

Conceptual Compost and Mulch Facility Design

City of Pittsburgh
Department of Public Works
Bureau of Environmental Services
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SCS ENGINEERS

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ACKNOWLEDGEMENTS

This study and report was completed under the Pennsylvania Department of Environmental Protection's (DEP) Recycling Technical Assistance Program. SCS Engineers acknowledges the support of DEP to complete this study:

1 PROJECT DESCRIPTION

The City of Pittsburgh (City) is a Pennsylvania Municipal Waste Planning, Recycling and Waste Reduction Act (Act 101) mandated recycling community. The City has established a mandatory recycling requirement as part of City Ordinance 619. Pittsburgh's stated goal is to be a zero waste community by 2030.

The City is interested in exploring the option of establishing a centralized organic material processing facility (location, to be determined), in order to conduct some operations internally, improve the program's cost effectiveness, and provide finished products to residents.

2 SUMMARY OF WORK

The following tasks were completed as part of this recycling technical assistance project.

Task 1 – Data Collection and Site Visit

SCS requested technical and operational information/data on the City's yard waste management and forestry programs. Information received was reviewed and site visits/field observations occurred on November 18, 2020 and included interviews with City staff. SCS conducted site investigations at three current or prospective yard waste management sites. Throughout the site visits, SCS staff asked questions to clarify operational practices and conditions in order to better understand the existing organic management programs.

Task 2 – Preliminary Site Layout Design

Using material quantity calculations and drawing software (AutoCAD), SCS prepared a conceptual layout of a compost and mulch facility. Available data (material types and quantities) pertaining to the City's yard waste collection and forestry programs factored into the proposed size and geometry of the site layouts. Due to lack of data, many basic assumptions were incorporated into the site layouts based on standard practices and other industry information. SCS developed the conceptual facility design for possible implementation at two locations currently utilized to manage organic material.

Task 3 – Capital Cost Estimates

SCS estimated capital costs for constructing the compost and mulch facility based on the conceptual site layouts developed in Task 2. Site-specific preparation costs such as grading, access improvements, and stormwater management features are not included in the preliminary capital cost estimates.

Task 4 – Final Report

This Final Report includes data and observations made in Task 1 and presents the conceptual facility layouts and cost estimates completed as part of Tasks 2 and 3.

3 CURRENT PROGRAM

The City's Bureau of Environmental Services collects yard waste curbside two times per year from residential properties, one time each in the spring and fall. The program includes 115,336 service locations, although not every household participates in the curbside program. The City collects leaves, branches, brush, and grass clippings as part of the curbside program. Yard waste must either be contained in paper bags that weigh no more than 35 pounds or brush/branches may be tied in bundles that are five feet or less in length. The City does not accept yard waste contained in plastic bags. Residents also have the option to dispose of yard waste, year-round, at three drop-off sites in the City, including:



A Public Works employee fills a roll-off container with stockpiled leaves

- East End Drop-Off Center at 6814 Hamilton Avenue;
- Hazelwood Drop-Off Center at 40 Melanchton Street; or
- West End Drop-Off Center at 1330 Hassler Street.

Use of the drop-off sites to dispose yard waste requires a per-trip fee of \$21 for cars, SUVs, and pickups. Larger dump trucks and box vans/trucks must pay a fee of \$52.50 to dump yard waste at these sites. Yard waste collected during the bi-annual curbside collection events are also consolidated at these sites. The City contracts with a vendor to transport the materials offsite for grinding and processing. Most of the material is used or sold by the vendor. However, a small portion of mulch is provided to the City for use in landscaping and beautification projects.

City staff estimate that about 4,200 tons of yard waste are collected annually through both the curbside and drop-off programs. City staff further estimate that about 90 percent of the material collected is branches/brush (i.e., woody material), while the remaining 10 percent is leaves and other compostable materials. It costs the City approximately \$200,000 annually for contracted collection and processing of the materials.

4 PRELIMINARY CONCEPTUAL DESIGN

SCS understands there is interest in developing an organics processing operation in the City. The costs for such an operation would be partly offset by eliminating contractor fees currently incurred for material removal. A conceptual design was prepared for a potential facility to be developed in two phases on a site located in or near the City. The two phases are as follows:

- **Phase 1 – Yard Waste Management Only:** Activities include grinding woody material into mulch and performing windrow composting of leaves with other compostable material such as grass clippings and small garden trimmings. In addition, an educational demonstration area was incorporated for purposes of public outreach.

- **Phase 2 – Yard Waste Management with Food Scraps Composting:** Addition of composting of source-separated food scraps (i.e. sorted material from internal City offices, community farmer’s markets, or similar sources).

PRELIMINARY DESIGN CRITERIA

Multiple regulatory, economic, and stakeholder preference-related factors will ultimately need to be considered in the facility’s final design criteria. Key assumptions presented in **Table 1** below formed much of the preliminary design criteria used to develop the conceptual design.

Table 1. Key Conceptual Design Assumptions

Key Assumption	Description	Value	Unit	Source/Assumption
Material Quantities	Quantity of material including yard debris, woody waste, leaves, grass clippings, and garden trimmings managed by Env. Services/Forestry.	4,200	Tons per year (tpy)	Provided by City staff
Leaf Quantities	Percentage of material quantity (4,200 tpy) attributable to leaves (weight basis)	20	%	10 percent estimate provided by City staff; however, it was doubled to be conservative, as leaf volume is the primary sizing consideration
Other Compostable Waste Quantities	Percentage of other compostable material, assumed to be the feedstock, relatively high in nitrogen for the leaf composting operation (weight basis)	10	%	Assumed value to provide 1:2 ratio of green (grass, plants, etc.) to brown (leaves) composting feedstock; mostly collected spring to summer, leaves are assumed to carry over as spring feedstock
Source Separate-ability	Browns (leaves) for composting, Greens (grass, plants, etc.) for composting, and woody material for grinding into mulch are all able to be collected and stored separately by material type	NA	NA	Assumption for feasible, efficient operations
Densities	Unique values by material type/mix and season.	Varies	Cubic Yard/ton	Technical resources available online and engineering judgement
Operational Areas	The following compost and mulch facility areas were included in the concept design and calculations: <i>equipment/general maintenance and storage; material receiving and storage; grinding, mixing, and screening pad; educational demonstration area; composting, curing, and product storage windrows/piles; and, end aisles and access roads.</i>	NA	NA	Calculations typical for sizing and configuring the arrangement of operational areas of organics management facilities informed the designs presented in the conceptual site layout.

For Phase 2 configuration, SCS assumed the addition of 500 tons per year of source-separated food scraps. Design assumptions, including food scrap quantity and covered aerated static pile (ASP) size and geometry were made based on urban compost program operated by Big Reuse in New York City.

Table 2 presents buffer requirements from the Pennsylvania Bureau of Waste Management General Permit WMGR025 for residual and municipal waste composting. If the City were to accept material other than yard waste (such as food scraps) for composting, the following buffers/setbacks would need to be considered for any and all applicable material types.

Table 2. General Permit WMGR025 Compost Facility Buffers

Existing Feature	Buffer (feet)
The property line	50
Adjacent residences	300; 900 for schools, parks, playgrounds
Drinking water supply wells	300
Perennial stream	100
Wetlands	300 from an exceptional value wetland; 100 for others

CONCEPTUAL SITE LAYOUT

The conceptual site layout for each of the two proposed phases is presented in **Appendix A1** and **Appendix A2**.

CAPITAL COST ESTIMATE

A capital cost estimate for developing the facility layout in Phase 1 is presented in **Appendix B**.

5 SITE REVIEWS

On November 18, 2020, SCS staff conducted site visits/field observations in conjunction with City staff representing both the Public Works Department (Environmental Services Division) and Planning Department, including the Sustainability and Resilience Office. Site visits included investigations of three locations selected by City staff: the Forestry Division operations center, the Pittsburgh Zoo lay down yard/overflow parking lot, and the Urban Redevelopment Authority's 62nd Street Bridge riverfront property. The former two locations are located on opposite ends of Highland Park, both within the Pittsburgh Park Conservancy limits. Parcel information for the three sites taken from the City's Geographic Information System (GIS) module and Allegheny County's Real Estate Portal is presented in **Table 3** below, and brief descriptions of each site follow.

Table 3. Visited Parcel Information

Site No.	Site Name	Parcel ID(s)	Address	Lot Area (Ac)	Zoning	Owner
1	Forestry Division	0082-H-00001-0000-02	6520 Stanton Ave. #2251	5 ¹	P ²	City of Pittsburgh
2	Zoo Overflow Parking	0082H00001000002; 0121L00128000000; Others	7370 Baker St	5 ¹	P ²	City of Pittsburgh
3	62 nd St. Bridge	0120-G-00145-0000-00	6111 Butler St	14.2	RIV-GI ³	Urban Redevelopment Authority of Pittsburgh

Notes:

1. Approximate area of portion of larger parcel(s) reviewed during site visit.
2. Parks and Open Space
3. Riverfront General Industrial

SITE OVERVIEW AND FIELD FINDINGS

Forestry Division

The City of Pittsburgh Forestry Division within the Public Works Department is based out of an administrative building and operations area off Stanton Avenue on the eastern side of the Highland Park neighborhood. According to City staff, the Forestry Division, in conjunction with the Environmental Services Division, manages the majority of collected leaves and woody material on a paved collection pad comprising the core operational area at this site. The pad includes a limited footprint (less than one acre) on the north side of the Forestry Division location. This portion of the property is situated on the edge of a steep bluff overlooking the Pittsburgh Police and Fire training and administrative facilities.

The location is within the boundary of Highland Park. The main Forestry Division area reviewed during the site visit is outlined in **Figure 1** and includes the operations pad at center.

Field Findings

Overview: SCS personnel toured the Division property and observed the stockpile/collected material management area, which was located at the end of a long (>200 feet) paved drive tucked behind a small berm and Highland Park Tennis Club facilities. The Forestry office, parking lot, and maintenance garage comprise the primary (central) portion of the site. The site is accessed from Stanton Avenue via a single entrance and the site is fenced on its west side.

Site Features: A sheer drop-off to its east limits the usability of this elongated site. City staff reported the drop-off had led to some close calls when citizens used the site in the past. The material management area is on an increasingly widening stretch of asphalt, with a 17-foot swing-gated area entrance at the front near an overhead power line pole cluster. The drive extends about 450 feet from the gate, but runs largely parallel to Stanton Avenue so the majority of materials stockpiled likely fall within a 300-foot buffer of nearby residences across Stanton Ave.

The main material storage area consists of a three-sided interlocking concrete block bunker with outside dimensions measured at 27-feet by 57-feet. It was also noted to be about eight-foot tall. Additional material extended from the bunker and City staff reported the piles sometimes extend the full length of the drive. During the site visit, the pile extended three feet or so over the walls of the three-sided bunker and over its middle divider, which was not visible but is evidenced in aerial images of the site.

Materials Observed: Material was noted to range significantly in size and character within the visible portion of the pile. A large amount of loose piled leaves and craft paper bags with leaves comprised the majority of visible material. In addition, a large quantity of branches/brush were observed to be under the leaves, or mixed in with them. The largest cut logs in the pile were in excess of 10 inches in diameter. A small pile of trimmed evergreen branches was also noted. Staff mentioned that Christmas trees are also collected at the site after the holidays. Various piles of other material, including mulch, soil-like material, tree well coverings and manhole lids, lined the side of the area.

Other: While on site, SCS personnel witnessed two key stages of the material load-out process: 1) the City's debris hauling contractor (Wood Waste Recycling, LLC) exiting the facility with a loaded roll-off container, and 2) City Public Works personnel filling a roll-off container with material using a Case 621E wheel loader from the East End Drop-off Center (Division) on Hamilton Avenue. The only flat and open area (besides the material management area) that did not appear to be maintained as a grass lawn or parking lot was observed to be located southeast of the Forestry building. Staff indicated that this area may have at one point been an experimental Chestnut tree growth area, but the project has long been abandoned.

Figure 1. Aerial View of the Forestry Division Site



Zoo Overflow Parking

Parking for the Pittsburgh Zoo and PPG Aquarium is located off Baker Street at the western edge of Highland Park. The mostly-paved area along the Heth's Run Valley is very flat due to its historical location as a waste in-fill area. South of the primary parking area centered at the Zoo's entrance, the parking overflow is located beyond an access gate. In the zoo's off season the area is used as a lay-down yard by the Public Works Department. The area reviewed by SCS staff was the wide part of the Valley centered on the collected yard waste material. The area is centered between the Heth's Run Open Space, Natoli Field, and Highland Park Reservoir No. 2. It is presented in **Figure 2**.

The Heth's Run, which drains over 600 acres of stormwater in its watershed, has been rerouted into a pipe mostly located beneath the surface of the parking area. A stormwater and open space management project currently in the planning stages is intended to restore the area to its pre-development state while enhancing parking and providing additional park amenities to City residents.

Field Findings

Overview: SCS personnel followed City staff through the zoo's primary parking area and much of the area available for overflow parking prior to arriving at the lay-down yard and materials management area. The lay down area was isolated, with no evidence of any more than one or two private properties on the surrounding hillsides visible.

Site Features: The area surrounding the collected yard waste material beyond the striped parking spots is roughly 400 feet by 600 feet in length. Various piles of material other than actively-collected yard waste and leaf material were staged along the eastern limits of the site, at the toe of the surrounding slope. This material appeared to have not been disturbed in some time. The site is almost entirely paved, with limited overgrown unpaved areas observed at the south end and in some places on the east side (though it could have been vegetation growing in staged piles of soil). A narrow ravine-like area south of the core yard waste area appeared to contain above grade infill, and may have been a former landfill site. There was a slight slope observed along the paved area of the property.

Materials Observed: The materials observed were similar in nature to those observed at the Forestry site, although a greater amount of woody material was observed. In addition, the woody material consisted of older, dead wood and included large stumps and irregular shaped branches.

Other: A conceptual rendering of a zoo parking reconfiguration which uses the lay down yard area prominently was prepared by Mackin Engineers and Consultants but has not been implemented. The conceptual design was developed through stakeholder input by a team of interdisciplinary consultants and does not appear to include any operational areas for Public Works in the vicinity of the current lay down yard.

Figure 2. Aerial View of Zoo Overflow Parking Site



62nd Street Bridge

The Urban Redevelopment Authority of Pittsburgh owns a 14 acre parcel just south of Tree Pittsburgh nursery on the Allegheny River. It is positioned in an industrial area between the south end of the 62nd Street bridge and the Sunoco Logistics terminal facility, along Butler Street. It is a rectangular parcel roughly 400 feet wide by 1,400 feet in length.

Field Findings

Overview: The property was the location of a former steel mill that has been mostly cleared from the site. An economic development deal to build residences at the site did not materialize and currently the City is considering its use as a new hub for the Environmental Services Division.

Site Features: The Site is largely flat although there is a notable grade drop from Butler Street down to the site. Gated entrances are located at both ends of the property; one on its west side accessed from Butler Street via Suydam Street and one on its east side off 62nd Street, though there are vehicle height limitations to access the property from the latter. SCS accessed the site from the Butler Street entrance and did not review the western part of the site.

Materials Observed: N/A – Site not currently used by Public Works/Forestry.

Other: NA

Figure 3. Aerial View of 62nd Street Bridge Site



6 CONCLUSION

Development of a compost and mulch facility will provide the City with more control over their DEP-required yard waste management program to facilitate greater diversion and better serve its residents. Based on current contractor costs for material hauling and the concept-level design and preliminary capital cost estimate, the development of a City-owned organics management facility also appears have a financial payback, although to what degree requires further assessment. Implementing site features in phases such as those presented in **Appendices A1** and **A2** may help alleviate budgetary constraints.

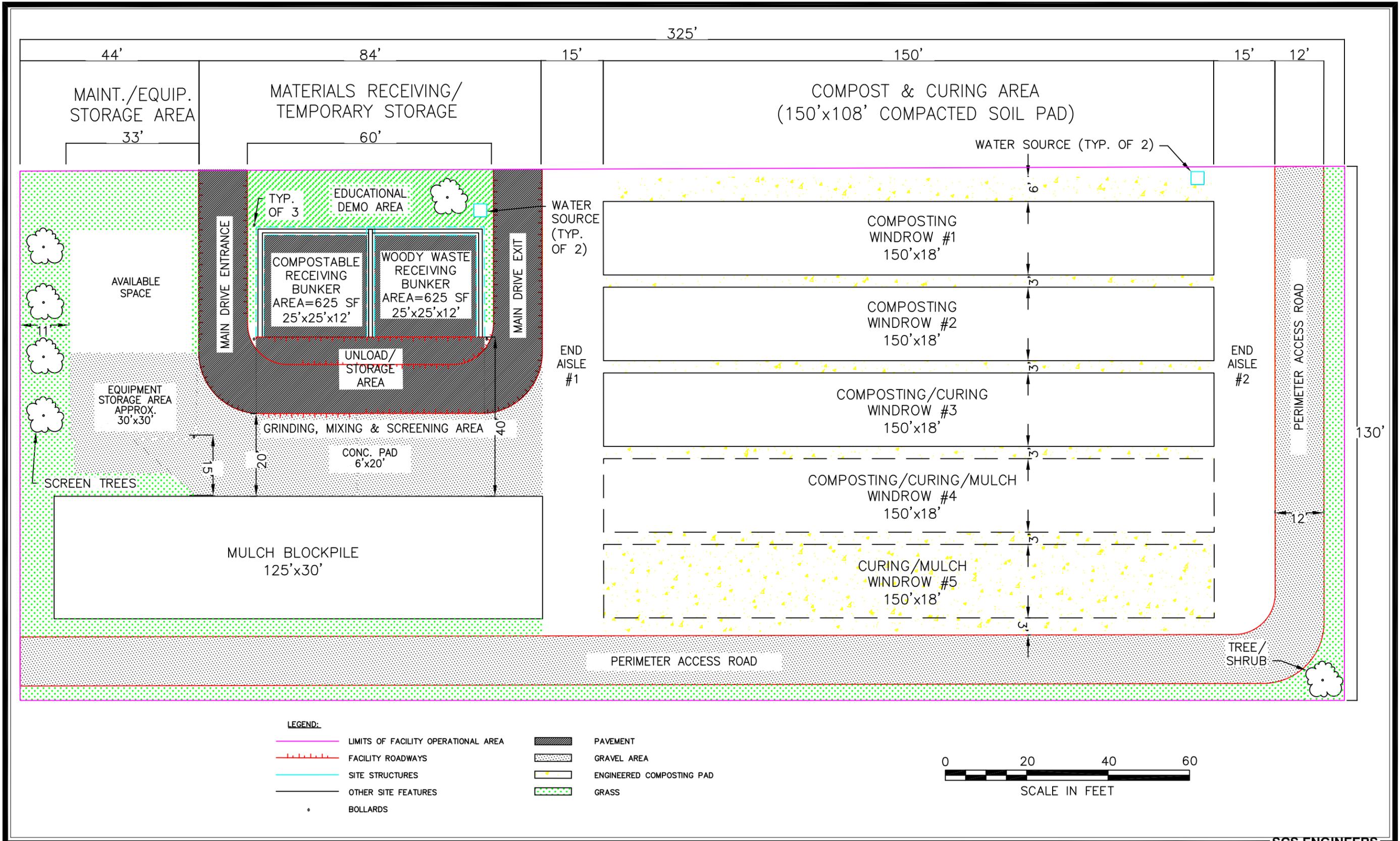
The majority of the Phase 1 capital cost estimate presented in **Appendix B** was for processing equipment, and particularly the wood waste grinder. Significant initial cost savings (as a portion of the capital cost estimate) may be obtained by contracting out wood waste grinding activities. The conceptual facility layout would still accommodate unprocessed material receiving and storage if the contracted activities were performed at an appropriate frequency.

Note that site improvement costs such as soil import, grading, access improvements, and stormwater features were not included in the capital cost estimate. In general, the three sites reviewed in this report appear to require relatively minimal grading improvements. In addition, select sites reviewed already have improved surfaces (asphalt paving) and other required facility features in place which would potentially reduce the initial costs required relative to the capital cost estimate.

According to the Pittsburgh Parks Conservancy website, two of the visited parcels are located either wholly or partially within Highland Park. The City should further explore how it may achieve compost facility buffers/setbacks required in Pennsylvania General Permit WMGR025, particularly those required from adjacent residences and parks.

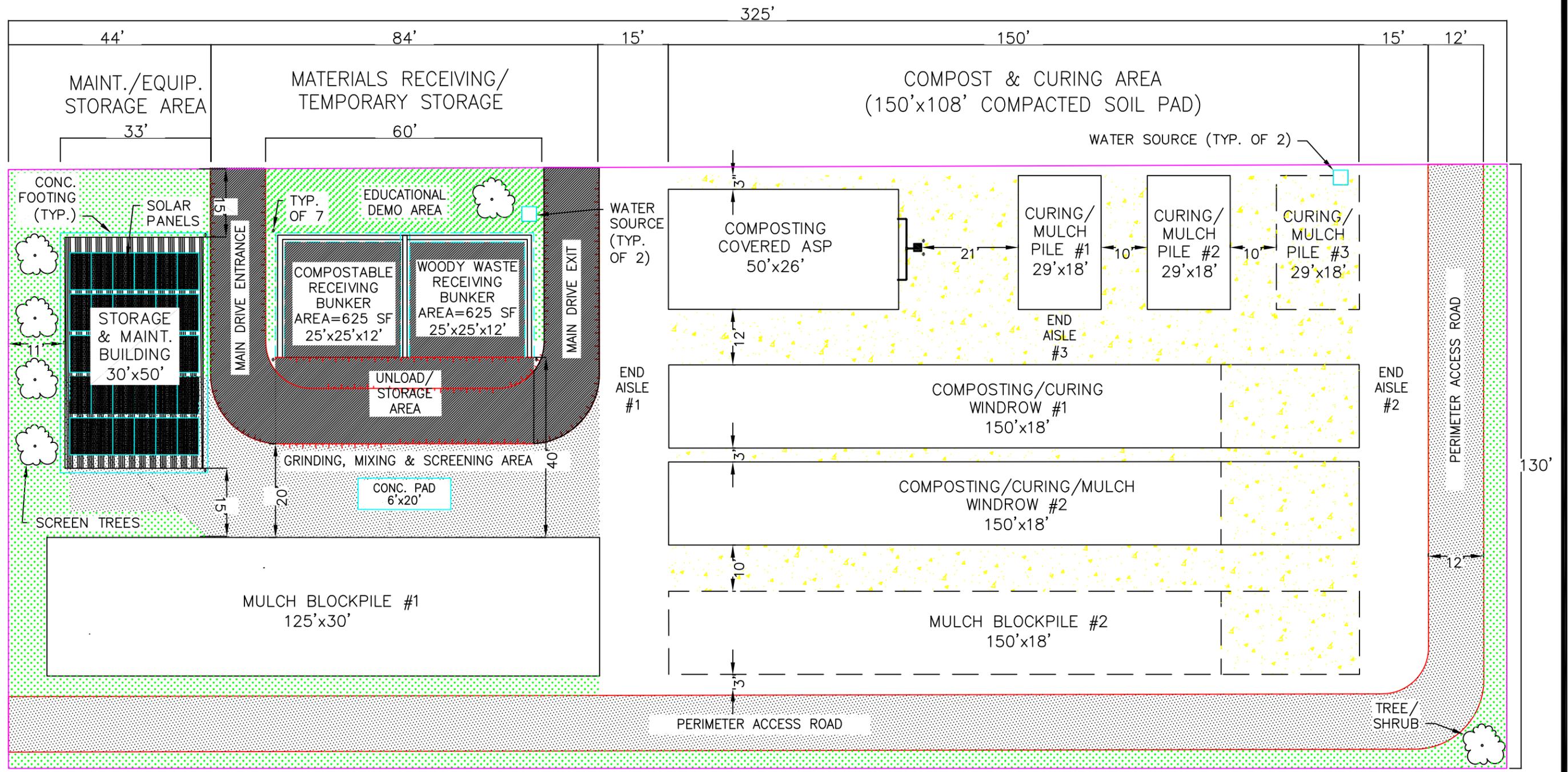
The three sites reviewed as part of the development of this report have some potential to become a composting and mulching site. SCS Engineers recommends, a thorough site feasibility study be performed to further evaluate these sites and select the most appropriate site for facility development.

Appendix A1
Preliminary Conceptual Layout – Phase I



CONCEPTUAL FACILITY LAYOUT - PHASE I

Appendix A2
Preliminary Conceptual Layout – Phase II



- LEGEND:**
- LIMITS OF FACILITY OPERATIONAL AREA
 - FACILITY ROADWAYS
 - SITE STRUCTURES
 - OTHER SITE FEATURES
 - BOLLARDS
 - PAVEMENT
 - GRAVEL AREA
 - ENGINEERED COMPOSTING PAD
 - GRASS



CONCEPTUAL FACILITY LAYOUT - PHASE II



Appendix B Capital Cost Estimate

COMPOST AND MULCH FACILITY
CITY OF PITTSBURGH, PENNSYLVANIA
PRELIMINARY CONCEPTUAL CAPITAL COST ESTIMATE - PHASE I

Project No.: 02217011.01-34
 Date: 1/15/2021

Calc. By: RJD
 Chk. By: BLD



COST ITEM NUMBER	DESCRIPTION	UNIT	QUANTITY (Q)	UNIT COST (UC)	LINE ITEM TOTAL
0	SITE IMPROVEMENTS¹ – NA (including fill import, heavy/fine grading, access improvements, and stormwater features.)				
				Subtotal	\$0
	SURFACE IMPROVEMENTS (assumes site adjacent to existing access road and only features presented in Phase I conceptual drawing included)				
1	Geotextile/Vapor Barrier (gravel/asphalt areas)	sy	1,400	\$2.00	\$2,800
2	Aggregate Sub-Base (8-9" depth, gravel/asphalt areas)	sy	1,400	\$12.00	\$16,800
3	Asphalt IM Base/Binder Course (4-6")	sy	500	\$34.00	\$17,000
4	Composting Pad Compaction	sy	1,800	\$1.00	\$1,800
				Subtotal	\$38,400
	STRUCTURES				
5	Concrete Grind Pad - 9" thick	sy	13	\$150	\$2,000
6	Block Storage Bunkers (per 6'x2'x2' block)	ea	120	\$200	\$24,000
7	Educational Demo Area (shelter)	ls	1	\$20,000	\$20,000
				Subtotal	\$46,000
	OTHER FACILITY IMPROVEMENTS & UTILITIES				
8	Water Pump	ls	1	\$10,000	\$10,000
9	Utilities - Water (inc. Trenching)	lf	200	\$70.00	\$14,000
				Subtotal	\$24,000
	MISC. SITE FEATURES & SECURITY				
10	Portable Toilet Screen (if no office bldg)	ls	1	\$2,000	\$2,000
11	Metal Bollards	ea	3	\$500	\$1,500
12	Signage	ea	10	\$400	\$4,000
13	Pavement Markings	ls	1	\$3,000	\$3,000
				Subtotal	\$10,500
				SUM OF SUBTOTALS \$118,900	
				Construction Stakeout (1%) \$1,200	
				Mob/De-Mob Costs (5%) \$6,000	
				Cons. Admin, Eng. & Mat. Testing (8%) \$9,600	
				Construction Pre-Contingency Total \$135,700	
				Contingency - inc. Minor Items (15%) \$20,400	
				CONSTRUCTION TOTAL \$156,100	
14	A/E and Surveying (Design/Permitting to Construction Bid)	%	20	\$27,000	\$27,000
	COMPOSTING & MULCHING EQUIPMENT^{2,3}				
15	Grinder (assume Morbark 6600 Hori)	ls	1	\$500,000	\$500,000
16	Conveyor (assume Mulch Master Stacker)	ls	1	\$20,000	\$20,000
17	Windrow Turner (assume Komptech X63 8.5'x18.5')	ls	1	\$275,000	\$275,000
				Equipment Subtotal	\$795,000
				CAPITAL COST ESTIMATE GRAND TOTAL \$978,100	

Notes:

1. Site Improvements not included in cost estimate due to highly variable, site-specific nature of cost item.
2. Used (second-hand) equipment was assumed for purposes of cost-effectiveness.
3. Assumes City-owned front loader available for miscellaneous movement of material and pile development.