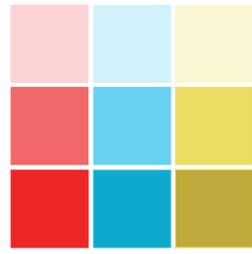


THE WEST- MINSTER MATRIX

CHRISTOPHE CHUNG
ELIZABETH RAMACCIA
JAIME YOUNG

WATER, LANDSCAPE, +
URBAN DESIGN 11.314



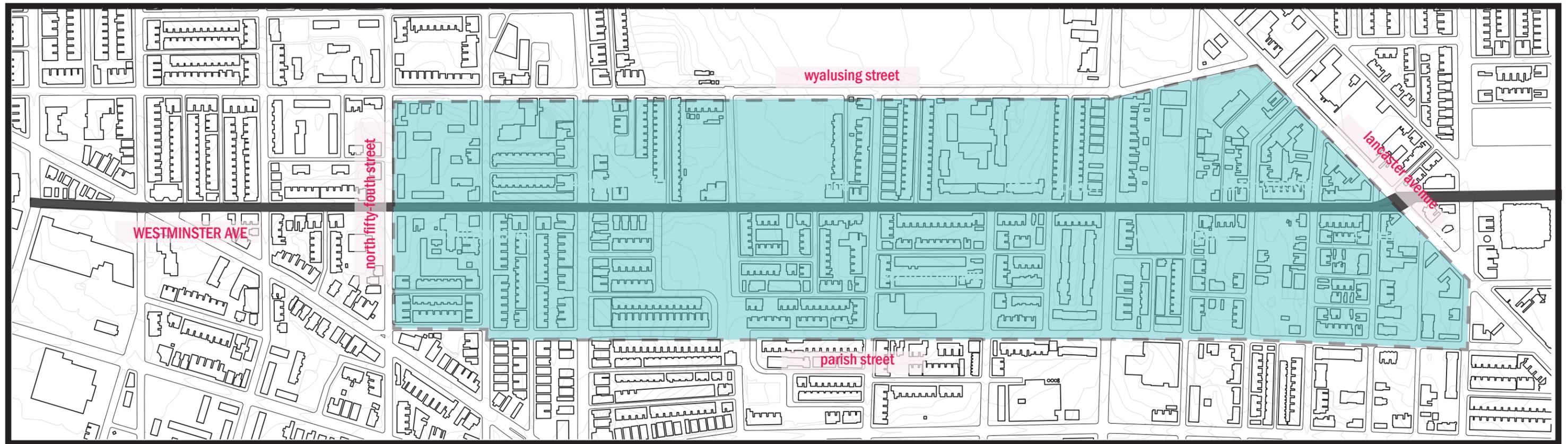


the purpose of the westminster matrix

The Westminster Matrix is a story about a street that could be many streets in West Philadelphia.

When walking along Westminster Avenue, one can sense how each block feels very different from another. The architecture of buildings changes parcel by parcel, while the extent to which residents take ownership of the street is variable. Some blocks and individual plots are well-maintained by residents, while others fall into disrepair.

The Westminster Matrix takes into account this diversity and creates a framework for understanding and analyzing this complexity. The matrix allows us to identify parcels by (a) street frontage typology and (b) the property occupier's capacity to maintain stormwater BMPs. Prototype stormwater interventions are suggested based upon a combination of these two variables, while maintaining a level of flexibility that allows interventions to evolve to surrounding changes over time.



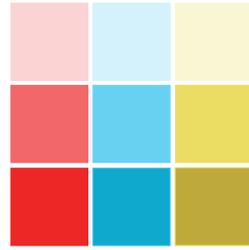
an overview of our intervention strategy :

Along with the diverse street frontage typologies and varying capacities of property occupiers to maintain stormwater BMPs, other factors have been taken into account to inform our intervention strategy. Analysis of US Census data, along with interviews with local residents, would suggest the existence of high rates of poverty, gender imbalance, demographic flight, and crime. While we do not suggest that our intervention strategy will single-handedly overcome all such challenges, knowledge of these realities ensure that our interventions in some way meets the social needs of residents while being sensitive to community concerns.

Analysis of the high percentage of existing impervious cover along Westminster Avenue has helped determine the BMPs suggested in this strategy. By accounting for stormwater run-off generated from a one-inch rainfall

on all rooftops, sidewalks, and a percentage of streets, a combination of rain barrels, planter boxes, tree trenches, and sub-surface vaults can increase the amount of rainwater diverted from sewers --from 14% to 52%. Construction of an optional detention basin in the "Diagonal" (a park created atop the Mill Creek Sewer after cave-ins in the 1960s and 1970s) can increase this percentage to 136%.

Our strategy is two-pronged and suggests interventions both along Westminster Avenue and within the Diagonal. While the former deals with individual residents, parcels and blocks, the latter proposes interventions with broader scales. Together these strategies meet some interests and answer some needs of the surrounding Westminster Avenue community in terms of reducing stormwater run-off, greening streets, and increasing general liveability. Our aim is to not only provide a strategy for Westminster Avenue alone but provide a possible precedent for greater West Philadelphia.



a summary of conditions and interventions

existing physical conditions along westminster avenue

Westminster Avenue represents a streetscape common throughout West Philadelphia and poses a number of challenges when proposing installation of stormwater BMPs. Particularly when attempting to increase pervious surfaces, some key challenges identified along the Westminster Avenue transect include:

- a high percentage of impervious cover
- dense development
- narrow sidewalks (an average of 9 feet wide)

stormwater calculations along westminster avenue

Key findings from stormwater calculations of Westminster Avenue (setback of 150 feet from the street centerline) include the following:

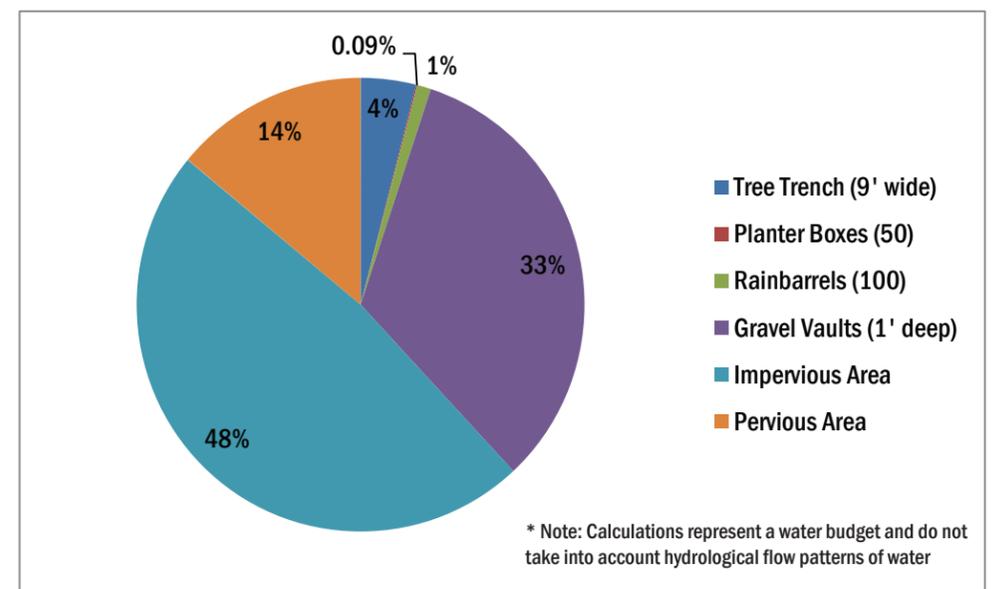
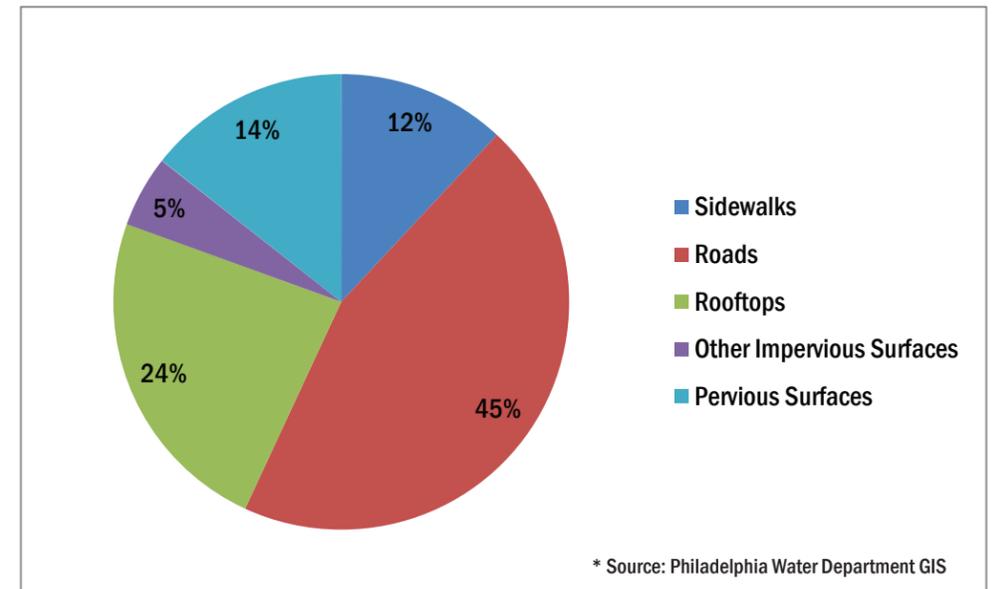
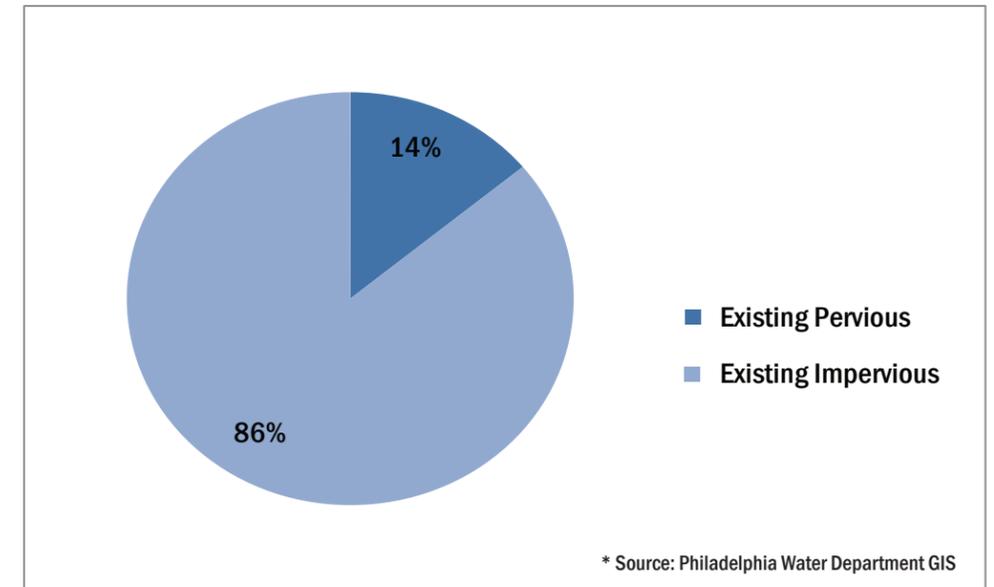
- roads comprise nearly half of all surfaces within the transect.
- sidewalk surfaces, when converted to pervious, provide an opportunity to accommodate stormwater.
- accounting for rooftop runoff can significantly reduce overall stormwater runoff.

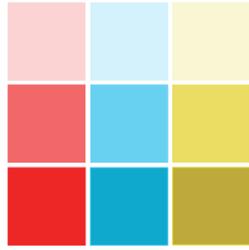
Our intervention strategy is therefore designed to account for stormwater runoff from all sidewalks and rooftops as well as a small percentage of stormwater runoff from roads.

proposed bmp interventions account for 52% of stormwater run-off

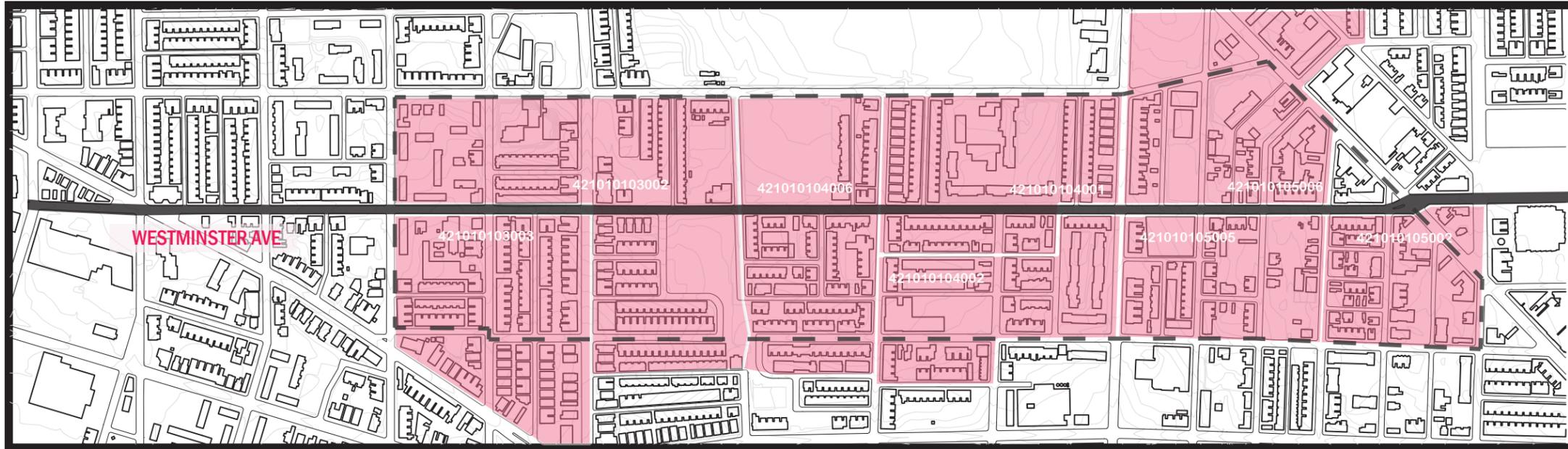
Tight space constraints along Westminster Avenue leave little room for increase of pervious surfaces. For this reason, larger infrastructural interventions are included in our proposed BMPs--in addition to the proposed tree trenches--to surpass a target of diverting 50% of stormwater from combined sewers.

- | | |
|--|------|
| · tree trenches (9' wide): | 4% |
| · gravel vaults (1' deep): | 33% |
| · optional detention basin (210' X 250' X 3'): | 136% |





a social map of westminster avenue: demographic data by block group

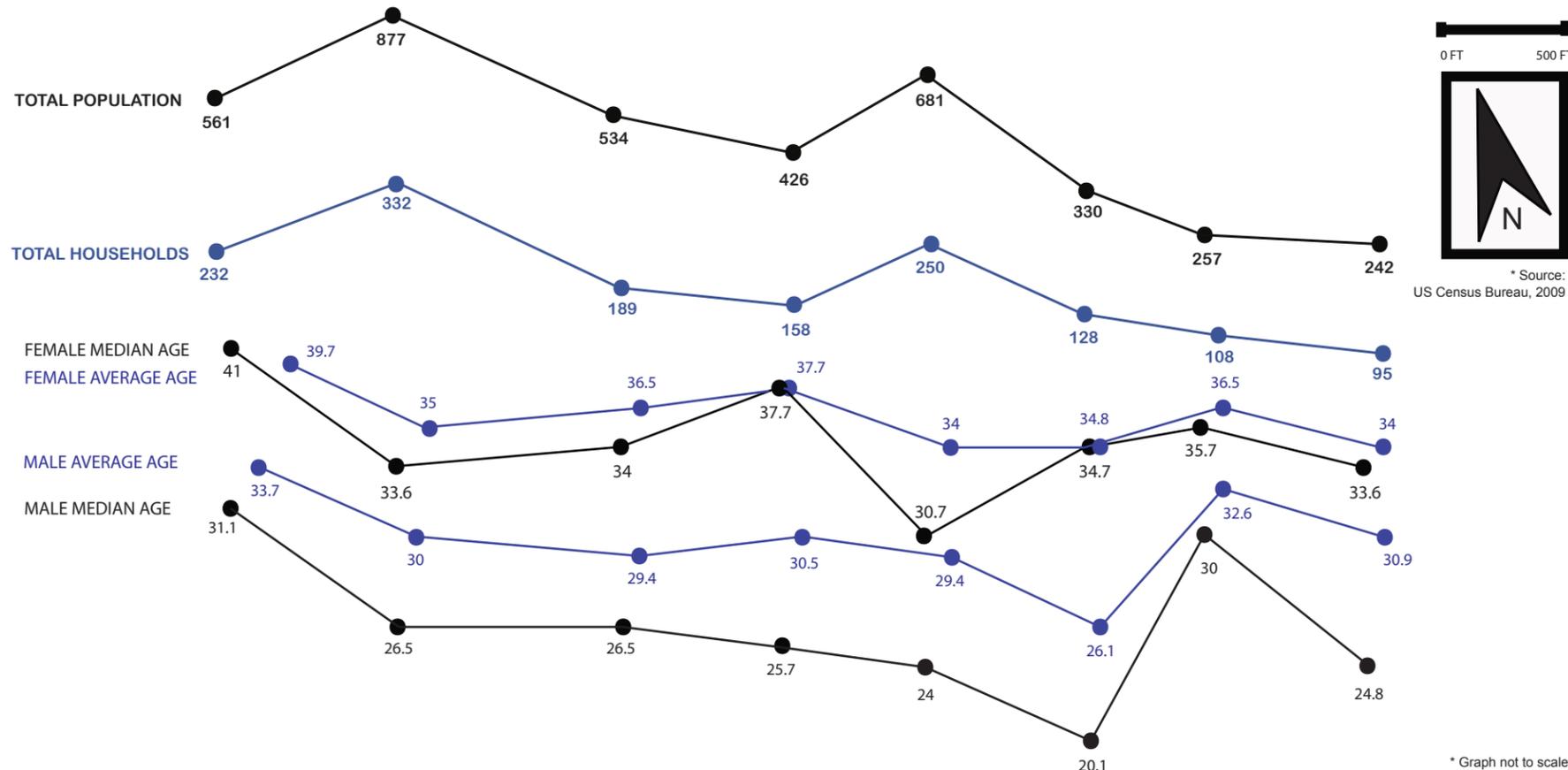


While piecing together an intervention strategy, our team felt it important to also understand the Westminster Avenue community. Through an analysis of US Census Bureau data, interviews with local residents, and a site visit to the transect, a number of social challenges have been identified and are as follows:

- a high rate of poverty, with a median household income of less than \$20,000 per year
- a significant gender imbalance, with a female population (2175) that is 25% higher than the male population (1733)
- an absence of adult males, as indicated by the significant difference in median ages of females and males. More specifically, an absence of young adult males is also indicated by the significant difference in average and median ages of males.

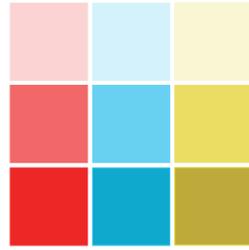
| DEMOGRAPHIC DATA: (for all 8 block groups) | |
|---|-----------|
| TOTAL POPULATION: | 3908 |
| AVERAGE HOUSEHOLD SIZE: | 2.59 |
| AVERAGE FAMILY SIZE: | 3.34 |
| HOUSEHOLD INCOME: (MEDIAN / CURRENT) | \$ 19,822 |
| TOTAL MALE POPULATION: | 1733 |
| TOTAL FEMALE POPULATION: | 2175 |
| MEDIAN AGE: | 30.71 |

* Source: US Census Bureau, 2009



Such challenges are not specific to Westminster Avenue alone, but are shared by many communities throughout West Philadelphia. Taking into account these realities is important as our intervention strategy relies on community involvement in maintenance of stormwater BMPs. This is especially significant when assessing a community's capacity to maintain.

However, as we noticed from our site visit that a significant amount of social variation exists throughout Westminster Avenue--both block by block and parcel by parcel--we have designed a matrix which provides a framework for understanding this diversity.



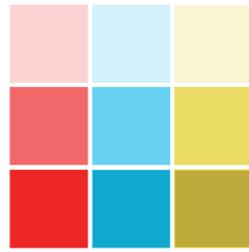
a guiding matrix to determine an appropriate intervention strategy

As previously noted, implementation of stormwater BMPs face a number of challenges in the Westminster Avenue and broader West Philadelphia contexts. However, such challenges should not be connoted with impossibility, as a number of opportunities have been identified--particularly along sidewalks and the building-sidewalk interface.

Two variables are taken into deep consideration when determining the most appropriate BMP for each individual site. The variables considered for sidewalk interventions are (1) building frontage, or more specifically a building's spatial relationship with the sidewalk and (2) the capacity of the building occupant to maintain the abutting BMP(s). The former variable is sub-categorized into public, semi-public and private spaces, while the latter is sub-categorized into low, medium and high capacity to maintain. One variable is considered for open space, (1) the capacity to maintain, which is largely determined by current ownership and management of the property. Like the other variables, the open space variable is sub-categorized into low, medium and high; however, this project does not provide design prescriptions for such spaces.

By taking into account a combination of physical conditions and the ability of the abutting property to maintain such BMPs, appropriate typologies and prototype interventions can be discerned. And, while this matrix has been drawn from Westminster Avenue, such a matrix can be applied to any site throughout West Philadelphia.

| | public | semi-public | private | open space |
|--------|--------|-------------|---------|------------|
| low | | | | |
| medium | | | | |
| high | | | | |



visual examples of matrix categorizations

public

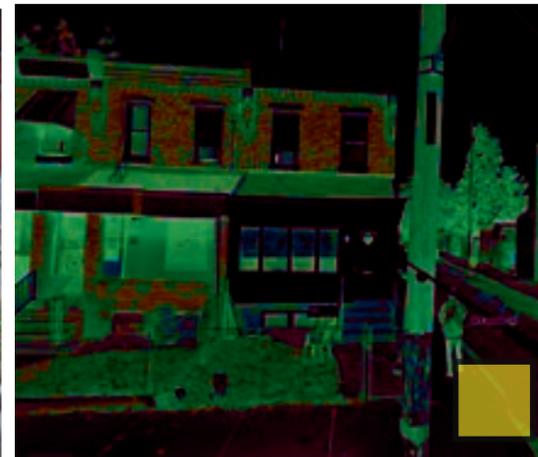
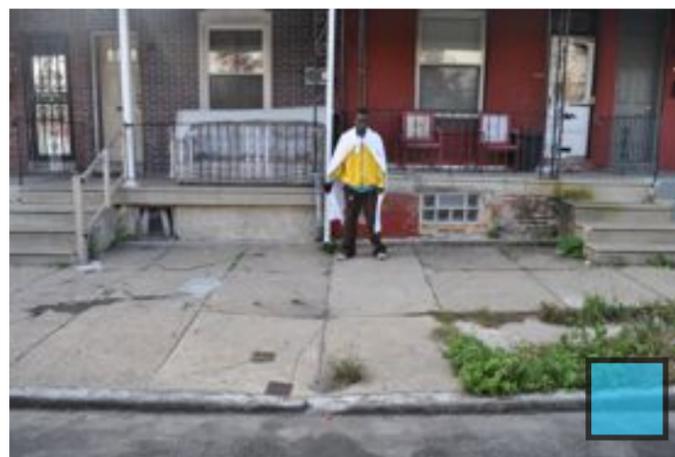
semi-public

private

low capacity



medium capacity



high capacity



Public, semi-public, and private are determined by building frontage--the spatial relationship between a building and a sidewalk--and are defined as follows:

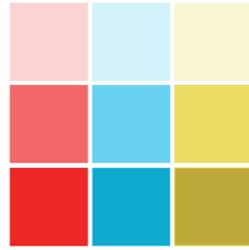
- public - a building immediately opening onto a sidewalk
- semi-public - an intermediary space created by a stoop, which enables semi-ownership
- private - an enclosed space separating the building from a sidewalk

Low, medium, and high capacities to maintain are determined by a close evaluation of the property occupant and are defined (generally) as follows:

- low capacity - an abandoned property
- medium capacity - a half-occupied property or a fully renter-occupied property
- high capacity - an owner-occupied property

Red, blue, and yellow is associated with public, semi-public, and private respectively, while varying levels of opacity determine low, medium and high capacities to maintain.

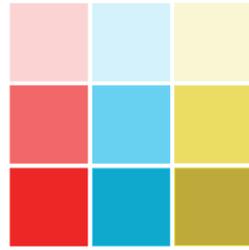
| | | | |
|---|-------------------------------|---|---------------------------|
|  | public / low capacity |  | private / low capacity |
|  | public / medium capacity |  | private / medium capacity |
|  | public / high capacity |  | private / high capacity |
|  | semi-public / low capacity | | |
|  | semi-public / medium capacity | | |
|  | semi-public / high capacity | | |



map 1: buildings with public, semi-public, and private frontages / open spaces along westminster avenue

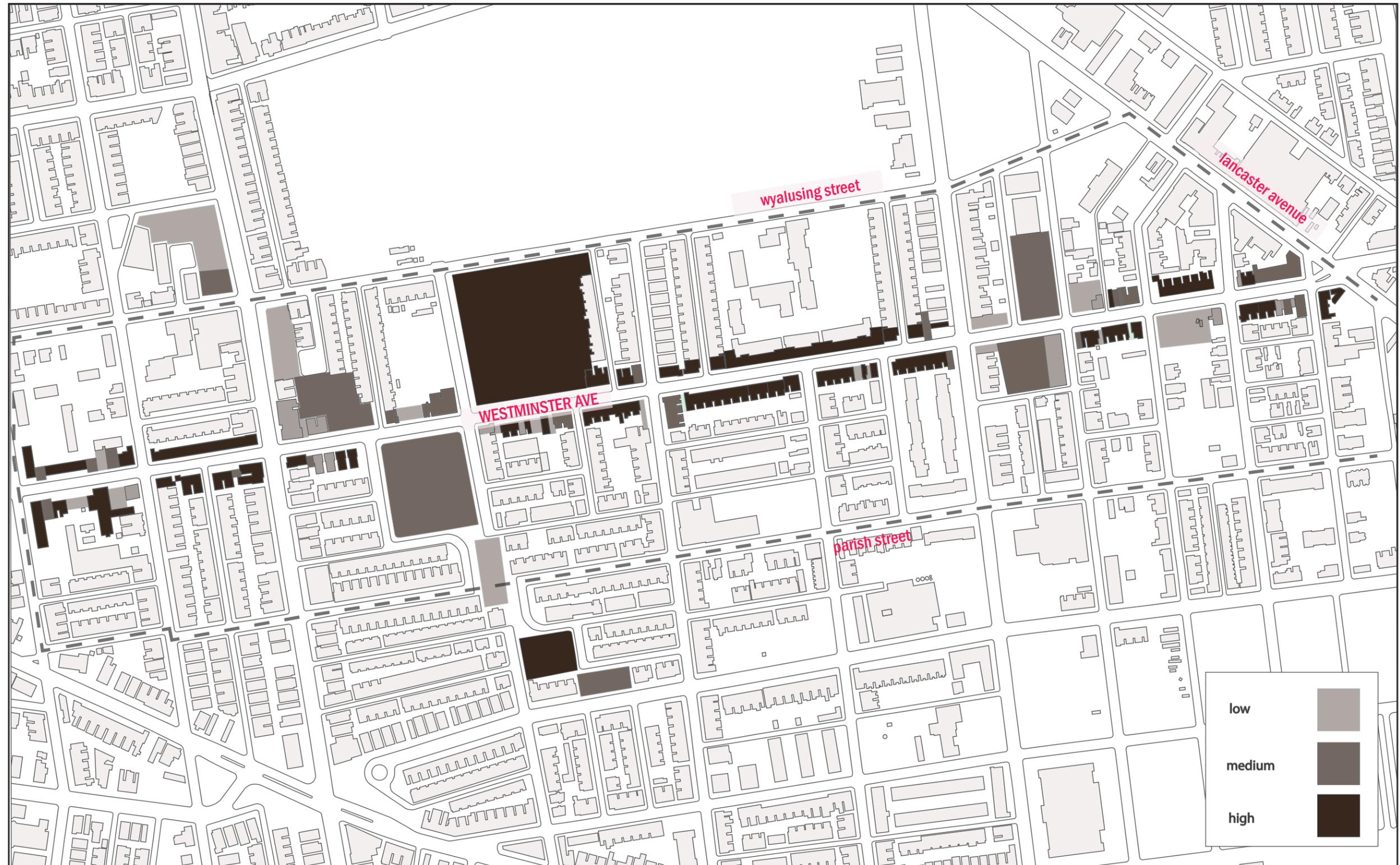
Building frontages--of public, semi-public, and private--vary considerably along Westminster Avenue. Even within blocks there is a diversity of building frontages, which would be more appropriate for one BMP or another. Open spaces--both pervious and impervious--exist along Westminster Avenue, with a substantial portion of such spaces located within the Diagonal.

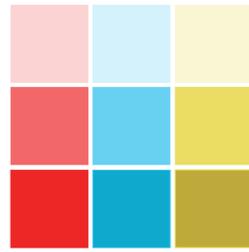




map 2: low, medium, and high capacity to maintain

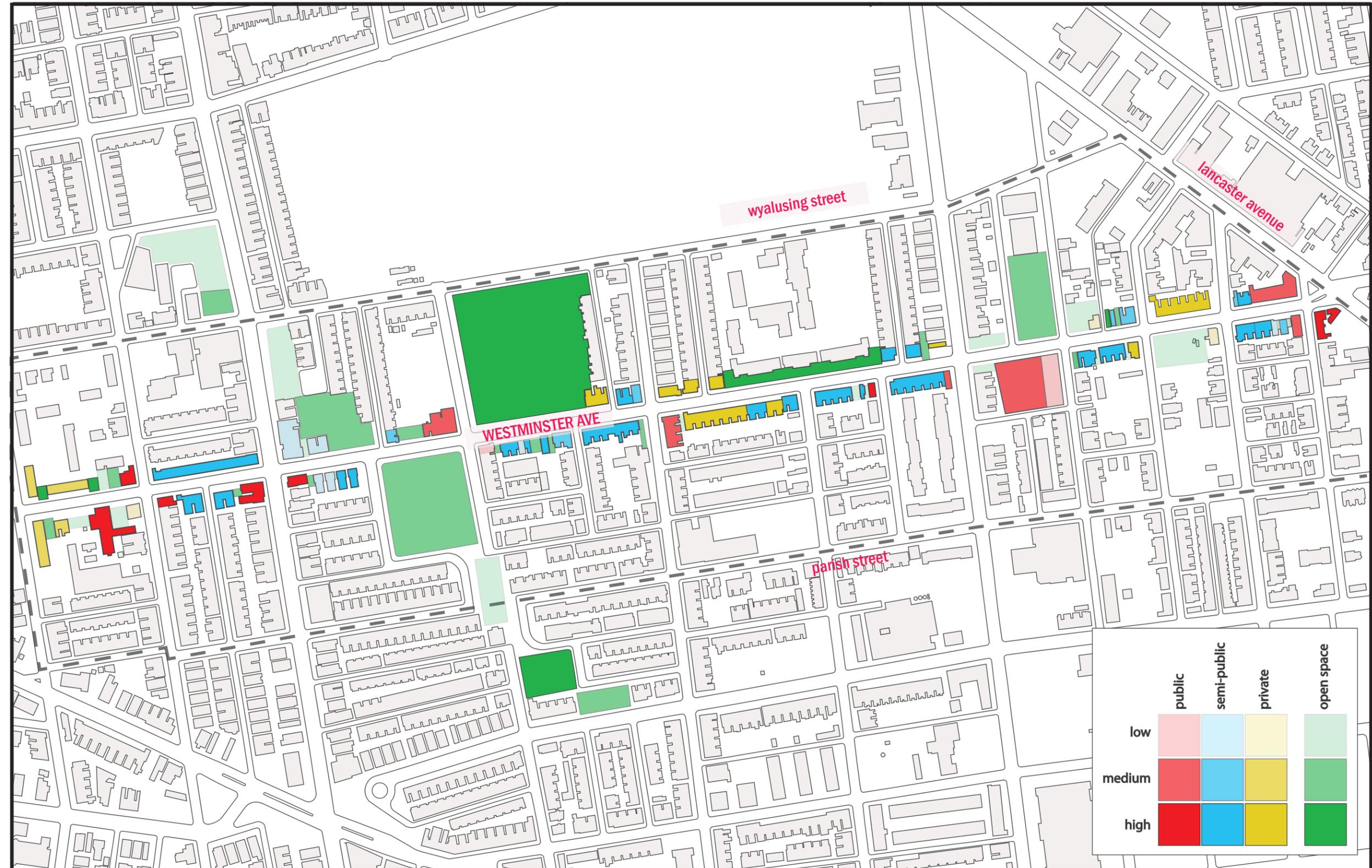
Similar to building frontages, the capacity of residents to maintain is highly variable along Westminster Avenue. Demographic out-migration significantly contributes to this variety. However, the capacity of an abutting property to maintain a BMP can change over time with change in occupancy. As increased and decreased occupancy of buildings are frequent, and properties continue to be reprogrammed, such a map is never stagnant and requires frequent updating to remain accurate.

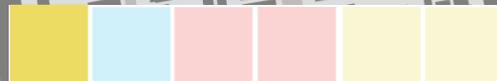




map 3: two variables combined - building frontages and capacities to maintain

Combining the two variables onto a single map shows few instances where buildings of the same category are situated side-by-side. Given this complexity, BMP solutions are recommended on differential scales. Tree trenches and sub-surface vaults should be implemented throughout the entire transect, while planter boxes and rain barrels will be utilized in semi-public and high capacity buildings respectively. And while calculations suggest that the benefits drawn from planter boxes and rain barrels are minimal in reaching substantial stormwater reductions targets, such BMPs nevertheless foster community ownership of the overall system as well as contribute to the greening of city blocks and the creation of more liveable communities.



 = low intensity BLOCK

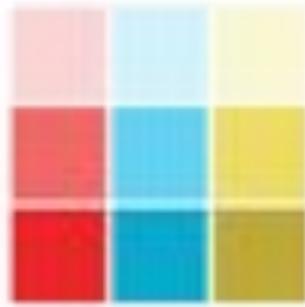
 = medium intensity BLOCK

 = high intensity BLOCK

The aggregation of parcel types allows one to begin identifying block types, displayed conceptually here. High intensity blocks could prove the best blocks to pilot a block group community development project, wherein materials and technical assistance are provided to the block in exchange for its maintenance

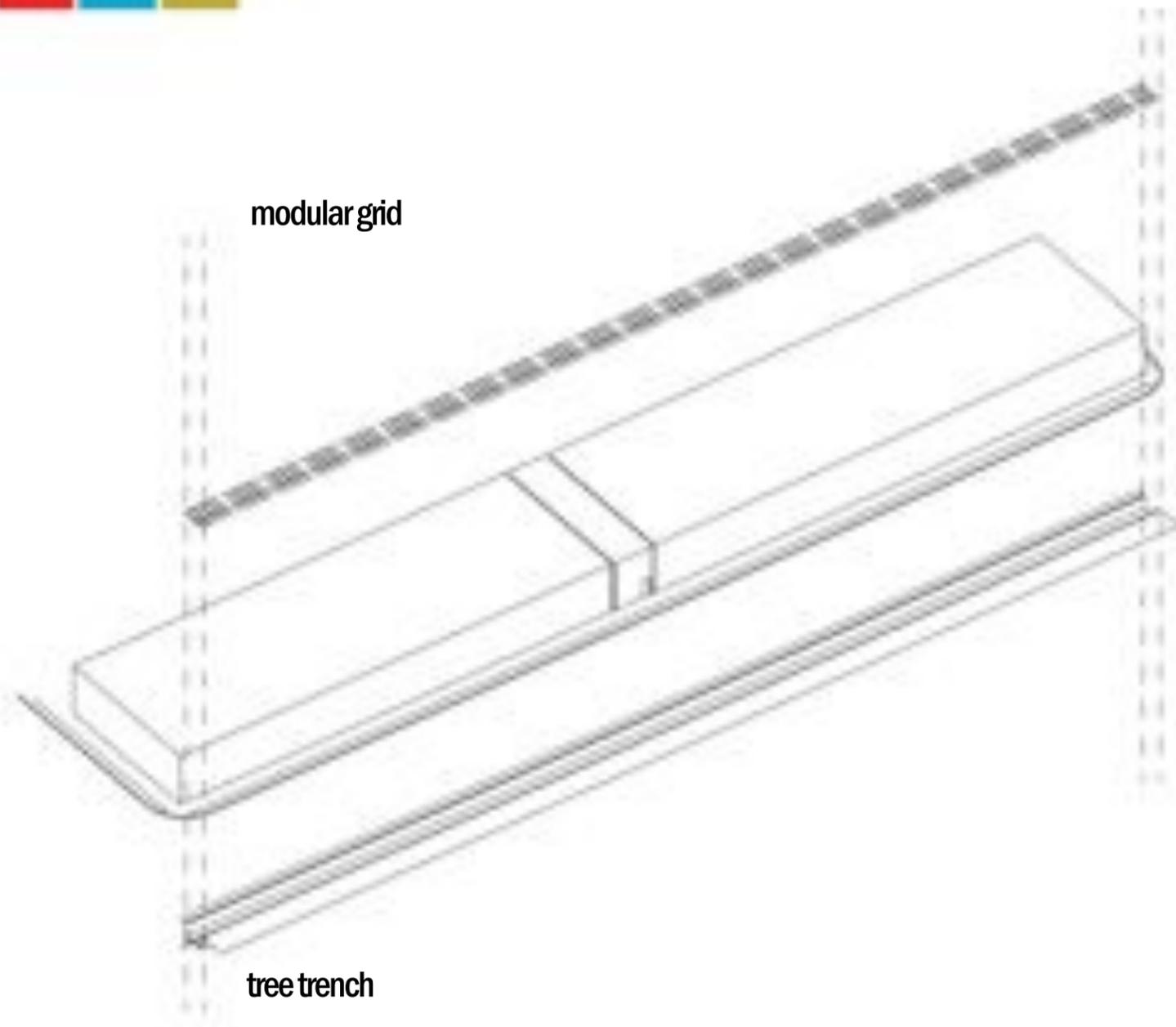
westminster avenue





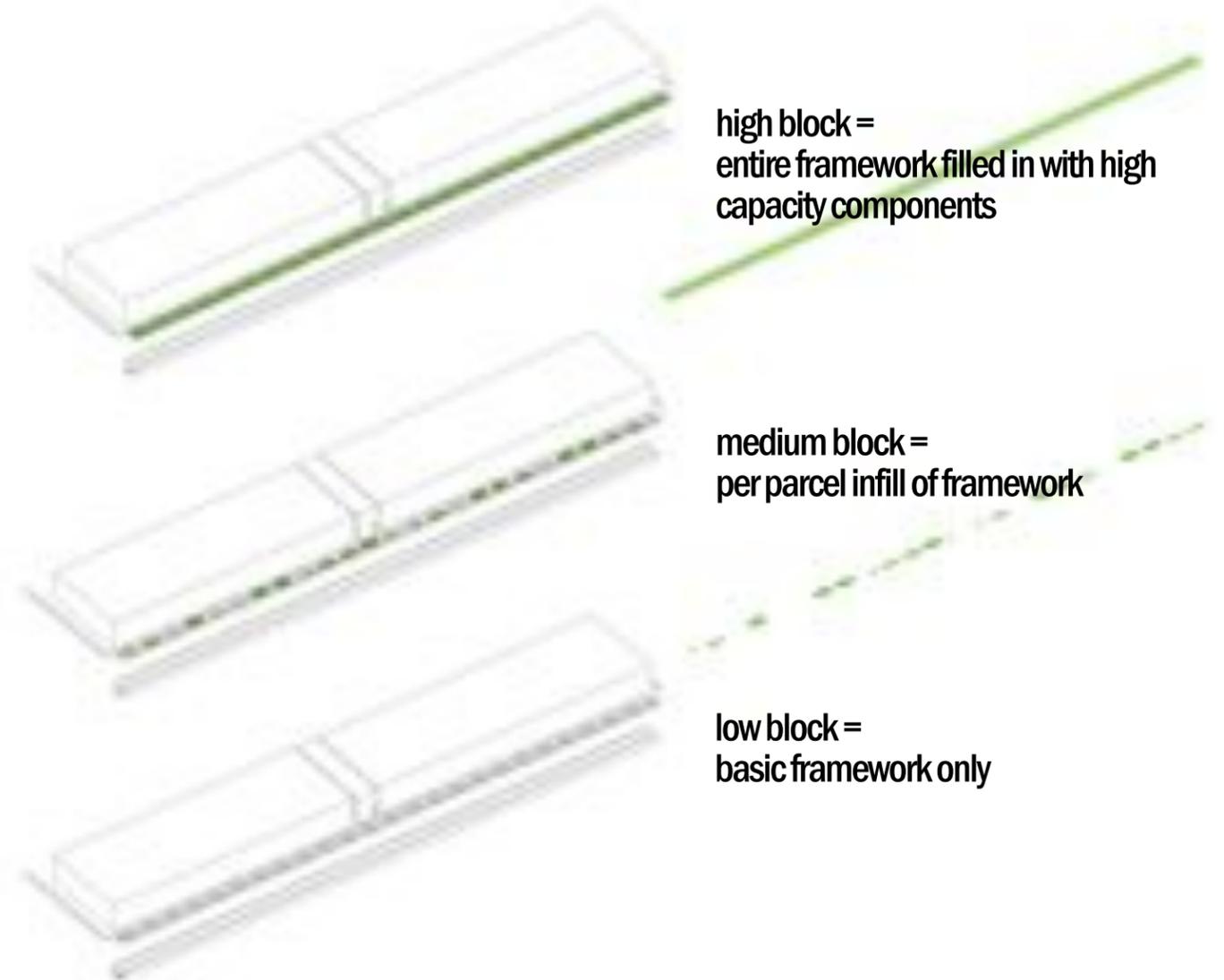
basic framework

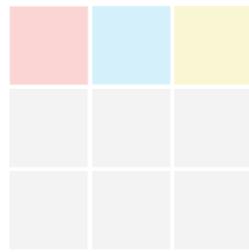
The basic framework is implemented at the scale of the street. A 9' wide linear trench, including a tree trench and gravel vault, is constructed under the sidewalk and street (details on following pages). Here the sidewalk and street are overlaid with a grid of 3' x 3' permeable pavers that can be removed depending on the interest of residents or block groups to reveal space for self-expression through planting and gardening.



community development strategy

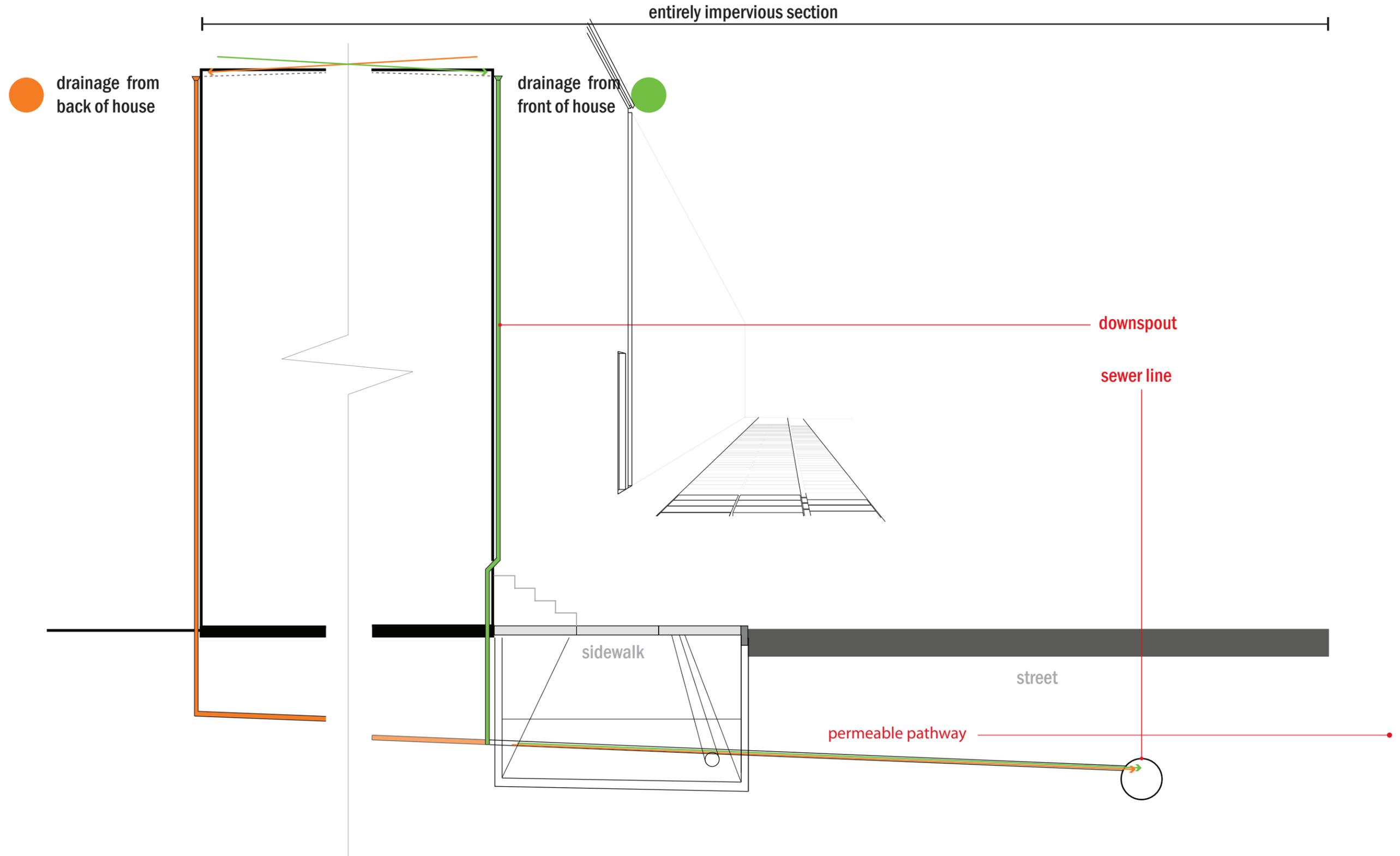
The images below diagram the various levels of appropriation that could occur at the block scale. This design strategy could be coupled with a community development strategy, in which blocks that can organize themselves (despite having the presence of low-capacity parcels) could receive technical and material assistance in exchange for maintaining their block. Such a block would become a 'high block' with the majority of pavers removed in lieu of planting. An unorganized block would function on a parcel-by-parcel basis, resembling the 'medium block' below. A block with many vacancies and little to no capacity would receive the basic framework and be considered a 'low block.'

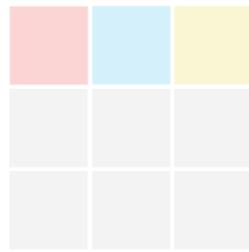




existing infrastructure

The imperviousness of the Westminster Street transect is apparent at the scale of the parcel. Most parcels lack both front and back yards. Rainwater from roofs flows directly into a combined sewer overflow through underground lines.

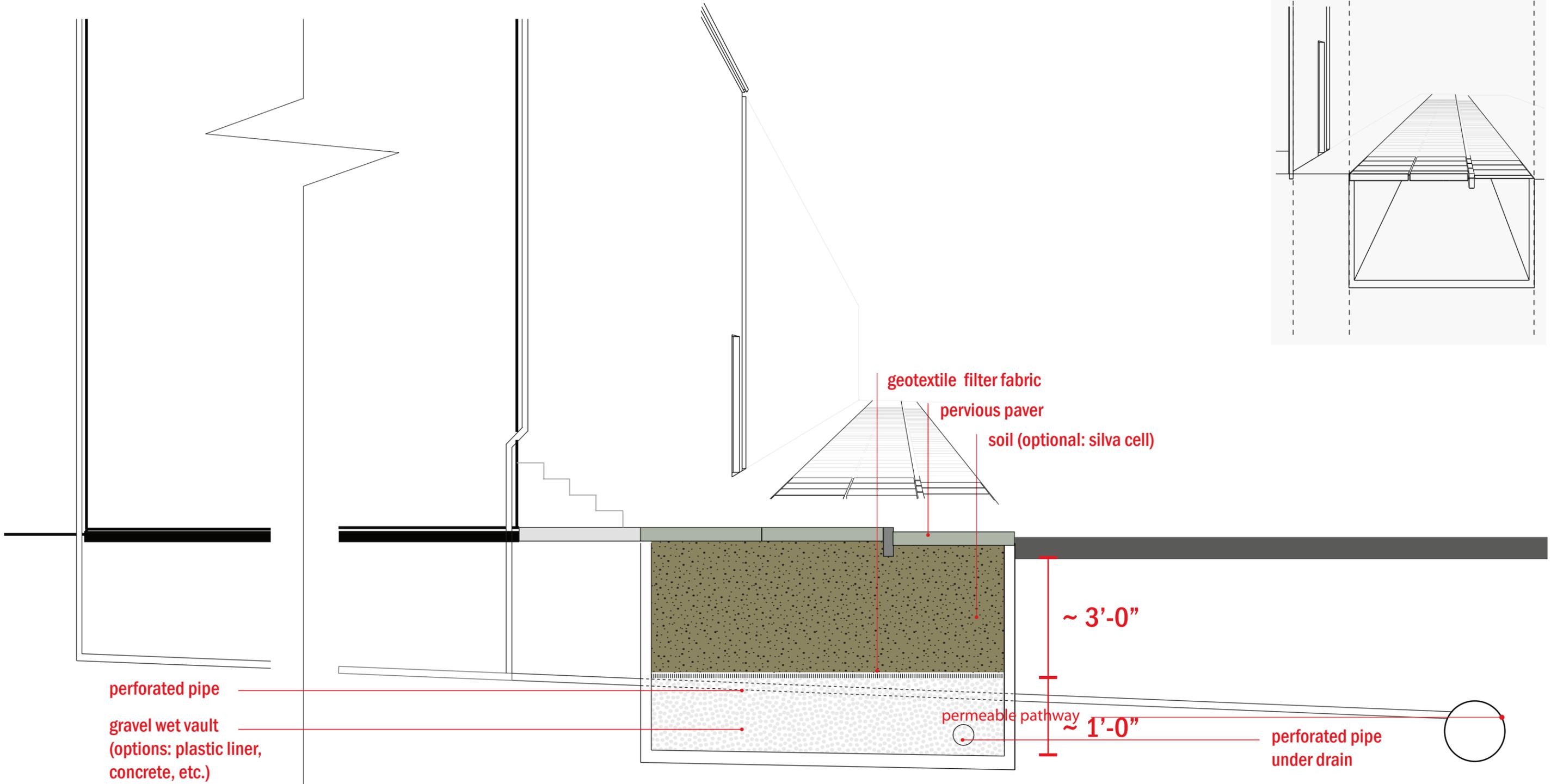
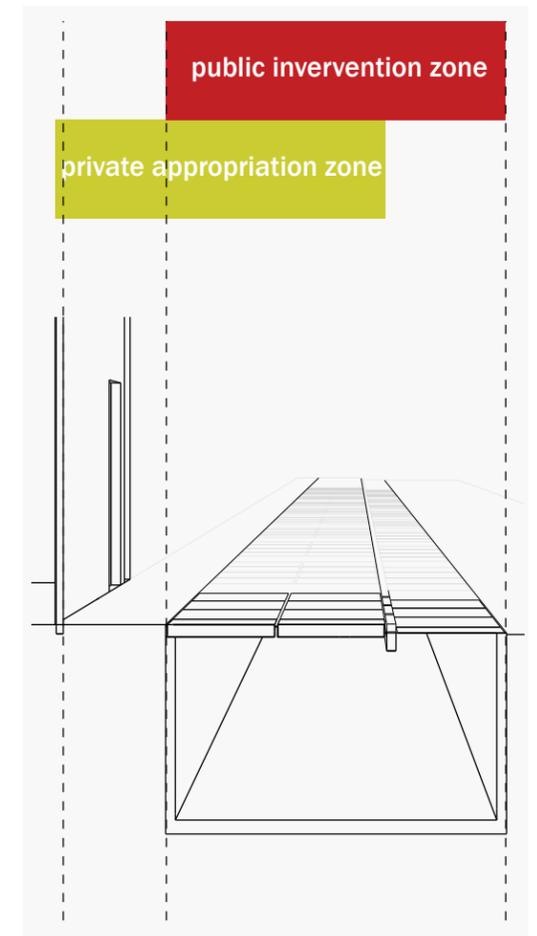


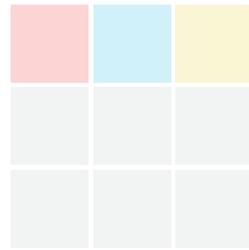


proposed basic infrastructure - detailed

Water from rooftops is relatively clean and does not need to be filtered. The constructed trench intersects the line out to the streets, capturing the water in a gravel vault that can store and transfer it to the green diagonal. Thus, clean water does not mix with the contents of the sewer and can be reused in a variety of ways (see the suggested program for the green diagonal for possible ideas).

This diagram outlines the public and private intervention zones across the proposed new infrastructure. Additionally, public responsibility lies mainly below the surface of the sidewalk and street, while private responsibility lies mainly on the surface.

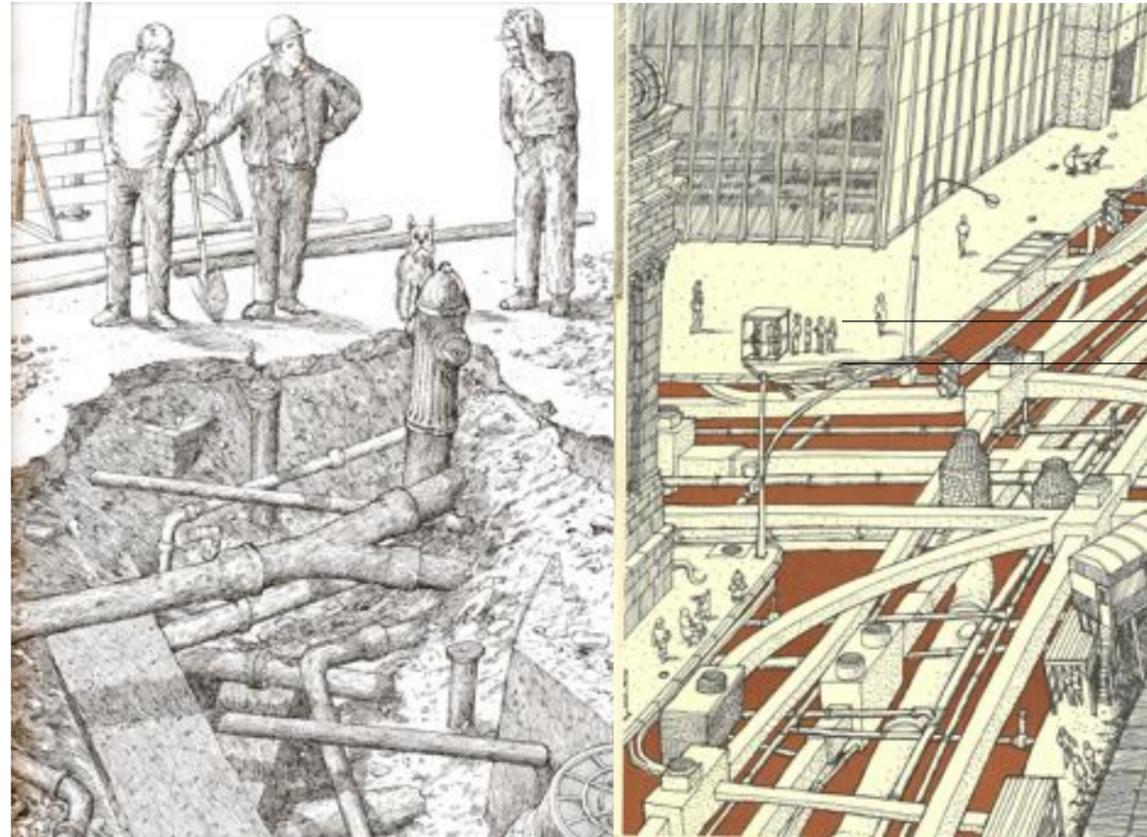




optional utility trench

Currently, the various utilities are spread throughout the subsurface of the sidewalk and road. Any repairs or improves that need to be made require digging up the pavement, causing significant disturbance and requiring time and money.

typical underground utilities

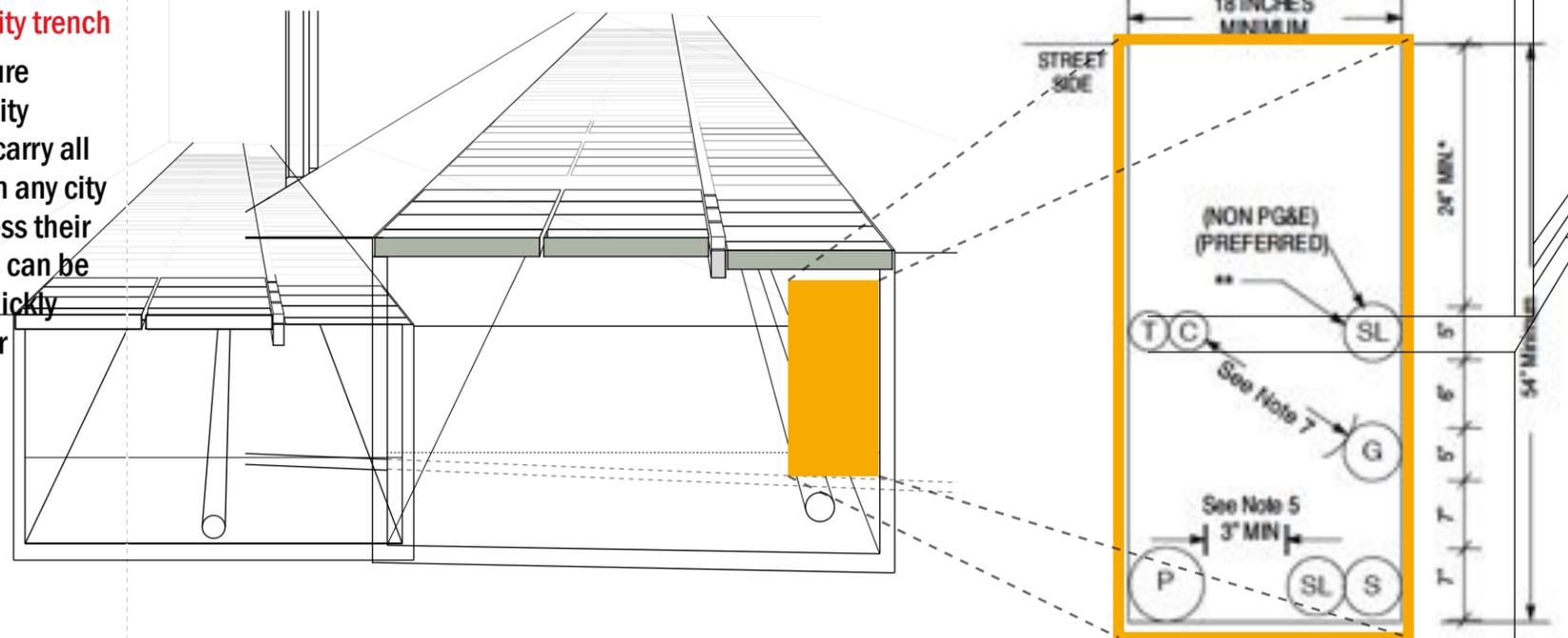


Macauley, David. Underground. New York: Houghton Mifflin Company, 1976. 44, 47.

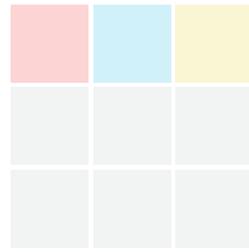
'Joint Trench Configurations & Occupancy Guide.' Pacific Gas and Electric Company, 2006. 1.

bundled utility trench

The proposed infrastructure system could house a utility trench under the road to carry all of the utilities. Thus, when any city utility would need to access their lines, the modular panels can be removed and replaced quickly and with minimal effort or disturbance.

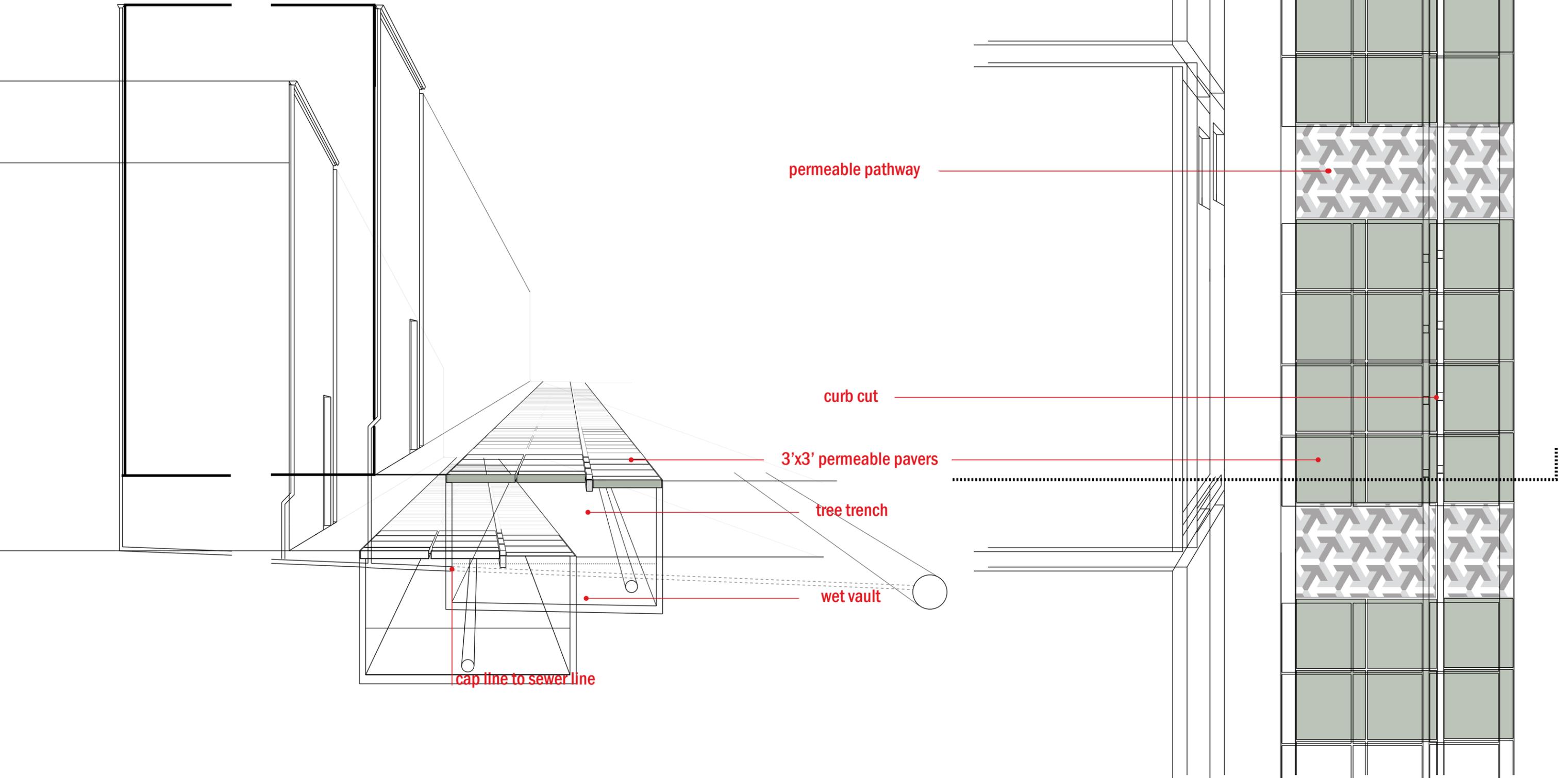


| | |
|----|---------------------------|
| G | (GAS) SEE NOTES 4, 7 & 13 |
| T | (TELEPHONE) DUCT |
| T | (TELEPHONE) DIRECT BURY |
| C | (CATV) |
| S | (ELECTRIC SECONDARY) |
| P | (ELECTRIC PRIMARY) |
| SL | (STREETLIGHT) SEE NOTE 5 |



basic framework [public, semi-public, private]

The basic framework consists of a tree trench and vault, as well as an overlaid grid of 3'x3' permeable pavers. The basic framework is applied along the entire length of the street, regardless of varying capacities of adjacent parcels.



permeable pathway

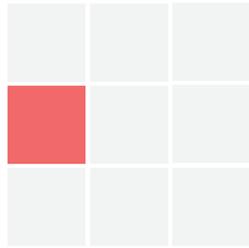
curb cut

3'x3' permeable pavers

tree trench

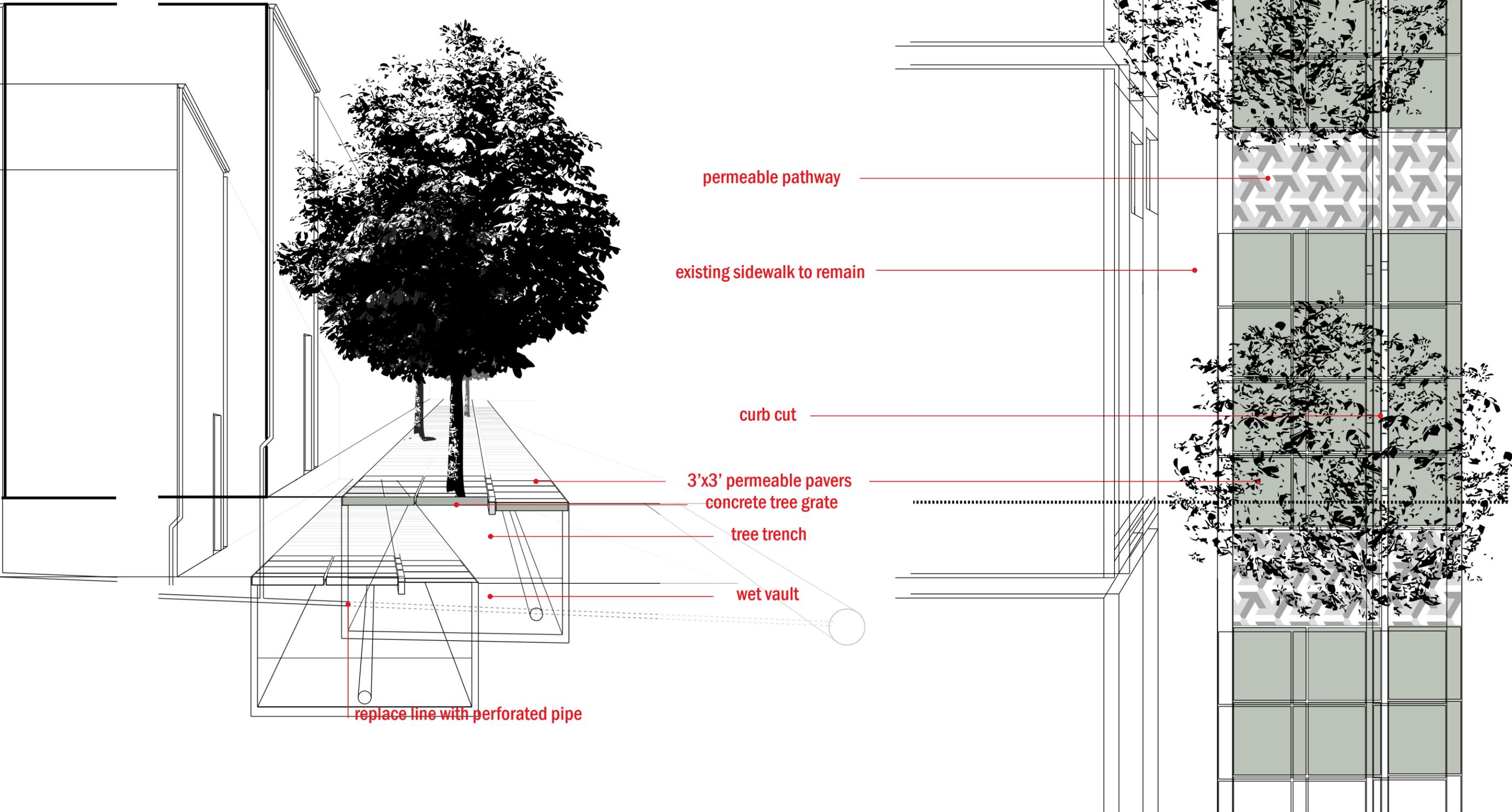
wet vault

cap line to sewer line



public | medium

Pavers can be removed and replaced with concrete tree grates for an upgrade to the basic infrastructure that requires little additional maintenance. In a public frontage condition, the 9' wide sidewalk is uninterrupted by stoops and other building protrusions. Therefore, pavers from either row in the sidewalk could be removed, resulting in a meandering path of trees alongside the street.



permeable pathway

existing sidewalk to remain

curb cut

3'x3' permeable pavers
concrete tree grate

tree trench

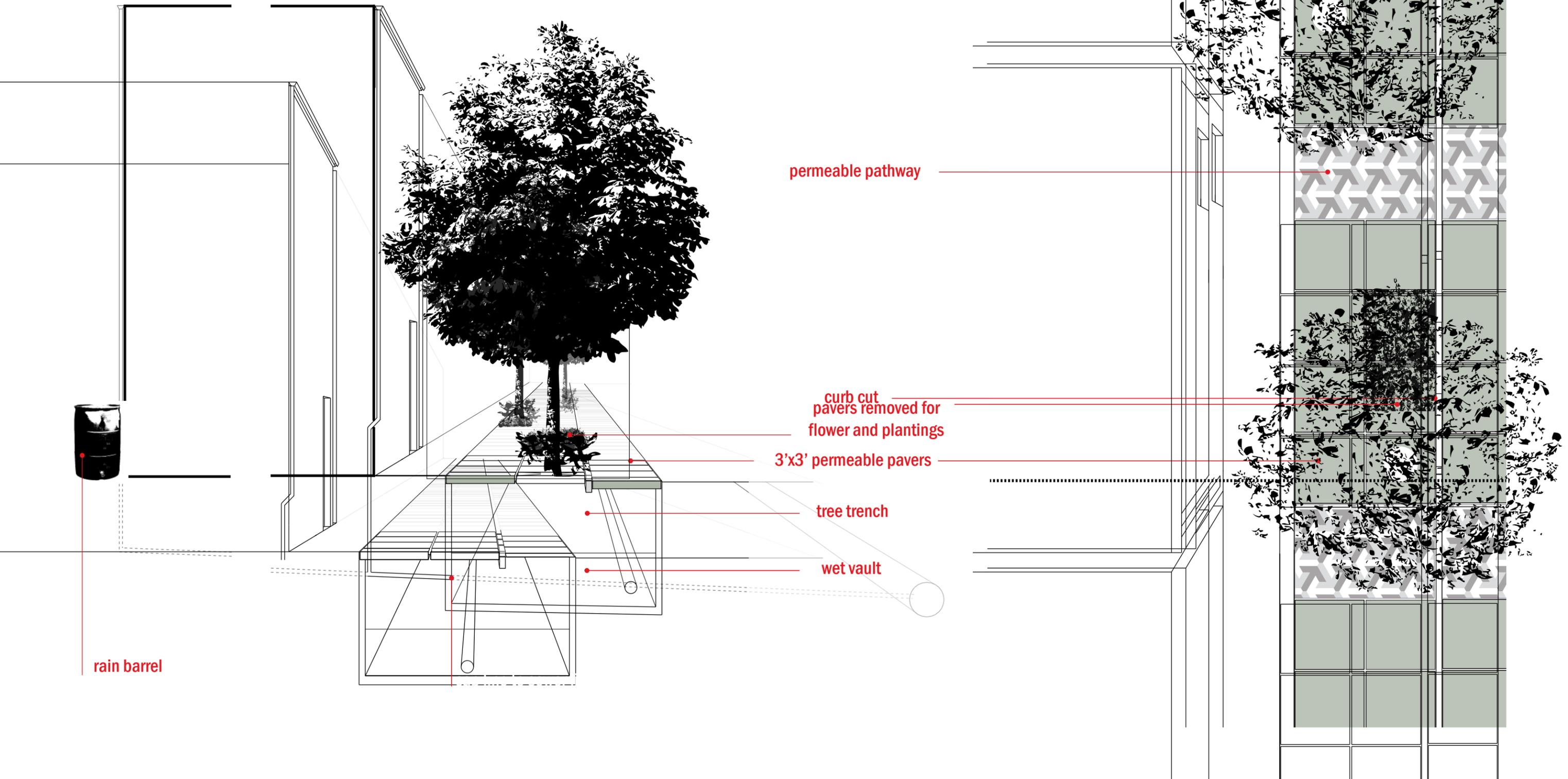
wet vault

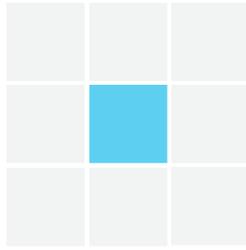
replace line with perforated pipe



public | high

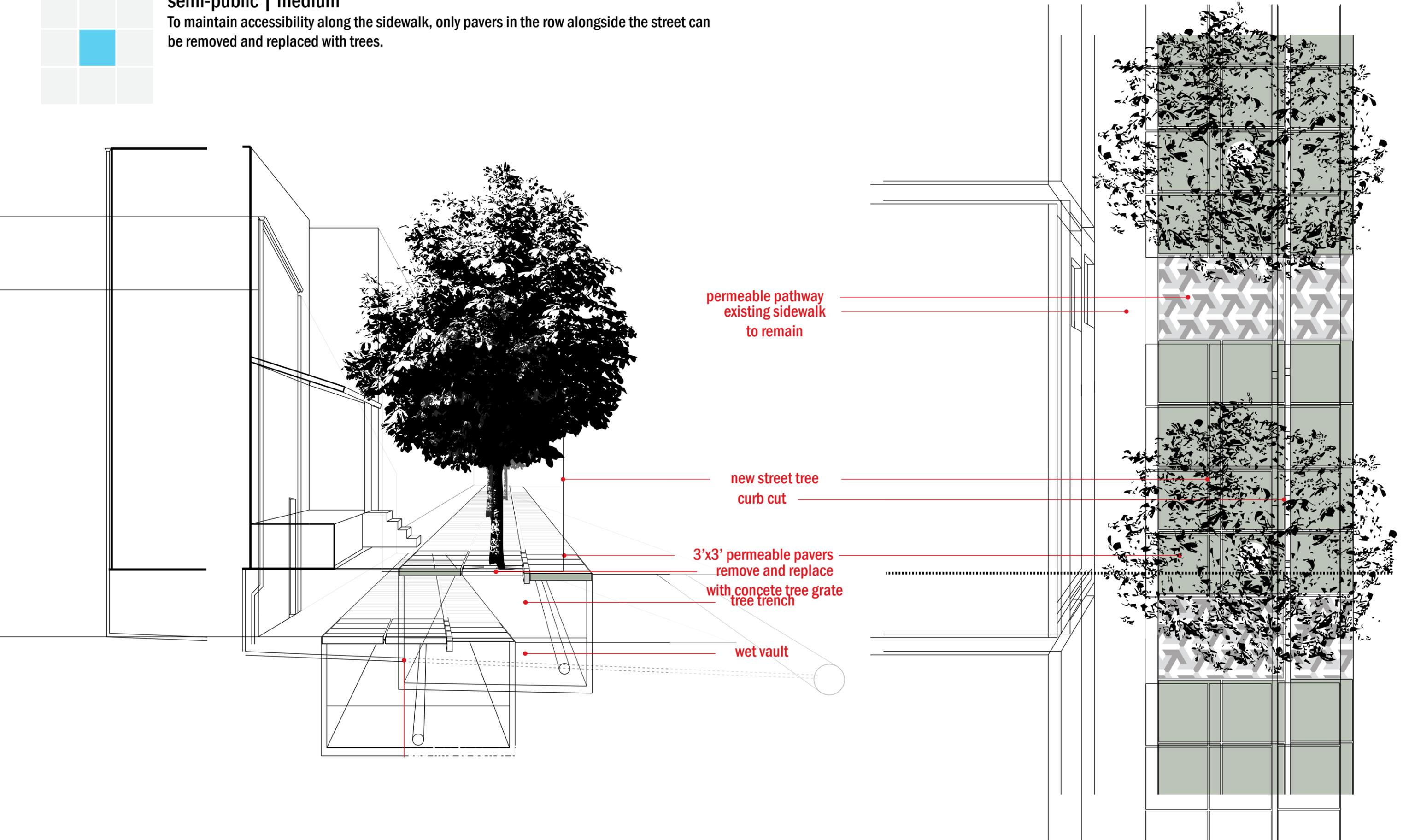
A situation wherein an individual owner or entire block group is capable of and interested in maintaining additional green space, pavers are removed in lieu of plantings and flowers. Beyond the aesthetic improvements the additional green can provide, it will also filter and clean polluted water from the street. Rain barrels, fed from a detached downspout on the front or back of the house, can be provided by the City to enable individuals to take care of the additional green space.





semi-public | medium

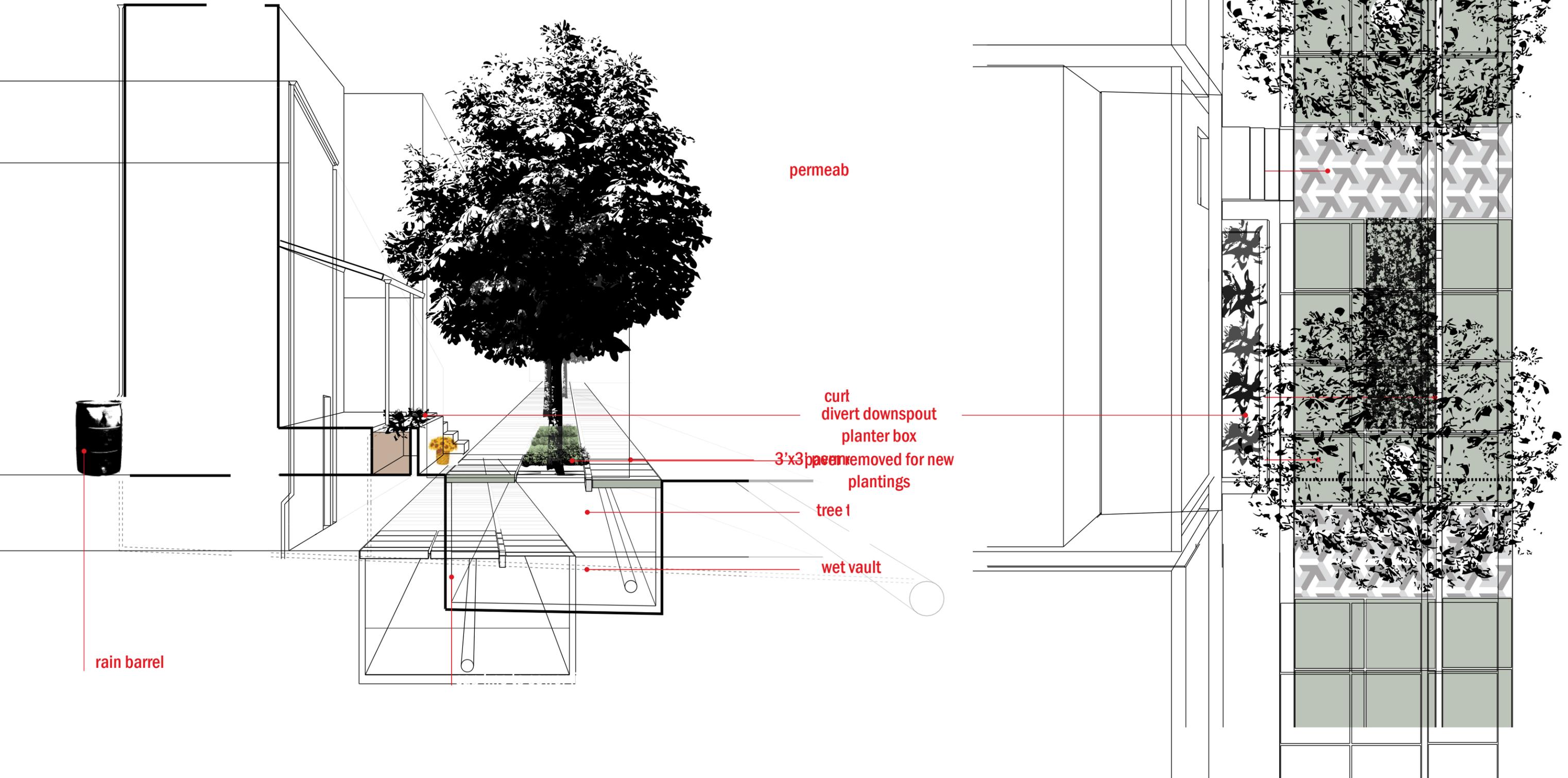
To maintain accessibility along the sidewalk, only pavers in the row alongside the street can be removed and replaced with trees.





semi-public | high

As semi-public conditions contain stoops and front porches, spaces are created between these features that residents are currently appropriating. To expand on this practice, planter boxes can fill these spaces. The front downspout can be detached to supply rooftop rainwater to new plantings. Rain barrels can be provided to residents (shown here on the back of the house), thus enabling them to manage the additional green space without the burden of using additional municipally-supplied water.

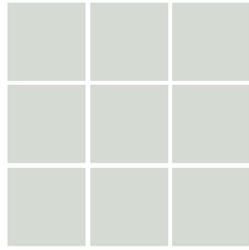




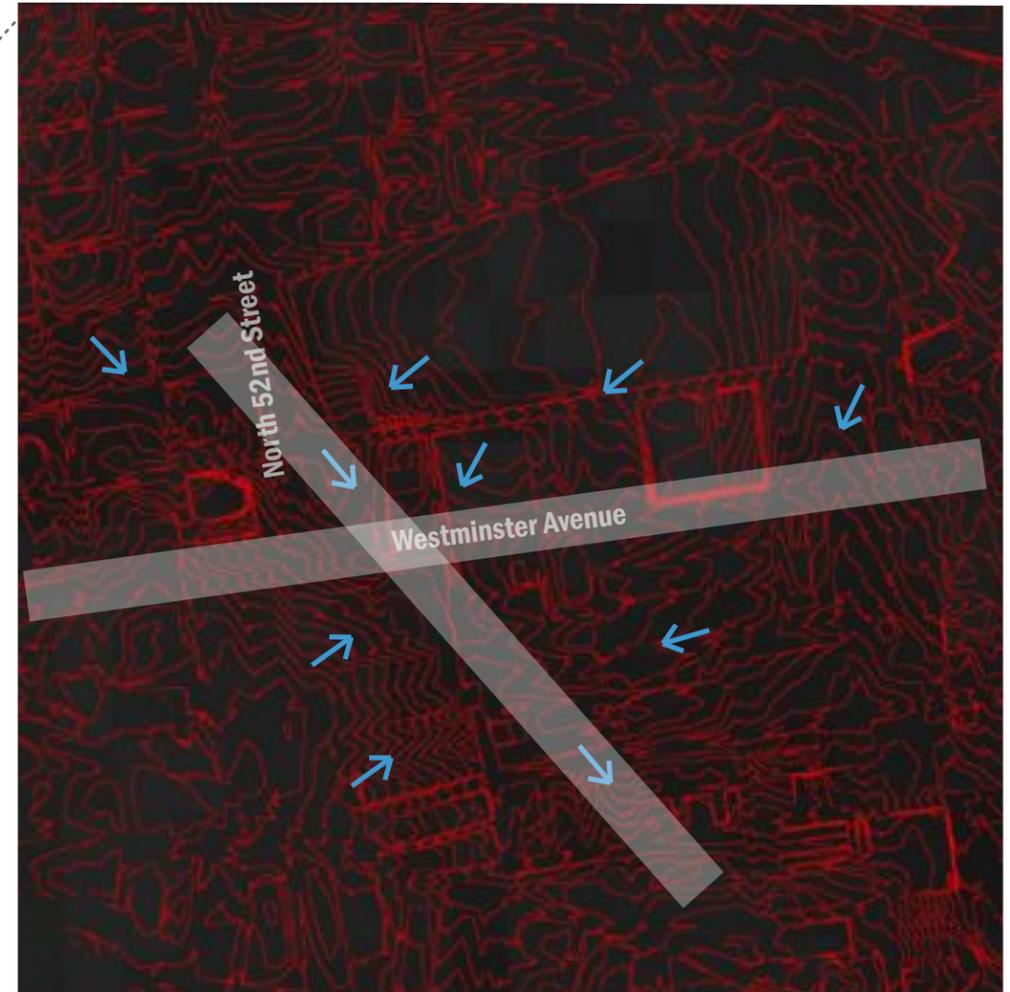
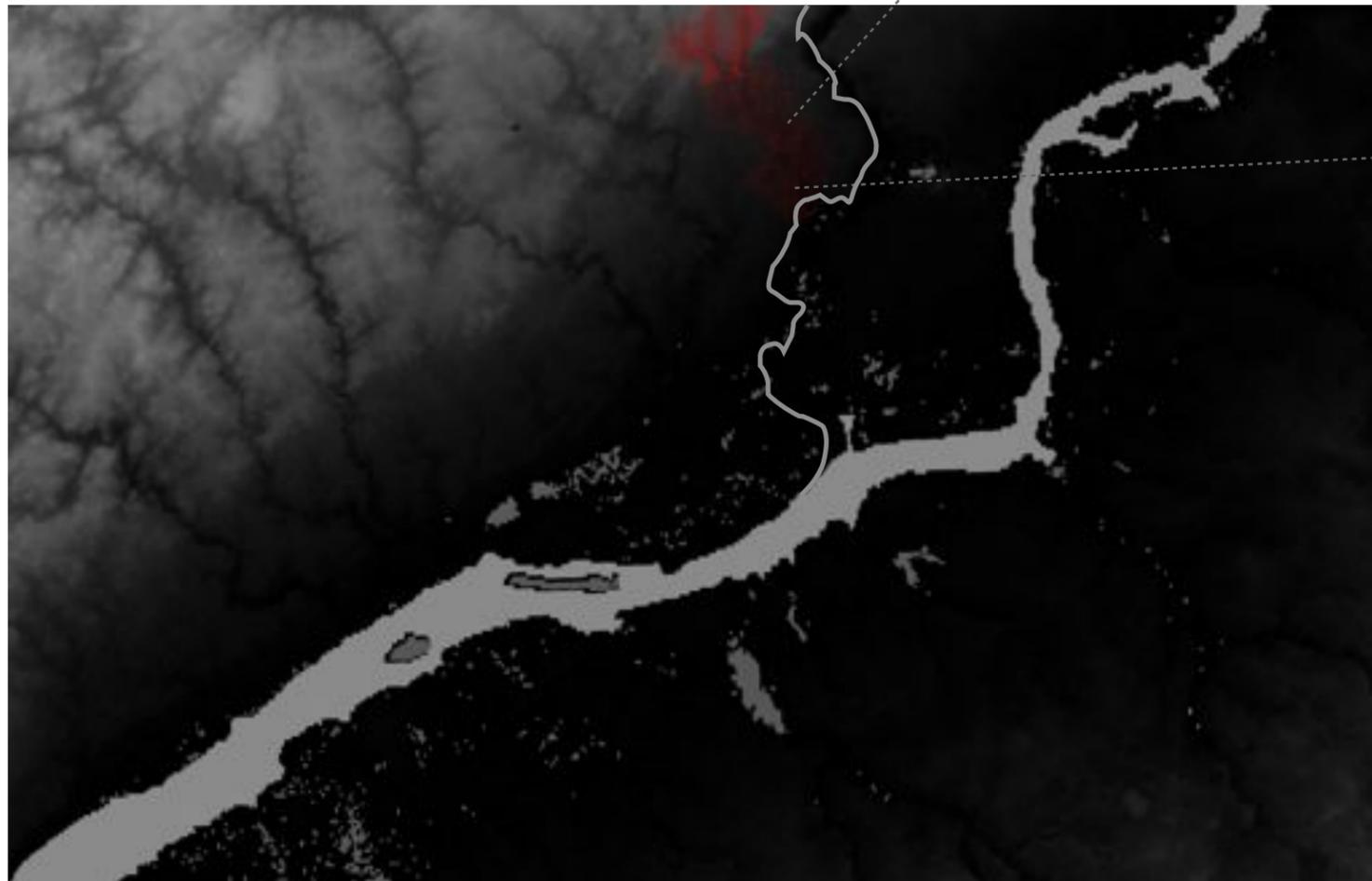
water flow

The continuous tree trench along both sides of Westminster Avenue will bring cleansed rainwater to a diagonal green space that transects the street. Here, it can be detained and used for a number of community activities.

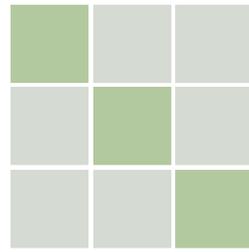




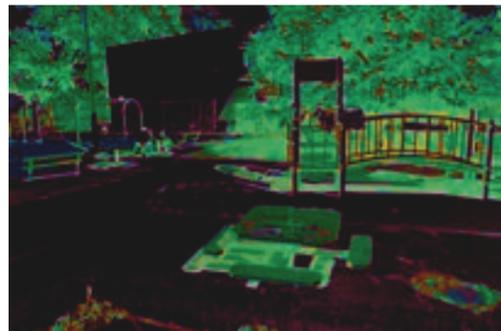
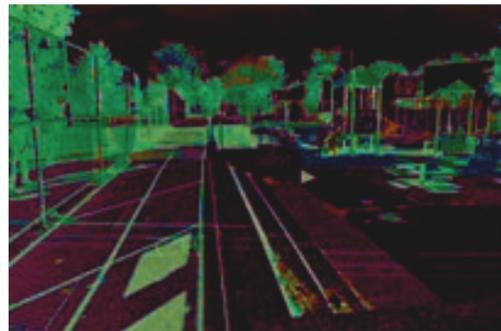
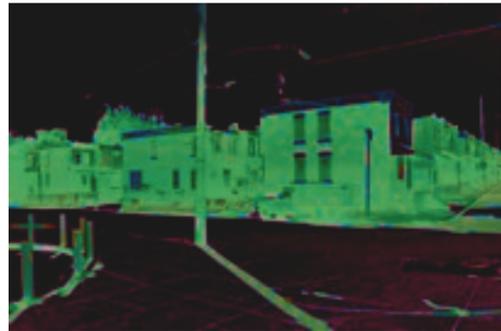
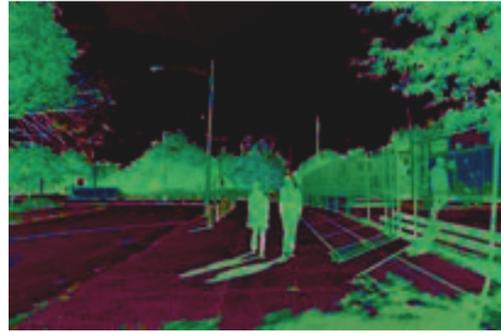
site analysis | topography



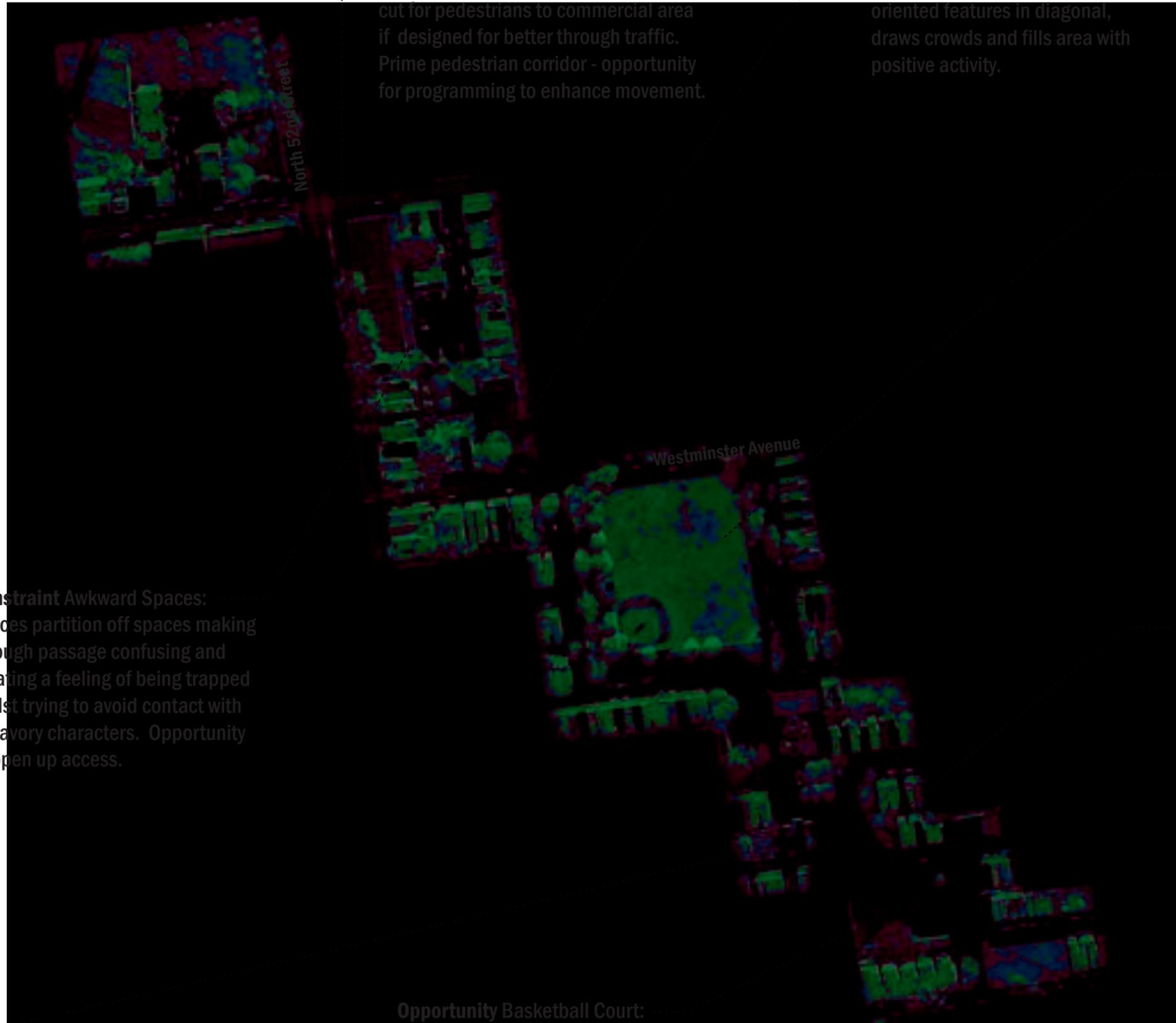
Topography Our site is situated to the west of the Schuylkill River which flows southward to the Delaware River. At the Westminster transect, water flows from the surrounding neighborhood toward the diagonal because of the low-lying land associated with the former Mill Creek.



diagonal | site analysis

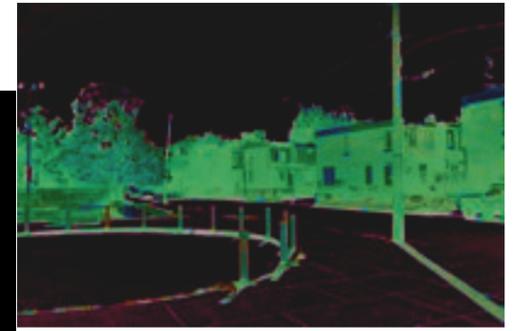


Opportunity Community Center: Possible integration of high school students into adjacent spaces besides building itself.

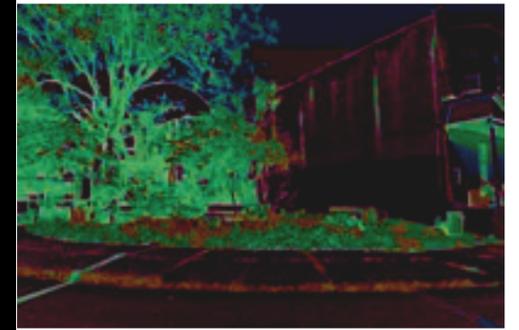


Opportunity Access: Bus stop on 52nd, diagonal is a short-cut for pedestrians to commercial area if designed for better through traffic. Prime pedestrian corridor - opportunity for programming to enhance movement.

Opportunity Basketball Court: Most heavily used and community oriented features in diagonal, draws crowds and fills area with positive activity.



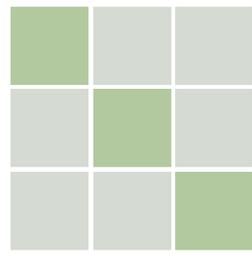
Opportunity Open Space: Large swaths of open space provide more opportunity for reducing impervious surfaces than do structures.



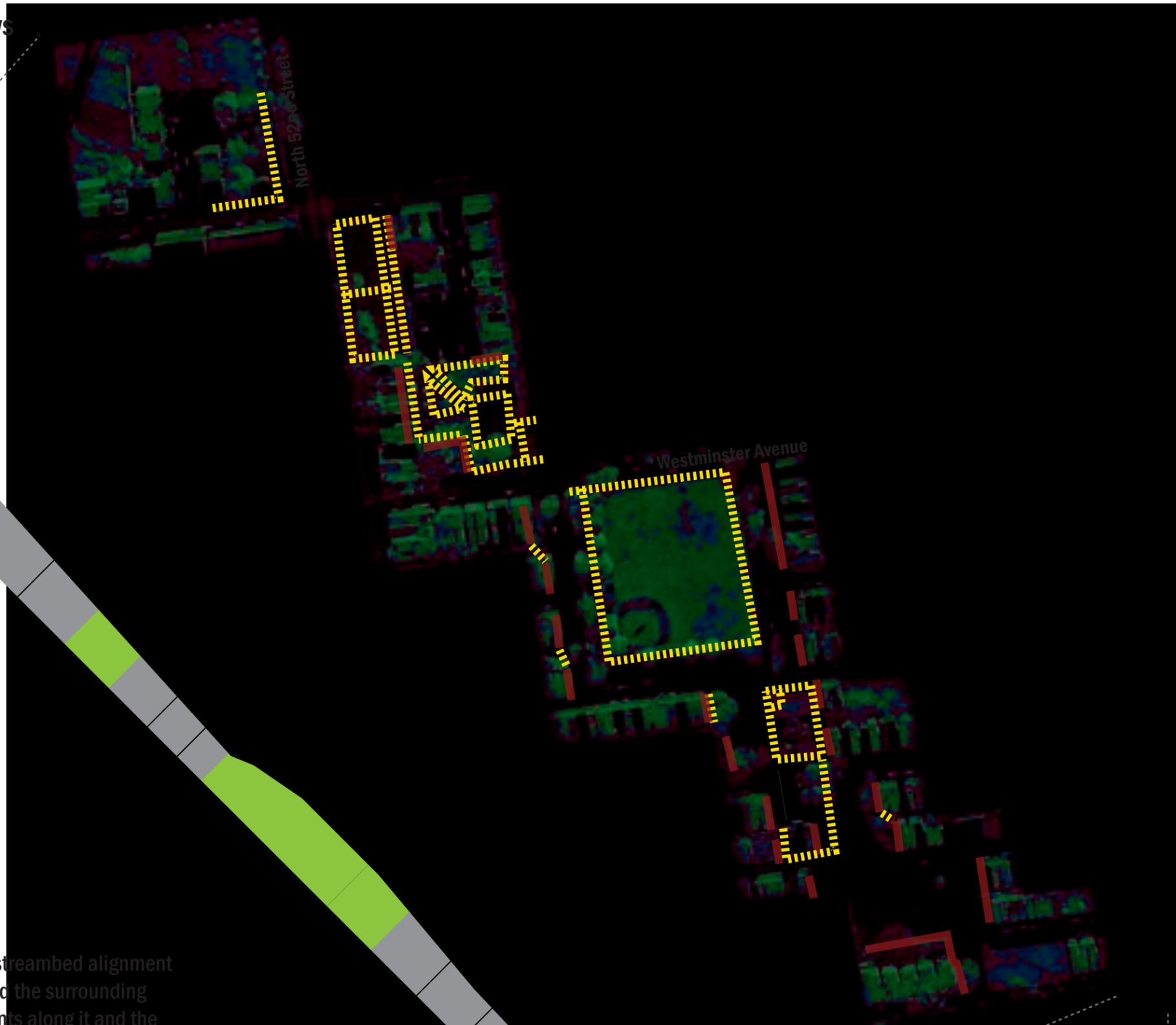
Constraint Lack of Community Surveillance: Open spaces in diagonal are faced by backs of houses, walls, abandoned houses abound nearby - all contribute to a lack of eyes on the space, exacerbating the illicit activity issue. Need to draw community into space to counteract crime with positive activity.



Opportunity Basketball Court: Most heavily used and community oriented features in diagonal, draws crowds and fills area with positive activity.

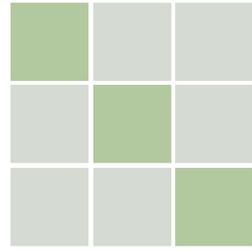


diagonal | site analysis flows



Flows: People and Water The diagonal as the former streambed alignment is the lowest-lying area of the Westminster Transect and the surrounding neighborhood. The diagonal itself has several low points along it and the stream that once flowed southeasterly toward to river leaves its legacy in the topography, as seen here in the section. As a natural corridor, the diagonal lends itself to movement, both of water because of the natural topography as well as people because of the lack of structures throughout. It currently has obstructions in the form of walls and fences but these can be rearranged to allow for better flows of pedestrians.

-  Pervious Surface
 -  Impervious Surface
 -  Chain Link Fence
 -  'Lack of Surveillance' Wall
- people | water



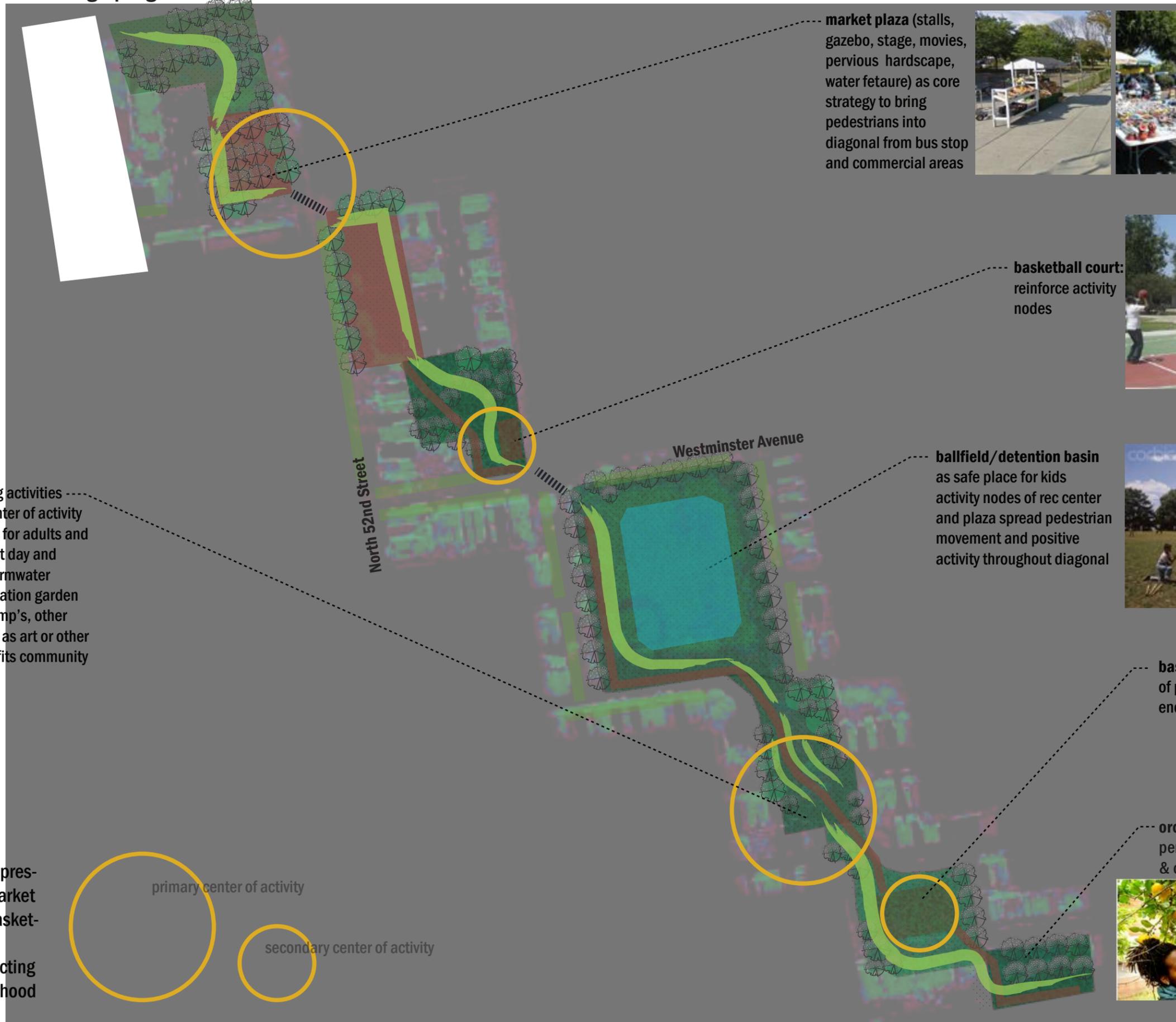
diagonal | schematic design program



rec center: existing activities remain, new epicenter of activity involving programs for adults and children throughout day and evening, hub of stormwater learning, demonstration garden for do-it-yourself bmp's, other programming such as art or other interest groups as fits community

strategy | program

series of activity nodes strengthen human presence throughout diagonal, anchored by market plaza and rec center, with sub nodes of basketball courts and other activity draws clearly delineated path throughout, connecting bus stop on 52nd with interior of neighborhood



market plaza (stalls, gazebo, stage, movies, pervious hardscape, water feature) as core strategy to bring pedestrians into diagonal from bus stop and commercial areas



basketball court: reinforce activity nodes



ballfield/detention basin as safe place for kids activity nodes of rec center and plaza spread pedestrian movement and positive activity throughout diagonal



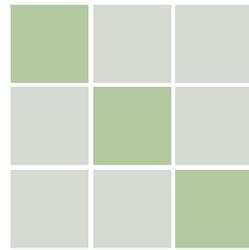
basketball court: node of positive activity, encourage more

orchard: tree trench along perimeter to capture street & orchard runoff

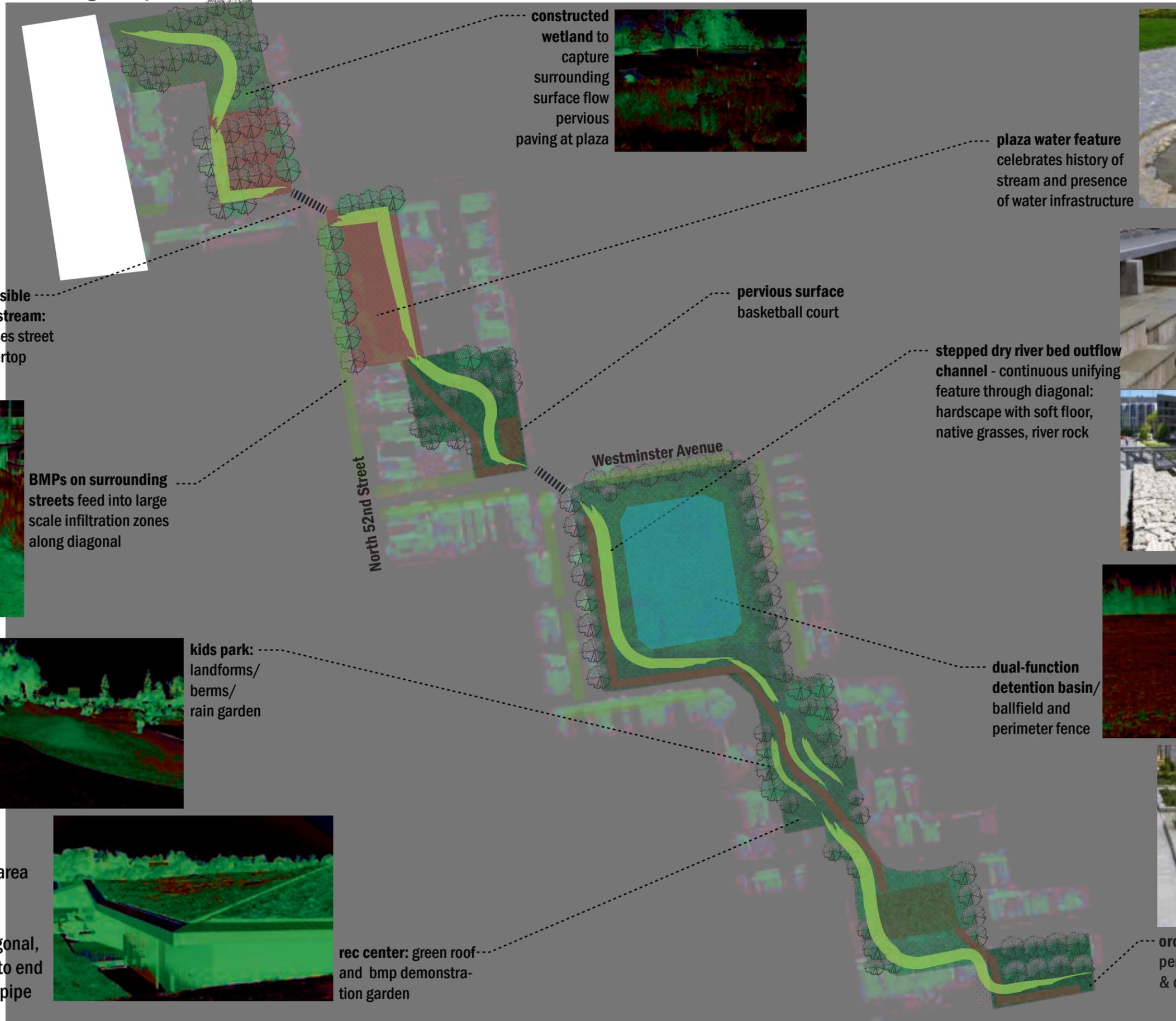


primary center of activity

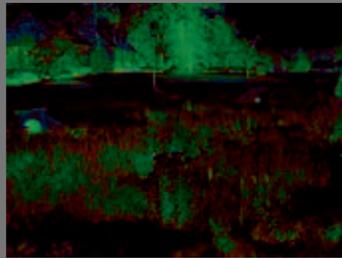
secondary center of activity



diagonal | schematic design bmp's



constructed wetland to capture surrounding surface flow pervious paving at plaza



plaza water feature celebrates history of stream and presence of water infrastructure



continuous visible reference to stream: channel crosses street with grate overtop



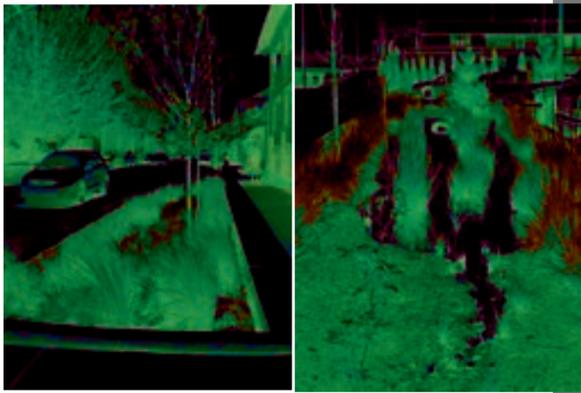
pervious surface basketball court



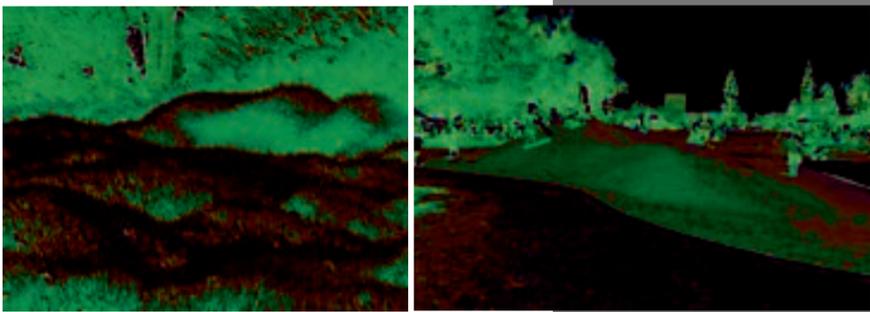
stepped dry river bed outflow channel - continuous unifying feature through diagonal: hardscape with soft floor, native grasses, river rock



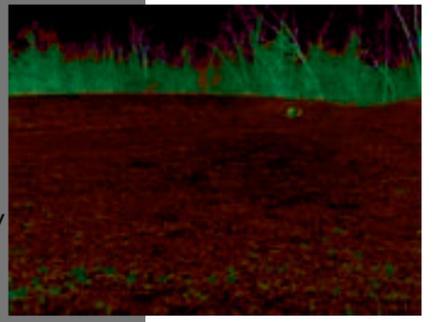
BMPs on surrounding streets feed into large scale infiltration zones along diagonal



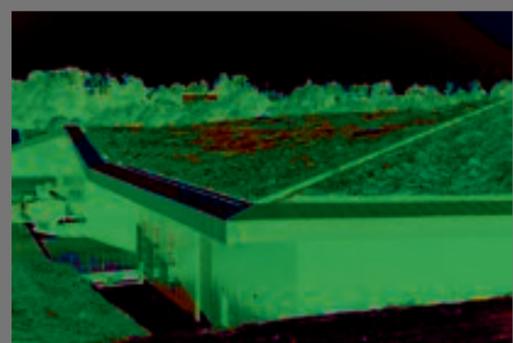
kids park: landforms/berms/rain garden



dual-function detention basin/ ballfield and perimeter fence



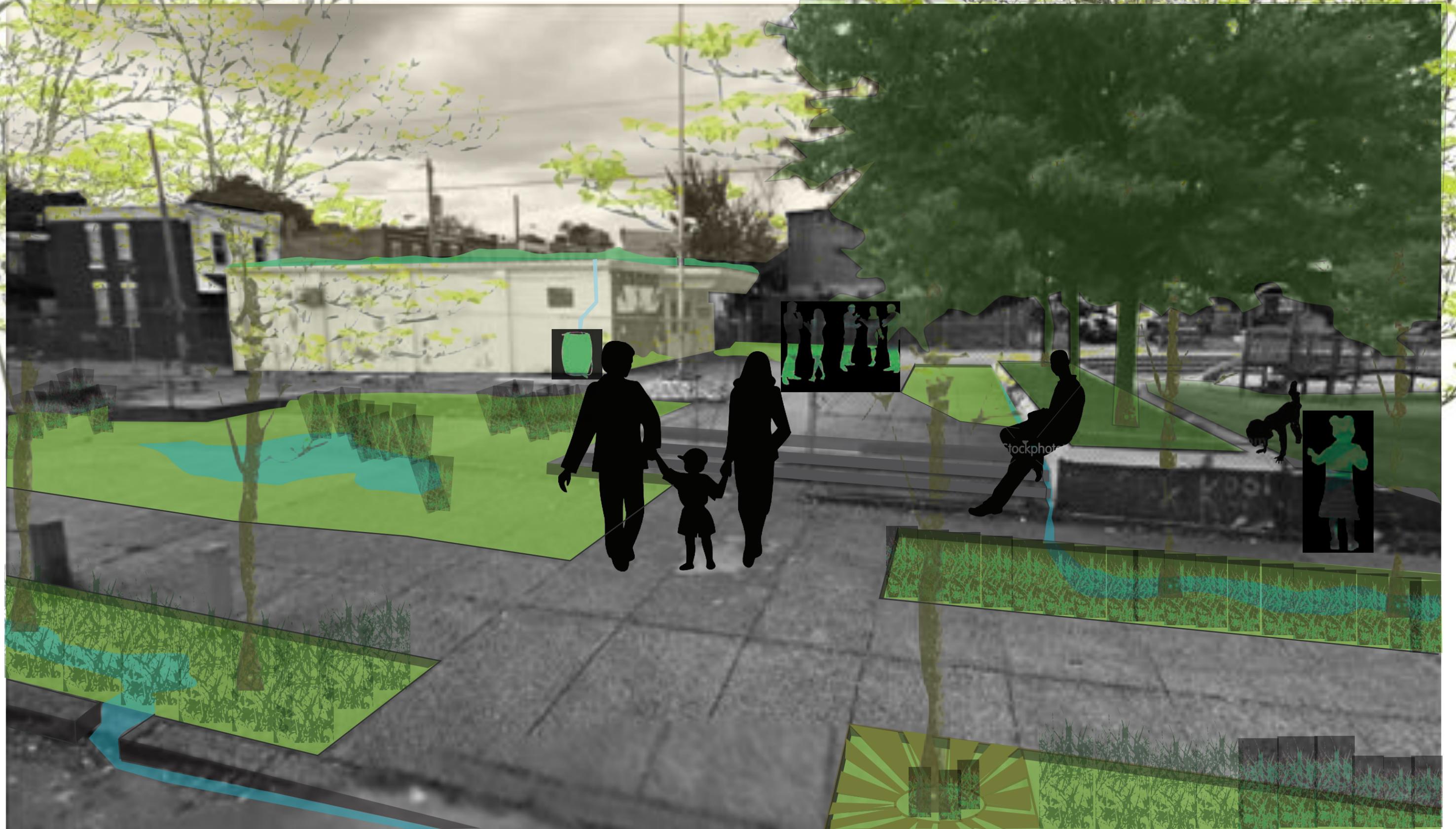
strategy | bmp's
as low point, diagonal acts as catchment area for all surrounding green infrastructure
detention basin is main storage area and stepped channel runs entire length of diagonal, unifying urbanistically and carrying water to end where open water flows into underground pipe



rec center: green roof and bmp demonstration garden

orchard: tree trench along perimeter to capture street & orchard runoff





Rec Center as neighborhood programmed space: resource center to learn about do-it-yourself bmps, programs throughout evening for all ages when not in use by youth programs, kids art gallery or other interest group programs as deemed appropriate, both inside and outside

BMP components: Rain garden, Tree trench with grate or plants, Modular pervious pavers, Planter box, Pervious surfaces, Streambed channel, Green roof on rec center OR disconnected downspout and rain barrel

Rec Center bmp Demonstration Garden



flexible space at times filled with market stalls, pavillion for outdoor films, social gatherings
modular pavers and tree trench along sidewalk to capture plaza and road runoff
pervious paving throughout plaza

Plaza at 52nd & Westminster