FINAL Technical Report

Applying the ISAP: Staff Guidance for Tropicana Field Site Redevelopment Concepts

Smart Cities, Healthy Community Design and Sustainable/Resilient Infrastructure Roadmap

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Executive Summary

This report documents research and analyses completed to support the application of City of St. Petersburg's Integrated Sustainability Action Plan (ISAP), focused on staff guidance for redevelopment concepts of the Tropicana Field site. The analysis provides an initial infrastructure roadmap to drive innovation and incorporate sustainability and resiliency at the earliest stages of redevelopment of the site. The roadmap provides a menu of best practices and the infrastructure needed for investment focused upon the following categories:

› Smart City technologies
› Healthy community design and smart mobility
› Sustainable and resilient infrastructure

Each of these categories of infrastructure options focus on benefits related to economic development, health, energy, digital capacity, and transportation. The analysis compares the costs and benefits of developing innovative infrastructure in the site versus developing traditional, "business-as-usual" infrastructure so the City can make informed planning and design decisions in the future.

General ISAP goals and strategies that redevelopment of the Tropicana Field site should incorporate include:

- Reduction of the City's and community's greenhouse gas (GHG) emissions,
- Consistency with the City's 100% Clean Energy Roadmap, and

> The City's ISAP is focused on the following goal categories originally defined by the STAR Communities rating system, in which St. Petersburg is currently certified as a 3-star community:
>
> - Built Environment
> - Climate & Energy
> - Economy & Jobs
> - Education, Arts & Community
> - Equity & Empowerment
> - Health & Safety
> - Natural Systems
>
> STAR Communities also recognizes innovative local government practices that accelerate community-scale achievement and benefit multiple sustainability categories, like the types of Tropicana Field site redevelopment options described in this report.

- Emphasis of complete and compact development, affordable and equitable access to housing and transportation, resilient buildings and infrastructure, efficient use of resources, and safe and healthy mobility options.

The ISAP GHG Emissions Inventory and Clean Energy Roadmap includes the following findings that are critical to consider and address within the Tropicana Field site redevelopment:

- 52% of all community GHG emissions are from electricity and natural gas use in buildings, while transportation consists of 42% of GHG emissions in the community.
- The City's 100% clean energy goal will only be achieved through aggressive and immediate action to create an energy network that is clean, reliable, affordable, and equitable. Redevelopment of the 85-acre Tropicana Field site should help to advance the following "pathways" to drive this goal –
  - Build infrastructure that is efficient and renewables-ready
  - Create and procure renewable energy
  - Develop a smart, reliable, and resilient energy system
  - Enhance and electrify transportation to reduce energy use
- To reach the City's 100% clean energy goal by 2035, community-wide GHG emissions from stationary sources (existing and new buildings) would need to be reduced by 44% between 2016 and 2025, and an additional 20% between 2025 and 2035.

Key findings of the analysis contained in this report include:

- "Smart City" technologies could be integrated into the public infrastructure and private development of the site to enhance safety, provide for environmental monitoring, and reduce energy consumption. Close coordination with Duke Energy Florida (utility provider) and private developer(s) is required for successful deployment of technologies.
- Planning and design measures that enhance walkability of the site, provide healthy food options, and access to healthcare facilities in the Tropicana Field site would result in quantifiable health improvements to surrounding neighborhoods.
- If the City develops the public infrastructure within the district (on approximately 37 acres of the 85-acre site) using sustainable and resilient design principles, the value of its investment would outweigh the financial costs associated with delivering and maintaining the infrastructure. An estimated $5.5 million financial investment in sustainable and resilient infrastructure would yield a $9.8 million social and environmental benefit, primarily from enhanced recreational value, decreased flood risk, and reduction in heat island effect.
- If the City requires that buildings are designed and constructed to the same high standards as municipal facilities are, then developers, occupants and the community would realize benefits of over $430 million, including:
  - Approximately $133 million in increased rents to the developers/owners,

- Approximately $250 million in operational cost savings (utility costs) to occupants, and
- Approximately $75 million in social and environmental benefits to the community (primarily from the reduction in carbon emissions).

Using findings of the Tropicana Field Conceptual Master Plan process and preliminary traditional infrastructure needs analyses by the City, priority investment options are identified in **Table 1-1** (with estimated costs and benefits). Each of these options (and many others) are described in greater detail in this report, in addition to the analysis methodology and recommendations.

Table 1-1 Recommended Actions

Smart City Technology Options		
DESIGN ELEMENT	**ESTIMATED COSTS**	**BENEFITS/RETURN ON INVESTMENT***
Networked Lighting and Streetlight Poles	Initial Costs = $125-$150 / Node Annual Costs = $5-$10 / Light	Creates a network of nodes for deployment of technologies, diming with limited activity, or flashing for warnings.
5G Cellular and Energy Storage-Integrated Streetlights	Initial Costs = $125K-$150K / Pole Annual Costs = $100 / Light	Enhances community resiliency and improved aesthetics in deployment of poles.
Batteries, Microgrids and Community Resiliency	Initial Costs = $600 - $800 per kWh	Provides significant capital and O&M cost savings over individual building systems.
Advanced Energy Sub-Metering with Artificial Intelligence	Initial Costs = $2K / Meter Annual Costs = $1.2K / Meter	More efficient energy monitoring per household per appliance (resulting in approximately 5-10% savings off utility bill), with a 2-year estimated payback.
Healthy Community Design / Smart Mobility Options		
Parking at Rear of Buildings	Code/Plan	Change LDRs to delegate parking locations through form-based codes to increase pedestrian walkability.
Access to Grocery Stores	Code/Plan	Identify parcel and programs for access within ½-mile to grocers.
Access to Health Care Providers	Code/Plan	Identify parcel and programs for access within ½-mile to health care providers.
Sustainable & Resilient Infrastructure Options		
LEED™ Gold Standards	5-15% Premium	Require early design integration for increased energy efficiency.
Strategic Action Plan	$200-$250K	Provide preliminary (15%) design basis with cost estimates and phasing for Developer Invitation to Participate.
Brownfield Remediation	Varies	Assess and remove any site development and occupancy limitations.
Sustainable Drainage Systems	Varies	Integrate stormwater infiltration through low impact development solutions within public r/w's.
Complete Streets	$275K / 100 L.F. / 100' RW	Create safe mobility for pedestrians, bicycles, transit users for increased access for live, work, and recreation.

* Return on Investment (ROI) does not include monetary value assigned to clear air, clean water, equity, etc. unless identified as Sustainable Return on Investment, or SROI.

Sources: Panasonic CityNOW, VHB Smart Mobility Model™, Impact Infrastructure Autocase™

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Purpose and Approach

The purpose of this analysis is to provide preliminary, innovative infrastructure guidance for the redevelopment of the Tropicana Field site that would make the area financially attractive for redevelopment while also meeting the City's sustainability and resiliency goals, including the commitment to 100% clean energy. A focus on innovation at the earliest stages of infrastructure planning will help to integrate sustainability into site redevelopment. The infrastructure roadmap provides a menu of best practices and the infrastructure needed for investment focused upon the following categories:

- **Economic Development**

  Economic development and job creation opportunities to lower operating costs for developers and tenants of district, to aid in attracting the markets identified in the City's Grow Smarter Strategy.

- **Health**

  Healthy community design principles and other measures to develop the district in a way that is consistent with the City's Health in All Policies (HiAP) commitment (i.e., infrastructure that maximizes opportunities for all residents to get physical activity, enhances housing opportunities, and promotes a healthy environment and social well-being).

- **Energy**

  Opportunities to integrate energy reduction and energy generation facilities into the district, consistent with City policy for 100% clean energy and with the ISAP Clean Energy Roadmap, which includes the following relevant key findings:

  - 52% of all community GHG emissions are from electricity and natural gas use in buildings.
  - The City's 100% clean energy goal will only be achieved through aggressive and immediate action to create an energy network that is clean, reliable, affordable, and equitable. Redevelopment of the 85-acre Tropicana Field site should help to advance the following "pathways" to drive this goal –
    - Build infrastructure that is efficient and renewables-ready

        - Create and procure renewable energy
        - Develop a smart, reliable, and resilient energy system
        - Enhance and electrify transportation to reduce energy use
    - To reach the City's 100% clean energy goal by 2035, community-wide GHG emissions from stationary sources (existing and new buildings) would need to be reduced by 44% between 2016 and 2025, and an additional 20% between 2025 and 2035.

- **Digital**

  Opportunities through Smart City technologies to incorporate district-wide digital infrastructure in a manner that is equitable to all district users.

- **Transportation**

  Opportunities for accommodation of next generation of travel modes, transit and reduction of parking needs where possible; focus on connected/autonomous vehicles, sensors and detectors, transportation system management and operations (TSM&O). Reduction of GHG emissions associated with transportation is a key component of the ISAP Clean Energy Roadmap, supported by the following findings and actions -

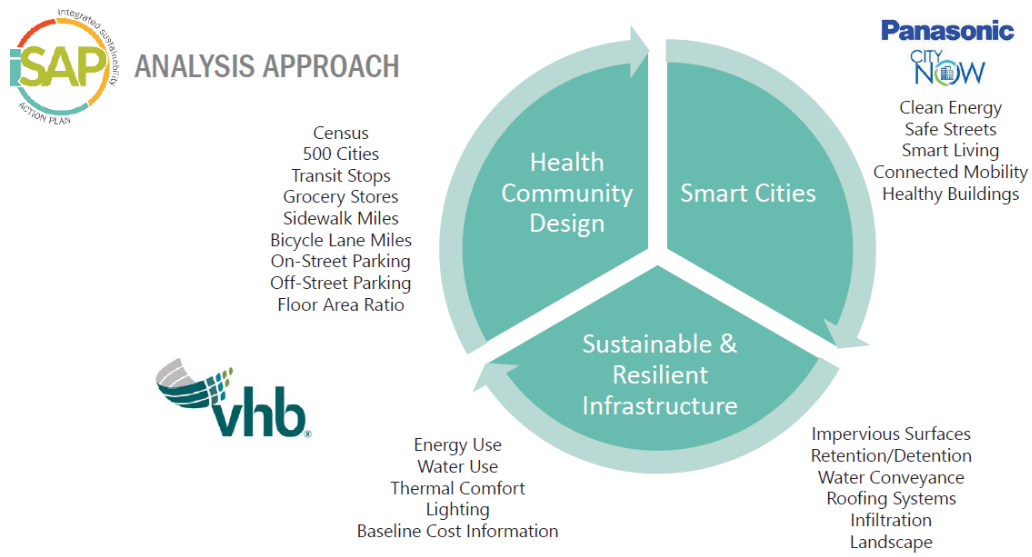
    - Transportation consists of 42% of GHG emissions in the community, and
    - Enhance and electrify transportation to reduce energy use (by 30% in 2035) is one of the "pathways" to 100% clean energy.

This roadmap details a preliminary implementation and staging plan that are generally organized by the following topics in Sections 4 through 6:

- Smart City technologies,
- Healthy Community Design and Smart Mobility, and
- Sustainable and Resilient Infrastructure.

Figure 2-1 shows the following analysis approach by topic category.

Figure 2-1 Analysis Approach Diagram



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Background

This analysis represents the merging of two recently completed planning efforts by the City – the Integrated Sustainability Action Plan (ISAP) and the Tropicana Field Site Conceptual Master Plan. Whereas the ISAP defines high-level goals and actions to advance sustainability and resiliency throughout the City, the Tropicana Field Site Conceptual Master Plan starts to define how the centrally-located district could be redeveloped. The future redevelopment of the property does not only provide a once-in-a-generation economic development opportunity but also a chance to implement sustainable and resilient planning, design, construction and operation principles generated from the ISAP. The two planning efforts are described in this chapter to provide additional context for the analysis.

3.1 Integrated Sustainability Action Plan (ISAP)

The City of St. Petersburg is committed to creating a community that thrives now and for future generations by balancing social, economic, and environmental solutions. Sustainability action will minimize negative impacts to the shared environment and foster a shared prosperity in a healthy and inclusive community. The ISAP includes a significant focus on strategies for improving energy efficiency, shifting to clean energy sources, and reducing greenhouse gas emissions, essential parts of mitigating St. Petersburg's contributions to global climate change and securing its own energy future. The ISAP also evaluates the City's vulnerabilities to changing climate conditions that will occur even if immediate actions are taken to reduce emissions.

The strategies, or actions, are arranged within the following STAR Communities goals framework listed in **Table 3-1**.

Table 3-1 STAR Communities Goal Areas

GOAL AREA	PURPOSE & INTENT
Built Environment	Achieve livability, choice, and access for all where people live, work, and play
Climate & Energy	Reduce climate impacts through adaptation and mitigation efforts and increase resource efficiency
Education, Arts & Community	Empower vibrant, educated, connected, and diverse communities
Economy & Jobs	Create equitably shared prosperity and access to quality jobs
Equity & Empowerment	Ensure equity, inclusion, and access to opportunity for all citizens
Health & Safety	Strengthen communities to be healthy, resilient and safe places for residents and businesses
Natural Systems	Protect and restore the natural resource base upon which life depends

Source: STAR Communities

In addition to the seven goal categories listed above, STAR Communities recognizes innovative local government practices that accelerate community-scale achievement. These items may not be covered in typical metrics and frequently benefit multiple sustainability categories.

This infrastructure roadmap analysis identifies and evaluates various innovations to incorporate into the redevelopment of the Tropicana Field site, consistent with the goals of the STAR Communities framework and the ISAP. Specific actions documented in the ISAP that have influenced the identification and evaluation of infrastructure options include:

- **Built Environment**
  - Promote the use of Compact and Complete Communities principles for all new development and redevelopment efforts
  - Adopt Green Building Standards for Affordable Housing
- **Climate and Energy**
  - Implement a Private Sector Building Challenge
  - Deploy electric vehicle (EV) infrastructure and establish EV incentives
  - Adopt a Building Energy Benchmarking and Disclosure Policy
  - Introduce building code provisions that support energy improvements and efficiency
- **Equity and Empowerment**
  - Construct new infrastructure in areas to reduce disparities in access
- **Health and Safety**
  - Implement the City's Health in All Policies (HiAP) approach
  - Use a performance management system to track local health goals
  - Leverage Smart Cities, HiAP, and environmental justice goals to monitor, report on, and improve indoor and outdoor air quality

- **Natural Systems**
  - Develop a community-wide green infrastructure plan that is integrated with all other relevant local plans
- **Resilience**
  - Improve facilities and infrastructure throughout the community to prepare for climate change impacts

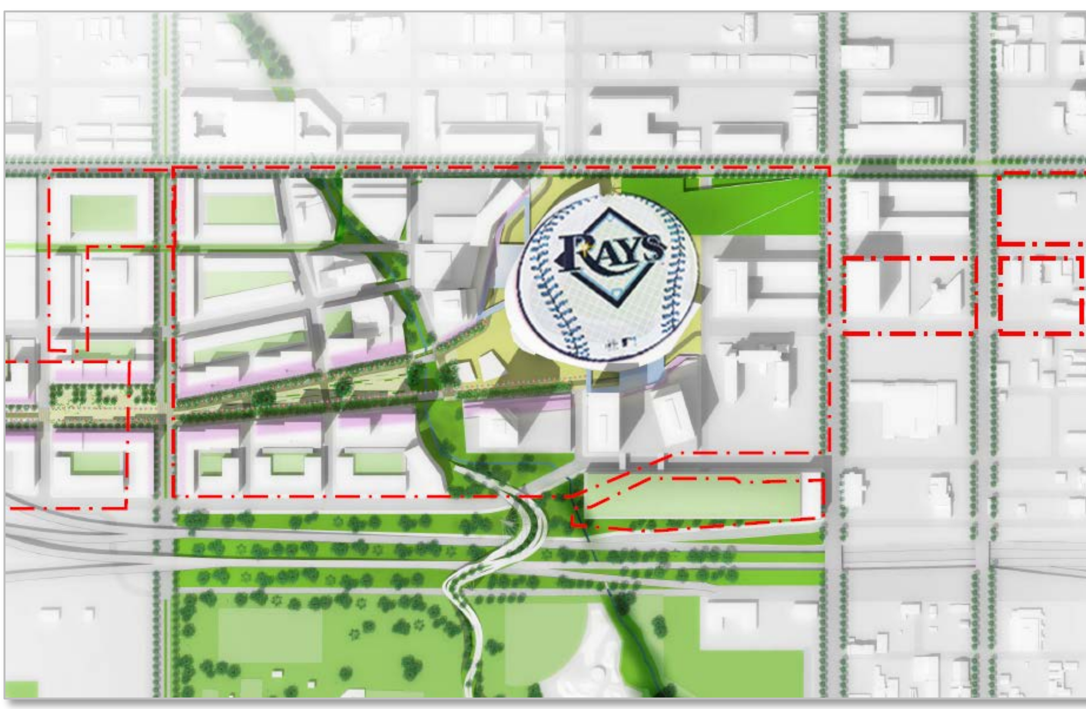
3.2 Tropicana Field Site Conceptual Master Plan

The City has developed conceptual plans to define the future of the Tropicana Field site. The City developed the plans with the clear intent to understand and guide the market forces that will transform the area, and proactively plan for the area's physical build-out with the capital and aesthetic improvements required to provide new infrastructure, a superior public realm environment, and quality of life for all the district's future residents and visitors. Two different scenarios were identified, completed, and presented to the City Council.

Scenario 1 – Planning with Major League Baseball (MLB) Stadium

The City initially prepared the Scenario 1 conceptual redevelopment plan including a new stadium location and surrounding redevelopment of the acreage. **Figure 3-1** depicts urban development encompassing the 85 acres with a conceptual MLB stadium site in the northeast quadrant, connected by new and improved local streets, linked with enhanced public realm and open space amenities.

Figure 3-1 Conceptual Plan with MLB Stadium



Scenario 2 – Planning without MLB Stadium

The Scenario 2 conceptual redevelopment plan encompasses a broader redevelopment of the entire Tropicana Field acreage. *The analyses presented in this report uses the Scenario 2 plan*. **Figure 3-2** depicts an urban pattern of development encompassing 23 identified parcel areas, connected by re-established gridded street network of new and improved local streets, linkage with enhanced public realm sidewalks, trails and bicycle lanes, and new open space amenities.

The pattern of development generally depicts residential uses to the west, transitioning to office, institutional and hotel to the east. A centralized open space and stormwater pond represents the redevelopment of existing Booker Creek, surrounding surface parking lots and remediation of existing brownfield contamination. A connection over I-175 is provided by an iconic pedestrian bridge system.

The Tropicana Field Site Redevelopment may also advance the City's **Grow Smarter Strategy** that seeks to emphasize the quality of life advantages that St. Petersburg has both in the region and in national competition. Infrastructure development actions can leverage future investments to deliver an expanded downtown environment that supports target industry attraction, retains local businesses, and recognizes the needs of a multi-generational population through connected neighborhoods, housing that is affordable and quality job growth.

The specific correlated development program for each identified parcel area is included in **Table 3-2** and a summary of the program by land use is provided in **Table 3-3.** Office and residential uses would consist of 64 percent of the total non-public acreage of the site.

Figure 3-2 Conceptual Plan without MLB Stadium

Table 3-2 Proposed Development Program

Scenario 2 – Conceptual Parcel Development Program					
Parcel #	**Land Use**	**Acres (Est.)**	**Gross Square Feet (Est.)**	**Floors (# Est.)**	
				Use	Parking
1	Office	1.8	100,000	11	5
2	Office	0.9	200,000	12	5
3	Office	1.7	400,000	20	4
4	Hotel	4.0	200,000	2-15	6
5	Entertainment / Cultural	3.0	200,000	1	TBD
6	Office	1.7	550,000	16	TBD
7	Office	1.8	550,000	16	TBD
8	Open Space	2.7	N/A	N/A	N/A
9	Institutional Campus	5.5	800,000	Varies	TBD
10	Institutional Campus	2.8	200,000	9	TBD
11	Office	0.8	100,000	16	4
12	Office	1.7	600,000	30	5
13	Office	1.7	100,000	11	3
14	Residential	1.5	550,000	9	TBD
15	Residential	2.4	620,000	10	TBD
16	Residential	2.1	580,000	8	TBD
17	Residential	2.5	300,000	5	TBD
18	Residential	0.7	100,000	6	TBD
19	Residential	2.7	400,000	6	TBD
20	Residential	2.5	300,000	5	TBD
21	Residential	2.3	200,000	3	TBD
22	Residential	1.3	150,000	2	TBD
23	Office	2.0	300,000	1	TBD
TOTALS		**50.1**	**7,500,000**		

N/A = Not applicable.

TBD = To be determined.

Source: Tropicana Field Site Conceptual Master Plan, HKS.

Table 3-3 Summary of Proposed Development Program by Land Use

Scenario 2 – Conceptual Parcel Development Program

Land Use	Acres (Est.)	Gross Square Feet (Est.)	Number of Parcels
Residential	18.0	3,200,000	9
Office	14.1	2,900,000	9
Institutional Campus	8.3	1,000,000	2
Hotel	4.0	200,000	1
Entertainment/ Cultural	3.0	200,000	1
Open Space	2.7	N/A	1
TOTALS	**50.1**	**7,500,000**	**23**

N/A = Not applicable.

Source: Tropicana Field Site Conceptual Master Plan, HKS.

Framework for Site Redevelopment

It is anticipated that the City will seek out private development partner(s) in a solicitation process who upon award would work with the City to complete the envisioned redevelopment project. This may include sole or multiple entities working in sequenced phasing over years to design, permit, construct the improvements. Logistics become critical in this type of phased project delivery.

It is likely that any future City-selected private development partners would want to control design elements and timing of the project phasing. The City would want to ensure that designs implement public vision, supports policy commitments, and ensure return on investments are accurately defined and realized. Ultimately, attraction and negotiation with developers would need to adequately define the roles and responsibilities in the development process.

Typically, urban redevelopment projects include the following phases:

- Prepare site evaluation assessments
- Implement alternative redevelopment strategies
- Prepare infrastructure plans for phased redevelopment
- Complete demolition and preliminary site preparation
- Construct public infrastructure for phased redevelopment

An overview of the development process for the Tropicana Field site is included in **Attachment 3** of this report. It includes sub-element tasks that the City would need to consider during implementation. It is anticipated that the City would need to focus its attention on how future public infrastructure improvements are completed to ensure phased delivery and buildout capacities are protected, and definition of funding responsibilities and/or reimbursements are defined.

4

Smart City Technology Options

A variety of "Smart City" technologies that could be applied to the redevelopment and operation of the Tropicana Field site are identified in this section, including technology descriptions, costs, benefits, key issues, potential stakeholders, and next steps.

Generally, Smart City technologies are various types of electronic Internet of Things (IoT) sensors to collect data and then use these data to manage assets and resources efficiently. IoT are networks of physical objects (like vehicles, buildings and light poles in a Smart City district) that are embedded with electronics, software, sensors and network connectivity that enables the objects to collect and exchange data. Smart City technologies can advance the implementation of sustainability in cities like St. Petersburg by providing more control to adjust energy use or store energy, for example, enhance resident and visitor experience, and provide more data to track performance and environmental conditions.

The Smart City technologies discussed in this section include:

- Autonomous Shuttles
- Digital Wayfinding Signage
- Environmental Sensing
- Public Safety
- Smart Waste Management
- Smart Transit Shelter
- Networked Lighting and Streetlight Poles
- 5G Cellular and Energy Storage-Integrated Streetlights
- Energy Storage Appliances
- Advanced Energy Sub-Metering with Artificial Intelligence
- Batteries, Microgrids, and Community Resiliency
- Net Zero Energy Consumption

4.1 Autonomous Shuttles

4.1.1 Description

St. Petersburg should encourage reduction of single-occupancy vehicle (SOV) traffic within the city and reduce transportation's contribution to energy consumption, which is consistent with the ISAP Clean Energy Roadmap. The City could develop an autonomous shuttle route within the redevelopment district or between the district and another area, such as the bordering Innovation District.

Most shuttles coming onto the market are electric and would charge overnight. Further coordination with Pinellas Suncoast Transit Agency (PSTA) could occur to understand autonomous and electric shuttles as a supplement or replacement of their current fleet.

The following features of a typical shuttle should be noted:

- **Autonomy**. Each vehicle can carry up to 4 battery packs for a total capacity up to 30 kWh. Vehicles can last up to 15 hours on one charge and typically take less than 5 hours to charge with a 5.7 kW charging power socket.
- **Accessibility.** Shuttles can be deployed with an automatically deploying wheelchair access ramp. At the push of a button, the vehicle can lower and deploy this accessible ramp.
- **User Interface.** Screen displays inside autonomous vehicles can show the position of the vehicle on its route, as well as other multi-modal information, advertisements, geo-localized content or other contents (See **Section 5.6**, *Smart Transit Shelter*, for similar descriptions of user interfaces).
- **Localization.** To ensure smooth operation irrespective of infrastructure constraints, visibility and/or weather conditions, shuttles use a localization sensing approach that computes data acquired through lasers (LIDAR), differential Global Positioning System (GPS), Inertial Measurement Unit encoders and cameras, to permanently compare the environment it senses and what it expects to sense.
- **Safety.** Safety features embedded in shuttle vehicles and software guarantee that the shuttles stay on their pre-defined course, adapt their behavior to the environment, and stop when an obstacle is present on their trajectory. Upon detection shuttles adjust their speed and deceleration leading to obstacle avoidance.
- **Fleet Management Software.** Fleet management systems enable driverless vehicles to perform transport tasks with minimal human intervention. Fleet management software can allow for integration with a customer interface (e.g., an app or website), and can enable data sharing and reporting based on the shuttles' usage.
- **Reliability.** Shuttle systems typically come with a warranty and maintenance assistance.

To deploy autonomous shuttles, typical on-site infrastructure must fulfill the following requirements:

- Covered storage area – approximately 220 gross square feet minimum per vehicle for the storage, plus 220 gross square feet for the maintenance area. Access storage with height > 32 feet. Equipped with charging spots having available standard electrical plugs able to deliver 6 kW each (standard SAE J1772) to benefit from a short charging time. Shuttles would be charged at night.

- 3G or 4G network must be accessible all along the proposed track with minimum level of service.
- Network Real Time Kinematic coverage.
- A control room must be accessible to incorporate the shuttle supervision center.
- Basic signage to highlight stations and indicate to passengers where the shuttle stops.
- Transit/shuttle stops (e.g., equipment, shading infrastructure, screens, etc.).
- Road network adjustment and signage system for safe cohabitation with all other road users.
- If desired, infrastructure to request service at bus/transit stop.
- A dedicated shuttle lane if they are not operating on residential streets or low speed streets.

To help ensure the shuttle system is deployed while meeting quality and safety standards, the following process should be followed:

1. **Site Analysis.** A deployment engineer would visit the site to assess the project feasibility in detail. Based on these observations, combined with the City's requirements, the final itinerary, fleet size, operational plan, charging schedule and recommendations on the required infrastructure and mitigations to deploy the shuttles safely with the highest level of reliability would be defined.
2. **Site Set-Up.** Once the vehicle system is on-site, an operator would manually drive the shuttle on the route with the purpose of "pre-learning" its route and operating environment. Over the following days, the vehicle creates a "reference map" that represents the route and site environment. The vehicle is then able to know its exact position by comparing its perceived environment to the "reference map."
3. **Operator Training.** Despite its autonomy, shuttle vehicles still require an operator - at least for the initial operations. Operators would be responsible for daily safety checks, day-to-day maintenance, and customer service (i.e., answering customers' questions). Operator training would cover system supervision, deployment, training (i.e., how to train new operators) and maintenance.

4.1.2 Financial Considerations

One autonomous shuttle can be leased for approximately $12,000-$14,000 per month with a 3-year contract. Partial costs can be recovered through advertising revenue from shuttle exterior advertisements, which could range from $500-$1,000 per ad per month (depending on ad size and the market).

4.1.3 Next Steps

- Further discussions with PSTA to understand autonomous and electric shuttles as a replacement of or addition to their current fleet.
- Once ownership structure is determined, see deployment process in **Section 5.1.1**.

4.2 Digital Wayfinding Signage

4.2.1 Description

St. Petersburg could consider placing two-sided digital kiosks at main pedestrian gathering points to aid in wayfinding, promote public transportation options and events happening within the City. In addition to the digital interaction, these kiosks have embedded Wi-Fi access points, which could help promote a tech-savvy experience. These kiosks are often popular with local retailers because it gives business improvement districts the ability to offer statistics on pedestrian traffic count past, dwell time, and interaction with any kiosk near those retailers. **Figure 4-1** below shows examples of potential form factors for a digital kiosk. As form factors are customized, prices increase.

Although advertising *could* be included on the kiosks, it is recognized that St. Petersburg residents have been active and vocal about all signage, including digital signs and light pollution. Community input would be required to determine the potential effects of digital signage with commercial advertising on city and/or district character. Potential options could include advertisement of small, local businesses to drive business to those retailers.

Figure 4-1 Examples of Digital Kiosks

Sources: Meridian Kiosks IKE Smart City

4.2.2 Financial Considerations

Each standalone two-sided kiosk would cost approximately $50K installed, with cost variance based on kiosk housing and whether the kiosk is one-sided or two. The simpler the housing, the lower the cost and the more basic the look and feel – which may run counter to the desired visual impact of the district. Annual costs for operations and maintenance and content management are estimated at $5K.

Initial creation of digital content on the kiosk could range from free to tens of thousands of dollars, depending on which content the City wants displayed and which organization manages the development.

4.2.3 Next Steps

- City to determine strategy (and potential budget) for digital kiosks, which would include community input to determine potential effects of digital signage with commercial advertising on city and/or district character.
- City to reach out to potential media partners to determine potential desire for subsidization of the initial capital expenditures of digital kiosks.
- City to determine form factor, if kiosks are desired.

4.3 Environmental Sensing

4.3.1 Description

Environmental sensing can be an important tool used to gauge environmental conditions within a city, including air quality, street activity, and other environmental conditions. Air quality sensing could be a reasonable safeguard measure to help meet residents' desires for healthy environmental conditions. This could be done through the deployment of a system such as Argonne National Laboratory's Array of Things™ (AoT) open data-based sensor platform, as shown in **Figure 4-2**.

The beehive-shaped nodes measure dozens of different targets, require 120 volt AC power to operate, never transmit personally identifiable information, and automatically transmit sensor data to an open data web portal. The data streams and uses include:

Figure 4-2 Example of Argonne Array of Things™ (AoT) Sensor

Sources: City of Chicago, Argonne National Laboratory

Environment

- Cloud cover; ambient light, UV, IR light; visibility; magnetic field; vibration; sound levels; temperature, RH; barometric pressure

Air Quality

- Particulate matter (PM) 1, 2.5, 40; carbon monoxide (CO); sulfur dioxide (SO_2); nitrogen dioxide (NO2); Ozone

Activity/Conditions

- Flooding; pedestrian / vehicle / bicycle flow; safety statistics

The open data nature of the platform makes it ideal for academic and civic outreach and would enable the City to collaborate with universities, colleges, and high schools to analyze the data from the deployment of sensor nodes throughout the district. Environmental sensing is an ideal technology to deploy more broadly across a district to build resident awareness, interest and support.

4.3.2 Financial Considerations

The Argonne AoT sensor examples cost about $5K each, with minimal monthly costs for cellular service from each node. Argonne is also planning to have a cheaper node available by

2019 that will cost less than $500 and track only temperature, humidity, and particulate matter (PM 2.5).

4.3.3 Next Steps

- City to determine environmental sensing budget, strategy, and preferred platform.
- City to determine installation locations if environmental sensing is desired.

4.4 Public Safety

4.4.1 Description

This section discusses the benefits of high-resolution cameras, license plate recognition, and facial recognition.

Figure 4-3 Example Clarity of Nighttime 4K Imaging

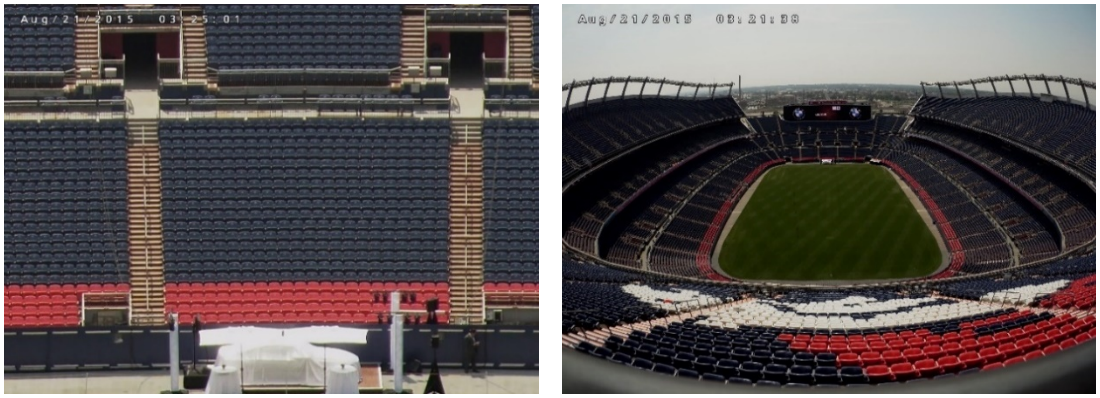
Source: Panasonic 4K multisensory camera

Cameras

4K resolution cameras allow greater coverage at higher resolution with fewer cameras. 4K cameras can accommodate four viewing angles within the same camera, which would allow placement of a single camera at an intersection to cover all four street directions. Placing fewer cameras would result in fewer fiber runs needed to connect the cameras.

These types of cameras have shown high resolution up to approximately 100 feet at night (**Figure 4-3**) and 550 feet during the day (**Figure 4-4**). The following figures show these resolutions.

Figure 4-4 Example Clarity of Daytime 4K Imaging



550-foot distance (left) and 110-degree angle (right)
Source: Panasonic 4K camera

License Plate Recognition

License plate recognition (LPR) is a software feature that allows for automation of license plate reading and identification. LPR makes it easy to capture license plates, help identify vehicles, and enforce parking restrictions. The key features that make a successful LPR program include:

- Unlimited license plate recording
- License plate capture in any weather condition (dependent on camera performance)
- Support for over 3,000 camera models, functionality with all U.S. and International plate information, and ability to tie multiple databases of plates tied to rules manager
- Advanced search box — filtering tags by day/range
- Ability to show all plate information by date/time and by camera
- Triggering of rules/actions based on license groups
- Assignment of plates to specific cameras/rules
- Specification of region or capture of entire image

An LPR rules manager should allow a user to create an unlimited number of groups of licenses, trigger rules based on groups, and provide actions that include alerts, outputs, emails, video pop-ups, instructions and layout changes. This would enable features such as:

- Popup alarms when an unwanted or unknown plate is detected
- Multiple databases of plates tied to a rules manager with ability to assign plate(s) to a specific camera
- Ability to create groups of licenses to trigger actions

Facial Recognition

Facial recognition is an evolving technology that identifies people's facial features and compares to existing databases. Because it is not yet fully proven, it would be recommended to start with a small-scale pilot program before committing to this technology. Deployment would be most appropriate at a high pedestrian throughput location to determine feasibility with environmental conditions. The City of San Francisco, CA recently became the first major American city to ban the use of facial recognition software by police and other agencies. Civil liberty groups have expressed fear of the technology's potential abuse by government. Data safety and digital privacy concerns would need to be addressed before implementation of facial recognition technologies in St. Petersburg.

Facial recognition software automatically identifies or verifies a person's face using live video streams or digital images from high-resolution digital surveillance cameras that are matched against a database of enrolled faces and perform notifications and alerting of face matches.

Facial recognition software should have the following specifications and features:

- Ability to search 5,000,000 faces in under three seconds.
- Age and gender recognition
- Ability to accurately identify angled faces at 45 degrees left/right and 30 degrees up/down
- Ability to accurately identify faces with sunglasses and surgical/air quality masks and identify faces changed by aging

Facial recognition only works in conjunction with the best-in-class high-resolution cameras. Thus, the cameras should have the following features to help provide facial clarity:

- With face detection, the cameras can recognize which part of the camera is a face and focus resources on making that portion of the image the clearest.
- Automatic adjustment of the key settings in real-time depending on the scenery and movement to reduce distortion such as motion blur and moving objects.

4.4.2 Financial Considerations

- $2,000-$4,000 hardware costs for 4K general surveillance cameras; pricing increases for cameras that are 4K multi-sensor (i.e. four different viewing angles).
- $25,000 for a license plate recognition system, which would include seven (7) cameras, software, and installation (no ongoing software costs).
- $40,000-$50,000 for a facial recognition system, which would include six (6) cameras, server hardware, software (no ongoing software costs), installation, and training.

4.4.3 Next Steps

If the City has a desire for more proactive public safety measures within the district, definition of the program should be led by the St. Petersburg Police Department (SPPD). As noted in **Section 4.4.1**, a robust community discussion of the use of facial recognition technology would need to take place to understand residents' desire for enhanced public safety with this emerging technology.

4.5 Smart Waste Management

4.5.1 Description

Smart waste management includes IoT machine-to-machine (M2M) technologies that enhance operational efficiency and reduce waste. Sensors in waste receptacles can accomplish the following goals:

1. Provide real-time data on which waste bins need to be collected (and which ones don't);
2. Optimize efficiency (cloud-based software can optimize waste collection routes, schedules and bin placements using historical data and predictive analytics), and;
3. Reduce cost through more efficient labor utilization, fuel consumption and plastic bag usage).

Figure 4-5 shows some examples of smart waste management sensors and monitoring products.

Figure 4-5 Examples of Smart Waste Management Products

Source: Ecube Lags Co.

Waste bin sensors can include the following features:

1. Sensor attachments to any type of waste container (small to large)
2. Detection of the fill-level of any type of substance or waste
3. Real-time data sent to a monitoring and data analytics platform

4.5.2 Financial Considerations

Capital and operating expenditures:

- Compacting bin w/ sensor = approximately $4,000
- Installation, freight, software = $150
- Sensor (stand-alone) = $200
- Monthly fee = $10-$20/month

Case studies have indicated a $9,000/year/bin savings in labor, materials and fuel.

4.5.3 Next Steps

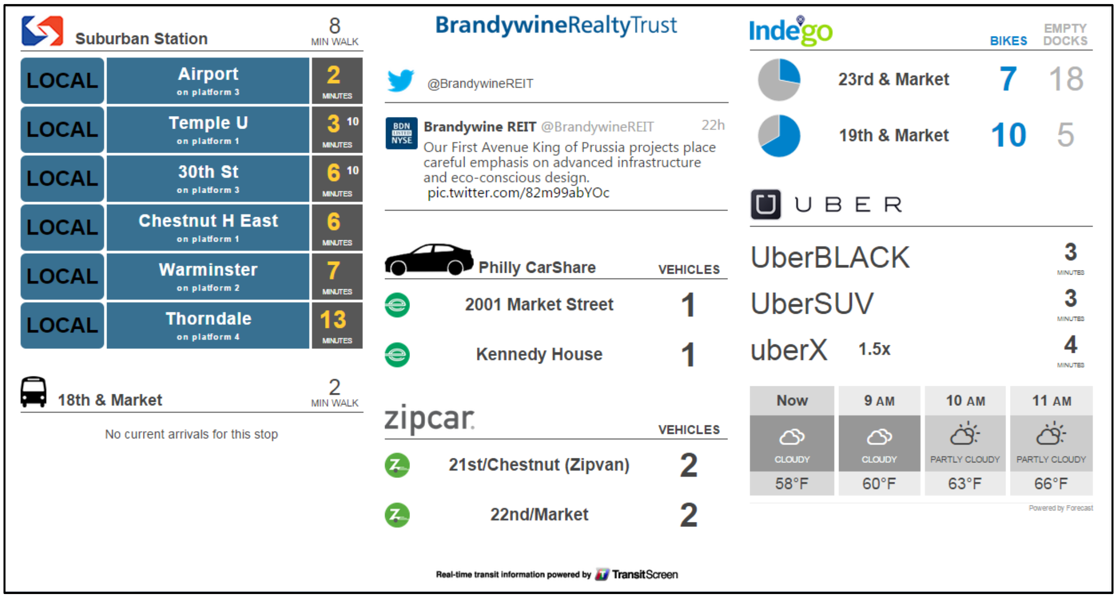
- City to determine scope and budget of district-wide smart waste management program.

4.6 Smart Transit Shelter

4.6.1 Solution Description

A “smart” transit shelter can serve many functions, including merging of digital wayfinding signage, or kiosks (described previously in **Section 4.2**) to provide local business advertising opportunities, Wi-Fi access, and directional information/mobility and messaging content platform. Real-time mobility information can include public transit options, Lyft or Uber, bikeshare, and even traffic estimates.

Figure 4-6 Example of Real-Time Digital Transit Screen



Source TransitScreen example from Center City Philadelphia.

Although advertising could be included in smart transit shelters, it is recognized that St. Petersburg residents have been active and vocal about all signage, including digital signs and light pollution. Community input would be required to determine the potential effects of digital signage with commercial advertising on city and/or district character. Potential options could include advertisement of small, local businesses to drive business to those retailers.

In addition to mobility options displayed over monitors, smart transit shelters can also include the following features:

- **Messaging:** Communicate and connect with occupants by adding specific information the City may control, like events and notifications.
- **Local Highlights**: Provide highlights of the local neighborhood(s) and feature local businesses and restaurants nearby.

4.6.2 Financial Considerations

For a single screen of the TransitScreen product, the first-year cost for all features would be $4,770 (not including the monitors to display the content, power, or cabling for the Internet connection). Recurring annual costs would be $4,320.

4.6.3 Next Steps

As a next step, the City would need to coordinate with PSTA regarding the feasibility of district-specific transit stations with this type of technology and determine the quantity and location of the transit shelters for potential implementation.

4.7 Networked Lighting and Streetlight Poles

4.7.1 Description

Streetlights are an important asset for smart city technology deployment because they create a powered network of nodes that naturally allows for IoT device integration. In addition, they provide opportunities for enhanced community resiliency by integrating battery energy storage, as discussed further in **Section 4.8**.

As Duke Energy replaces existing HID streetlight luminaries with light emitting diode (LED) luminaires, the City could consider recommending the following to Utility:

A. Streetlights should be upgraded, at a minimum, with National Electrical Manufacturer's Association (NEMA)-compliant wireless controller sockets for future install of wireless controls (if deciding not to install streetlight controls while upgrading).

    1. The sockets on top of the luminaire need to be 5-pin or 7-pin because wireless controls are not compatible with 3-pin sockets.

    2. This discussion should happen prior to further investment.

B. The City should discuss the streetlight form factor with Duke Energy, keeping in mind the following:

    1. Does the City desire a narrow (<8" diameter) pole form factor that requires Internet of Things (IoT) devices to be strapped onto the pole, or;

    2. Does the City desire a form factor that could integrate IoT control equipment? This is largely driven by the IoT devices deployed or planned.

C. Coordinated with Duke Energy to evaluate streetlight interactivity with smart city and IoT applications as appropriate, such as:

    1. Flashing localized streetlights if a 'Help' button is selected by a nearby user via a city or other app, or;

    2. Enabling first responders to control some or all lights based on dynamic needs (all off/on), or;

    3. Dimming lights from 90% to 50% output from 12:00am to 4:00 except when vehicle or pedestrian traffic is detected.

D. Determine which streetlights need to have direct fiber runs to support video surveillance, community Wi-Fi, and other IoT applications.

4.7.2 Financial Considerations

In general, streetlight controllers cost about $125-$150 in modest volumes, plus $5-10 per year per light for software licensing. One or more network gateways would be required to connect with the 900-Megahertz (MHz) mesh network radios and to route streetlight data and controls. The City should plan to route fiber to new streetlights that may have high-bandwidth communication needs.

4.7.3 Next Steps

See **Section 4.7.1**.

4.8 5G Cellular and Energy Storage-Integrated Streetlights

4.8.1 Solution Description

As an alternate form factor for battery energy storage, the City and Duke Energy could consider a network of distributed energy storage assets integrated into smart streetlight poles deployed throughout the district as shown in **Figure 4-7**. Each pole could have up to 50 Kilowatt-hours (kWh) of energy storage available in the base of the pole. Each pole also has space to hold multiple 4G or 5G cellular antennas. A network of these poles could replace the potential eye-sore of a larger centralized battery container and exterior-mounted cellular antennas.

Figure 4-7 Example of Streetlight with Integrated Storage

Due to costs, it is recommended that a pilot program of two poles be initiated, with subsequent phasing so that the deployment can increase within the district.[1]

This integrated approach provides the following benefits:

1. **Resiliency** – During emergency operation, distributed energy storage can provide backup power for streetlighting and critical communications infrastructure when it's needed most. Furthermore, aggregating this resource and dispatching on the distribution network could provide backup power for critical loads in the district. In combination with distributed energy resources, the aggregated energy storage can be used to effectively island and form a resilient microgrid for the district.
2. **Aesthetics and right-of-way** – Existing utility deployments of distributed energy storage assets have required some aesthetic trade-offs and negotiations regarding right-of-way and utility access. Integrating these assets into the streetlight pole provides the advantage of utilizing an existing asset (streetlight pole) that has already been reviewed and approved through local authorities having jurisdiction. For light poles on private property, it also provides aesthetic benefit.
3. **Grid Services** – During normal operation, distributed energy storage in aggregate can provide voltage and frequency support to increase reliability of the local distribution network as needed.
4. **Peak demand reduction** – Distributed energy storage in aggregate can provide peak demand reduction for the utility. It can shave utility bill costs for a customer.
5. **Renewable energy integration** – Distributed renewable energy solutions like solar and wind are intermittent resources. A distributed energy resource within the City will provide a buffer to mitigate those fast ramping resources and provide firming capacity when needed, allowing for increased penetration of these resources and further decreasing greenhouse gas emissions.

4.8.2 Financial Considerations

› Equipment Costs = approximately $125,000/pole

› Integration Costs = approximately $10,000/pole

› Operation Costs = approximately $100/year/pole

4.8.3 Next Steps

Define a specific location for a pilot program (see footnote regarding the Innovation District's US Ignite Smart City award).

[1] The St. Petersburg Innovation District is installing a small number of "smart" light poles through its US Ignite Smart City award. The City could use the Innovation District's experience as a pilot program for potential integration of the technology into the Tropicana Field redevelopment site.

4.9 Energy Storage Appliances

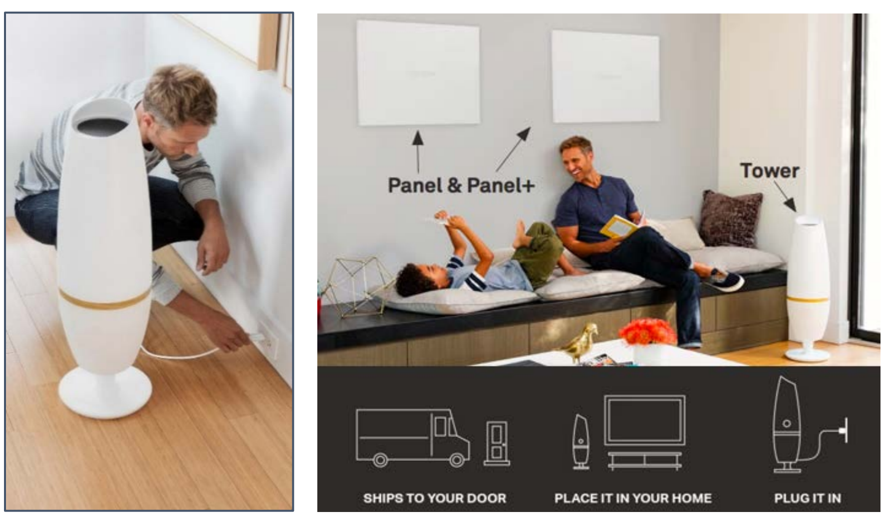
4.9.1 Description

In-home and behind-the-meter batteries are gaining popularity as residents begin to show their desire for energy storage and additional resiliency in their dwelling. Many of these market solutions target single family homes with battery packs that are expensive. St. Petersburg (possibly through Duke Energy) could provide or incentivize an easy to install, plug-in multi-family energy storage solution, to help unlock more resilient energy for all residents. In the case of utility disruption, this energy storage could allow residents to charge their smart phone and operate their refrigerator and other small appliances until power is restored.

The City, developer or Utility could offer this as an optional energy storage and resiliency upgrade to residents. It could be showcased in the model unit, to help future residents decide if they want a resiliency upgrade. The Utility could potentially finance this energy storage for the residents, with the costs paid back on their utility bill. Residents may also receive energy savings, as the utility can leverage the batteries as part of its demand response program. Over the long run, residents would eventually own their own energy storage system, have access to higher energy resiliency, and can decrease their energy costs. A Utility return on investment will come from the customer payments until the equipment is paid off, and from potential demand reductions if this is incorporated into a demand response program.

Some products are coming onto the market, including a wall-mounted panel battery, and a floor-mounted tower battery. Several units can be ganged together to create additional energy storage. These in-unit battery systems range in size from 2.2 KWH to 15.4 KWH.

Figure 4-8 Examples of In-Home Battery Solutions



Source: Orison.

4.9.2 Financial Considerations

In-unit battery systems range in size from 2.2 KWH to 15.4 KWH, with a cost range of about $1,800 to $9,600 depending on the size and configuration. These could also be part of a Utility energy resiliency program, where the Utility owns the assets. Since this is emerging technology, it is difficult to predict how the costs will change over time, but it is likely the cost for the batteries could drop 30% in 5 years per some of the manufacturers.

There are case studies explaining financial models that are being considered by others, including energy retailers and utilities in the U.S.:

Energy Retailers

Energy retailers in deregulated markets, such as Texas, are looking to differentiate their offerings as they work to capture greater market share. However, they do not have the same value proposition since electricity rates are low, competition is steep, and financial incentives do not exist.

The average energy retailer in Texas loses a significant number of existing customers to the competition every year. Many of the new sales simply replace lost customers, so business growth is relatively stagnant. One opportunity being explored is to offer energy storage to customers as part of an energy service package. The energy retailer could have plug-in battery units available on a truck as the sales force canvases neighborhoods. When a new customer signs up for service, the salesperson can offer instant fulfillment by setting up energy storage that same day. This helps with the energy retailers' second issue which is to quickly engage customers, ensuring contract retention. Many of their initial sales back out before the first services can be put into action.

Consideration is being given to sell this battery storage service on a fixed monthly rate, coupled with the empowerment of safety, security and personal resiliency. Additionally, having storage in customer homes enables more comprehensive services such as monitoring, IoT, and connected home appliances that can further reduce customer usage, optimize time of use, and increase comfort and savings with a tailored plan that meets everyone's needs. Once a certain level of market penetration is reached in each region, the retailer would be able to reduce the amount of higher cost, peak-time energy purchased, which could significantly lower overhead.

Utilities

In Arizona, one utility is working on alternative pricing models to incentivize solar-plus-storage. A new pilot retail rate is being offered by Arizona Public Service (APS), which is designed to incentivize peak demand reductions from residential customers. The rate combines a $0.50 per day service charge with a very low per-kilowatt-hour energy rate (around $0.05) and a stiff monthly on-peak demand charge (up to $20.25 per kilowatt). Customers must have several distributed energy assets like rooftop solar, energy storage, or an electric vehicle to qualify.

In California, San Diego Gas & Electric (SDG&E) has a residential pilot program aimed at demonstrating how one-minute to ten-minute events can help smooth grid fluctuations by utilizing customer sited assets, such as electric vehicles, solar, and in-unit energy storage. The dynamic pricing model adjusts pricing under certain grid conditions from as low as $.05 per kilowatt up to $5.00 per kilowatt. This program would utilize distributed energy resources to automatically reduce demand from the grid by using locally stored energy.

The belief is that with this type of incentive program, ratepayers will be more willing to move to dynamic pricing since the ROI for electric cars and energy storage is more attractive. Dynamic pricing has the potential to be a win-win opportunity by better aligning pricing and costs along with ratepayers and utilities. Dynamic pricing signals will help guide customer usage. By combining dynamic pricing with customer sited energy storage, customers can seamlessly help utilities achieve lower generation and distribution costs as well as renewable energy integration while gaining options, flexibility, and control over their environment.

In Colorado, Xcel is looking to study the opportunity to invest in customer sited storage to ensure customers have resiliency in the face of weather-based grid outages. They believe that by moving resources to the grid edge they can increase customer satisfaction and reduce transmission/distribution maintenance fees. They also see an opportunity to increase fixed service revenue with customers as they can offer IoT based products tailored to each individual need.

4.9.3 Next Steps

- The City to determine which buildings this solution could support.
- The City could approach the Utility as a potential partner for this solution.

4.10 Advanced Energy Sub-Metering with Artificial Intelligence

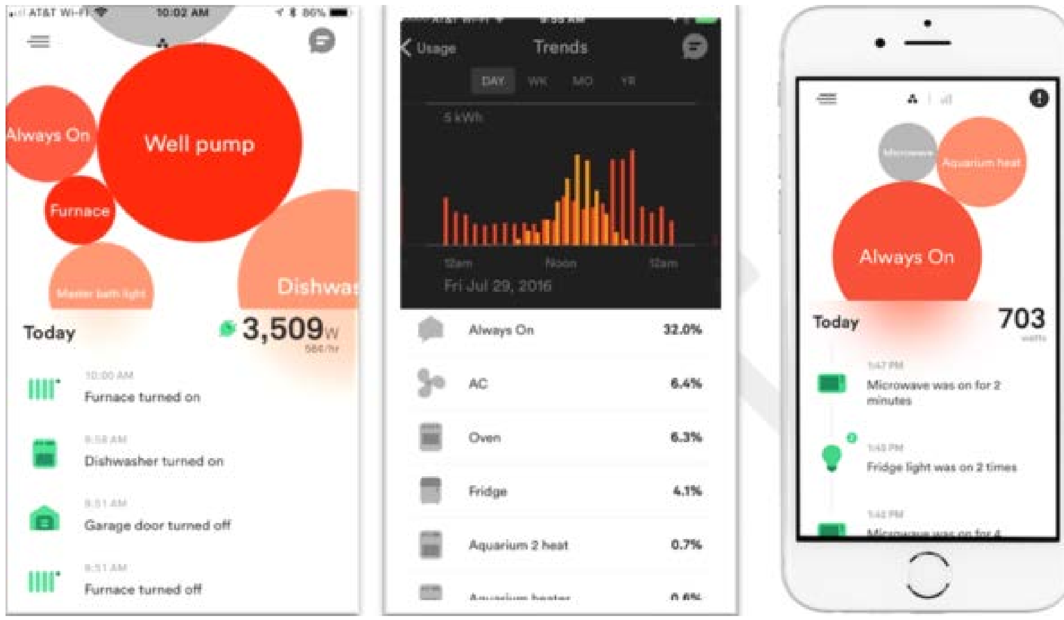
4.10.1 Description

Artificial intelligence (AI) and machine learning are changing many industries, including energy monitoring. New electric meters are leveraging AI to learn the “signature” of individual electrical devices within a home or office through just one meter. This allows residents and businesses to better understand their energy consumption, without the need for more expensive sub-metering or analysis.

Understanding exactly where energy is used can help residents and businesses understand how they can reduce their own specific power bill. These meters can also alert the resident to issues, such as accidentally leaving a refrigerator door open, or potential faults with their electrical devices.

The City could partner with the Utility to unlock this advanced technology for residents and businesses within the district, through an optional advanced home energy monitoring upgrade in which the Utility charges a monthly service fee on its bill to provide detailed energy breakdowns to the resident or business owner. The resident or business owner could leverage that information to reduce their energy costs beyond the service charge. The Utility could also leverage this to provide deeper demand response (i.e., see exactly which devices are on and use smart plugs to control them off during demand response).

Figure 4-9   Example Reports from an AI Meter



Source: Sense.

This type of technology also offers safety, security and comfort benefits on top of energy efficiency assistance. A customer can tell from their smart phone if they accidentally left the oven on, or they can tell that someone must be in their apartment using the TV while they are out of town on vacation. They may also be able to see a fault or anomaly in the air-conditioning equipment, predicting an upcoming failure.

Oftentimes, after a building is commissioned, its energy performance begins to decrease, and energy consumption continues to creep higher than anticipated energy performance projected during the design process. Commercial building metering solutions can give building operators the ability to easily track equipment faults by receiving instant notifications when an equipment is consuming too much energy, oscillating, or spiking.

Deeper energy savings can be realized when building owners let the AI platform monitor electricity demand and turn off certain power usage when it detects a higher than normal electrical load. This often results in average monthly electricity bill savings greater than 10%, on top of the time-savings that are created when building operators don't have to manually address these issues.

4.10.2 Financial Considerations

These sub-metering systems would typically have the following benefits:

- Electricity bill savings, typically above 10%.
- Operation and maintenance staff time savings.
- Avoided energy audit and retro-commissioning costs.
- Dashboard to allow consumers to understand how their actions affect energy and sustainability.

Hardware costs for residential meters are approximately $300 each. The total installed cost is likely around $500. If the City or Utility wants anonymized access to the data, it would cost $20 per year per meter and could be reduced if there were a commitment to a higher quantity of meters.

Example costs for a commercial sub-meter system is provided in **Table 4-1**.

Table 4-1 Costs of Example Commercial Sub-Meter System

Number of Systems	Upfront Hardware Cost	Annual Cost	Annual Energy Cost Savings	Simple Payback (Yrs.)
6	$12,000	$7,200	5-10% (approx. $15,000)	2.0

Source: Verdigris Technologies, Inc.

These sub-meter systems could be offered as an optional energy management service. The Utility could install the meter and charge the customer a monthly rate to recoup the costs. The Utility could also subsidize some of the costs if this is leveraged for demand response by the customer. To further drive the costs down, the Utility could partner with one of the AI meter companies to embed this technology into their smart meters.

4.10.3 Next Steps

- The City to discuss feasibility with the Utility.

4.11 Batteries, Microgrids, and Community Resiliency

4.11.1 Description

Most buildings in the Tropicana Field site redevelopment would be required, by code, to have an emergency backup power source. This is typically accomplished with diesel generators, lights with battery packs, and/or diesel fire pumps. St. Petersburg and Duke Energy may want to consider working with the building code officials/inspectors and the development team to analyze an alternative approach, leveraging micro-grids and utility scale batteries to replace some of the traditional emergency power. These batteries could also potentially power a receptacle or two per residential unit.

As one example, a city in the Western U.S. is currently partnering with a developer and the utility around an urban redevelopment project that will include about 3.8 million square feet of new multi-family residential. A more traditional design would include six new 500 kW diesel generators, on the customer side of the electric meter, to provide back-up power for the various buildings. The utility is looking to replace these generators with battery storage. These batteries would be even larger, such that they could provide beneficial grid services for the utility but have a minimum charge state to ensure they can provide necessary back-up power to the new buildings.

This approach has already been accomplished at Pena Station NEXT in Denver, where Panasonic avoided a diesel generator for their new building several years ago, by building a micro-grid and tapping into a 2 MWh battery owned and operated by the local utility (Xcel Energy).

This type of approach can save the developer significant capital costs to provide the generators, plus save them in ongoing O&M costs associated with maintaining and exercising the generators. The utility benefits from overall grid services, plus they can explore developing a resiliency as a service structure with the development.

If the utility provides batteries to replace generators, and wishes to utilize them for other grid services, the minimum charge state for these batteries would have to be set by the emergency power needs. These batteries would be placed into a "micro-grid" that already must already be provided for the building – including the emergency power wiring, Automatic Transfer Switch, etc. This is a non-standard approach that would have to be discussed with the local code officials and inspectors. Battery packs are used in lights for emergency power for smaller buildings, and a battery is generally less likely to break down than a generator.

To recoup the costs, the utility could consider developing a new resilient rate approach. The developer essentially gets to save on capital costs and pays a higher utility costs to account for their first cost savings. Xcel Energy is currently looking at similar new business models and may re-capture the costs in how they charge customers for dual feeder service.

4.11.2 Financial Considerations

The current installed costs for large scale battery storage range from $600 - $800 per kWh.

4.11.3 Next Steps

The City could begin to analyze the back-up power needs and the potential electric load profiles for the redevelopment project and begin negotiating with Duke Energy on appropriate battery storage sizes and business cases.

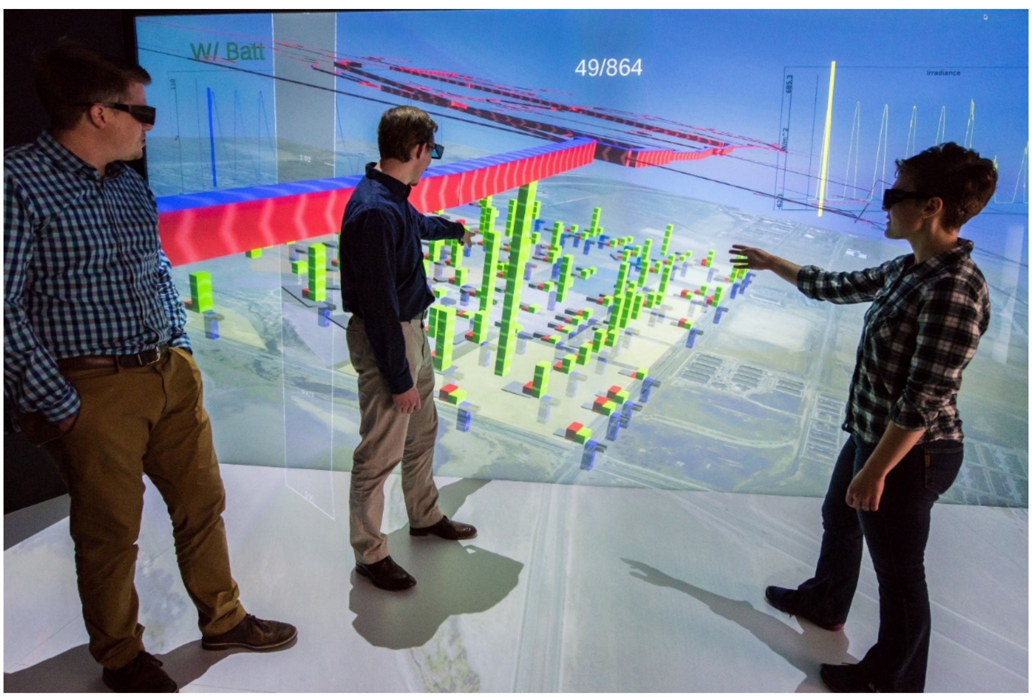
4.12 Net-Zero Energy Consumption

4.12.1 Description

To achieve net-zero energy, the City and/or developer could implement early phase energy modeling. This would allow for tradeoffs, such as adding insulation to decrease the air-conditioning size. Taking this early approach, and embedding the energy criteria into the development proforma, would optimize the economics of achieving net-zero energy. The analysis would also provide information to discuss potential utility investments and incentives to achieve net-zero.

As an example, at the 382-acre Pena Station NEXT development in Denver, the horizontal developer has performed energy modeling well prior to design of most of the vertical buildings, which includes approximately 100 future building energy models. These energy models were also linked with the utility's distribution models, to show the impact of energy efficiency and renewable energy on the grid. This provides a path to reduce traditional electrical infrastructure and encourage the utility to instead invest in clean and resilient power. **Figure 4-10** shows the 3-Dimensional energy model of the neighborhood buildings along with the underground electrical infrastructure.

Figure 4-10 Example of 3-Dimensional Energy Model



Source: Panasonic CityNext

4.12.2 Financial Considerations

The cost to perform this level of modeling can vary widely depending on the complexity of the models desired by the City and/or developer. It is suggested that the City and/or developer budget $100,000 to $250,000 to support early net-zero energy analysis of the Tropicana Field Redevelopment site.

4.12.3 Next Steps

If net-zero energy is desired, include a budget to perform the analysis and hire an experienced energy modeling team to perform this work in the concept design or planning phase (prior to schematics).

4.13 Recommendations

Each of the Smart City technology options described in this chapter require coordination with public and/or private partners. To implement successful Smart City technologies, the City should develop a district-wide Master Plan and Roadmap to guide its vision of developing a "smart district", and produce positive economic, environmental and social impacts. The Master Plan and Roadmap would:

- Ensure consistency with the direction of the City's and district's stakeholders,
- Help to encourage collaboration with other jurisdictions and agencies, and
- Share successful business cases for the public and private sectors.

5

Healthy Community Design/Smart Mobility

This section describes the analysis and recommended next steps for effective design measures to enhance the health of the area surrounding the Tropicana Field site. The healthy community design options discussed in this section are based on VHB's Smart Mobility Model, which correlates available Center for Disease Control and Prevention (CDC) data to demographic, urban design, and transportation network data. Detailed analysis results are provided in **Attachment 1**.

5.1 Introduction

The City of St. Petersburg has established the Healthy St. Pete initiative with the purpose "to build a culture of health in our city by making the healthy choice the easy choice." As part of Healthy St. Pete, the City has established a Health in All Policies (HiAP) Executive Order, which "recognizes that all departments have a role to play in ensuring everyone can live a long and healthy life." Health risk factors are heavily influenced by the attributes of a community's built and social environment, and the Tropicana Field Site Conceptual Master Plan includes features that would have a positive impact on the health of the site and surrounding area – including a return of the street grid network, compact urban design, public trails and other recreational opportunities.

To further understand the impact of the built environment, VHB's Smart Mobility Model was used to correlate land use, urban design and transportation factors to the health of the surrounding neighborhoods. The Smart Mobility Model utilizes data that are readily available and allows for the ability to factor health into community and transportation planning decision making in a quantitative manner.

5.2 Smart Mobility Model

The goals of the Smart Mobility Model are to:

- Analyze land use, urban design, and mobility factors that affect community health;
- Leverage big data and applied technology into a scalable, transferable model;

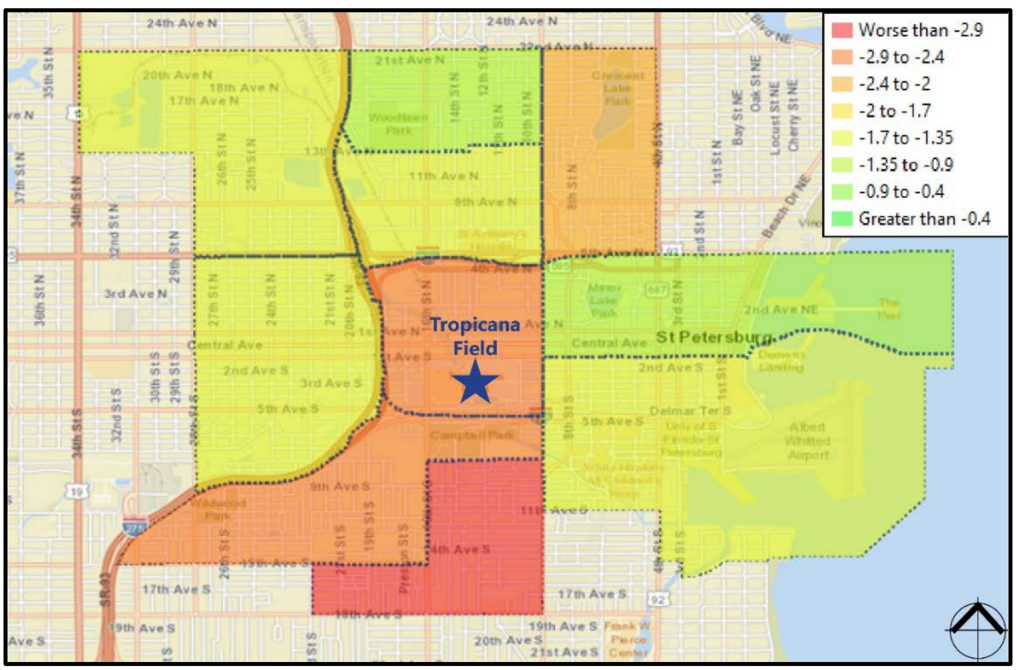
- Forecast likely community health outcomes or conditions; and,
- Identify physical (infrastructure) improvements that can enhance community health.

The VHB Smart Mobility Model analyzes readily available Census and demographics data, as well as urban design against available data from the CDC's 500 Cities Project, which estimates health data for census tracts in 500 of the largest cities in the United States, including the City of St Petersburg. Based on the Census data, including poverty and income, educational attainment, unemployment, commute times/mode share, and population density, the Smart Mobility Model develops a Community Health Profile, which identifies areas of concern or opportunity.

The Community Health Profile for the area surrounding the Tropicana Field site is shown in **Figure 5-1**. The scores shown in the legend indicate general health trends, and the lower the numerical score (indicated in orange and red), the more likely residents of the census tract are to experience increased incidents of chronic diseases.

The Community Health Profile shown in **Figure 5-1** shows the census track that contains all or parts of the Campbell Park, Thirteenth Street and Fruitland Heights neighborhoods as the most at-risk section of the Study Area.

Figure 5-1 Smart Mobility Model – Community Health Profile of Area Around Tropicana Field Site



Source: Smart Mobility Model, VHB.

5.3 Analysis Findings

In addition to developing a Community Health Profile, the Smart Mobility Model identifies community and transportation policy opportunities to enhance health within the Study Area and allows for prioritization based on improvements that would result in the strongest correlation to improved health outcomes. The opportunities to improve health outcomes are based on map reviews and field analysis to identify existing public realm, urban design, and mobility network factors, including:

- Presence of sidewalks, bike facilities, electric vehicle charging stations, and a bike-share program
- Number of road lanes
- Block length
- Presence of on-street parking
- Location of off-street parking - either in front of building (i.e. conventional suburban development model) or behind building (i.e. new urbanism development model)
- Public realm with a destination (e.g. park or civic building) acting as a visual and/or physical terminus
- Percent of households within walking distance (½-Mile) of grocery stores, health care, and schools

Each of these design and mobility factors were run through Smart Mobility Model to determine which exhibit the strongest correlations to chronic health diseases. The analysis shown in **Table 5-1** identifies how well each design and mobility factor could improve each of the diseases (green signifies the best effect and red identifies the least effect on a disease).

The following key findings were identified from the analysis:

- Three design and mobility factors would result in the greatest reductions of chronic health diseases compared to other factors:
  1) *Off-Street Parking located behind the building instead of in front*. Parking behind buildings is typically found in new urbanism development models that encourage walking between adjacent mixed land uses, whereas parking in front in buildings is typically found in conventional suburban development models that discourage walking and encourage driving between separated land uses.
  2) *Percent of household within walking distance (1/2-mile) from a health care provider*.
  3) *Percent of household within walking distance (1/2-mile) from a grocery store*.
- In addition to the factors above, poverty status had a statistically significant correlation to health outcomes for every health factor.

These finding are similar with analyses conducted in other downtown areas. Previous analyses of corridors in Orlando and Tampa showed significant or "borderline" significant correlations between chronic health diseases and the following mobility factors: the number of lanes of main street (increased number of lanes leads to increased estimated incidents of chronic health diseases); location of off-street parking; presence of bicycle lanes; and, percent of households within walking distance of a grocery store.

Table 5-1 Effectiveness of Design/Mobility Factors in Addressing Chronic Disease Near the Tropicana Field Redevelopment Site

Overall Health Score Rank	Design/ Mobility Factor	Chronic Disease							
		Diabetes	Coronary Heart Disease (CHD)	High Blood Pressure (HBP)	Obesity	Asthma	High Cholesterol	Chronic Obstructive Pulmonary Disease (COPD)	Overall Health Score
1	Grocery Store	-1.82	-2.49	-2.28	-1.12	-0.86	-1.21	-2.41	-1.74
2	Off-Street Parking	-2.21	-1.64	-1.73	-1.37	-1.07	-0.67	-1.76	-1.49
3	Health Care	-1.83	-0.82	-1.97	-1.89	-2.05	0.08	-1.08	-1.37
4	EV Charging	-0.90	0.73	-0.54	-2.49	-2.14	0.30	-0.43	-0.78
5	Bike Facilities	-0.65	0.28	-0.05	-0.99	-0.99	-1.25	0.00	-0.52
6	Destination Terminus	-1.04	-0.78	-0.50	-0.54	-0.02	0.50	-1.12	-0.50
7	Sidewalks	-0.04	-1.23	-0.55	0.45	0.70	-0.69	-0.80	-0.31
8	Road Lanes	-0.15	-0.12	0.46	0.10	0.45	-0.37	-0.24	0.02
9	On-Street Parking	-0.02	1.13	0.90	-0.73	-0.82	1.49	0.36	0.33
10	Parks	0.00	-0.03	0.56	0.71	0.28	1.52	-0.40	0.38
11	Block Length	0.89	1.21	0.30	0.14	-0.54	0.87	1.11	0.57
12	Schools	0.90	1.10	1.30	1.31	1.38	0.30	1.39	1.10
13	Bike Share	1.93	0.08	1.49	2.40	2.47	-0.63	0.24	1.14

Lower values (green coloring) indicate more positive effect on a chronic disease; higher values (red coloring) indicate less of a positive effect on chronic disease.
Source: Smart Mobility Model, VHB.

5.4 Recommendations

In addition to developing a Community Health Profile based on local data from the CDC and factors such as poverty and income, educational attainment, unemployment, commute times/mode share, and population density, a series of design and mobility factors were evaluated to determine the greatest effectiveness to address chronic health diseases.

Based on the analysis of the Tropicana Field site, the City can take the following actions to enhance the health of the surrounding neighborhoods:

1. Amend land development regulations (LDRs) to prohibit or limit parking location in front of buildings within the Tropicana Field site. This can be accomplished with form-based codes, design standard overlays, etc.
2. Review allowable land uses to determine if there are barriers to grocery stores or health care providers within the Tropicana Field site. If so, amend land uses/zoning to allow for these uses, and/or craft developer Request for Proposals (RFPs) to attract these target users.
3. Develop design principles for the site to account for HiAP and common measures to enhance the health of the area.

6

Sustainable & Resilient Infrastructure Options

The previously described Tropicana Field Redevelopment Scenario 2 conceptual plan (**Section 3.2**) and supporting Exhibits (**Figure 3-2** and **Attachment 3**) include numerous design enhancements that seek to improve the future sustainability and resiliency performance of the site. As part of this evaluation, the conceptual plan was further analyzed to identify features that could support the City's additional investment in green infrastructure design and establish an economic basis for future site redevelopment requirements.

The City has made a major commitment to enhance the long-term performance and resiliency of future development, including horizontal infrastructure for improved sustainability. It is anticipated that the City will seek private developer(s) involvement in future private-public partnership investments for site redevelopment. Mutually agreed upon investments would need to enhance the sustainability and resiliency performance for these projects. Identifying an economic benefit will add to longer term return on investment discussions and inform decision-makers about the multiple benefits for these future site redevelopment investments.

Development of healthy, green buildings on the site can attract occupants because they typically are exposed to far lower levels of indoor pollutants and have significantly greater satisfaction with air quality and lighting than occupants of conventional buildings. Research conducted at Carnegie Mellon University shows that these benefits can translate into a 2% to 16% increase in workers' and students' productivity. Even small increases in productivity can dramatically increase the value of a building.[2]

[2] V. Loftness, V. Hertkopf, B. Gurtekin, and Y. Hua, "Building Investment Decision Support (BIDSTM): Cost-Benefit Tool to Promote High Performance Components, Flexible Infrastructures and Systems Integration for Sustainable Commercial Buildings and Productive Organizations," Report on university research (AIA, 2005).

6.1 Introduction to Green Infrastructure Cost Benefit Analysis

Green infrastructure refers to planning and design of approaches that mimic or restore natural processes within a built environment to manage stormwater at its source. It is a network of decentralized stormwater practices, such as: green roofs, trees, rain gardens, permeable pavement, that capture and infiltrate rain where it falls. These practices reduce stormwater runoff and improves the health of surrounding waterways. Green infrastructure practices have also been shown to positively impact energy consumption, air quality, carbon reduction, recreation, and improve other community health values.

The purpose of a Cost Benefit Analysis (CBA) is to have a means to determine the positive and negative features of various paths through a project, presented in present-day dollars. CBAs are a formal way of organizing the evidence on key good and bad effects of projects and demonstrating the benefits of decisions. The objective may be to decide whether to proceed with the project, to see if the benefits justify the costs, to place a value on the project, or to decide which of the various possible alternatives would be the most cost-effective. CBAs will give the City a way to minimize risks and maximize resulting gains in green infrastructure investment both for itself, its residents and its future partners.

As part of this analysis, the team utilized specialized modeling Autocase™ software. Autocase™ is an automated, cloud-based software that conducts triple bottom line analyses to assess the impacts of infrastructure investments, building design, and policy guidelines. The model calculates the dollar value and return on investment of green infrastructure (related to USGBC LEED™ [3] criteria) in both vertical building and horizontal site development projects, and estimates the financial, social, and environmental benefits that are produced for owners, occupants, and community. The software is designed to provide a CBA that uses and follows general principles and best practices outlined in guidance from the US Federal Government, including Office of Management and Budget (OMB) Circular AA-94, which provides guidance on US Federal CBA process.

The Autocase™ software model calculates the economic benefit or value of the project for investments in green infrastructure versus a conventional development design approach. It does not include any calculation of other economic impacts, such as jobs created, gross domestic product (GDP), or income created. **Attachment 2** of this report includes a complete Autocase™ CBA software input description, best practice assumptions, and list of definitions. To compare alternatives of the same project that may have costs and benefits occurring in different years, discounting is used to convert future benefits and costs to current year perspective.

The estimations provided in this chapter are for the design elements that the Scenario 2 conceptual plan could include based on the City's sustainability and resiliency goals and model

[3] U.S. Green Building Council (USGBC) Leadership in Energy and Environmental Design, or LEED.

capabilities. The software includes two modules - Sites (horizontal) and Buildings (vertical) - which correlate with the type of project being evaluated. As the Tropicana Field Site Redevelopment would include both horizontal and vertical development improvements, both modules were utilized. Software default inputs were used in areas where more detailed design plan data doesn't yet exist.

The software evaluates a base case existing condition to a defined alternative design and measures the incremental change in financial, social and environmental benefits. The team reviewed the Scenario 2 Conceptual Plan, supporting workshop presentation materials, City ISAP and other policy guidance, and then identified major design assumptions that had been publicly discussed as vision goals for the redevelopment project.

6.2 Value of Sustainable and Resilient Site Infrastructure Development by City

Attachment 2 of this report provides exhibits that define a measurable study area context used in the analyses, and include:

- Block Areas – parcel areas, proposed major land use types, and building limits in the project area.
- Street Network – existing, new and possibly retrofitted street system in the project area.
- Open Spaces – major open spaces and acreages in the project area.

Future refinement of the concept plan and analysis is recommended as planning and design of the site advances further. For example, refined base mapping would increase plan and estimates accuracy by permitting the adjustment of the conceptual site plan proposed street network right-of-way widths to accommodate the represented design elements and ultimately development parcel areas. This section includes a summary of the sustainable and resilient site infrastructure analysis and findings, an overview of the site redevelopment concept and further information on the financial considerations in the analysis.

6.2.1 Summary of Analysis and Findings

A summary of the analysis of the site and findings include:

- There are approximately 37 acres of public areas within the Tropicana Field site that would be developed by the City to mitigate flood risks, provide recreational opportunities and reduce urban heat island effects, among other benefits.
- Analysis compared the value of the property now to design and construction of sustainable and resilient public infrastructure within the 37 acres in the district.
- Total investments by the City in sustainable and resilient infrastructure would be approximately $5.5 million.
- However, those capital expenditure and operations & maintenance costs would be outweighed by large social returns, particularly from increased recreational value to the community (approximately $3.8 million) and reduced flood risks (over $3 million).

› *If the City develops the public infrastructure within the district using sustainable and resilient design principals, the value of its investment would provide almost double the financial costs in social and environmental benefits.*

The value of sustainable and resilient infrastructure site development by the City (in today's dollars) is estimated to be $4,504,768; a cost of $5,340,600 to the City, with social benefits of $9,014,834 and environmental benefits of $830,534.

Value of Sustainable and Resilient Site Infrastructure Development by City

Financial Benefit		Social & Environmental Benefits		Total Value
($5,340,600)	+	**$9,845,368**	=	**$4,504,768**

Note: A negative number refers to a cost associated with the development.

Source: Autocase™

6.2.2 Site Redevelopment Concept

The Scenario 2 conceptual plan includes site improvements to the Booker Creek catchment area, among other items. For modeling purposes, the analysis assumes a start date of 01/01/2020, with a three-year planning phase, a three-year construction phase and a 28-year operational phase.

The following financial, social and environmental model impact types were identified:

- Costs
  - Capital expenditures,
  - Carbon emissions from concrete,
  - Operations and maintenance, and
  - Heat island effect.
- Benefits
  - Air pollution and carbon reduction from vegetation,
  - Recreational value,
  - Flood risk,
  - Water quality,
  - Property value, and
  - Residual value of assets.

A comparison of the existing conditions (stadium and parking lot) and the proposed redevelopment consistent with the Tropicana Field Site Redevelopment Plan was conducted using Autocase™. The proposed redevelopment scenario includes the following infrastructure items that would be implemented by the City to support enhanced sustainability and resiliency within the site:

- Storage systems,
- Impervious surfaces,
- Retention/detention,
- Water conveyance,
- Roofing systems,
- Infiltration practices, and
- Landscaping practices.

6.2.3 Financial Considerations

The costs to include sustainable and resilient infrastructure enhancements in future capital projects can be reduced if specific goals are included early in the horizontal and vertical design process (it is costlier to include as the design process progresses). As the Tropicana Field Site is publicly owned, there is a higher level of control that can be specified within future development specifications. The following financial considerations associated with site redevelopment should be considered by the City:

- **LEED™ Standards**

  The City has identified its policy desire to meet LEED™ Gold or higher standards in future public capital improvement projects in response to its adopted Sustainability & Resiliency City Facility Building Ordinance. It is estimated that adding enhanced sustainability and resiliency standards can add 5-15% premium to overall costs of a project if the sustainability design goals are included in early initial design phases. The return on investment is realized in reduced lifecycle, operations and maintenance costs savings over time.

- **Strategic Action Plan**

  Delivery of horizontal improvements envisioned with the redevelopment plan will require design assessment and cost estimation to adequately plan for the phased delivery of public services. A strategic action plan is a preliminary engineering design (15%) approach during which base data collection and initial engineering assessments are completed. At a high level, the results of these assessments provide the City with phasing requirements and alternatives that can serve as basis of design for developer invitation to participate process, and/or City budgeting for final design, permitting, site preparation and final construction of improvements. Estimated costs range $200,000 to $250,000 for a Strategic Action Plan, depending upon level of base data availability.

- **Brownfield Remediation**

  The City property has a previously identified brownfield contamination existing east of the existing stadium that was from a former operations of a manufactured gas plant operations from 1914 to 1962. Engineering controls including, asphalt parking lot, stormwater pond liner and concrete bulkhead barrier by Booker Creek were constructed and Florida Department of Environmental Protection (FDEP) issued a conditional site rehabilitation completion order in 2016. A restrictive covenant was placed on portions of the property that are anticipated to be redeveloped. As such, it may be anticipated that additional site assessment and remediation may be required as part of site demolition and preparation actions. Phasing of the investigation and any remediation may affect the overall site developability and schedule to market. Costs can vary substantially.

› **Sustainable Drainage Solutions**

Efficient use of pavement areas for localized stormwater infiltration will be important in the site redevelopment. The increased public realm pedestrian spaces (e.g. sidewalks, trails, plazas, parking spaces, etc.) can add to the urban experience by creating pervious infiltration areas under suspended pavement systems and tree wells. Accommodating additional areawide stormwater volume and treatment will provide an economic incentive to private parcel area development. The Scenario 2 conceptual design anticipates an urban city block development that will maximize vertical development at build-to-lines along public right-of-way.

› **Complete Streets**

The City is implementing complete street designs in their capital improvement program. The Tropicana Field Site Redevelopment will benefit from an inter-connected street network where operations enable safe access to all users, including pedestrians, bicyclists, motorists, and transit users of all ages. The inclusion of widened sidewalks, bike lanes, on-street parking spaces, and narrowed pedestrian crossings advance safety ideals. City provided data estimated $275,000 per 100 feet for a 100 feet wide right-of-way condition that is like most proposed street conditions in the redevelopment. Signalization, stormwater, bridges, and other design elements would be additional costs.

6.3 Value of Efficient Building Design and Construction by Developers

The benefits of green infrastructure investment vary across building typologies, locations, and ultimately the final design of improvements. The City's policy to meet LEED^{TM} Gold standards or higher in future municipal projects (Sustainability & Resiliency City Facility Building Ordinance) is a significant goal that was applied to *all* development within the Tropicana Field site for analysis purposes. In addition, the analysis assumes a start date of 01/01/2020, with a three-year planning phase, a three-year construction phase and a 28-year operational phase. This section includes a summary of the sustainable and resilient building design and construction analysis and findings and an overview of findings for each of the building types analyzed.

Sustainability & Resiliency City Facility Building Ordinance

The City has adopted the Sustainability & Resiliency City Facility Building Ordinance, which in addition to requiring that capital and operational budgets prioritize resiliency upgrades as a measure for reducing long-term risk, requires that new construction or significant redevelopment of City building projects 5,000 square feet and over are required to achieve LEED^{TM} Gold or higher certification. The certification will help support energy efficiency standards in new municipal building construction and operation.

6.3.1 Summary of Analysis and Findings

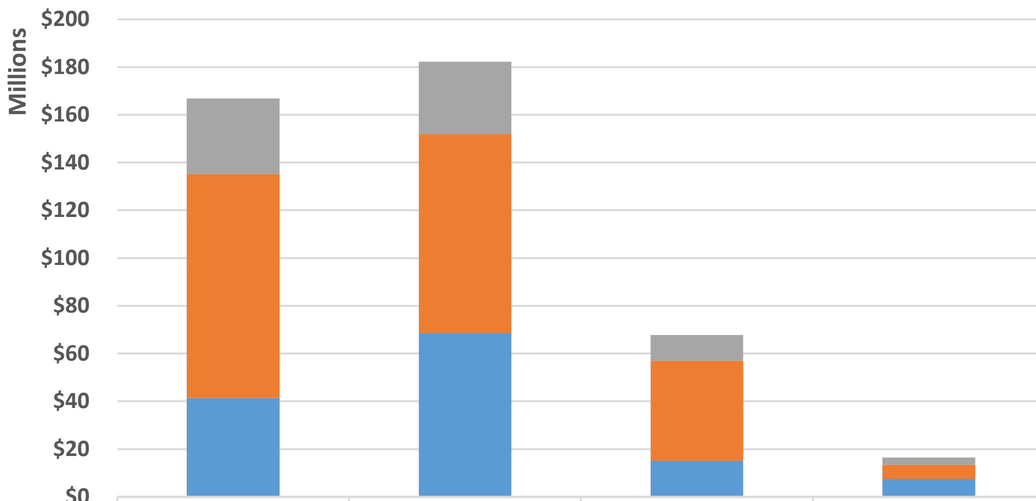
A summary of the analysis of the buildings and findings include:

- Approximately 20 buildings are included in the conceptual plan and the analysis considered all the types (office, residential, institutional and retail) to determine the costs vs. benefits.
- At this stage of the conceptual planning, the building construction costs are not known, therefore (aside from the rental premium that would be paid from the occupant to the owner), this is a pure benefits analysis. Construction cost premiums associated with a LEED^{TM} certification could range from 5% to 15% higher than conventional methods.
- Analysis compared the value of designing and constructing buildings in the district to minimum code requirements vs. a more stringent LEED Gold standard (like requirements for City facilities).
- The higher building standards include the following factors:
    - Optimization of energy performance
    - Renewable energy production
    - Daylighting and interior lighting
    - Low emitting materials
    - Quality views
    - Thermal comfort
    - Indoor air quality management
    - Reduction of indoor water use
    - Bicycle facilities

- The analysis shows that if developers are required to build to the higher standards, over $430 million of value can be created from financial, social and environmental perspectives.
- The largest financial benefits of implementing higher building standards in the district would be utility cost savings of over $250 million for building occupants over the course of 25 years of operation. There would also be significant positive effects on occupant health and productivity because of investments in indoor environmental quality.
- These operational benefits would be slightly offset by higher rent that could be charged by the owner due to the higher building performance – estimated at approximately $133 million over 25 years.
- From an environmental perspective, the value of carbon emissions reductions associated with the higher standards would reach approximately $64 million.
- *If the City requires that buildings are designed and constructed to the same high standards as City facilities are, then developers, occupants and the community would realize benefits of over $430 million, including:*
    - *Approximately $133 million in increased rents to the developers/owners,*
    - *Approximately $250 million in operational cost savings (utility costs) to occupants, and*
    - *Approximately $75 million in social and environmental benefits to the community (primarily from the reduction in carbon emissions).*

Figure 6-1 depicts the consolidated net present value benefit for stakeholder and building type in lifetime values.

Figure 6-1 **Net Present Value of Sustainable and Resilient Building Design and Construction by Building Type**



	Office	Residential	Institutional	Retail
Community	$31,587,580	$30,282,774	$10,904,006	$3,068,767
Occupant	$93,711,850	$83,291,831	$41,698,560	$6,007,266
Owner	$41,562,225	$68,603,713	$15,248,883	$7,421,825

Source: Autocase™

Additionally, a sample parcel development for the Office (Parcel 1) and Residential (Parcel 20) building types/uses were included as the uses represent most of the proposed development program. A summary report is provided for each in **Attachment 2**, and they are described in Sections 6.3.1 and 6.3.2, respectively.

6.3.1 Office Building Types

The conceptual site plan includes 2,800,000 gross square feet of Office and/or Hotel uses in regularly occupied floor space. For modeling purposes, the analysis assumes a start date of 01/01/2020, with a three-year planning phase, a three-year construction phase and a 28-year operational phase.

The total value of sustainable and resilient office building design and construction by the developer (in today's dollars) is estimated to be $166,861,655, with $78,424,334 in financial benefits, and $88,437,321 in social and environmental benefits to the community.

Value of Green Office Building Design and Construction - Districtwide

Financial Benefit		Social & Environmental Benefits		Total Value
$78,424,334	**+**	**$88,437,321**	**=**	**$166,861,655**

Source: Autocase™

The conceptual redevelopment plan Parcel 1 (see **Figure 3-2** and **Attachment 3**) is located at the SW corner of 1st Avenue South and 8th Street South. It is an approximately 1.8-acre parcel that is anticipated to be easily brought to market it is currently unimproved surface parking, and street and utility infrastructure exists nearby. The assessment of Parcel 1 included additional site and building infrastructure design assumptions. The present value of benefits would be $1.48 million for the owner (primarily from rental premiums), $2.28 million for the occupant (primarily from reduced electricity costs and enhanced employee productivity), and $.92 million for the community (primarily from reduced carbon emissions).

Value of Green Office Building Design and Construction – Parcel 1

Financial Benefit		Social & Environmental Benefits		Total Value
$1,738,184	+	**$2,950,294**	=	**$4,688,478**

Source: Autocase™

6.3.2 Residential Building Types

The conceptual plan includes 3,200,000 gross square feet (i.e. 3,000 units) gross square feet of Residential uses in regularly occupied floor space. For modeling purposes, the analysis assumes a start date of 01/01/2020, with a three-year planning phase, a three-year construction phase and a 28-year operational phase.

The total value of sustainable and resilient office building design and construction by the developer (in today's dollars) is estimated to be $177,898,024, with $119,277,2019 in financial benefits, and $58,670,815 in social and environmental benefits to the community.

Value of Green Residential Building Design and Construction - Districtwide

Financial Benefit		Social & Environmental Benefits		Total Value
$119,277,209	+	**$58,670,815**	=	**$177,898,024**

Source: Autocase™

The conceptual redevelopment plan's Parcel 20 (see **Figure 3-2** and **Attachment 3**) is located at the NW corner of 5th Avenue South and 16th Street South. It is an approximately 2.5-acre parcel that is anticipated to be easily brought to market as it is currently surface parking lot, and street and utility infrastructure exists nearby. The assessment of Parcel 20 included additional site and building infrastructure design assumptions and thereby depicts increased net present value benefits. The present value of benefits would be $6.4 million for the owner from rental premiums, $6.1 million for the occupant (primarily from reduced electricity and water costs), and $2.8 million for the community (primarily from reduced carbon emissions).

Value of Green Residential Building Design and Construction – Parcel 20

Financial Benefit		Social & Environmental Benefits		Total Value
$13,194,586	+	**$2,202,040**	=	**$15,396,626**

Source: Autocase™

6.3.3 Institutional Building Types

The conceptual plan includes 1,000,000 gross square feet of Institutional use in regularly occupied floor space. For modeling purposes, the analysis assumes a start date of 01/01/2020, with a three-year planning phase, a three-year construction phase and a 28-year operational phase.

The total value of sustainable and resilient office building design and construction by the developer (in today's dollars) is estimated to be $64,100,582, with $20,523,914 in financial benefits, and $43,576,668 in social and environmental benefits to the community.

Value of Green Institutional Building Design and Construction

Financial Benefit		Social & Environmental Benefits		Total Value
$20,523,914	+	**$43,576,668**	=	**$64,100,582**

Source: Autocase™

6.3.4 Retail Building Types

The conceptual plan includes 500,000 gross square feet of Retail / Entertainment / Cultural uses in regularly occupied floor space. The triple bottom line CBA assesses financial, social and environmental impacts of achieving LEED™ credits for this project. For modeling purposes, the analysis assumes a start date of 01/01/2020, with a three-year planning phase, a three-year construction phase and a 28-year operational phase.

The total value of sustainable and resilient office building design and construction by the developer (in today's dollars) is estimated to be $15,879,028, with $5,950,470 in financial benefits, and $9,928,558 in social and environmental benefits to the community.

Value of Green Retail Building Design and Construction

Financial Benefit		Social & Environmental Benefits		Total Value
$5,950,470	+	**$9,928,558**	=	**$15,879,028**

Source: Autocase™

6.4 Recommendations

A triple-bottom line life cycle cost analysis approach, like the one presented in this chapter, should be considered when developing design guidance or principles for the Tropicana Field site. Based on the analysis presented in this chapter, it is recommended that the City of St. Petersburg implement the following measures:

1. Maximize sustainable and resilient infrastructure development within the public spaces of the Tropicana Field site to enhance the stormwater capacity of the district, reduce flood risks and provide recreational value to the community. Social and environmental benefits would nearly double the financial investment the City would make in stormwater storage systems, retention/detention, water conveyance, infiltration practices and landscaping.

2. Incorporate green building design and construction requirements in the district, like the LEED Gold standards prescribed in the Sustainability & Resiliency City Facility Building Ordinance. Benefits to the developer/owners would be realized in rental premiums, and occupants in all building types would realize significant financial benefits (even with the rental premiums) through lower utility costs. Requiring higher building standards in the Tropicana Field site would be consistent with the City's ISAP and would implement the Clean Energy Roadmap.

ATTACHMENT 1: SMART MOBILITY MODEL ANALYSIS RESULTS

The VHB Smart Mobility Model analyzes two "tiers" of data, and both are evaluated with available data from the Center for Disease Control and Prevention's (CDC) 500 Cities Project. The 500 Cities data and the scores for the Smart Mobility Model tiers are depicted in **Figures A.1-1 through A.1-3**. Lower scores indicate areas of poor health conditions and are shown in orange and red. Higher scores indicated areas of better health conditions and are shown in green.

500 Cities datasets utilized in the analysis include estimated rates for asthma, diabetes, Coronary Heart Disease (CHD), high blood pressure (HBP), obesity, stroke, and Chronic Obstructive Pulmonary Disease (COPD). As depicted in **Figure A.1-1**, the 500 Cities data identifies the census tracts surrounding and south of the Tropicana Field site as the areas with the highest estimated incidents of composite health issues.

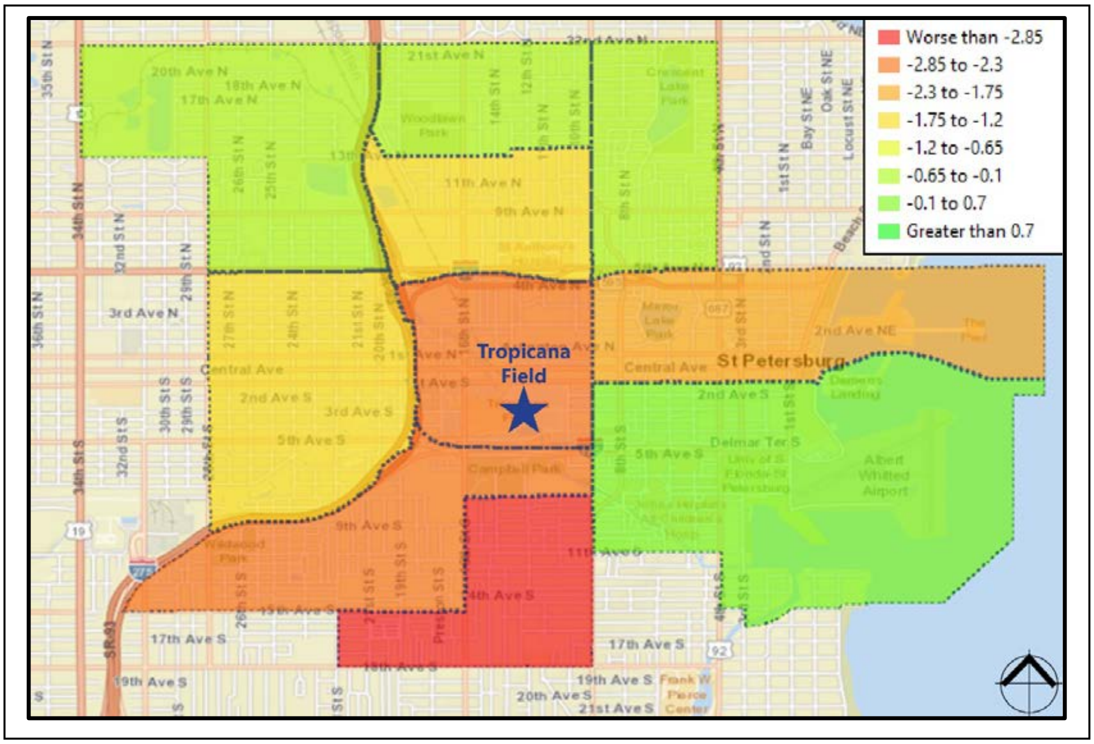


Figure A.1-1 Study Area – 500 Cities Data

The first level (Tier 1) is intended to identify areas of concern or areas of opportunity. Tier 1 is based on available census and demographic data. This data is readily available and identifies at risk populations and census tracts. Tier 1 factors included in the analysis include poverty and income, educational attainment, unemployment, commute times and mode share, and population density. Like the 500 Cities data, the Tier 1 analysis identifies the same areas surrounding and south of Tropicana Field as the most at-risk census tracts within the Study Area. Each demographic factor was given a score and the combined score is depicted in **Figure A.1-2** below.

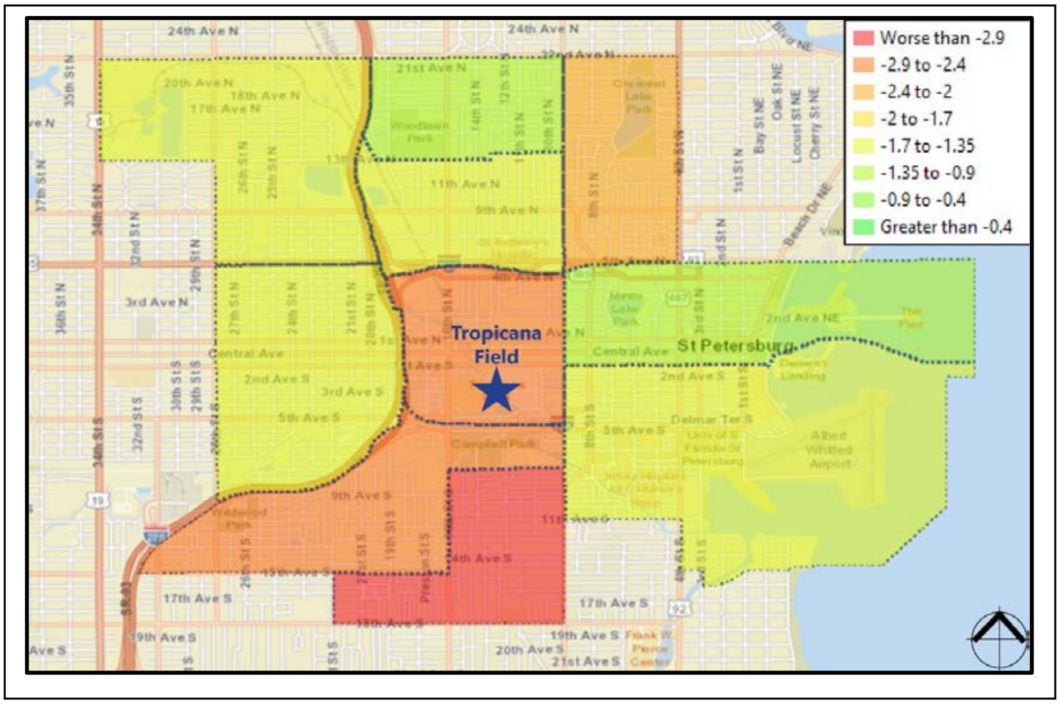


Figure A.1-2 Study Area – Smart Mobility Tier 1

The second level (Tier 2) is intended to identify opportunities to provide improvements within the Study Area, and prioritize which improvements have the strongest correlation to improved health outcomes in each Study Area. Unlike Tier 1, Tier 2 is based on a desktop or field analysis to identify existing public realm and mobility network factors, including:

- Presence of Sidewalks, Bike Facilities, Electric Vehicle Charging Stations, and a Bike Share Program
- Number of Road Lanes
- Block Length
- Presence of On-Street Parking
- Location of Off-Street Parking, either in front of building (i.e. conventional suburban development model), or behind building (i.e. new urbanism development model)
- Public Realm with a Destination (e.g. Park or Civic Building) acting as a Visual and/or Physical Terminus
- Percent of Households within Walking Distance (½-Mile) of Grocery Stores, Health Care, and Schools

Like the 500 Cities data and Tier 1, the Tier 2 analysis identifies the same areas surrounding and south of Tropicana Field as the census tracts with the highest potential for health issues within the Study Area. The following section summarizes the results of the analysis. To map Tier 2, and to complete an analysis of the total mobility network, a combined Tier 2 score has been determined. Each mobility factor has been given a score and the combined score is depicted in **Figure A.1-3** below.

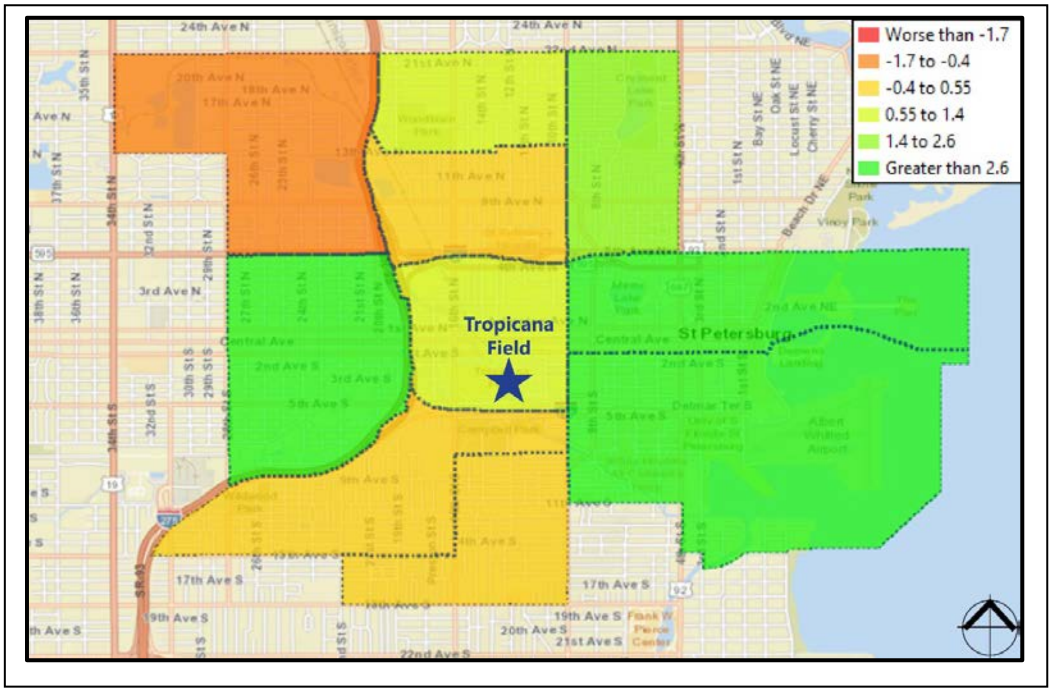


Figure A.1-3 Study Area – Smart Mobility Tier 2

To determine the strongest correlations between Smart Mobility Model factors and chronic health diseases, an Ordinary Least Squares (OLS) regression analysis was conducted using the tools available in GIS. To properly run the OLS analysis, census tracts outside of the primary Study Area were required. Therefore, regression analysis includes a total of 38 census tracts in St. Petersburg.

The OLS analysis provided T-scores for each correlation. The higher the T-score, the stronger the correlation. A T-test over one (1) represents a significant correlation, shown in **bold** in **Table A.1-1** below. Any T-score over 2 represents a very strong correlations between the mobility factor and the health outcome. The sign of the T-score indicates the type of correlation. For example, a T-score of -2.02 for percentage of households within walking distance of a grocery store related to diabetes means that as the percentage of households increases, the incidence of diabetes decreases.

Table A.1-1 T-Test Results – Smart Mobility Model Tier 2

Mobility Factor	Diabetes	CHD	HBP	Obesity	Asthma	High Cholesterol	COPD	Average T-Factor
Sidewalks	-0.04	-1.23	-0.55	0.45	0.70	-0.69	-0.80	-0.31
Bike Facilities	-0.65	0.28	-0.05	-0.99	-0.99	**-1.25**	0.00	-0.52
Road Lanes	-0.15	-0.12	0.46	0.10	0.45	-0.37	-0.24	0.02
Block Length	0.89	**1.21**	0.30	0.14	-0.54	0.87	**1.11**	0.57
On-Street Parking	-0.02	**1.13**	0.90	-0.73	-0.82	**1.49**	0.36	0.33
Off-Street Parking	**-2.21**	**-1.64**	**-1.73**	**-1.37**	**-1.07**	-0.67	**-1.76**	**-1.49**
EV Charging	-0.90	0.73	-0.54	**-2.49**	**-2.14**	0.30	-0.43	-0.78
Bike Share	**1.93**	0.08	**1.49**	**2.40**	**2.47**	-0.63	0.24	**1.14**
Destination Terminus	**-1.04**	-0.78	-0.50	-0.54	-0.02	0.50	**-1.12**	-0.50
Parks	0.00	-0.03	0.56	0.71	0.28	**1.52**	**-0.40**	0.38
Health Care	**-1.83**	-0.82	**-1.97**	**-1.89**	**-2.05**	0.08	**-1.08**	**-1.37**
Grocery Store	**-1.82**	**-2.49**	**-2.28**	**-1.12**	-0.86	**-1.21**	**-2.41**	**-1.74**
Schools	0.90	**1.10**	**1.30**	**1.31**	**1.38**	0.30	**1.39**	**1.10**

In addition to the OLS analysis run in GIS for each individual mobility factors, an analysis of the combined Tier 2 Smart Mobility Model score was completed to determine the correlation between the combined Smart Mobility Model factors, representing the built environment, and provided the R-squared values shown in **Table A.1-2**. This analysis indicated a strong correlation between the Smart Mobility Model factors and diabetes, Obesity, Asthma, and COPD.

Table A.1-2 R-Squared Results – Smart Mobility Model Tier 2

	Diabetes	CHD	HBP	Obesity	Asthma	High Cholesterol	COPD
R-Squared Value	0.83	0.54	0.76	0.90	0.88	0.72	0.80

These analysis findings shown in **Tables A.1-1 and A.1-2** are similar with other Tier 2 analyses that have been conducted using the Smart Mobility Model. Previous analysis of corridors in Orlando and Tampa showed significant or "borderline" significant correlations between chronic health diseases and the following mobility factors: the number of lanes of main street; location of off-street parking; presence of E.V. charging stations; presence of bicycle lanes; and, percent of households within walking distance of a grocery store.

As planners and designers, we believe the public realm and mobility network impacts a community's health. The analysis completed for the Study Area, in addition to a similar analysis in other cities, have showed there are strong correlations between mobility factors and chronic health diseases.

ATTACHMENT 2: AUTOCASE™ ANALYSIS OUTPUTS

Tropicana Field Redevelopment

Results Reporting

Prepared by Impact Infrastructure
June 2019

1. Introduction

Vanasse Hangen Brustlin (VHB) and Impact Infrastructure, makers of Autocase, have partnered to produce a set of analyses around the proposed redevelopment of the Tropicana Field site in St. Petersburg, Florida, an 85-acre section of downtown seen in Figure 1. This captures what the City of St. Petersburg calls Scenario 2, where no replacement MLB Stadium is constructed, and focuses on the financial, social and environmental impacts and outcomes as a result of this planning scenario.

In this analysis, the suite of Autocase software was leveraged to evaluate both the buildings and site designs shown in Figure 2. The buildings set was segmented by building type to capture the large-scale impacts of the overall development plan. These building types were institutional, retail, residential and office. The site design aspects analyzed include the surface type choices, street greening aspects, as well as the communal area with a pond and the stream restoration leading into it.

Details on methods, data inputs, and assumptions driving the analysis conducted for this report are provided in Appendices A and B. The analyses presented here assume a 3-year construction duration beginning in 2020, followed by a 25-year operations duration to calculate the benefits. These future returns are discounted into current day dollars, generating values termed net present value (NPV). Displayed in Table 2 are a list of impacts assessed in the project using a triple bottom line - cost benefit analysis (TBL-CBA), described in more detail below. Appendices C and D provide parcel-specific analyses of office and residential buildings, respectively.

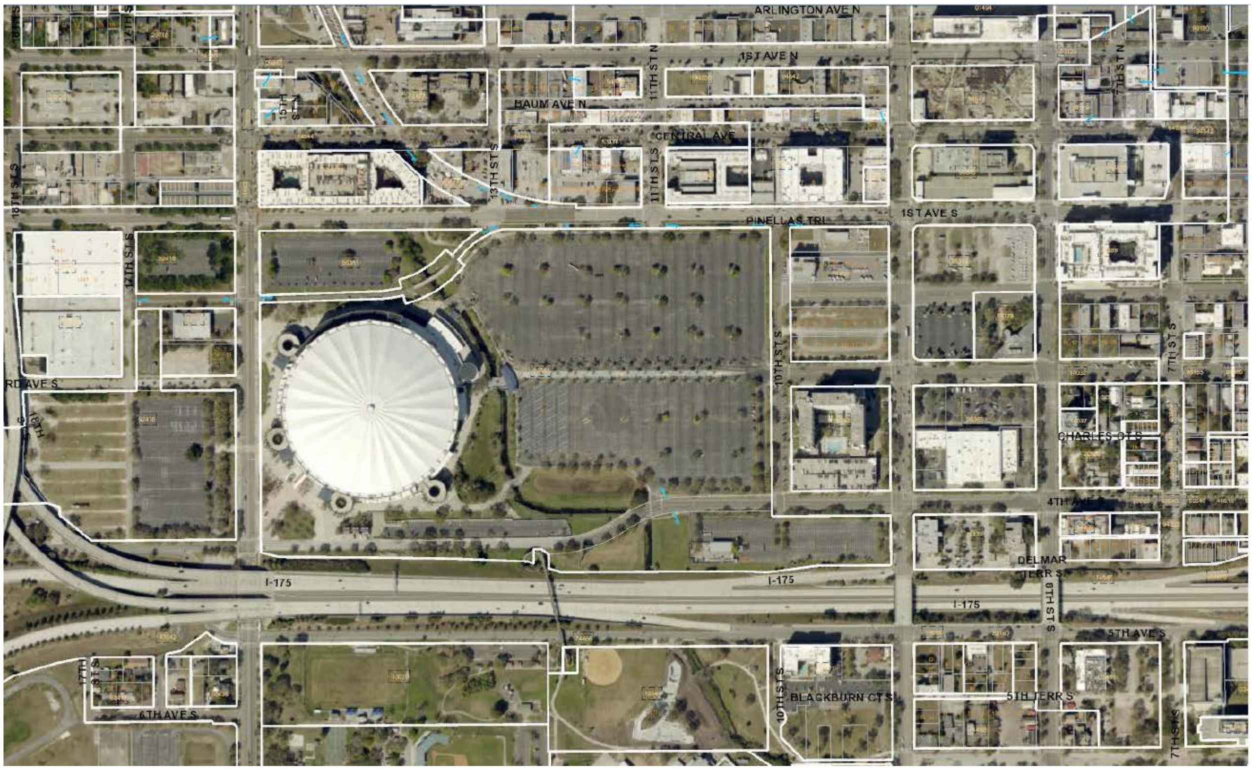


Figure 1: Tropicana Field Site Aerial Photo

Figure 2: Tropicana Field Site Proposed Master Plan

2. The Triple Bottom Line Cost Benefit Analysis (TBL-CBA) Methodology Process

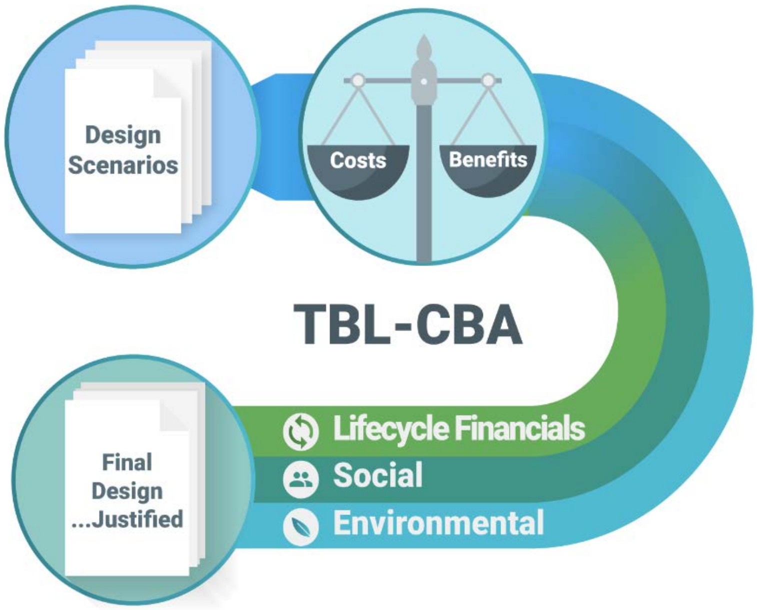


Figure 3 - Triple Bottom Line Cost Benefit Analysis (TBL-CBA) Framework

TBL-CBA is a systematic, evidence-based economic business case framework that uses best practice Life Cycle Cost Analysis (LCCA) and Cost Benefit Analysis (CBA) techniques to quantify and attribute monetary values to the Triple Bottom Line (TBL) impacts resulting from an investment. TBL-CBA expands the traditional financial reporting framework (such as capital expenditure and operations and maintenance costs) to consider social and environmental performance. TBL-CBA provides an objective, transparent, and defensible economic business case approach to assess the costs and benefits pertaining to the project being analyzed.

Autocase is an automated, cloud-based software that conducts TBL-CBA to assess the impacts of infrastructure investments, building design, and policy guidelines. This process involves translation of project details into its various effects, as well as subsequent quantification and monetization of those effects and outcomes. TBL-CBA evaluates these impacts through the lens of alternatives, compared to a base case, thus providing results that are incremental and relative. Both benefits and costs are expressed in monetary units, discounted to present value terms, which allows for an evaluation of different alternatives with a variety of attributes using a common measure.

3. Buildings Benefits Analysis Results

The building set in the plan is estimated to contain 7.5 million square feet of floorspace across the four different building types. As part of the development plan, institution of a higher standard for building performance is being considered, and this analysis considers the benefits associated with the policy mandate. As cost estimates were not available at this early stage in the process, the following values demonstrate the pure benefits some of the building level adjustments necessary to reach this benchmark.

Table 1: Building Stock Square Footage Breakdown

Building Type	Square Feet
Office/Hotel	2,800,000
Residential	3,200,000
Retail/Entertainment/Cultural	500,000
Institutional	1,000,000
Total Building Stock	**7,500,000**

The Autocase software has a LEED specific module which generates business cases tied directly to the categories in LEED v4 and points achieved in those categories. This evaluation was run, with some small variation across the four building categories based on the building type limitations, with each group maximizing the possible points in the categories shown in Table 2. The resulting analysis covers 39 LEED points across 10 categories, with some aspects of the Sustainable Sites section of LEED v4 additionally covered in the site level analysis.

Table 2 – LEED Category Credit Details

LEED v4 Category	Points Achieved	Category Details
Optimize Energy Performance	18	50% from baseline
Renewable Energy Production	3	10% of energy cost must be offset
Daylighting	3	75% of floorspace is daylit
Interior Lighting	2	90% of interior spaces have lighting controls 75% of total connected light load is high-efficiency
Low Emitting Materials	3	6 compliant categories
Quality Views	1	75% of occupied floor area has a view of the outdoors
Thermal Comfort	1	Design HVAC systems to meet ASHRAE standard 55-2010
Construction Indoor Air Quality Management Plan	1	
Indoor Water Use Reduction	6	50% reduction from baseline
Bicycle Facilities	1	
Total Points Analyzed	**39**	

Figure 4 shows the total benefits accrued across the building typologies, which comes to over $430 million through the 25 years of operation. The bulk of these benefits are financial savings of various types, which make up almost 58 percent of the benefits assessed. These financial aspects are trailed by the social and environmental benefits, with the social ones making up 27 percent of the total.

These benefits are segmented by stakeholder attribution in Figure 5, demonstrating the value provided by the project to either owner, occupant or community. The two figures provide an interesting comparison of the discrepancy between impact type and stakeholder impacted; the occupants accrue a large amount of the financial benefits, while a segment of the social impacts are attributed to the community at large. The building occupants are the largest benefit recipients, receiving over half of the total value, speaking to the variety of building improvements aimed at the indoor environment as part of the LEED Gold standard.

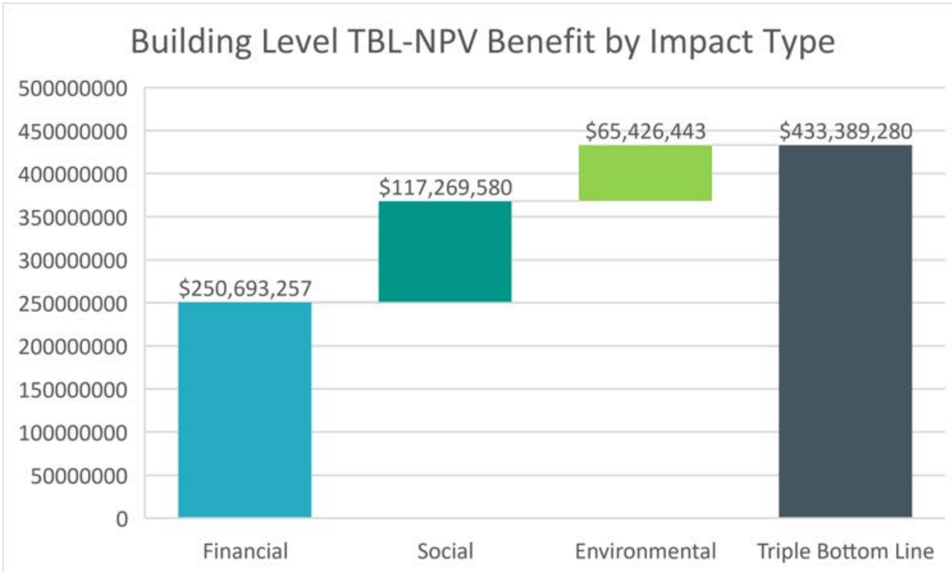


Figure 4 – TBL-NPV Breakdown by Impact Type

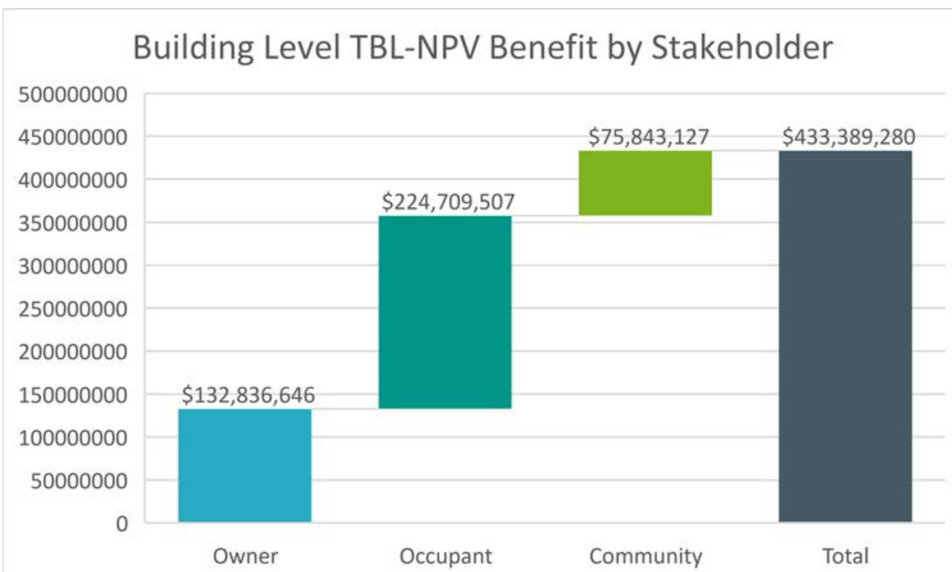


Figure 5 – TBL-NPV Breakdown by Stakeholder

Table 3 shows the detailed breakdown of the four building types and their aggregated benefits in each category, impact type and the TBL-NPV overall. The dominant factor in the benefits analysis is the utility bill savings that come along with the energy consumption reduction associated with the Optimize Energy Performance credit. The $200 million plus in financial savings accounts for around 47 percent of the total benefit number, representing most of the occupant benefit as well. Also of note in the financial impacts are the rental premium benefits transfers, with around $132 million changing hands from the occupants to the owners. this is tied to rent increases associated with LEED certification and serves as a proxy for the added property value. A benefits transfer implies that while the owner receives a benefit in terms of an inherent increase in property value, the occupant receives an equal disbenefit in terms of a higher rent, thereby nullifying the outcomes in our TBL analysis.

The building typology differences are heavily influenced by total square footage, however some variation between buildings types exists. For example, the residential building type accounts for nearly 43 percent of the total square footage of the building portfolio but over 53 percent of the electricity savings. This discrepancy is captured through Autocase's database of sources and is based on a higher average energy use intensity from residential spaces. Similar comparisons across building types and cost/benefit categories are captured throughout the analysis, providing nuanced insights into the value added by the portfolio level mandate.

Table 3 – Building Stock TBL Benefits Analysis Results

Triple Bottom Line of the Case Studies							
Stakeholder	Impact Type	Cost/Benefit	Buildings Office Value	Institutional Value	Residential Value	Retail Value	Total Value
Occupant	Financial	Financial Savings from Electricity	$68,409,645	$19,569,325	$109,168,733	$6,305,871	$203,453,574
Occupant	Financial	Financial Savings from Natural Gas	$5,980,815	$931,046	$6,668,125	$341,586	$13,921,572
Occupant	Financial	Financial Savings from Water	$4,033,874	$3,574,054	$25,324,447	$385,736	$33,318,111
Owner	Financial	Rental Premium to Owner	$41,562,225	$15,248,883	$68,603,713	$7,421,825	$132,836,646
Occupant	Financial	Rental Premium to Occupant	-$41,562,225	-$15,248,883	-$68,603,713	-$7,421,825	-$132,836,646
Occupant	Social	Cycling Health Benefits	$10,123,679	$5,822,899	$0	$1,150,418	$17,096,996
Occupant	Social	Employee Absenteeism	$4,606,375	$2,682,301	$2,665,117	$523,451	$10,477,244
Occupant	Social	Occupant Health	$10,880,978	$6,209,024	$6,005,734	$1,186,427	$24,282,163
Occupant	Social	Employee Productivity	$31,238,709	$18,158,794	$2,063,388	$3,535,602	$54,996,493
Community	Social	Vehicle Usage	$6,178,323	$3,536,280	$0	$702,081	$10,416,684
Community	Environmental	Air Pollution	$474,804	$181,662	$398,907	$50,542	$1,105,915
Community	Environmental	Carbon Emissions	$24,885,875	$7,143,158	$29,646,605	$2,311,500	$63,987,138
Community	Environmental	Social Value of Water	$48,578	$42,906	$237,262	$4,644	$333,390
	Financial NPV		$78,424,334	$24,074,425	$141,161,305	$7,033,193	$250,693,257
	Social NPV		$63,028,064	$36,409,298	$10,734,239	$7,097,979	$117,269,580
	Environmental NPV		$25,409,257	$7,367,726	$30,282,774	$2,366,686	$65,426,443
	Triple Bottom Line NPV		$166,861,655	$67,851,449	$182,178,318	$16,497,858	$433,389,280

4. Sites TBL-CBA Analysis Results

The horizontal infrastructure aspects of Scenario 2 serve a wide variety of purposes, including flood risk mitigation, recreational opportunity and urban heat island effect. The proposed set of green infrastructure investments covers 37 acres, with the vegetated sections of managed turf and buffer strips augmented by a large intervention of porous concrete. For the purposes of stormwater management - several retention/detention areas are planned, highlighted by the large recreational pond that sits at the low-point of the site, shown in Figure 6.

Figure 6 – Green Infrastructure Section of Master Plan

Figure 7 shows the impact breakdown of the TBL-CBA outcomes by impact category, visualizing the offsetting of the initial and ongoing expenditures by the social and environmental benefits. Autocase has cost estimation capabilities associated with green infrastructure interventions, and as such the site level analysis allows us to analyze the balance between costs and benefits attributable to the project. The total investments into green infrastructure accumulates to roughly $5.5 million over the project life-cycle. This analysis is a comparison of the Master Plan to a “do-nothing” scenario that has no financial outlay. Thus, all the financial expenditures associated with Scenario Two are absolute.

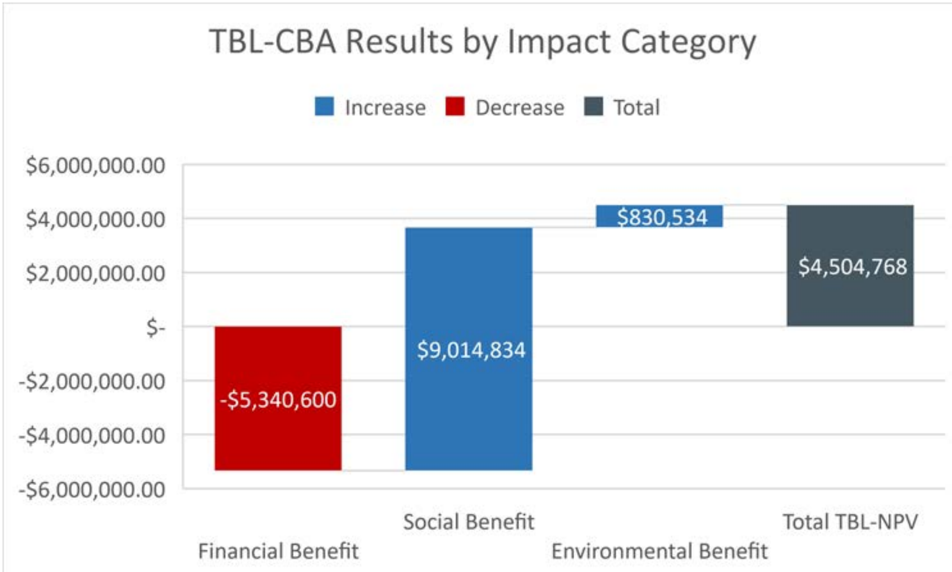


Figure 7 – TBL-CBA Impact Category Breakdown

Table 4 shows the detailed breakdown of the site level analysis. The financial costs are split between capital expenditure, operations and maintenance as well as replacement costs. The ranges on the values are intended to capture uncertainty around the impacts over time and in the available literature, with the total TBL-NPV benefits being unanimously positive as a very good sign that the project is value adding.

These financial costs are outpaced by a substantial social return, as the site project's improvements are largely aimed at social benefit, accruing to the people of the St. Petersburg area at large. The ability for visitors to enjoy the space in a variety of ways, such as dog walking, running or attending events, is a stark change from the unidimensional site in the base case, resulting in large benefits to the St. Petersburg community in terms of recreational benefits.

Another major factor in the social benefits is the flood risk mitigation as a result of the larger set of green infrastructure on site. Despite the relatively poor soil quality, the large increase in vegetated area provides substantial infiltration capability. This reduction in stormwater flow provides a buffer for flooding, that allows for the prevention of property damages in the nearby floodplain area. Further, the seepage of water in vegetated and porous areas allows for the reduction in runoff water and therefore a decrease in the pollutant load flowing in the larger water system.

Table 4 – Site Level TBL-CBA Analysis Breakdown

Category	Impact Name	Mean Value	Low	High
Financial	Capital Expenditures	($2,460,000)	($3,830,034)	($1,525,318)
Financial	Operations and Maintenance	($2,880,000)	($4,575,007)	($1,440,140)
Financial	Replacement Costs	($73,900)	($407,895)	$0
Financial	Residual Value of Assets	$73,300	$32,737	$132,740
Social	Shadow Wage	$77,600	$44,403	$123,120
Social	Flood Risk	$3,094,145	$3,094,145	$3,094,145
Social	Property Value	$238,254	$237,516	$238,874
Social	Recreational Value	$4,795,846	$4,252,374	$5,448,013
Social	Heat Island Effect	$808,988	$642,371	$1,001,315
Environmental	Water Quality	$609,761	$609,761	$609,761
Environmental	Air Pollution Reduced by Vegetation	$184,861	$115,796	$250,876
Environmental	Carbon Reduction by Vegetation	$35,913	$15,507	$61,059
Financial Benefit		**($5,340,600)**	**($8,780,199)**	**($2,832,718)**
Social Benefit		**$9,014,834**	**$8,270,809**	**$9,905,468**
Environmental Benefit		**$830,534**	**$741,064**	**$921,695**
Total TBL-NPV		**$4,504,768**	**$231,674**	**$7,994,445**

5. Combined Master Plan Benefits Analysis Results

To capture the total TBL benefits of Scenario 2, the buildings level analysis and the sites level benefits analysis, without including the costs, were aggregated to provide an overview of the impacts. The cost estimations from the site analysis were eliminated in the aggregate analysis to ensure consistency, across the two analyses. The benefits accrued from both the analyses provide an informative benchmark for the project design and implementation process. Figure 8 shows the total benefits of the master plan, attributed by stakeholder category. The largest beneficiary for this project is the building occupants, who are expected to accrue over half of the total anticipated benefits across the total TBL impact types. This large benefits accrual is attributed to the indoor environmental quality benefits from the building's investments and the recreational value as well as avoided flood risk from the site's investments.

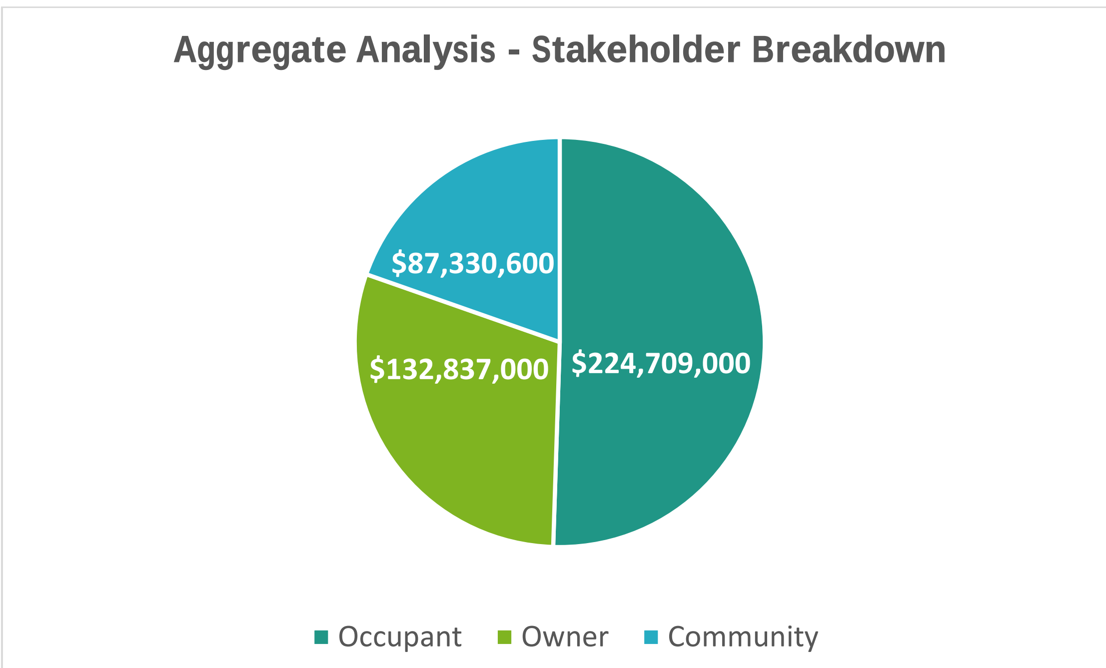


Figure 8 – Aggregate Analysis Stakeholder Breakdown

Table 5 shows the detailed and aggregated benefits, broken down by category, impact and stakeholder. The proposed redevelopment strategy accrues over $250 million in financial benefits that are anticipated over the 25-year period, providing a significant incentive to meet the standards set by the LEED Gold mandate. There are substantial social benefits, highlighted by the impacts on building occupants, such as productivity uplift and overall health, and the social benefits to the community generally such as recreation benefits and flood risk mitigation. Stemming from improvements to building efficiency and stormwater management are over $65 million in environmental benefits, almost entirely owing to greenhouse gas emission reductions.

The approximately $445 million in benefits offered by Scenario 2 is a compelling case for consideration of the strategy proposed and provides an important insight into the possible returns. This information should help to better determine the appetite for expenditures in the way of a break-even point for these interventions. It also provides a basis for discussion around the benefits of development strategies, the nature of those benefits, and the parties to which those benefits accrue.

Table 5 – Master Plan TBL-NPV Breakdown

Tropicana Field Aggregate Analysis			
Stakeholder	Impact Type	Benefit Type	Value
Occupant	Financial	Financial Savings from Electricity	$203,454,000
Occupant	Financial	Financial Savings from Natural Gas	$13,922,000
Occupant	Financial	Financial Savings from Water	$33,318,000
Owner	Financial	Rental Premium to Owner	$132,837,000
Occupant	Financial	Rental Premium to Occupant	($132,837,000)
Occupant	Social	Cycling Health Benefits	$17,097,000
Occupant	Social	Employee Absenteeism	$10,477,000
Occupant	Social	Occupant Health	$24,282,000
Occupant	Social	Employee Productivity	$54,996,000
Community	Social	Vehicle Usage	$12,356,000
Community	Social	Flood Risk Mitigation	$3,094,000
Community	Social	Property Value Uplift	$238,300
Community	Social	Recreation Benefit	$4,796,000
Community	Social	Shadow Wage	$77,600
Community	Social	Urban Heat Island Effect	$511,500
Community	Environmental	Air Pollution	$1,291,000
Community	Environmental	Carbon Emissions	$64,023,000
Community	Environmental	Social Value of Water	$333,400
Community	Environmental	Water Quality	$609,800

Financial NPV	$250,694,000
Social NPV	$127,925,400
Environmental NPV	$66,257,200
Triple Bottom Line NPV	**$444,876,600**

Appendix A: Glossary of Terms

A.1 Financial Impacts

Capital Expenditures

Capital expenditure (Capex) is the upfront costs of the project.

Operations and Maintenance Costs

Operations and maintenance (O&M) costs are those that occur yearly throughout the life of the project. Values are discounted to produce a present value of the costs.

Replacement Costs

Elements of an infrastructure project need to be replaced at some point, and feature types have different lifespans, as well as different costs of replacement at the end of their operating lives.

Residual Value

The residual value of an asset or investment refers to the financial benefit arising at the end of the life of a building or study period, for any assets with a remaining useful life.

Financial Savings from Electricity

The estimated financial savings of consuming less electricity, using local utility prices from the Energy Information Administration.

Financial Savings from Natural Gas

The estimated financial savings of consuming less natural gas, using local utility prices from the Energy Information Administration.

Financial Savings from Water

The estimated financial savings of consuming less water, using local water and waste water pricing rates from the American Water Works Association.

Rental Premium

This is the value the occupant pays beyond the base case rent price to be inside a sustainable building. This is a transfer payment between the occupant and the owner therefore the net benefit is zero.

Discounting

A dollar today is not worth the same as a dollar tomorrow. Due to time preference and the growth of capital over time, dollar values of benefits in different years must all be discounted to the same base year.

A.2 Social Impacts

Employee Absenteeism

Improvements in indoor environmental quality such as lighting, ventilation, thermal comfort and sightlines has been found to reduce the amount of days taken off by employees.

Occupant Health

Improvements in indoor environmental quality such as lighting, ventilation, thermal comfort and sightlines has been found to reduce the prevalence of illness for employees and occupants.

Employee Productivity

Improvements in indoor environmental quality such as lighting, ventilation, thermal comfort and sightlines has been found to improve the productivity of employees.

Vehicle Usage

The vehicle usage captures considerations around congestion, vehicle operating costs, and various other community benefits related to a shift in transit mode that reduces the usage of vehicles.

Flood Risk Mitigation

Flood risk is quantified by estimating the percent flood risk mitigated in the city as a result of the project design and is monetized through property value in the town/city.

Recreation Value

Use values can be assigned to the various recreational amenities offered by the environment. Although the protection of public space and the provision of recreational amenities are typically not priced, they nevertheless have significant value to society, and economists have developed sophisticated analytical techniques to derive monetary values for these types of goods.

Urban Heat Island Effect

The Urban Heat Island (UHI) effect compromises human health and discomfort by causing respiratory difficulties, exhaustion, heat stroke, and heat-related mortality.

A.3 Environmental Impacts

Water Quality

The components involved in water quality evaluations involve pollutant loading reduction and the social cost of total suspended solids, nitrogen, and phosphorous.

Social Value of Water

The value of water is determined by both the water use category and region, taking into account regional scarcity and the possible instream and off-stream uses of that water on its journey to its end point.

Carbon Emission Reduction

Reducing electricity, natural gas and water usage as well as newly planted greenery results in the reduction of Carbon being emitted from the grid and the building. The benefit of reduced carbon is monetized by applying the social cost of carbon to the amount of carbon dioxide equivalent emissions reduced.

Air Pollution Reduction

Criteria Air Contaminants (CACs) are air pollutants emitted by combustion engines, which affect the health of people immediately in their vicinity. These pollutants include carbon monoxide (CO), sulphur dioxide (SO2), nitrogen dioxide (NO2), ozone (O3), and particulate matter smaller than 2.5 micrometers (PM2.5). They can be reduced by reducing electricity, natural gas and water usage as well as planting greenery. This reduction is monetized by applying the social cost of each CAC to the amount of CAC emissions reduced.

Social Cost of Carbon and Air Pollutants

The value of economic harm from emitting one ton of the given pollutant. If this pollutant in reduced the environment is better off resulting in a positive benefit.

Appendix B: Inputs and Assumptions

Inputs

Input Name	Value	Description/Unit
General Inputs		
Construction Start Date	01/01/2020	
Construction Duration	3	Years
Operations Duration	25	Years
Project Discount Rate	3	%
Building Inputs		
Building Typology Inputs		
Office	2,800,000	Sf
- Occupant Count	9240	
Residential	3,200,000	Sf
- Occupant Count	6600	
Retail	500,000	Sf
- Occupant Count	1050	
Institutional	1,000,000	Sf
- Occupant Count	5300	
LEED Category Inputs		
Optimize Energy Performance	18	50% from baseline
Renewable Energy Production	3	10% of energy cost must be offset
Daylighting	3	75% of floorspace is daylit
Interior Lighting	2	90% of interior spaces have lighting controls 75% of total connected light load is high-efficiency
Low Emitting Materials	3	6 compliant categories
Quality Views	1	75% of occupied floor area has a view of the outdoors

Thermal Comfort	1	Design HVAC systems to meet ASHRAE standard 55-2010
Construction Indoor Air Quality Management Plan	1	
Indoor Water Use Reduction	6	50% reduction from baseline
Bicycle Facilities	1	
Site Inputs		
Base Case		
Dry Detention Pond	43560	Sq Ft
Unmanaged Turf	453365	Sq Ft
Additional Shrubs	1.5	Acres
Parking Lots	2093144	Sq Ft
Other Concrete	50000	Sq Ft
Additional Trees	0.71	Acres
Design Case		
Green Roof	5.6	Acres
Retention Ponds	3.6	Acres
Dry Detention Ponds	5.4	Acres
Managed Turf	8.8	Acres
Vegetated Buffer Strip	2.5	Acres
Porous Concrete	49856	Sq Ft
Additional Shrubs	5	Acres
Additional Trees	5	Acres
Recreation Visits	20000	Per year

Assumptions

Residential Occupants	2.2 per household	From VHB
Individual vs Group Occupant Spaces	1 individual space per group space	
LEED Benchmarks	Minimum value to reach maximum points in each category	From LEED v4 manual
Soil Type	Soil Type D across entire site	

Appendix C: Office Building Parcel 1 Analysis

June 25, 2019

Autocase

Tropicana Office - Parcel 1 (10 Years)

Lifecycle Financial	+	Social & Environmental	=	Triple Bottom Line
$1,738,184		$2,950,294		$4,688,478

Summary

This project is located in St. Petersburg, FL and has an area of regularly occupied floor space of 100,000 square feet. This triple bottom line, cost benefit analysis (TBL-CBA) assesses the financial, social, and environmental impacts of achieving 10 LEED credits for this project. TBL-CBA is a systematic evidence-based economic business case approach to quantify and attribute monetary values to the direct financial impacts, as well as broader social and environmental impacts. This analysis looks at the costs and benefits, over a 28 year study period, of achieving the following LEED credits: Low Emitting Materials, Construction Indoor Air Quality Management Plan, Interior Lighting, Thermal Comfort, Daylighting, Indoor Water Use Reduction, Bicycle Facilities , Quality Views, Renewable Energy Production, and Optimize Energy Performance. The net presentvalue (NPV) is the principal measure of economic worth and is the triple bottom line result as it combines the financial, social and environmental costs and benefits. A positive NPV indicates that benefits exceed costs. The total NPV of this project was $4,688,478. The NPV results can also be broken out by stakeholder; Owner, Occupant and Community. This project's stakeholder NPV results were $1,484,365 for the Owner, $2,284,165 for the Occupant, and $919,948 for the Community.

Credits included in this project

- Optimize Energy Performance
- Renewable Energy Production
- Construction Indoor Air Quality Management Plan
- Daylighting
- Interior Lighting
- Low Emitting Materials
- Quality Views
- Thermal Comfort
- Bicycle Facilities
- Indoor Water Use Reduction

Total LEED Points

LEED 38

Total Value per Point

$ $123,381

LEED Pilot Credit Checklist

- ✓ Minimum of 6 total LEED credits analyzed
- ✗ Minimum "Core" LEED credits analyzed
- ✓ Includes additional 5 "soft dollar" impacts
- ✓ Capital expenditure costs included
- ✓ Replacement costs included
- ✓ O&M costs included
- ✓ Relative to a baseline
- ✓ Study period > 20 years (or project's life)
- ✓ Values in USD

Value by Stakeholder

Cost or Benefit Category	Lifetime Value
Owner	
Rental Premium (Owner)	$1,484,365
Occupant	
Health	$388,606
Water Costs	$4,756
Absenteeism	$164,513
Natural Gas Costs	$500,732
Productivity	$1,115,668
Electricity Costs	$1,232,696
Rental Premium (Tenant)	-$1,484,365
Cycling Health Benefits	$361,559
Community	
Air Pollution	$64,875
Carbon Emissions	$593,357
Congestion	$125,574
Social Water Value	$56
Vehicle Operating Costs	$95,080
Reduced Vehicle Use	$41,006
Stakeholder Group Totals	**Lifetime Value**
Owner	$1,484,365
Occupant	$2,284,165
Community	$919,948
Net Present Value (NPV)	**$4,688,478**

Appendix D: Residential Building Parcel 20 Analysis

June 25, 2019

Autocase

Tropicana Residential - Parcel 20

Lifecycle Financial		Social & Environmental		Triple Bottom Line
$13,194,586	+	$2,202,040	=	$15,396,626

Summary

This project is located in St. Petersburg, FL and has an area of regularly occupied floor space of 300,000 square feet. This triple bottom line, cost benefit analysis (TBL-CBA) assesses the financial, social, and environmental impacts of achieving 9 LEED credits for this project. TBL-CBA is a systematic evidence-based economic business case approach to quantify and attribute monetary values to the direct financial impacts, as well as broader social and environmental impacts. This analysis looks at the costs and benefits, over a 28 year study period, of achieving the following LEED credits: Daylighting, Quality Views, Thermal Comfort, Low Emitting Materials, Construction Indoor Air Quality Management Plan, Renewable Energy Production, Interior Lighting, Optimize Energy Performance, and Indoor Water Use Reduction. The net presentvalue (NPV) is the principal measure of economic worth and is the triple bottom line result as it combines the financial, social and environmental costs and benefits. A positive NPV indicates that benefits exceed costs. The total NPV of this project was $15,396,626. The NPV results can also be broken out by stakeholder; Owner, Occupant and Community. This project's stakeholder NPV results were $6,431,598 for the Owner, $6,134,179 for the Occupant, and $2,830,849 for the Community.

Credits included in this project

- Optimize Energy Performance
- Renewable Energy Production
- Construction Indoor Air Quality Management Plan
- Daylighting
- Interior Lighting
- Low Emitting Materials
- Quality Views
- Thermal Comfort
- Indoor Water Use Reduction

Total LEED Points

LEED 37

Total Value per Point

$ $416,125

LEED Pilot Credit Checklist

- ✔ Minimum of 6 total LEED credits analyzed
- ✖ Minimum "Core" LEED credits analyzed
- ✔ Includes additional 5 "soft dollar" impacts
- ✔ Capital expenditure costs included
- ✔ Replacement costs included
- ✔ O&M costs included
- ✔ Relative to a baseline
- ✔ Study period > 20 years (or project's life)
- ✔ Values in USD

Value by Stakeholder

Cost or Benefit Category	Lifetime Value
Owner	
Rental Premium (Owner)	$6,431,598
Occupant	
Health	-$1,038,638
Water Costs	$2,372,896
Absenteeism	$249,551
Natural Gas Costs	$580,563
Productivity	$160,278
Electricity Costs	$10,241,127
Rental Premium (Tenant)	-$6,431,598
Community	
Air Pollution	$34,651
Carbon Emissions	$2,773,967
Social Water Value	$22,231

Stakeholder Group Totals	Lifetime Value
Owner	$6,431,598
Occupant	$6,134,179
Community	$2,830,849
Net Present Value (NPV)	**$15,396,626**

ATTACHMENT 3: SITE PLAN EXHIBIT

THE Development Process

Prepare Site Evaluation Assessments

- Define project redevelopment conditions, limitations, phasing and delivery methods
- Strategic Action Plan (phasing and cost estimates)
- Phase 1, 2 and 3 environmental site assessments
- Complete Streets design standards
- Selective geotechnical borings
- Ownership, encumbrance, title reports
- Boundary survey/legal descriptions
- County land ownership agreement modification
- Tampa Bay Rays lease development agreement update

Implement Alternative Redevelopment Strategies

- Public-Private-Partnership (P3) Agreements
- ITP's/RFPs
- Structured Parking
- Infrastructure Reimbursement

Prepare Infrastructure Plans for Phased Redevelopment

- Phased redevelopment of streets, utilities, stormwater, and public realm elements
- Schematic Design (30%)
- Construction Documents (60%–Final)
- Permitting/bidding

Complete Demolition and Preliminary Site Preparation

- Demolition
- Brownfield remediation
- Preliminary grading
- Preliminary stormwater

Construct Public Infrastructure for Phase Redevelopment

- RFP Design-Bid-Build / Design-Build/CM at-risk
- Developer invitation to participate
- Construction administration

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Framework for Tropicana Site Redevelopment

Future Development Vision
- Tropicana Site Concept Master Plan, Scenarios 1 and 2
- Grow Smarter Strategy
- One Community Plan
- St. Petersburg 2050 Plan

Funding/Investment
- Sources
- Competing projects and demands

Transportation
- Streets
- Trails
- Parking
- Transit

Environmental
- Brownfield Remediation

Sustainability and Resiliency
- Integrated Sustainability Action Plan
- Health-in-all-Policies
- Clean Energy Roadmap
- Tampa Bay Regional Resiliency Coalition

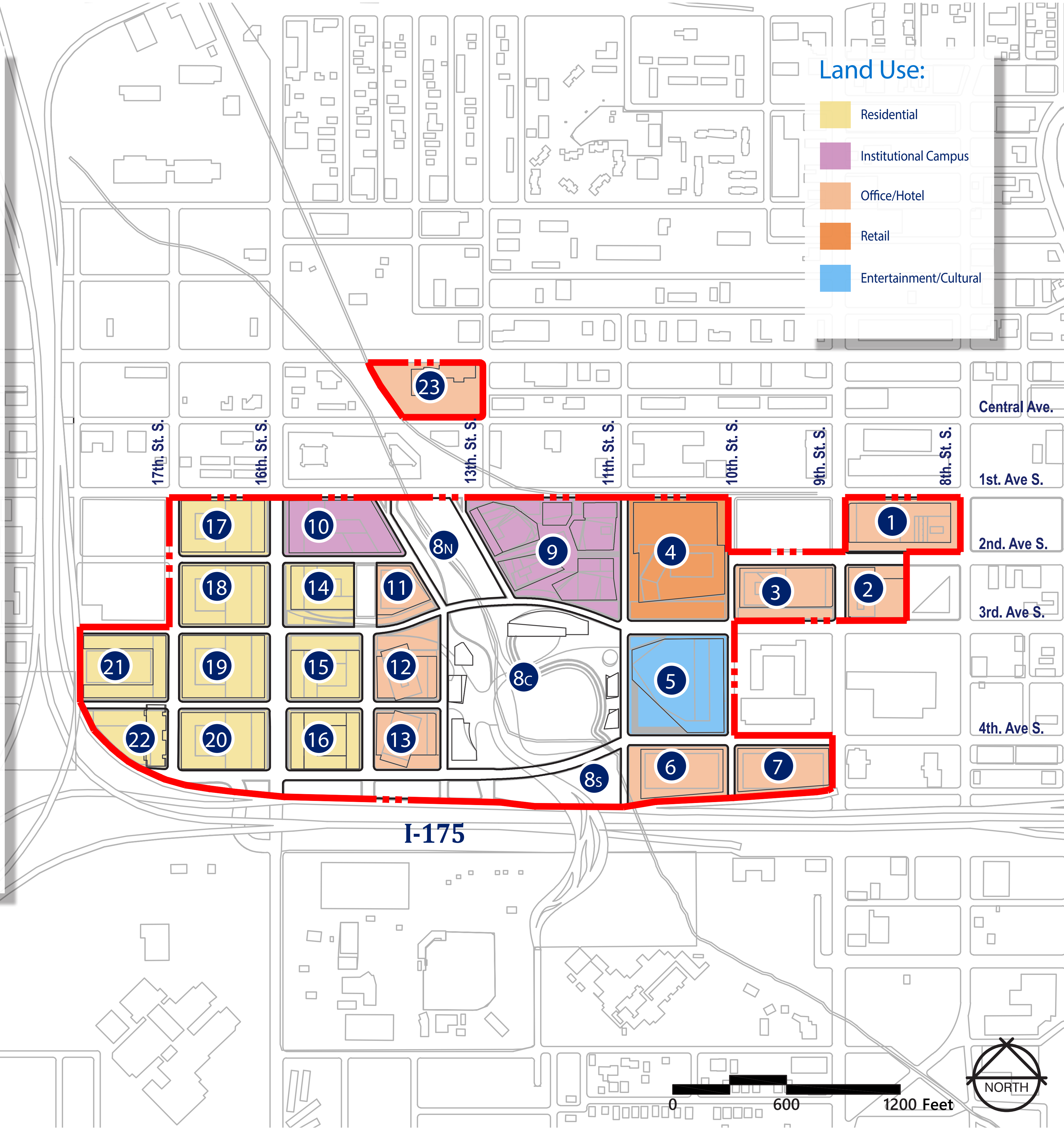
Political
- Fiscal and economic impact

Champions/Leadership
- City of St. Petersburg
- Pinellas County
- Tampa Bay Rays
- South St. Petersburg CRA
- St. Petersburg Area EDC

Block Areas:

- Study Area Total: 102 AC / 4,480,218 S.F.

1	Parcel Area: 3.0 AC / 132,700 S.F.	Bldg Foot Print: 84,559 S.F
2	Parcel Area: 1.7 AC / 72,186 S.F.	Bldg Foot Print: 53,048 S.F.
3	Parcel Area: 2.7 AC / 119,397 S.F.	Bldg Foot Print: 76,891 S.F.
4	Parcel Area: 6.0 AC / 262,700 S.F.	Bldg Foot Print: 173,241S.F.
5	Parcel Area: 4.9 AC / 214,453 S.F.	Bldg Foot Print: 147,366 S.F.
6	Parcel Area: 2.7 AC / 118,228 S.F.	Bldg Foot Print: 80,377 S.F.
7	Parcel Area: 2.3 AC / 101,660 S.F.	Bldg Foot Print: 77,131 S.F.
8N	Parcel Area: 3.0 AC / 132,366 S.F.	Bldg Foot Print: N/A
8C	Parcel Area: 12.7 AC / 553,181 S.F.	Bldg Foot Print: 79,828 S.F.
8S	Parcel Area: 4.1 AC / 178,622 S.F.	Bldg Foot Print: N/A
9	Parcel Area: 7.0 AC / 304,376 S.F.	Bldg Foot Print: 173,349 S.F.
10	Parcel Area: 3.1 AC / 134,874 S.F.	Bldg Foot Print: 107,731 S.F.
11	Parcel Area: 0.4 AC / 15,344 S.F.	Bldg Foot Print: 42,102 S.F.
12	Parcel Area: 2.4 AC / 106,342 S.F.	Bldg Foot Print: 58,040 S.F.
13	Parcel Area: 2.0 AC / 87,006 S.F.	Bldg Foot Print: 58,040 S.F.
14	Parcel Area: 2.2 AC / 97,034 S.F.	Bldg Foot Print: 58,116 S.F.
15	Parcel Area: 2.5 AC / 109,326 S.F.	Bldg Foot Print: 68,497 S.F.
16	Parcel Area: 2.3 AC / 99,576 S.F.	Bldg Foot Print: 81,550 S.F.
17	Parcel Area: 2.6 AC / 113,033 S.F.	Bldg Foot Print: 90,644 S.F.
18	Parcel Area: 2.8 AC / 123,782 S.F.	Bldg Foot Print: 101,555 S.F.
19	Parcel Area: 3.0 AC / 131,112 S.F.	Bldg Foot Print: 108,605 S.F.
20	Parcel Area: 2.7 AC / 119,509 S.F.	Bldg Foot Print: 99,310 S.F.
21	Parcel Area: 2.9 AC / 126,579 S.F.	Bldg Foot Print: 55,514 S.F.
22	Parcel Area: 1.8 AC / 79,499 S.F.	Bldg Foot Print: 24,291 S.F.
23	Parcel Area: 2.6 AC / 114,725 S.F.	Bldg Foot Print: 24,585 S.F.
Totals:	83.4 AC / 3,647,610 S.F.	1,924,370 S.F.



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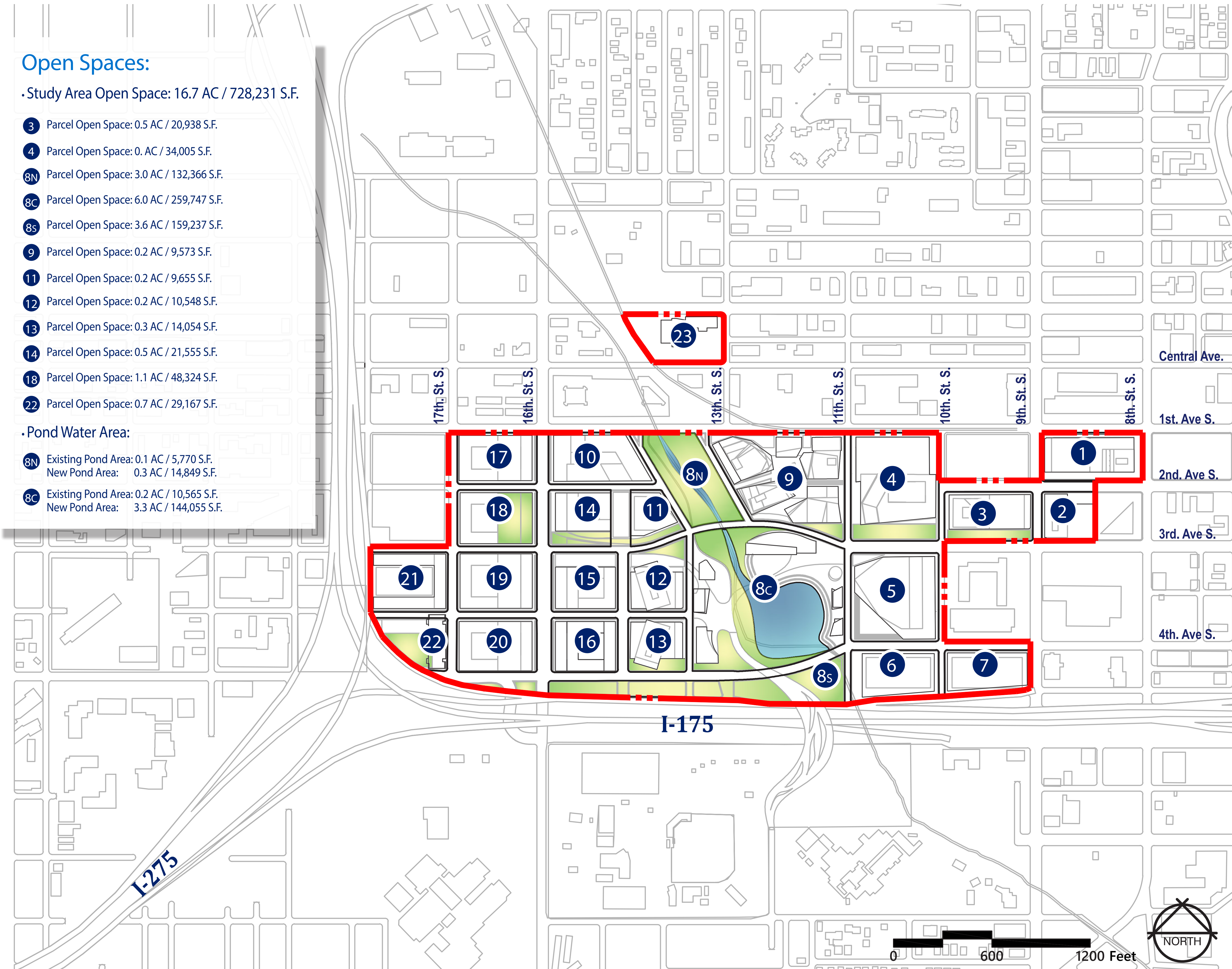
Framework for Tropicana Site Redevelopment

Source: City/HKS Site Plan Note: Study Area limits and acreages are estimates only and subject to change based upon accuracy of base files by others.



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Framework for Tropicana Site Redevelopment

Street Network:

- Existing Street
- Potential Retrofitted Street
- New Street

- Total L.F. of Roads Within Study Area: 10,763 L.F.

Existing Roadway Within Study Area:

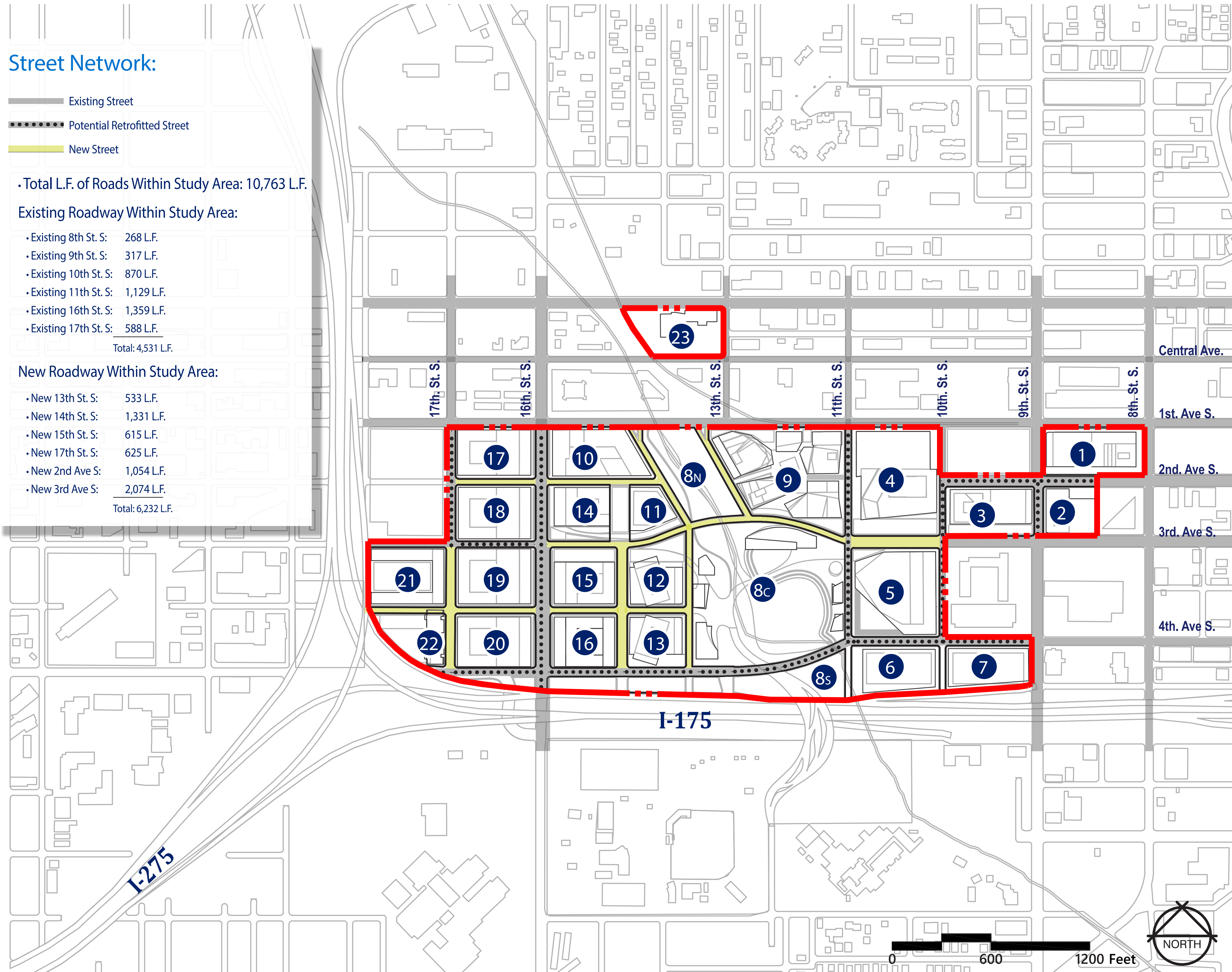
- Existing 8th St. S: 268 L.F.
- Existing 9th St. S: 317 L.F.
- Existing 10th St. S: 870 L.F.
- Existing 11th St. S: 1,129 L.F.
- Existing 16th St. S: 1,359 L.F.
- Existing 17th St. S: 588 L.F.

Total: 4,531 L.F.

New Roadway Within Study Area:

- New 13th St. S: 533 L.F.
- New 14th St. S: 1,331 L.F.
- New 15th St. S: 615 L.F.
- New 17th St. S: 625 L.F.
- New 2nd Ave S: 1,054 L.F.
- New 3rd Ave S: 2,074 L.F.

Total: 6,232 L.F.



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Framework for Tropicana Site Redevelopment