

2013

Feasibility Study for Urban Woody Biomass Utilization for Urban Economics Development -- Phase 1



12-JV-01-057

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8/26/2013

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EXECUTIVE SUMMARY

The Forest Product Laboratory (FPL) Feasibility Study for Urban Woody Biomass Utilization for Urban Economics Development—Phase 1 (12-JV-01-057) serves as a mechanism to consolidate existing research, discussions and activities into an integrated system for the collection, processing and distribution of urban woody biomass in Baltimore, MD.

Unlike many existing urban wood utilization efforts, this integrated system includes deconstructed building materials which result in value-added products and opportunities to generate economic gains and jobs for inner-city urban residents. The key component of this system is to create jobs for chronically unemployed and under-employed inner city residents.

This assessment includes an overview of the City's economic conditions, raw material supply, labor resources, current process and systems, infrastructure requirements, potential markets and development opportunities.

The findings of this report include:

1. Compliance with current environmental policies and legislative actions require that an aggregated system be put in place to appropriately manage the increase in urban wood waste.
2. Public and Private sector partners are willing to cooperate – the increases in wood volume have both public and private organizations concerned about disposal outlets.
3. The volume of wood waste is significant and currently sufficient to support an aggregated collection system and a milling operation.
4. The collection system should be designed as a spoke and wheel: a central log and sort yard with rail and deep water access and 5-7 satellites that correspond with BG&E territories.

Based upon the volumes of urban wood waste generated, a sort yard operation would create jobs within its own operation as well as generate jobs in tertiary businesses. It is estimated that the urban wood sort yard and satellite centers, in full operation, would support 75 workers. The created jobs would include: plant manager, yard manager, kiln manager, sales representatives, log graders, sawyers, graders, edgerman/trimmerman, sorters, stackers, loaders and laborers, drivers, machinist, maintenance supervisor, satellite staff, administration, and security.

The sort yard would ideally be structured as a nonprofit, social enterprise. A social enterprise is a business that addresses social and/or environmental challenges through use of market forces. This will be accomplished by discovering and creating market outlets for reclaimed materials. Such market outlets will be a vital part of achieving broad-based economic, social and environmental benefits.

Finding and directing woody materials to high-value markets will require both coordinated efforts between existing businesses and the public producers of waste materials and successful

market penetration on the part of the system. Current markets are not robust enough to consume the available supply, thus part of the system's coordinated efforts must be to increase demand for the system's products.

PROCESS

The process of gathering information on a workable urban wood sort yard consisted of: (i) a literature review; (ii) partnerships with relevant organizations; (iii) meetings with officials from Baltimore and other interested agencies and stakeholders; and (iv) information gathered from John Stephenson's report studying the economics of an urban sort yard creation in Baltimore city.

LITERATURE REVIEW.

During the course of this study, a literature search and review was conducted to gauge how other regions and municipalities handled their urban waste wood with an eye towards seeing which programs could be adapted to Baltimore and what lessons could be learned. When looking for activities to be replicated, regional, geographical and cultural differences peculiar to Baltimore and the surrounding region were considered. Please see [*Attachment 1*](#) for a complete list of literature reviewed.

LOCAL PARTNERSHIPS.

The USDA Forest Products Laboratory (FPL) has primarily been interested in the creation of an aggregated urban wood sort-yard which results in job opportunities for the underemployed or unemployed, low-skill, urban residents. A coordinated approach towards this objective is necessary to achieve this goal. FPL representatives and U.S. Forest Service staff met with Humanim senior executives and formalized a working partnership among the organizations.

Humanim is a nonprofit with over 41 years of experience providing comprehensive employment and clinical services to difficult-to-serve populations across Maryland. Humanim's newly launched deconstruction business, DETAILS, focuses on job training and economic self-sufficiency for individuals with barriers to employment. They expect to become an economically viable social enterprise by becoming the industry leader in deconstruction and innovative reuse of building materials in the Baltimore region. FPL has, for many years, conducted research on deconstruction and re-use of deconstructed wood materials. DETAILS' mission and business activities fit well within an aggregated urban sort yard system. It is anticipated that the urban wood sort yard will open up additional market outlets for urban wood, including deconstructed wood and other materials. It is expected that the use of deconstructed materials will become mainstream practice, particularly as other localities adopt similar practices. Deconstruction holds the promise of tapping the value of wood currently found in blighted properties of which there are more than 16,000 abandoned residential properties in Baltimore. As the value of such deconstructed materials is recognized, increased demand for the materials will create an employment stream stemming from the sort yard.

LOCAL MEETINGS.

Individual meetings were held with City staff to brief them on the purpose of the project and to gather their perspective and knowledge.

- Met with the Baltimore City Department of Sustainability to discuss the use of Camp Small as a possible site for the envisioned sort yard.
- Met with the Chief of Urban Forestry for the Baltimore City Recreation and Parks to discuss the volume and process which is currently in place for receiving woody materials. Camp Small was toured and Erik Diehl was consulted on how wood was transported, processed and disposed of currently.
- Met with the Baltimore City Department of Public Works, to discuss ways in which Humanim's labor force expertise and the idea of materials in the proposed sort yard could fit into Baltimore City's Storm Center Initiative.

It was clear after conducting these meetings that a lot of prior thought and discussion had been given to using Baltimore City wood waste as a biomass fuel supply. However, FPL requested that the highest and best use for urban wood waste be examined. Using wood, especially valuable hardwood, as a fuel source was determined to not be "the highest and best use." Therefore, use of woody waste for waste- to-energy fuel systems was not investigated as a primary strategy. However, data gathered for this report does support using the enormous amount of wood chips generated in the Baltimore Region as a potential fuel supply. Consequently, as part of this project, discussions with the Maryland Port Authority have been initiated and there is interest in exporting wood chips or pellets to Northern Europe from the Port of Baltimore.

Two separate meetings were convened of public and private suppliers to discuss how to create both value and jobs from waste wood. The topics covered included: collection; transportation; supply and types of wood waste; processing; and possible locations of the sort yard.

The first meeting included representatives from Baltimore City, USDA, the State of Maryland, Humanim and Baltimore Gas and Electric.

- Bill VanderSack, Baltimore City Parks and Recreation;
- Mara D'Angelo, Baltimore City Housing and Community Development;
- Kim Burgess, Department of Public Works,
- Anne Hamby, Baltimore City Department of General Services;
- Ted Atwood, Baltimore City Department of General Services;
- Beth Stromman, Office of Sustainability;
- Dan Rider, Maryland Department of Natural Resources;
- Marian Honeczy, Maryland Department of Natural Resources;
- Jeff Smith Humanim;
- Jeff Carroll, Humanim;
- Cindy Truitt, Humanim;
- Bill Rees, Baltimore Gas & Electric
- Morgan Groves, USDA Forest Service

- Elizabeth Larry, USDA Forest Service

City and State staff recommended the review of existing reports recently completed for Baltimore and the incorporation of their data into this report. These included studies conducted by Cyclelogic's David Hill for the City of Baltimore, (Baltimore City Biomass Study Phase I Report (10/19/11), Baltimore City Biomass Study Phase II Report (1/23/12), Baltimore City Biomass Study Phase III Report (5/16/12), and Baltimore City Biomass Study Draft Final Report (7/30/12)) and report by Resource Professionals Group, (Supplying Renewable Energy to Heat and/or Cool Selected Baltimore County Facilities with Sustainably Produced Woody Biomass Fuel (June 1, 2011)). All of these reports are included on the attached literature list.

To wisely locate and design the ideal network of sort yards envisioned, more information was needed. In order to determine the best location and equipment needs for the sort yard, it was necessary to speak with the current collectors of wood waste to gauge the volume and characteristics of the wood products that they currently work with. A second meeting was convened of private suppliers which consisted of arborists contracted by BG&E to remove tree trimmings in compliance with PSC regulations, U.S. Forest service representatives and representatives from the state of Maryland Department of Natural Resources. 13 companies were invited (see list below) and 5 of the invited companies attended.

- A & A Tree Experts, Inc.
- AAA Cumberland Valley Tree Service Inc.
- Asplundh Tree Expert Company
- Carroll Tree Service, Inc.
- Community Tree Experts
- Ex-Cel Tree Expert Company, Inc.
- F. A. Bartlett Tree Expert Company
- Lewis Tree Service, Inc.
- Mercier's, Inc.
- Penn Line Service, Inc.
- The Care Of Trees
- The Davey Tree Expert Company
- Tree Services, Inc. T/A Adirondack Tree Experts

Based on information gathered at these meetings and through follow up with individual companies, the design and location of the urban sort yard were determined. Wood volume and specie types were gathered from these contractors and incorporated into John Stephenson's, 3-1-13 Draft Report: *Baltimore Urban Woody Bio-Mass Initiative*. Using the volume and disposal process information gained from these meetings, the location, design, equipment needs, and staffing of the urban wood sort yard were determined. This report incorporates the findings from John Stephenson's investigation and research.

A preliminary investigation of potential end-markets based on volume and species of wood has been conducted. It is already known that there is a strong desire on the part of local architects and builders for incorporating locally grown and manufactured building products into their

projects. What is not known are the anticipated volumes of the specific products demanded and the acceptable price point for each product. Cataloging these items and their market valuations is essential to developing a profitable value-added processing system. These items will be cover in Phase II of the project.

INTRODUCTION

As one of the largest industries in the state of Maryland, the forestry industry generates more than \$245 million for the state's economy and over 5,618 jobs. Nearly 2.7 million acres, or 43 percent of Maryland's surface, is covered by forest. The forested portion of Maryland's urban land is estimated to be 310,000 acres.ⁱ

In every case, the generation of woody materials in urban forests and the costs associated with the handling and disposal of these materials is considered as a cost center. In contrast, these same woody materials should be viewed as a profit center. Urban forests are just as much a natural resource as are rural forests. The wood generated from their management, i.e., urban wood waste, should similarly be regarded as an asset for building community wealth.

Motivated mostly by cost avoidance, many municipalities have implemented innovative ideas utilizing urban wood. For example, Camden NJ has partnered with the Citilog, an urban milling operation, to utilize urban logs from municipal wood waste. However, few, if any, municipalities, in contrast to their rural counterparts, have considered their urban wood supply as a job generator.

The goal of this project is to create a preliminary plan for an integrated system that aggregates urban wood waste (woody biomass and deconstructed lumber) and creates market outlets and economic activities of sufficient economic value that jobs are created for inner-city urban residents. (See Figure 1)

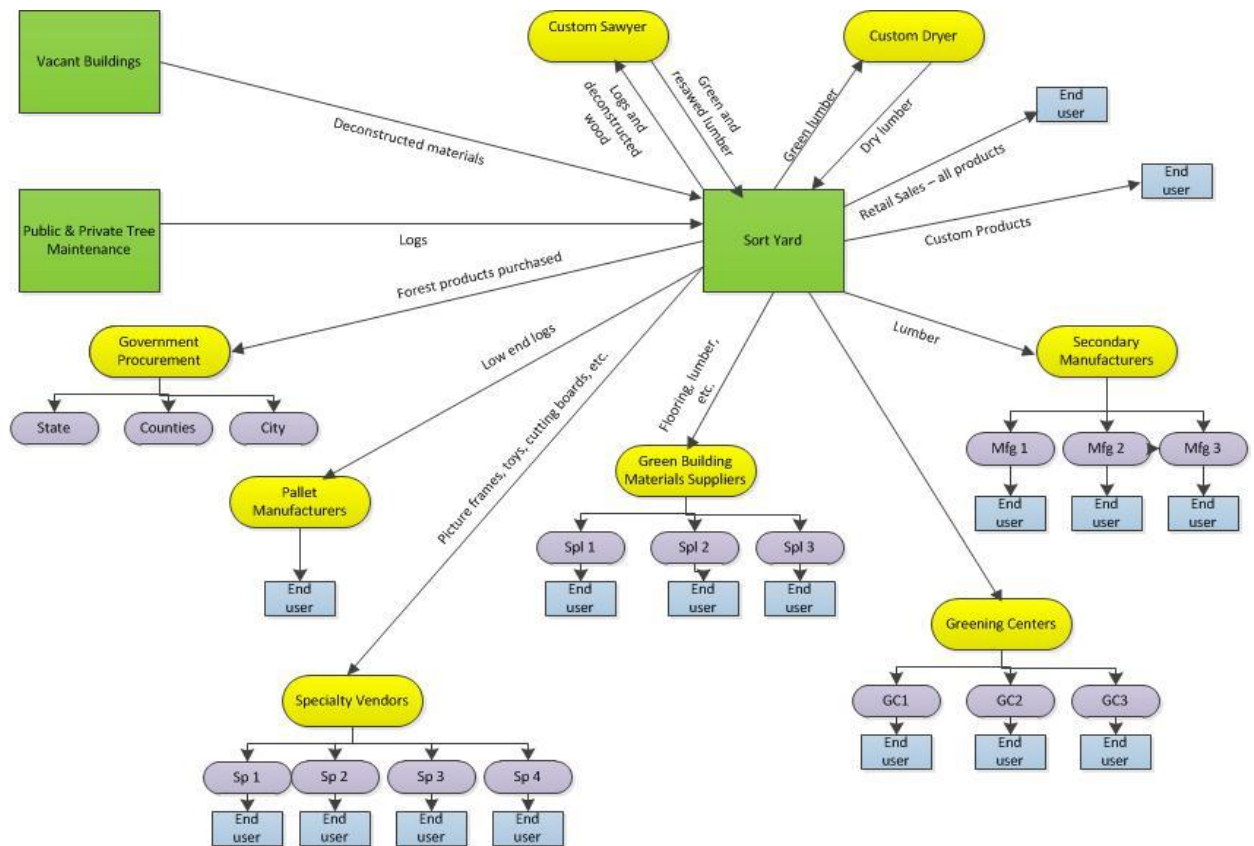
BALTIMORE CITY ECONOMIC CONDITIONS

Many Baltimore neighborhoods are mired in crime, poverty and despair. Census Data posts dismal employment statistics in Baltimore City as compared to the state of Maryland. The number of individuals in Baltimore who are unemployed, living in poverty, on public assistance, and/or are without a high school diploma/ GED, are considerable. This acts as a drain on city resources. Many are currently unable to function as productive members of the community. The following indicators demonstrate the dramatic need for jobs in Baltimore City.

Measure	Baltimore	Maryland
Unemployment rate 2000	5.9%	3.6%
Unemployment rate 2005	7.1%	4.1%
Unemployment rate 2010	11.1%	7.2%
% of residents living in poverty	18.8%	7.8%
% of households on public assistance	5.3%	1.9%
% residents age 16 and over not in labor force	37.8%	30.4%
% of people over age 25 that do not have a GED or HS Diploma	22.6%	12.2%

Source: 2010 U.S. Census Data

FIGURE 1



The relationship (network) of wood from the Sort Yard to supporting and complimentary businesses

WASTE TO WEALTH

Baltimore City Mayor Stephanie Rawlings Blake's Waste to Wealth (W2W) takes three issues which are currently major problems in the city: (1) the huge amounts of waste (food, leaves, wood, manure) being sent to landfills for disposal; (2) a daunting inventory of vacant land and buildings; and (3) an underemployed populace; and repositions them as assets. The W2W initiative puts in place aggregate systems that collect waste streams and turn them into new commodities. This initiative utilizes programs, policies and an agency-wide commitments to work with non-profits, community organizations, and interested businesses in order to ensure that reclaimed materials are put to their highest and best use within the city.

This project, sponsored by FPL, explores the benefits of an aggregated sort yard where wood products can be delivered on a large scale and sorted according to their highest and best use. The project has become one of the strategies which can be utilized to achieve Mayor Rawlings-Blake's W2W vision. The proposed integrated system includes both urban wood waste and deconstructed building materials. These materials will be removed from the waste stream and

converted into commodities. The aggregated sort yard will open up additional market outlets for the urban wood, including deconstructed wood. It would also increase the value of wood in blighted properties. By increasing the demand and value of deconstructed materials and urban woody biomass, jobs will be created upstream of the sort yard.

BALTIMORE'S FOREST RESOURCE

The health of Baltimore's urban forest varies. More than half the trees are in good or excellent condition. One quarter of the trees is in fair condition and nearly one quarter of the trees are in dead or in poor, critical or nearly dead conditions. The average life-span of a tree in Baltimore is 15 years and only one-third of the tree population lives past age 15.ⁱⁱ

Species Composition Of And Estimated Number Of Trees
(Including Dead Trees) In Baltimore's Urban Forest

Species	Number of trees	Percent of population
White/green ash	293,400	10.3
Other species (primarily dead)	175,100	6.2
American elm	166,700	5.9
American beech	163,900	5.8
Black cherry	161,300	5.7
Black locust	155,000	5.5
Tree of heaven	146,200	5.2
White oak	103,100	3.6
Sassafras	95,100	3.4
Boxelder	93,100	3.3
White mulberry	89,400	3.2
Flowering dogwood	88,000	3.1
Northern red oak	85,000	3.0
Chinese elm	81,700	2.9
Silver maple	78,800	2.8
Red maple	73,800	2.6
Tulip tree	62,000	2.2
Eastern white pine	57,200	2.0
Mockernut hickory	41,700	1.5
Norway spruce	36,800	1.3
Slippery elm	33,500	1.2
American sycamore	32,900	1.2
Norway maple	32,700	1.2
Common pear	29,700	1.0
Willow oak	29,600	1.0
Cherry	26,100	0.9
Eastern red cedar	23,200	0.8
Black oak	22,800	0.8
Eastern hemlock	19,600	0.7
Sugar maple	18,100	0.6
Black tupelo	18,000	0.6
Alternate-leaf dogwood	17,000	0.6
Chestnut oak	14,600	0.5
Common juniper	14,500	0.5
Japanese maple	13,800	0.5
American hornbeam	13,300	0.5
Oriental arbor vitae	13,200	0.5
American holly	12,100	0.4
Black walnut	10,300	0.4
Pin oak	10,300	0.4
American basswood	9,600	0.3

Species	Number of trees	Percent of population
Eastern hophornbeam	9,200	0.3
Northern catalpa	8,900	0.3
Sweet cherry	8,300	0.3
Juniper	8,100	0.3
Honeylocust	6,900	0.2
Crabapple	6,900	0.2
Rhododendron	6,900	0.2
Eastern redbud	6,000	0.2
Witch hazel	6,000	0.2
Northern hackberry	5,800	0.2
Cucumber tree	5,200	0.2
Russian olive	4,900	0.2
Sawtooth oak	4,900	0.2
Pecan	4,600	0.2
Pumpkin ash	4,600	0.2
Japanese pieris	4,600	0.2
Red spruce	4,600	0.2
Northern white cedar	4,600	0.2
Bitternut hickory	4,000	0.1
Pignut hickory	4,000	0.1
Southern red oak	3,700	0.1
Littleleaf linden	3,700	0.1
Arrowwood	3,700	0.1
Dogwood	3,000	0.1
Ash	3,000	0.1
Spicebush	3,000	0.1
Sumac	3,000	0.1
Maple	2,900	0.1
Almond	2,900	0.1
Weeping willow	2,900	0.1
Cedar of lebanon	2,300	0.1
Atlantic white cedar	2,300	0.1
Rose-of-sharon	2,300	0.1
Eastern cottonwood	2,300	0.1
Nectarine	2,300	0.1
Sweetgum	2,000	0.1
Oak	2,000	0.1
Scarlet oak	2,000	0.1
American elder	1,500	0.1
Pawpaw	1,000	0.0
Nutmeg hickory	1,000	0.0
Total	2,835,500	100.0

Source: *TreeBaltimore Report Appendix B (see endnote)*

COLLECTIONS AND PROCESSING

BG&E generates logs from large transmission rights-of-way. However, increasingly, logs are being generated from work on the distribution system (local lines running along roads and through neighborhoods). Currently, the majority of logs from the transmission system are left on-site. They are cut-up for firewood by crews and left on the property. During routine maintenance, small branches (8" diameter or smaller) are normally chipped and removed from the property. The region's current aggregation yards exist as for-profit small businesses which focus on mulch production. BG&E contract arborists are reluctant to send their supply to these yards beyond a certain distance and during times when the aggregation yards elevate their "tipping fees" as a means to curb incoming supply.

Branches larger than 8" are cut and left for the property owner. In the BG&E service areas, the final disposition of this material is the responsibility of the property and/or tree owner. The City of Baltimore requires that BG&E and their contract tree companies remove material from sites where they have performed tree maintenance.

Baltimore City's Forestry Division is responsible for tree maintenance and care within Baltimore City. The division has five tree maintenance crews (three workers each), two stump-grinding crews (1-2 workers each), and two log loader crews. The division hires nine tree maintenance crews (3 members per crew) by contracting with tree maintenance companies. The City owns three log loader trucks and contracts with two other outside companiesⁱⁱⁱ. Current practice is to cut the trees into large logs and transport them to Camp Small for collection. Division policy is to not chip the trees in order to control labor costs and to preserve the value of the wood as whole logs.



RAW MATERIAL SUPPLY: NOW AND IN THE FUTURE

This feasibility study examines the raw material supply of two sources—woody biomass and deconstructed lumber.

Woody Biomass-- Woody biomass is defined as both trees and bushes. Currently wood is generated as a by-product of on-going operations by numerous entities. Urban woody biomass is derived from private businesses, municipal agencies and utilities whose work includes removing diseased or damaged trees^{iv}.

It is clear that tree maintenance produces the vast majority of wood volumes which are estimated at 800,000 tons annually for Maryland's urban areas. This volume is mostly in the form of ground material bound for disposal either at landfills or mulch markets provided by independent small businesses. An unknown but significant quantity of usable building materials could be recaptured from building deconstruction and industrial or commercial waste streams. These waste streams could be redirected for re-use in various applications such as millwork, structural lumber and other end-uses. For example, these materials could be used in public works projects such as storm water control devices.

An inventory was done from selected producers: Baltimore City and arborists under contract with the local utility Baltimore Gas and Electric (BG&E) to quantify their current production volumes and the characteristics of the wood products generated. These entities were chosen for inclusion because of the city's and BG&E's interest in finding higher value streams for their products in order to reduce costs and their abilities to control the cutting of and disposal of their supply. Data was gathered directly from Baltimore City, private arborists and outside consultants' reports. Data and findings found in those reports reconfirmed this study's findings.

The estimated annual available amount of urban woody biomass supply is 42,564 tons annually (Baltimore City and County only).

	Tons Wood Material	Tons Chips
Baltimore City	9,500	6,825
Baltimore County	13,926	625
Private Contractors* County	14,863	39,000
Private Contractors* City	4,275	39,000
Total	42564.00	85450.00

On an annual basis, there is an average of 9,500 tons of woody tree material stored at Camp Small, the central location site for wood waste in Baltimore City. It is also estimated that approximately 1,750 cubic yards (yd³) of ground wood chips and limbed, but un-ground trees are collected on a monthly basis (21,000 yd³/year) mostly from the City's Department of Recreation and Parks and from private landscapers.^v

There is average of 13,926 tons of woody tree material and 625 tons of wood chips^{vi} from Baltimore County. This supply comes from the removal of diseased or damaged trees from yards and street sides, the recycling of pallets and crates, from lots that have been cleared for development and homeowner disposal of branches and brush from yard clean-up. The statistics on this material comes from the County's Eastern Sanitary Landfill.

Previous reports cited that seven private contracting firms generated 14,843 tons annually of woody material.^{vii} Data collected for this report of 8 private contractors.....NEED IT IN TONS FOR CONSISTENCY

Each of these companies is reported to collect on an annual basis an average of 156 loads. One company can generate a potential average volume in board feet of about 436,000. Multiply this number by eight tree removal companies under contract with BG&E and the volume from the BG&E service area and Baltimore City is estimated at 3,500,000 bd. ft. This number is consistent with the volumes a typical working sawmill can produce in a rural community where there is good access to loggers and a steady supply of timber from a true forest resource.

Deconstructed Lumber- The regional metro area has more than 2,500 residential demolitions every year that are also good candidates for deconstruction. The City of Baltimore is burdened with approximately 16,000 vacant buildings, roughly 25% of which are city owned. Baltimore Housing estimates that more than 5,700 of the vacant structures are in areas with existing or emerging development demand.

POLICIES AND PROGRAMS

The Baltimore Region has several program and policies in place that generate a significant amount of annual urban wood waste.

MARYLAND PUBLIC SERVICE COMMISSION (PSC) RM 43 REGULATIONS—

- The PSC developed regulations as required by the 2011 Maryland Electricity Service Quality and Reliability Act to govern how Maryland utilities manage their reliability efforts. As a result, new regulations - called RM43 - were developed through a partnership with BGE, other Maryland utilities, and key stakeholders. These new regulations improve electric reliability through the increased management of trees and vegetation near power lines. The regulations went into effect May 29, 2012. It has been estimated that these regulations increase the amount wood chips per contractor by 30,000 to 45,000 cubic yards per year, totaling 45,000 to 60,000 cubic yards per year . This surge in volume will last for an estimated 4 to 6 years before returning to the

current 15,000 cubic yards per year^{viii}. Current outlet streams are unable to absorb this increased volume.



URBAN TREE MANAGEMENT—

As in most urban areas, a municipalities' Forestry Division or its equivalent is responsible for the maintenance of all public trees within its boundaries. In Baltimore City, the Forestry Divisions' major focus is on the maintenance of trees on public streets and medians in the city's rights-of-way. There is considerable constituent interest and demand to plant and service trees in these areas. Budget and labor constraints restrict attention given to trees on public parklands. In the City of Baltimore, 300 days for tree pruning, and 180 days for tree removal are scheduled.^{ix} [Footnote: Treepeople Report]

MARYLAND REFORESTATION LAW—

This regulation applies to all highway construction projects utilizing \$1 or more of State funding and impacting a minimum of 1 acre of forest.

URBAN TREE CANOPY (UTC) PROGRAM-

Thirty-six communities in Maryland have committed to participation in the UTC Goal effort to date. They include Annapolis, Baltimore, Baltimore County (29 communities), Bowie, Cumberland, Greenbelt, Hyattsville, and Rockville. Baltimore City has adopted the goal of doubling their UTC to 40% by 2036.

ZERO WASTE—

Governor Martin O'Malley is leading an initiative to further reduce climate change in Maryland. A zero waste program is included in this package of policies. It calls for requirements which will increase the percentage of waste collected to be recycled and will place limits on the amount of waste which can be directed into landfills.

VACANTS TO VALUE—

This is Baltimore City's major urban revitalization program. The Baltimore Housing Department has set a goal of tearing down 1,500 vacant properties and renovating another 1,500 in the 36-month period that began in January 2013.

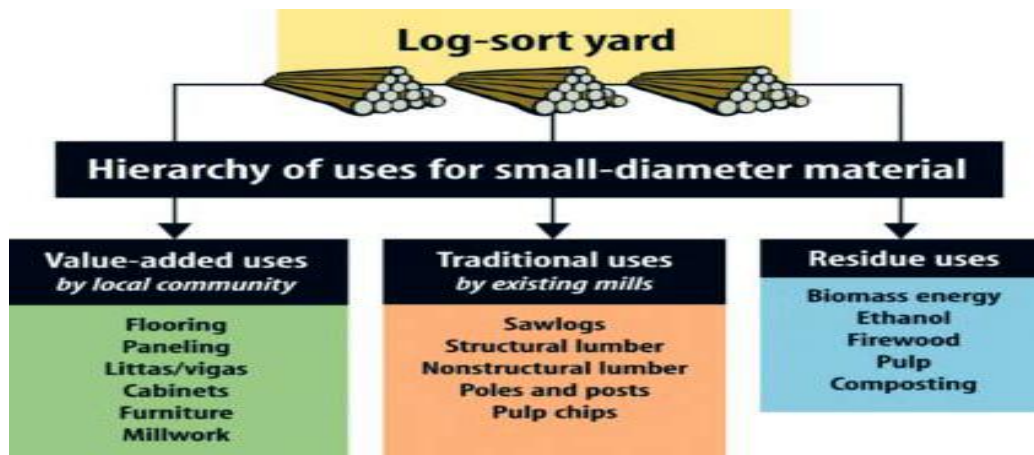
As a result of all these proposed policies, increased maintenance of the urban tree canopy and restrictions on disposal of the waste are headed for a collision court with a zero waste policy. There must be an integrated approach to utilizing these waste materials. Stresses from compliance with RM 43 regulations are already showing up in the current system. Public and private organizations are concerned the ability of disposal outlets to absorb the increased in wood volume. Private contractors have commented that “it is getting tougher as of late due to the fact that we are producing many more chips because of enhanced trimming on high voltage power lines and reclamation projects from BGE.”^x

There is also significant concern about the Emerald Ash Borer. While no infestation has yet been reported in Baltimore City, Ash is the most common tree in Baltimore City’s urban forest. They make up about 10 percent of total trees. Ash trees account for over three percent of the trees in naturally wooded areas in Baltimore and surrounding counties. USDA has estimated that losses could reach almost \$300 million in the Baltimore area alone.

Additionally there has been an increase in fallen and damaged trees from extreme weather events over the last five years. Because of the problematic nature of weather events, it is impossible to calculate with any certainty the amount of anticipated volume but this demonstrates that a system must be put in place to deal with unexpected increases in wood waste volume.

AN INTEGRATED APPROACH

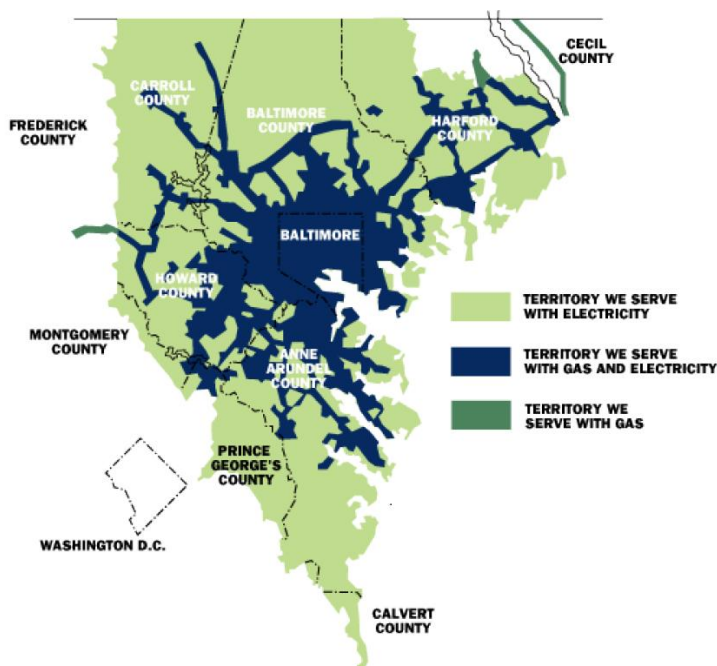
Typical of urban areas, wood materials in the Baltimore region are generated on a small scale, and subsequently redistributed into small scale value streams, if at all. This is the central problem to be solved in order to add value to the wood materials. By aggregating all the raw materials gathered from small individual producers into a centralized location, efficiencies of scale can be brought to bear on the system. Large, consolidated volumes allow for bulk processing and sorting wood waste into high value products. Alone, the small producers simply could not participate in value-added markets. The costs of sorting, reprocessing and marketing can’t be recouped on a small scale. Overcoming the forces of economy of scale associated with low-value inputs/high-cost products requires a mass accumulation of raw materials and efficient handling and processing. The creation of one or more sort yards which allows to high volumes to be collected is the first step. Once sufficient volume is achieved through aggregation of the small producers, the system will allow the capture of the wood wastes’ true potential value.



Graph Courtesy of U.S. Forest Products Laboratory

DESIGN OF THE SYSTEM

Contracted private utility and residential tree removal companies suggested early on that a series of convenient and conveniently located drop off sites be available to them in Baltimore City and throughout the region. In order to maximize volume and increase efficiencies, five to eight satellite centers should be established that feed into the main collection site in Baltimore City. The satellite centers should correspond to the BGE territories (refer to graph below). It is important to note that the BG&E territory incorporates the counties of Carroll, Harford, Howard, Anne Arundel, Baltimore and Baltimore City.



Logs will be transported by the sort yard operator to the main collection area known as the Central Log Salvage and Sort Yard. Here the logs from the satellite drop off sites will be sorted, identified by species, milled into boards, graded/sorted, kiln dried,

packaged, and shipped.

A minimum of 15 acres will be needed to accommodate a sawmill operation for the volume of timber expected. This acreage is required for potential future expansion as volume numbers increase with other companies coming on line or large storm events bring down unexpected amounts of timber. Placement of this main sort yard should be on the waterfront with access to the docks for shipping, trucking, and rail lines. The site should also be served by public transportation.

This site will accommodate a sawmill, kiln and potentially a pelletizing plant, which can maximize the value of the large volume of wood chips generated and produce wood pellets for biomass projects locally as well as export to domestically and internationally (i.e. Northern Europe).

Originally, Camp Small, the location where the City currently stores wood waste, was considered the primary site for an aggregated sort yard. However, Camp Small is located in the northern area of the City off of the Jones Falls Expressway (I-83) at Cold Spring Lane. It is a non-gated site so the public can gain access but it is somewhat hidden from view so someone would have to have knowledge that it exists. Camp Small is roughly 12.97 acres. This excludes the roadways and extends into some land that is currently considered unusable. It is bordered by the highway and residential areas.

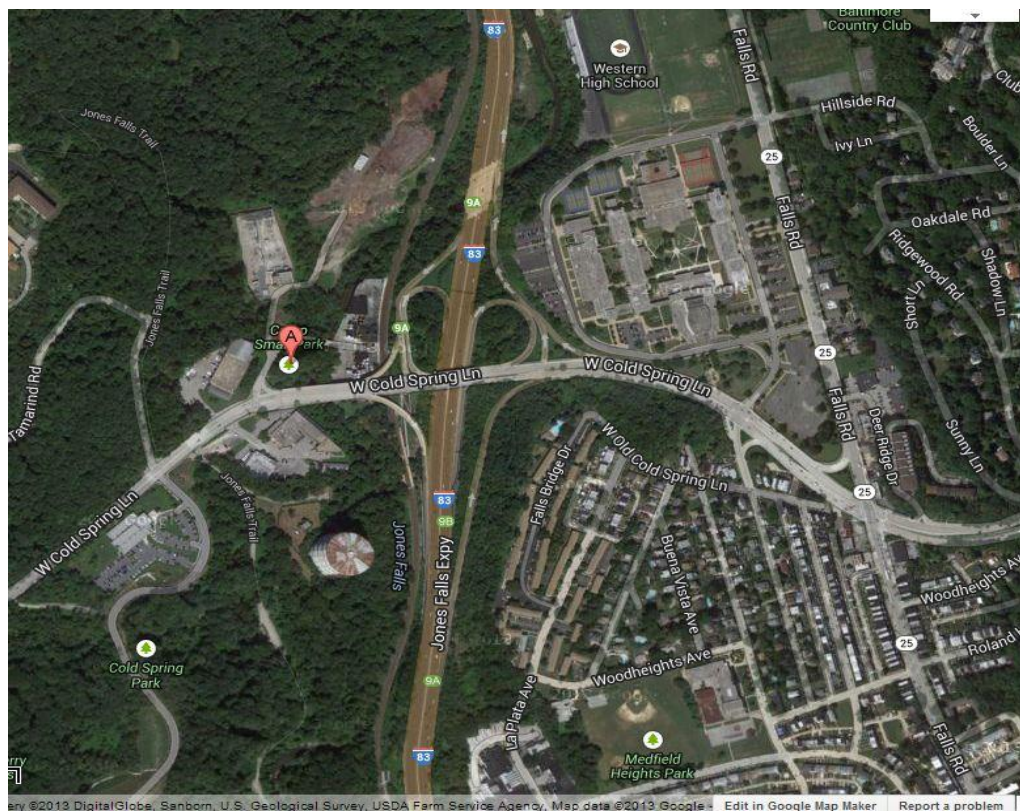


FIGURE 1 CAMP SMALL IS INDICATED BY "A"

To achieve environmental, financial and job creation success, it is critical that market outlets are created. The Central Log Salvage and Sort Yard must be located at a site with export capabilities. A site located in South Baltimore, i.e., the Fairfield area, would be ideal. The area has access to deep water, rail and trucking lines. Land costs are less expensive. Currently, the City of Baltimore is looking for a site in this area that meets the parameters outlined.

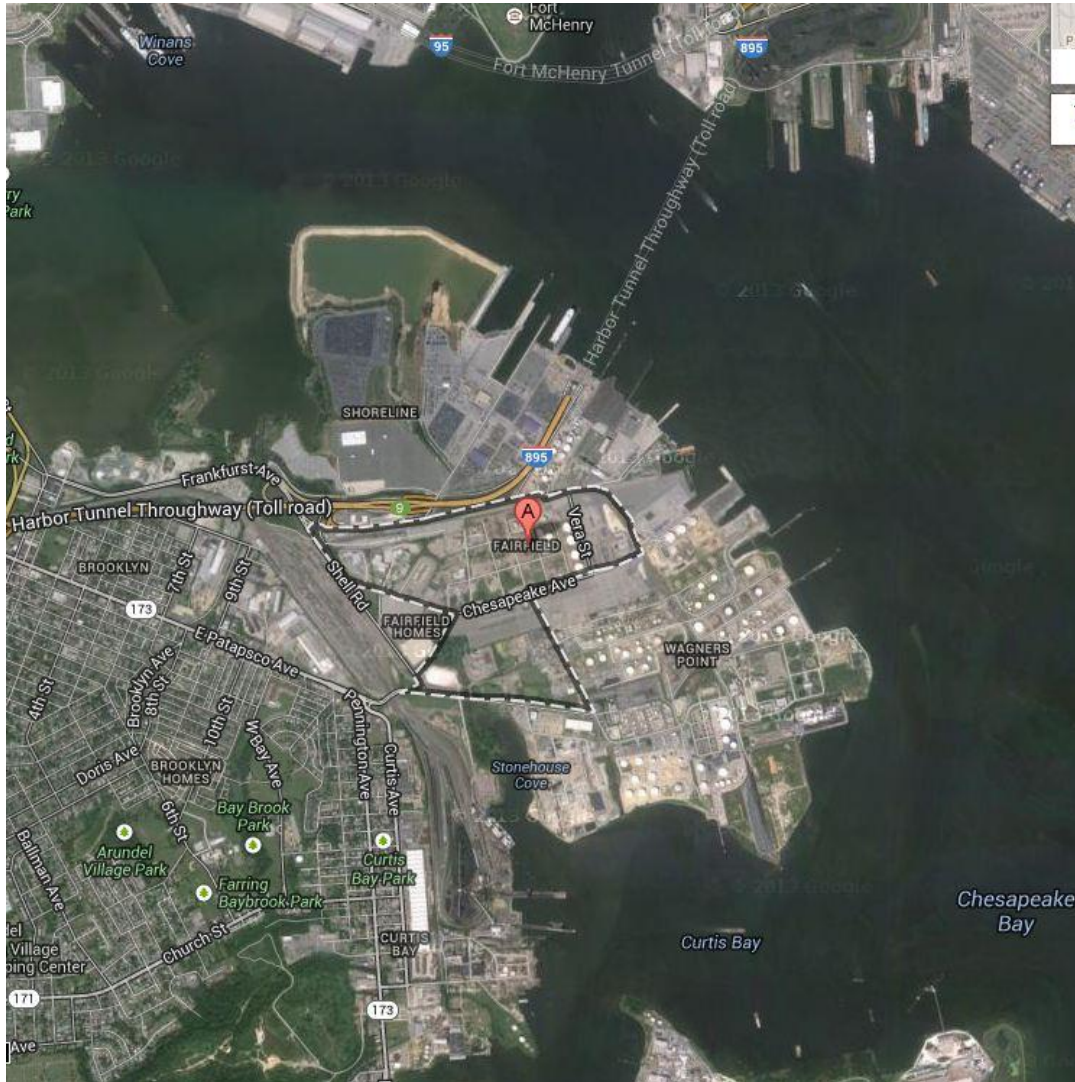


FIGURE 2 POTENTIAL SITES FOR SORT YARD IN FAIRFIELD AREA OF SOUTH BALTIMORE

MILLING OPERATIONS

It is envisioned that milling operations would be done at the Central Log and Sort Yard. Two production lines would be set up. All operations at the satellite yards and the central facility would run on a single 8 hour shift Monday through Friday.

Log milling will be done using two band saws with a 36" diameter capacity. The equipment required consists of: a metal detector; a de-barker; edgers; transfers; log decks; conveyors; 3-head band re-saw units; de-dusters to remove saw dust from the boards; off-stacking conveyer belts; and stacking racks to sort for kiln charges. A wheeled log loader is essential for transferring and loading logs to the de-barker deck and removing sawdust. Estimated total cost for both production lines including the loader is \$340,000.00

Equipment Type	Quantity Needed	Estimated Cost
30-foot log trucks with Prentice-style loaders	2	\$125,000.00
Baker Manufacturing Corporation Dominator Band Saws with 36" diameter capacity + full production lines including debarker, edger, the transfers, the log decks, the conveyors, 3 head band re-saw units. Two wheeled log loaders stacking racks	2	\$340,000.00
Metal detector.-- LICON HX system	1	\$33,000.00
Kiln – Nyle Systems, LLC 30,000 BF kilns. Includes everything necessary	5	\$5-6 / BF of holding capacity* \$900,000.00
Kiln – Nyle Systems ILC 25,000	6	\$5-6 / BF of holding capacity* \$900,000.00

One metal detector will be needed for both production lines. Metal embedded in urban logs is a common occurrence and a big problem. Protection of the saw heads, edgers, and planers is critical. A whole log metal detecting system is necessary to ensure safety of the operators and to prevent damage to the expensive equipment. There are whole log detecting systems that allow a conveyor belt to pass through the circular detector to detect metal objects in logs prior to being loaded onto the main saw heads.

Kiln drying will be done on all sorted and graded wood coming off the sawmill production lines. Due to the variety of log species coming into the yard, five 30,000 BF kilns or six 25,000 BF dehumidification kilns are necessary. Drying cycles for each species vary significantly and thus the need for specific chambers for each charge. Kiln set-up costs typically run about \$5-6 per BF of holding capacity, which includes all costs from the foundation, floors, walls on up to the roof. Wiring, venting, control systems, filters, UL labels, permits for EPA are also all included. Total estimated cost for five kilns is \$900,000.00.

JOB CREATION

Based upon anticipated volumes of urban wood waste generated, a sort yard operation would create jobs within its own operation as well as generate job creation in tertiary businesses. It is estimated that the urban wood sort yard and satellite centers in full operation would support a 75 workers. Jobs include: plant manager, yard manager, kiln manager, sales representatives, log graders, sawyers, graders, edgerman/trimmerman, sorters, stackers, loaders and laborers, drivers, machinist, maintenance supervisor, satellite staff, administration, and security.

The sort yard would ideally be structured as a nonprofit, social enterprise; a business that addresses social and/or environmental challenges through the use of market forces. Urban poverty is part of a cycle of economic and political alienation, principally fostered by an inability to participate in the modern economy as a result of lack of education, criminal background or a disability. It is the role of social enterprises to break this cycle by creating jobs where residents of these communities can learn the skills necessary to participate, should they choose to. This opens up options previously unattainable and affects the quality of the social fabric in these communities by reducing recidivism and raising the standard of living and the level of social equity. The ripple effects of such a program would bring not only a net positive effect to the community and the families within it, but to the greater region at large.

The Urban Wood Sort Yard will provide jobs for the under and unemployed urban residents. Most of the positions do not require a university education or advanced certification. Instead the available positions require aptitude, an eye for detail and a willingness to learn. Humanim will provide training and support structures to help cultivate an employee's soft and hard skills. It is this set of employment characteristics, once learned, that will help the employee move on to other employment should he/she choose to or advance on a career ladder.

SATELLITE DROP YARDS

Staffing could be done with one individual that opens and closes the facility each day. This person could even be an unskilled laborer that simply keeps track of the number of trucks, loads, and specific companies that come through; they would be authorized to tip loads at the facility. One person needed at each site. An hourly wage of \$8.00- \$10.00 plus benefits would be expected. The individual maintains site security, opens up in the morning and locks up at the close of business each day.

Sawmill Operations Staff

Plant manager: Oversees all aspects of the facility from the Greening Center through the Sawmill operations to the Kiln operations--including shipping and receiving. A B.S. in Forestry is required. Salary \$45,000-\$65,000.00 plus benefits is the national average for an experienced person in this position.

Yard manager: This is the hands- on manager of the sawmill line. He/She directs the sorting of the logs and sets the schedule for the milling run each day. A B.S. in Forestry and operations experience is required. Salary is \$45,000-\$50,000 plus benefits.

Kiln manager: He/She oversees the loading of the kilns with specific charges based on species. This person sets the drying schedules, the loading, the air drying, the unloading, and the downloading for shipping. A B.S. in Forestry is needed plus experience. Salary is \$40,000-\$50,000.00 plus benefits

Sales Representatives: Essential individual or individuals needed in this role. They work very closely with management to expedite the special orders for key customers, both nationally and internationally. The only wood product companies that survived the downturn in the forest products sector were those that had little debt and skilled sales representatives for main and niche markets. These individuals are typically paid on a commission basis which varies based on the volume of sales. I would expect a small salary plus commission to be around \$75,000.00-\$95,000.00 per year.

Log Grader: Probably one of the most important people in the yard. He/She grades the logs as they come into the yard and identifies them by species for proper sorting for the line. This person can also grade lumber after it is milled but needs to focus on raw logs coming into the yard. High school is required, but no degree is needed. However, training is mandatory by the National Hardwood Lumber Association (NHLA). Salary is \$35,000-\$38,000.00 plus benefits.

Sawyers: A single skilled operator (Sawyer) can run the Baker Band Saw from an enclosed air conditioned and heated cab. Two are needed for the two production lines. High school is required but no degree is needed. Experience is a must for this position. Salary is \$35,000-\$40,000 per year plus benefits.

Graders: Two are needed, one for each line as they come off the re-saw and head to stacking. High school is required but no degree is needed. However, training is mandatory by NHLA and these positions need to be filled by experienced individuals. Salary is \$35,000-\$40,000 plus benefits.

Edgemen/Trimmermen: Two are needed, one for each line on the mill. These workers can be unskilled and trained in-house. Salary or hourly wage of \$20,000-\$25,000 plus benefits.

Sorters, stackers, shippers, loaders, and laborers: These are the backbone of the entire operation and I would suggest at least 15-20 employees needed for hire to keep the two production lines and kilns efficient and safe. Wages for these individuals would be on a per hour basis of \$10.00- \$12.00 plus benefits. A High School diploma is ideal but not needed. A valid driver's license is a plus.

Drivers: Two competent properly licensed drivers are needed for the log trucks. [A 30 foot log truck is going to be at least a 10 speed high power diesel machine that will easily exceed the weight limits when loaded.] They must have experience handling vehicles of this size and be capable of operating the Prentice-style log loaders attached to these same trucks. A valid commercial driver (CDL) license is going to be mandatory for the log truck drivers that will shuttle logs from the satellite drop-off sites to the main facility. (If the log trucks purchased are less than 26,001 lbs. gross weight including loads, a valid Maryland driver's license alone is sufficient.) They should receive compensation of \$14.00 to \$16.00 per hour plus benefits.

Mechanic/Machinist/Maintenance Supervisor: This individual would be responsible for the daily maintenance and repairs on all the machinery, trucks, and kilns. Skilled position and experience needed to keep all the production lines in order and operating at peak production. Salary needed of \$35,000- \$40,000.00 per year plus benefits.

Greening Center Staff.

All operations are run on a single 8 hour shift Monday through Saturday.

4-5 individuals needed with entry level skill sets. Workers must be able to greet customers and visitors; make change and run a cash register with credit cards; and help load vehicles or trailers with purchased items after the sale has been made. They must also be able to conduct tours of the site and help with cleaning, moving inventory, opening, closing, and locking the facility at the close of business each day. This pays \$ 8-\$10 per hour plus benefits.

Sort Yard / Sawmill Operations	Type of Employment	Number	Skill Level	Pay
	Plant manager	1	BS in Forestry preferred	\$45-65k + benefits
	Yard manager	1	BS in Forestry and operations preferred + experience	\$45-\$50k + benefits
	Kiln manager	1	BS in Forestry preferred + experience	\$40-50k + benefits
	Sales Representatives	1-2	Experienced with wood products	Salary plus commission @\$75-95k
	Log Graders	1	HS _ training from National Hardwood Lumber Association (NHLA)	\$25-\$38K + benefits
	Sawyers	1	HS + experience	\$35-40K + benefits
	Graders	2	HS + NHLA training + experience	\$35-40K + benefits
	Edgerman/trimmerman	2	Entry level	\$20-\$25k + benefits
	Sorters/stackers/shippers /loaders/laborers	15-20	Entry level – no educational requirements	\$10-12/hour + benefits
	Drivers	5	CDL License Experience	\$14-16/hour + benefits
	Mechanic/Machinist/Maintenance Supervisor	1	Skilled position with experience	\$35-40K + benefits
	Administrative staff	5	record keeping of tree inventory; billing, payroll, book keeping	\$15-20/hour

	Security staff	5		\$15-20/hour
Satellite Drop Yard	General employee	10	Entry-level	\$8-10/hour + benefits
Kiln	General employee	1	Entry-level HS	\$8-10/hour + benefits
Greening Center	General employees	5	Entry-level	\$8-10/hour + benefits

END PRODUCTS BASED ON TYPES OF WOOD SPECIES:

Baltimore City has three parks—Druid Hill, Leakin Park and Clyburn Arboretum -- where old growth forests remain today. Consequently, some of the oldest forest stands in the region are found in Baltimore’s parks. Some biologists have remarked upon the significant size of the trees in the groves in Druid Hill. The stands found in Baltimore on undisturbed sites include plant associations of Oak-Hickory, Missed Mesophytic, and Tulip Poplar^{xi}.

Baltimore’s urban forests have 80 different species indigenous to the area. They contain trees native to the region as well as exotic trees, i.e. species native to another continent.

The most commonly found species are White and Green Ash, at 10 percent of the forests. Other common species occurring are American Elm, American Beech, Black Cherry, Tree Of Heaven and Black Locust, each estimated at 5 percent.

Species Composition Of And Estimated Number Of Trees
(Including Dead Trees) In Baltimore's Urban Forest

Species	Number of trees	Percent of population
White/green ash	293,400	10.3
Other species (primarily dead)	175,100	6.2
American elm	168,700	5.9
American beech	163,900	5.8
Black cherry	161,300	5.7
Black locust	155,000	5.5
Tree of heaven	146,200	5.2
White oak	103,100	3.6
Sassafras	95,100	3.4
Bokelder	93,100	3.3
White mulberry	89,400	3.2
Flowering dogwood	88,000	3.1
Northern red oak	85,000	3.0
Chinese elm	81,700	2.9
Silver maple	78,800	2.8
Red maple	73,800	2.6
Tulip tree	62,000	2.2
Eastern white pine	57,200	2.0
Mocknut hickory	41,700	1.5
Norway spruce	36,800	1.3
Slippery elm	33,500	1.2
American sycamore	32,900	1.2
Norway maple	32,700	1.2
Common pear	29,700	1.0
Willow oak	29,600	1.0
Cherry	26,100	0.9
Eastern red cedar	23,200	0.8
Black oak	22,800	0.8
Eastern hemlock	19,600	0.7
Sugar maple	18,100	0.6
Black tupelo	18,000	0.6
Alternate-leaf dogwood	17,000	0.6
Chestnut oak	14,600	0.5
Common juniper	14,500	0.5
Japanese maple	13,800	0.5
American hophornbeam	13,300	0.5
Oriental arbor vitae	13,200	0.5
American holly	12,100	0.4
Black walnut	10,300	0.4
Pin oak	10,300	0.4
American basswood	9,600	0.3

Species	Number of trees	Percent of population
Eastern hophornbeam	9,200	0.3
Northern catalpa	8,900	0.3
Sweet cherry	8,300	0.3
Juniper	8,100	0.3
Honeylocust	6,900	0.2
Crabapple	6,900	0.2
Rhododendron	6,900	0.2
Eastern redbud	6,000	0.2
Witch hazel	6,000	0.2
Northern hackberry	5,800	0.2
Cucumber tree	5,200	0.2
Russian olive	4,900	0.2
Sawtooth oak	4,900	0.2
Pecan	4,600	0.2
Pumpkin ash	4,600	0.2
Japanese pieris	4,600	0.2
Red spruce	4,600	0.2
Northern white cedar	4,600	0.2
Bitternut hickory	4,000	0.1
Pignut hickory	4,000	0.1
Southern red oak	3,700	0.1
Littleleaf linden	3,700	0.1
Arrowwood	3,700	0.1
Dogwood	3,000	0.1
Ash	3,000	0.1
Spicebush	3,000	0.1
Sumac	3,000	0.1
Maple	2,900	0.1
Almond	2,900	0.1
Weeping willow	2,900	0.1
Cedar of Lebanon	2,300	0.1
Atlantic white cedar	2,300	0.1
Rose-of-sharon	2,300	0.1
Eastern cottonwood	2,300	0.1
Nectarine	2,300	0.1
Sweetgum	2,000	0.1
Oak	2,000	0.1
Scarlet oak	2,000	0.1
American elder	1,500	0.1
Prappaw	1,000	0.0
Nutmeg hickory	1,000	0.0
Total	2,835,500	100.0

Data received from private arborists surveyed for this project indicated that the species breakdown they were typically harvesting included:

- Tulip Poplar
- White Oak And Red Oak
- Sugar Maple
- White Pine And Red Pine, Jack Pine
- Other mixed -Black Cherry, Sycamore/London Plain, Alder, Cottonwood Or Poplar And Ash.

It is expect that Ash will become a much larger component of the over-all species composition in collected wood waste as the Emerald Ash Borer begins to exact its toll on the biological rotation age of this species.

POTENTIAL END PRODUCTS

Reclamation, Recycling and Reuse efforts need market outlets to be successful. Based on a preliminary inventory analysis, urban wood waste consists mostly Sugar Maple, White Oak, White Pine and Tulip Poplar. Sugar Maple is used for flooring and furniture making. Tulip Poplar is a very valuable as a secondary wood in cabinet making for drawer slides. White oak and red oak are used for flooring, trim, batter/mop boards in new home construction. White pine and red pine, jack pine can be sent to Western Maryland and Pennsylvania pulp mills for papermaking.

There is also market potential for lumber that is not kiln dried and is simply shipped green after milling, grading/sorting, packaging. Pulp wood species will also be cut here into cords and staged for pick-up by timber buyers for the paper mills in this region.

The deconstructed wood can be marketed as the *Historic Woods of Baltimore*, a product that could easily be selected to supply above average grade lumber for the high-end builders and homeowners in this region. Selling directly to local and regional wood workers is quite lucrative and as a home hobby niche would bring significant income to the project.

A starter list of products for the Community Greening Centers would be produced on site from the salvaged logs. These products include clean mulch at no charge, wooden Leopold bench kits for purchase, raised wooden garden bed kits for purchase, wooden compost bins for purchase, wooden sandbox kits for sale, kiln dried firewood for sale. In addition, waste by-products could be used in composting initiatives. All of these product lines could generate additional revenue.

Wood chips sold as a fuel supply could be a lucrative market outlet because of the large volume of wood chips generated. This would require accepting the woody debris material forms for subsequent re-use. The primary objective of this system is converting usable logs into higher value uses.

Using arboricultural by-products (i.e., wood grindings) for energy production is a well known solution for offsetting the rising costs of fossil fueled plants. The side benefits derived from this are many: improved local economies, cleaner air, healthier forests, reduced demand for expensive fossil fuels (in low value uses), and predictable and stable budgeting for energy costs. No such energy system currently exists in the Baltimore region. However, Baltimore County has

recently completed a feasibility study, which identifies several opportunities for converting aging heating and cooling systems in many of their buildings. Given the area's low cost of natural gas, it is highly unlikely that the Baltimore Region becomes a hot bed for biomass projects. However, if there is a government program that could provide incentives for fuel oil switching; then there could be a market up tick. In the meantime, the exporting to Northern Europe seems to be the most financially lucrative strategy.

Waste-to-energy was not the primary focus of this study and therefore this strategy was not fully developed. Should an aggregation yard that focused on lumber be established, such a yard would be well positioned for fuel production. There is advantage in having a diversity of products; when the demand for one product slips, the processor can direct efforts and resources into those products exhibiting a rising demand curve. There are some beneficial synergies to co-locating a urban wood utilization system and wood energy system.

Synergies between Urban Wood Utilization and Urban Wood Energy	
Urban Wood Utilization (lumber production)	Urban Wood Energy (Biomass)
Aggregation of logs	Aggregation of biomass (fuel)
Process various species	Species indiscriminate
Conversion process generates byproducts	Uses mill wastes - byproducts for fuel
Wood byproducts: bark, dust, slabs, trimmings	Flexible on material types/form
Slabs, cut off's require size reduction	Size reduction equipment on site
Wood byproducts are green wood	Fuel green or dry acceptable
Byproducts generated daily	Stable fuel demand
Byproducts typically not stored, limited space	Fuel storage space significant
Higher production mills electric powered	Electrical generation
Higher production mills are stationary	Power plant stationary
Kiln drying lumber energy intensive	Waste heat available daily
Sound log use only	Utilize remaining tree volume
Hollow, cull, or metal impregnated logs not usable	Process non-merchantable logs into fuel
Yard equipment required (i.e. loader)	Yard equipment required (i.e. loader)

Source: Feasibility Study for a Community Wood Reclamation System, Pg. 32

BUDGET

LUMBER VALUES

A quick, conservative look at current rough sawn lumber prices with the species expected to be harvested in Baltimore City and Baltimore County have an average wholesale board foot (BF) price of \$0.75/BF. If the expected yield of Grade 1 and Grade 2 lumber is 2,100,000 BF annually,

this would generate gross revenues around \$1,575,000.00. However, this is totally dependent upon putting markets into place. Without viable marketing and sales, success will not be possible. Data suggests that the price points for rough sawn hardwood lumber of Grade 1 and Grade 2 is increasing. There is increased demand from the housing construction sectors and from international markets in China and Vietnam.

Of the lumber collected, it is expected that there will be a 40% attrition rate of logs that do not qualify as Grade 1 or Grade 2. This is calculated to be equal to 1,400,000 BF. This lumber could be milled into railroad ties or made into cants for pallets. The potential revenue from these markets could average at least \$0.35/BF or an annual gross revenue of \$500,000.00

There is potential income from the sale of pulp wood and chips to regional pulp mills. Cords of mixed species or pine sells from between \$12.00 to \$14.00 per cord. If 100 cords a month are stacked and sold to pulp mills, a revenue stream of \$14,000/annum could be realized.

As production gears up at the Urban Sort Yard and as additional companies gain access to drop sites, these volume numbers are expected to increase. Likewise, as the Emerald Ash Borer begins to settle into Eastern Seaboard forests, wood waste volume will increase. Grade 1 FAS/1F Ash, when kiln dried, is currently priced at \$1.26-\$1.45 BF. This could generate an impressive amount of revenue.

A rough estimate of total capital investment needed to establish the Sort Yard is \$5 million: \$2.5 million of which is needed to put in place the infrastructure (boilers, tub grinders, trucks, etc.); \$500,000 needed for community outreach and education; and \$2 million for operation of the new waste reclamation and building deconstruction efforts, and the Community Greening Centers. The Community Greening Centers will need to train and hire additional staff, which were not included in the staff estimates above.

FUNDING

A number of municipalities have funded their wood waste recycling projects through city tipping fees and/or the sale of the wood waste as a commodity. When an non-profit has been formed to manage this, they have typically been subsidized by the state, although there are a few for-profit organizations operating. While these for-profits have not released financial numbers for review and their levels of profitability are unknown, the simple fact that they have existed multiple years suggests that they operate at a profit.

For the Baltimore sort yard project, start-up capital could be gotten from a number of sources: the sale of municipal bonds; HUD's Section 108 loans; or use of new market tax credits. Crowd funding could be explored as an option although that may be unrealistic to raise a sufficient level of capital.

Additional sources of revenue could be raised from NMTC, state recycling credits and the generation and sale/trading of carbon credits in the system which Maryland has been working on implementing.

CONCLUSION

It is clear that the Baltimore Region's environmental policies and legislative actions require an aggregated system to be put in place to appropriately manage the increase in urban wood waste—both woody biomass and deconstructed materials. Urban milling operations exist that utilize urban logs from municipal wood waste. For example, in New Jersey a for-profit venture, Citilogs is successful at producing products to multiple market outlets. Such entities have had financial success because they secured a free wood supply and cheap land on which to operate.

It would be ideal if that system created in the Baltimore region provided for the highest and best use of material and simultaneously generated jobs for some of the region's hardest to employ residents. However, an aggregated sort yard and processing system, such as has been proposed, will require a significant financial investment and costs may exceed revenue. It will also require a long-term commitment from public agencies—both in supply and purchasing. It will require an aggressive and dedicated management team. It also must be operated as an independent nonprofit social enterprise, working in conjunction with public and private entities.

The success of Baltimore's urban wood sort yard project – satellite yards and central yard and processing—is dependent on several critical factors. As mentioned above, two of the critical factors are a free supply of wood and inexpensive or free land. There must be a consistent, reliable supply. In order to obtain the minimum volume to meet economic viability and job creation/retention goals, the projects requires that all the supply under the control that the City and BG&E be directed and aggregated. This study examined that supply from those two sources primarily because it is possible that long-term control can be exercised there supply. The economics of the project have been built around this control of this wood waste. Without such a guarantee in place, other less expensive and job intensive alternatives need to be explored. For example, portable milling via contractors or partnerships with a for-profit partner or other strategies as outlined in recent reports.

Obtaining public and/or private financing requires that a dedicated supply be in place through long-term supply agreements. Policy changes and practices will have to occur in order for the supply to meet specifications required. To maximize revenue, whole logs are required. The current practice of cutting wood waste logs into smaller pieces and chipping needs to be reduced. This requires that BG&E shift stated policies and require their contractors to do the same. Incentives to make this shift include:

- Cost Avoidance;
- Guarantee of acceptance of material;
- Stable disposal;
- Assurance logs utilized to their highest value; and
- Convenient locations with easy access and egress.

If the project is established as a 501(c) 3, a possible additional incentive, similar to DETAILS' deconstruction model, is to offer a tax credit in exchange for the wood. A system would be put in place that marks the logs so as to identify source and ownership. The logs would be transported to the sort yard and assessed a value depending on type of species and size. The

owner (BG&E or the homeowner) would receive a statement of the value as a charitable donation. The details of this system need to be worked out but such a system would incentivize private owners to supply wood. This would help to ensure the continued delivery of the necessary volumes of logs.

Structuring the project in this manner creates additional opportunities for funding from a variety of sources such as New Market Tax Credits, labor grants or CDBG to name a few.

Workforce training and development needs must be factored in. They must be trained to properly collect, evaluate, sort, process, and distribute reclaimed materials. This will require existing City staff to understand the value of materials when making decisions for distribution, and that they track the volumes of materials in order to assure adequate supplies. Employees at sort yards and demolition companies must understand how to identify and sort materials for distribution and end markets.

Finally, an informed, active, and engaged citizenry is also required. Public engagement campaigns should be funded and expanded to help citizens understand the use of salvaged materials, and to connect the public to resources to assist with access. This will help to lead to a steady supply as well generate market demand for products.

Current markets are not robust enough to consume the available supply of wood waste and increasing the demand for wood supply is necessary. Directing woody materials to high value markets will require coordination with existing businesses and public producers of the material. An aggressive outreach, networking and collaboration strategy—an industry cluster—must be implemented to create the market outlets and demand for products. Industry clusters are working in other geographical areas to spur innovation, foster entrepreneurship, increase trained workforce and employ residents. It should be a strategy that is utilized in the Baltimore region for this project.

In conclusion, an aggregated urban wood sort yard in Baltimore is feasible. It can generate jobs for urban residents if all the critical factors are addressed but this will take time and will not happen immediately, as this is a huge undertaking. The environmental and societal advantages of Baltimore's urban wood sort yard project – satellite yards and central yard and processing-- outweigh the initial financial disadvantages and are worth taking the risk. These financial issues can be minimized if there is a long-term commitment by all of the stakeholders to make the project work. If that commitment cannot be achieved, then other alternatives should be sought.

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ATTACHMENT 1

LITERATURE REVIEW

- Brashaw, B., Ross, R., Wang, X. and Wiemann, M., Wood Utilization Options for Urban Trees Infested by Invasive Species, (2012), a study done by the University of Minnesota for the Wood Education and Resource Center, Northeastern Area State and Private Forestry, Forest Service, U.S. Department of Agriculture.
- Bratkovich, S. (October 2001 NA-TP-06-01) Utilizing Municipal Trees: Ideas From Across the Country. Report for Northeastern Area State and Private Forestry, U.S. Forest Service, U.S. Department of Agriculture
- Bratkovich, Steve and Fernholz, Kathryn, Using Industrial Clusters to Build an Urban Wood Utilization Program: a Twin Cities Case Study (June 30, 2010) (study done by Dovetail Partners, Inc. for the Wood Education and Resource Center, Northeastern Area State and Private Forestry, Forest Service, U.S. Department of Agriculture) (award number 09-DG-089))
- Falk, R., Cramer, S., and Evans, J., Framing Lumber from Building Removal: How Do We Best Utilize This Untapped Structural Resource? in the Forest Products Journal Vol. 62, No. 7/8 pps 493-499
- Gomez, H. and Marquez, P. Social Enterprise: Market Initiatives with Low-Income Sectors in ReVista – Harvard Review of Latin America. Fall 2006
- Harrison, N. and Tansey, B. (October 2004) Biomass Sector Skills Audit Final Report. Prepared by Northwoods by the Government Office for the North East and the Biomass Implementation Group.
- Hill, David, Baltimore City Biomass Study Phase I Report (10/19/11) (study done by Cyclelogic for the City of Baltimore)
- Hill, David, Baltimore City Biomass Study Phase II Report (1/23/12) (study done by Cyclelogic for the City of Baltimore)
- Hill, David, Baltimore City Biomass Study Phase III Report (5/16/12) (study done by Cyclelogic for the City of Baltimore)
- Hill, David, Baltimore City Biomass Study Draft Final Report (&/30/12) (study done by Cyclelogic for the City of Baltimore)
- Kays, Jonathan. February 2, 2012. For Maryland Policy & Decision Makers and Citizens: A Prospectus for Advancing Biomass Thermal Energy in Maryland Developed by the Maryland Wood Energy Coalition

- Little, D., Makra Kusnierz, E., Greenwood, R. and Beaulieux, M., Feasibility Study for a Community Wood Reclamation System (December 21, 2011) (study done for Wood education and Resource Center, Northeastern Area State and Private Forestry, Forest Service, U.S. Department of Agriculture (Federal Grant Number 10DG-11420004-107)).
- McKeever, D. and Skog, K. 2003. Urban Tree and Woody Yard Residues – Another Wood Resource. Res. Note FPL-RN-0290, Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory.
- Resource Professionals Group, (June 1, 2011), Supplying Renewable Energy to Heat and/or Cool Selected Baltimore County Facilities with Sustainably Produced Woody Biomass Fuel. A Report for the Maryland Environmental Service and the County of Baltimore, Maryland.
- Ritter, M., Skog, K., Bergman, R. 2011. Science Supporting the Economic and Environmental Benefits of Using Wood and Wood Products in Green Building Construction. General Technical Report FPL-GTR-206. Madison, WI: U.S.D. Department of Agriculture, Forest Service, Forest Products Laboratory.
- Solid Waste Association of North America, 2002, Successful Approaches to Recycling Urban Wood Waste, Gen. Tech Rep. FPL-GTR-133. Madison, WI: U.S. Department of Agriculture, forest Service, Forest Products Laboratory, 20 p.
- John Stephenson, Baltimore Urban Woody Bio-Mass Initiative (3/1/13 DRAFT)(study done for the Forest Products Laboratory)
- TreeBaltimore, Urban Forest Management Plan – DRAFT as of April 27, 2007 for the City of Baltimore Recreation & Parks
- Torcellini, P., Pless, S., Deru, M. and Crawley, D. (Conference Paper NREL-CP-550-39833 June 2006) Zero Energy Buildings: A Critical Look at the Definition

This work was funded through a cooperative agreement with the USDA Forests Products Laboratory in Madison, WI.

REFERENCES

ⁱ Based on the Forest Inventory and Analysis (FIA) program at the Northern Research Station of the U.S. Forest Service, definition of forest land.

ⁱⁱ pp. 67-68, Appendix B: Species composition of and estimated number of trees in Baltimore's urban forest. TreeBaltimore, Urban Forest Management Plan – Draft as of April 27, 2007 for the City of Baltimore Recreation & Parks

ⁱⁱⁱ Pp. 19-20, TreeBaltimore Urban Forest Management Plan

^{iv} Pg. 9 Resource Professionals Group, (June 1, 2011), Supplying Renewable Energy to Head and/or Cool Selected Baltimore County Facilities with Sustainably Produced Woody Biomass Fuel. A Report for the Maryland Environmental Service and the County of Baltimore, Maryland.

^v Pp. 2. 3 CycleLogic Baltimore City Biomass Study Phase II Report

^{vi} P 9, Resource Professionals Group, (June 1, 2011), Supplying Renewable Energy to Head and/or Cool Selected Baltimore County Facilities with Sustainably Produced Woody Biomass Fuel. A Report for the Maryland Environmental Service and the County of Baltimore, Maryland.

^{vii} Pg. 14, Resource Professionals Group, (June 1, 2011), Supplying Renewable Energy to Head and/or Cool Selected Baltimore County Facilities with Sustainably Produced Woody Biomass Fuel. A Report for the Maryland Environmental Service and the County of Baltimore, Maryland.

^{viii} Pg. 8, CycleLogic Baltimore City Biomass Draft Final Report

^{ix} Pg. 19, TreeBaltimore Urban Forest Management Plan

^x Pg. 27 of CycleLogic Baltimore City Biomass Phase II Report. Letter from Bob Bageant, Division Manager Merciers Inc.

^{xi} pp. 67-68, Appendix B: Species composition of and estimated number of trees in Baltimore's urban forest. TreeBaltimore, Urban Forest Management Plan – Draft as of April 27, 2007 for the City of Baltimore Recreation & Parks