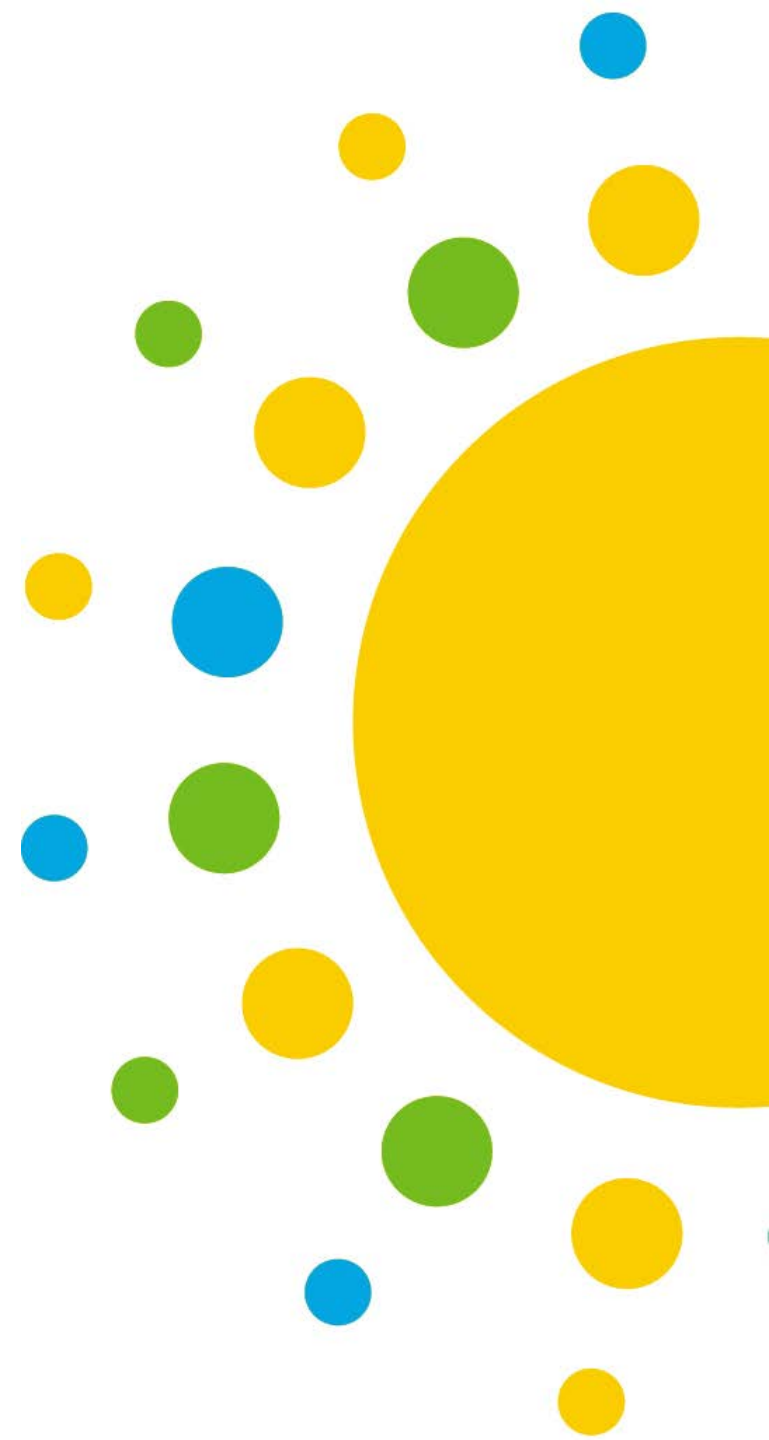
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# Communities LEAP Scoping Context

Through the Communities Local Energy Action Program (LEAP) Pilot, the National Renewable Energy Laboratory (NREL) engaged the Highland Park Stakeholder Coalition to scope four technical assistance work areas to address their energy needs and goals.

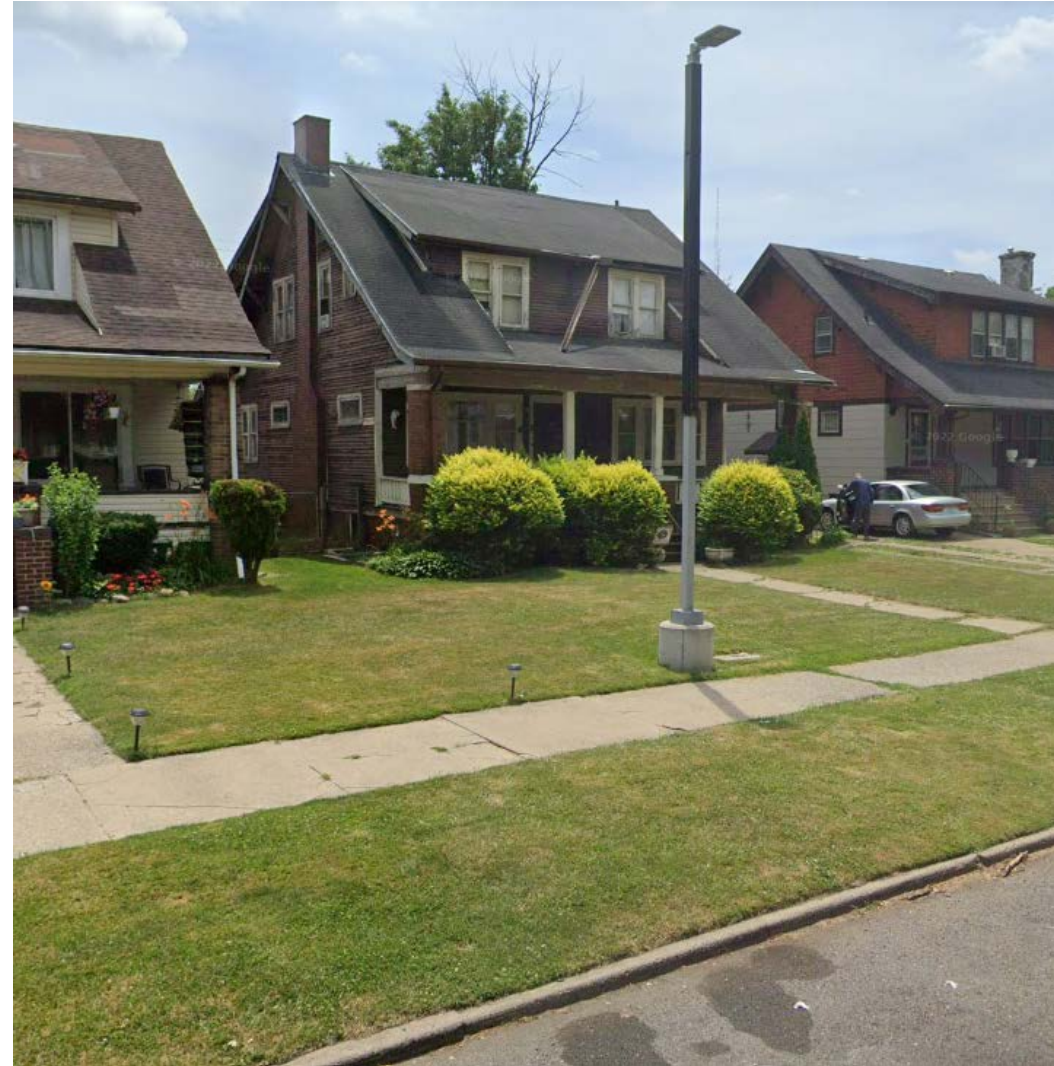
This slide deck addresses the highlighted tasks under Work Area "A."

A . City-Wide Solar Street Lighting and Policy Analysis	B. Grid Analysis	C. Community Choice: Home Energy Improvements	D. Bonus Bucket: Transportation and Mobility with Michigan Clean Cities
<ul style="list-style-type: none"><li>• <b>Task 1: Solar Street Lighting Financial Model Review</b></li><li>• Task 2: Due Diligence References</li><li>• <b>Task 3: Case Studies for Implementation</b></li><li>• Task 4: Master Plan Gap Analysis</li><li>• Task 5: Zoning Code + Applications Gap Analysis</li><li>• Task 6: Review Proposed Solar Ordinance.</li></ul>	<ul style="list-style-type: none"><li>• Task 1: Determine Existing Load Profile + Feeder Model (reference case)</li><li>• Task 2: Grid Analysis (limitations and capacity under three growth scenarios)</li><li>• Task 3: Feasibility Analysis 3 Actionable Behind Meter Projects (within city's authority under current grid configuration ).</li></ul>	<ul style="list-style-type: none"><li>• Task 1: Support a coalition-facilitated selection process</li><li>• Task 2: Housing Characteristics and Energy Burden Analysis.</li></ul>	<ul style="list-style-type: none"><li>• Task 1: Coordinate with Michigan Clean Cities on feasibility study for Perimeter Loop micro-mobility utilizing electric shuttles.</li></ul>

# Project Context

Due to economic collapse, the City of Highland Park negotiated repossession of its neighborhood streetlights to help pay its debt to its power provider, Detroit Edison (DTE). Without street lighting on residential streets, public safety is at risk.

A local community-based-organization, Soulardarity, began installing off-grid solar streetlights to improve visibility for vehicles and pedestrians in Highland Park's neighborhoods. Residents and leaders of the community who served on the Communities LEAP Coalition requested NREL review a financial model Soulardarity proposed to operate a city-wide solar street lighting program on the city's behalf. The coalition also requested NREL identify examples of similar implemented city-wide solar street lighting programs.



Solar streetlight installed by Soulardarity at 219 Moss Street in Highland Park. *Picture from Google Streetview*

# Task A1: Solar Street Lighting Financial Model: Workbook Review

Soulardarity provided a draft financial model workbook to NREL for a proposed municipal solar street lighting program that would be deployed and managed by Community Coalition member, Soulardarity. NREL created a new tab labeled “NREL Comments” that poses questions regarding assumptions in the draft financial model. These comments are intended for internal consideration by the Coalition to strengthen the model and investment confidence.

## Feedback Takeaways

- Validate costs and life cycle assumptions against Dania Beach request for proposals (RFP) and/or consult Public Utilities Management and Planning Services (PUMPS) for second opinion.
- Some parameters do not provide sufficient detail, such as labor, failure rates, interest rates, inflation, and construction period.
- Confirm potential regulatory barriers such as bonding or insurance requirements.
- Obtain multiple vendor quotes.
- Maximize tax incentive value, accelerated depreciation, and investigate eligibility for Community Development Block Grant (CDBG).

# Task A1: Solar Street Lighting Financial Model: Conclusions

## Risks/Unknowns

- Asset life and replacement assumptions
- Operations and maintenance costs
- Capital cost assumptions
- Inflation
- Construction schedule
- Highland Park's financing for upfront payment
- Legal uncertainty around Municipal Lighting Authority definitions and bonding
- Replaceability of components.

## Opportunities

- Tax incentives (investigate Inflation Reduction Act eligibility under direct payment guidelines)
- CDBG
- Financing partners
- Independent estimate of component capital expenditure and operations and maintenance costs.

# Task A1: Solar Street Lighting Financial Model: Conclusions

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## Considerations

- Generally, solar lighting tends to be more expensive than grid-tied lighting.
- How to fund municipal lighting operations and maintenance without imposing costs and increased burden on residents?
- Competitive vendor request for quotes process.
- Maximize tax incentive value, CDBG grants.
- Invite Fred Bloetscher from PUMPS to talk to Highland Park City staff and Soulardarity directly.

## Alternatives

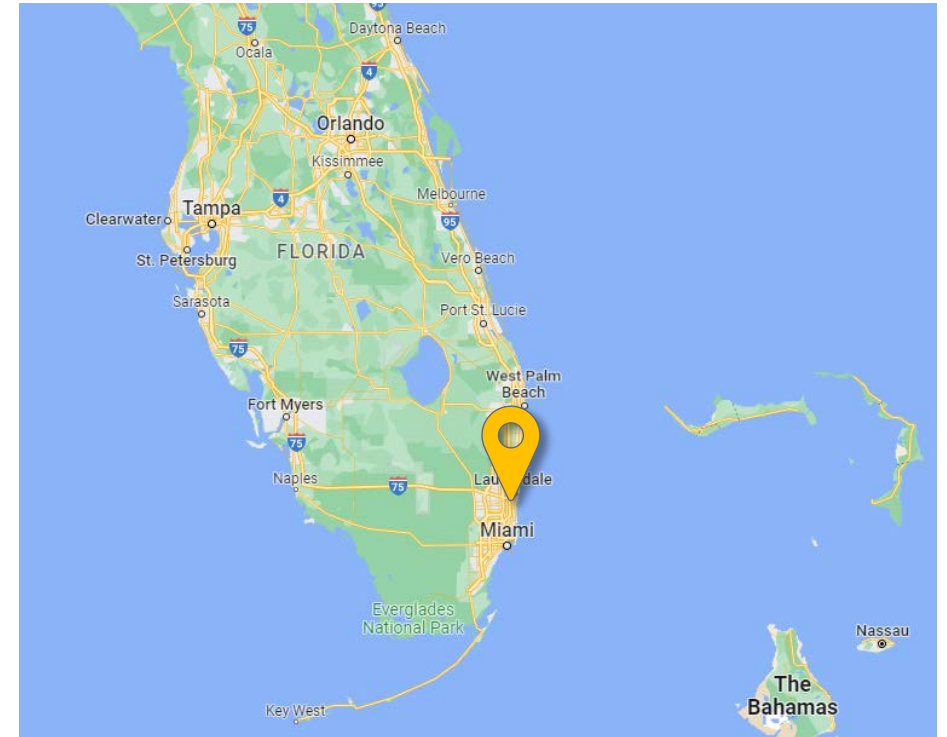
- Scaled approach—pilot 100 lights in most critical area
- Transit/bus stop lighting and other street safety.

# Task A3: Implementation Case Study: Dania Beach Solar Street Lighting

The following case study highlights lessons learned from a city-wide solar streetlighting program operated and maintained by the City of Dania Beach in southern Florida.

## Dania Beach, Florida: Community Characteristics

- Population 31,500
- 20 miles north of Miami, FL, along Atlantic coast
- Area prone to hurricane-force wind and grid outages [Bloetscher 2023].



Dania Beach is located in southern Florida. *Picture from Google Maps*

# Task A3: Implementation Case Study: Dania Beach Solar Street Lighting

## Pilot Success

- 2008-2010 pilot project installed ~360 solar streetlights in an annexed and underlit low-income neighborhood.
- Addressed gaps in services, mitigated hazards, improved safety, and increased reliability and resilience.
- Second pilot project installed 12 lights on municipal properties.
- Another ~118 installed from 2013-2022, 50 more expected by end of 2023 (bringing total to ~518, 20% of city total).
- Use of request for proposal process since 2013 [City of Dania Beach 2022].



Photovoltaic-powered light in Golden, Colorado. Image by Warren Gretz / NREL 01654

# Task A3: Implementation Case Study: Dania Beach Solar Street Lighting

## Funding and Maintenance

- Lights are owned and maintained by the city's Public Services department [Bloetscher 2023].
- Initial pilot paid by city general revenue bonds (\$1 million)
- Won CDBG for neighborhood improvements to cover capital expenses during scaling phase [HUD n.d.].
- Maintenance covered through general fund, paid by street maintenance budget.



Worker installing a photovoltaic-powered street light in Brazil. Image by Roger Taylor / NREL 01860

# Task A3: Implementation Case Study: Dania Beach Solar Street Lighting

## Pilot Phase

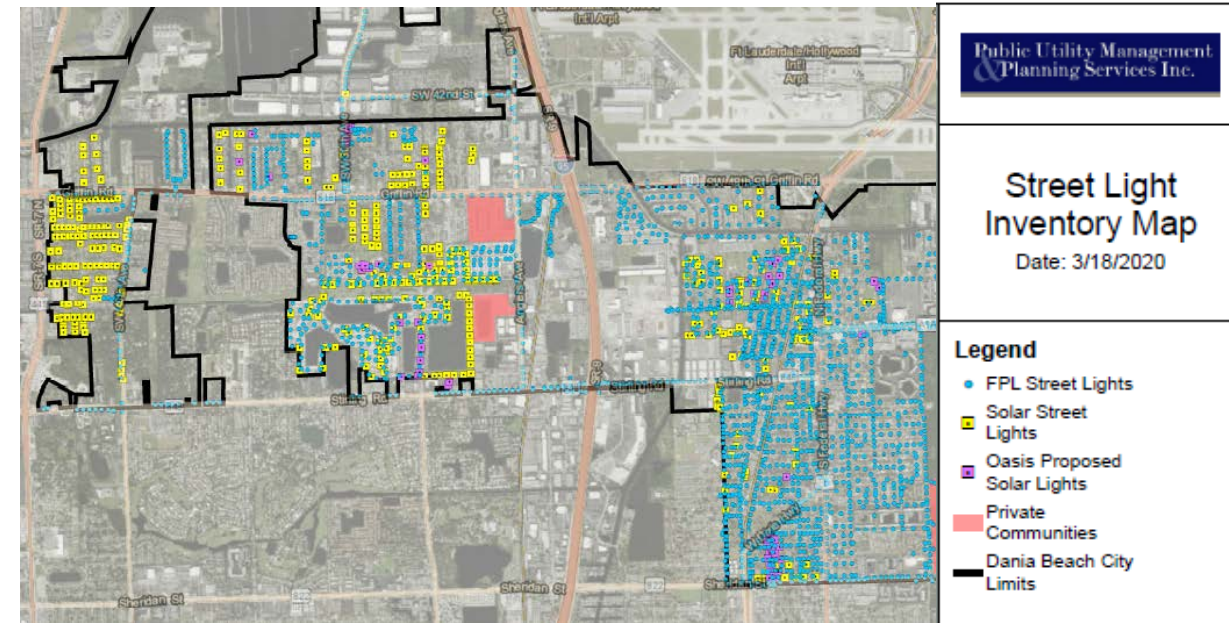
1. City hired consultant: PUMPS [Bloetscher 2023]
2. Piloted two projects 2008-2012 (360 street, 12 municipal)
3. Scaled municipal program from 2013-2023

## Planning Phase

1. Adopted City Lighting Policy
2. Conducted a lighting assessment and 10-year master plan to form the basis of prioritization (lighting need, technology cost)
3. Developed a first-phase budget, identifying funding sources for construction, maintenance, and operation to gain city approvals for funding
4. Applied for and won CDBG funding, installed lighting as funding became available

## Implementation Phase

1. Issued a request for proposals (RFP)
2. Developed engineering and construction drawings
3. Applied to city for permit
4. Operate and maintain. Maintain inventory using communication hardware tied to web-based geographic information system (GIS) geodatabase.



A street light inventory using ArcGIS Online informed a 10-year lighting master plan, including solar lights. Picture from PUMPS [Bloetscher 2023]

# Task A3: Implementation Case Study: Dania Beach Solar Street Lighting

## Design with Community in Mind

- Residents will likely have aesthetic preferences for pole types and pole placements.
- Consider the maintainability and replaceability, cost of replacement, and snow/wind load of various pole and panel configurations. Poles with photovoltaic (PV) panels vertically integrated into structure may be more difficult to maintain.
- Siting considerations:
  - Generally, locate poles on property lines, within the right-of-way (ROW).
  - Locate poles on the opposite side of the street from overhead lines and underground utilities.
  - Avoid utilities (electric, water, sewer, cable, phone) and shade trees. Orient poles and panels away from trees.
  - Avoid shining light into residences.
- House battery and panels up high to avoid vandalism and damage from flooding.



Solar lights installed along prioritized streets in Dania Beach. Picture from Google Streetview

# Task A3: Implementation Case Study: Dania Beach Solar Street Lighting

## Technical Design Considerations

- Consider lengths of run time and load demand based on different latitudes and seasons (cold temperature batteries, ice storm hardening, worst-case winter nighttime load in hours and number of days, in Florida v. Michigan).
- Use a breakaway design feature to reduce severity of vehicular accidents.
- Concrete poles may be lower cost and more readily available but must be vendor-compatible for installation and maintenance.
- Wi-Fi feature is potentially problematic as it consumes more power. May draw down battery or exceed power generated from panels.
- Do not use high-pressure sodium vapor bulbs. LEDs provide similar lumens at a similar power demand compared to sodium vapor but have a longer lifespan and are more durable.

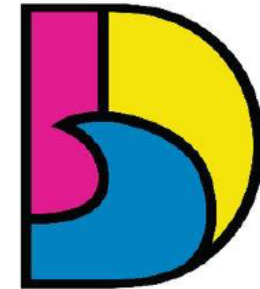
Per Dania Beach request for proposals:  
“Solar lights may be installed only if the following conditions are met:

1. No water lines buried within 10 feet of the proposed light
2. No overhead power lines on that side of the street
3. No buried power on that side of the street
4. Locations close to property corners, but avoiding underground utilities
5. No trees within 50 ft.”

# Task A3: Implementation Case Study: Dania Beach Solar Street Lighting

## Request for Proposals Best Practices

- Detailed construction requirements (locating underground infrastructure, traffic control, site restoration, liability insurance).
- System performance: commissioning, 5-year turnkey warranty, expected 15-year system life
- Equipment specifications:
  - Standard PV module certified to UL 1703, ASCE-7 structural wind design speeds, no exposed cabling
  - Vandalism protection:
    - “PV riveted to a protective bottom surface aluminum module pan”
    - Tamper -resistant stainless-steel fittings.
  - Battery rated to its environment, installed internally within pole (base collar), designed for 7-year life
  - LED lighting requirements (Luminaire- 10-year full warranty, 5-year warranty- LED and ballast).



**DANIA BEACH**  
SEA IT. LIVE IT. LOVE IT.

**YEAR 46 – CDBG SOLAR LIGHTS**

**City of Dania Beach Bid No. 21-\*\***

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**February 2021**

SOLAR LIGHTS 2021

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City of Dania Beach

Screenshot from the Dania Beach solar street lighting RFP [HUD n.d.]

# Task A3: Implementation Case Study - Dania Beach Solar Street Lighting

## Operations and Maintenance

- The City of Dania Beach Public Services division is responsible for operations and maintenance [Bloetscher 2023].
- One maintenance staff person and one cherry picker-style service truck.
- The project consultant, PUMPS, maintains a GIS geodatabase in ArcGIS Online of all lighting assets on behalf of the city.
- Data: location, condition, roadway ownership (private, city, county, state) component types at each location, installation date, warranty, tree trimming needs, and photos.
- PUMPS continues to manage the CDBG application, siting, procurement, and construction processes.
- The city carries casualty insurance and bonding for the lighting.

## Component Life Expectancy

- Lithium-ion batteries (5 years)
- LED light (long life)
- Light sensor/controller (2-5 years, weakest link)
- PV panel (10 years)
- Poles (20 years)
- Full life expectancy for fixture components, excluding poles, is around 10-15 years and fail at a rate of approximately 7% per year.

## Costs

- A full pole with all components costs about \$11,000.
- Poles and bases do not fail. Lights, balance, controller, and battery – totaling \$3,500 – need to be replaced every ~15 years (\$233 per pole per year + staff time and equipment).
- Florida Power and Light lights cost about \$360 per year to maintain, for reference.

# Task A3: Implementation Case Study - Dania Beach Lessons Learned

## Planning

- Adopt or update a City Lighting Policy, including specifications for lighting standards.
- Conduct a lighting assessment and master plan to form the basis of prioritization.
- Recommend prioritized list of locations. Consult police, fire, and community members on final placement.
- Stay engaged with community to inform siting and make siting adjustments. Educate residents about the benefits of solar lighting.

## Funding

- Gain city approvals for funding. Develop a first-phase budget, identifying funding sources for construction, maintenance, and operation.
- Fund construction with CDBG and fund maintenance through streets general fund.
- Justify cost by safety, reliability, and resilience benefits [Bloetscher 2023].

## Construction

- Issue a request for proposals. Require manufacturer and installer prequalifications, include lighting standards specifications, follow state and local procurement regulations. Require vendors to provide full life cycle analysis for 10-year plan.
- Install lighting as funding becomes available.



Solar lights placement study for use consulting community members prior to installation. Picture from Google Streetview, modified by PUMPS [Bloetscher 2023]

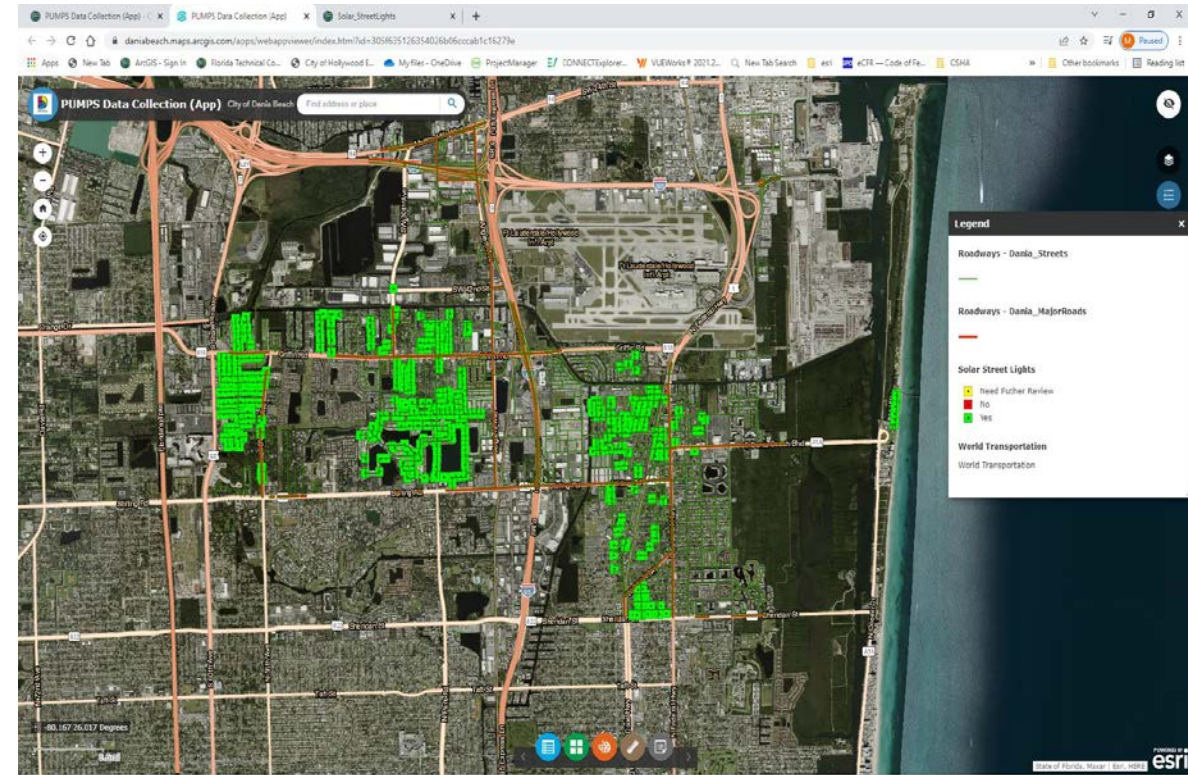


Solar lights placement study for use consulting community members prior to installation. Picture from Google Maps, modified by PUMPS [Bloetscher 2023]

# Task A3: Implementation Case Study: Dania Beach Lessons Learned

## Planning, Operations, and Maintenance Recommendations from PUMPS

- **Require asset management software in request for proposals** to communicate with the lights for remote monitoring [Bloetscher 2023].
- **Be consistent with the products.** Having many different lights is an issue for maintaining a stock of replacement parts. Limit the number of vendors to 2-3, but do not sole-source in case one vendor loses supply.
- **Keep an inventory of a limited number of vendor's replacement parts** on hand. Do not store too many parts. Ensure availability and timeline of replacement parts.
- **Maintain a GIS geodatabase** with GPS locations, date of install, product type, warranties, tree conditions, roadway type, and photos.
- **Monitor your warranties.** Use a GIS geodatabase. Track date of acceptance, warranty period, and replacement policy.
- **Consider contracting maintenance and operations.** Contracting installers/vendors to manage system remotely may be more cost-effective than hiring staff until an economy of scale is met to justify a dedicated staff person (approx. 12k-13k lights). Solar lights require more specialty skills, purchase order processing, data management, and on-the-ground maintenance crews and equipment.
- **Budget for maintenance and perform maintenance consistently.** Do not defer until full replacement is needed.



ArcGIS Online is used to maintain an inventory of lights installed in Dania Beach, including location, date of installation, product model, warranties, roadway type, photos, and surrounding tree conditions. *Picture from PUMPS [Bloetscher 2023]*

# References and Resources

## References

[1] Bloetscher, Fred. 2023. Phone call and email. January 3, 2023. PUMPS.

[2] City of Dania Beach. 2022. “YEAR 46/47– CDBG SOLAR LIGHTS. City of Dania Beach Bid No. 22-\*\*.”<https://ci.dania-beach.fl.us/DocumentCenter/View/16387/CDBG-Year-46-47Solar-Light-Bid-Specifications?bidId=>.

[3] HUD. N.d. “Community Development Block Grant Guide for Dania Beach Solar Street Lights.”  
[https://www.daniabeachfl.gov/DocumentCenter/View/16385/46-47CDBG\\_DaniaBeach\\_Boiler-Plate?bidId=](https://www.daniabeachfl.gov/DocumentCenter/View/16385/46-47CDBG_DaniaBeach_Boiler-Plate?bidId=).

## Resources

Dania Beach Solar Street Lighting guidance for bidders:  
<https://daniabeachfl.gov/DocumentCenter/View/12125/19-007-CDBG-Years-43-and-44---Neighborhood-Improvements-Project-Installation-of-Solar-Lights-ITB---Addendum-1---PowerPoint-Presentation?bidId=>.

## Points of Contact

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# Thank You

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