

NYCSanitation

NEW YORK'S STRONGEST

BLADERUNNER: GPS SUPPORT FOR DSNY FIELD OPERATIONS

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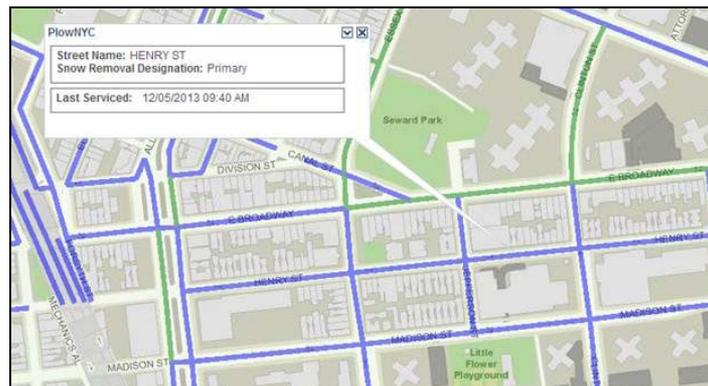
Game-Changing Initiatives for Solid Waste
The Cooper Union
June 10, 2015

AGENDA

1. History
2. Challenge
3. Solution
4. BladeRunner Functions – Field
5. BladeRunner Functions – HQ/Management
6. Future Enhancements
7. Technology
8. Lessons Learned

HISTORY

- After a severe blizzard hit New York City in 2010, DSNY implemented an online tool to track snow-fighting operations.
- A key requirement was to enable New Yorkers to see snow removal progress – block-by-block, across the entire City.
- This substantial effort included installing GPS tracking devices (Motorola flip phones) in most of the fleet. Working with DoITT, applications for internal and public views were implemented.
- As the Department used this technology to manage snow clearing operations, new ways to improve and expand operations came to light, including non-snow related activities.



CHALLENGE

- DSNY tracks and manages over 3,000 snow-fighting assets, including: salt-spreading equipment; plows; mobile supervisors; and vehicles and staff from Other City Agencies (OCAs).
- Collectively, they must clear more than 19,000 lane miles of public roadways – often multiple times, depending on the severity of the weather event.
- There are more than a dozen different types of routes that are run for various purposes, such as collections, recycling, CFC evacuation, etc.

CHALLENGE CONTINUED

Field Supervisors must:

- During Snow Operations: Oversee 20-50 plows and salt spreaders in one of NYC's 59 districts
- During Normal Operations: Oversee 15+ collection trucks and sweepers in traffic and multi-tasking (hands-free, of course!)
- Orient themselves when assigned to unfamiliar geographic areas

Managers and Executives must:

- Report progress of snow clearing efforts – at the Citywide, borough, district and citizen level (through public website).
- Be alert to local issues as displayed on public-facing PlowNYC website and correlate with high-complaint areas
- Track compliance with all operational orders

SOLUTION: BLADERUNNER

- Implement a highly-customized, next-generation GPS Tracking solution, AKA BladeRunner.
- BladeRunner was designed from the ground up to meet the specific needs of DSNY field staff and users at the headquarters.
- An RFP was developed in 2012. From the beginning, business requirements were defined with deep user involvement.
- The **Geographic Information System (GIS)** software platform chosen was ESRI, an industry leader in Geospatial technology.

SOLUTION: BLADERUNNER CONTINUED

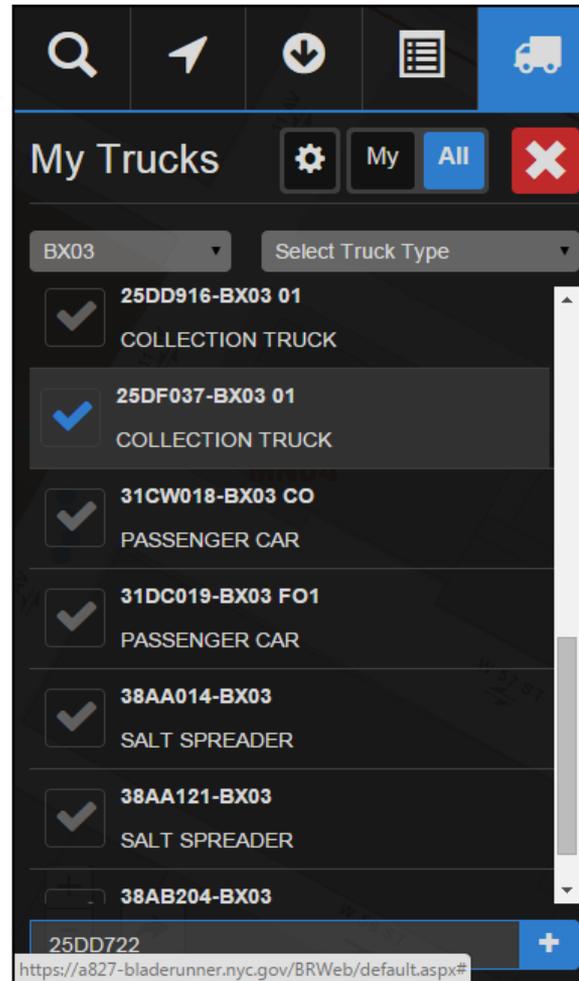
- We selected an ESRI Partner firm (Critigen) from available City back-drop contract vendors.
- An Agile software development life cycle was used, allowing users to flesh out requirements and quickly try out working code.
- The scope included replacement of end-of-life flip phones with dedicated “black box” devices built specifically for fleet tracking purposes.
- The first phase of BladeRunner was rolled out to production in October 2014.

BLADERUNNER FEATURES: FIELD SUPERVISORS

- User interface optimized for Samsung smartphones
- Pre-populated with operational data from other systems
- Supervisors can easily select vehicles to track
- Quick access to truck's current vital statistics
- Stopped truck alerts, options to flag and follow trucks
- Ability to display a truck's route over 8-hour period
- Many map layers for daily collection areas and facilities
- Search feature to locate facilities and 'Find-me' to orient supervisor and provide detail on current location

BLADERUNNER FEATURES: FIELD

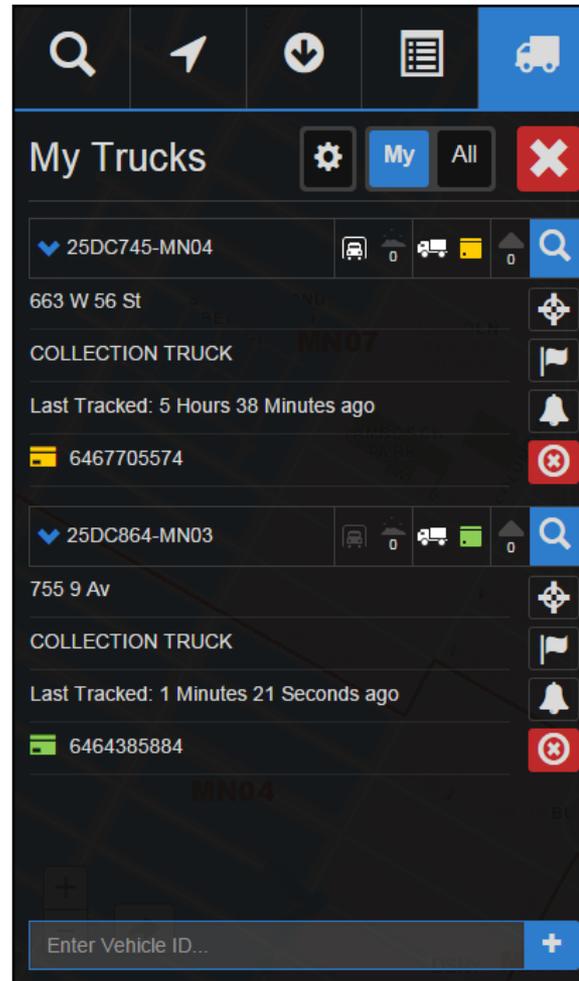
Select Trucks



BLADERUNNER FEATURES: FIELD

Details:

- Address
- In garage?
- # Dumps
- Up/Down?
- GPS OK?
- # Salt loads
- Center Truck
- Flag Truck
- Alerts on/off



BLADERUNNER FEATURES: FIELD

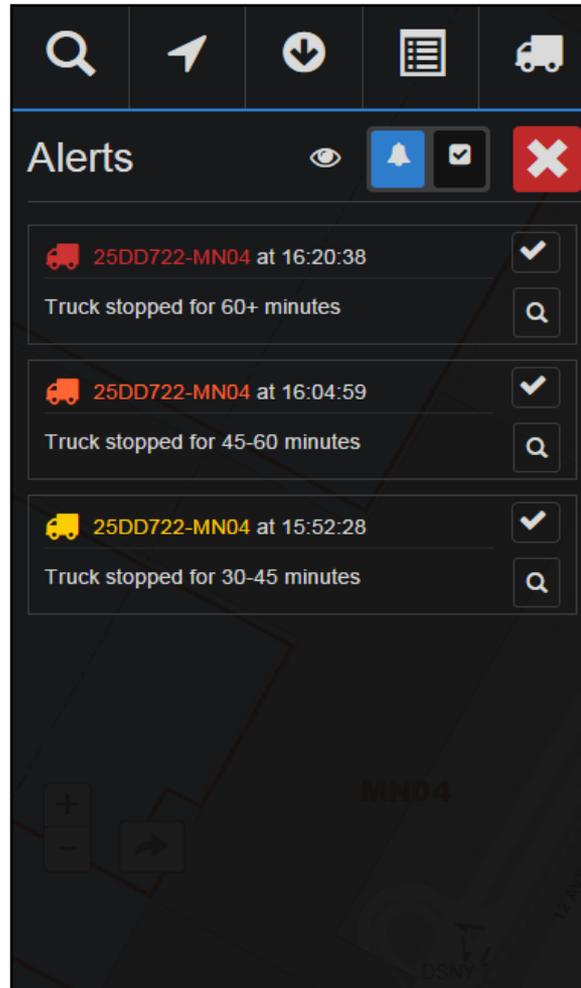
- Breadcrumbs
- Geofences



BLADERUNNER FEATURES: FIELD

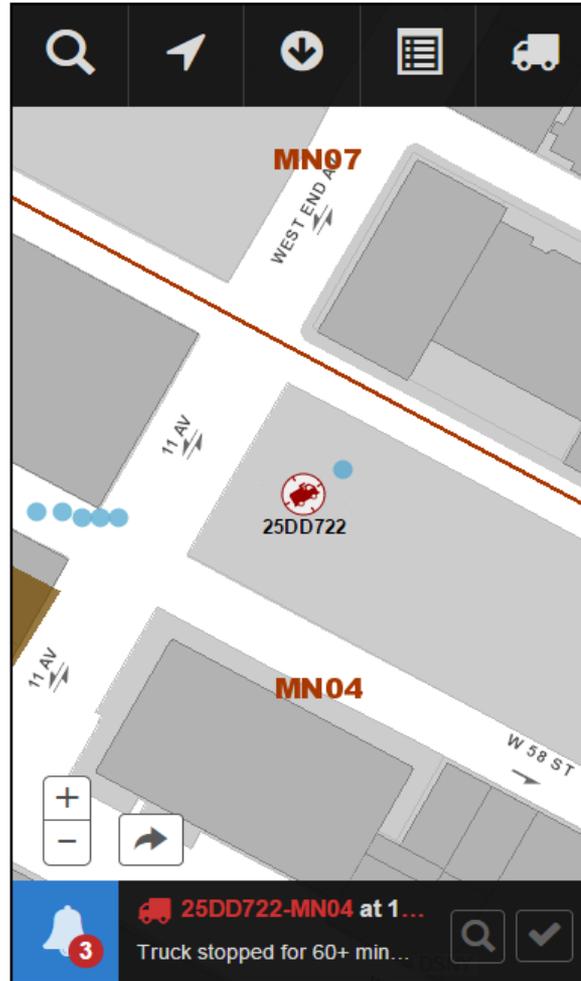
Alerts

- Yellow (30'-45')
- Orange (45'-60')
- Red (60'+)



BLADERUNNER FEATURES: FIELD

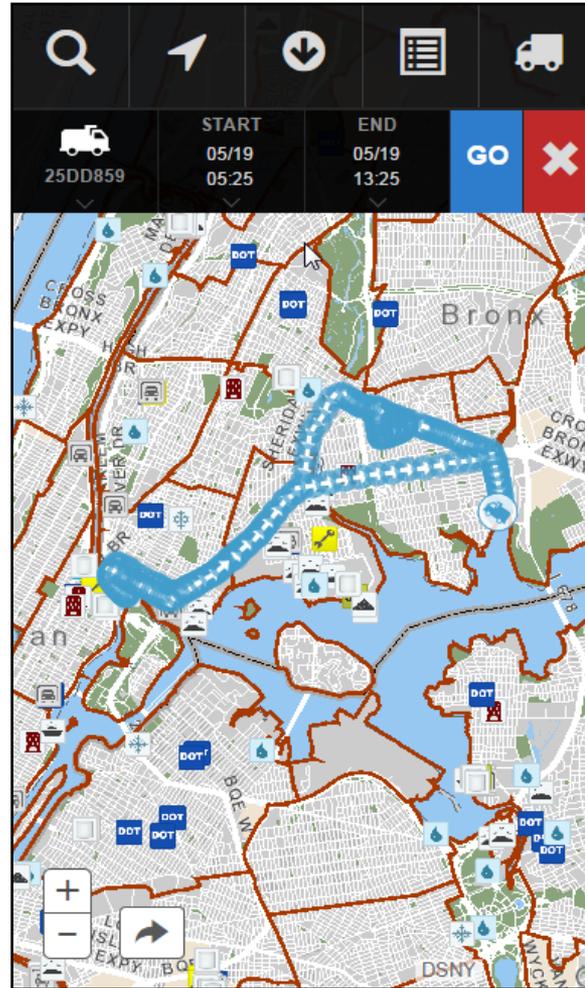
Alerts on Map



BLADERUNNER FEATURES: FIELD

Track Route

- 8-hour interval



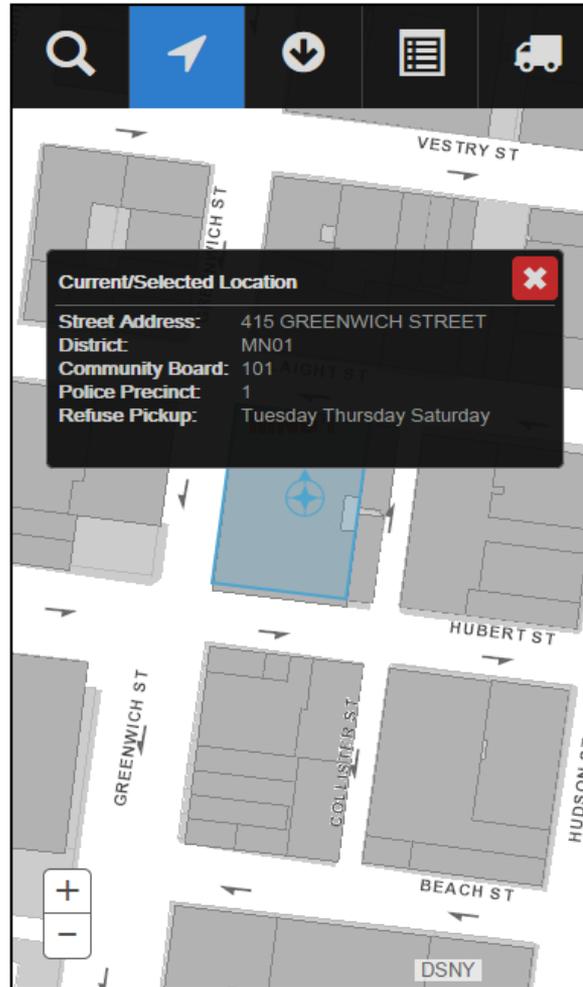
BLADERUNNER FEATURES: FIELD

Scheduled
Collection Areas



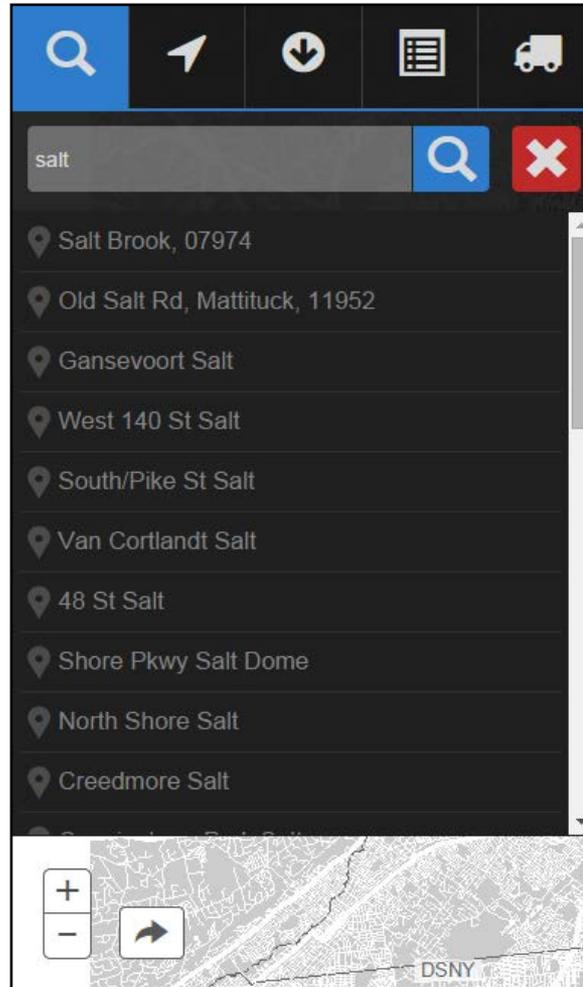
BLADERUNNER FEATURES: FIELD

'Find Me'



BLADERUNNER FEATURES: FIELD

Search DSNY
Facilities

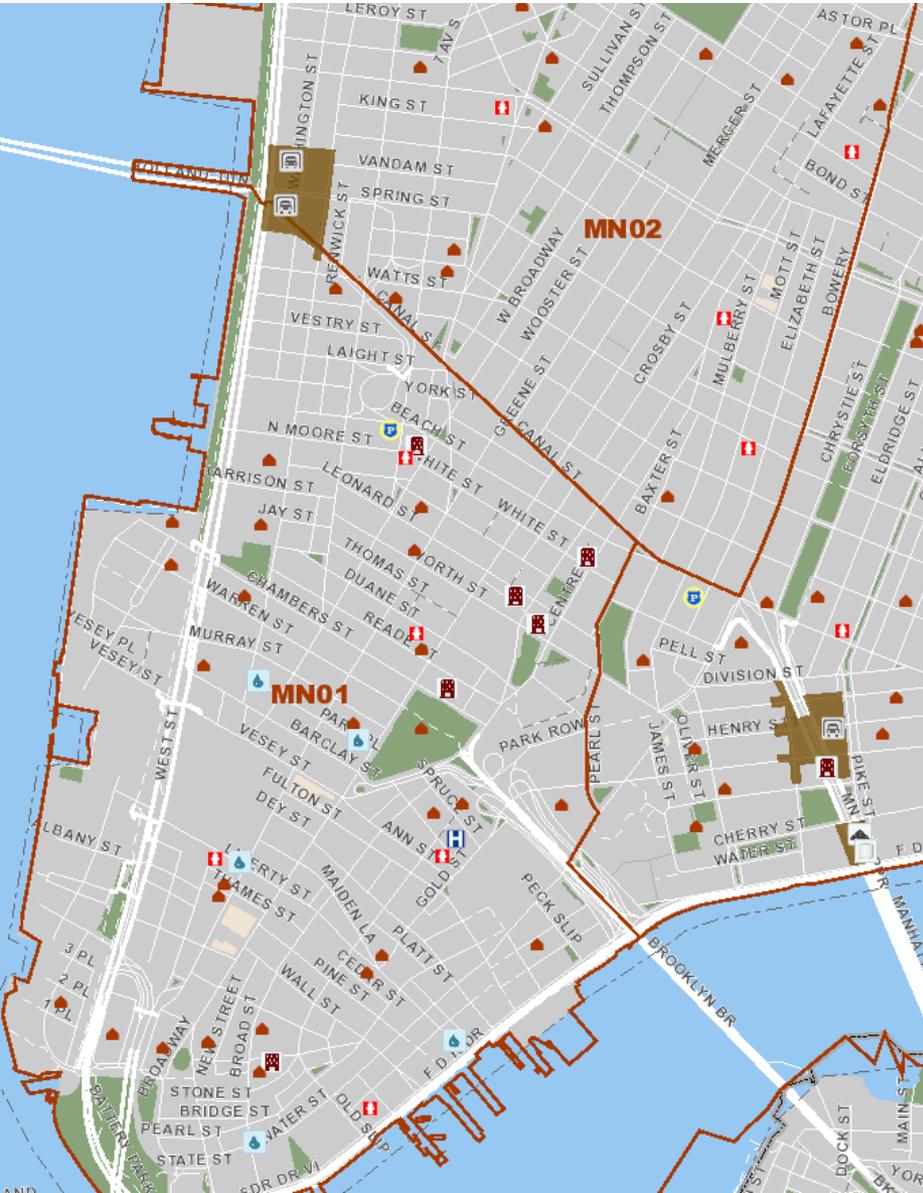


BLADERUNNER'S BASE MAP

- 11 zoom levels, from Citywide to block details
- City-standard base map includes:
 - County, borough, District, police precinct borders
 - Streets with names and traffic direction
 - Parks, water bodies
 - Building outlines



MAP LAYERS



Layers ✕

Selected Facilities and Program Sites

- 🚒 FDNY Station
- 👮 NYPD Station
- 🚑 EMS Station
- 🏥 Hospitals
- 🎓 Schools

DSNY Snow Facilities

- 🧊 Calcium Chloride Tank
- 🏠 Salt Dome
- ❄️ Snow Dump
- 💧 Snow Melter
- 🚗 NYC DOT Parking Lot

DSNY Other Facilities

- 🗑️ No Type
- 🗑️ Disposal
- 🚚 Drop Off Site
- 🚗 Garage
- 🚗 MTS
- 🏢 Office Building
- 🔧 Repair

- P DSNY Parking
- SP Sanitation Police

Streets By Snow Priority

- Primary
- Secondary
- Tertiary
- Non-DSNY Service Area

Sanitation Frequency

Two Day a Week Collection

- Monday, Thursday Collection
- Tuesday, Friday Collection
- Wednesday, Saturday Collection

Three Day a Week Collection

- Geofence
- DSNY District Boundaries

DSNY Districts By Color

- Sections
- Community Districts
- Police Precincts

Ad-hoc Events

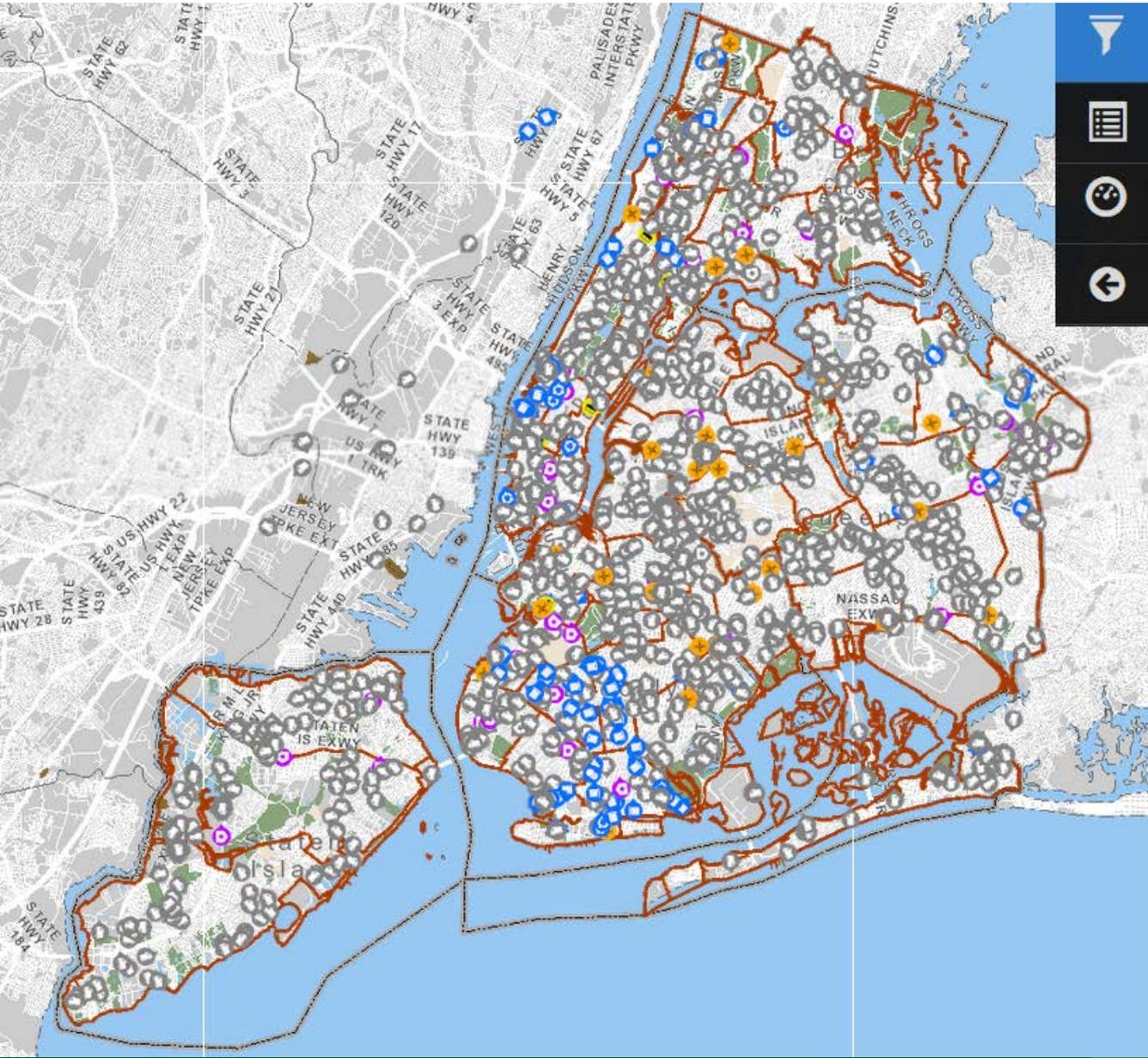
- PLUTO Tax Lots

BLADERUNNER FEATURES: HEADQUARTERS

For Managers:

- User interface optimized for Citywide and borough overviews
- Pick groups of trucks by assigned functions, identified by distinctive icons (Plowing, Salting, Collection, Supervision)
- Map layers for street priority/sectors, time since last plowed/salted
- Map layer and data grid giving percent completed for Plowing and Salting, by district/boro/City and street priorities/sectors.
- Formatted screen prints for history and sharing around the organization.

HQ CONSOLE



Filters

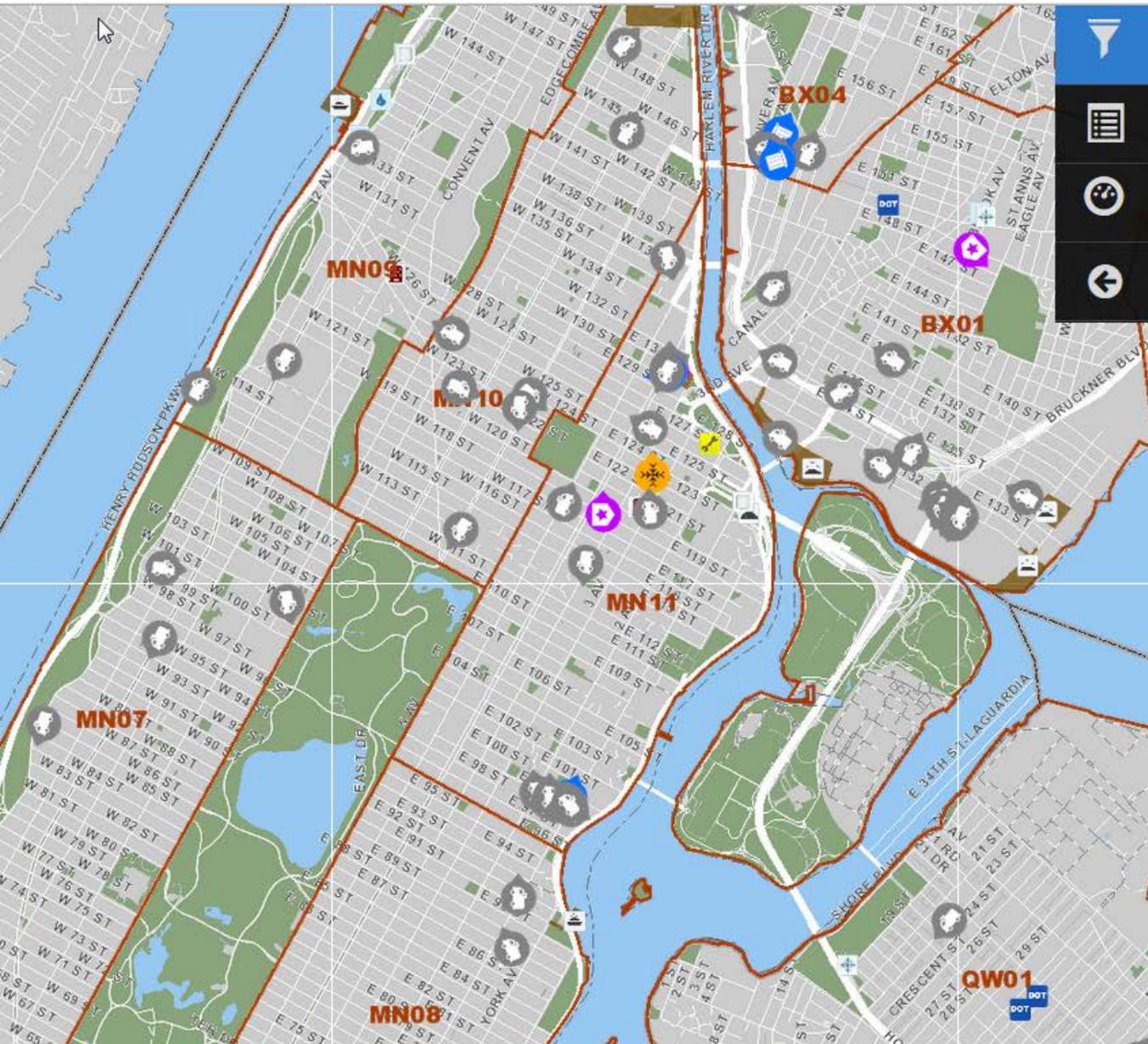
Zoom to a Location...

Select Truck Filters

Legend

- Spreading
- Plowing
- Refuse
- Recycling
- Multi
- Cleaning
- Emergency
- Supervisor
- Unassigned Supervisor
- Unassigned

HQ CONSOLE: FILTERED



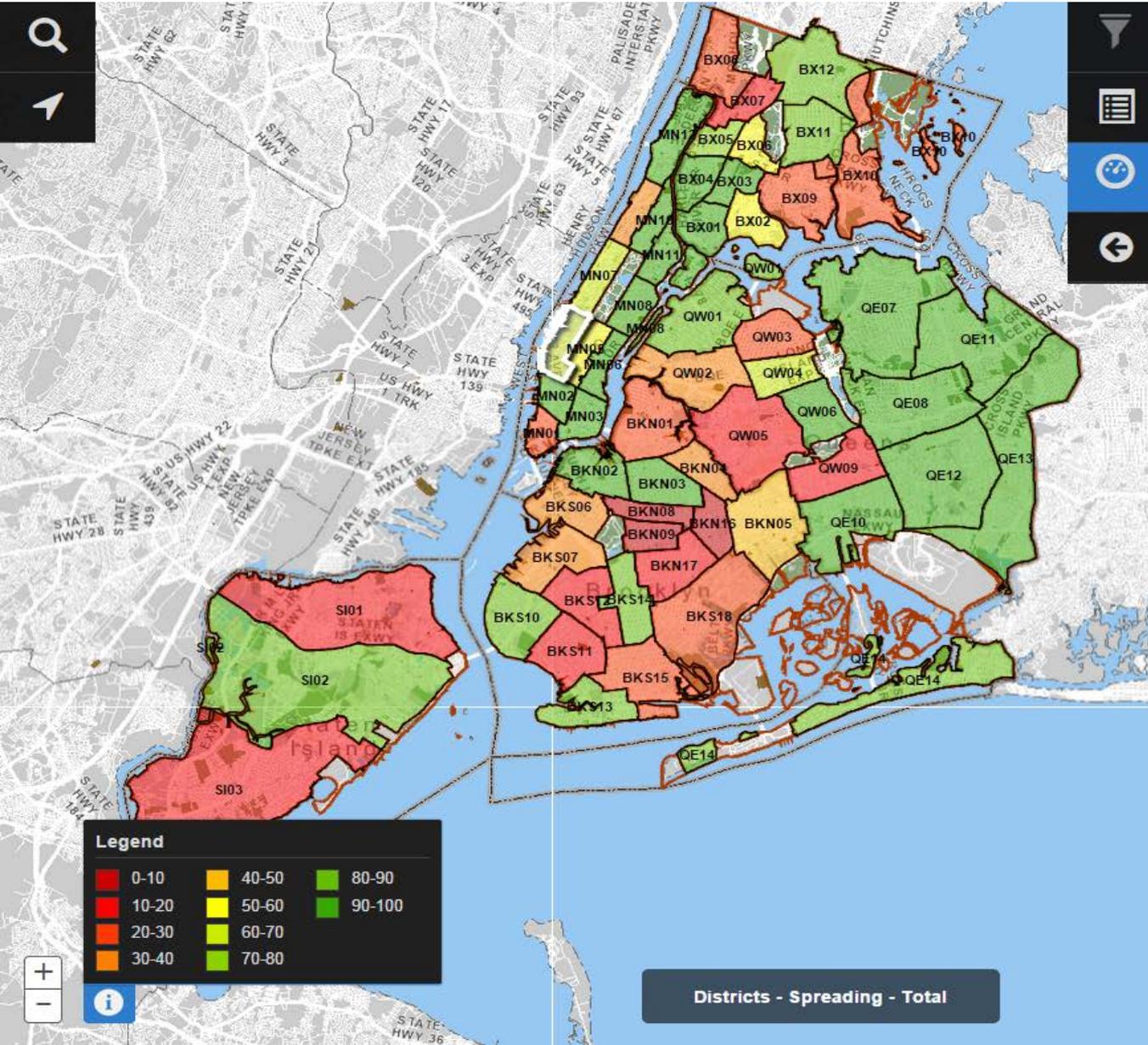
Filters

Loading...

Select Truck Filters

- Cleaning
- Cleaning Officer
- Collection Truck
- Field Officer
- Multi
- Recycling
- Refuse

HQ CONSOLE: PERCENT COMPLETE



Percent Complete

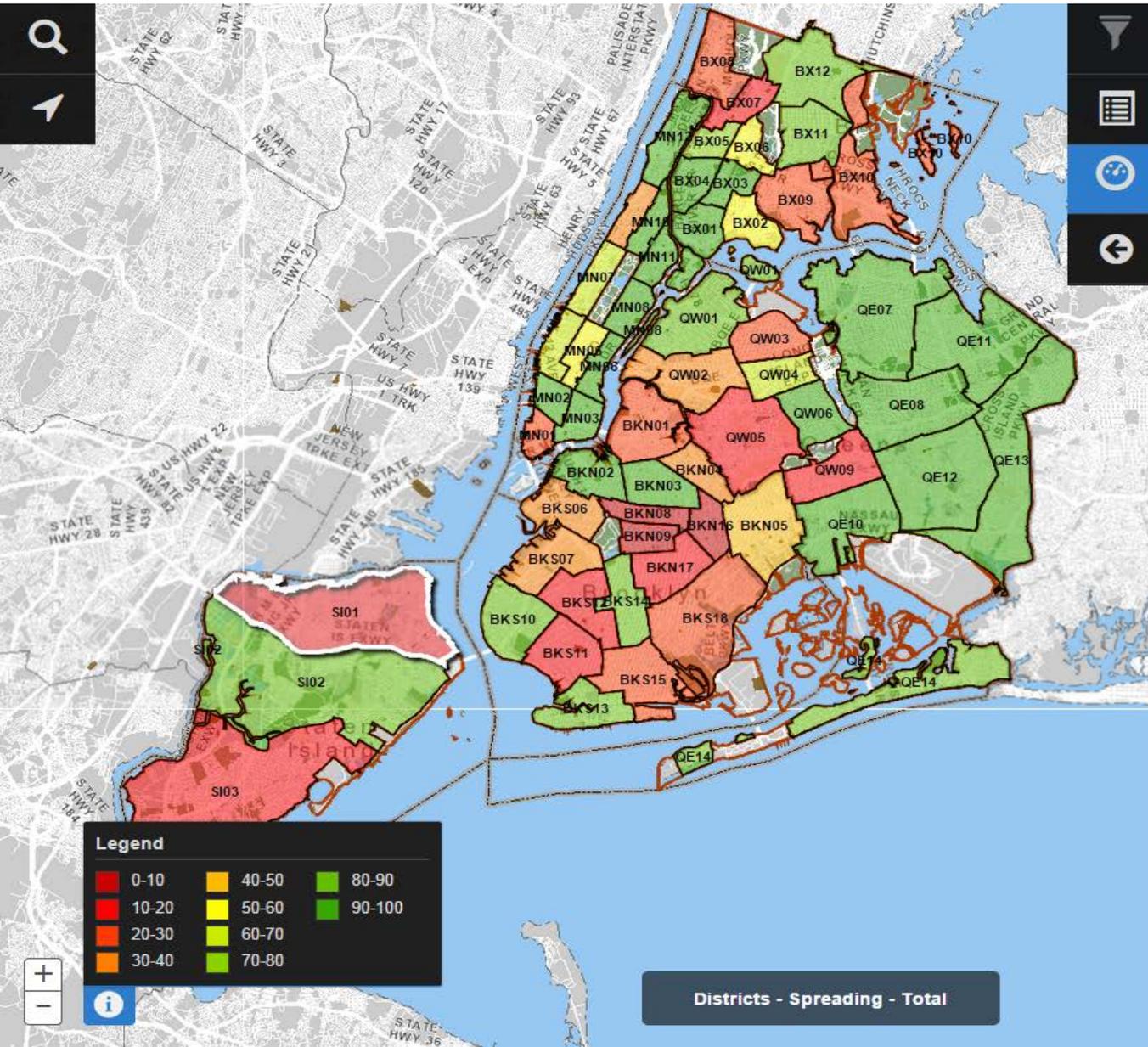
Citywide > Manhattan > MN04

	Spreading	Plowing
	03/15/15 12:00	03/15/15 03:00
MN04 - P/S/T		
TOTAL	63.0 % 43 / 68 mi.	98.0 % 67 / 68 mi.
PRIMARY	69.4 % 32 / 46 mi.	98.4 % 46 / 46 mi.
SECONDARY	49.7 % 11 / 22 mi.	97.2 % 21 / 22 mi.
TERTIARY	0.0 % 0 / 0 mi.	0.0 % 0 / 0 mi.
MN04 - C/S/H		
TOTAL	0.0 % 0 / 0 mi.	0.0 % 0 / 0 mi.
CRITICAL	0.0 % 0 / 0 mi.	0.0 % 0 / 0 mi.
SECTOR	0.0 % 0 / 0 mi.	0.0 % 0 / 0 mi.
HAUL/STER	0.0 % 0 / 0 mi.	0.0 % 0 / 0 mi.

Districts - Spreading - Total

Deactivate

HQ CONSOLE: PERCENT COMPLETE



Percent Complete

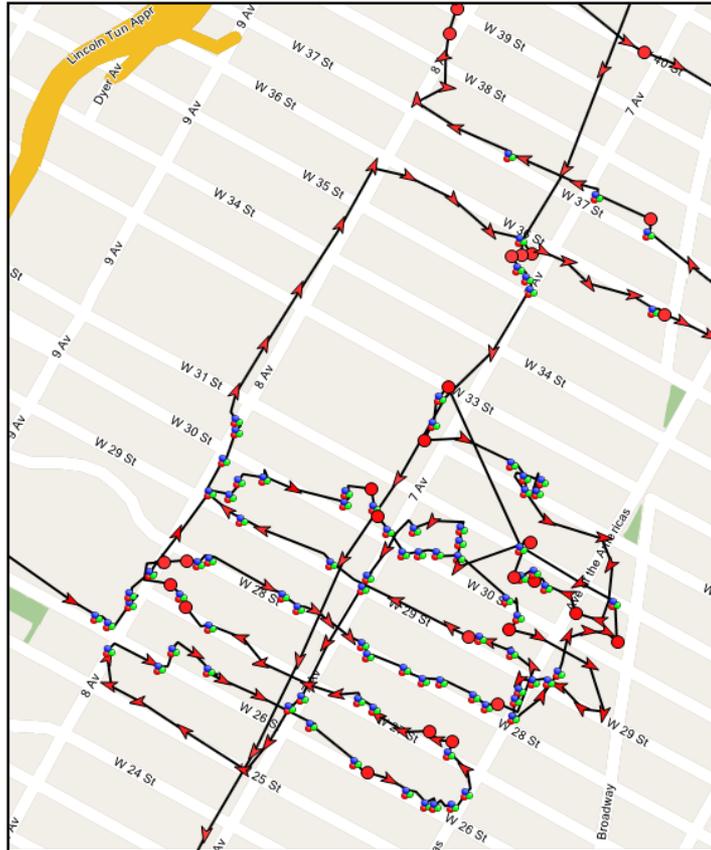
Citywide > Staten Island > SI01

	Spreading	Plowing
	03/15/15 12:!	03/15/15 03:
SI01 - P/S/T		
TOTAL	12.2 % 45 / 368 mi.	91.6 % 337 / 368 mi.
PRIMARY	22.5 % 39 / 173 mi.	94.9 % 165 / 173 mi.
SECONDARY	2.7 % 5 / 169 mi.	89.8 % 152 / 169 mi.
TERTIARY	4.6 % 1 / 25 mi.	80.8 % 20 / 25 mi.
SI01 - C/S/H		
TOTAL	12.2 % 45 / 367 mi.	91.7 % 336 / 367 mi.
CRITICAL	21.0 % 40 / 191 mi.	95.9 % 183 / 191 mi.
SECTOR	7.3 % 18 / 243 mi.	90.2 % 219 / 243 mi.
HAUL/STER	5.3 % 2 / 38 mi.	87.1 % 33 / 38 mi.

Deactivate

IMPORTANCE OF SNAP-TO-GRID

From this...



To this...



FUTURE ENHANCEMENTS

Additional map layers showing:

- Time block was last serviced (field)
- Percent route/area completed (field)
- Display 311 complaints/clusters on the map

Additional capabilities:

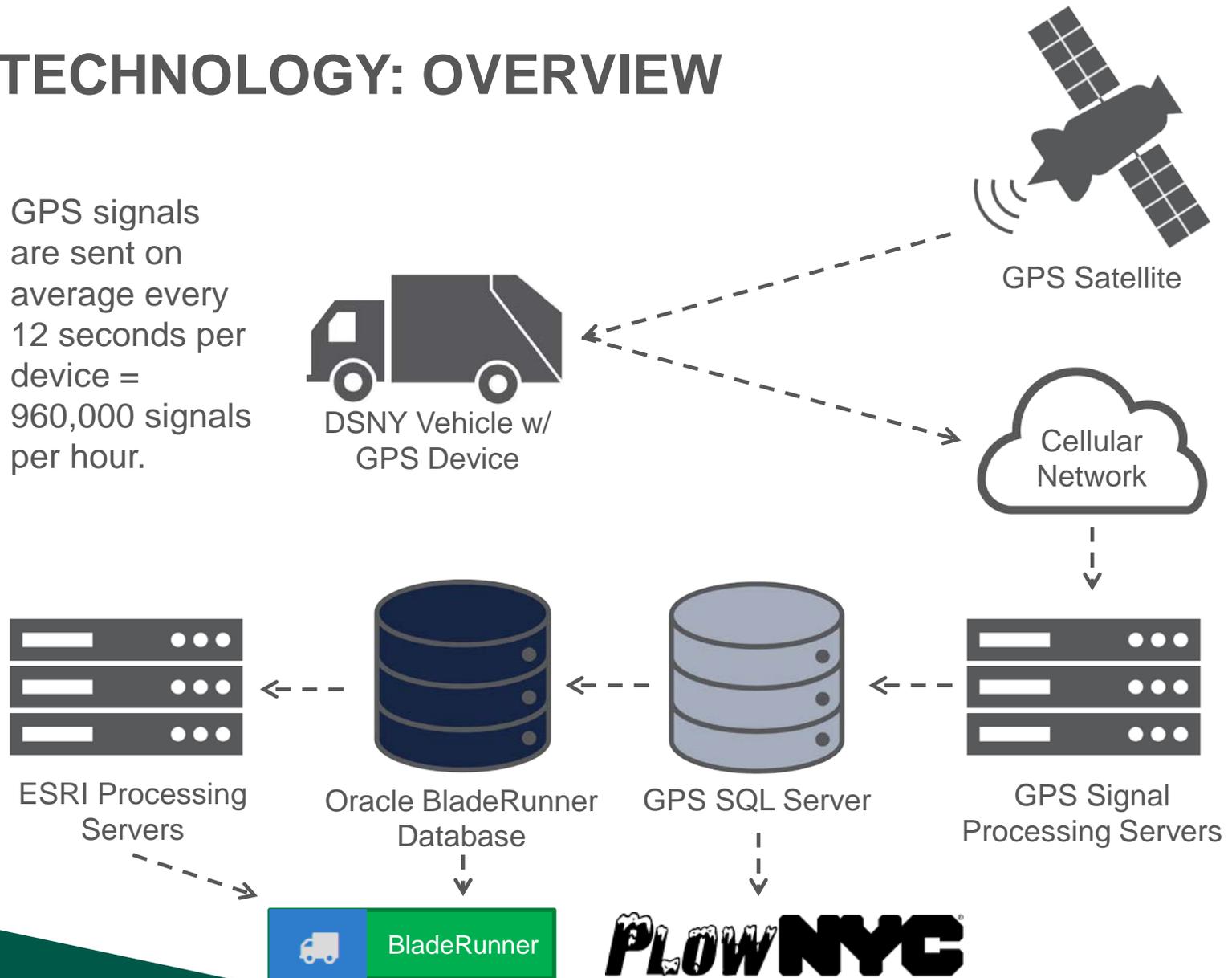
- Find trucks that traversed a specific location during a time period.
- Have ability to communicate from the field to HQ about alerts, complaints, weather, etc.

FUTURE ENHANCEMENTS CONTINUED

- Issue operations orders from HQ to the field
- Integration with:
 - Supervisors' daily activity logs
 - Daily operations scheduling system
 - Accident reporting
- Replay history of blocks serviced for a full district in a storm
- Expanded reporting, simulation and analysis
- Digital turn-by-turn directions for drivers
- Explore route optimization

TECHNOLOGY: OVERVIEW

GPS signals are sent on average every 12 seconds per device = 960,000 signals per hour.



TECHNOLOGY: DEDICATED GPS DEVICES

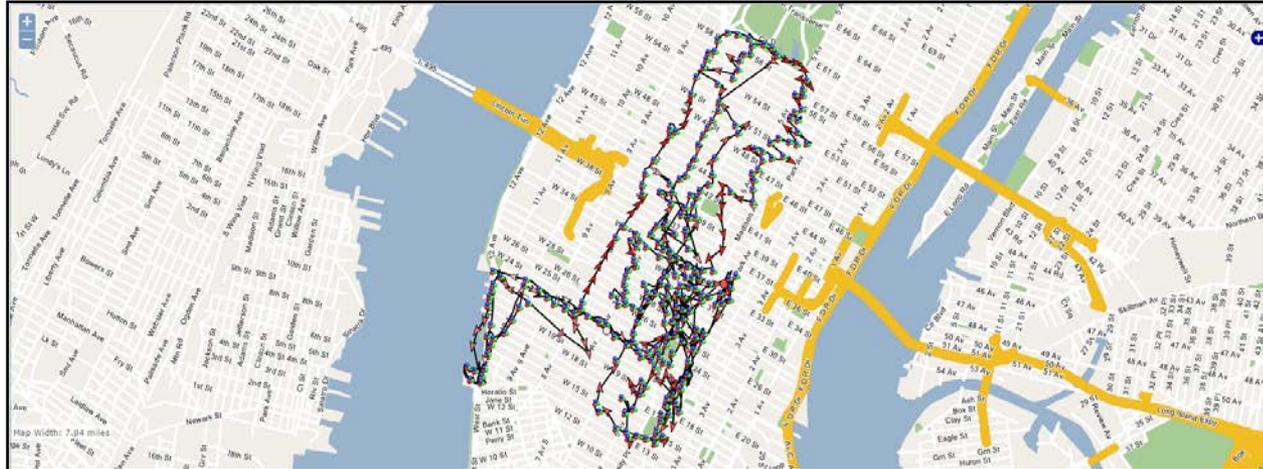
- DSNY chose to use dedicated devices for the second generation GPS system.
- Advanced GPS capabilities - 50 channel GPS Receiver, 2 meter location accuracy, US Military Specification for shock and vibration.
- Installed under vehicle dashboard to minimize damage.
- Can be used with an external antenna to improve accuracy.
- Over-the-air management capability to install patches, check health, reboot device, etc.
- Serial ports to enable additional sensor inputs.
- Piloted a “dead reckoning” (DR) device to mitigate “urban canyon effect” in certain areas.



CalAmp LMU 4225 device

KEY CHALLENGE: POSITION ACCURACY

Internal antenna



External antenna



TECHNOLOGY: SOFTWARE

- The application is built on the C#.NET platform.
- It was conceived and designed as a mobile application from the beginning; the display is highly optimized for smart phone usage.
- A proprietary system (Rastrac) is used for collecting GPS data points, providing system management tools, and generating public-facing information on when a block was last serviced (during snow).
- Rastrac processes the raw GPS signals to link each GPS location point to a specific block in the City's street network ("snap-to-grid").

TECHNOLOGY: SOFTWARE CONTINUED

- ESRI-based servers are used to further relate GPS points to specific map views which DSNY maintains and controls internally.
- ESRI geo-fencing services are used to identify whether a GPS point is located within the boundaries of garage, a salt dome or a disposal location.
- Oracle and MS-SQL databases are used for storing large quantities of GPS points which are processed by multiple ESRI and BladeRunner servers.

LESSONS LEARNED

- Do not underestimate level of effort. AVL GPS systems are very complicated.
- Data volumes are extreme and specialized architectures are required.
- Determine the level of accuracy required upfront before evaluating tracking device options.
- Clearly define operational requirements: If you are a first responder or have a public-facing component, increase your time/budget for failover design and add extra time for stress and load testing.

LESSONS LEARNED CONTINUED

- Conduct extensive device testing in all representative geographic operating areas.
- Urban Canyon effect - impact on street painting
- Organizational change management is required to achieve maximum operational benefit.
- Minimize the number of vendors involved in building and maintaining the system.
- Understand the entire end-to-end architecture for both hardware and software; your weakest link will kill you.

THANK YOU

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