

## Summary

The Mural Arts Program is looking to expand its offerings for youth after-school arts programming. In this report, we will present our findings after analyzing the city of Philadelphia in search for the most strategic locations for new programs.

We've determined areas throughout Philadelphia that are the most suitable places for the Mural Arts Program to establish new afterschool programs. Using ArcGIS, a geospatial analysis program, we made maps that include important criteria in locating new programs. These show us which places are the most suitable for new programs based on all of the factors we've considered.

In this report, we will introduce you to the project and the questions we were trying to answer. We will describe our criteria and how we operationalized different factors using data and maps. Then we will outline our methods, including raster analysis and creating a model. Finally, we will present the results of our analysis and offer some conclusions.

## Introduction

*Our question:* Which areas in Philadelphia are most suitable for potential new sites for Mural Arts Program (MAP) after school programming?

We decided that suitability, for this project, needed to encompass multiple ways of thinking about geographic space. The most suitable sites would be accessible and near community resources; and they would also meet the priorities of MAP funders, reach particular demographic groups (minority populations and lower-income neighborhoods) and take into account crime statistics. It was also important to consider where current sites were located, as well as competing after school programs. Together, all of these factors would influence suitability, but not equally. Our analysis needed to allow for flexibility and for some factors to have a greater impact on suitability than others.

We framed our understanding of suitability this way so that we could take each category or factor and operationalize it with statistical data and spatial information. We worked together with representatives from the Mural Arts Program to generate a list of specific factors that would ultimately influence suitability of a given area. We developed criteria that both had meaning for MAP's work and had explanatory power for the analysis we were going to conduct.

For each criterion, we created an individual map layer that displayed the particular factor across every location in Philadelphia. Some factors were based on proximity to a particular location or resource (libraries, transit stops, etc) while others were based on density (of student residences or crime incidents). When we put the layers together, we adjusted the analysis so that some factors would have a greater impact on the final suitability than others. We built a model so that these criteria can be adjusted based on their importance to Mural Arts.

We know that identifying individual areas/neighborhoods that are ideal for neighborhood placements will have limited utility because MAP programs require a partnership with available sites, and we cannot control where those partnerships are possible. We hope that this analysis will show Philadelphia as a

spectrum of suitability with areas that have a range of different qualities to offer the MAP, knowing that the MAP has much to offer individual neighborhoods. How can the MAP maximize its impact? Are there areas that are saturated with MAP programs or areas that demonstrate the greatest need for more programs, given our criteria? Knowing which areas are most suitable, how can the MAP build new partnerships that will be mutually beneficial?

We know that there are more questions to ask, especially since Philadelphia neighborhoods change faster than we can measure them. Nonetheless, we hope the results of this analysis will help the MAP move forward strategically as it continues to beautify the city and impact the lives of youth.

### **Data**

We prepared about 20 layers, each of which would contribute to the final suitability analysis. Each layer allowed us to map information about a particular quality that helps determine suitable neighborhoods for after school programs. In this section, we will describe how we gathered the data for each layer.

*The schools layer* uses network location analysis. The data includes, “public schools, charter schools, many private schools, school annexes, and athletic fields and facilities.”<sup>1</sup> For every location in the city of Philadelphia, we know if it is within .25, .5, .75, 1.0, 1.25 miles of a school on a path that follows real streets. If a location is more than 1.25 miles away from a school, we consider it to be unsuitable. We use the .25 mile measurement because it is a reasonable walking distance for students.

*Existing site* layers also use network distance analysis. The data comes directly from the Mural Arts Program. In determining suitability, being close to existing sites may be the priority if Mural Arts wants to have clusters of after school programs. It may be a detracting factor if Mural Arts wants to spread its impact in different parts of the city. We’ve prepared layers for both scenario that show if a site is “near” or “far” from existing sites.

*Census demographics* represent the 2010 population demographics of every census tract in Philadelphia. We prepared maps depicting total non-white population density in each tract, African American population density, Asian population density, Hispanic population density, and density of households below the poverty line. We expect that Mural Arts wants to reach non-white participants that are living below the poverty line. We therefore define areas with high non-white or poor populations as being more suitable.

*Crime density* (high and low) shows the density of Part 1 crimes in 2012. Part 1 crimes include aggravated assaults, homicides, rapes, robberies, and thefts.

*Student data* shows a location analysis of Mural Art’s current students. We created 1/4 mile buffers around each of the student’s home addresses and created a point density layer. Depending on whether or not Mural Arts is hoping to reach new students/neighborhoods or further assist students they already reach, suitability will be defined differently. Two layers were created, one depicting higher suitability near current students and one depicting higher suitability further from current students.

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<sup>1</sup> <http://www.opendataphilly.org/opendata/resource/38/schools/>

*Parks, playgrounds, and recreation centers* are point locations taken from OpenDataPhilly.org. Each location is treated equally in our analysis and thus are all shown as a single layer. The distance to the nearest park, playground, or recreation center from each cell within Philadelphia was calculated and a layer was created that defines areas closer to these features as more suitable.

The *transit layer* determines suitability based on location analysis, similar to the schools layer above. The data includes regional rail stops, subway stops and trolley stops all taken from OpenDataPhilly.org. Network distance service areas from 0.25 to 1.25 miles were created, with areas closer to transit stops defined as more suitable.

*After school programs* are taken from After School Activities Partnership (ASAP)'s After School Activities Directory. Based on ASAP's description, after school programs that are focused primarily in the arts were determined to be "arts-based after school programs." Further, programs recognized by Mural Arts as similar or to their own were added to this list. Two separate layers were created, one showing the density of all after school programs and one for the density of arts after school programs. The model can be used to define areas of high or low density of after school programs as more suitable.

*High crime zip codes* were taken from a list of zip codes provided by Noni Clemens of Mural Arts. These are represented in our maps as zip codes either as high crime or not, where high crime zip codes represent the suitability. Zip codes that are not high crime represent unsuitability.

*High priority DHS areas* are zip codes recognized by the Philadelphia Department of Human Services as high priority zip codes. The zip codes are separated into three categories, rated by importance. The highest priority zip codes are marked as most suitable, with the non-priority zip codes marked as least suitable.

*Libraries* are point locations come from OpenDataPhilly.org. Network distance service areas from 0.25 through 1.25 miles were created, with areas closer to libraries defined as more suitable.

## **Methods**

A list of criteria for suitable sites was generated, based on community characteristics, safety, accessibility and demography. Parks, libraries and afterschool programs represented community characteristics, while the number of transit stops represented the level of accessibility. Each criterion's attribute became the set of neighborhood characteristics used to determine suitability for potential afterschool sites.

We created several map layers of Philadelphia that consisted of half block areas, which were represented by cells on each grid. And then plotted the locations of the neighborhood characteristics on separate layers.

Using one of two approaches, we looked for spatial patterns for each neighborhood characteristic. The information was displayed based either on how much of the characteristic was represented within a specified boundary zone, or the magnitude of the characteristic that was present in any Philadelphia area. Based on the degree to which a characteristic was represented within a Philadelphia half block, we gave the area a suitability score ranging from 0-100, with 100 being the most suitable to place an afterschool.

Afterwards, we gave each layer a weighted score based on the level of importance of each criterion in selecting suitable sites.

Finally we combined each layer into one, displaying a range of areas in Philadelphia that were most suitable to areas that were least suitable.

### *Model*

A model was built that incorporates each of the listed layers in a weighted average. When the model is run each layer can be given a priority weighting to indicate how important the specified factor is to making a site suitable. The model then runs and creates a map that assigns each cell in Philadelphia a value between 0 and 100 with higher numbers indicating locations of higher suitability.

### **Results**

We compiled all of the above criteria and methods to determine the final suitable areas for a new MAP site location. Noni Clemens of Mural Arts provided us with information on which data was more or less important in determining a new Mural Arts site. The following list shows the weighting assigned to each layer by Mural Arts on a scale from 1 to 10:

Near parks/playgrounds/recreation centers: 4

Near libraries: 5

Near schools: 6

High crime density: 6

High poverty density: 6

Far from existing Mural Arts sites: 7

Far from after-school programs: 7

High student density: 8

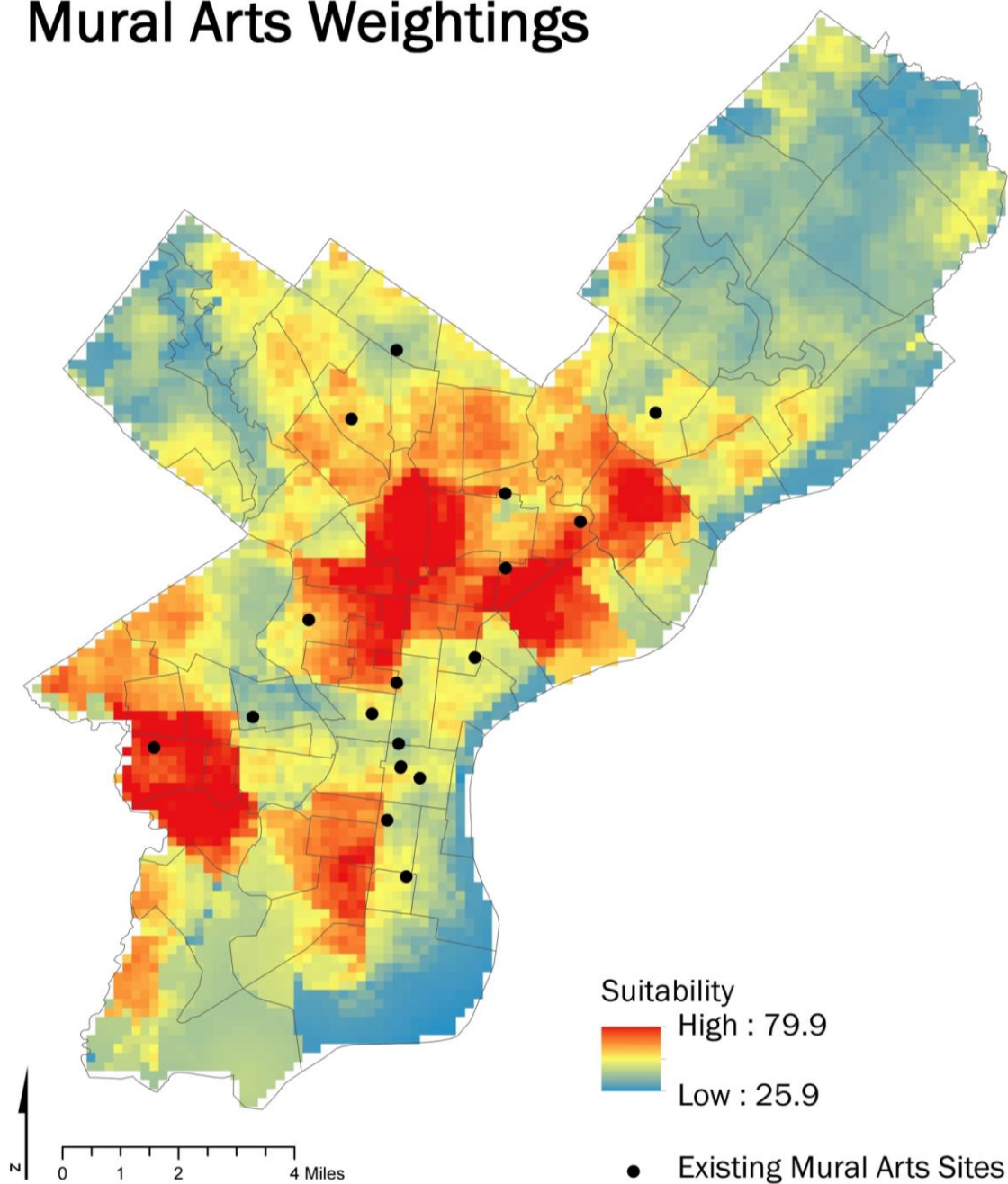
Within high crime police districts: 8

Near transit stations: 9

Within DHS priority zip codes: 9

The corresponding layers were weighted with this information and put together in a final map showing suitable areas.

# Mural Arts Weightings



Then, to explore how the different layers affect the final city-wide suitability, we prepared a few other maps that show different weightings of the various layers.

To demonstrate a thematic consideration, we prepared this map which shows areas it would be good to place sites in if the primary concern were being in areas of high crime. The following weightings were assigned:

Within DHS priority zip codes: 9

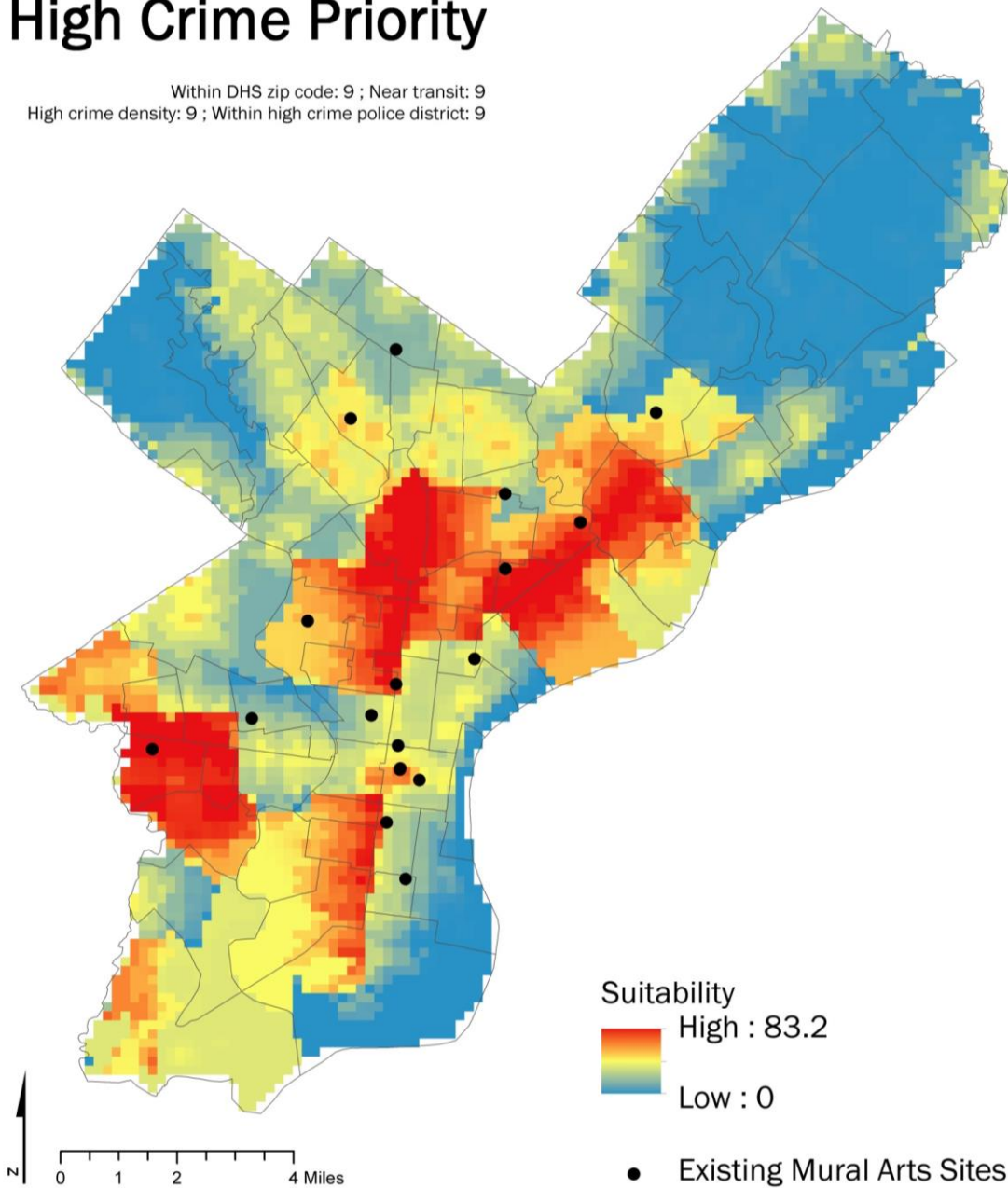
Near transit stations: 9

Within high crime police districts: 9

High crime density: 9

## High Crime Priority

Within DHS zip code: 9 ; Near transit: 9  
High crime density: 9 ; Within high crime police district: 9



Next, we were considering whether Mural Arts would be interested in placing sites in areas where there is a high concentration of students that currently attend Mural Arts programs, or whether they would prefer to reach areas of the city that do not currently have many students attending programs. We prepared two maps with identical weightings except that the first ranks being in an area with a high density of current students highly, while the second ranks being in an area with a low density of current students highly.

For the first the following weightings were applied:

High student density: 9

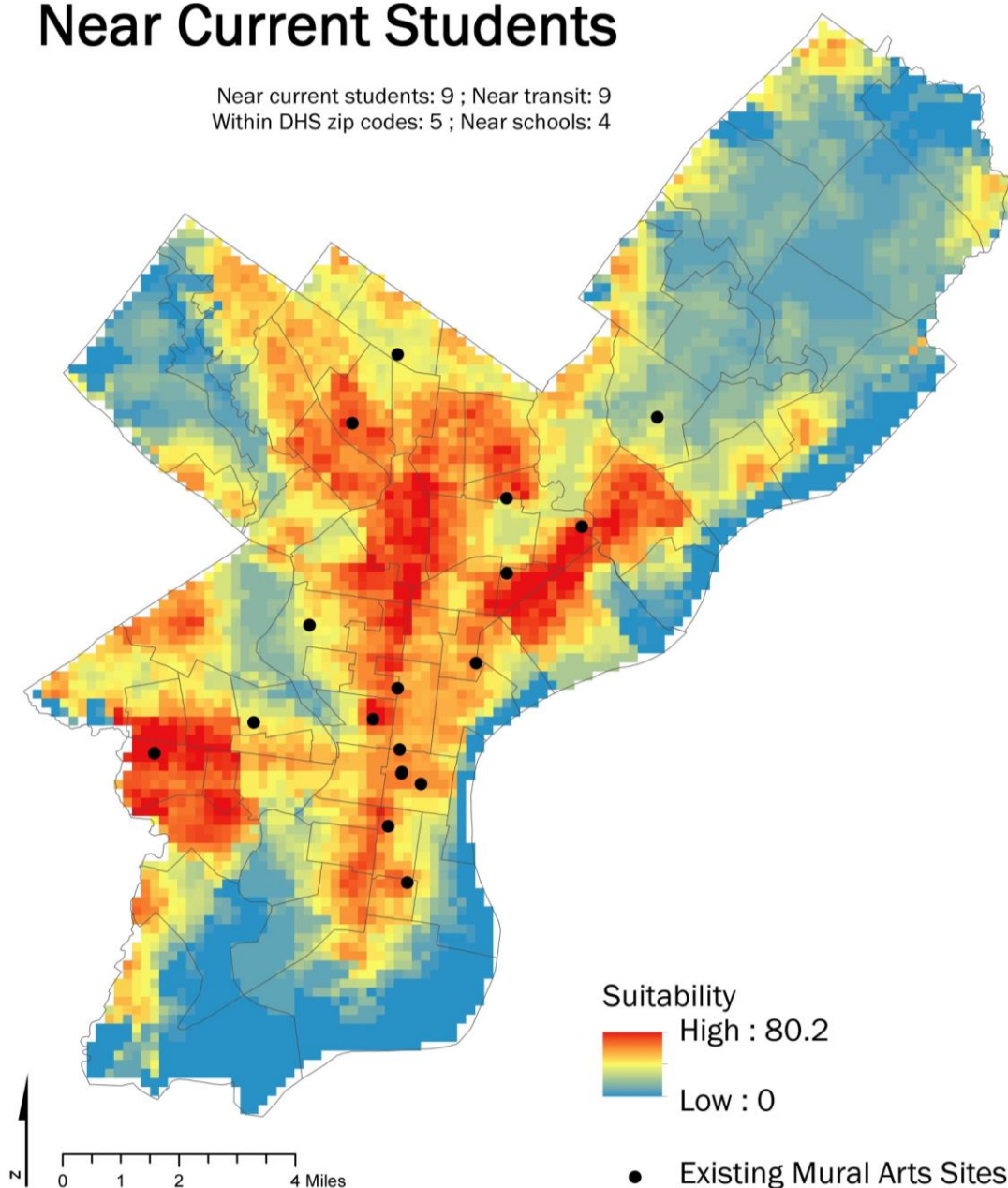
Within DHS high priority zip codes: 5

Near transit stops: 9

Near schools: 4

## Near Current Students

Near current students: 9 ; Near transit: 9  
Within DHS zip codes: 5 ; Near schools: 4





For the second the following weightings were applied:

Low student density: 9

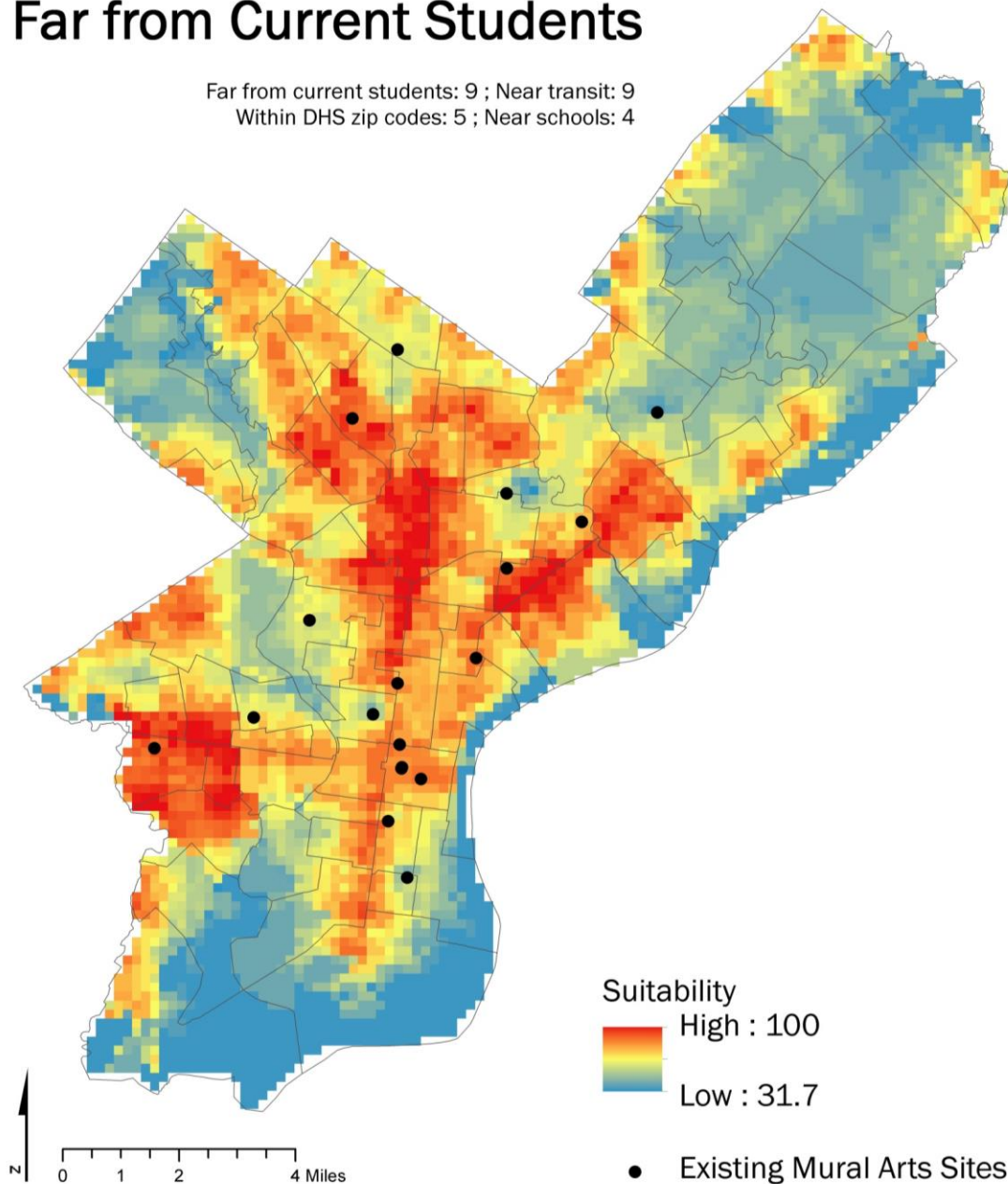
Within DHS high priority zip codes: 5

Near transit stops: 9

Near schools: 4

## Far from Current Students

Far from current students: 9 ; Near transit: 9  
Within DHS zip codes: 5 ; Near schools: 4



It appears that the most suitable regions of each are very similar. This can be attributed to the high weighting of being near transit, so even when looking for areas with a low density of current students, those that do not live near transit are not highlighted. We thus prepared another map that is the same as the previous one except that it removes the transit priority.



The following weightings were applied:

Low student density: 9

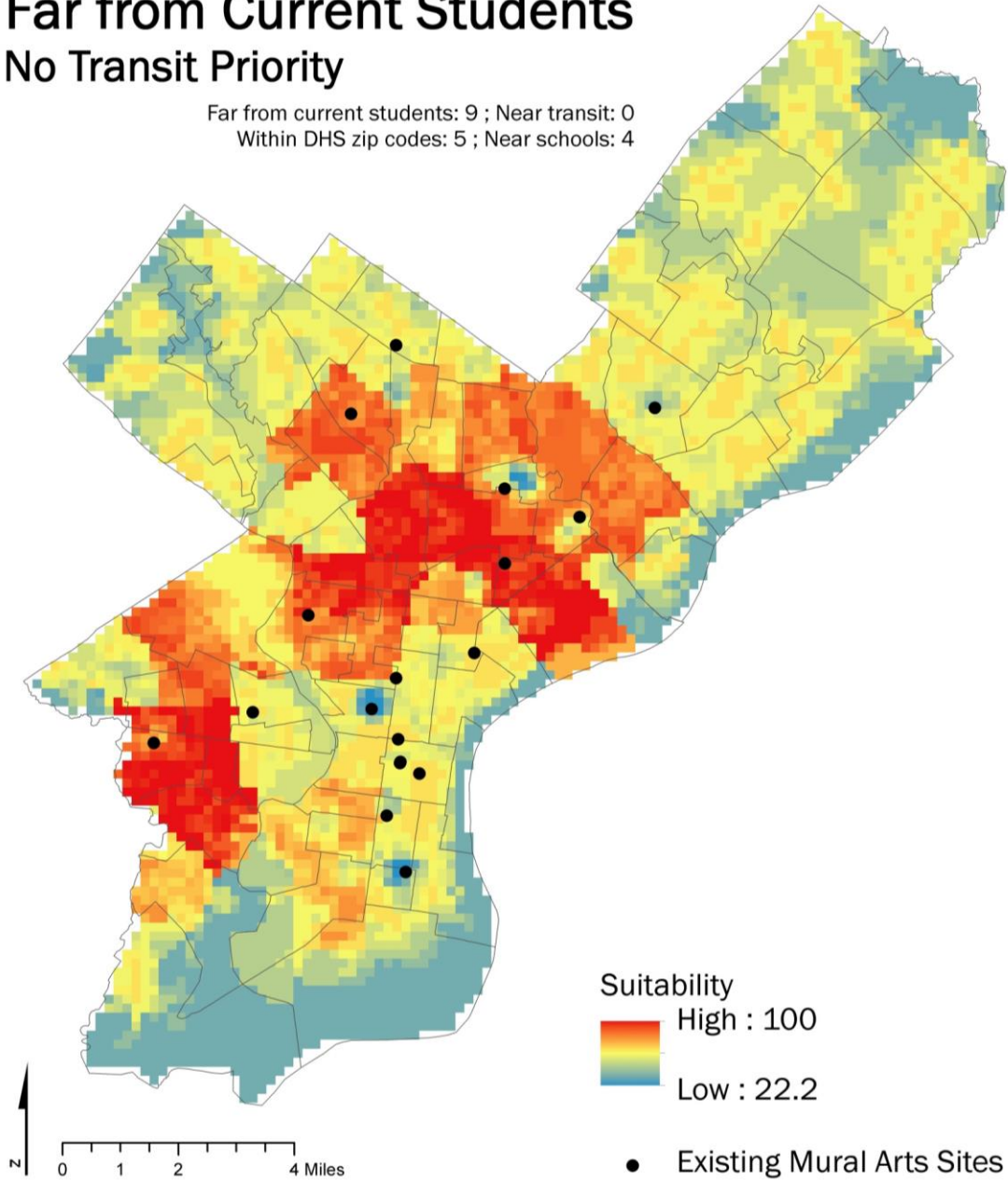
Near transit stops: 0

Within DHS high priority zip codes: 5

Near schools: 4

## Far from Current Students No Transit Priority

Far from current students: 9 ; Near transit: 0  
Within DHS zip codes: 5 ; Near schools: 4



## Conclusion

In conclusion, based on Mural Arts' initial criteria we developed a final map showing the parts of Philadelphia that are the most suitable for future programs.

The alternative maps that we show in the results section convey the idea that the selection of future programs could change if the weights assigned to the criteria change. The three alternative criteria weights that we give privilege to are: proximity to students, distance from students, and distance from high speed transportation.

The alternative maps that we generate show that even if MAP changes the weights assigned to the criteria, there are certain parts of Philadelphia that are more likely to be suitable for future programs than others. These are areas that fit a majority of the criteria to a high degree.

There are a few shortcomings that we have determined. The shortcomings will focus on the operationalization of the model. It is difficult to simulate a real life condition in any model while allowing the model to be applicable to similar real life conditions. As a result, we had to make decisions about how to operationalize our conceptualization of the criteria.

The operationalization for us had an intermediary layer in between the model and real life events. The intermediary layer is the actual data that is available on the real life conditions. Two examples of this are the high funding concept and the community resource concept. The data used to represent high funding are the DHS zipcodes. However, the DHS zipcodes are not necessarily the only areas that might receive high funding. To account for this shortcoming it might behoove us to include donors and event attendees as an alternative or additional proxy for high funding. The data used to represent resources were parks, playgrounds, and recreational centers. There are other data that can be used in lieu or in addition to the resource data that we selected. The "resources" that we selected vary in size and capacity and this is difficult to capture so we approximated. As a result there was an additional compounding source of error: from the tradeoff of selecting parks, libraries and recreational centers to operationalize resources over other alternatives; and the error derived from approximating the resources so that they were standardized among each other.

There are a few directions that future research can take. With more information the power of our tool can be more effective. The type of information that would be useful for future analysis include paired data on the school and program attended by each MAP student. This data would help us to capture transportation and accessibility more exactly. Recall that we only currently have paired data on the home address of each MAP student. It is possible and perhaps more likely that MAP students travel from the location of their school to the MAP location before returning home.

Another change that can produce a more exact tool is the ability to analyze whether research questions and factors significantly differ based on the age of the MAP student. As a result, it could be useful to disaggregate the data and strategy it based on student age groups and compare the suitability results.

We have sincerely enjoyed working with Mural Arts and appreciated the feedback given during our presentation on April 19, 2013. We hope our results can be helpful in your site selection process.