Accessible and Equitable Drinking Fountain Placement Strategy

For the City of Vancouver, Engineering Services

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August 2022

This report was produced as part of the Greenest City or Healthy City Scholars Program, a partnership between the City of Vancouver and the University of British Columbia, in support of the Greenest City Action Plan and the Healthy City Strategy.

This project was conducted under the mentorship of City staff. The opinions and recommendations in this report, and any errors, are those of the author, and do not necessarily reflect the views of the City of Vancouver or The University of British Columbia.

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Acknowledgements

The work for this project took place on the unceded, traditional, and ancestral lands of the xwməθkwəy̓əm (Musqueam), Skwxwú7mesh (Squamish), Stó:lō and Səl̓ílwətaʔ/Selilwitulh (Tsleil-Waututh) Nations. For First Peoples, access to clean water is a traditional and ancestral right. It is my hope that the research conducted for this project will increase water access for people around Vancouver.

I would like to thank the following individuals for their contribution, feedback, and support throughout this project:

Robyn King

Chris Twemlow

Sarah Labahn

Karen Taylor

Eric Haggen

Cover photo by Destination Vancouver

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Executive Summary

The City of Vancouver provides public drinking fountains to support public health, enhance livability, reduce reliance on single-use plastics, and ensure access to drinking water for all residents. However, fountains are not currently distributed widely enough throughout the city to reliably meet these goals. Analysis of spatial data using ArcGIS Pro revealed 29 priority sites for drinking fountain installation, and an additional 18 secondary sites for further consideration. Undertaking new drinking fountain construction at these 47 sites would greatly improve equity in access to drinking water throughout the city.

The strategic installation of new drinking fountains responds to important policy goals of the City. It responds to Vancouver's *Climate Change Adaptation Strategy* by increasing access to drinking water during heat waves. It helps Vancouver execute its commitment to provide drinking water as a human right to all residents.

To meet these important policy goals, this report outlines a methodology for using GIS to locate areas with suboptimal access to drinking fountains. It uses maps to visualize where the city should build new drinking fountains and provides a Five-year Plan for carrying out this construction. It also outlines longer-term planning considerations relevant to public drinking fountains.

Lastly, this report outlines several crucial areas of future research and emphasizes areas of possible collaboration within city government to ensure accessible and equitable access to drinking fountains throughout Vancouver.

Introduction

In the summer of 2021, British Columbia suffered a major heat wave. Across the province, high temperature records were smashed and 619 people died—the vast majority of whom resided in the greater Vancouver area (Egilson, 2022). This heat wave, like many other events around the world, was made significantly more likely by human-caused climate change (IPCC, 2022). In the context of a warming world in which heat hazards like this one are increasingly common, it is of paramount importance for residents of Vancouver to have adequate access to public drinking water.

This report argues for the construction of new drinking fountain infrastructure across Vancouver. In addition to preparing for future heat events, adequate access to drinking water is crucially important for physiological, cognitive, and emotional health (Popkin et. al., 2010; D'Anci, 2006; Ganio, 2011). To efficiently meet these climate adaptation and public health goals, the City of Vancouver must undertake strategic construction of new drinking fountains across Vancouver. This report uses ArcGIS to propose 29 primary sites and 18 secondary sites for new drinking fountain installation.

From an equity and accessibility perspective, which is to say a perspective that prioritizes drinking water availability for all residents of Vancouver, it is of critical importance to build new infrastructure in currently underserved areas. Using spatial data, this report identifies areas of Vancouver that have the least access to public drinking water. Building new drinking fountains in these areas will ensure that the greatest number of Vancouverites have suitable access to drinking water. This approach meets existing need in the most cost-effective way.

There are several major sections to this report. I begin by outlining the specific policy context for drinking fountains in Vancouver and providing a brief overview of relevant contexts. Then, I describe in detail the methodology used to create the GIS, as well as some important limitations to this project. The following section features maps showing availability of drinking fountains across Vancouver and recommended sites for new construction. After this, I provide a 5-Year Plan for undertaking new construction, long-term planning considerations, and recommendations for future research to build on the present project. The report also includes an Appendix summarizing informal interviews conducted with community members across Vancouver on new drinking fountain construction.

Vancouver is consistently ranked one of the most livable cities in the world (Charach, 2022). Providing adequate access to public drinking water is an important aspect of livability, although it may seem like a mundane concern compared to mountains, beaches, and a temperate climate.

This report provides the tools to ensure that Vancouver is an amazing place to live in one more way.

Background and Policy Context

The goal of this project is to build a GIS visualizing where the City of Vancouver should construct new drinking fountains to increase equity and accessibility in water access. This corresponds to several high-level city policy designs.

Vancouver's *Climate Change Adaptation Strategy* includes building new drinking fountains as action item C.14 (City of Vancouver, 2018: 54). Due to climate change, Vancouver and its surrounding region is likely to experience hotter summers with longer heat waves, higher maximum temperatures, and less rain (ibid, 8). Strategically constructing new drinking fountains will build resilience to these events by ensuring that vulnerable populations have access to potable water. As such, this intervention represents an "adaptation," a way that our city can adjust to its changing environment.

An important aspect of this project is how vulnerability is defined. In other words, what factors make a person or community more vulnerable to heat events? Since at least the 1990s, it has been widely accepted in policy circles around the world that vulnerability is largely socially produced (Wisner et. al., 2004). This means that social factors, like race, class, age, medical conditions, and others, are generally more indicative of who is vulnerable to a heat event than the severity of the hazard itself. Following the excellent research done by Vancouver Coastal Health, I have adopted their set of factors that contribute to vulnerability to heat hazard, which suggests that age, pre-existing health conditions, race, indigeneity, precariously housed, and living alone are major contributors to heat vulnerability (Yu et. al., 2020: 7-8). See Methodology for GIS section below for a longer discussion of this data.

Equally important, the City of Vancouver recognizes the United Nation's resolution that access to drinking water is a basic human right (City of Vancouver, 2020; United Nations, 2010). The City must therefore make sure that there is adequate access to drinking water in the public realm (i.e., not under the exclusive jurisdiction of private interests). Constructing drinking fountains in areas of the city that do not currently have access to public drinking water infrastructure is necessary to meet this important goal.

In addition to the goal of increasing access to drinking water, both as a human right and as a form of climate adaptation, plentiful public drinking fountains will reduce reliance on single-use plastic water bottles. Likewise, by ensuring abundant access to drinking water, new drinking fountain construction in strategic areas will promote hydration and encourage residents to drink water rather than sugary drinks.

The ambition of this project is to build resilience to heat events, ensure water access as a human right, increase hydration year-round, and promote healthier consumption choices by creating more public drinking water infrastructure. Using spatial data and ArcGIS Pro, the remainder of this report outlines 29 priority sites within the City of Vancouver for near-term new drinking fountain construction, as well as 18 sites for secondary consideration. Strategically building new fountains in areas that currently have a suboptimal level of service will ensure that all Vancouver residents have adequate access to water and can lead healthy, hydrated lives.

Methodology and Limitations

In this section, I discuss the methodology I used to build the GIS and the limitations of this study. I begin with the limitations, particularly with what is out of scope for this project, because these limitations inform the methodology ultimately adopted.

Limitations

There are two notable limitations that informed my approach to building the GIS. The first is that this project specifically concerns new drinking fountain construction by the City of Vancouver's Waterworks Utility. Because the Vancouver Board of Parks and Recreation provides water access to parks within Vancouver, Engineering Services will not construct new fountains inside parks. Parks are therefore out of scope for this project. In the future, Engineering Services and the Parks Board could consider collaborating on a joint plan, drawing on the results of the present study, to distribute drinking fountains accessibly and equitably throughout the City of Vancouver.

The second limitation is that the methodology outlined below gives information about the *relative* access to public drinking fountains rather than *absolute* access. This means, essentially, that this GIS does not tell us whether a particular area has adequate or inadequate water access, but rather how well served each area is relative to the rest of the city. Therefore, this map emphasizes an equitable distribution of water fountains and achieving a similar level of public water access throughout the City of Vancouver. This has seemed to me to be a reasonable approach because it highlights areas that are currently not receiving comparable service to the rest of the city. From an equity and accessibility standpoint, new drinking fountain construction should be directed towards these areas. I nonetheless mention this limitation to avoid the following maps being interpreted as an absolute measure of public water access throughout the city.

Methodology for GIS

The data for this project was collected from the City of Vancouver Open Data Portal (ODP), except for the Heat Vulnerability shapefile, which was provided by Vancouver Coastal Health (VCH). I used ArcGIS Pro to make the maps included in the Results section (see below).

To determine potential sites for new drinking fountain construction, I used a modified version of the suitability map model described by ESRI (2021). This map shows suitable sites for new drinking fountain construction by visualizing which parts of the city have relatively good access to public drinking fountains and which areas have relatively poor access to the same. It is, to adopt

the language my supervisors have used, a 'heat map' with red areas indicating poor access and green areas indicating good access (see Map 1). From the areas of the city with poor access to public drinking fountains and access to a suitable water main, the 29 most urgent areas were selected as potential sites for new fountain construction.

Several factors go into determining suitability for new drinking fountain construction:

1. Access to an appropriate water main
2. Vulnerability to heat hazard
3. Distance from existing drinking fountain infrastructure
4. Density and traffic
5. Parks (out of scope)

The first step towards building the map was obtaining spatial data for each factor. Here I will briefly discuss each of the data sets I used, particularly the Heat Vulnerability data obtained from VCH, as it is rather complex.

Access to a suitable water main. I downloaded two datasets from the ODP, Water transmission mains and water distribution mains. These shapefiles spatially represent water mains throughout the city.

Vulnerability to heat hazard. This dataset was obtained from VCH. Vulnerability, as I discussed above, refers to the social (and to a lesser degree environmental) factors that render particular populations more at risk to various hazards. VCH mapped vulnerability to heat hazard, defined essentially as extreme heat events, across Vancouver. They "conducted systematic literature reviews and applied epidemiologic and geospatial analyses using multiple publicly-available sources" to create a map of which areas and populations in Vancouver are most susceptible to heat hazards (Yu et. al., 2020: 2; Vancouver Coastal Health et. al., 2021). The shapefile generated is therefore an index that includes many variables. This is important, because I chose *not* to include most of these variables as a separate layer because they are already represented in the VCH heat vulnerability index.

VCH divides their vulnerability index into three categories: exposure (i.e., how likely is an area to be exposed to extreme heat?), sensitivity (i.e., how much will the population be affected by extreme heat?), and adaptive capacity (i.e., what resources can this group draw on in an extreme heat event?). Their vulnerability index thus includes data about maximum temperatures, age, pre-existing health conditions, socioeconomic status, race, housing, and kinship networks (Yu et. al., 2020: 7-8). It is an extremely comprehensive dataset. Please see *Mapping spatial patterns in vulnerability to climate change-related health hazards: 2020 report* for more details.

Distance from existing fountain infrastructure. I downloaded a shapefile for drinking fountains from the ODP. This includes fountains maintained both by the Parks Board and Engineering Services, as well as temporary fountains.

Density and Traffic. I downloaded several datasets to represent density and traffic from the ODP. I downloaded a shapefile representing zoning in Vancouver, a shapefile representing bikeways, and a shapefile representing public housing.

Parks (out of scope). I downloaded polygon representations of Vancouver parks from the ODP. This data does not directly enter the model, but existing parks are overlayed on top of the heat map to show areas that are out of consideration for new construction.

Having collected the necessary datasets, I brought the shapefiles into ArcGIS Pro and extracted the relevant data from each shapefile using spatial analysis tools. See Figure 1 for a diagram of the process of creating the map, which I explain in more detail below.

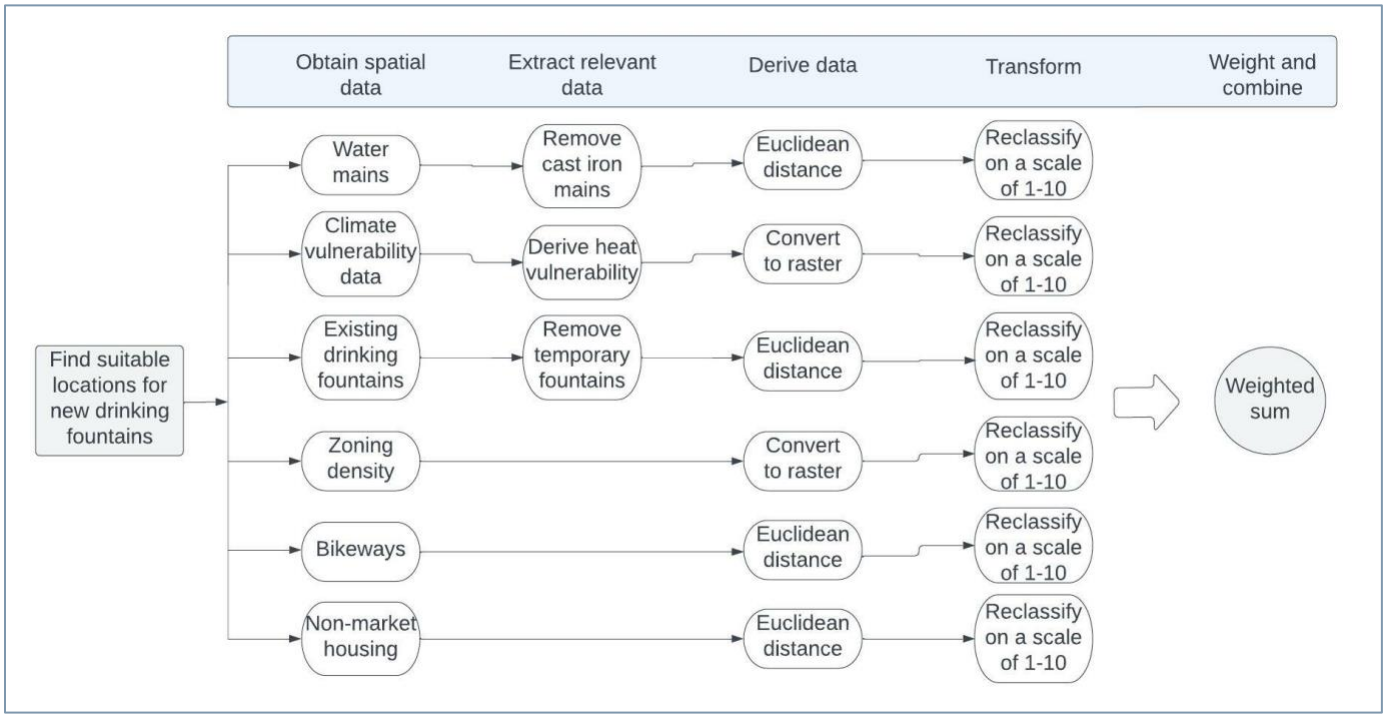


Figure 1. Process Diagram

For each shapefile, I performed several operations to create a raster layer in which each cell has a score between 1 and 10, with 10 being the highest suitability for new fountain construction and 1 being the lowest. I describe these operations below, noting relevant spatial analysis functions in

parentheses. (This process could be run as a model instead, but I describe it in this more comprehensive way here.)

Water mains: After bringing the relevant datasets into ArcGIS, I created a new layer that excluded cast iron mains, as these are in the process of being replaced by the City (Select by Attribute-> New Layer from Selection). After that, I merged both water main layers into a single layer (Merge). Then I created a raster layer showing proximity to a suitable water main (Euclidean distance). Finally, I reclassified the raster on a scale of 1 to 10, with 1 being furthest from a suitable main and 10 being closest (Reclassify data).

Climate vulnerability: I selected only the heat vulnerability attribute and created a new layer that only included this data (and polygon information). Because heat vulnerability data was already represented in this layer as polygons with a number between 0 and 1 (with 1 being most vulnerable), I converted these polygons to raster (Polygon to Raster). Then I reclassified the data to a scale of 1 to 10, with 1 being least vulnerable and 10 being most vulnerable to heat (Reclassify data).

Existing Drinking Fountains: I manually removed temporary drinking fountains from the dataset based off a list provided by Robyn King. (More specifically, I created a separate layer of only temporary drinking fountains for visualizations). Then I created a raster layer showing distance from existing drinking fountains (Euclidean distance). I reclassified this raster to a scale of 1-10, with 1 being closest to a drinking fountain and 10 being furthest away (Reclassify data). This means that fountain construction is prioritized further away from existing drinking fountains.

Zoning density: Zoning data displays polygons of different zoning areas in the city with their zoning classification. I converted this polygon data to raster and then reclassified it to assign a number from 1 to 10 based off density and commercial traffic.

Bikeways. I created a raster layer showing distance from bikeways (Euclidean distance). Then I reclassified the raster to a scale of 1-10, with 1 being far from any bikeway and 10 being close to a bikeway (Reclassify data).

Non-market housing: Non-market housing is represented as point data. I created a raster later showing proximity to non-market housing (Euclidean distance). Then I reclassified to assign a value between 1 and 10, with 1 being far from non-market housing and 10 being close (Reclassify data). I include non-market housing here because it correlates with housing precarity, thus indicating areas where public water access is especially important (VitforJ et. al., 2022).

After performing these operations, I had 6 raster layers with values between 1 and 10, with 10 being most suitable for new fountain construction in each case. I used the Weighted Sum spatial

analysis tool to generate a new raster layer that summed these 6 layers. I weighted existing drinking fountain infrastructure x3, weighted heat vulnerability x0.5, and weighted all the other layers x1. I did this, firstly, to prioritize drinking fountain construction in areas that currently have very little to no drinking fountain service. Less than x3 weight resulted in maps that tended to cluster new construction around existing infrastructure where other variables gave high scores. Likewise, I weighted heat vulnerability by half because the Downtown Eastside (DTES) has a much higher heat vulnerability score than the rest of Vancouver. To avoid results only appearing on the DTES, I weighted vulnerability by half. Some people would undoubtedly suggest that if the DTES has a much higher vulnerability, more drinking fountains *should* be constructed there. Whether the DTES should be considered for extensive and exceptional permanent drinking fountain construction is an important (indeed, necessary) topic for future study. I refrain from expressing my thoughts on this crucial matter here.

(ArcGIS Pro also has a Suitability Modeler that can be used as an alternative to the Weighted Sum. I found it less usable than the method above.)

The final step was to choose potential sites for new fountain construction.[1] I selected the top 1% highest scoring cells, which yielded 29 discrete sites for priority fountain construction. My reason for choosing such a small sample of the data is to identify areas that score highly across all criteria (access to water main, heat vulnerability, close to bikeways, commercial or high-density areas, near precarious housing, and far from existing drinking fountains). Taking a larger sample tended to yield nonspecific results.

This methodology generates a set of potential sites for new construction based off the factors outlined here. Before continuing on to the maps themselves, I want to emphasize that the actual siting of fountains should use these maps as an informative guide rather than an absolute rule. The map directs attention to areas of the city, but the actual siting of the fountain should be done in conjunction with community groups that have a strong, concrete understanding of that neighborhood (see Appendix 1).

[1] The Weighted Sum layer, for reasons beyond my immediate understanding, does not come equipped with an attribute table. In order to select a group of values, it is necessary to use the INT tool to convert the Weighted Sum layer to integers. The resulting layer has an attribute table.

Results and Maps

The GIS constructed according to the methodology outlined above yielded 29 priority sites for new drinking fountain construction, represented in Map 1: Public Drinking Fountain Availability in Vancouver. This map shows existing drinking water fountain infrastructure, broken up into parks, city, and temporary fountains. Temporary fountains do not count as existing infrastructure in the GIS model, but are shown here for reference. The map visualizes access to public drinking fountains in Vancouver, with green areas having relatively good access and red areas having relatively poor access. Bright red areas are priority sites for new construction.

Investing in new drinking fountain infrastructure at these 29 priority sites will increase drinking fountain access in the most underserved areas of the city in terms of public drinking water. The geographic impact of this investment is very large: 60% of relatively underserved areas would be brought up to a comparable level of service with the rest of the city.

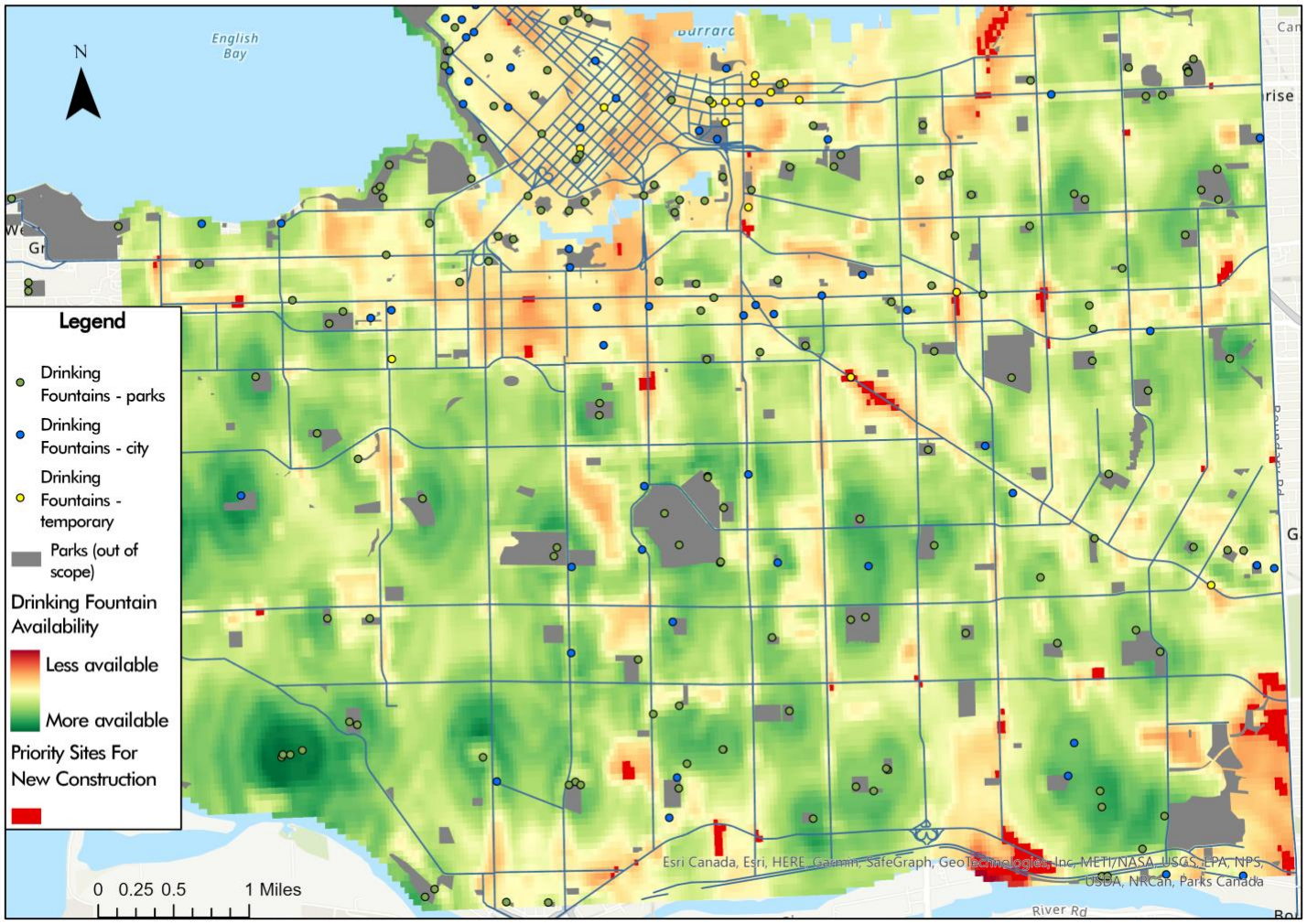
The approximate sites where new drinking fountain construction should be considered are as follows, with the understanding that the siting process may involve looking at adjacent blocks:

- Commercial Drive and E Broadway
- Nanaimo Street and E Broadway
- Renfrew Street and Venables Street
- Cassiar Street and E Hastings Street
- Victoria Drive and E Hastings Street
- Skeena Street and E 5th Ave
- Rupert Street and E 29th Ave
- Joyce Street and E 29th Ave
- Champlain Heights (potentially multiple sites)
    - Matheson Crescent and Celistar Drive
    - Marine Way and E Sawmill Crescent
- Victoria Drive and E Kent Ave
- Victoria Drive between Newport Ave and E 49th Ave
- E 49th Ave between Elliott Street and Vivian Street
- Knight Street and E 49th Ave
- Fraser Street and E 49th Ave
    - E 45th Ave and E 48th Ave were also suggested in an interview with the Fraser Street BIA (see Appendix)
- Kingsway between Fraser Street and Knight Street

- Main Street and E 2nd Ave
- Main Street and Union Street
- Main Street and Southeast Marine Drive
- Southeast Marine drive and W 70th Ave
- Heather Street and W 54th Ave[2]
- 41st Ave between Blenheim Street and Mackenzie Street
- Alma Street and W 4th Ave
- Greektown (W Broadway between Blenheim Street and MacDonald Street)
- Fairview (W Broadway between Hemlock Street and Oak Street)
- Alder Street and W 14th Ave
- Cambie Street between W 16th Ave and W 19th Ave
- Moberly Road between Millyard and Commodore Road
- N Lakewood Drive and Dundas Street
- Robson Street between Denman Street and Nicola Street

[2] It is worth noting that this site was selected mainly due to the density of assisted living facilities.

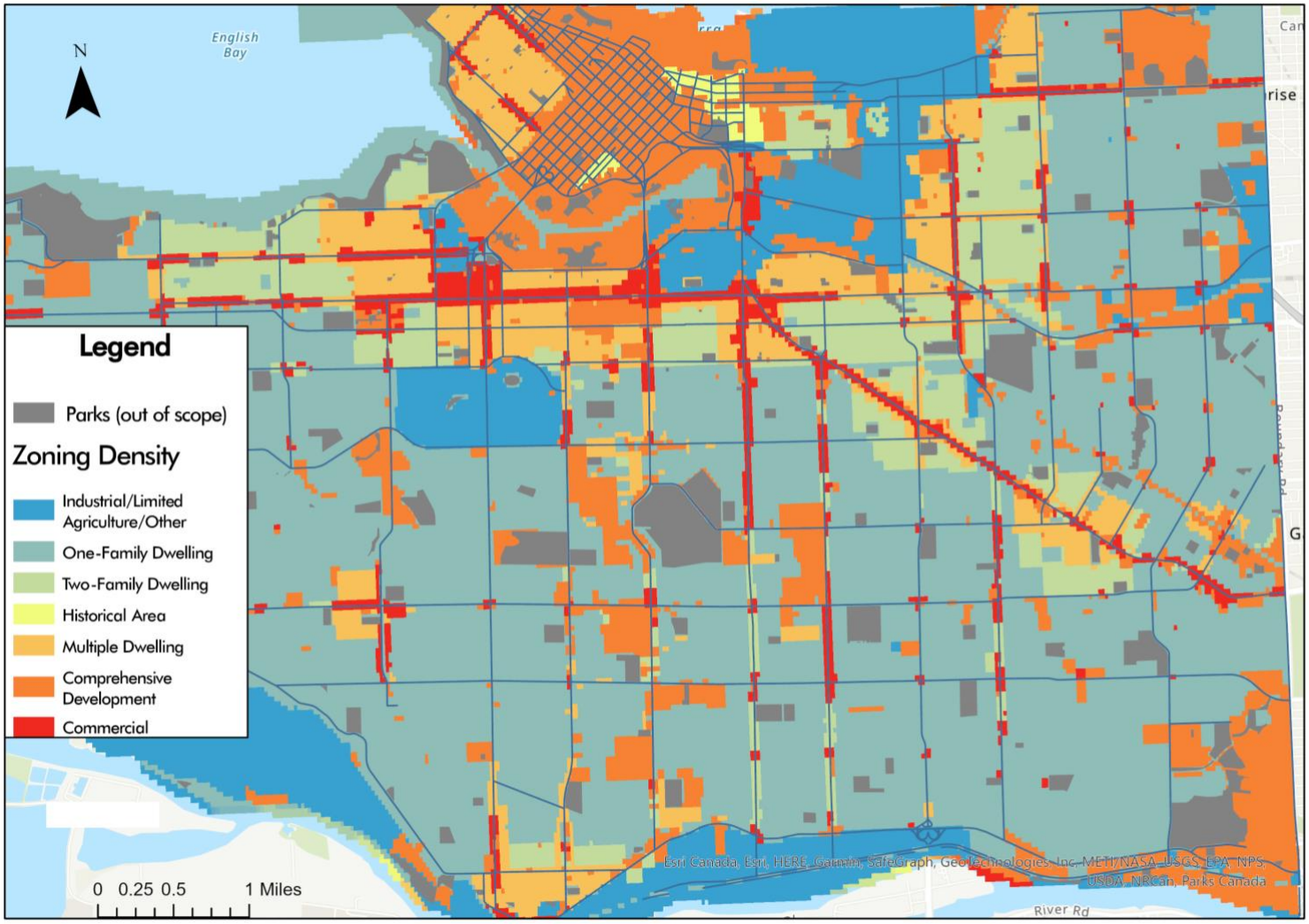
Public Drinking Fountain Availability in Vancouver



Map 1. Public Drinking Fountain Availability in Vancouver

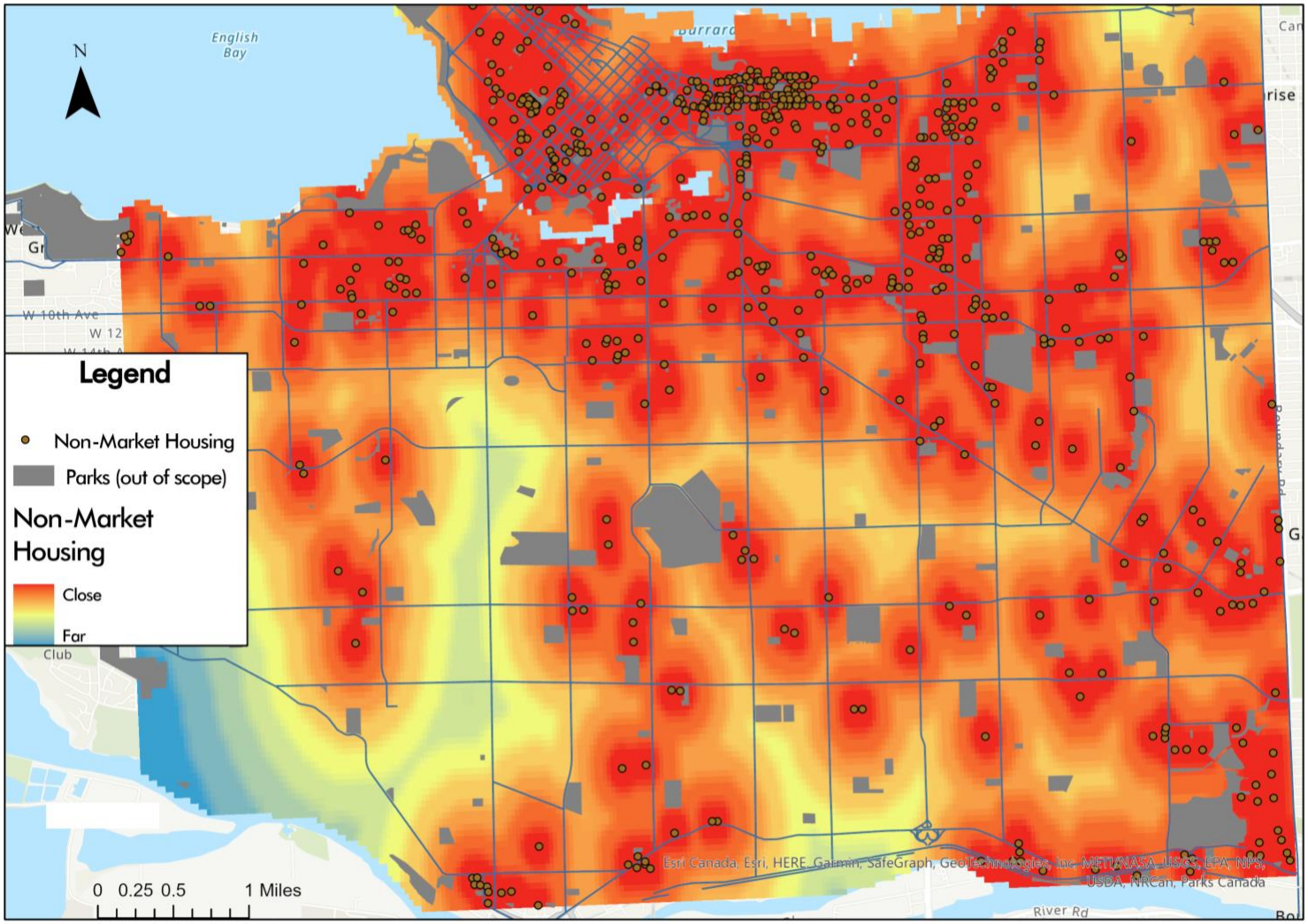
The remainder of this section provides visualizations of each of the variables that were used in compiling the public water access and suitability map (Maps 2-7). These variables were described in the methodology section above. After showing these process maps, I detail 18 secondary sites to be considered for drinking fountain construction after the priority sites are built.

Zoning Density



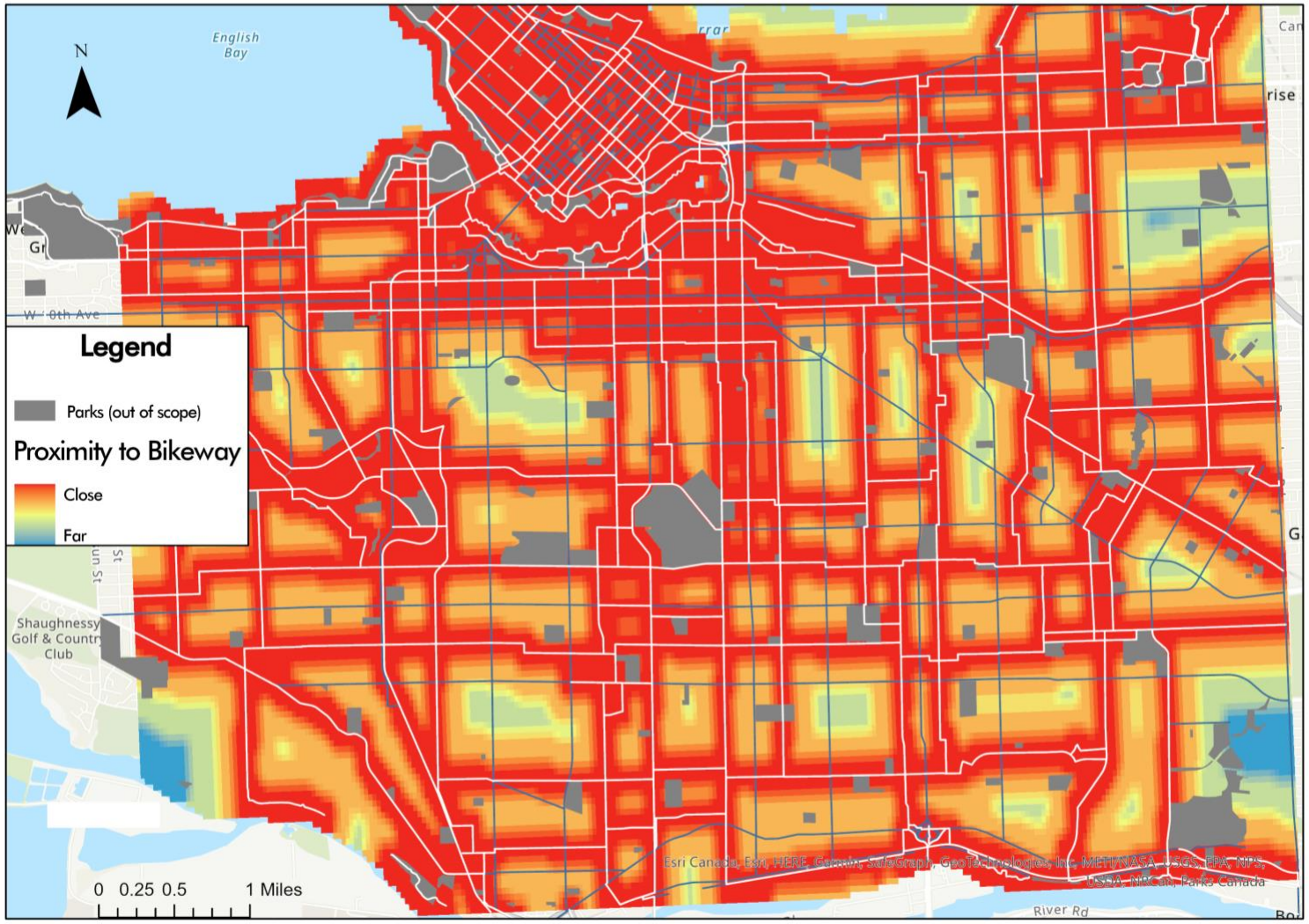
Map 2. Zoning Density

Proximity to Non-Market Housing



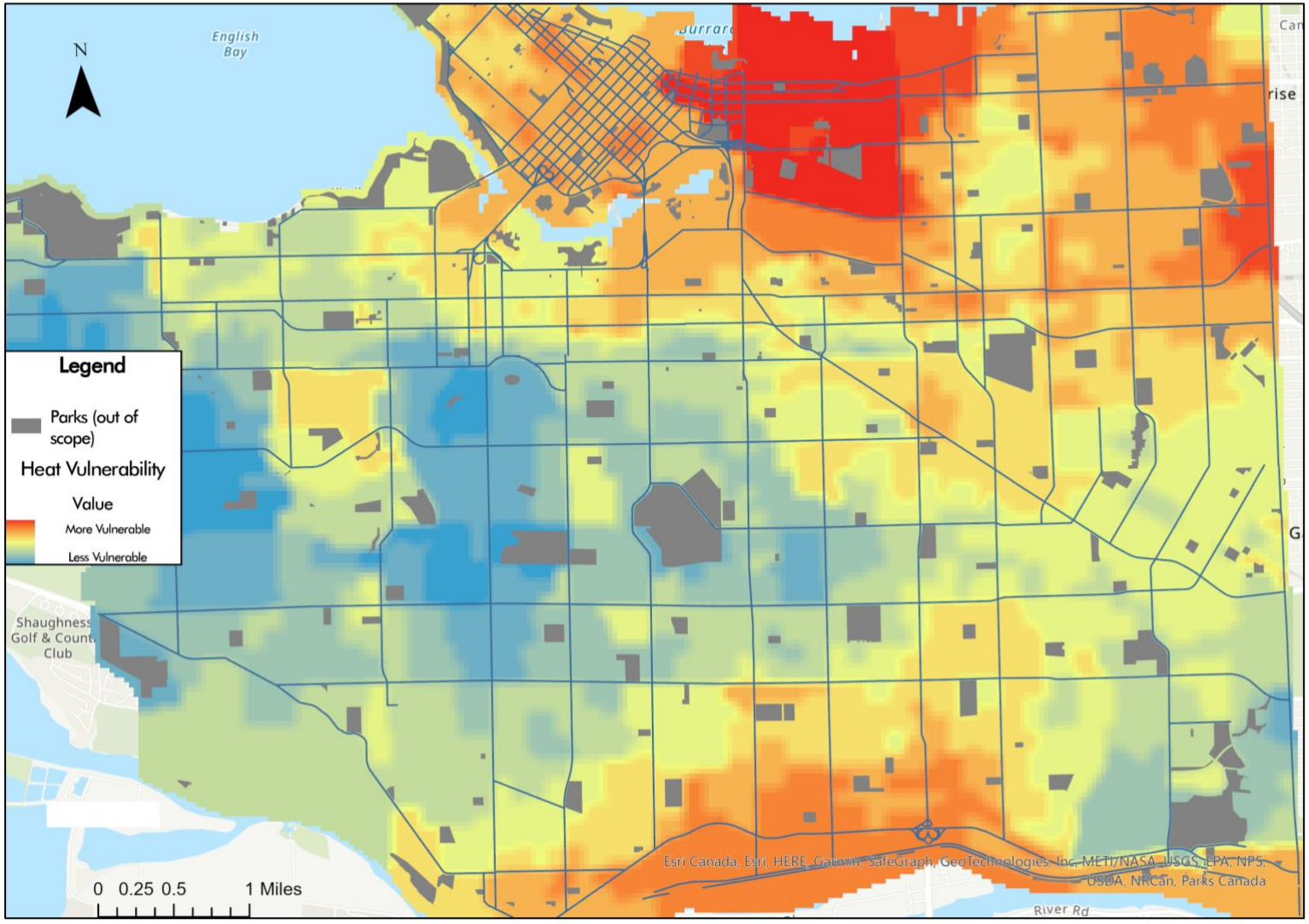
Map 3. Proximity to Non-Market Housing

Bikeways



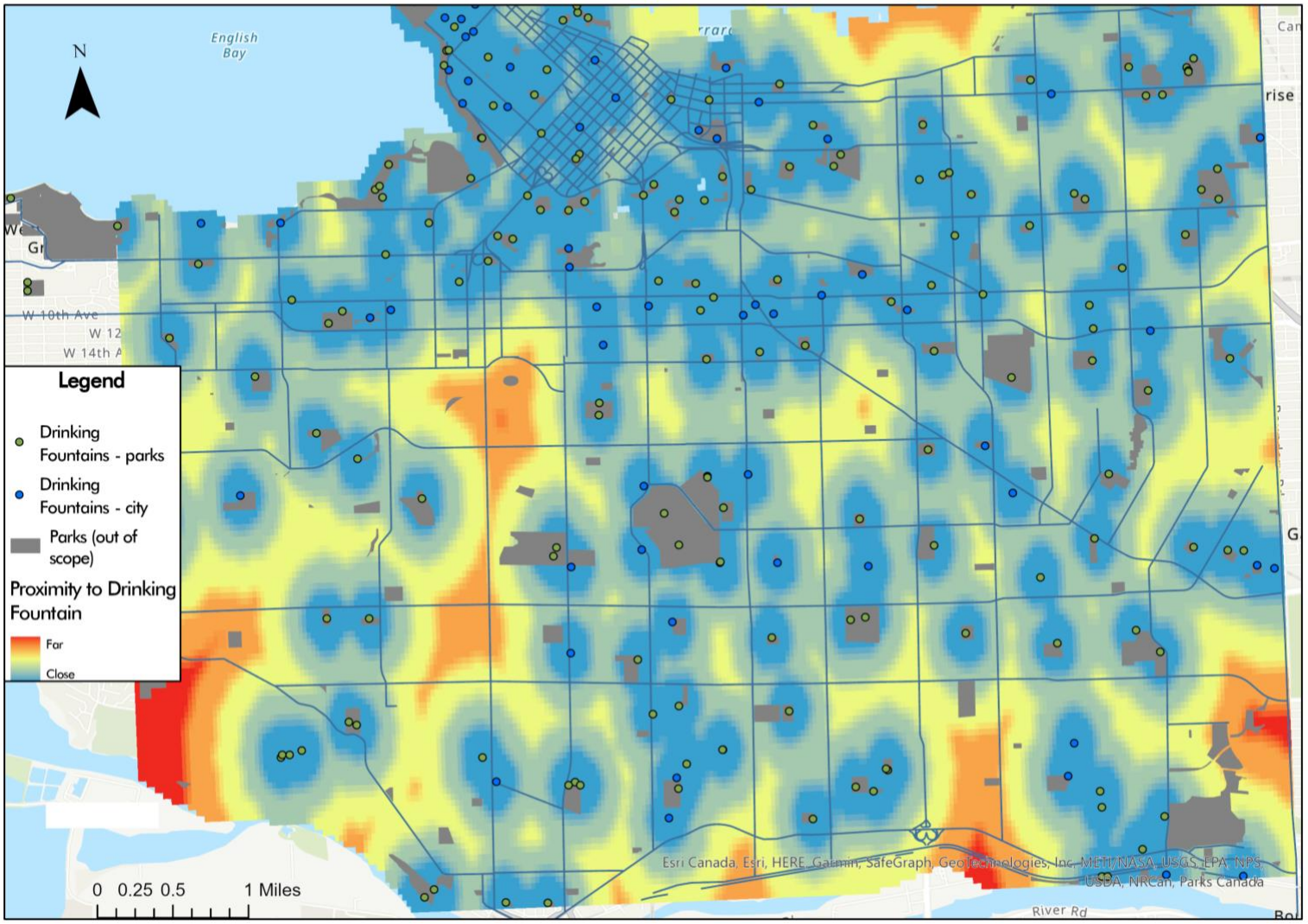
Map 4. Bikeways

Heat Vulnerability



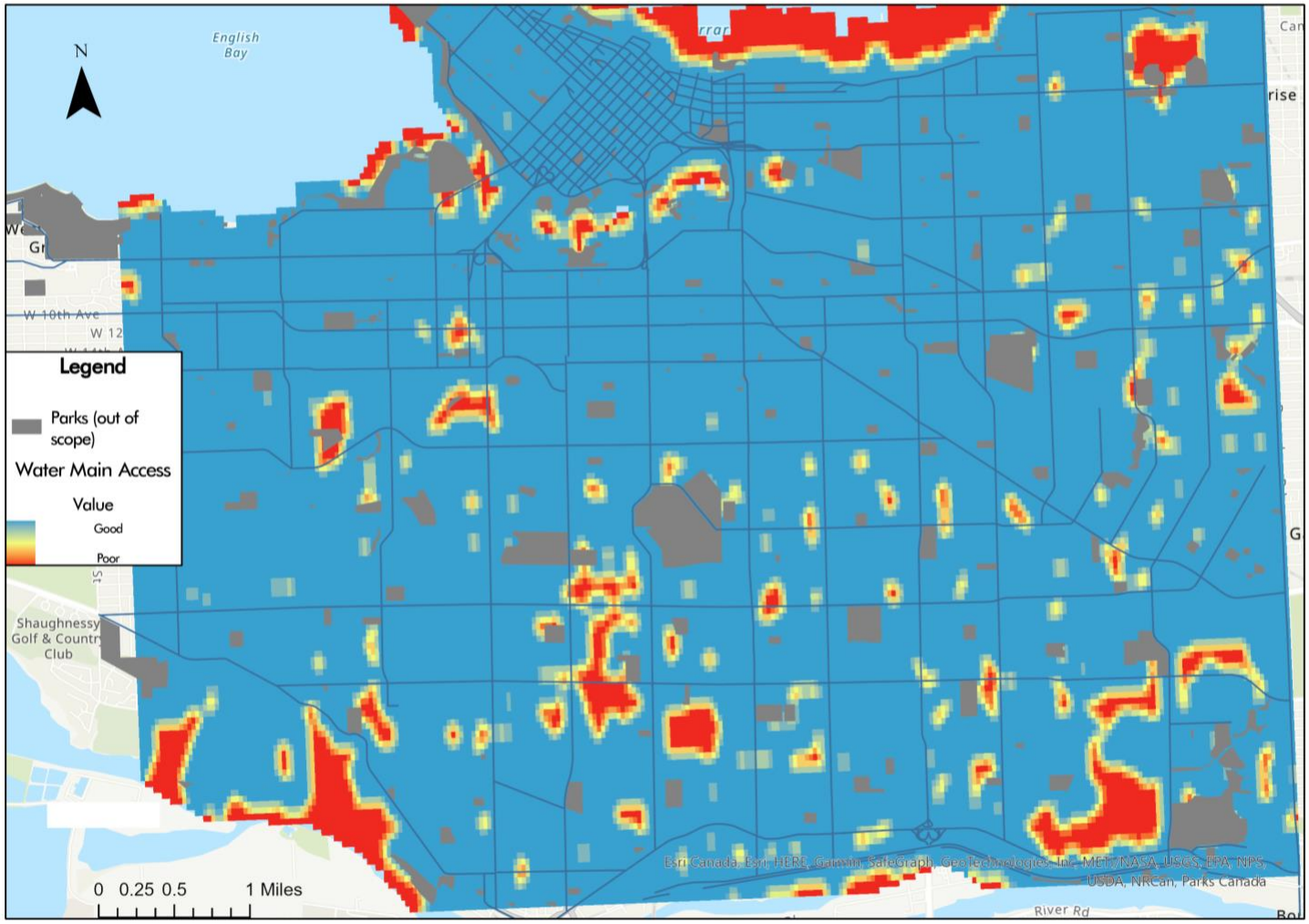
Map 5. Heat Vulnerability

Proximity to Existing Drinking Fountains



Map 6. Proximity to Existing Drinking Fountains

Suitable Water Main Access



Map 7. Suitable Water Main Access

Finally, there are 18 secondary sites that should be considered for siting new drinking fountains (see Map 8 below). These sites should be investigated once priority sites for new construction have been investigated and construction is underway (see the Five-Year Plan below). They are by nature somewhat more speculative and are contingent on where exactly the priority fountains are constructed. Therefore, I often offer less precise locations here.

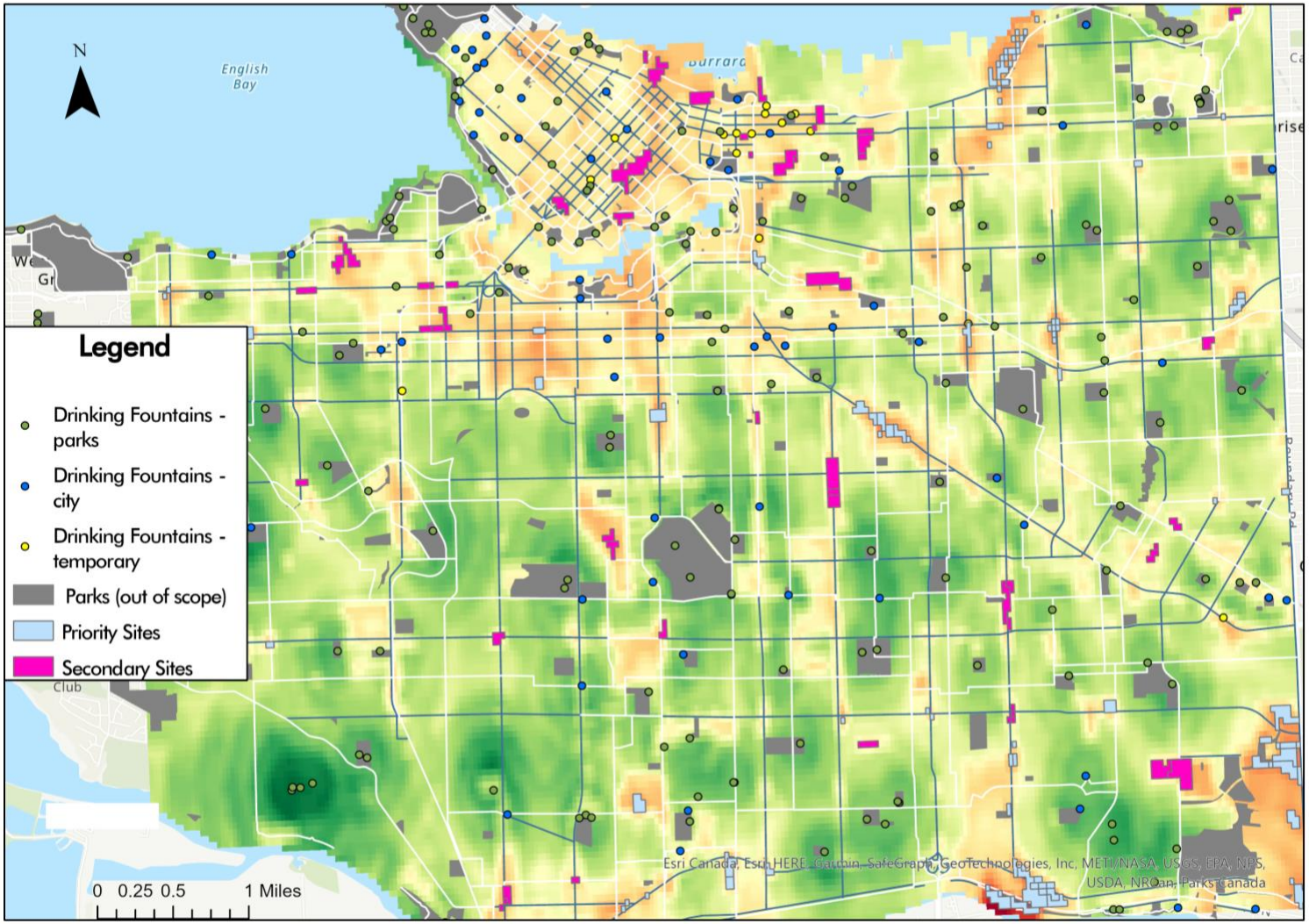
Casting a slightly wider net, as I do for these secondary sites, reveals some areas of the city with a slightly more non-specific need for drinking fountains (e.g., the Downtown Eastside, Gastown, the Downtown West End). These places show a need for more drinking water infrastructure, but no particular intersections or blocks stand out. For these areas, it is especially important to coordinate with community groups when siting fountains, as they have a strong understanding of where people congregate. I have listed potential sites that were suggested to me in informal interviews (see the Appendix), but it would be important to connect with these groups again during the siting process.

Potential secondary sites for drinking fountain construction:

- Rupert Street and Central Valley Breenway
- Vaness Ave and Rupert Street
- Kerr Street and E 54th Ave
- Victoria Drive and E 49th Ave
- Victoria Drive between E 41st Ave and E 33rd Ave
- Cambie Street and W 41st Ave
- Marpole
    - Granville Street and W 67th Ave was suggested by an interviewee at the Marpole BIA
    - Also consider: Granville Street and W 70th Ave or Oak Street and W 70th Ave
- Granville Street and W 41st Ave
- Heather Street, between W King Edward Ave and W 33rd Ave
- Macdonald Street and W 24th Ave
- Vine Street and W 4th Ave
- W Broadway between Arbutus Street and Burrard Street
- Hamilton Street between Davie Street and Nelson Street
- Downtown West End
    - Hamilton Street and Nelson Street
    - Davie Street and Marinaside Crescent
    - Richards Street and Nelson Street

- Gastown
    - Blood Alley Square
    - Maple Tree Square
    - W Cordova Street between Richards Street and Carrall Street
- Downtown Eastside
    - Columbia Street and Keefer Street (currently a temporary fountain that is widely used)
    - Main Street and E Hastings Street, particularly outside Carnegie Community Centre
    - Cordova Street and W Abbott Street
- Central Valley Greenway, between Thornton Street and Foley Street
- Campbell Street between Prior Street and E Hastings Street

Priority and Secondary Sites



Map 8. Priority and Secondary Sites for New Construction

In sum, this report recommends 29 priority sites for construction, and a further 18 secondary sites for further consideration and, ideally, construction. An investment in drinking fountain infrastructure at these sites over the next 5 years would play a major role in ensuring that Vancouverites have adequate access to drinking water as heat waves become more common, and in particular ensure that this access is equitably distributed throughout Vancouver.

Five-Year Plan and Long-Term Planning Considerations

In line with my recommendations from the previous section, here I outline a Five-Year Plan for the construction of 47 new drinking fountains, as well as some long-term planning considerations.

Five-Year Plan

Phase 1: Priority Construction

Year 1:

- Visit the 29 priority sites and ensure that all are fit for construction.
- Liaise with community groups in the vicinity of these sites.
- Determine specific locations for 15 fountains and begin installation.

Year 2:

- Determine specific locations for the remaining 14 fountains and begin installation.
- Begin to liaise with community groups relevant to the secondary sites for new construction.
- Maintain fountains constructed so far.

Phase 2: Secondary Construction

Year 3:

- Finish constructing fountains from Phase 1.
- Continue liaising with relevant community groups.
- Visit the 18 secondary sites and ensure all sites are fit for construction.
- Begin construction at half of these sites.
- Maintain fountains constructed so far.

Year 4:

- Begin construction on the other half of the fountains sited for secondary construction.
- Maintain fountains constructed so far.

Phase 3: Looking Forward

Year 5:

- Finish constructing fountains from Phase 2.

- Maintain fountains constructed so far.
- Develop an index for determining adequate and inadequate access to public drinking fountain infrastructure in absolute terms, rather than the relative terms used in this report. Developing a more objective measure will make long-term planning easier.
- *Alternatively,* the process I have outlined in this report could be repeated. After the construction of the drinking fountains recommended here, the data used in this report should be updated. From there, it can be determined which areas of the city are relatively underserved.
- Pursue potential collaboration with the Vancouver Board of Parks and Recreation on the future construction of drinking fountains.

Long-Term Planning Considerations

The long-term planning considerations for drinking fountain construction in Vancouver hinge upon two major factors. The first is the delineation of parks fountains and city fountains. As parks tend to be one of most desirable locations for drinking fountains—though, as this report has hopefully shown, far from the only possible location—a successful long-term plan would ideally involve coordination between these bodies. I suggest in year 5 of the above plan that collaboration with the Parks Board should be pursued for precisely this reason.

The second factor is the creation of a more objective index for what constitutes an adequate level of public water access in an urban area. The development of such an index would likely be a project at least as demanding as the one outlined here, even if it did not involve siting new fountains. However, an index of adequate public water access would be immensely useful for long-term planning. Benchmarks could be created for a basic level of water access, and plans could be made to bring every part of Vancouver up to that level of access. While investment in the fountains suggested here would be hugely impactful, the subjective views expressed by interview participants (see Appendix) suggest that the City may need to pursue significant further construction in order to reach a sufficient level of service.

In the absence of an objective index, it would be useful to recreate the map according to the methodology I outlined above every 5 years with new data to track demographic developments as well as shifting vulnerability throughout the city. If climate change continues to progress at its current clip, then it will be necessary to continually reevaluate which areas of the city are most in need of new construction.

Possibilities for Future Research

In addition to pursuing the construction of new drinking fountains as outlined in the Five-Year Plan above, this report points to several areas where more research would be useful. Many of these recommendations have been alluded to elsewhere in the report.

First, it would be ideal if the Waterworks Utility and the Vancouver Board of Parks and Recreation could collaborate on a plan for future drinking fountain construction after the Five-Year Plan outlined above is completed. The planning considerations for which parks most urgently need new drinking fountain construction may differ from the considerations developed here. Nonetheless, given that the Parks Board and Waterworks are both tasked with bringing potable water into the public realm, it would be useful to generate a long-term plan coordinating the interests of these branches of the city government. Coordinating on these plans would ensure that new infrastructure is distributed efficiently and cost-effectively throughout the city. Research into potential avenues for collaboration would be useful here.

Second, further research into what constitutes a sufficient level of public water access would help to inform how many new drinking fountains ought to be constructed. As I detail in Appendix 1, many of the community organizations (Business Improvement Areas and Community Policing Centres) that I interviewed expressed that their neighborhood needed more drinking fountains. It would be useful to develop a standard by which to measure adequate and inadequate access to public drinking water in absolute terms, as opposed to the relative terms adopted by this report. To my knowledge, there does not currently exist a method for measuring this.

Third, as a geographer I feel it is my duty to point out that there is one further aspect of accessible drinking fountain placement that could profitably be studied. This is the *mobility* of different residents of the city. The fact that people are able to move in different ways and at different speeds is an important aspect of the human geography of any urban area (Cresswell, 2011). For instance, older adults may not be able to walk as far between fountains. At the other end of the spectrum, bikers and runners are likely to want to travel further between fountains, so it would be reasonable to place drinking fountains on bikeways at wider intervals.

What does this mean for drinking fountain construction? It means that it is very difficult to determine *in general* how far apart drinking fountains should be from one another. It means that how far it is reasonable to expect people to travel between drinking fountains is not a function of distance but of the mobility of the group in question. A project aimed at understanding the relative mobility of different groups in different parts of the city would likely be vast and

complicated, but it would be a useful component of any inquiry into what constitutes a sufficient level of public water access.

Summary

This report has argued that new drinking fountains should be installed at 29 priority sites and 18 secondary sites throughout the City of Vancouver over the next five years. Building new infrastructure at these locations will grant increased access to drinking water to underserved areas of the city, ensuring equitable access for all Vancouverites. As climate change accelerates and heat waves become more frequent, honoring Vancouver's commitment to drinking water as a human right means making public drinking infrastructure as plentiful as possible. Likewise, access to drinking water will reduce reliance on single use plastics and cut down on the consumption of sugary drinks. Building new infrastructure according to the distribution outlined in this report will meet these goals as efficiently and cost-effectively as possible.

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Appendix: Interviews with Community Members

As part of this project, I conducted informal interviews with various community groups around Vancouver. There were two major goals for these interviews. The first was to assess need for and interest in new drinking fountain construction. The second was to determine what considerations community groups think the city should account for when siting new fountains.

I contacted 33 community organizations, received responses from 12 organizations, and ultimately conducted 8 interviews. The list of organizations to contact was provided by Robyn King and Chris Twemlow, and consisted of Business Improvement Associations (BIAs) and Community Policing Centres (CPCs) across Vancouver. In the following discussion, I have anonymized the results of my interviews.

I asked three major questions in each interview, but permitted the conversation to evolve away from these questions depending on the participants' responses. I asked (1) if there was a perceived need for more drinking fountains in the community (and, relatedly, if this need manifested during the heatwave of 2021), (2) what the city should consider when siting new drinking fountains, and (3) if there are particular areas that would be a good candidate for a drinking fountain in the community. I emphasized to the participants that this research is exploratory in nature and, while I strongly advocate for new drinking fountain infrastructure in many areas of the city, these conversations did not indicate any kind of commitment from the city to undertake construction.

The participants were unequally distributed throughout the city, with the highest cluster being in the downtown core and the Downtown Eastside. Participants from Marpole, South Main, and South Fraser were also included. These results should therefore be taken with a grain of salt, given the geographic bias of the sample. A more formal survey would need to confront the lack of response from parts of the city that are unrepresented here. This is all to say that while there are some interesting and even illuminating findings here, a more formal and encompassing study should be undertaken to verify these findings. Lastly, my including of the perspectives represented here should not be interpreted as an endorsement.

All 8 interview subjects expressed subjective need for new drinking fountain infrastructure in their community and hoped the city would construct new infrastructure. All groups also hoped to be contacted by the city in the event that a fountain would be sited in their area, as they feel they can provide important perspective in the siting process. Interestingly, however, the desire for more drinking fountains was tempered by several concerns.

First, four participants expressed concern that the city must maintain and clean any new infrastructure they build. This was accompanied by concern that drinking fountains should be built in visible areas to avoid attracting "illegal" activity. Participants emphasized the drinking fountains should "be for everyone."

Second, multiple participants emphasized the limitations of drinking fountains for ensuring the hydration of Vancouverites. Three participants noted that unless drinking fountains are placed very closely together throughout the city, residents will need reusable water bottles to carry water with them. These three participants, independently of each other, wondered if the city had considered any kind of reusable water bottle distribution program to accompany new fountain construction, as well as education about routinely carrying drinking water.

Community groups across the city reported distributing water bottles during the heat wave last year. These groups agreed that new fountain construction, as well as an increased use of reusable water bottles, would take the burden off community groups to provide drinking water during heat events.

One participant strongly advocated for more drinking fountain construction on the Downtown Eastside. This participant felt that water access essentially boils down to a question of housing security: those who are securely housed have steady access to water; those who are not securely housed do not have access to water. They argued that for the unhoused, access to water is the real issue and they truly need public water sources; for everyone who is securely housed, it is more an issue of education, i.e., of owning and using a reusable water bottle.

The second and third questions tended to blur together in conversation, as people usually moved between general statements (e.g., "fountains should be built in busy areas") and concrete statements (e.g., "we could use a fountain at 48th and Fraser"). However, basically every participant agreed that fountains should be built in (1) busy parks with lots of shade, and (2) central intersections in commercial areas. Option (1) is out of scope for this project but speaks to the potential usefulness of collaborating with the Parks Board on future construction.

One important shared concern was that community groups be involved in the process of siting fountains in particular areas. In other words, if the city elects to build a new drinking fountain within the remit of a particular BIA, the BIA can be seen as a valuable partner to the city in this process because they are a reservoir of local knowledge. Although the map might, for instance, show very high need for a drinking fountain at 49th and Fraser, consultation with community groups might reveal that 48th and Fraser is a more appropriate site.

Outside of the questions I asked directly, six participants independently noted that they would like more temporary drinking fountains in their community. They felt that permanent drinking water infrastructure was desirable, but in the short term, and particularly for hot summers, temporary infrastructure should be deployed more widely. Lastly, three participants expressed concern that new drinking fountain infrastructure should include a spigot at the bottom for pets. The type of fountain to be installed is, of course, out of scope for this project.

In sum, surveyed community groups were overwhelmingly in favor of new drinking fountains construction, but hope the city will consider several adjacent matters in conjunction with this project. They also hope to be included in the process of siting fountains when the city undertakes construction in their vicinity.