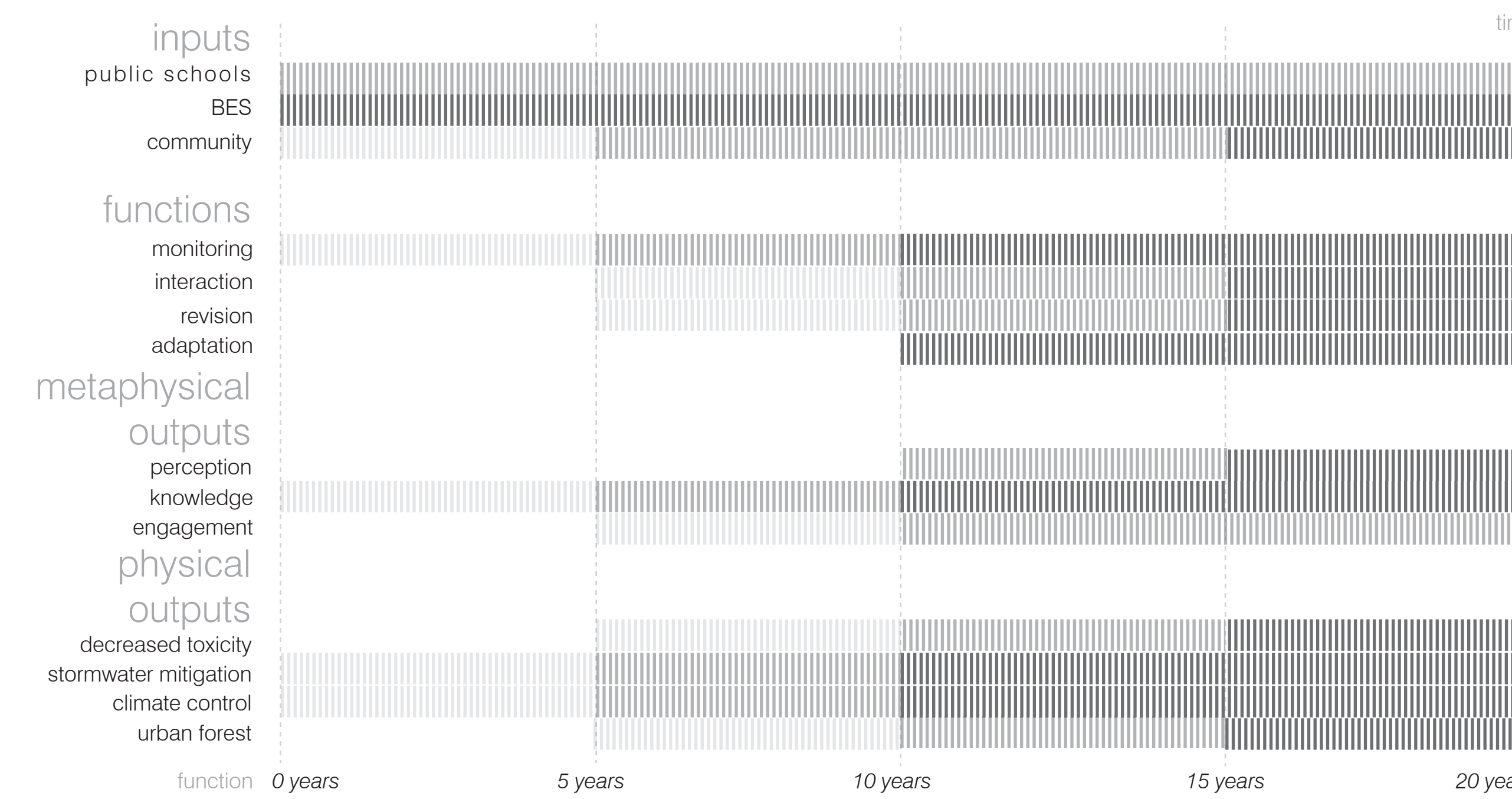


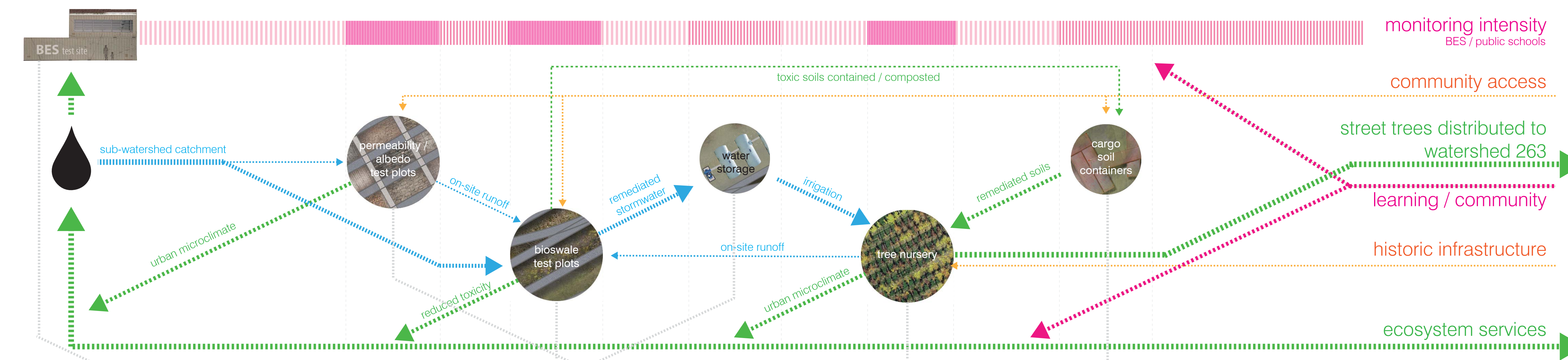
Baltimore Loading Yard

site concept

The Baltimore Loading Yard evokes a historical rail yard site, through contextual form, and metaphorical function. The site behaves as an active study model for the Baltimore Ecosystem Study, and provides learning opportunity and engagement from the Baltimore Public Schools. The goal of the design is engage BES researchers with elementary and middle school students to document and discover methods for decreasing toxicity, mitigating climate changes, managing stormwater, and creating an urban forest. There are three key site elements that are actively being studied and adapted – the tree nursery, the permeability and albedo test plot, and the bio-swales. The Loading Yard behaves as a comprehensive case study for ecosystem services, from which successful research developments can be applied throughout Watershed 263 and the rest of Baltimore. It also produces street trees to be used throughout key street corridors.



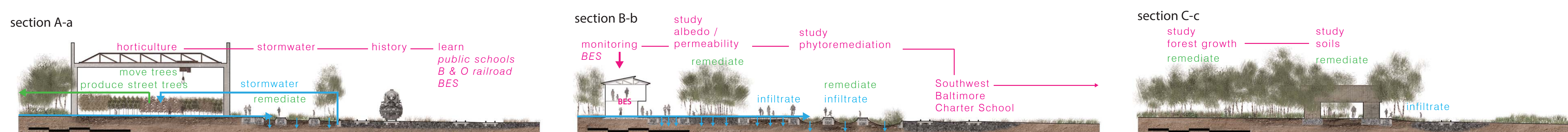
human-habitat connections



connections to site - birdseye



program relationship - 30 scale



community scale changes - 400 scale

removing barriers

Mt Clare (New Southwest)
272 vacancies / 75.7 acres
3.6 vacancies per acre



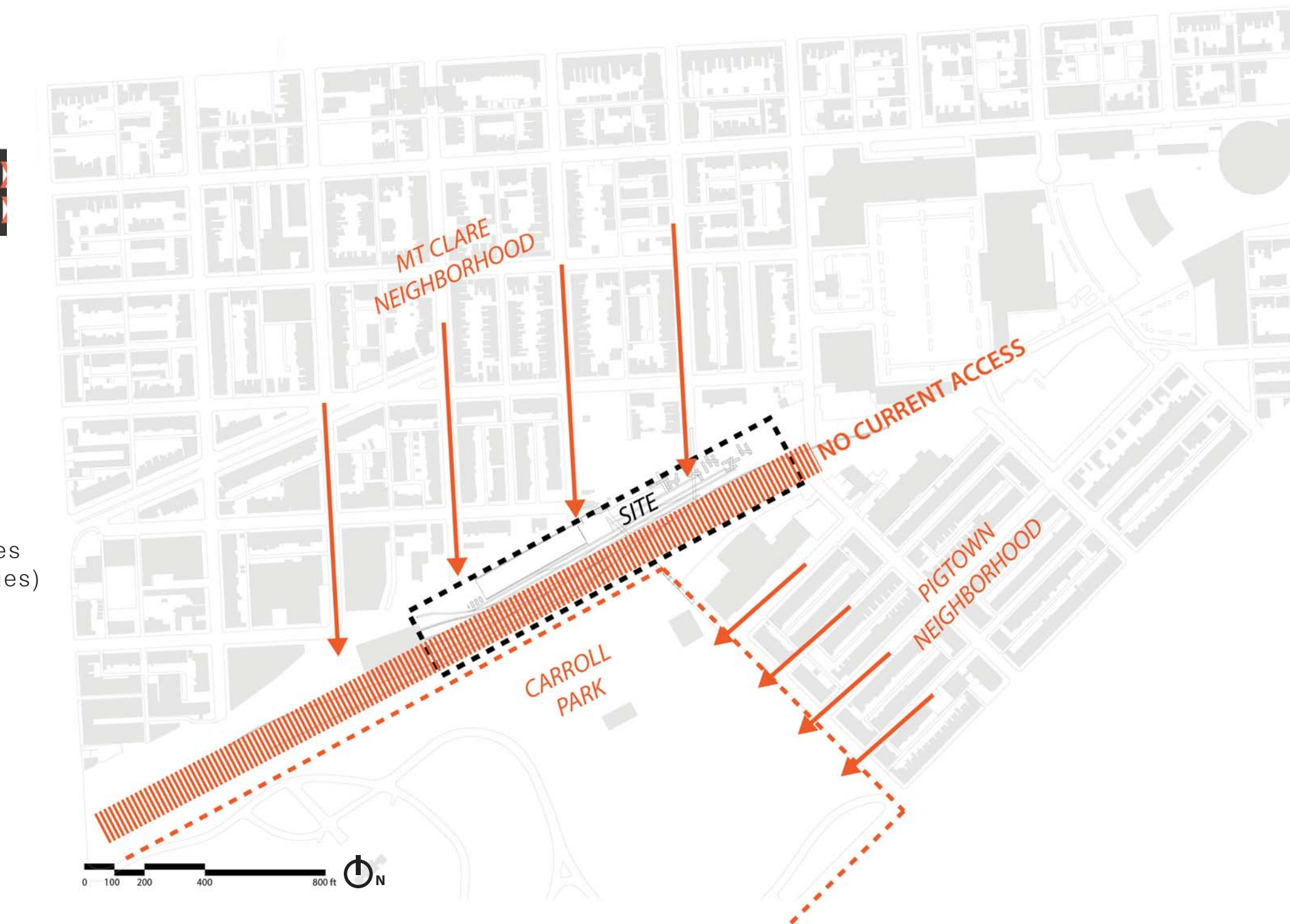
Pigtown (Washington Village)
200 vacancies / 209.2 acres
0.9 vacancies per acre



making Mt Clare consistent with Pigtown
(75.7 acres) x (.9 vacancy rate) = 68 vacancies
272 (current vacancies) - 68 (proposed vacancies)
= 204 homes reoccupied

provide access across rail corridor to Carroll Park to reoccupy vacant homes in Mt Clare

204 homes occupied



expanding ecology networks

create 1.4 miles of ecological corridor from Gwynns Falls to B&O Railroad Museum, and provide alternative trail route for Gwynns Falls Trail

1.4 miles of ecological corridor

develop on-site tree nursery to produce street trees for Watershed 263

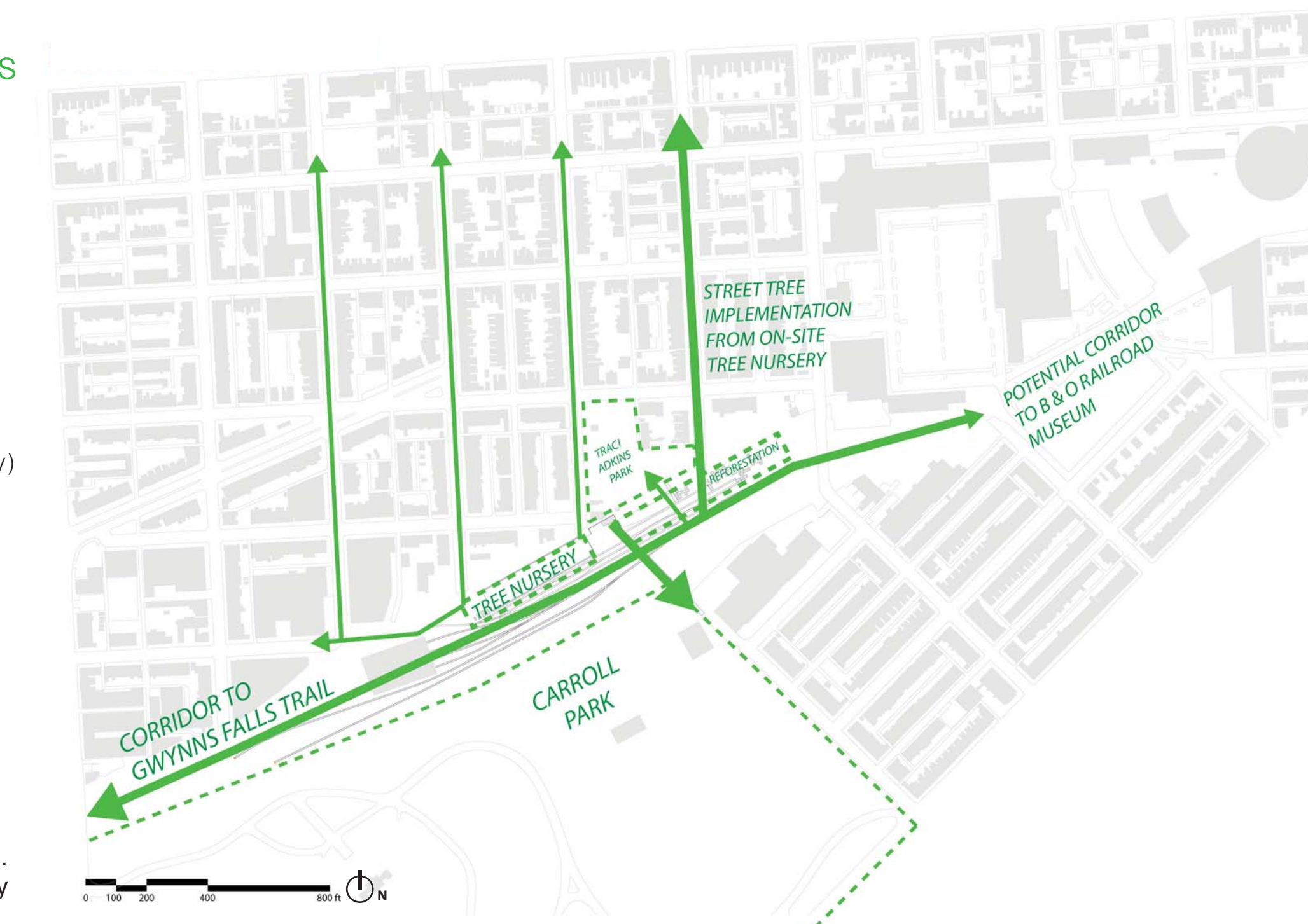
27,000 sq ft. tree nursery (27,000 sq ft area) / (16 sq ft. pot-in-pot nursery) = 1,600 trees @ 70% success rate = 1,100 trees

1,100 2-2.5" cal. trees per 5 years

1,100 trees per 5 years
2,200 trees per 10 years
3,300 trees per 15 years
4,400 trees per 20 years

transplant trees from nursery to Baltimore neighborhood city blocks

125 miles of tree covered sidewalks at 30 ft. spacing over 20 years from tree nursery



linking learning

connect 3 elementary schools and 2 middle schools within Watershed 263 as first phase of neural network

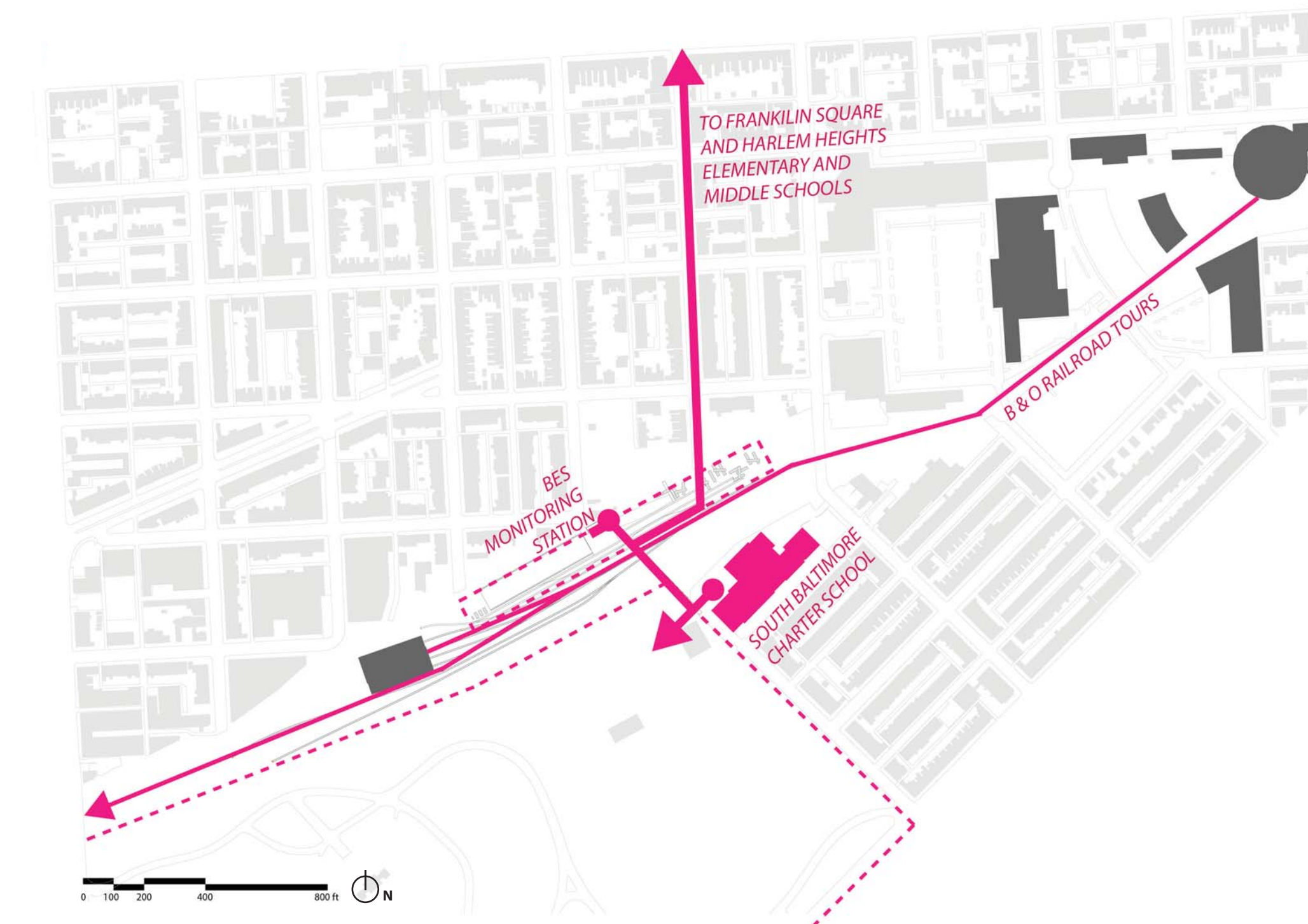
Southwest Baltimore Charter School
Franklin Square Elementary + Middle School
Harlem Heights Elementary + Middle School

B & O Railroad Museum

create BES monitoring station on site to integrate BES with Public School Programs

integrated public school network with BES study

monitor with schools:
paving (infiltration rate + albedo / temp.)
tree production (success + quality)
stormwater (catchment and soil remediation)



managing stormwater

provide stormwater catchment for 35.5 acres of surface runoff of Watershed 263

35.5 acres of sub-watershed
8 bioswales capture and remediate water for tree nursery production

48,450 cu. ft. of water per storm event

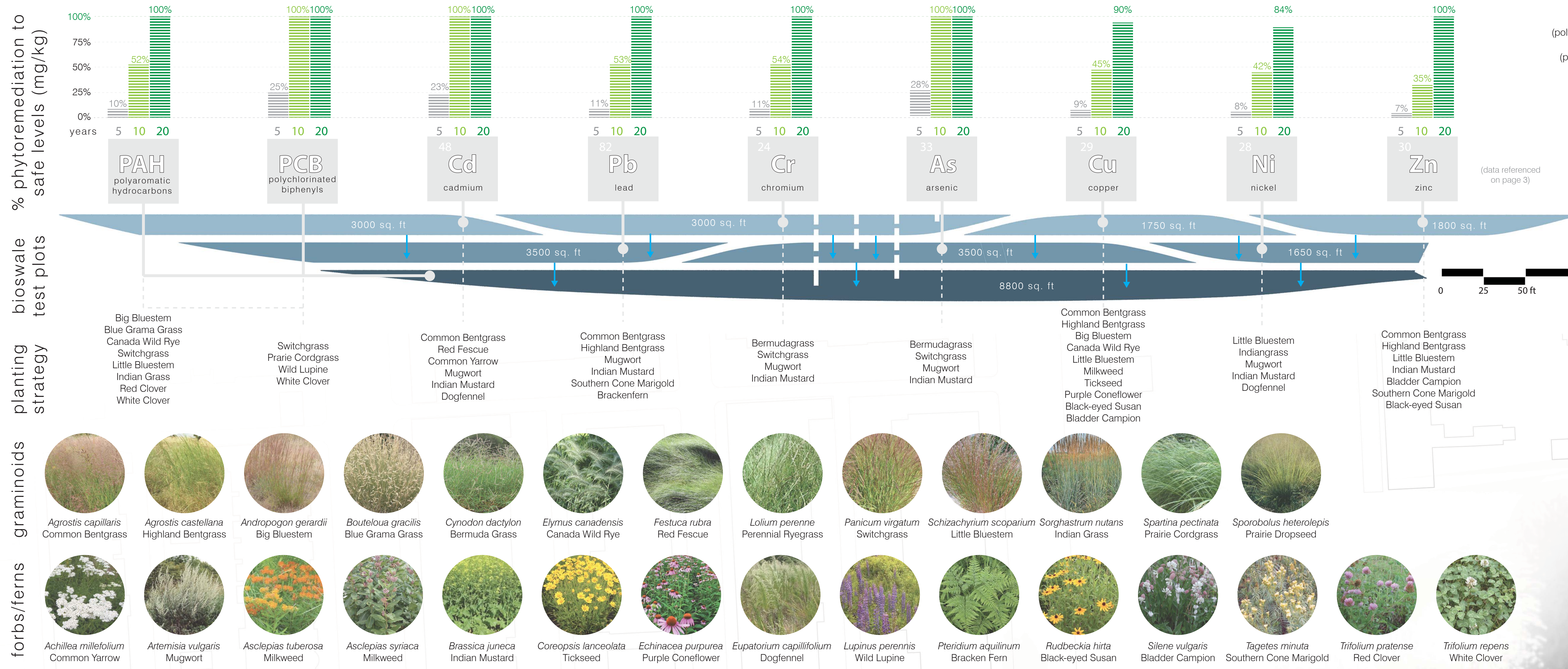
remediate brownfield conditions for:
PAH (polyaromatic hydrocarbons)
PCB (polychlorinated biphenyls)
TPH (total petroleum hydrocarbons)
heavy metal contaminants

84-100% phytoremediation to safe levels in 20 years

7,500+ gallons of stormwater stored at 2% of maximum bioswale capacity



remediate toxins / bioswale test plots



toxins (mg/kg) / health effects

site toxins	current level (mg/kg)	safety level (mg/kg)	rate above safety level / effect
(polyaromatic hydrocarbons) PAH	30	1	30x red blood cell damage, immune suppression, cancer
(polychlorinated biphenyls) PCB	20000	1	20000x reproductive and nervous system damages, cancer
cadmium Cd	13.5	2.5	5.4x kidney damage, fragile bones
lead Pb	2400	30	80x neural development disorders, organ damage
chromium Cr	500	36	14x cancer, liver damage, skin and nose irritation
arsenic As	1250	16	78x skin, lung, bladder, kidney cancer
copper Cu	500	20	25x kidney and liver damage, hypotension, vomiting
nickel Ni	1300	10	130x breast and lung cancer, oxidative stress
zinc Zn	225	150	1.5x nausea vomiting

image: *Acer rubrum*, [abnathnursery.com](#), Accessed 4-14-2015.
 image: *Agrostis capillaris*, [natura.info](#), Accessed 4-14-2015.
 image: *Agrostis capillaris*, [smithsonian.com](#), Accessed 4-14-2015.
 image: *Agrostis capillaris*, [flickr.com](#), Accessed 4-14-2015.
 image: *Asclepias tuberosa*, [minnesotawildflowers.info](#), Accessed 4-14-2015.
 image: *Asclepias syriaca*, [iherb.com](#), Accessed 4-14-2015.
 image: *Betula pendula*, [nature.org](#), Accessed 4-14-2015.
 image: *Betula populifolia*, [nature.org](#), Accessed 4-14-2015.
 image: *Bouteloua gracilis*, [imgardening.com](#), Accessed 4-14-2015.
 image: *Brassica juncea*, [herb-education.eu](#), Accessed 4-14-2015.
 image: *Caryopsis lanceolata*, [actaplantatum.com](#), Accessed 4-14-2015.
 image: *Cynodon dactylon*, [actaplantatum.com](#), Accessed 4-14-2015.
 image: *Echinacea purpurea*, [imgardening.com](#), Accessed 4-14-2015.
 image: *Elymus canadensis*, [imgardening.com](#), Accessed 4-14-2015.
 image: *Eupatorium capillifolium*, [jaysn.co](#), Accessed 4-14-2015.
 image: *Festuca rubra*, [imgardening.com](#), Accessed 4-14-2015.
 image: *Gleditsia triacanthos*, [pannickplants.com](#), Accessed 4-14-2015.
 image: *Lolium perenne*, [habitat.org.uk](#), Accessed 4-14-2015.
 image: *Lupinus perennis*, [nicrossows.org](#), Accessed 4-14-2015.
 image: *Panicum virgatum*, [flickr.com](#), Accessed 4-14-2015.
 image: *Platanus acerifolia*, [divergarden.com](#), Accessed 4-14-2015.
 image: *Pteridium aquilinum*, [web.new.edu](#), Accessed 4-14-2015.
 image: *Rhus copallinum*, [wetland.org](#), Accessed 4-14-2015.
 image: *Rudbeckia hirta*, [gardensperiments.com](#), Accessed 4-14-2015.
 image: *Salix nigra*, [commons.wikimedia.com](#), Accessed 4-14-2015.
 image: *Schizachyrium scaparium*, [imgardening.com](#), Accessed 4-14-2015.

enhance node / successional forest growth

site trees	ecosystem value for site plantings	5 years	10 years	20 years
<i>Betula pendula</i> Silver Birch	200 species	\$2,800	\$6,000	\$16,200
<i>Betula populifolia</i> Gray Birch	200 species	\$2,800	\$6,000	\$16,200
<i>Rhus copallinum</i> Winged Sumac	200 species	\$1,200	\$2,000	\$4,000
<i>Rhus typhina</i> Staghorn Sumac	200 species	\$1,200	\$2,000	\$4,000
<i>Salix nigra</i> Black Willow	200 species	\$2,800	\$7,400	\$19,400
totals	1,000 species	\$10,800	\$23,400	\$59,800

based on "Tree Benefit Calculator," [trees.maryland.gov](#), 2015.

facilitate corridors / tree nursery

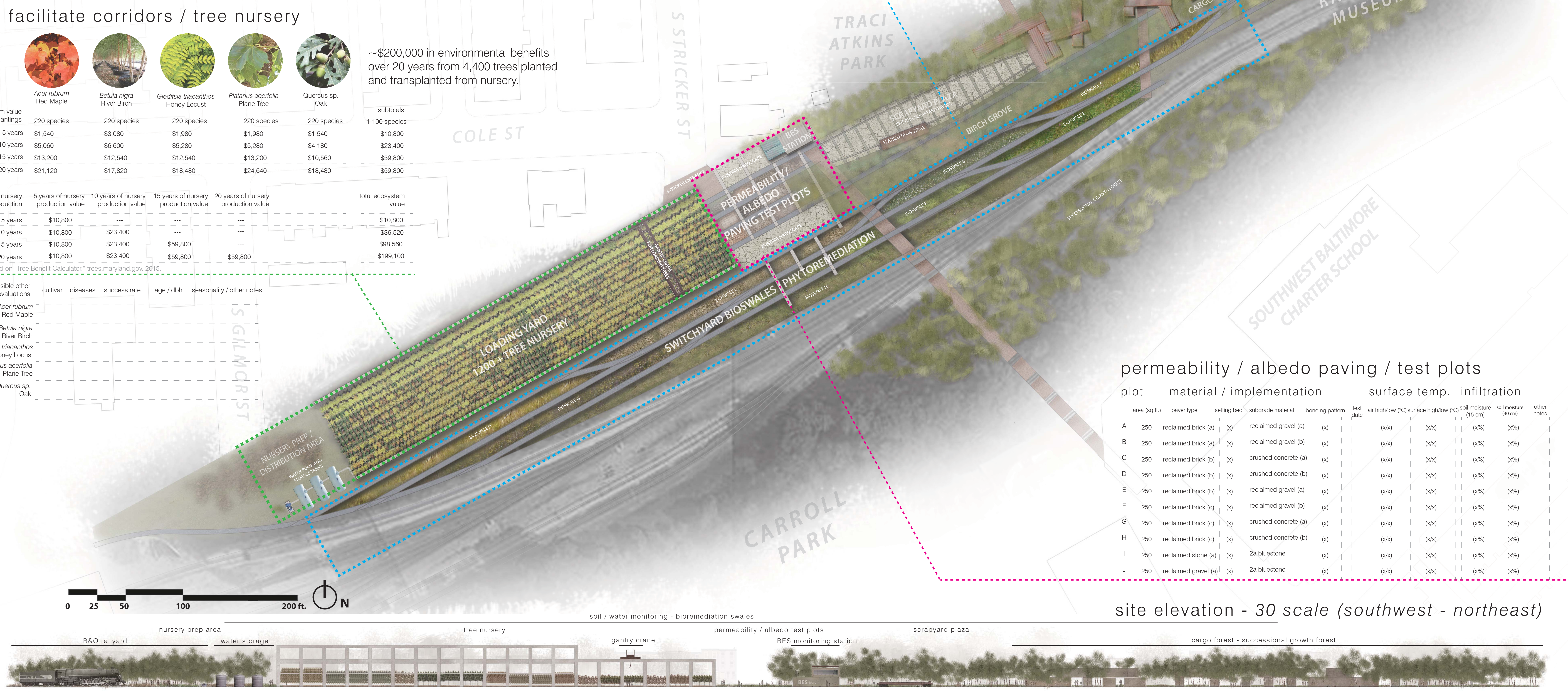
nursery trees	ecosystem value for site plantings	5 years	10 years	15 years	20 years
<i>Acer rubrum</i> Red Maple	220 species	\$1,540	\$5,060	\$13,200	\$21,120
<i>Betula nigra</i> River Birch	220 species	\$3,080	\$6,600	\$12,540	\$17,820
<i>Gleditsia triacanthos</i> Honey Locust	220 species	\$1,980	\$5,280	\$12,540	\$18,480
<i>Platanus acerifolia</i> Plane Tree	220 species	\$1,980	\$5,280	\$13,200	\$24,640
<i>Quercus sp.</i> Oak	220 species	\$1,540	\$4,180	\$10,560	\$18,480
subtotals	1,100 species	\$10,800	\$23,400	\$59,800	\$98,560

nursery production	5 years of nursery production value	10 years of nursery production value	15 years of nursery production value	20 years of nursery production value	total ecosystem value
5 years	\$10,800	---	---	---	\$10,800
10 years	\$10,800	\$23,400	---	---	\$36,520
15 years	\$10,800	\$23,400	\$59,800	---	\$98,560
20 years	\$10,800	\$23,400	\$59,800	\$59,800	\$199,100

based on "Tree Benefit Calculator," [trees.maryland.gov](#), 2015.

~\$200,000 in environmental benefits over 20 years from 4,400 trees planted and transplanted from nursery.

possible other tree evaluations	cultivar	diseases	success rate	age / dbh	seasonality / other notes
<i>Acer rubrum</i> Red Maple					
<i>Betula nigra</i> River Birch					
<i>Gleditsia triacanthos</i> Honey Locust					
<i>Platanus acerifolia</i> Plane Tree					
<i>Quercus sp.</i> Oak					

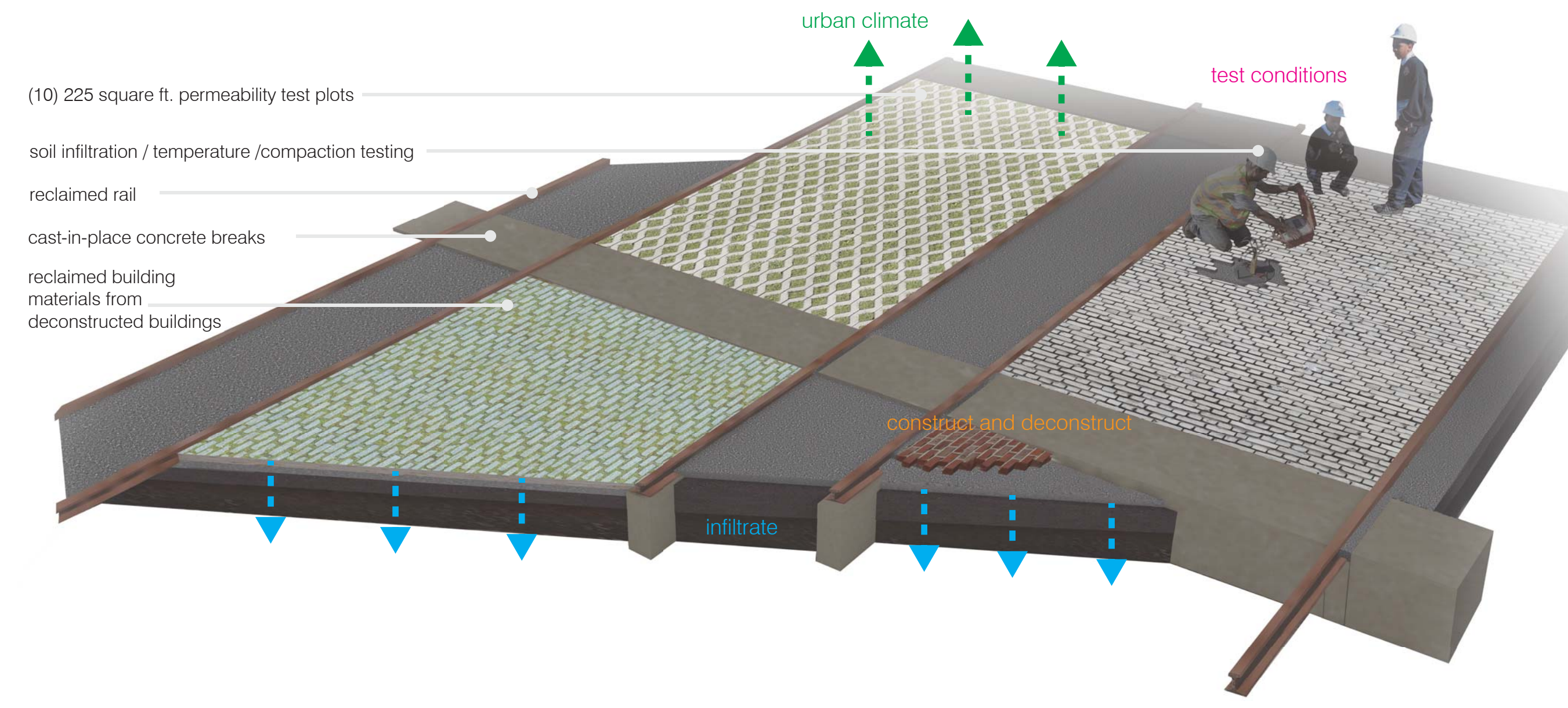
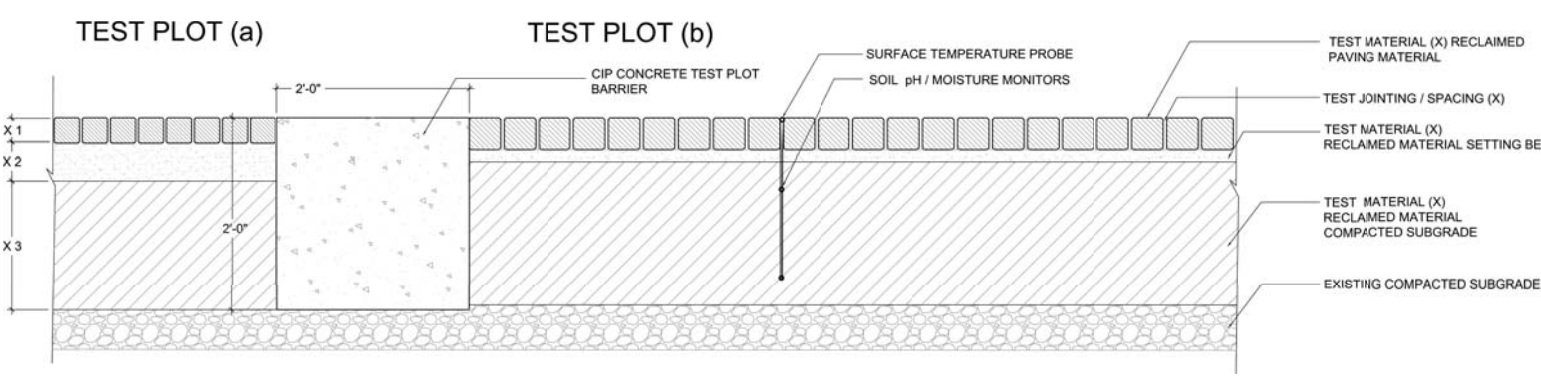


permeability / albedo paving / test plots

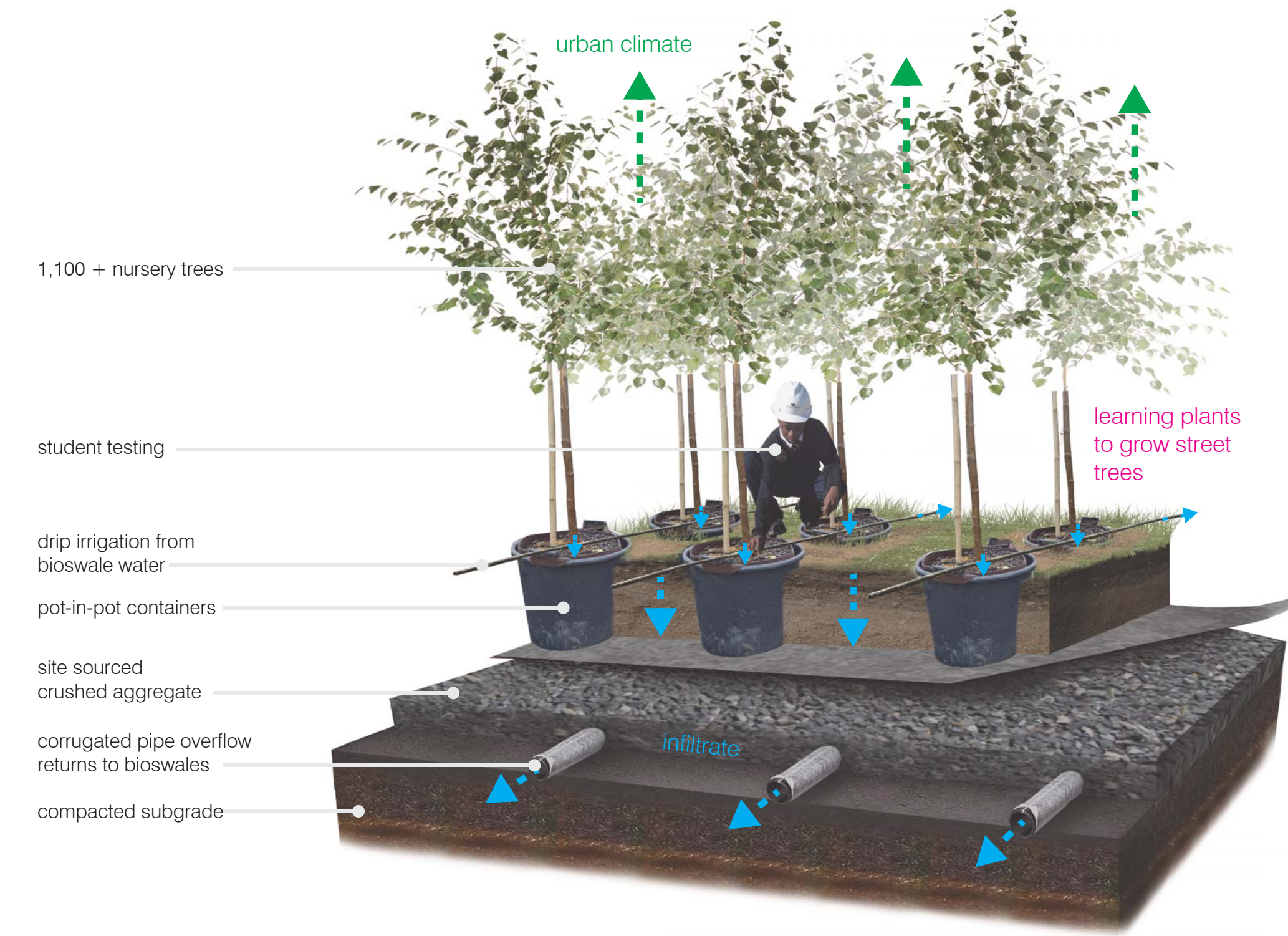
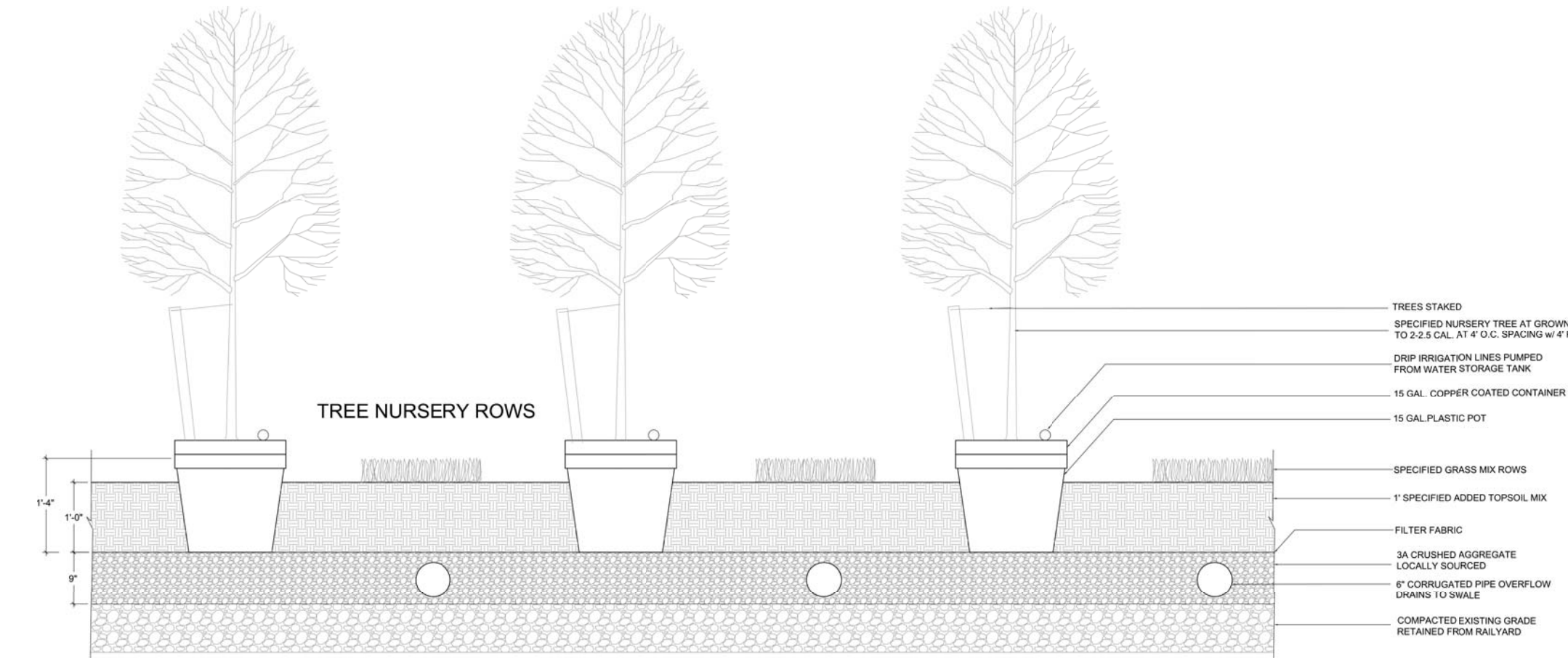
plot	area (sq ft.)	paver type	setting bed	subgrade material	bonding pattern	test date	air high/low (°C)	surface high/low (°C)	soil moisture (15 cm)	soil moisture (30 cm)	other notes
A	250	reclaimed brick (a)	(x)	reclaimed gravel (a)	(x)		(x/x)	(x/x)	(x%)	(x%)	
B	250	reclaimed brick (a)	(x)	reclaimed gravel (b)	(x)		(x/x)	(x/x)	(x%)	(x%)	
C	250	reclaimed brick (b)	(x)	crushed concrete (a)	(x)		(x/x)	(x/x)	(x%)	(x%)	
D	250	reclaimed brick (b)	(x)	crushed concrete (b)	(x)		(x/x)	(x/x)	(x%)	(x%)	
E	250	reclaimed brick (b)	(x)	reclaimed gravel (a)	(x)		(x/x)	(x/x)	(x%)	(x%)	
F	250	reclaimed brick (c)	(x)	reclaimed gravel (b)	(x)		(x/x)	(x/x)	(x%)	(x%)	
G	250	reclaimed brick (c)	(x)	crushed concrete (a)	(x)		(x/x)	(x/x)	(x%)	(x%)	
H	250	reclaimed brick (c)	(x)	crushed concrete (b)	(x)		(x/x)	(x/x)	(x%)	(x%)	
I	250	reclaimed stone (a)	(x)	2a bluestone	(x)		(x/x)	(x/x)	(x%)	(x%)	
J	250	reclaimed gravel (a)	(x)	2a bluestone	(x)		(x/x)	(x/x)	(x%)	(x%)	

site elevation - 30 scale (southwest - northeast)

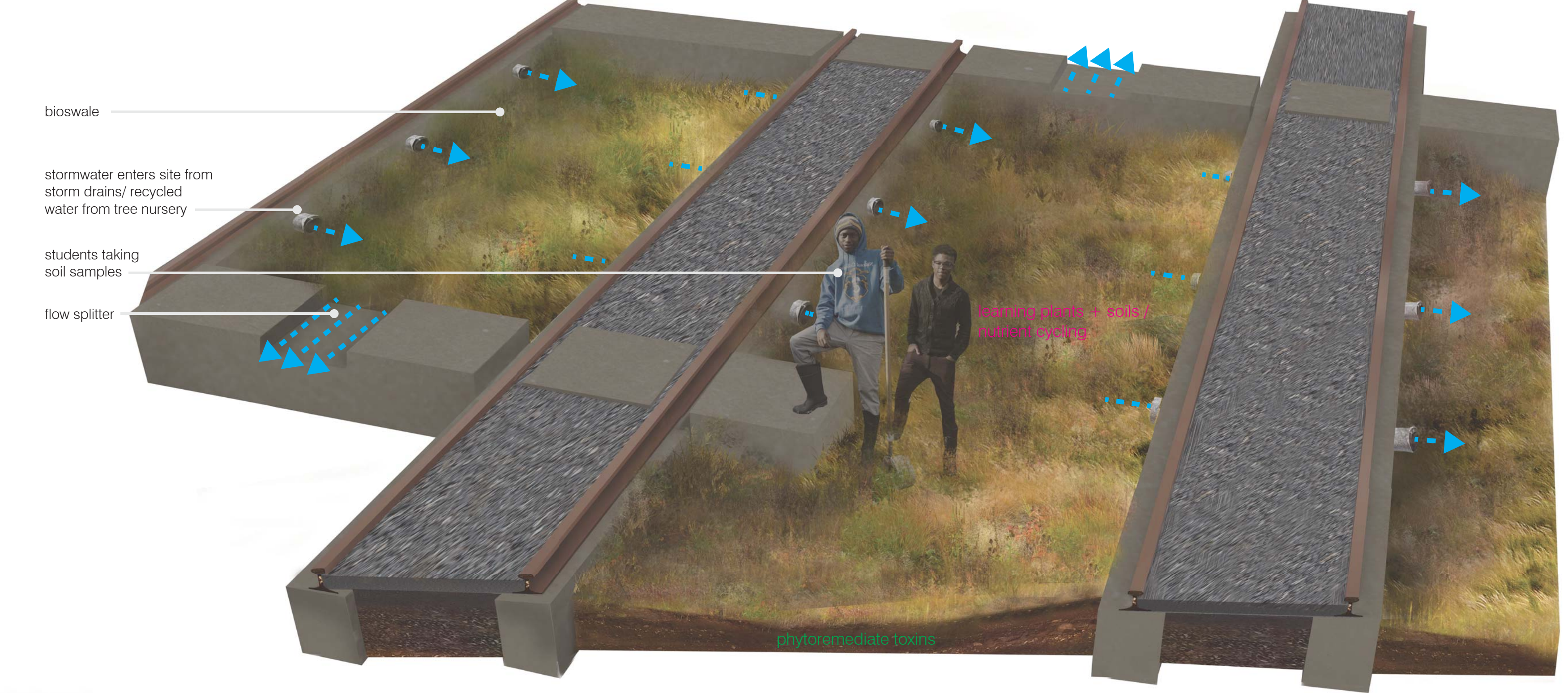
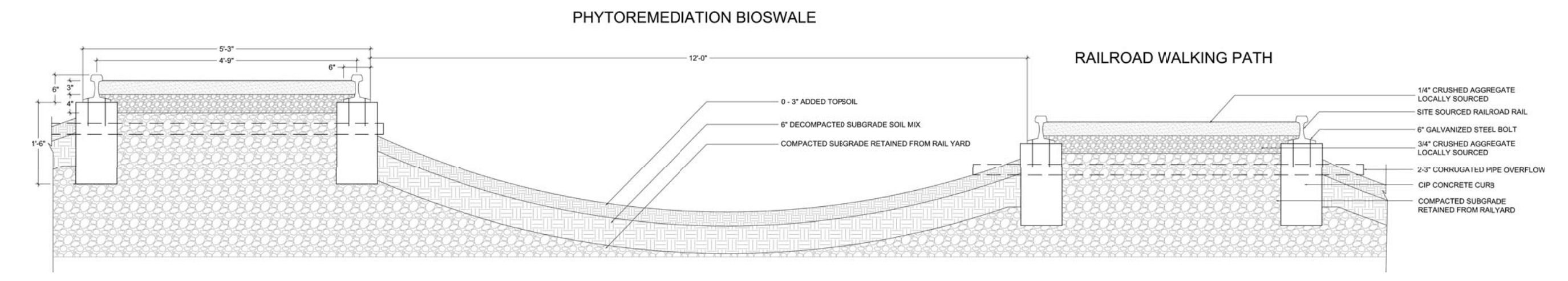
permeability / albedo paving / test plots - detail



tree nursery - detail



remediate toxins / bioswale test plots - detail



enhance node / successional forest growth

tree nursery specific

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