

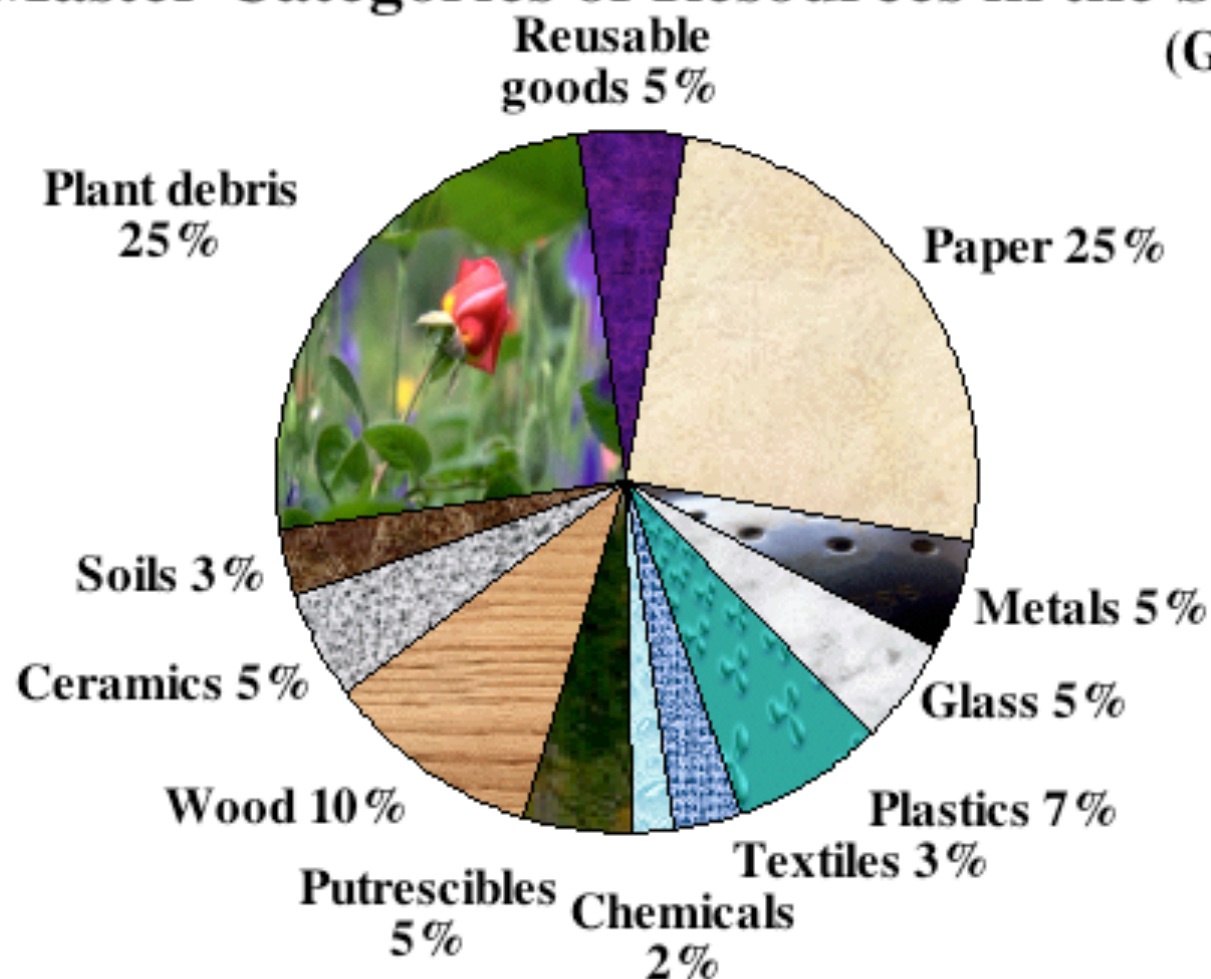
DESIGNING FOR ZERO WASTE

**Daniel Knapp, Ph.D.
President, General Manager**

June 22, 2010

Basic Science: 12 Master Categories, Nothing Left Out and Nothing Left Over

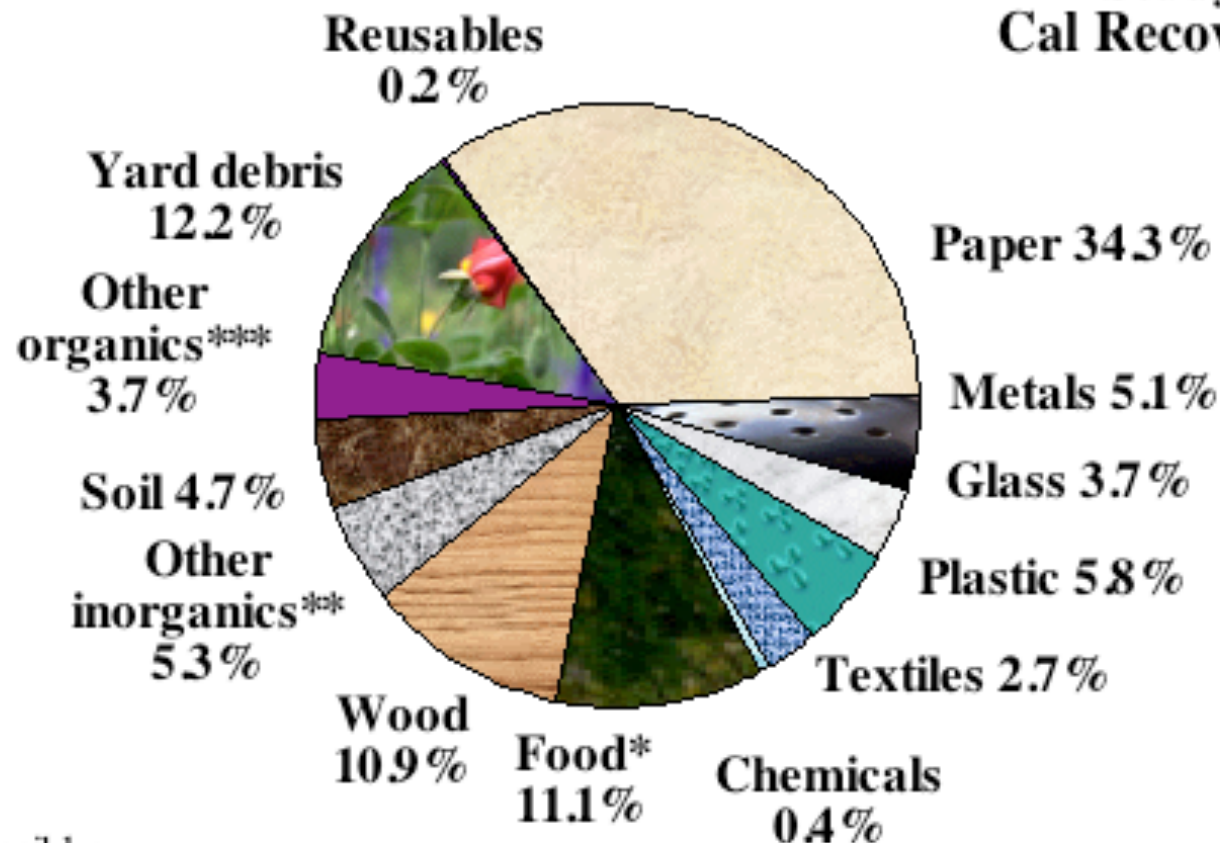
12 Master Categories of Resources in the Supply (Generic)



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Actual Study Results in Berkeley, California

Study by
Cal Recovery

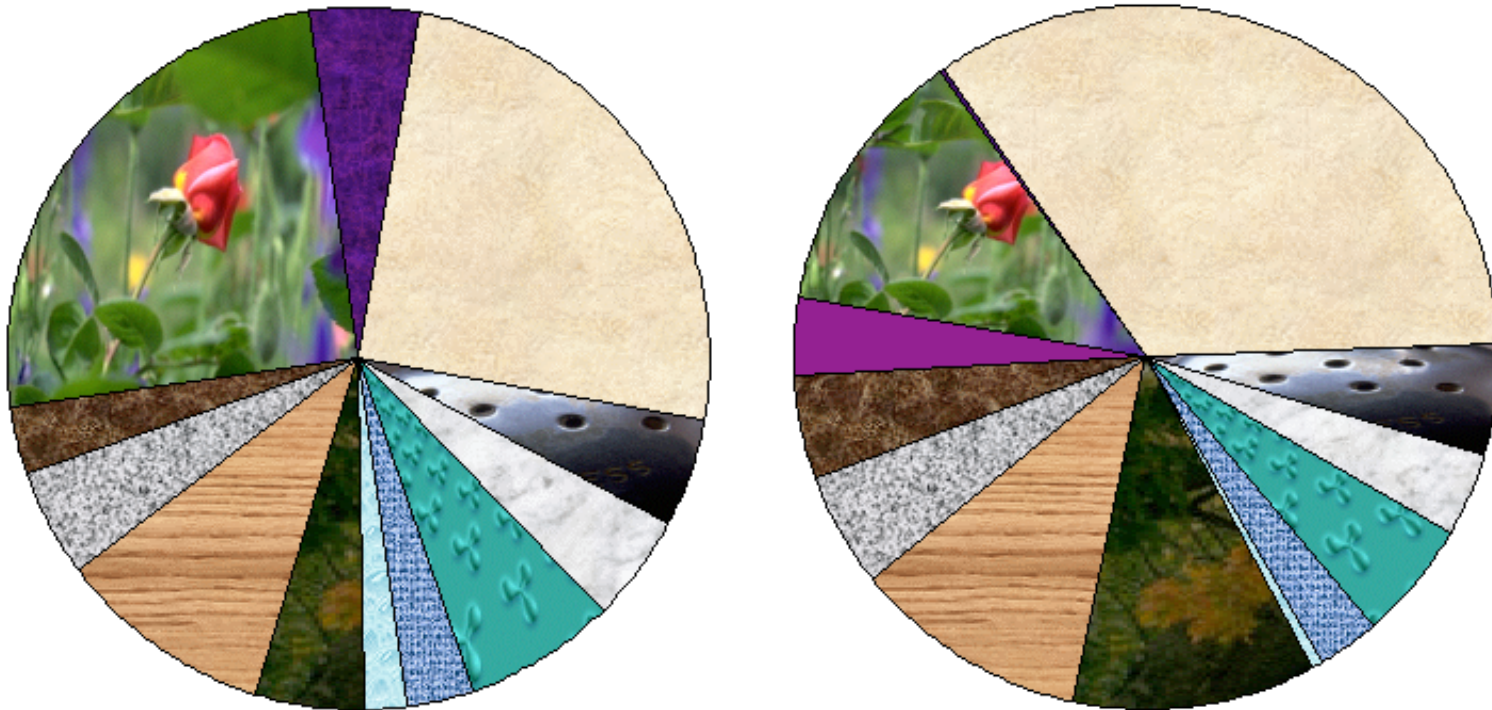


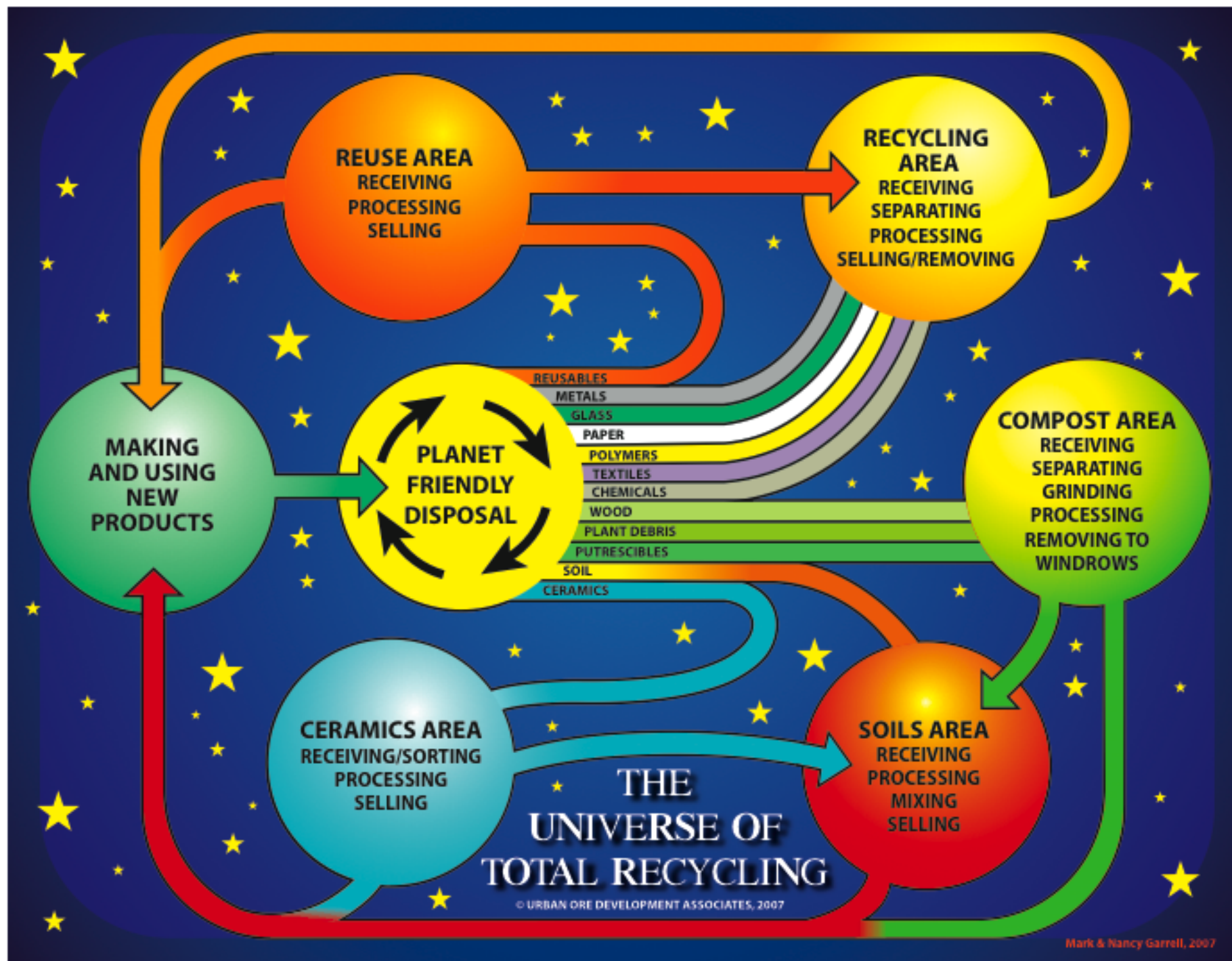
* Putrescibles

** Soil, concrete, rock, bricks, gypsum wallboard

*** Rubber, tires, leather, disposable diapers, nonsortable organic fines

Hypothesis & Measurement





Application 1: Market Analysis

- **600 population**
- **Coastal town**
- **Remote from bulk markets**

Distant Market		Local Market			
Material		Material	Value-adding enterprises	Compost & crushing	Reuse
Paper	newsprint	Reusable mixed matls	X		X
	office pack	Paper			
	mixed paper	waxed boxes		X	
	cardboard	wet/spoiled		X	
		reusable/rare	X		X
Glass	color sorted	Textiles	X	X	X
		Soils		X	
		Glass			
Plastics	HDPE	mixed window	X	X	X
	PET	Plastics			
		computers	X		X
		other reusable	X		X
		Plant debris		X	
		Putrescibles			
		disposable diapers		X	
		litter/feces		X	
		dead animals		X	
		Wood			
		reusable	X		X
		compostable		X	
		Chemicals			
Metals	iron & steel scrap	paint	X		X
	nonferrous scrap	Ceramics			
	aluminum	reusable			X
	copper	crushable		X	
	brass	Metals			
	lead	iron & steel objects	X		X
	nonferrous objects	X		X	

Application 2: Financial Analysis

Annual Performance Projections
100 TPD Integrated Resource Recovery Facility
After 10 Years of Evolution
 From the URBAN ORE® West Virginia Report

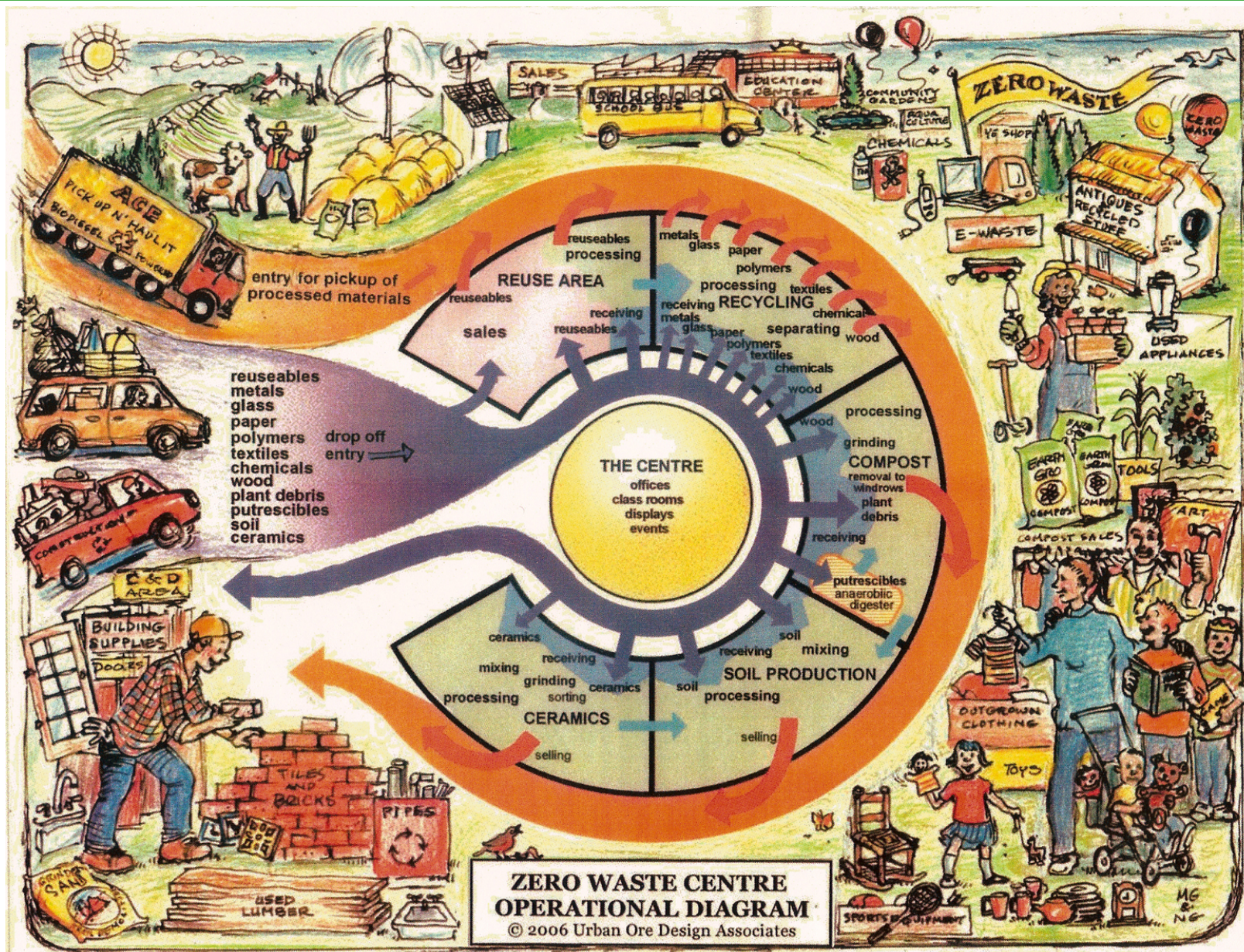
INCOME

	REUSE			RECYCLING			COMPOSTING			COMBINED	
	Tons	\$/T	\$	Tons	\$/T	\$	Tons	\$/T	\$	Tons	\$
Tipping fees											
Appliances	85	120	10,200	200	120	24,000				285	34,200
Chemicals	18	100	1,800	14	400	5,600				32	7,400
Tires		50	0		50	0				0	0
Ceramics							1,720	15	25,800	1,720	25,800
Paper							1,800	24	43,200	1,800	43,200
Putrescibles							2,286	35	80,010	2,286	80,010
Soil							1,706	15	25,590	1,706	25,590
Wood							2,160	20	43,200	2,160	43,200
Yard debris							5,461	24	131,064	5,461	131,064
Textiles											
Subtotal	103		12,000	214		29,600	15,133		348,864	15,450	390,464
Tons in, no fee	5,672			14,878			0			20,550	

Product sales											
Reusables	5,775	400	2,310,000							5,775	2,310,000
Glass				270	25	6,750				270	6,750
Metals				1,080	80	86,400				1,080	86,400
Paper				9,000	100	900,000				9,000	900,000
Plastics				3,600	150	540,000				3,600	540,000
Textiles				540	20	10,800				540	10,800
Wood				602	25	15,050	500	10	5,000	1,102	20,050
Animal bedding							900	30	27,000	900	27,000
Compost & soil							3,715	35	130,025	3,715	130,025
Gravel & sand							1,720	15	25,800	1,720	25,800
Subtotal	5,775		2,310,000	15,092		1,559,000	6,835		187,825	27,702	4,056,825

	REUSE		RECYCLING		COMPOSTING		COMBINED	
TOTAL INCOME	\$2,322,000		\$1,588,600		\$536,689		\$4,447,289	
TONS IN	5,775		15,092		15,133		36,000	
TONS OUT	5,775		15,092		6,835		27,702	

Application 3: Zero-Waste Facility Design



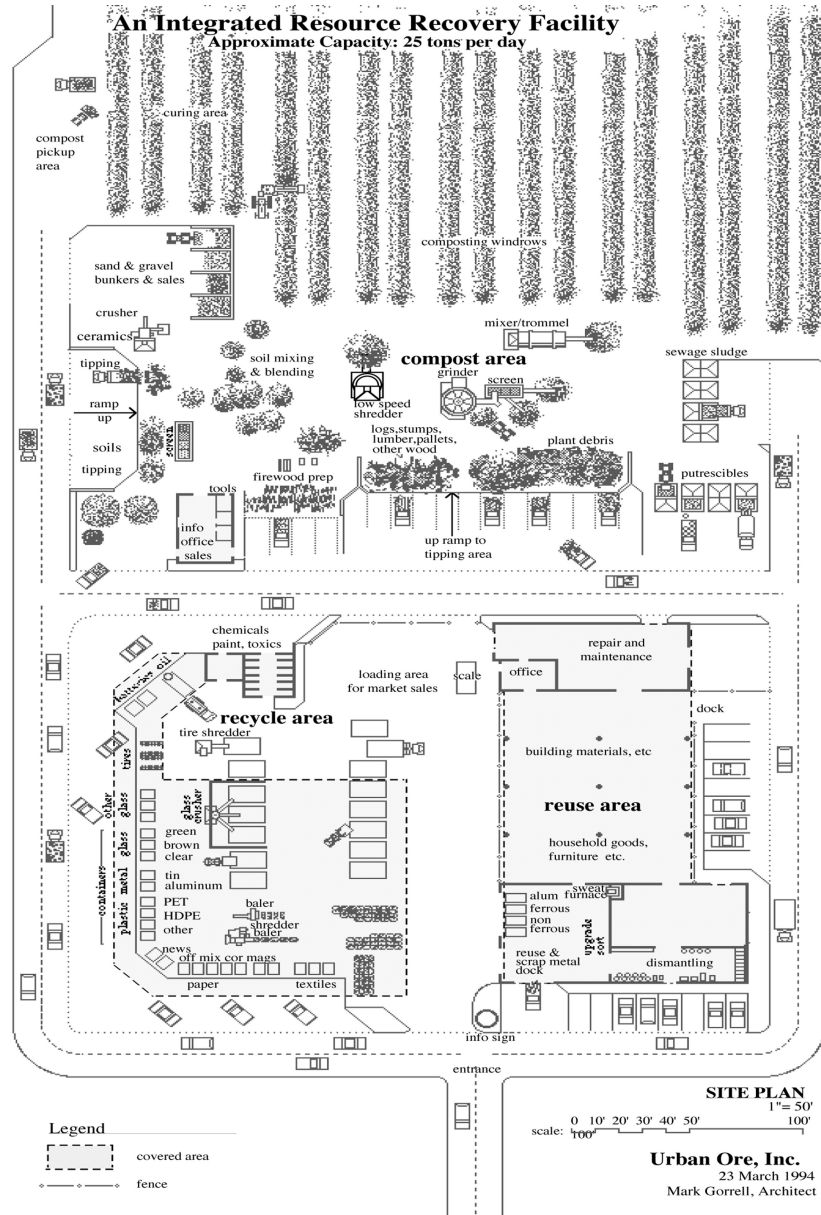
West Virginia

Conceptual Designs for Interactive Rural and Urban Zero-Waste Transfer Stations

25 TPD Rural Site Provides Windrows.

Imports yard debris and food from cities, sells compost to farmers.

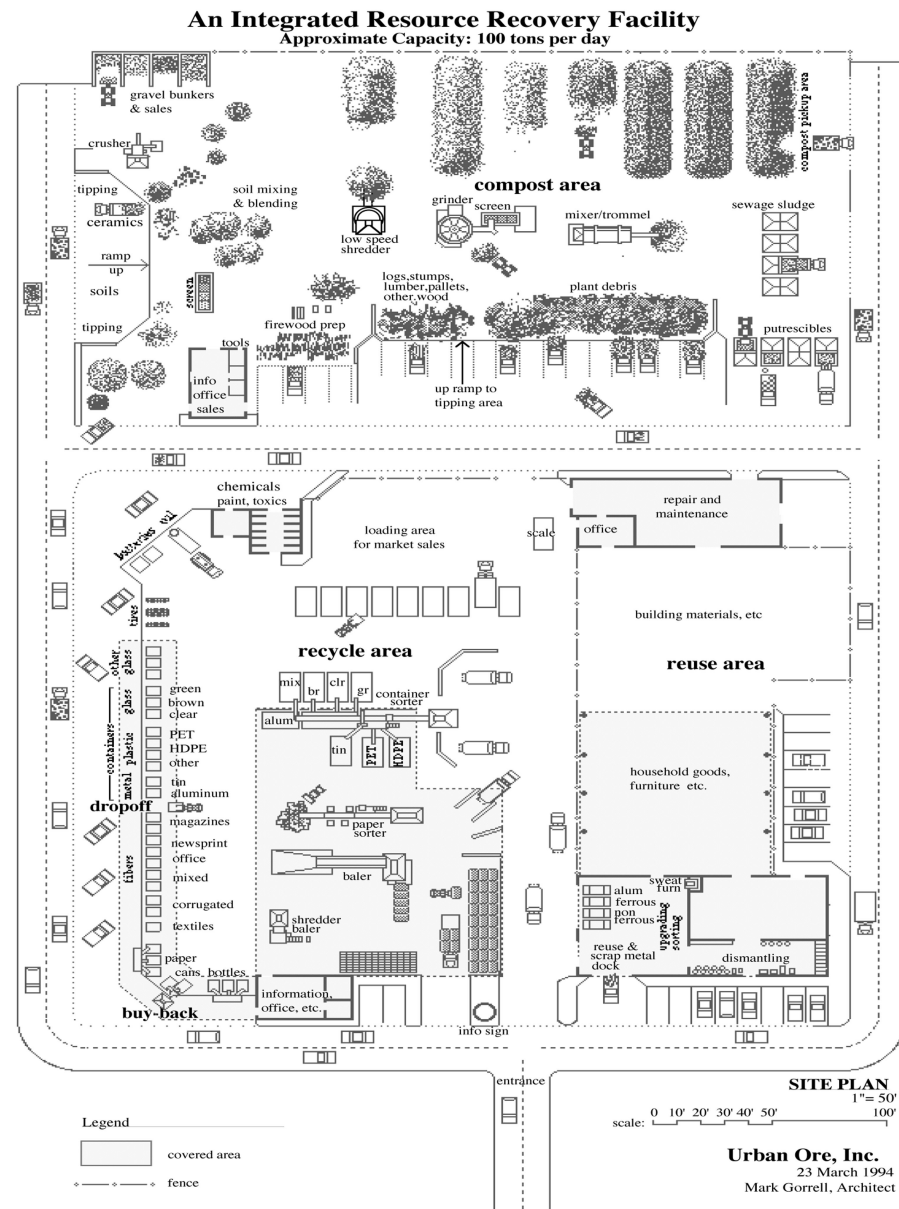
Exports upgraded commodities to urban site.



100 TPD Urban Site

Imports commodities
from rural sites,
consolidates for bulk
markets.

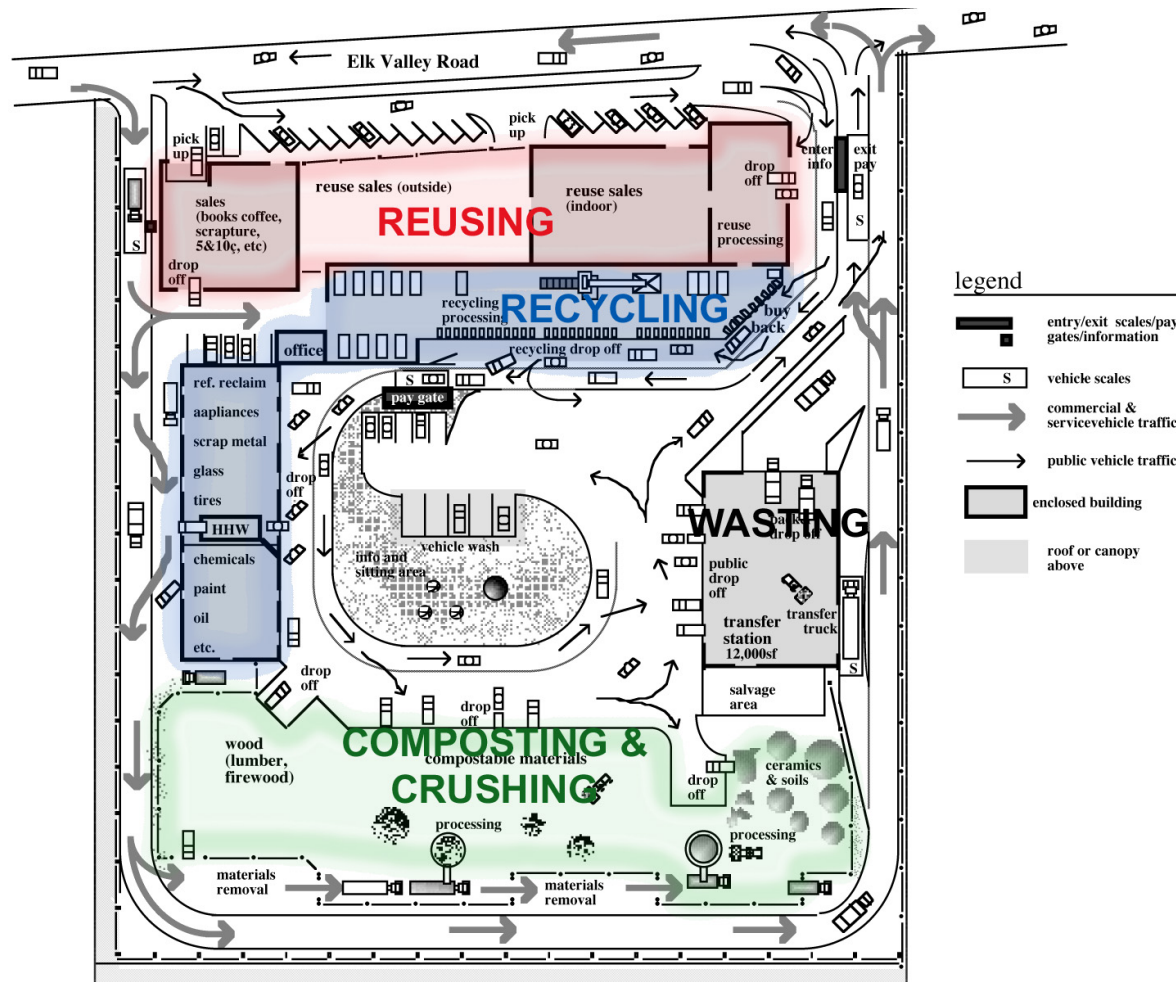
Exports yard debris
and food for
composting and
agriculture.

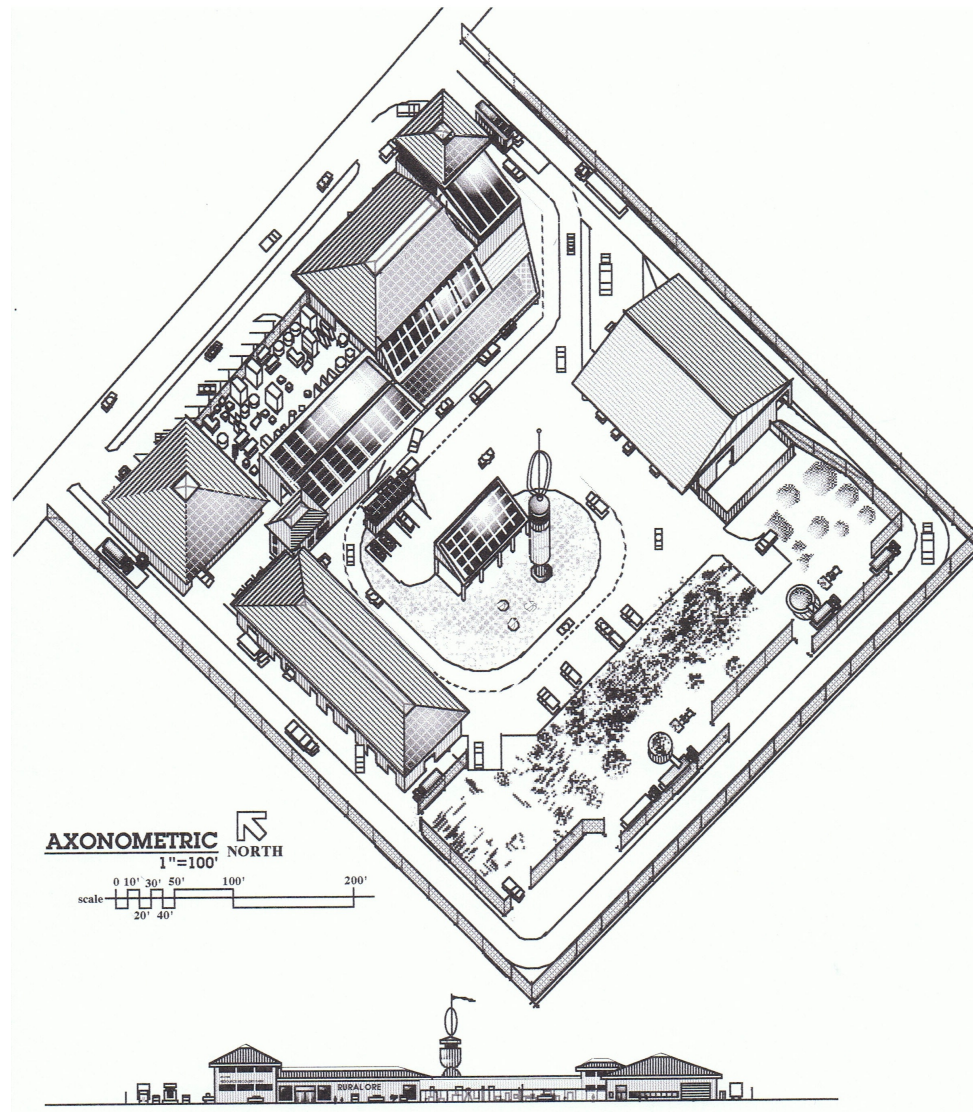


Del Norte County, California

**Zero-Waste Transfer Station
Multiple Site Plans for
Successive Siting Attempts
Phased Implementation**

Enterprise Clusters



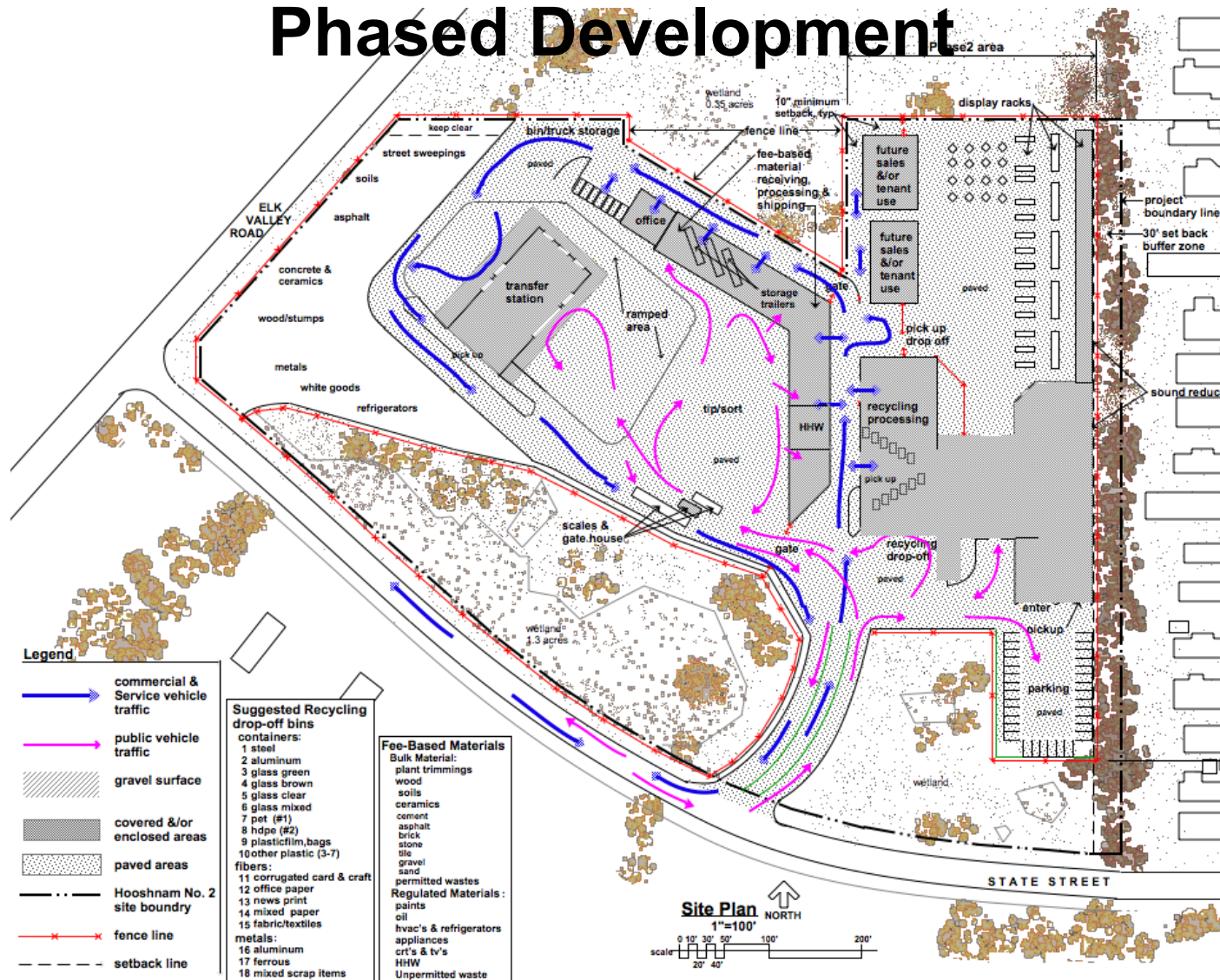


RURAL

NORTH ELEVATION
1"=100'

URBANORE
TO END THE AGE OF WASTE

Phased Development



“Say It With Pricing.” –Tedd Ward, Del Norte County

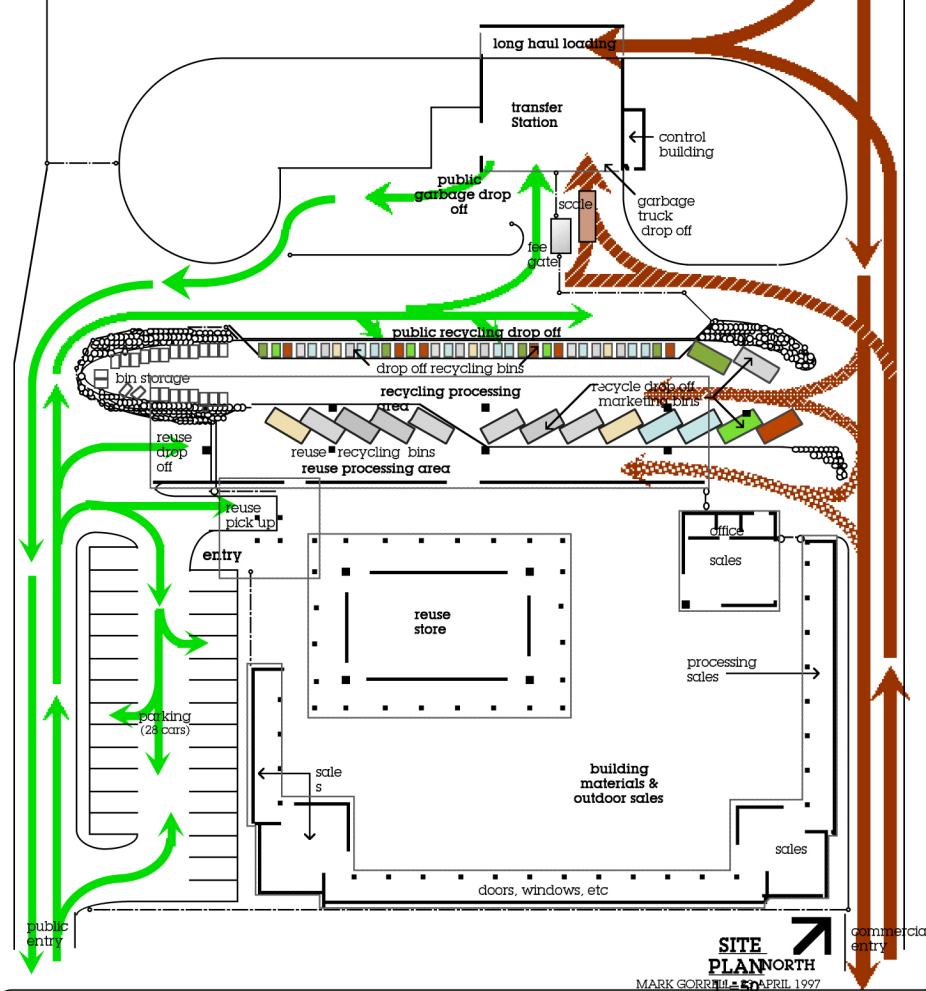
More than 30%
of customers go
over scale more
than once.

Commercial, Franchise or Self-Haul wastes \$116.26 / ton	
Separated Recyclable Items no minimum charge:	
Non-waxed corrugated cardboard	\$ 15.08 / ton
Non-Ferrous metals	\$ 15.08 / ton
Ferrous or Mixed metals	\$ 22.63 / ton
Brush (no grass or stumps)	\$ 40.73 / ton
Grass or leaves	\$ 40.73 / ton
Untreated wood or lumber	\$ 40.73 / ton
Stumps	\$ 52.80 / ton
Clean clothing and textiles	\$ 116.26 / ton
Bulky Items:	
Appliance, large and metal	\$ 24.14 ea.
Furniture, Bulky	\$ 4.00 ea + wt. Chg.
Mattress or box spring	\$ 7.95 ea + wt. Chg.
Refrigerator	\$ 31.68 ea
Trailers, modular homes	\$ 191.68 / ton
Tires:	
Auto, pickup, motorcycle each no rims	\$ 5.28 ea
Auto, pickup, motorcycle each with rims	\$ 7.54 ea
Truck, no rim	\$ 10.56 ea
Truck with rims	\$ 19.61 ea
Oversize tires (>60" in diameter), no rim	\$ 113.13 ea
Small, 10" no rim	\$ 4.90 ea
Small, <10" with rim	\$ 6.03 ea
Separated & Uncontaminated Rocks & Soils:	
Clean soil, sand, or harbor dredge	\$ 38.47 / ton
Asphalt	\$ 38.47 / ton
Concrete, no steel	\$ 42.24 / ton
street sweepings	\$ 116.26 / ton
non-friable asbestos	\$ 148.57 / ton
Volume - Based Rates (available only when weighing is not possible):	
Loose Refuse / cu. yd.	\$ 12.79
Loose Brush / cu. yd.	\$ 5.09
Loose Mixed Metals	\$ 14.09
Household Hazardous Wastes:	
Used motor oil	\$ 0.16 paid / gal
The following materials may be disposed by residents for no charge: Used oil filters, ethylene glycol antifreeze, lead acid batteries, fluorescent tubes, non-aerosol latex paint, and televisions, computer monitors and other items containing cathode ray tubes	

Kauai, Hawaii

**Zero-Waste Transfer Station
Including Reuse Sales and
Artisan Niches**

Separated Traffic Flows



**KAUAI RESOURCE EXCHANGE CENTER
INCLUDING RECYCLING AND TRANSFER
FACILITIES**

URBAN ORE DESIGN GROUP
URBAN ORE, INC.
1333 SIXTH STREET • BERKELEY • CA 94710

**SITE
PLAN**
NORTH
MARK GORRILL - 50
APRIL 1997

**2x
flipped**

Includes Niches for Reuse Artisans and the Required Hawaiiana Roofs



Melbourne, Australia

Zero-Waste Transfer Station

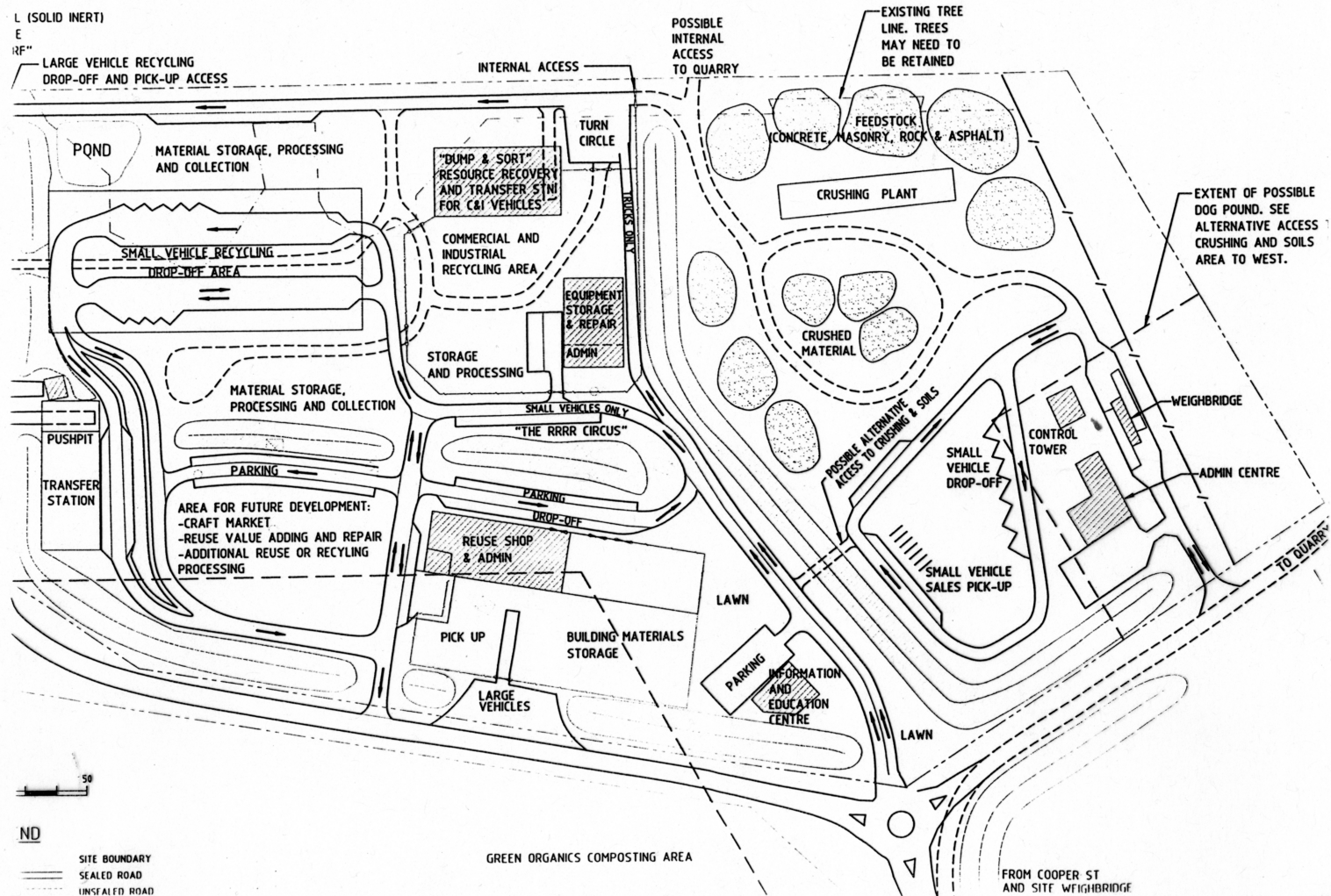
Clean DozenSM Categories as Used in Melbourne, Australia

Category	Total annual weight (tonnes)	Percent total weight (%)
1 Re-usables	200	0.21%
2 Paper	4,000	4.21%
3 Green organics [plant debris]	22,000	23.13%
4 Wood	8,000	8.41%
5 Plastics (incl tyres)	1,500	1.58%
6 Food organics [putrescibles]	300	0.32%
7 Concrete, masonry, and rock (incl plasterboard) [ceramics]	23,237	24.43%
8 Glass	1,000	1.05%
9 Metal	2,500	2.63%
10 Textiles (incl bed mattresses)	1,000	1.05%
11 Soils	31,168	32.77%
12 Chemicals	200	0.21%
Total	95,105	100.00%

Municipal kerbside garbage not included.

Table 5-7, Estimated Current Composition and Quantities Discarded to Cooper St Area. Connell Wagner, "Northern Region Waste Management Group Regional Integrated Discard Management Centre Masterplan & Feasibility Study Report," January 1999.

This profile reflects the high construction activity in this rapidly growing inland suburban area. Note how high the tonnages are for wood, ceramics, soils, and plant debris – 88% of the incoming discards! They are given large and convenient processing areas in Connell-Wagner's resource

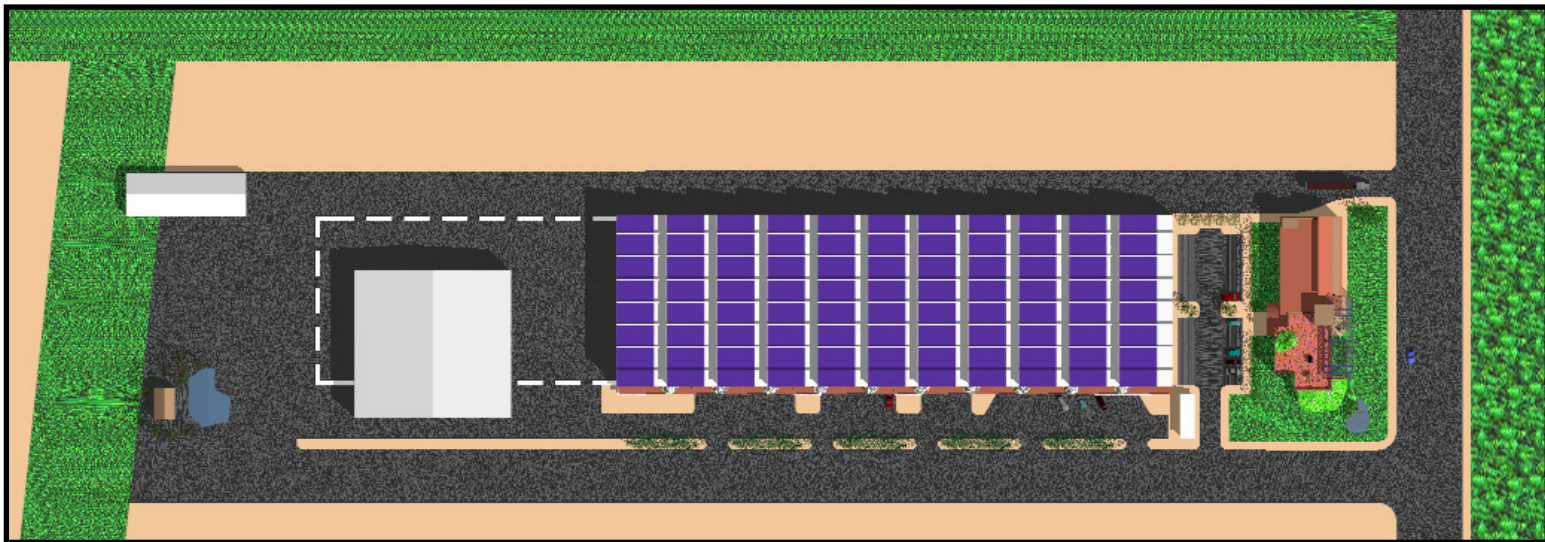


Berkeley, California

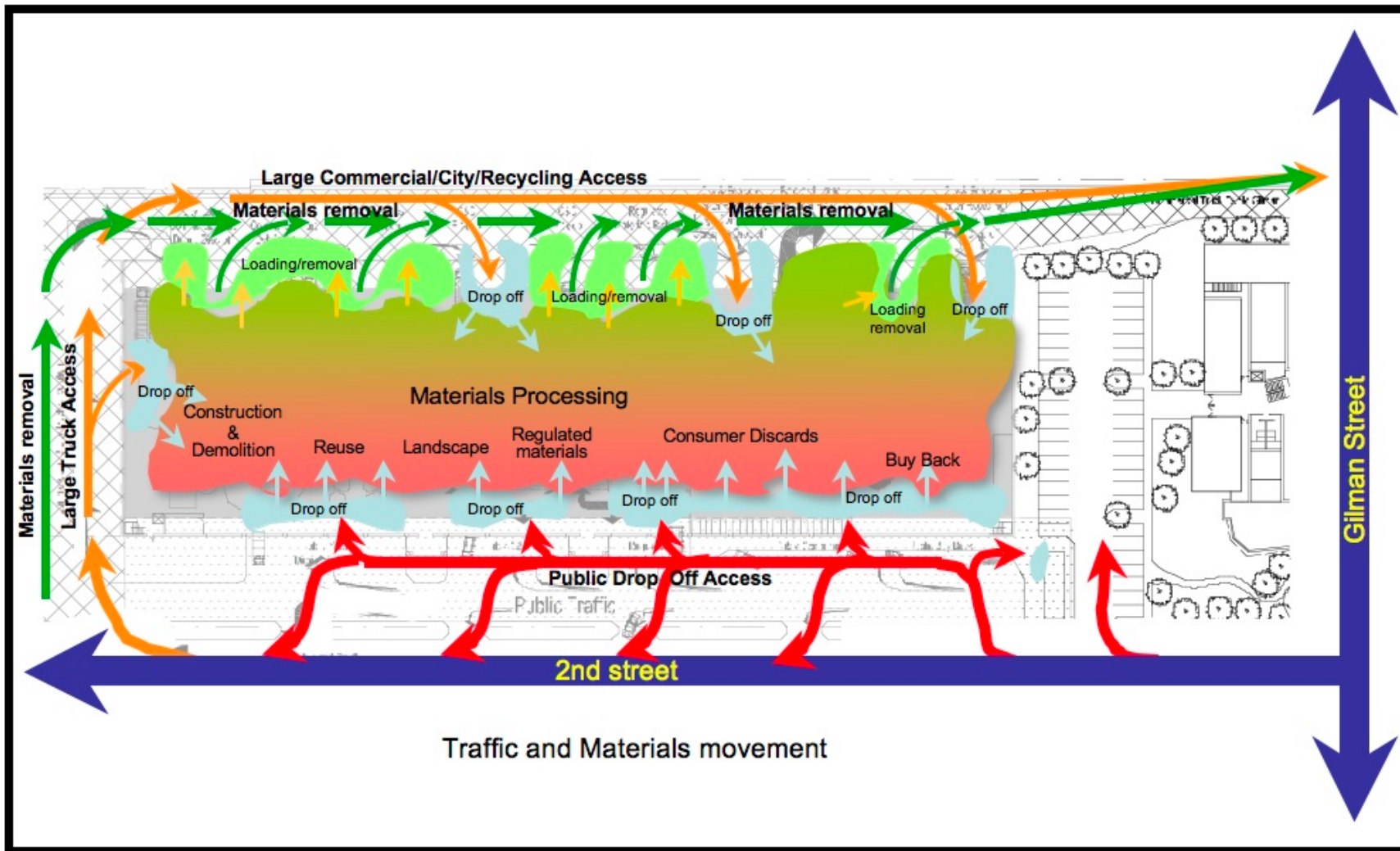
**Task: Replace existing recycling MRF,
phasing construction to
stay in operation.**

Design donated to community.

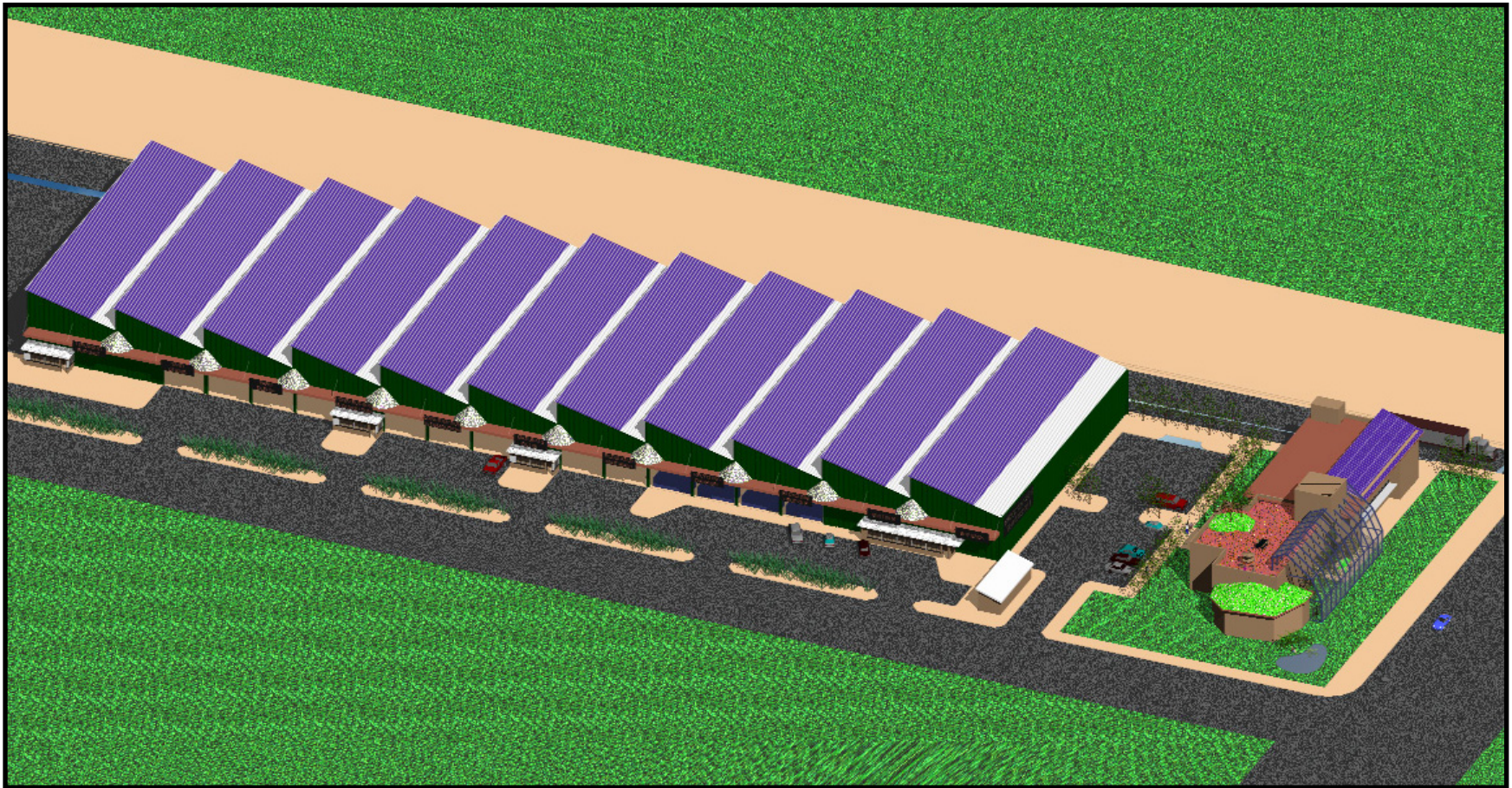
Redesign Uses Same Footprint



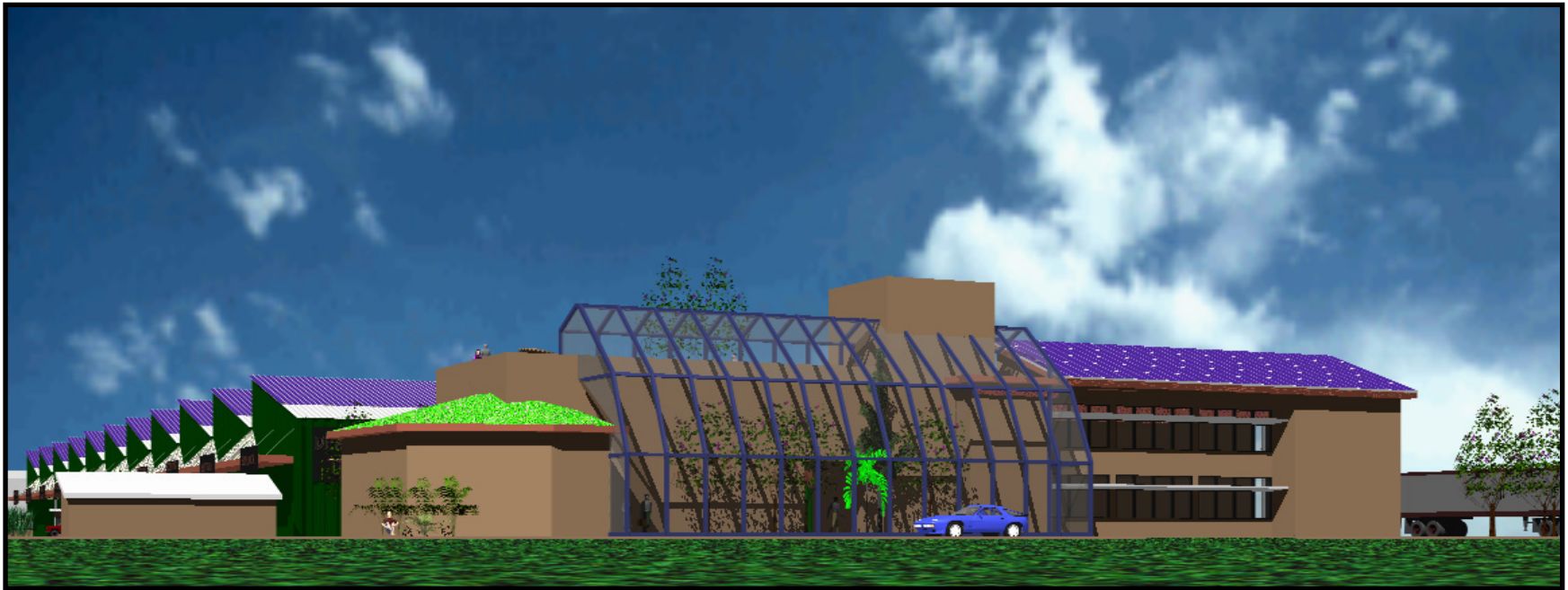
Materials Flow Is Streamlined



Solar Roof Provides Power



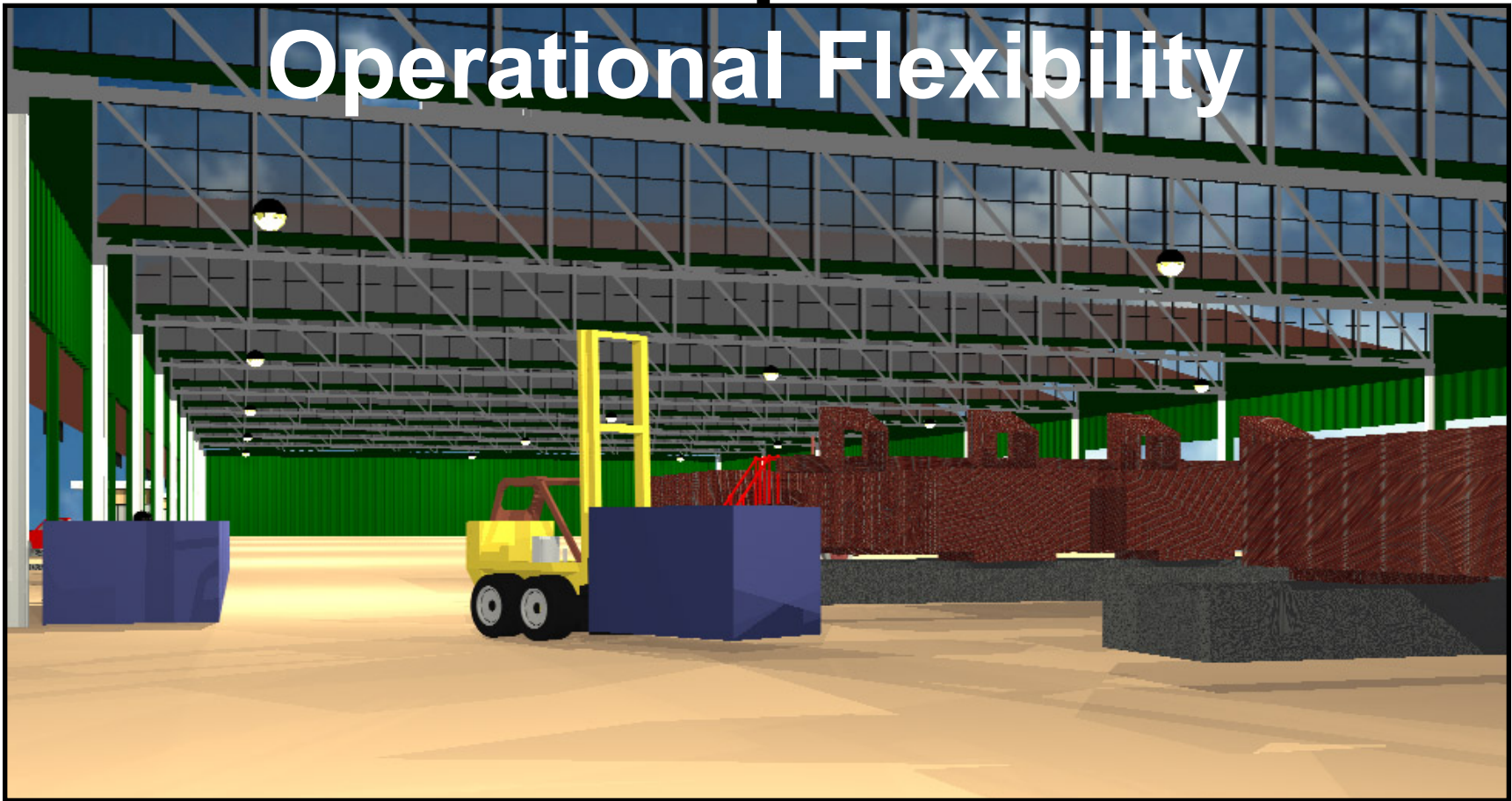
Solar Greenhouse Heats Offices



Airport-Style Unloading Is Familiar and Fast



Eliminating Columns Maximizes Usable Space and Operational Flexibility





**REMEMBER
FOLKS,
*waste isn't
waste until
it's wasted!***



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