Suitable Sites Analysis for Private Schools in Toronto

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Introduction

The greater part of the GTA offers a diverse range of private schooling spanning downtown Toronto, North York, Scarborough, Vaughan, Mississauga, Etobicoke, Markham, Thornhill, and Richmond Hill. These schools vary and include boarding, Montessori, special needs, gifted, Christian, Catholic, language immersion, IB, AP, preschool and daycare. In fact, in most developed countries, education is largely publicly provided, however, there have been cases that show that along with low funding, inefficiencies, and poor structure public schooling has been failing both on paper and in practice. There was a study done in Indonesia comparing the effectiveness of private versus public schools, and it found that “contrary to conventional wisdom, selection-corrected earnings revealed that private non-religious schools are more effective”[1]. In the same study, the suggested reason why the difference in outcome was between public and private was given to be that private schools perform better due to a “greater school-level autonomy” as well as their ability to meet the needs of both its students and parents. Funny enough, countless other articles suggest that although the private system is better, the reason for its efficiency isn't the monetary input but rather the superior management and organizational practice of the given school will trump the rest in success. For these reasons, we dived into the private schooling system in Toronto and decided to collect, identify, and analyze data corresponding to existing schools, current vacant lands, as well as other social demographics to better understand the current layout of private education, as well as looking for possible areas that can be converted into a facility for private education.

Data Sources

1. Toronto Signature Sites

Link: https://open.toronto.ca/dataset/toronto-signature-sites/

The Toronto Signature Sites dataset provides a collection of large industrial & commercial properties for sale or lease in Toronto. A signature site is defined as a listing of industrial and commercial properties for sale or lease. The dataset includes select sites which are at minimum three acres of vacant land and 50,000 sq ft for existing buildings. This data set was downloaded from the Toronto data portal which is well known for its credibility since it is administered by city officials and it is frequently updated. This data set includes several attributes but the key attributes that were relevant to our analysis were the following:

- _id: Unique row identifier for Open Data database
- Site_name: Name of the site

- geometry: multipoint geometry type representing each site location in the WGS 84 coordinate system.

The following command was used to load the data in the PostgreSQL database named *ggr381project*, into a schema named *sites* with the table named *site*. The SRID was projected from 4326 to 26917 so that we can work with the units of measure in meters:

shp2pgsql -s 4326:26917 -g geom -I TorontoSites.shp sites.site |psql -h localhost -U postgres -p 5432 -d ggr381project

2. Statistic Canada Census Data 2021 (Income Data)

Link: https://censusmapper.ca/api

The Statistics Canada census data set is a collection of demographic, social, and economic information gathered from individuals and households across the country. Statistics Canada is a reputable data source because it is a federal government-administered source which has transparent reporting practices, adheres to statistical standards and ensures accuracy. The data was extracted using the census mapper API to get the spatial representation of the neighbourhoods with attributes for our analysis from the 2021 census data. The data set includes several attributes but the key attributes that were relevant to our analysis were the following:

- name: unique numerical identifier of each of the neighbourhood
- vMtii2ar(: median income for each neighbourhood
- Geometry: Polygon geometry type representing each site location in the WGS 84 coordinate system.

The following command was used to load the data in the PostgreSQL database named *ggr381project*, into a schema named *incomes* with the table named *income*. The SRID was projected from 4326 to 26917 so that we can work with the units of measure in meters:

shp2pgsql -s 4326:26917 -g geom -I toronto_income.shp incomes.income |psql -h localhost -U postgres -p 5432 -d ggr381project

3. School Locations - All Types

Link: https://open.toronto.ca/dataset/school-locations-all-types/

The School Location dataset covers the City of Toronto and contains all the point locations of schools that reside within the city boundary. This dataset also differentiates

between different types of schools which include public and private settings. This data set was downloaded from the Toronto data portal which is well known for its credibility since it is administered by city officials and it is frequently updated. This data set includes several attributes but the key attributes that were relevant for our analysis were the following:

- _id: Unique row identifier for Open Data database
- SCHOOL_TYPE: Type of school
- Geometry: multipoint geometry type representing each school location in the WGS 84 coordinate system.

The following command was used to load the data in the PostgreSQL database named *ggr381project*, into a schema named *sites* with the table named *site*. The SRID was projected from 4326 to 26917 so that we can work with the units of measure in meters:

shp2pgsql -s 4326:26917 -g geom -I school_locations.shp schools.school |psql -h localhost -U postgres -p 5432 -d ggr381project

4. Statistic Canada Census Data 2021 (Population Density Data)

Link: https://censusmapper.ca/api

Statistics Canada is the national statistical agency of Canada, responsible for producing and disseminating official statistics on the country's population, economy, society, and more. The Census of Population is conducted every five years, and it gathers demographic and social information about Canadian residents. Population density is a measure of the number of people living per unit of area, often expressed as persons per square kilometer. It is a key demographic indicator that helps understand the concentration of people in different regions.This data set includes several attributes but the key attributes that were relevant for our analysis were the following:

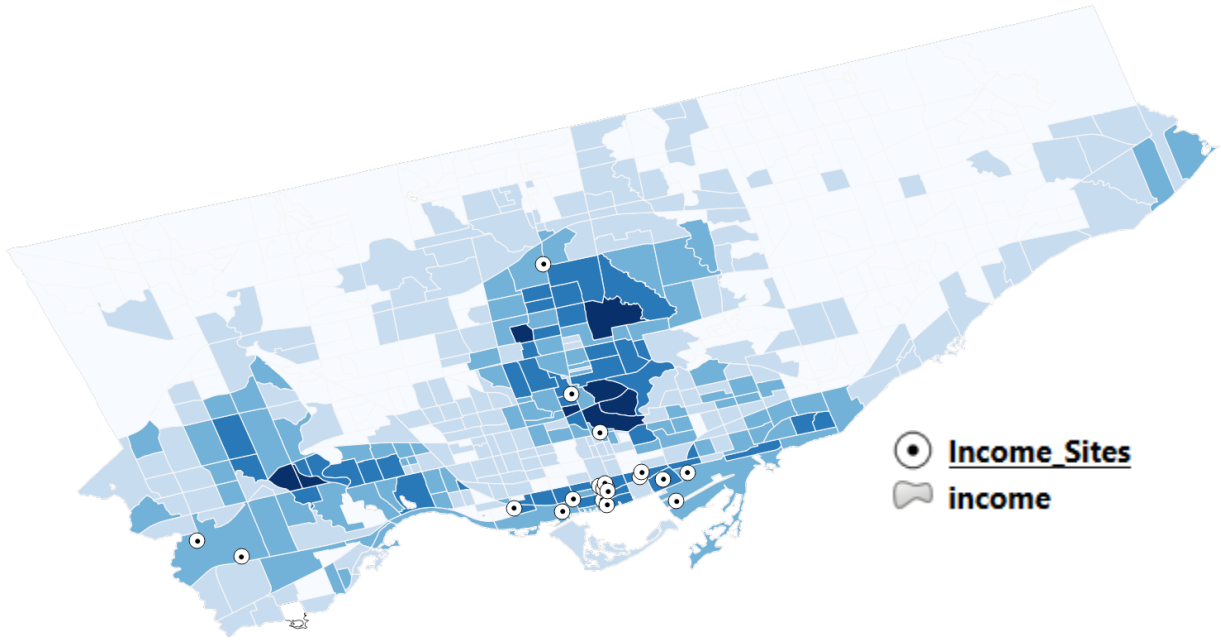
- name: unique numerical identifier of each of the neighbourhood
- Popultn: population count for each neighbourhood
- Geometry: Polygon geometry type representing each site location in the WGS 84 coordinate system.

The following command was used to load the data in the PostgreSQL database named *ggr381project*, into a schema named *pop* with the table named *density*. The SRID was projected from 4326 to 26917 so that we can work with the units of measure in meters:

shp2pgsql -s 4326:26917 -g geom -I toronto_density.shp pop.density |psql -h localhost -U postgres -p 5432 -d ggr381project

Methodology/Analysis

Neighbourhood Income vs Site Location



One of the metrics we choose to determine suitable sites for private schools in Toronto is neighbourhood income because of its obvious correlation with education accessibility, especially when you have to pay for schools like private schools. Neighbourhoods with higher incomes often indicate that more families can afford private education, suggesting a potential higher demand for private school services. Additionally, a community with higher income levels may be more committed to education for their kids which will lead to higher enrollment. So, assessing neighbourhood income helps in identifying locations where a private school is likely to thrive, providing valuable insights for strategically choosing a suitable site. Keeping that in mind, we used the Toronto sites dataset and Census data set described above to write a query for us to determine the top sites with the highest neighbourhood median income. These datasets were useful in this case because they gave us a geometric polygon representation of each neighbourhood along with the median income and point representation of each site, which we were then able to relate to determine the median income associated with each site. The following query does just that to determine the

top 20 sites with the highest neighbourhood median income. At first, the query left joins the site table with the median income table by spatially determining if the site point is within the neighbourhood polygon. Next, it outputs the site's unique ID, site name, neighbourhood's unique ID, neighbourhood name and median income. The result is sorted in descending order and gives the top 20 results. From this query, we see the names of the top suitable sites based on income in the second query along with the neighbourhood median income in the last column.

select s.gid, s.site_na4 as site_name, i.gid, i.name as neighbourhood, i."vmtii2ar(" as median_income from sites.site s left join incomes.income i on ST_Within(s.geom, i.geom) order by median_income desc limit 20;

```
ggr381project=# select s.gid, s.site_na4 as site_name, i.gid, i.name as neighbourhood, i."vmtii2ar(" as median_income from sites.site
s left join incomes.income i on ST_Within(s.geom, i.geom) order by median_income desc limit 20;
 gid |                       site_name                       | gid | neighbourhood |     median_income
-----+-------------------------------------------------------+-----+---------------+-----------------------
  31 | 8 Spadina Avenue                                      |  14 | 0011.01       | 71000.000000000000000
  15 | 99 Atlantic Avenue                                    |   9 | 0008.01       | 70000.000000000000000
  38 | 100 Queens Quay East                                  |  21 | 0013.02       | 67000.000000000000000
  51 | 500 Richmond Street East                              |  24 | 0016.00       | 66500.000000000000000
  29 | 25 Ontario Street                                     |  24 | 0016.00       | 66500.000000000000000
  68 | 125 Mill Street                                       |  25 | 0017.01       | 63600.000000000000000
  37 | 16 York Street                                        |  18 | 0012.03       | 63200.000000000000000
  47 | 30 St. Clair Avenue West                              | 153 | 0122.00       | 62000.000000000000000
  10 | 895 Don Mills Road                                    | 346 | 0275.00       | 61200.000000000000000
  48 | 320 Bay Street                                        |  22 | 0014.00       | 60000.000000000000000
  76 | 200 Bay Street                                        |  22 | 0014.00       | 60000.000000000000000
  30 | 222 Bay Street                                        |  22 | 0014.00       | 60000.000000000000000
  39 | 66 Wellington Street West                             |  22 | 0014.00       | 60000.000000000000000
  34 | 130 King Street West                                  |  22 | 0014.00       | 60000.000000000000000
  74 | 176 Cherry Street                                     |   1 | 0001.00       | 57200.000000000000000
  16 | East Harbour - 21 Don Roadway                         |   1 | 0001.00       | 57200.000000000000000
  35 | 500 Lake Shore Boulevard West                         |  17 | 0012.01       | 55200.000000000000000
  46 | 160 Bloor Street East                                 | 112 | 0088.00       | 55200.000000000000000
  25 | 181 The West Mall                                     | 257 | 0213.02       | 52400.000000000000000
  24 | 1543-1551 The Queensway and 66-76 Fordhouse Boulevard | 257 | 0213.02       | 52400.000000000000000
(20 rows)
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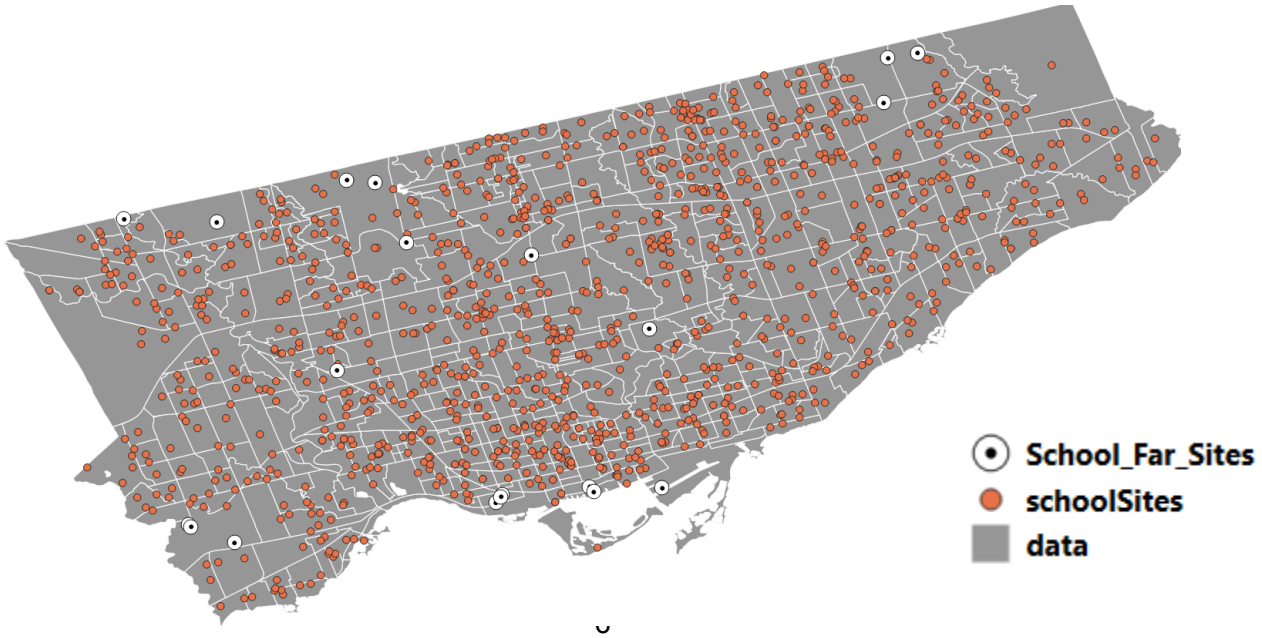
Proximity of Sites to Neighboring Schools



Another metric we choose to determine suitable sites for private schools in Toronto is the proximity of each site to neighbouring schools. Proximity analysis provides insights into the landscape of schools, which allows us to understand the distribution of schools locally. By assessing the distances to nearby schools, we can understand the level of competition, identify underserved areas, and strategically position the new private school in the most effective area to maximize enrollment. Evaluating the proximity of the sites to the other schools is key in making informed decisions that enhance accessibility for students, and the overall success and sustainability of the new private school. Hence, to determine such sites, we used the Toronto sites and schools data sets described above to determine the sites with the lowest proximity to other schools. This allowed for the geometric point representations of the sites and schools within Toronto, which we could use to determine the proximity of schools to each site. The following query helps us determine this by providing the top 20 sites with the lowest number of schools within a 1 KM radius. We chose to look within the 1 KM radius because that is the usual proximity of schools in Toronto. The query starts by left-joining the possible sites table with the school's table on the condition that the site is within 1 KM. Then it outputs the results by providing the unique identifier for the site, the site name and the number of schools within 1 KM. The result is sorted in ascending order and only shows the top 20 sites in this case. The second column in the screenshot below showcases the top 20 suitable sites based on proximity with the lowest proximity count to neighbouring schools within 1 KM.

select s.gid, s.site_na4, count(*) as num_schools from sites.site s left join schools.school l on ST_Dwithin(s.geom,l.geom, 1000) group by s.gid order by num_schools asc limit 20;

```
ggr381project=# select s.gid, s.site_na4, count(*) as num_schools from sites.site s left join
 schools.school l on ST_Dwithin(s.geom,l.geom, 1000) group by s.gid order by num_schools asc
limit 20;
 gid |                        site_na4                         | num_schools
-----+---------------------------------------------------------+-------------
  24 | 1543-1551 The Queensway and 66-76 Fordhouse Boulevard  |           1
  17 | Finch Avenue East and Tiffield Road (northeast corner) |           1
  80 | 80 Fenmar Drive                                        |           1
  20 | 185, 191 and 195 The West Mall                         |           1
  73 | 675 Petrolia Road                                      |           1
  36 | 568 Passmore Avenue and 3250 Markham Road              |           1
  74 | 176 Cherry Street                                      |           1
  37 | 16 York Street                                         |           1
  10 | 895 Don Mills Road                                     |           1
  38 | 100 Queens Quay East                                   |           1
  66 | 601 Supertest Road                                     |           1
  13 | 7 and 15 Fraser Avenue                                 |           1
  25 | 181 The West Mall                                      |           1
  15 | 99 Atlantic Avenue                                     |           1
  41 | 25 Liberty Street                                      |           1
  71 | 4701 Steeles Avenue West                               |           2
  59 | 116 Industry Street                                    |           2
  40 | 985 Passmore Avenue, East of Tapscott                  |           2
   2 | 1035 Sheppard Avenue West                              |           2
  50 | 158 Wicksteed Avenue                                   |           2
(20 rows)
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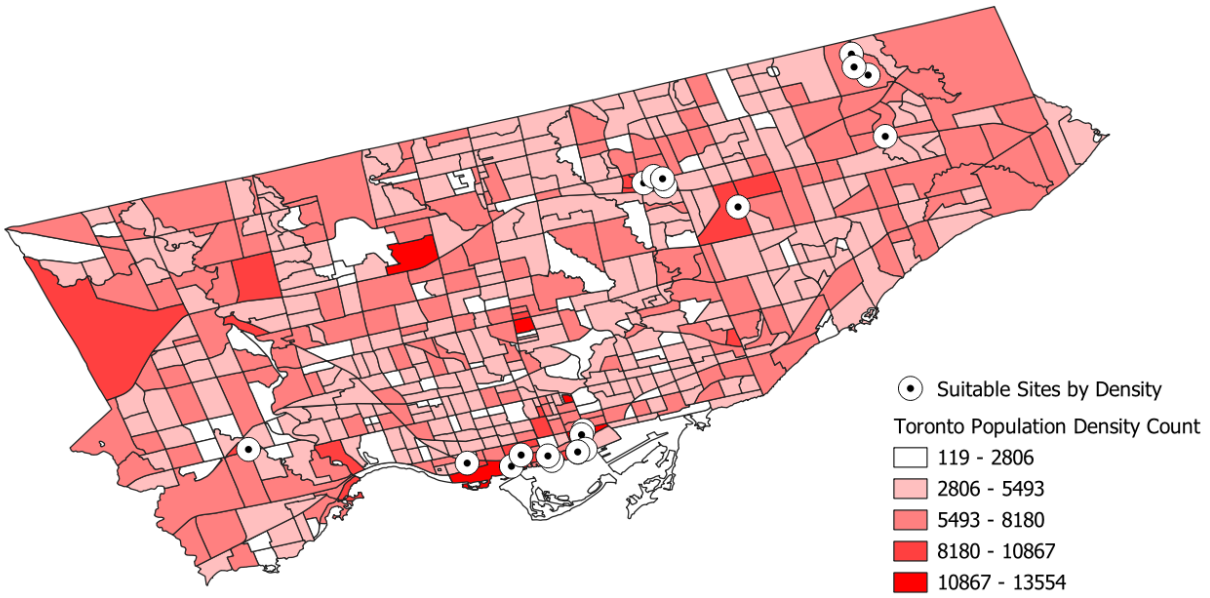
Population Density vs Site Location



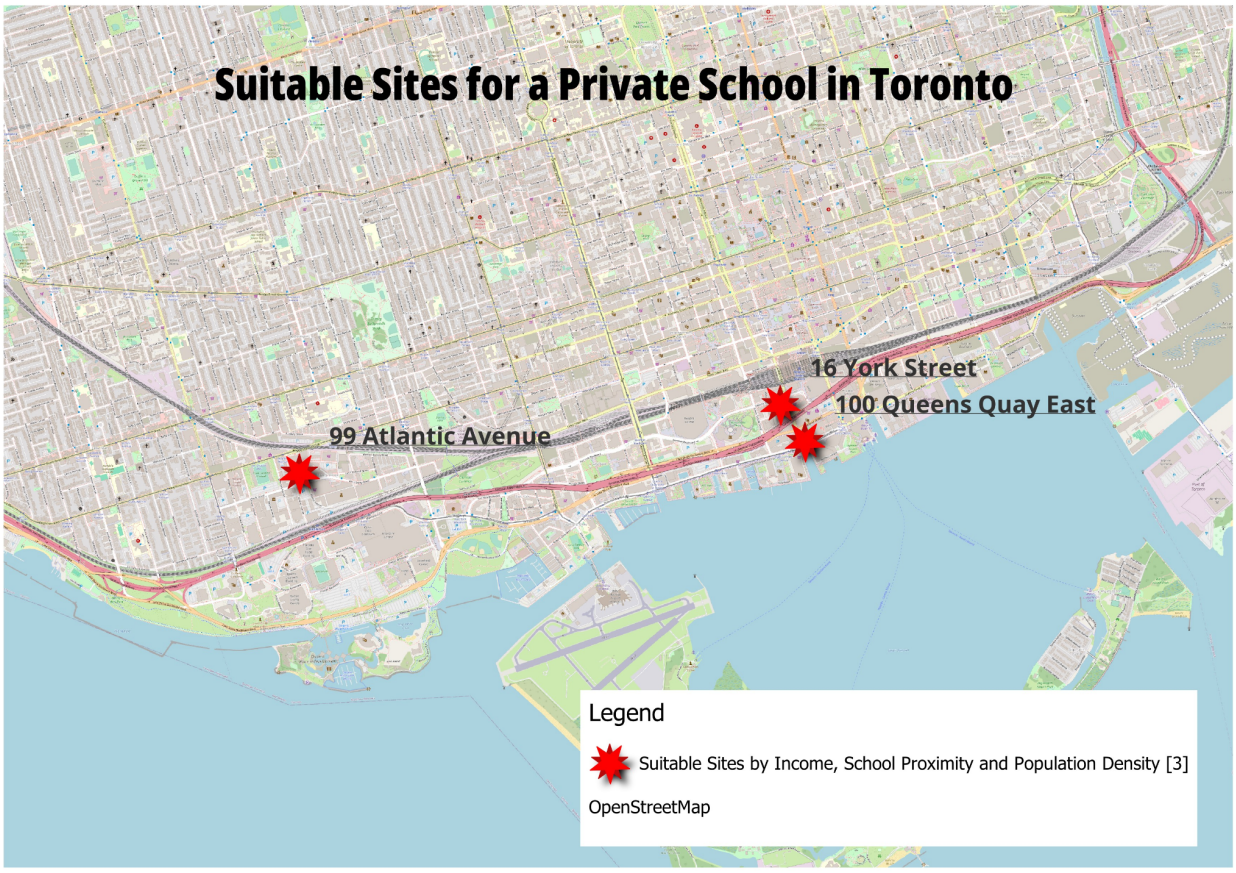
The final metric we used to determine suitable sites for private schools in Toronto was population density. This approach provided us with an understanding of the demand for education, particularly for children, in various census tract areas. Understanding the population density distribution across different areas helped us pinpoint locations where the demand for education services, specifically tailored for students, was likely to be higher. Population density serves as a key indicator of the concentration of potential students within a given geographic area, allowing us to identify regions where the establishment of private schools would meet the needs of the local population. To implement this metric, we utilized the Toronto sites dataset and the Census dataset described earlier. Through a query, we determined the top sites with the highest population density possibly indicating a greater flux in school-aged children.The query retrieves information about sites and their associated neighbourhoods, including the population density of each neighbourhood. The SELECT clause specifies the fields to be included in the result set. The query selects the unique identifier (gid) and name (site_na4) for each site, as well as the unique identifier (gid), name (name), and population density (popultn) for each neighbourhood. In the FROM clause, the query specifies the source table as "sites.site" and aliases it as "s." This is the table containing information about the private school sites. The LEFT JOIN clause connects the private school sites table (sites.site) with the population density table (pop.density) using a spatial join condition. The join is established based on the spatial relationship defined by the ST_Within function, where the geometry of each private school site (s.geom) must

be within the geometry of the corresponding neighbourhood (p.geom). This ensures that each private school site is associated with its respective neighbourhood and its population density. The ORDER BY clause arranges the result set in descending order based on the population density (population_density). This means that private school sites in neighbourhoods with higher population density will appear first in the output. Finally, the LIMIT clause restricts the result set to the top 20 rows, focusing on the 20 private school sites with the highest population density. This SQL query is a spatial join that combines information about private school sites with the population density of their corresponding neighbourhoods. The result is a list of the top 20 potential private school locations based on the density of the surrounding population. This query is useful for identifying potential suitable private school location sites based on the population density of the surrounding neighbourhoods.

select s.gid, s.site_na4 AS site_name, p.gid, p.name as neighbourhood, p.popultn as population_density from sites.site s left join pop.density p ON ST_Within(s.geom, p.geom) ORDER BY population_density desc limit 20;

```
ggr381project=# SELECT s.gid, s.site_na4 AS site_name, p.gid, p.name as neighbourhood, p.popultn as popula
tion_density from sites.site s left join pop.density p ON ST_Within(s.geom, p.geom) ORDER BY population_de
nsity desc limit 20;
 gid |                 site_name                  | gid | neighbourhood | population_density
-----+--------------------------------------------+-----+---------------+--------------------
  35 | 500 Lake Shore Boulevard West              |  17 | 0012.01       |              13554
  51 | 500 Richmond Street East                   |  24 | 0016.00       |              11144
  29 | 25 Ontario Street                          |  24 | 0016.00       |              11144
   9 | 3326 Bloor Street West and Islington Avenue | 273 | 0225.02       |              10827
  38 | 100 Queens Quay East                       |  21 | 0013.02       |              10439
  31 | 8 Spadina Avenue                           |  14 | 0011.01       |               9592
  37 | 16 York Street                             |  18 | 0012.03       |               8957
  63 | 225 Yorkland Boulevard                     | 388 | 0301.04       |               8766
  28 | 2135 Sheppard Avenue East                  | 388 | 0301.04       |               8766
  11 | 501 Consumers Road                         | 388 | 0301.04       |               8766
   8 | 2225, 2235 and 2255 Sheppard Avenue East   | 388 | 0301.04       |               8766
   3 | 125 and 155 Queens Quay East               |  26 | 0017.02       |               8710
  19 | T3 Bayside - Queens Quay Place             |  26 | 0017.02       |               8710
  58 | 300 Queens Quay East                       |  26 | 0017.02       |               8710
  15 | 99 Atlantic Avenue                         |   9 | 0008.01       |               8480
   6 | 1550 Birchmount Road                       | 530 | 0371.00       |               8463
  79 | 601-607 Milner Avenue                      | 562 | 0378.03       |               7948
  40 | 985 Passmore Avenue, East of Tapscott      | 580 | 0378.25       |               7612
  18 | 2450 Morningside Avenue                    | 580 | 0378.25       |               7612
  49 | 3880 McNicoll Avenue                       | 580 | 0378.25       |               7612
(20 rows)
```

Conclusion



After overlaying the selective criteria that were decided in the selection of the best vacant areas to be selected for the building of a private school, we reached the following three sites as our most suitable sites. These sites were near the higher population of youth, as well as income in Toronto and were also situated in areas that were relatively distant from the nearest schools. They were determined by finding the intersection of the sites from the query results shown above and visualized using the QGIS's feature to determine intersections of layers.

Site 1 - 99 Atlantic Rd

As seen in Google Earth, the given site has been taken over by a new office building that was just finished last year! This eliminates the site's availability and will be removed from the available sites.

Site 2 -16 York Street

Welcome to our second site, which is now a 32-storey condo site in the heart of downtown Toronto. Once again, this removes the site from the list of available lots as we move on to our final site of selection.

Site 3 - 100 Queens Quay East

Last but not least is our final remaining site, on Queens Quay East. This site now holds another mixed office and condominium space that was recently completed in 2021. This eliminates our final site from contention and concludes the selection process for the pertaining sites.

In conclusion, the given sites that were selected have already been occupied by condominiums or office buildings, and are no longer available for the construction of a public school. However, this does not diminish the validity of the data as these areas were in prime real estate for a school, and fit all the criteria models necessary for a private school to flourish. There are some obvious limitations with the data that led to the conclusion that none of the three sites are suitable for the current proposal. This is due to limitations within the data of vacant sites, as although the data does say it was last updated on Dec 1, 2023, it does not show the date published, or what exactly was updated. To the credit of the data source's validity, all the condos and office spaces seen in our final sites were created within the last 2-5 years and are considered relatively new pieces of construction. Hence, a more concurrent data source might have been necessary to accurately attain the current available sites. In the end, although all the sites fit the general criteria, the concluding sites in this study were no longer vacant, meaning that the results remain inconclusive. However, the study did create a very translatable methodology and sequencing of data that can apply to many other cities, as our selection criteria can be used for the analysis and identification of such land space needed for important matters like private schooling.

Citations

[1] Arjun S. Bedi a, A. S., & Garg, A. (2000, April 5). *The effectiveness of private versus public schools: The case of indonesia*. Journal of Development Economics. https://www.sciencedirect.com/science/article/pii/S0304387800000651?via%3Dihub