A Policy Analysis: Evaluating the Level of Service Standard for Lynnwood's Park System

Photo: Scriber Lake Park

Report prepared for the City of Lynnwood Parks,
Recreation & Cultural Arts Department

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EXECUTIVE SUMMARY

The City of Lynnwood is experiencing rapid population and development growth. With about 40,600 current residents and 7.89 square miles of land area, the city faces rising property values, limited buildable land, and increased construction costs. These factors have contributed to the reduction of Lynnwood's parks Level of Service (LOS) standard from 10 acres per 1,000 residents to 3.5 acres per 1,000 residents. To address this problem, the City of Lynnwood Parks, Recreation & Cultural Arts (PRCA) Department sought to re-evaluate its LOS methodology. Therefore, our overarching research questions were:

1. What is the prevailing standard methodology of Lynnwood's LOS policy, and are there current and future needs that should be addressed?
2. Based on the research of current best practices, which metrics should be integrated into the LOS standards to more accurately represent the values and needs of the Lynnwood community?

We first conducted an extensive literature review of current LOS measures used by parks departments in the U.S. From this research and the specific needs of the City of Lynnwood, we focused our policy analysis on the following options:

1. Status Quo (Park Acreage per Resident)
2. Park Access (Percent of Residents living within ½ Mile Walk to Park)
3. Capital Value Per Person
4. Trail Connectivity (Total Trail Mileage)

We evaluated the policy options on their ability to represent *social health equity, economic equity, environmental equity, and usage demands* within the city. Based on our literature review, our evaluation of specific policy options, and feasibility considerations, we ultimately recommend a two-tiered approach: the City of Lynnwood should adopt the **half-mile walk** to a park or trail LOS into its future comprehensive parks planning, and prepare to use **capital value per person** as its long-term LOS approach.

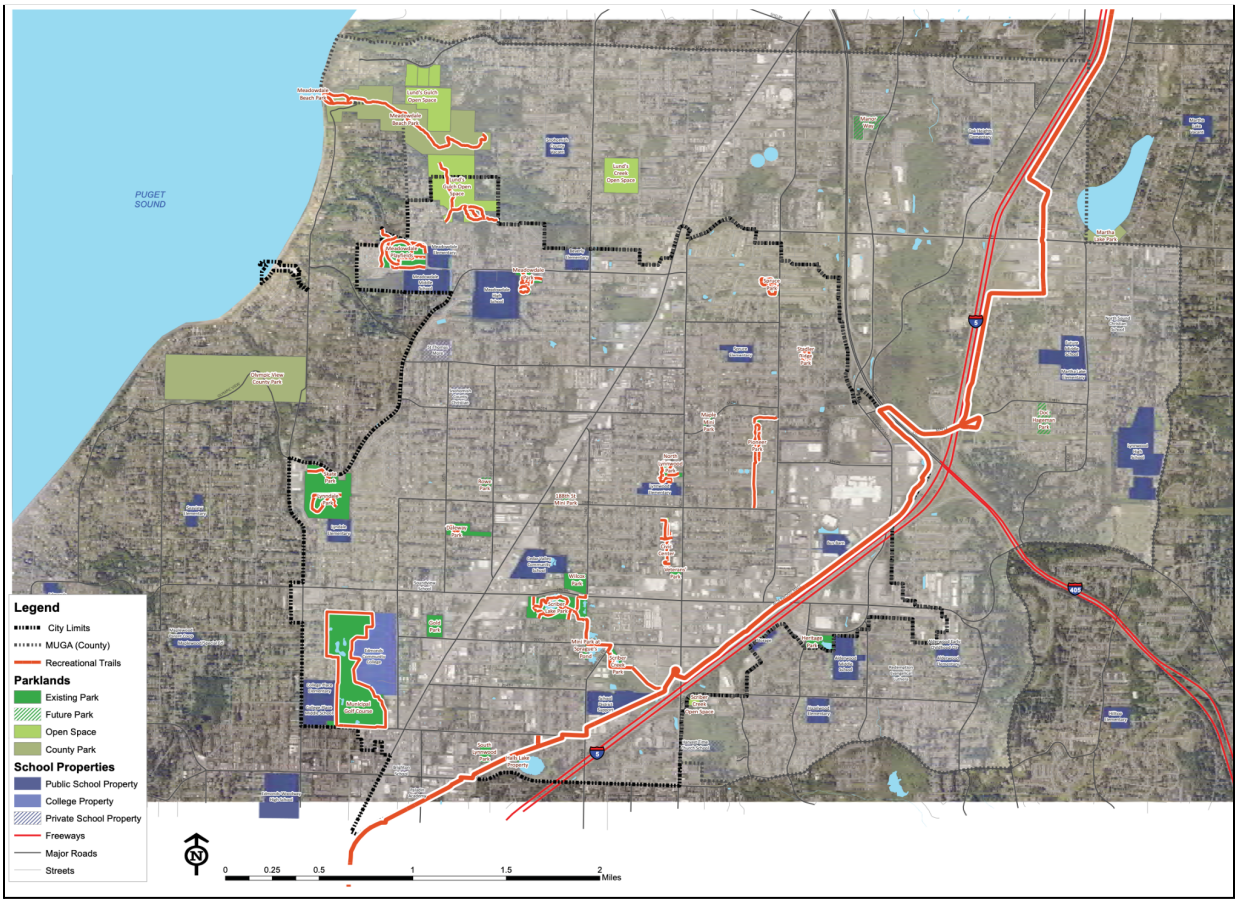
Additionally, our assessment and scoring of the current parks system may help the PRCA Department identify gaps in parks service and subsequent planning goals. Regardless of the City's ultimate decision, we view this report as a tool to aid further Level of Service evaluation.

CHAPTER ONE: INTRODUCTION

1.1 Background

The City of Lynnwood Parks, Recreation & Cultural Arts (PRCA) Department aims to *create a healthy community through people, parks, programs and partnerships.*[1] The PRCA Department is responsible for planning and developing parks and recreational facilities, operating and maintaining them, and providing affordable recreational activities and programs to residents of all ages in the City of Lynnwood.

To reach these goals, Lynwood has a ten-year comprehensive Parks, Arts, Recreation, and Conservation (PARC) Plan to provide services through 2025. The PRCA Department is updating this plan in 2022, and seeks recommendations to improve current program evaluation measurements.



Map 1: Citywide parks, open space & trails.[2]

[1] City of Lynnwood. (n.d.). 2016 PARC Plan.
[2] City of Lynnwood. (n.d.). 2016 PARC Plan.

The main goals of the PARC Plan:[3]

1. To foster a healthy, active community
2. To create great parks & spaces
3. To ensure sound management
4. To prepare for the future
5. To encourage connectedness

The PRCA Department evaluates its park system using Level of Service (LOS) standards. The status quo LOS methodology is park acreage per 1,000 residents. However, to better address the current and future needs of the local community, the National Recreation and Park Association (NRPA) encourages agencies to develop their own LOS standards rather than rely on any national standards.[4] Therefore, our study focused on finding the most representative LOS measurement for the City of Lynnwood and evaluated the current park system's performance based on it.

1.2 Problem

Lynnwood is experiencing rapid population and development growth. With about 40,600 current residents and 7.89 square miles of land area, the city faces rising property values, limited buildable land, and increased construction costs. These factors have contributed to the reduction of Lynnwood's LOS standard from **10 acres per 1,000 residents** to **3.5 acres per 1,000** residents in 2016.[5] This current measurement does not fully reflect the value of the parks systems and it will continue to decrease over time due to population growth. To help the City of Lynnwood improve its parks and trails services for all residents (while still considering future sustainable development), the PRCA Department is actively searching for alternative policies to update its LOS standard.

Given the available resources provided by the City of Lynnwood (reports, plans, data, examples from other cities), our overarching research questions were:

1. **What is the prevailing standard methodology of Lynnwood's LOS policy, and are there current and future needs that should be addressed?**

2. **Based on the research of current best practices, which metrics should be integrated into the LOS standards to more accurately represent the values and needs of the Lynnwood community?**

[3] City of Lynnwood. (n.d.). PARC 2017-2018 Report.
[4] Barth, D. (2016). *Alternatives for Determining Parks and Recreation Level of Service*. American Planning Association. http://www.barthassoc.com/wp-content/uploads/2017/01/Barth-PAS-Memo-5_16.pdf
[5] City of Lynnwood. (n.d.). Park Usage Study.

1.3 Client Objective & Deliverables

Guided by the research questions and the Deputy Director of Lynnwood's PRCA Department, Sarah Olson, this project consisted of four main components:

1. **Literature Review**
   An evaluation and discussion of *alternative LOS methodologies*, with the status quo being parkland acre per 1,000 residents. Through a literature review and summary of successful examples, the following measures were reviewed:
   a. Park Access (Proximity): percent of residents living within a half-mile walk of a park
   b. Park Access (Barriers): investment in removing walking network barriers
   c. Park Quality (Condition): measure of deferred maintenance and ADA compliance issues
   d. Park Quality (Variety): mix and location of park amenities
   e. Park Availability: measure of park capacity, use, and demand
   f. Trail Connectivity: total linear miles, trail ratio to population, and overall connectedness
   g. Capital Value Per Person: ratio of a city's total value of parks and recreation inventory compared to their equivalent population

2. **Current Lynnwood Park System**
   We combined available data to summarize and analyze each parks' characteristics based on the proposed LOS measures.

3. **Policy Analysis**
   We conducted a policy analysis on the alternative LOS measurements. The criteria for evaluation was informed by the literature and based on Lynnwood's PARC Plan's main goals and values. For each LOS measurement, we focused on evaluating social, economic, and environmental equity while also considering Lynnwood's future needs.

4. **Final Scorecard & Recommendation**
   Based on the policy analysis, we chose the most representative LOS measurement(s) to incorporate into the final scorecards for all Lynnwood parks. This included setting benchmark standards and a final recommendation for incorporation into Lynnwood's 2022 PARC comprehensive plan.

1.4 Key Findings

Based on the literature review, quantitative policy analysis, and ease of model replicability feedback, we recommend that the City of Lynnwood adopt the **half-mile walk** to a park or trail LOS into its future comprehensive parks planning, and prepare to use **capital value per person** as its long-term LOS approach. Within this recommendation, we highlight important trade offs and implementation considerations. Regardless of the City's ultimate decision, we view this report as a tool to aid further level of service evaluation.

CHAPTER TWO: DIAGNOSIS & RESEARCH

2.1 Literature Review Summary

The purpose of this review is to help readers more easily understand the various methods used in the process of park assessment. Our research focused on academic reports and government documents related to park projects and evaluations. This review summarized several methods used by city governments to analyze the parks service level: park access, park quality, park availability, trail connectivity, and capital value.

For **park access**, one significant finding showed that most people were willing to walk less than half a mile to a park, which equated to about 10 minutes or less of walking time.[6] Furthermore, when people felt that there were obstacles on their route, or their personal safety was uncertain, their access to the park became restricted.[7] Due in part to the historical inequities in urban planning, low-income communities and communities of color have disproportionately experienced less access to quality parks in some U.S. cities.[8]

In addition to park access, the **condition and variety** of parks were closely related to the well-being of community residents. Literature showed that high-quality parks not only benefited people's physical and mental health,[9] but also acted as an excellent social gathering space,[10] which in turn further benefited their community.[11] Deferred maintenance (the process of postponing maintenance operations), ADA compliance issues, and the variety of amenities available were key factors to measuring the quality of a park.[12] To improve the life cycle of park facilities, researchers cited several methods: shorten deferred maintenance, improve park and trail accessibility design, seek partnerships with non-profit organizations, and create or improve facilities.[13]

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[6] Harnik, P., & Martin, A. (2016). *Close-to-Home Parks: A Half-Mile or Less* [PDF]. The Trust for Public Land.
[7] *Safe Routes to Parks: Improving Access to Parks through Walkability* [PDF]. (n.d.). Ashburn: National Recreation and Park Association.
[8] U. (2011, July). Disparities in Park Space by Race and Income. Retrieved from https://activelivingresearch.org/sites/activelivingresearch.org/files/PolicyBrief_ParkDisparities_0.pdf
[9] Godbey, G., Mowen, A. (2010). The Benefits of Physical Activity Provided by Park and Recreation Services: The Scientific Evidence. *National Recreation and Park Association*. Retrieved January 29, 2021, from http://www.deltastate.edu/PDFFiles/hper%20outdoor%20program/benefits%20of%20PA%20provided%20by%20P&R%20services.pdf
[10] Roberts, H., Kellar, I., Conner, M., Gidlow, C., Kelly, B., Nieuwenhuijsen, M., & McEachan, R. (2019, October 20). Associations between park features, park satisfaction and park use in a multi-ethnic deprived urban area. *Urban Forestry & Urban Greening,* 46. Retrieved January 29, 2021, from https://www.sciencedirect.com/science/article/pii/S1618866719301323
[11] McCormack, G., Rock, M., Toohey, A., & Hignell, D. (2010, March 12). Characteristics of urban parks associated with park use and physical activity: A review of qualitative research. *Health & Place*, 16(4), 712-726. Retrieved January 29, 2021, from https://www.sciencedirect.com/science/article/pii/S1353829210000316#bib20
[12] Chen, S. (2020). *Exploring Park Quality in Urban Setting with Environmental Justice, Alternative Measurements, and Social Interaction.* DigitalCommons@USU. https://digitalcommons.usu.edu/cgi/viewcontent.cgi?article=8930&context=etd
[13] Godbey, G., Mowen, A. (2010).

City **trails** can act as a subcomponent to park access, with special attention placed on trail connectivity and trail type. Trails can range from steep forested hikes to paved low-grade pathways that are accessible for all-ages and all-abilities. Parks departments use the total linear miles of trails as the most common Level of Service (LOS) metric.[14] Just like parks themselves, trails can provide citizens with physical and mental health benefits, and make the community as a whole more desirable.[15]

Capital value is a measurement that allows for cities to provide a current baseline value in preparation for future population growth. By making an LOS service based on population and economic value, cities can more effectively predict and budget for future park improvements. The nearby city of Issaquah has recently implemented this novel measurement as the LOS standard for their park system.[16] The City of Lynnwood also uses this measurement to assess its park impact fee rates.

Each parks department is unique and must find an LOS standard that fits their community. Parks are seen as an essential service for their economic value, health and environmental benefits, and social importance.[17] Successful LOS measurements properly reflect these values and are *easy to replicate, clear to understand, and in line with planning goals, equity considerations, and community needs*.[18]

Through this research, we gained a clearer understanding of the general theory behind the LOS approach, and how LOS analysis is used in conjunction with other methodologies to help determine current and future needs for cities. We were able to more closely consider the proposed metrics that were initially suggested (accessibility, quality, etc.) as well as some potential alternative metrics that might help to address community needs. Finally, we gathered enough information to begin the process of creating and evaluating a new LOS framework for Lynnwood's Parks, Recreation & Cultural Arts (PRCA) Department.

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[14] NRPA: National Recreation and Park Association. (2020). *Agency Review.* https://www.nrpa.org/siteassets/nrpa-agency-performance-review.pdf

[15] Washington State Recreation and Conservation Office. (2019). *Executive Summary: Economic and Health Benefits of Walking, Hiking and Bicycling on Recreational Trails in Washington State*. https://rco.wa.gov/wp-content/uploads/2020/01/HikingBikingExecSummary.pdf

[16] *Parks Strategic Plan* [PDF]. (2018). Issaquah: City of Issaquah.

[17] NRPA: National Recreation and Park Association. (2010). *Why Parks and Recreation are Essential Public Services.* https://www.nrpa.org/uploadedFiles/nrpa.org/Advocacy/Resources/Parks-Recreation-Essential-Public-Services-January-2010.pdf

[18] Barth, D. (2016). *Alternatives for Determining Parks and Recreation Level of Service*. American Planning Association. http://www.barthassoc.com/wp-content/uploads/2017/01/Barth-PAS-Memo-5_16.pdf

2.2 Full Literature Review

This chapter is a review of the information we gathered in our examination of current and historical literature on the park assessment process. The majority of our literature review focuses on academic reports and government documents related to park programs and evaluations. We reviewed the following measures currently used by city governments for analyzing their parks Level of Service (LOS):

1. Park Access (Proximity): percent of residents living within a half-mile walk of a park
2. Park Access (Barriers): investment in removing walking network barriers
3. Park Quality (Condition): measure of deferred maintenance and ADA compliance issues
4. Park Quality (Variety): mix and location of park amenities
5. Park Availability: measure of park capacity, use, and demand
6. Trail Connectivity: total linear miles, trail ratio to population, and overall connectedness
7. Capital Value per Person: ratio of a city's total value of parks and recreation inventory compared to its equivalent population

These themes and metrics were chosen because they comprised the most likely alternative measurements for calculating LOS for Lynnwood's park system.

2.2.1 Park Access

Proximity

In order for people to benefit from the parks in their city, one or more parks need to be located in close proximity to where they live. Studies have shown that most people are willing to walk a half-mile to their neighborhood park, which translates to a 10-minute travel time for nearly all pedestrians.[19] While the half-mile benchmark is used most frequently, some cities have implemented other proximity standards that are both greater and less than the half-mile benchmark for analyzing park LOS. Some studies have shown that low-income neighborhoods and communities of color have fewer quality parks located within walking distance.[20] Because of the historical inequities in city planning, it is important to recognize how living further from parks may negatively impact certain communities more than others.

Barriers

While proximity to parks is undoubtedly the most significant barrier to enjoying the benefits of a city park, there are many obstacles that may limit someone's ability to travel to a park. For example, if a park is a half-mile away but there is not a safe way to get to the park, it becomes much less beneficial to the potential user. Lack of infrastructure that allows pedestrians to walk to parks like sidewalks, bridges, and crosswalks are significant barriers when it comes to

[19] Harnik, P., & Martin, A. (2016). *Close-to-Home Parks: A Half-Mile or Less* [PDF]. The Trust for Public Land.
[20] Burrowes, K. (2020, April). *Is COVID-19 Uncovering Park Inequities?* [PDF]. Ashburn: National Recreation and Park Association.

traveling by foot to a park.[21] Other known barriers to parks are traffic and crime safety; if people did not feel safe in the park or while traveling to and from the park, their access can be severely limited.

2.2.2 Park Quality

Condition

The quality of the park may impact the park usage. To better understand the park quality in the City of Lynnwood, we studied the condition of parks in Lynwood from two perspectives: 1) deferred maintenance, and 2) ADA compliance issues.

In general, deferred maintenance is the process of postponing maintenance operations in order to save money, meet budget funding levels, or realign available budget funds, such as renovations to both real estate and personal property. Addressing deferred maintenance is critical to preserve the safety and performance of the parks and provide a joyful visiting experience to city residents in Lynnwood.

Deferred maintenance may lead to the following problems impacting parks and open spaces:[22]

1. Unreliability and unavailability
   Sometimes buildings and facilities are not available due to a lack of management or maintenance. Without safe and reliable amenities and spaces, the daily activities of the local community can not be carried out as planned, resulting in a decrease in life satisfaction, productivity, and operational efficiency.

2. Code compliance
   Some local building codes have very specific requirements for safety and operation. Improper or non-performing maintenance can also endanger compliance with regulatory standards.

3. Increased safety risk
   When a park is not maintained as expected, the safety risk to park visitors and local residents will increase. In addition, there are other less obvious risk increases, such as insurance risk and liability. These risks can increase a city's cost of ownership and total ownership burden.

4. Overburdened maintenance personnel
   By deferring maintenance, a city requires maintenance personnel to carry out more work, which makes maintenance technicians overburdened, reduces their work quality, and increases the cost of facilities maintenance. By postponing maintenance or using

[21] *Safe Routes to Parks: Improving Access to Parks through Walkability* [PDF]. (n.d.). Ashburn: National Recreation and Park Association.
[22] CGLcompany (n.d.). *CGL-White Paper: Deferred Maintenance Crisis.* [PDF].

subcontractors for maintenance, cities actually spend more, especially over the life of the park.[23]

The Americans with Disabilities Act of 1990 (ADA) is a civil rights law that prohibits discrimination on the basis of a disability. ADA requires that newly constructed and altered state and local government assets, public places, and commercial facilities shall be readily accessible and usable to individuals with disabilities. Recreation facilities, such as public open parks, are among the types of facilities covered under the ADA. A recent assessment of Lynnwood's legacy park system showed that at least some facilities in every park and open space are out of compliance with the ADA Standards for Accessible Design. [24]

Cities must address ADA compliance issues to ensure that all citizens, regardless of disability status, can enjoy and benefit from the parks system. This is especially true considering that physically or mentally disabled people are often low participants in outdoor activities. Facilities that are obstructed or inaccessible further perpetuate already present inequities and may lead to serious consequences for the health and well-being of those considered disabled under the ADA. Overall, not complying with ADA standards can lead to negative physical and social outcomes for a community.[25] Additionally, ADA compliance issues may cause local citizens or visitors who are seeking fair access to sue the local government with ADA compliance lawsuits. [26]

Variety

For the variety of park quality, the City of Lynnwood seeks standards in setting the mix and location of park amenities. The literature review in this section focused on 3 areas: 1) the definition of park amenities, 2) the importance of promoting park quality (variety), and 3) the measurement and improvement of park amenities.

Park amenities are common-use amenities and facilities located within the park that are available to all residents.[27] Generally, there are four benefits of promoting a range, in both variety and location, of park amenities. The first two benefits are based on the theory that park amenities can increase the number of physical activities held in parks.[28] Therefore, these activities can not only directly increase park usage but also facilitate sports and social interactions among multiple age

[23] CGL Company. (2020). Whitepaper: The Deferred Maintenance Crisis Predicting Negative Effects. https://www.cglcompanies.com/wp-content/uploads/2020/09/DeferredMaintenanceWhitepaper_2020updated.pdf
[24] City of Lynnwood. (n.d.). 2016 PARC Plan.
[25] Rimmer, J.H. (2008). *Promoting inclusive physical activity communities for people with disabilities.* President's Council on Physical Fitness and Sports Research Digest, 9, 1-8.
[26] Torrez, D. (2019, February 21). *The Real Reason Local Governments are Facing More ADA Non-Compliance Fines*. Www.Civicplus.Com. https://www.civicplus.com/blog/ce/local-governments-facing-ada-accessibility-fines
[27] Mountain View Mobile Home Park Rules and Regulations. Retrieved March, 1 from: https://www.lawinsider.com/documents/5euKmjh4RQX#park-facilities
[28] McCormack, G., Rock, M., Toohey, A., & Hignell, D. (2010, March 12). Characteristics of urban parks associated with park use and physical activity: A review of qualitative research. *Health & Place*, 16(4), 712-726. Retrieved January 29, 2021, from https://www.sciencedirect.com/science/article/pii/S1353829210000316#bib20

groups, which provides health benefits to the community.[29] [30] Because different demographic groups have different needs in park amenities,[31] improving the diversity of park features can directly lead to the third benefit: increased park satisfaction among different ethnic and socioeconomic groups.[32] Emerging research on park amenities shows disparities among low-income and minority populations when compared to high-income and white populations.[33] This implies that improving park amenities policies can lead to the fourth benefit: increased equity between neighborhoods.

There is no uniform LOS standard for recreation facilities in the U.S., as the number and the type of facilities needed varies differently across communities.[34] Park amenities are commonly measured as 1) prevalence and population per facility, 2) facilities per capita, and 3) quality LOS standards for parks and recreation facilities. [35] [36] These measurements not only focus on the quality and availability of park amenities, but also manage to represent the equitable distribution of various park facilities in the community.

1. Prevalence and population per facility
   This measurement separates indoor and outdoor park facilities. For a typical park and recreation agency in 2020, the top three most common park amenities were measured as: one playground for every 3,750 residents; one basketball court for every 7,400 residents; and one outdoor tennis court for every 5,004 residents.[37] For indoor amenities, the top three most common park amenities were measured as: one recreation center to serve 31,141 residents, one community center serves 28,939 residents, and one senior center serves 60,513 residents.[38] The City of Lynnwood only has **one recreation center** and **one**

[29] Cohen, D., Marsh, T., Williamson, S., Derose, K., Martinez, H., Setodji, C., & McKenzie, T. (2009, October 19). Parks and physical activity: Why are some parks used more than others? *Preventive Medicin*e, 50, S9-S12. Retrieved January 29, 2021, from https://www.sciencedirect.com/science/article/pii/S009174350900485X
[30] Godbey, G., Mowen, A. (2010) The Benefits of Physical Activity Provided by Park and Recreation Services: The Scientific Evidence. *National Recreation and Park Association*. Retrieved January 29, 2021, from http://www.deltastate.edu/PDFFiles/hper%20outdoor%20program/benefits%20of%20PA%20provided%20by%20P&R%20services.pdf
[31] Kaczynski, A., Besenyi, M, G., Stanis, A, W, Sonja. (2014, December 6). Are park proximity and park features related to park use and park-based physical activity among adults? Variations by multiple socio-demographic characteristics. *International Journal of Behavioral Nutrition and Physical Activity*, 146. Retrieved January 29, 2021, from https://ijbnpa.biomedcentral.com/articles/10.1186/s12966-014-0146-4
[32] Roberts, H., Kellar, I., Conner, M., Gidlow, C., Kelly, B., Nieuwenhuijsen, M., & McEachan, R. (2019, October 20). Associations between park features, park satisfaction and park use in a multi-ethnic deprived urban area. *Urban Forestry & Urban Greening,* 46. Retrieved January 29, 2021, from https://www.sciencedirect.com/science/article/pii/S1618866719301323
[33] Smiley, T, K., Sharma, T., Steinberg, A., el. (2016, February). More Inclusive Parks Planning: Park Quality and Preferences for Park Access and Amenities. Environmental Justice, 9,1. Retrieved February 10, from https://www.liebertpub.com/doi/full/10.1089/env.2015.0030
[34] Barth, D. (2016). *Alternatives for Determining Parks and Recreation Level of Service*. American Planning Association. http://www.barthassoc.com/wp-content/uploads/2017/01/Barth-PAS-Memo-5_16.pdf
[35] NRPA: National Recreation and Park Association. (2020). *Agency Review.* https://www.nrpa.org/siteassets/nrpa-agency-performance-review.pdf
[36] Barth, D. (2016). *Alternatives for Determining Parks and Recreation Level of Service*. American Planning Association. http://www.barthassoc.com/wp-content/uploads/2017/01/Barth-PAS-Memo-5_16.pdf
[37] NRPA: National Recreation and Park Association. (2020). *Agency Review.*
[38] NRPA: National Recreation and Park Association. (2020). *Agency Review.*

senior center per 40,600 residents.[39] The service of the recreation center is below the national average whereas the senior center is above the national average. Since population is crucial to this metric, these outdoor and indoor facilities were measured in different population ranges, a method that Lynnwood may emulate while setting its own benchmark goals.

2. Facilities per 1,000 capita
   This metric is similar to the one above. The first step is to determine if a community has enough recreation facilities, and secondly, if the facilities are equitably distributed based on population and geography.[40] However, there are no specific quantitative standards for this method.

3. Quality LOS standards for parks and recreation facilities
   To provide services to a diverse community, parks should also consider establishing quality LOS standards for their amenities. Quality LOS measurements are developed based on the values and priorities of the community and they determine if park facilities and geographies are consistently and equitably distributed across geographies.[41] Typical quality LOS measurements include the quality of construction materials, the frequency of maintenance and safety inspections, aesthetics, multimodal access, and cleanliness.[42] Once the LOS is established, the mix and location of parks and recreation facilities will be evaluated. By considering these requirements in our analysis, parks in Lynnwood can provide better activities that help promote equity among the city.

To improve park amenities, experts provide these solutions: design and renovate parks to enhance activity options across all age groups, seek partnerships with nonprofit organizations, and create new (or improve) amenity systems.[43] Finally, some studies show that the value of park amenities is also related to factors such as neighborhood safety and social environment.[44]

2.2.3 Park Availability

While park availability (capacity, usage, demand) is a very meaningful metric, the time and cost to conduct such analysis makes it an unrealistic LOS for cities to use year after year. In our literature review, we found limited examples of parks departments actually quantifying their

[39] City of Lynnwood. (2016). *2016-2025 PARC Plan.*
[40] Barth, D. (2016). *Alternatives for Determining Parks and Recreation Level of Service*. American Planning Association. http://www.barthassoc.com/wp-content/uploads/2017/01/Barth-PAS-Memo-5_16.pdf
[41] Barth, D. (2016). *Alternatives for Determining Parks and Recreation Level of Service*. American Planning Association. http://www.barthassoc.com/wp-content/uploads/2017/01/Barth-PAS-Memo-5_16.pdf
[42] Barth, D. (2016). *Alternatives for Determining Parks and Recreation Level of Service*. American Planning Association. http://www.barthassoc.com/wp-content/uploads/2017/01/Barth-PAS-Memo-5_16.pdf
[43] Godbey, G., Mowen, A. (2010) The Benefits of Physical Activity Provided by Park and Recreation Services: The Scientific Evidence. *National Recreation and Park Association*. Retrieved January 29, 2021, from http://www.deltastate.edu/PDFFiles/hper%20outdoor%20program/benefits%20of%20PA%20provided%20by%20P&R%20services.pdf
[44] Albouy, D., Christensen, P., Sarmiento-Barbieri, I. (2020, February). Unlocking Amenities: Estimating Public Good Complementarity. Journal of Public Economics, 182. Retrieved May 11, from https://www.sciencedirect.com/science/article/pii/S0047272719301720

parks usage in a comprehensive way. Because of this, *we eliminated this LOS policy option* from our further analysis. However, the City of Lynnwood is fortunate to be simultaneously conducting a novel **usage study**, which we did incorporate as a criterion to evaluate our other policy options.

A research team from the University of Washington Tacoma (UWT)[45] conducted a rigorous analysis on park and trail usage for the City of Lynnwood. Their data came from Streetlight Data, a company focused on providing mobility data using mobile phone location data, and they provided our group with key usage data needed to answer our research questions. We were able to see how many people, pedestrians or on bikes, used each park every year from 2018 - 2020. Their project[46] provides detailed analysis on usage based on seasonality and demographics, but for the purpose of our project, we simply integrated the average yearly park and trail metrics into our research.

2.2.4 Trail Connectivity

City trails can provide physical, mental, and emotional health benefits for citizens. Trails can be a mode of transportation, a place for outdoor exercise, a space to gather with friends or family, or act as means to connect with nature or one's self.[47] In 2019, the Washington State Recreation and Conservation Office estimated health care cost savings of $390 million from citizens with access to trails for exercise.[48] Additionally, Washington trails and open spaces make communities more desirable and can offer significant economic advantages, such as improved walkability and tourism benefits for local businesses. For city governments, it is important to acknowledge these overall benefits while also having a quantifiable metric to evaluate the success of their individual trail networks.

There are three common methods used to measure city trail connectivity: 1) total linear miles, 2) total linear miles per thousand residents, and 3) the number of trail connections.

1. <u>Total linear miles of trails</u>
   This is the most common LOS measurement used across the United States. As a simple and straightforward metric, it allows for easy LOS comparisons between different communities. On average, individual park and recreation agencies managed about **11 miles** of trails for walking, hiking, running and/or biking in 2020.[49] West Coast cities had a higher average of total trails at **16 miles**, compared to east coast cities with an average of 9 miles.[50] Population played an obvious factor in these averages with agencies serving

[45] Gauri Patil, Kevin McInerny, Trishali Ranjan, Monib Sabet. June 2021. Lynnwood Parks & Trails Usage Analysis.
[46] Gauri Patil, Kevin McInerny, Trishali Ranjan, Monib Sabet. June 2021. Lynnwood Parks & Trails Usage Analysis.
[47] Swierad, E. M., & Huang, T. (2018). An Exploration of Psychosocial Pathways of Parks' Effects on Health: A Qualitative Study. International journal of environmental research and public health, 15(8), 1693. https://doi.org/10.3390/ijerph15081693
[48] Washington State Recreation and Conservation Office. (2019). *Executive Summary: Economic and Health Benefits of Walking, Hiking and Bicycling on Recreational Trails in Washington State*.
[49] NRPA: National Recreation and Park Association. (2020). *Agency Review.* https://www.nrpa.org/siteassets/nrpa-agency-performance-review.pdf
[50] NRPA: National Recreation and Park Association. (2020). *Agency Review.*

over 250,000 residents having significantly larger trail networks.[51] The City of Lynnwood currently stands at **14 miles** of total trails,[52] which is above the national average and just below the West Coast average. Its small population and overall area should be considered when setting benchmark goals.

2. Total linear miles per thousand residents
   This metric has essentially the same purpose as the one above, but accounts for population, making it more adaptable and useful for comparing cities of differing sizes. The existing standard of mileage per capita is about **0.25 miles per 1,000 population**.[53] However, this standard has similar issues with the status quo LOS (park acreage per 1,000 population) in that it favors rural and open communities, and may not fully capture the value and benefits of urban trail networks.

3. Number of trail connections
   This LOS focuses on improving the network and walkability or bikeability of a city. It can be quantified in a number of ways including the number or percent of trails that connect to each other, the percent of parks with multimodal bike or pedestrian routes, or the number of added connections to existing trail networks.[54] Priorities for measuring connections will differ between communities. For instance, the City of Seattle placed special emphasis on "paved trail connections to nearby schools and parks via existing and planned Neighborhood Greenways and protected bike lanes" to increase functional use for its citizens.[55]

Additionally, city trails can act as a subcomponent to park access, with special attention placed on trail connectivity and trail type. Trails can range from steep forested hikes to paved low-grade pathways that are accessible for all-ages and all-abilities. Most parks departments separate paved and dirt trails in their LOS benchmark standards. Depending on the demographics of the community, one trail type may take priority over another. For instance, "age-friendly" (accessible for young and elderly residents) communities will focus on flat paved bicycle and pedestrian pathways, and communities wanting to encourage downtown walkability will prioritize pathway connections with decreased traffic congestion and increased safety routes.[56]

While total linear miles is the most widely-used metric, it does not account for variation within the city and may lead to gaps in **equity and access** analysis. To remedy this, cities may quantify linear miles by different segments of land area or combine multiple LOS measurements to get a more thorough understanding of the variation within the community. A common practice is to

[51] NRPA: National Recreation and Park Association. (2020). *Agency Review.*
[52] City of Lynnwood. (2016). 2016-2025 PARC Plan.
[53] City of Lynnwood. (2016). 2016-2025 PARC Plan.
[54] Barth, D. (2016). *Alternatives for Determining Parks and Recreation Level of Service*. American Planning Association. http://www.barthassoc.com/wp-content/uploads/2017/01/Barth-PAS-Memo-5_16.pdf
[55] Seattle Department of Transportation. (2017). Trail Upgrade Plan. https://www.seattle.gov/Documents/Departments/SDOT/BikeProgram/TUP_Final_Complete.pdf
[56] Barth, D. (2016). *Alternatives for Determining Parks and Recreation Level of Service*. American Planning Association. http://www.barthassoc.com/wp-content/uploads/2017/01/Barth-PAS-Memo-5_16.pdf

use both total linear miles and the number of trail connections as a multi-tiered LOS benchmark.[57]

2.2.5 Capital Value Per Person

The capital value per person measure is an economic approach to assessing a city's LOS. It is especially useful when a city experiences an increase in population and is unable to produce a comparable increase in its park acreage. Issaquah, a city of nearly 40,000 people located just east of Seattle, is experiencing some of the same challenges as Lynnwood, and have recently adopted this LOS method for their park system.[58] There are four steps to calculating a city's LOS using the capital value per person metric: 1) determine the LOS parks capital value per person, 2) determine the value needed for growth, 3) determine the investment needed, and 4) determine investment to be paid by growth to maintain LOS.

1. Determine the LOS parks capital value per person

   Value of Parks and Recreation Inventory ÷ Equivalent Population = Capital Value per Person

   The capital value per person measure is calculated by finding the value of a city's entire park system and dividing that value by the city's equivalent population. The total value of parks and recreation inventory can be calculated by adding the current value of the land, facilities, and committed improvements for each park within a city. The equivalent population variable can be calculated by totalling the city's current residents as well as accounting for individuals who work and visit the city.

2. Determine the value needed for growth

   Capital Value per Person × City's Population Growth = Value Needed for Growth

   To calculate the value needed to account for the city's population growth, the capital value per person is simply multiplied by the estimated population growth for the next year.

3. Determine the investment needed

   Existing Value of Parks Inventory + Value Needed for Growth = Value Needed for Next Year

   To calculate the total investment needed to account for the population growth by year, the existing value of parks and recreation inventory is added to the value needed for growth.

4. Determine investment to be paid by growth to maintain LOS

[57] City of Bremerton. (2019). *Chapter 4: Needs Assessment.* Parks, Recreation and Open Space Plan, Working. Draft. https://www.bremertonwa.gov/DocumentCenter/View/7701/Chapter-4---Needs-Analysis-PDF
[58] C. (2016, July). City of Issaquah 2018 Parks Strategic Plan. Retrieved from https://www.issaquahwa.gov/DocumentCenter/View/4898/2018-Parks-Strategic-Plan?bidId=

Value Needed for Growth - City Revenue Investment = Investment Needed to Maintain LOS

If there are revenues that the city has already invested in parks and recreation infrastructure, then that revenue is subtracted from the total value needed for growth; this calculation will equate to the total investment needed to maintain a city's LOS.

2.2.6 Criteria for Developing Level of Service for Parks

The final element to consider, and arguably the most important, is that each parks department must find an LOS that fits its unique community. Parks are seen as an essential service for their **economic value, health and environmental benefits**, **and social importance**.[59] Successful LOS measurements will properly reflect these values and be easy to replicate, clear to understand, and in line with planning goals and equity considerations.[60]

In addition, the following are key questions to ask when selecting LOS metrics:[61]

- What are the specific needs of the residents? Do measurements align?
- Is the data logical, clear, easy to collect, and available?
- Are the metrics truly representative of the LOS provided?
- Do they provide a comprehensive assessment of the parks system?

Agencies must pick which measurement tool works for them, creating useful and realistic LOS goals. They must also be flexible, reviewing assessment methods every few years and creating projections for future supply and demand needs.[62] Just like the variation in methodology, benchmarks will vary across cities as well.[63] National averages (**Appendix A**) or comparable cities may provide useful insights, but ultimately the individual parks agency must pick standards that work for its own community and planning goals.

2.2.7 Case Examples

To better understand the variety of current and emerging LOS standards, we selected several cities based on population, geography, and park ratings to analyze. The following cities are in the Northwestern U.S. and have a population of nearly 40,000:

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[59] NRPA: National Recreation and Park Association. (2010). *Why Parks and Recreation are Essential Public Services.* https://www.nrpa.org/uploadedFiles/nrpa.org/Advocacy/Resources/Parks-Recreation-Essential-Public-Services-January-2010.pdf

[60] Barth, D. (2016). *Alternatives for Determining Parks and Recreation Level of Service*. American Planning Association.

[61] Barth, D. (2016). *Alternatives for Determining Parks and Recreation Level of Service*. American Planning Association.

[62] Arlington Parks & Recreation. (n.d.). Population Based Level of Service Methodology. http://parks4everyone.org/wp-content/uploads/2018/11/POPS_LOS-Methodology_171220.pdf

[63] Barth, D. (2016). *Alternatives for Determining Parks and Recreation Level of Service*. American Planning Association.

City	LOS Method
City of Issaquah[64]	● Capital value per person ○ The ratio of a city's total value of parks and recreation inventory compared to their equivalent population
City of Bothell[65]	● Total park acreage ratio ○ Separate calculations for city limits and municipal urban growth areas (MUGA)
City of Bremerton[66]	● Park access ○ For community parks: 2–5 mile driving distance ○ For neighborhood parks: 1/2 mile walking distance = 10 minute walk

Table 1. LOS Examples from NW Cities with Roughly 40,000 population.

We also looked at several successful park recreation planning examples based on the client's direction, including the City of Chicago, LA County, Seattle, and Kansas City.

City	LOS Method
Chicago[67]	● Park access ○ ½ mile for open space ○ 1 mile for a basic facilities like playgrounds and basketball courts ○ 2 miles for a field house ○ 3 miles for a swimming pool
Los Angeles County[68]	● Park acreage ratio ○ 4 acres of local parkland per 1,000 residents in unincorporated areas ○ 6 acres of regional parkland per 1,000 residents in total ● California Quimby Act ○ 3 acres of parkland per 1,000 residents, in subdivisions
Seattle[69]	● Park acreage ratio ○ 8 acres of parkland per 1,000 residents as an acceptable guideline (2017-2023) ○ Also identified considerations in LOS implementation gaps: access, walkability, equity and health, income and poverty, density, and bus and transit service.

[64] *Parks Strategic Plan* [PDF]. (2018). Issaquah: City of Issaquah.
[65] *Parks, Recreation & Open Space Action Program* [PDF]. (2014). Bothell: City of Bothell.
[66] City of Bremerton. (2019). Chapter 4: Needs Assessment. Parks, Recreation and Open Space Plan, Working. Draft. https://www.bremertonwa.gov/DocumentCenter/View/7701/Chapter-4---Needs-Analysis-PDF
[67] *Our Response to the FOTP State of the Parks Report* [PDF]. (2018, December). Chicago: Chicago Parks District.
[68] *Los Angeles County General Plan* [PDF]. (2015, October). Los Angeles: Los Angeles County.
[69] 2017 Parks and Open Space Plan. [PDF]. (2017, August 7). Seattle Parks & Recreation.

Kansas City[70]	● LOS standards are designed based on the particular situation and needs of the community, and by using a combination of resources. ○ The National Recreation and Park Association (NRPA) guidelines, the Fitness and Leisure Participation in the Kansas City area and the community observations. ○ This city adopted these national standards to its population whereas also focusing on the gaps and surpluses during implementation.

Table 2. Successful LOS Examples from other U.S. Cities.

These case examples and our literature review as a whole serve a resource to aid in the PRCA Department's comprehensive planning and assessment of potential LOS options.

[70] Strategic Business Plan for Parks and Recreation 2015-2020. [PDF]. (2015, October). Kansas City Parks and Recreation Department.

CHAPTER THREE: RESEARCH METHODS

3.1 Introduction

The research design consisted of four stages: the literature review, the summary of Lynnwood's current park system, the Level of Service (LOS) policy options analysis, and the final park scorecards and recommendation. The first stage helped us generate an overall understanding of why LOS methods matter in cities, the current situation in adopting these methods at the City of Lynnwood, and how comparable cities practice these methods. In the second stage, we compiled available data to create a comprehensive summary of Lynnwood's park system. This allowed us to better understand its present characteristics and future needs. In the third stage, we conducted a policy analysis for the City of Lynnwood's alternative LOS measurements by developing a set of criteria that represented the city's needs. Finally, in the fourth stage, we created a scoring system to demonstrate the LOS across all parks and gave a final recommendation to Lynnwood Parks, Recreation & Cultural Arts (PRCA) Department.

3.2 Research Questions

1. What is the prevailing standard methodology of Lynnwood's LOS policy, and are there current and future needs that should be addressed?
2. Based on the research of current best practices, which metrics should be integrated into the LOS standards to more accurately represent the values and needs of the Lynnwood community?

3.3 Methods

3.3.1 Research Method One: Literature Review

Our literature review (chapter 2) focused on academic reports and government documents that were related to park projects and assessments. We started the research by selecting published academic journal articles, which provided us background on park recreation and LOS policies. Then we summarized the current situation of the City of Lynnwood's park system by reviewing relevant PARC plans, the city's comprehensive plans, maps, and other internal documents. Once we had a basic understanding of this project, we selected comparable cities as samples in developing criteria for evaluating LOS methods.

Our sampling strategy was to select at least 5 other cities that satisfied either of the following features:

- Similar geographic area and size, with a population of nearly 40,000.
- Outstanding cases: we considered cities with successful park and recreation planning based on the client's direction, such as Kansas City, City of Chicago, Seattle, and LA County.

3.3.2 Research Method Two: Current Lynnwood Park System

Through evaluating each park's current situation, we gained a better understanding of Lynnwood's park system as a whole. We first created a spreadsheet to summarize the parks' characteristics using the proposed LOS methods. Then, we conducted analysis for the overall park system in Lynnwood based on each proposed LOS measurement. Through methods one and two, we were able to answer our first research question.

3.3.3 Research Method Three: Policy Analysis

To answer the second research question, we conducted a policy analysis of alternative LOS measurements. This analysis contained the following criteria and policy options:

Evaluative Criteria

The criteria were chosen based on the literature review (summarized in section 2.2.6) and client directed needs for the City of Lynnwood.

Criterion 1: Increase Social Health Equity within the Community

> This criterion considers how the social and health needs of the community are being met among different park areas in Lynnwood. We assessed if each policy option is correlated with these health indicators and if there are varying degrees of improvements among the residents. This data came from the Trust for Public Land's GIS database,[71] and we used obesity percentage as a rough proxy for health and activity. We acknowledge that obesity is an imperfect, but still useful, metric to represent co-morbidities and health issues.[72] Additionally, we added the CDC's social vulnerability index to refer to the resilience of the community in confronting external stresses, which come from themes like socio-economic status, household composition & disability, minority status & language, and housing type & transportation, to help us better represent this criterion.[73] [74] We assessed if each LOS policy option showed an ability (i.e. a correlation) to demonstrate changes or gaps in social health equity within the community.

Criterion 2: Increase Economic Equity within the Community

> This criterion considers how the economic needs of the community are being met among different demographic groups and areas in Lynnwood. We assessed if each policy option is correlated with socio-economic measurements. This data came from the Trust for

[71] Trust for Public Land. (2021). Lynnwood Project Evaluator. https://web.tplgis.org/lynnwoodsecure/viewer/
[72] Djalalinia, S., Qorbani, M., Peykari, N., & Kelishadi, R. (2015). Health impacts of Obesity. Pakistan journal of medical sciences, 31(1), 239–242. https://doi.org/10.12669/pjms.311.7033
[73] Hallisey, E., Flanagan, B., Kolling, J., et al. (n.d.). A Social Vulnerability Index (SVI) from the CDC. *Center for Disease Control and Prevention*. https://svi.cdc.gov/Documents/Publications/CDC_ATSDR_SVI_Materials/SVI_Poster_07032014_FINAL.pdf
[74] Fact Sheet. Social Vulnerability. *Agency for Toxic Substances and Disease Registry*. https://www.atsdr.cdc.gov/placeandhealth/svi/fact_sheet/fact_sheet.html

Public Land's GIS database,[75] and we chose two variables to represent this criterion: reduced low income rate and the percentage of people of color served by the park. We assessed if each LOS policy option showed an ability (i.e. a correlation) to demonstrate changes or gaps in economic equity within the community.

Criterion 3: Increase Environmental Equity within the Community

This criterion considers how the environmental needs of the community are being met among different park areas in Lynnwood. We assessed if each policy option is correlated with environmental indicators. This data came from the Trust for Public Land's GIS database,[76] and we chose two variables to represent this criterion: air quality, and urban heat island effect.[77] [78] We assessed if each LOS policy option showed an ability (i.e. a correlation) to demonstrate changes or gaps in environmental equity within the community; ideally improved air quality and reduced urban heat island effect.

Criterion 4: Increase Ability to Meet Demand for Future Growth

This criterion addresses the potential for an LOS policy to meet the future needs of the city. The population of Lynnwood is projected to grow for the foreseeable future, so the ideal LOS measure needs to respond appropriately with the value of a growing city. This criterion is based on the park usage data from the UW Tacoma Research Team.[79] We assessed if each LOS policy option showed an ability (i.e. a correlation) to demonstrate changes in park usage.

Methods to quantify each criterion and run statistical analyses are explained in more detail in the table below. See **Appendix B** for more specifics on each dataset.

Criterion	**Detailed explanation**
Increase Social Health Equity within the Community	Using quantifiable data from the Trust for Public Land's GIS system as dependent variables, run regressions with each policy option to show: ● What is the correlation between each LOS policy option and obesity percentage? ● What is the correlation between each LOS policy option and social vulnerability index? ● How well does the LOS correlate with community health indicators?

[75] Trust for Public Land. (2021). 10-Minute Walk Access to Parks. Lynnwood. https://parkserve.tpl.org/mapping/index.html?CityID=5340840#reportTop
[76] Trust for Public Land. (2021). Lynnwood Project Evaluator. https://web.tplgis.org/lynnwoodsecure/viewer/
[77] The urban heat island effect is a phenomenon where cities with limited green space and more impermeable surfaces experience 5-10 degree increases in summer heat temperatures compared to greener and less paved neighborhoods. Decades of racist housing policies mean that people of color experience the urban heat island effect at a disproportionate rate.
[78] Plumer, B & Popovich, N. (2020). *How Decades of Racist Housing Policy Left Neighborhoods Sweltering*. New York Times. https://www.nytimes.com/interactive/2020/08/24/climate/racism-redlining-cities-global-warming.htm
[79] Gauri Patil, Kevin McInerny, Trishali Ranjan, Monib Sabet. June 2021. Lynnwood Parks & Trails Usage Analysis.

Increase Economic Equity within the Community	Using quantifiable socio-economic data from the US Census as the dependent variables, run regressions with each policy option to show: ● What is the correlation between each LOS policy option and a reduced low income rate? ● What is the correlation between each LOS policy option and the percentage of people of color served by the parks system? ● How well does the LOS represent socio-economic equity within the community?
Increase Environmental Equity within the Community	Using quantifiable data from the Trust for Public Land's GIS system as dependent variables, run regressions with each policy option to show: ● What is the correlation between each LOS policy option and improved air quality? ● What is the correlation between each LOS policy option and a reduced urban heat island effect? ● How well does the LOS demonstrate these environmental benefits within the community?
Increase Ability to Meet Demand for Future Growth	Using UWT park usage data (average park usage from 2018-2020) as dependent variables, run regressions with each policy option to show: ● What is the correlation between each LOS policy option and park or trail usage? ● Which LOS measurement properly reflects the accurate usage and demand of the Lynnwood park system, thereby representing the needs of a growing city?

Table 3. Statistical Analysis Methodology.

Finally, we originally planned to include a fifth criterion - *Increase Ease of Model Replicability* - but due to the lack of specific data for the regression analysis, we decided to remove it from our quantitative assessment. Instead, this criterion was included as part of our qualitative research that informs our overall recommendation, much like the literature review and case examples. We opted to send our client a survey (**Appendix C**), to determine the relative time, cost, and database management needed to measure each LOS.

Policy Options

The following policy options were chosen based on a review of current LOS practices (sections 2.2.1 through 2.2.5), case examples (2.2.7), and current conditions in Lynnwood. We used the data gathered from research method two (3.3.2) to quantify each park based on four policy options below, and ran regressions as outlined in Table 3.

Policy Option 1: Status Quo (Park Acreage per Resident)

Lynnwood's LOS standard has historically been represented by an acreage per resident ratio. Initially, the city followed the national benchmark of 10 acres per 1,000 residents

and is currently adhering to 3.5 acres per 1,000 residents. To keep the current LOS based on the current park acres per resident ratio, Lynnwood could plan to reduce their acreage standard every several years as the population grows or could benchmark a ratio in hopes of creating more park land in the future. Some larger areas like Seattle and Los Angeles County use this LOS method.

Policy Option 2: Park Access (Percent of Residents living within ½ Mile Walk to Park)

A common and popular practice is to base a city's LOS on the overall population's access to city parks based on their proximity to those parks. Chicago, famous for its many parks, uses a proximity LOS method. The most common barriers to park access in Lynnwood are state highways that bisect the city, a lack of sidewalks in some areas, and poor sidewalk conditions near certain parks. These barriers act as a subcomponent to access-based LOS.

Policy Option 3: Capital Value Per Person

The capital value per person LOS method is calculated by first finding the value for a city's entire park system, and then dividing that number by the population. This number is then multiplied by the projected future population growth for the city to determine the value needed to maintain a consistent LOS. According to Lynnwood's Park Asset Inventory and Value chart, the total value of Lynnwood's park system based on its 2015 inventory was about $227,032,902. The *equivalent population* at the time the document was published in 2018 was 60,006 people. By dividing those two numbers, Lynnwood's capital value per person was estimated to be about $3,783 per person.[80]

Policy Option 4: Trail Connectivity (Total Trail Mileage)

A simple and common metric is to measure the total trail mileage within a city. This LOS is similar to the park acreage per resident, but for trails, and can be further divided and analyzed by dirt and paved pathways, or quantified per 1,000 residents to evaluate density. For the purpose of this policy analysis, trails were represented as a binary variable, i.e. does the park have a trail or not, and evaluated on how trail presence correlated with the criteria. In chapter 5, we discuss a trails LOS recommendation that is seperate from the parks analysis.

Our policy analysis was an iterative process. By running regressions and reviewing the available data, we developed more specific measurements for each criterion. Based on the results of the policy analysis, we decided which LOS to prioritize in the final steps of our research process; *the LOS measurement(s) that showed the greatest ability to increase our criteria was chosen for our scorecard assessment*.

[80] City of Lynnwood. (n.d). Park Impact Fee Ordinance. https://www.lynnwoodwa.gov/files/sharedassets/public/development-and-business-services/permit-applications-amp-forms/permit-and-impact-fees/park-impact-fees/park-impact-fee-ordinance-3288.pdf

3.3.4 Research Method Four: Final Scorecards and Recommendation

After selecting our LOS measurements, we developed a scoring system for Lynnwood's parks. This approach expanded on stage two, the assessment of the current park system, by eliminating less useful LOS measurements. A crucial component of this analysis was to set **benchmark** quantities for these measurements. The benchmarks had to be realistic for current and future planning goals, while also aspirational enough to hold the City of Lynnwood accountable to its citizens through its parks services. We then provided a final recommendation, including a trade-offs analysis and implementation considerations, to the City of Lynnwood PRCA Department.

CHAPTER FOUR: RESULTS & ANALYSIS

This chapter includes our results, analysis, and data visualizations. It is organized by our research stages outlined in the methods section (3.3). See chapter two for the literature review and case examples.

4.1 Current Lynnwood Park System

Below are the summarized findings for the current state of Lynnwood's park system. Each park was analyzed by acreage, location, quality (amenities and condition), trails, and access. An example for Lynndale Park is shown below. See the "Current park situation in Lynnwood" spreadsheet for the detailed assessment.

Lynndale Park	40.57 acres, located in southwest Lynnwood
Amenities	*Basic:* large reservable picnic shelter, restrooms, parking, grass play area *Playground:* 1 play equipment ages 5-12, 1 slanding slide, 6 swings (3 tot) *Sports:* 3 lighted baseball fields, soccer field, 4 tennis courts, 2 basketball courts, orienteering course *Natural areas:* forested areas, wildlife habitat, steep slopes, lawn *Leisure facilities:* skate park, amphitheater
Condition	ADA accessible: yes / no Facility improvement schedule: 2025/26
Trails	0.6 miles of walking trails, 0.7 miles of hiking trails
Access	Number of people within 10-minute walk: 3,903 Access issues: sidewalk conditions Barrier removal project completed: yes

Table 4. Lynndale Park - Example from the Current Park Situation Assessment.

After compiling the individual park level data, we then reviewed the parks system as a whole based on the proposed Level of Service (LOS) policy options. The city-level summary for overall Park Quality is included below, since it was excluded from the policy analysis stage but still provides useful insight. The other LOS options (Park Acreage, Access, Capital Value, and Trail Connectivity) are *summarized in section 4.2* along with their criteria assessment.

4.1.1 Park Quality - Condition

Before 2016, the total costs for an identified deferred maintenance project, which includes the deferred maintenance for existing, developed parks and open spaces, was nearly $3 million.[81]

[81] City of Lynnwood. (n.d.). *2016 PARC Plan.*

The Lynnwood City Council distributed $83,000 in deferred maintenance and ADA improvement in 2018 for the 2016-2025 PARC Plan.[82] The ADA condition assessment assigned relative values of ADA compliance for major park asset types, which accounted for the need to replace grills, benches, picnic tables, and other park maintenance issues. In 2016, the aggregate average rating score across all public parks and outdoor sites in Lynnwood was **2.5 out of 3** which suggests the need to address ADA compliance issues and upgrades over time.[83] In the fall of 2017, the City of Lynnwood initiated the ADA Self-Evaluation and Transition Plan (SETP) project to assess and guide public open sites of Lynnwood to become more accessible. The project included evaluations of ADA policy & programs, buildings, parks and trails, the Right-of-Way, and included a virtual open house for community involvement. The ADA SETP project will be completed in spring 2021.[84]

4.1.2 Park Quality - Amenities

According to the City of Lynnwood 2016-2025 Parks, Arts, Recreation & Conservation (PARC) Plan, the city of Lynnwood has 14 core parks, 2 special use parks and 4 open spaces.[85] The core parks are classified as 4 community parks, 7 neighborhood parks, and 3 mini parks. Among the core parks, the amenities inventory includes facilities from 7 categories: basic infrastructure, water related amenities, plants related amenities, playgrounds, sports field, natural areas, and leisure facilities. These amenities vary by geographic location in Lynnwood, and **Appendix D** offers a detailed summary of park amenities by city quadrant. This data was then used as part of the calculations for the capital value assessment.

4.2 Policy Option Analysis

Based on our literature review and assessment of the current state of Lynnwood parks, we narrowed our LOS policy options to the following: Status Quo (Park Acreage), Park Access, Capital Value Per Person, and Trail Connectivity. Capital Value encapsulates the condition and amenities of the parks.

Matrix 1 represents a summary of our policy analysis based on the LOS options and criteria outlined in section 3.3.3. The goal of this stage was to see if any of the LOS options significantly correlated with the criterion, therefore showing a rough ability to represent the important social, economic, environmental, and growth needs of Lynnwood parks. See the spreadsheet "Policy analysis" to review all data used in this analysis. After conducting the regression analyses, we ranked the LOS options in the following way:

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[82] City of Lynnwood. (n.d.). *PARC 2017-2018 Report.*
[83] City of Lynnwood. (n.d.). *City of Lynnwood 2016-2025 Parks, Arts, Recreation & Conservation Plan* [PDF]. The ADA condition assessment with a rating scale of 1 to 3 to assign relative values of ADA compliance for major park asset types, which accounted for the need to replace grills, benches, picnic tables, and other park maintenance issues; the rating 1 indicated the high likelihood of compliance with ADA standards and rating 3 indicated the low. In 2016, the aggregate average rating score across all public parks and outdoor sites in Lynnwood was 2.5 which suggests the need to address ADA compliance issues and upgrades over time.
[84] City of Lynnwood. (n.d.). *ADA Self-Evaluation and Transition Plan, City of Lynnwood, Washington.*
[85] For more information on these categories, see Appendix D.

- LOW: no correlation and no statistical significance[86]
- MEDIUM: weak statistically significant correlation with the criterion, p-value < 0.1
- HIGH: strong statistically significant correlation with the criterion, p-value <0.05

Criteria **LOS Policy Option**	**Increase Social Health Equity**	**Increase Economic Equity**	**Increase Environmental Equity**	**Increase Ability to Meet Demand for Future Growth**
1. Status Quo (Park Acreage)	LOW: acreage is positively correlated with health & social vulnerability, both statistically insignificant	MEDIUM: acreage is slightly correlated with reducing low income rates (insignificant), but may have reduced % POC served (significant)	LOW-MEDIUM: acreage is correlated with lowering the urban heat island effect (weakly significant), but has no correlation with air quality	HIGH: acreage is positively correlated with usage, statistically significant
2. Park Access (½ Mile Walk)	MEDIUM: access is positively correlated with health (insignificant) & with social vulnerability (significant)	LOW: access is slightly linked with increased low income, but may increase % POC served, both insignificant	LOW: access is correlated with lowering the urban heat island effect, but also worsened air quality, both insignificant	LOW: access is positively correlated with usage, statistically insignificant
3. Capital Value Per Person	MEDIUM: capital value is positively correlated with health (weakly significant) and negatively with social vulnerability (weakly significant)	HIGH: capital value is positively correlated with reduced low income rate (significant), but may decrease % POC served (significant)	LOW-MEDIUM: capital value is positively correlated with reduced urban heat island effect (weakly significant) but negatively correlated with air quality (insignificant)	HIGH: capital value is positively correlated with usage, significant
4. Trail Connectivity (Trail Presence)	LOW: park trails are positively correlated with health and negatively with social vulnerability, both insignificant	LOW: park trails are positively correlated with reduced low income, but may decrease the % POC served, both insignificant	MEDIUM: park trails are positively correlated with reduced urban heat island effect (significant) and improved air quality (insignificant)	LOW: park trails are positively correlated with usage, insignificant

Matrix 1. LOS Policy Options Analysis Summary.

[86] Statistical significance means our data supports the hypothesis that these two variables have a non-zero correlation at the population level.

Next, we provide detailed explanations and break down each LOS option by the criteria. Additionally, **Appendix E** contains statistical descriptions for all regression analyses conducted.

4.2.1 Status Quo (Park Acreage per Resident)

As outlined in section 1.2, Lynnwood's overall LOS acreage standard has been steadily declining as the city experiences rapid population growth and limited available land. The overall LOS has dropped from 10 acres per 1,000 residents to **3.5 acres per 1,000** residents in 2016, and will likely continue to decline.[87] Based on the policy analysis, park acreage per resident showed mixed ability to represent the criteria.

Criterion 1: Increase Social Health Equity

Park acreage is positively correlated with health indicators in that larger parks may be linked to reduced obesity rates, but the relationship is statistically insignificant.[88] Additionally, increased park acreage may be linked to increased social vulnerability, demonstrating negative social health indicators, although this relationship is also statistically insignificant.[89] Because of these contradicting and weak correlations, acreage was ranked as **LOW** for social health equity.

Criterion 2: Increase Economic Equity

Increased park acreage is slighted correlated with reduced low income rates (statistically insignificant),[90] but has a statistically significant correlation with the reduced percentage of people of color served by parks.[91] While these relationships are weak, they may hint at the fact that higher income and/or whiter neighborhoods may currently benefit from greater park acreage. Due to the potential equity concerns yet ability to measure gaps in service, we ranked acreage as **MEDIUM** for economic equity.

Criterion 3: Increase Environmental Equity

Park acreage is correlated with lowering the urban heat island effect (weakly significant),[92] but has no correlation with air quality data.[93] With more park land and permeable green surfaces or canopy cover, the park and surrounding community may experience a decreased urban heat

[87] City of Lynnwood. (n.d.). Park Usage Study.

[88] With the one unit increase of park acreage, the possibility that the community obesity rate lies between 14-33% decreases by 0.64%, whereas the likelihood for a community obesity rate between 0-7% increases by 0.20% (statistically insignificant).

[89] With one unit increase in park acreage, the possibility of the highest social vulnerability rate increases by 0.52%, whereas the likelihood for a low social vulnerability rate decreases by 0.11% (statistically insignificant).

[90] With one unit increase in park acreage, the percentage of low income rate in the community will decrease by 0.0027% (statistically insignificant).

[91] With one unit increase in park acreage, the percentage of white people served by parks will increase by 0.0045% ($p<0.05$), the percentage of Black people served by parks will decrease by 0.0008% ($p<0.1$), the percentage of Asian people served by parks will decrease by 0.0026% ($p<0.1$), and the percentage of other races served by parks will decrease by 0.0012% (statistically insignificant).

[92] With one unit increase in park acreage, the likelihood for the community to have zero urban heat island effect would increase by 1.35% ($p<0.1$), whereas the possibility for high urban heat island effect to happen would decrease by 1.67% (statistically insignificant).

[93] With one unit increase in park acreage, the possibility for the community to have high air quality would decrease by 0.39%, whereas the likelihood for low air quality would increase by 0.53% (statistically insignificant).

island effect.[94] Our analysis shows the potential for acreage LOS to encapsulate some environmental benefits, and help city planners continuously prioritize a more equitable distribution of green spaces. However, because the air quality data showed no correlation, we only ranked acreage as **LOW-MEDIUM** for environmental equity.

Criterion 4: Increase Ability to Meet Demand for Future Growth
Finally, park acreage is positively correlated with usage within respective neighborhoods, and the regression results were statistically significant.[95] With greater space and area to play, more people are willing and able to visit the park. This relationship suggests that acreage can potentially represent future changes in demand due to population growth; acreage was ranked as **HIGH** for this criterion.

4.2.2 Park Access (½ Mile Walk to a Park)

Currently, The Trust for Public Land projects that **76.6 percent** of Lynnwood's population lives within a 10-minute walk of a park or trail, which is well above the national average of 55 percent. If we add the Lynnwood Golf Course Trail, which was not originally included in the calculations, the actual population served increases to **79.4 percent of all Lynnwood residents**. Correcting for the missing trail adds another 1,089 people who currently live within a 10-minute walking distance of a park or trail.[96] Nearly all demographics based on age, income, and race are represented equally within the 10-minute walk metric (based on the original 76.6 percent of the population served).[97] [98]

For ease of regression analysis, we quantified park access as the number of residents served within a half-mile walk to the park, rather than the percentage of residents. Park Access showed limited ability to represent the criteria.

Criterion 1: Increase Social Health Equity
Park access is positively correlated with reduced obesity, but the results were insignificant.[99] However, access is also *positively correlated with social vulnerability and the results were significant*. This means that a community with high vulnerability may have greater park access, but the park also serves more residents, hinting at density and park capacity concerns.[100] Given the combination of those two variables, we ranked access as **MEDIUM** for health equity.

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[94] The urban heat island effect is a phenomenon where cities with limited green space and more impermeable surfaces experience 5-10 degree increases in summer heat temperatures compared to greener and less paved neighborhoods.
[95] With one unit increase in park acreage, park usage will increase by 3668 visits ($p<0.01$).
[96] *Everyone deserves a park within a 10-minute walk of home.* The Trust for Public Land. (n.d.). https://www.tpl.org/city/lynnwood-washington.
[97] *Park Access Plan* [PDF]. (2020, December). Lynnwood: City of Lynnwood.
[98] *Everyone should have a park within a 10-minute walk of home.* The Trust for Public Land. (n.d.). https://www.tpl.org/city/lynnwood-washington.
[99] With 1000 more residents served by the park, the possibility of a community obesity rate between 14-33% decreases by 0.0849%, whereas the likelihood for a community obesity rate between 0-7% increases by 0.0258% (statistically insignificant).
[100] With 1000 more residents served by the park, the likelihood for the neighborhood to have the highest vulnerability level will increase by 30.68%. ($p<0.01$).

Additionally, without access to parks and trails, any potential benefits gained from usage will not be attainable. Using the 10-minute walk metric as a baseline for proximity to parks, Lynnwood currently serves nearly 80 percent of its residents. While this proximity metric is a useful and simple LOS measure, it can also be easily manipulated. For example, increased construction of new population centers near parks and trails will increase the percentage of the populations near those trails, but it does not account for the quality or capacity of those parks and trails. The health benefits of having access to parks and trails could be reduced by overuse as population density increases.

Criterion 2: Increase Economic Equity

Access is slightly linked with reduced low income[101] and may increase the percentage of people of color served,[102] however since both of these results were statistically insignificant, we ranked access as **LOW** for economic equity.

Increasing access to parks can provide a community with more economic value and increase economic equity. Although, if park access is increased by building more dense housing in areas near parks, then the overall value and equity of the community may not increase. If population density increases near parks without additional investments to those parks, there may be a decrease in the overall value of those parks per resident. Economic value and equity gained by increasing park access would likely be due to increasing the overall acreage of parks and trails in areas that are currently without them. Providing more access by building new parks and trails in areas without them would likely increase equity and the values of the land and houses in the area. Some negative effects of increased property values could be increased rent, taxes, and gentrification of the community.

Criterion 3: Increase Environmental Equity

Access is correlated with lowering the urban heat island effect,[103] but also worsened air quality.[104] Since both relationships were insignificant, we ranked access as **LOW** for this criterion. Any increase in environmental equity through increasing park access would likely be due to an increase in overall park and trail acreage. If a city's park access metric increases without a comparable increase in acreage, environmental equity will likely decline as there would be more people per park area.

[101] With 1000 more residents served by the park, the percentage of low income rate in the community will increase by 0.04% (statistically insignificant).

[102] With 1000 more residents served by the park, the percentage of white population served by parks will increase by 0.015*% (statistically insignificant), the percentage of Black population served by parks will increase by 0.00085% (statistically insignificant), the percentage of Asian population served by parks will decrease by 0.024% (statistically insignificant), and the percentage of other races served by parks will decrease by 0.0084% (statistically insignificant).

[103] With 1000 more residents served by the park, the likelihood for the community to have zero urban heat island effect would increase by 5.92%, whereas the possibility for high urban heat island effect to happen would decrease by 6.99% (statistically insignificant).

[104] With 1000 more residents served by the park, the possibility for the community to have high air quality would decrease by 3.28%, whereas the likelihood for low air quality to occur would increase by 4.60% (statistically insignificant).

Criterion 4: Increase Ability to Meet Demand for Future Growth

As a simple metric, using the number of residents within a 10-minute walk can be very useful for meeting the demand for future growth, but there would need to be some other calculations included. A positive increase in this proximity metric could actually have a negative impact on the overall parks LOS. For example, a city could increase new population growth areas near existing parks and trails, which would increase the overall percentage of the population near parks and trails. While that could be a good thing as it pertains to the LOS, if the parks are overcrowded or amenities are not increased, the overall LOS provided could actually decrease. Furthermore, in this analysis access showed no statistical correlation to usage,[105] and was therefore ranked as **LOW** in its ability to represent future demand.

4.2.3 Capital Value Per Person

According to an impact fee study conducted by the Trust for Public Land in 2018, the capital value per person in Lynnwood is about $3,783 (based on 2015 inventory values):[106]

Exhibit 6. Value of Parks per Equivalent Population		
Total Value of Lynnwood Parks	Current (2017) Equivalent Population	Capital Value per Equivalent Population
$227,032,902	60,006	$3,783

Table 5. Value of Park per Equivalent Population.

For this analysis we used *the number of people who have park access* as the denominator to determine capital value per person for each individual park. This allowed us to evaluate differences across the system and run regression analyses to see how well capital value related to the criteria. Overall, this LOS has several significant correlations.

Criterion 1: Increase Social Health Equity

Based on Lynnwood's health and population data, we found a connection between parks with a higher capital value per person and lower obesity rates within those communities.[107] Additionally, capital value is negatively correlated with the social vulnerability index[108] (weakly significant). Taken together, this demonstrates a relationship between health benefits and increased capital value investment, and we therefore ranked this criterion as **MEDIUM**. Considering this LOS takes into account the total value of Lynnwood's parks per capita, this relationship could be due to a variety of factors: more land, more amenities, higher quality facilities, etc.

[105] With 1000 more residents served by the park, park usage will increase by 9240 visits (statistically insignificant).
[106] The Trust For Public Land. (2009, November). Rate Study for Impact Fees for Parks, Open Space, and Recreation Facilities. Lynnwood, Washington.
[107] With a $1,000 increase in park capital value per person, the possibility for the community to have an obesity rate between 0-7% increases by 1.00% (statistically insignificant), whereas the likelihood for obesity lies between 14-33% decreases by 5.00% ($p<0.1$).
[108] With a $1,000 increase in park capital value per person, the possibility for the community to have the highest vulnerability level will decrease by 4.9% ($p<0.1$).

Criterion 2: Increase Economic Equity

Capital value per person is correlated with the income rate in Lynnwood.[109] A higher capital value (per person) park is associated with less low-income residents in those areas. While a higher capital value per person may not directly cause an increase in a community's income, the two variables are clearly linked. Furthermore, the opposite relationship is true for capital value and the percent of people of color served by the park.[110] This LOS metric could be used to equitably distribute value throughout the city year-to-year by providing adequately valued parks and trails to specific neighborhoods in Lynnwood, and therefore we ranked it as **HIGH** for this criterion.

Criterion 3: Increase Environmental Equity within the Community

Capital value is positively correlated with reduced urban heat island effect[111] (weakly significant) but negatively correlated with air quality[112] (insignificant). We ranked it as **LOW-MEDIUM** because capital value per person is not directly correlated with environmental equity. While some aspects of capital value could be related to environmental equity like parks with increased acreage per population, this would mostly be due to the land value and not necessarily the value of the whole park system.

Criterion 4: Increase Ability to Meet Demand for Future Growth

Capital value per person of the park is positively and significantly linked with the park usage within the community.[113] Capital value per person may be an appropriate metric to use to meet the demand for future growth. Studies show that increasing park quality, such as conducting park renovations, could bring increases in park use and physical activity,[114] which is important for minority and low-income communities who often have poorer park conditions and lower physical activity levels.[115] Because of the link between capital value and usage, we ranked this LOS as **HIGH** for this criterion.

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[109] With a $1,000 increase in park capital value per person, the percentage of low income rate in the community will decrease by 0.0152% ($p<0.05$).

[110] With a $1,000 increase in park capital value per person, the percentage of white population served by parks will increase by 0.0100*% ($p<0.01$), the percentage of Black population served by parks will decrease by 0.0029% ($p<0.05$), the percentage of Asian population served by parks will decrease by 0.0061% (statistically insignificant), and the percentage of other races served by parks will decrease by 0.0058% ($p<0.1$).

[111] With a $1,000 increase in park capital value per person, the possibility for the community to have zero urban heat island effect would increase by 4.00% (statistically insignificant), and the likelihood for high urban heat island effect to occur would decrease by 5.00% (statistically insignificant).

[112] With a $1,000 increase in park capital value per person, the possibility for the community to have high air quality would decrease by 0.65%, whereas the likelihood for low air quality to happen would increase by 0.89% (statistically insignificant).

[113] With a $1,000 increase in park capital value per person, the usage of the park will increase by 11,430 visits ($p<0.01$).

[114] Cohen, A, D., Han, B., Isacoff, J., et al. (2015, February). Impact of Park Renovations on Park Use and Park-based Physical Activity. *Journal of Phys Act Health*; 12(2): 289-295. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4851467/

[115] Knapp, M., Gustat, J., Darensbourg, R., et al. (2019). The Relationships between Park Quality, Park Usage, and Levels of Physical Activity in Low-income, African American Neighborhoods. *International Journal of Environmental Research and Public Health*. https://www.mdpi.com/1660-4601/16/1/85

4.2.4 Trail Connectivity

Overall, the City of Lynnwood has **14 miles of trails**,[116] which is higher than the national average of 11 but lower than the west coast average of 16 miles.[117] Based on a ratio to population, Lynnwood has approximately **0.37 miles of trail / 1,000 residents**, which is higher than the current national standard of 0.25. Despite these metrics typically favoring rural and less populated cities, Lynnwood is in good standing compared to national averages for overall trail miles. The majority of the mileage comes from longer trail networks, such as the Interurban Trail which spans from North Seattle to Everett. However, within the parks themselves, there are 4.42 miles of walking paths and about 2 miles of hiking trails.

For the ease of regression analysis, we coded trails as a binary variable: does the park have a trail / trail access or not. We acknowledge that this limits the interpretation of trail connectivity, but it does provide insight into value added for internal park trails and walking paths. Additionally, section 5.2.2 contains a LOS recommendation for the trails system independent of the parks analysis.

Criterion 1: Increase Social Health Equity

Park trails are positively correlated with health[118] and negatively with social vulnerability,[119] but both relationships are statistically insignificant. We ranked this LOS as **LOW** since we were unable to find significant health benefits from park trails. This was likely in part due to our limited data set and assumptions made in the regression analysis. A more thorough assessment of Lynnwood's trail system and health indicators would likely have different results.

Criterion 2: Increase Economic Equity

Park trails are positively correlated with reduced low income,[120] but may decrease the percentage of people of color served by the park.[121] Both results were insignificant and so we ranked park trails as **LOW** for this criterion. Again, our analysis is almost certainly missing out on some economic benefits provided by these park trails.

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[116] City of Lynnwood. (2016). 2016-2025 PARC Plan. https://www.lynnwoodwa.gov/files/sharedassets/public/public-works/project-folders/south-lynnwood-park-reno/2016-2025-parks-arts-recreation-conservation-plan.pdf

[117] NRPA: National Recreation and Park Association. (2020). Agency Review. https://www.nrpa.org/siteassets/nrpa-agency-performance-review.pdf

[118] Compared to parks without trails, for parks with trails, the possibility for the community to have an obesity rate between 0-7% increases by 4.87%, whereas the possibility for an obesity rate between 14-33% decreases by 29.92% (statistically insignificant).

[119] Compared to parks without trails, for parks with trails, the likelihood for its community to have the highest vulnerability level will decrease by 6.24% (statistically insignificant).

[120] Compared to parks without trails, for parks with trails, the percentage of low income rate in the community will decrease by 0.06% (statistically insignificant).

[121] Compared to parks without trails, for parks with trails, the percentage of white population served by parks will increase by 0.03*% (statistically insignificant), the percentage of Black population served by parks will decrease by 0.0023% (statistically insignificant), the percentage of Asian population served by parks will decrease by 0.02% (statistically insignificant), and the percentage of other races served by parks will decrease by 0.0081% (statistically insignificant).

Criterion 3: Increase Environmental Equity

Park trails are positively correlated with reduced urban heat island effect[122] (significant) and improved air quality[123] (insignificant). With a variety of trail surfaces and increased canopy cover, the park and surrounding community may experience a decreased urban heat island effect. Therefore, our analysis shows the potential for a park trail LOS to encapsulate some environmental benefits (**MEDIUM**), and potentially help city planners continuously prioritize a more equitable distribution of green spaces.

Criterion 4: Increase Ability to Meet Demand for Future Growth

Finally, park trails are positively correlated with usage, but the results were insignificant.[124] We therefore ranked this LOS as **LOW** for meeting the demand of future growth, with the caveat that the UWT Usage Study[125] is a better resource to understand the full correlations between larger trail networks in Lynnwood and usage.

4.3 Data Visualization

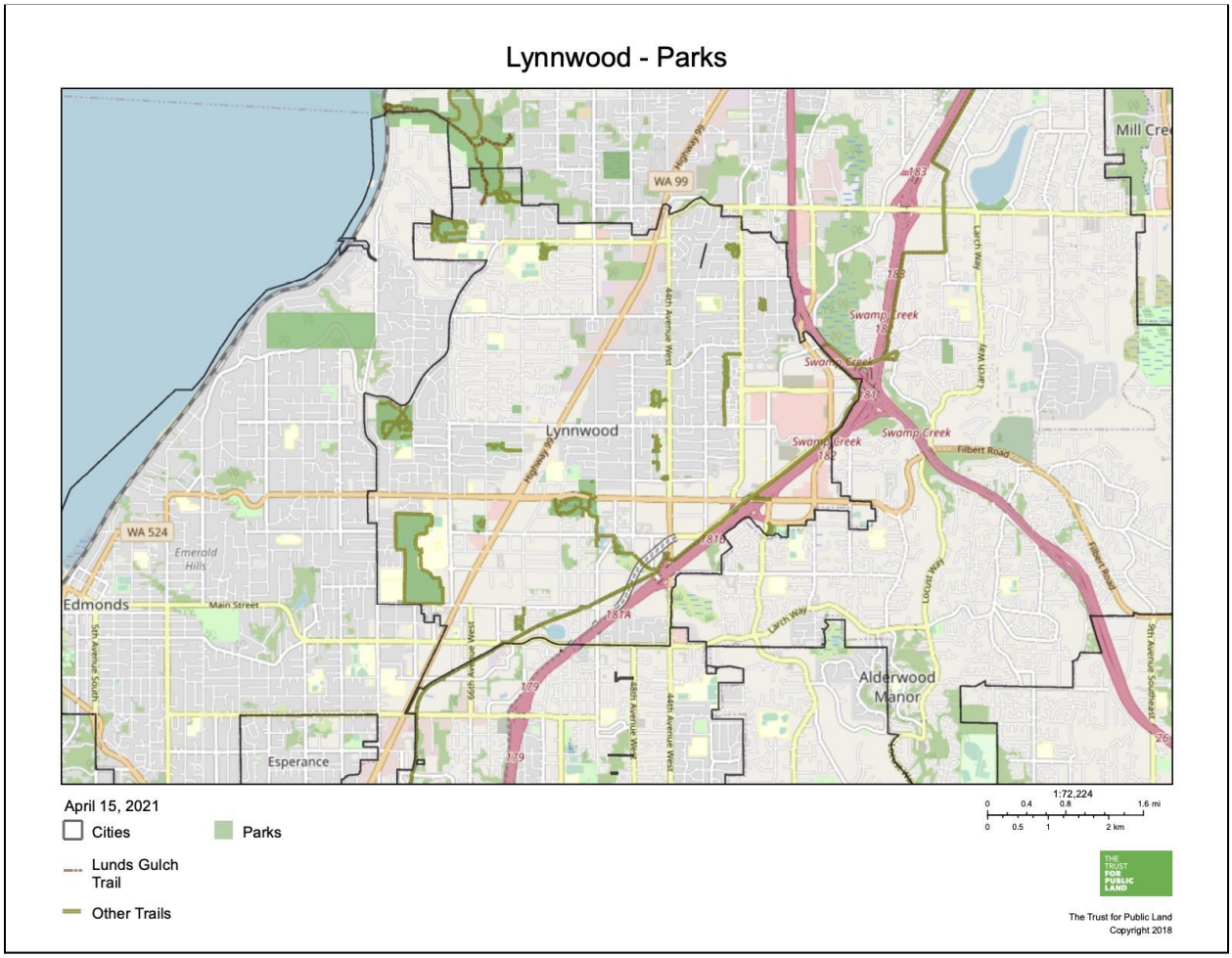
To help describe our data sources and findings, this section consists of several visualizations of both the criterion and LOS policy options.

4.3.1 GIS Visualizations

In order to quantify the environmental and social health data for criterions one and three, we pulled data from the Trust for Public Land's GIS project evaluator tool.[126] Below are several visualizations for the City of Lynnwood.

[122] Compared to parks without trails, for parks with trails, the likelihood for the community to have zero urban heat island effect would increase by 33.33% ($p<0.01$), whereas the likelihood for high urban heat island effect to happen would decrease by 73.33% ($p<0.01$).
[123] Compared to parks without trails, for parks with trails, the likelihood for the community to have high air quality would increase by 9.33%, whereas the likelihood for low air quality to happen would decrease by 24.57% (statistically insignificant).
[124] For parks with trails, they have 33103 more visits compared with parks without trails (statistically insignificant).
[125] UWT: Gauri Patil, Kevin McInerny, Trishali Ranjan, Monib Sabet. June 2021. Lynnwood Parks & Trails Usage Analysis.
[126] Trust for Public Land. (2021). Lynnwood Project Evaluator. https://web.tplgis.org/lynnwoodsecure/viewer/

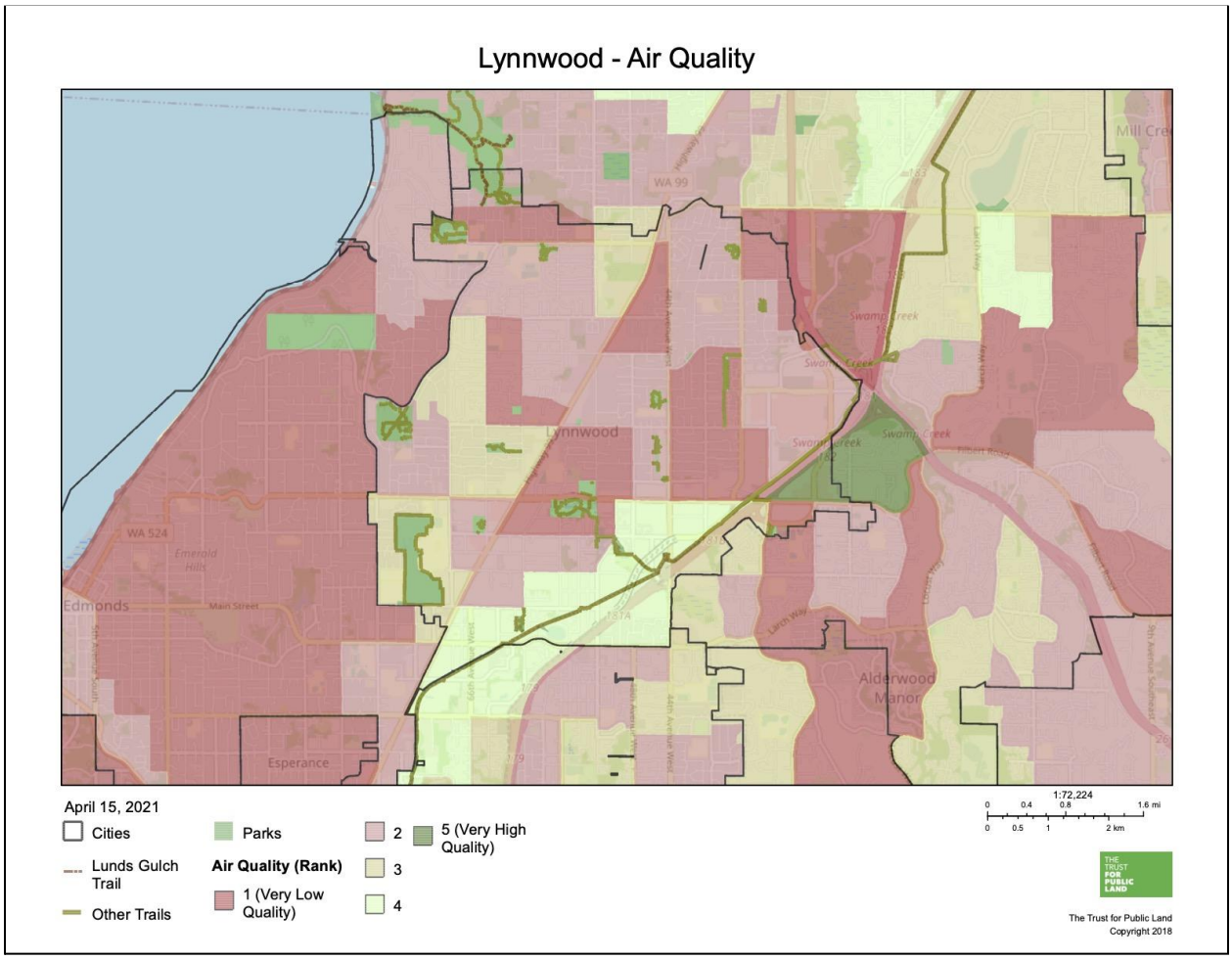
General Data



Map 2. Lynnwood's Current Parks & Trails.

This map demonstrates a birds eye view of Lynnwood's parks, shown in green, and trails, in brown.

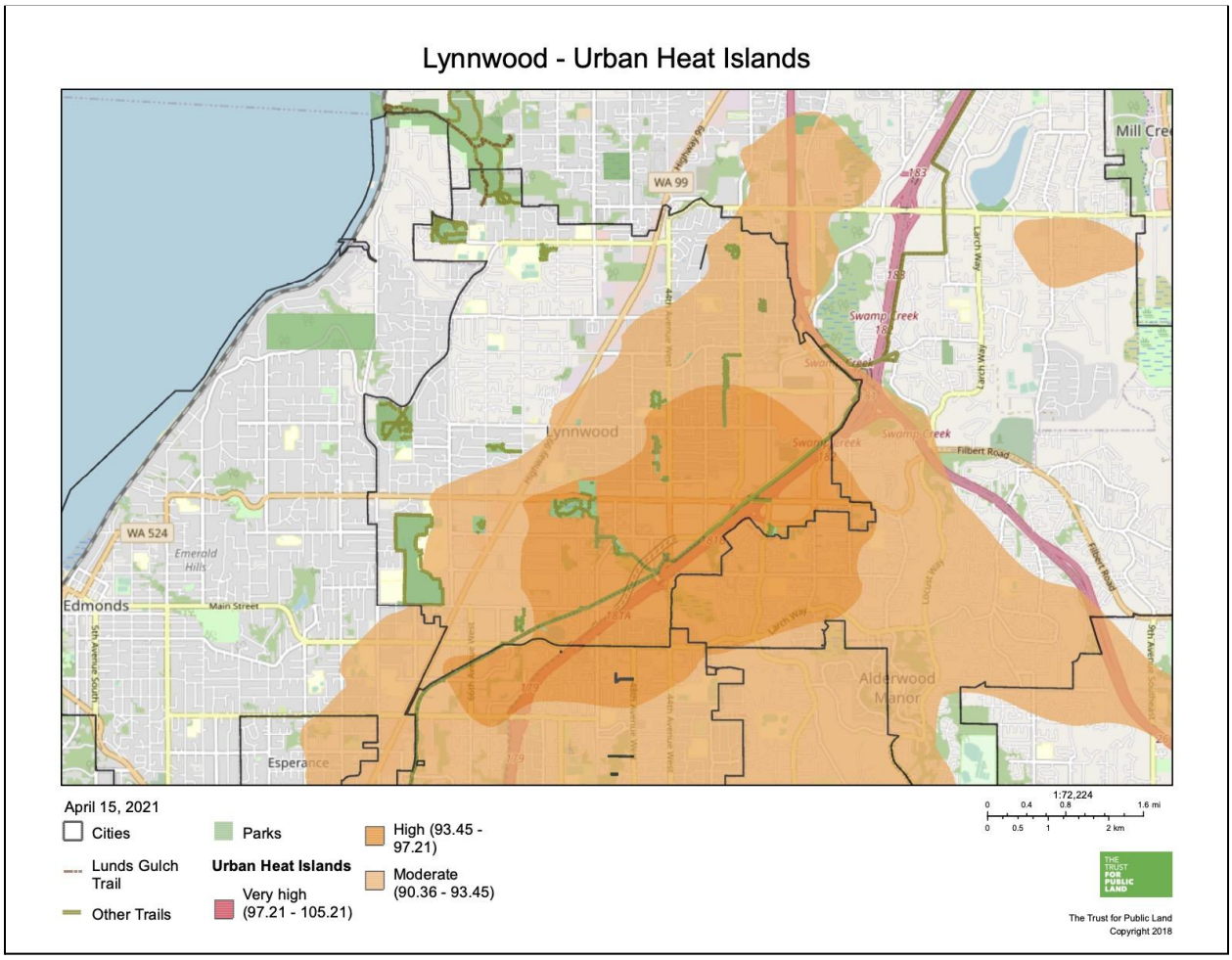
Environmental Data



Map 3. Air Quality Data & Lynnwood Parks.

Low air quality is concentrated near Highway 99, while higher air quality is present near the southeast along trail corridors. Trail presence showed a positive correlation with air quality improvements, and all other LOS measurements showed negative or insignificant correlations.

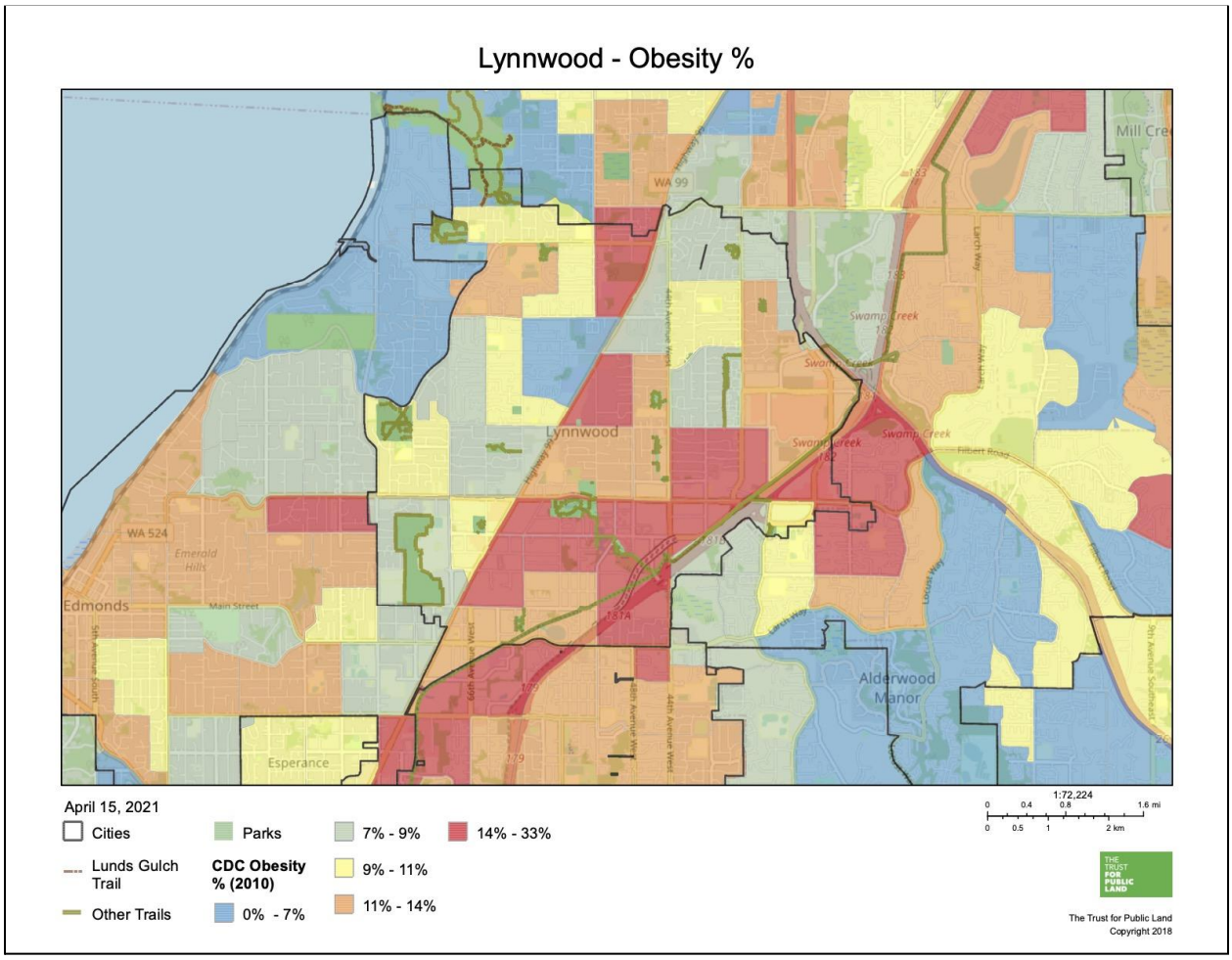
Environmental Data



Map 4. The Urban Heat Island Effect & Lynnwood Parks.

The urban heat island effect is concentrated in the southeastern part of the city. Our results showed all LOS measures having a positive correlation with lowering the intensity of the effect: trails had the highest potential impact, followed by capital value, park acreage, and then access.

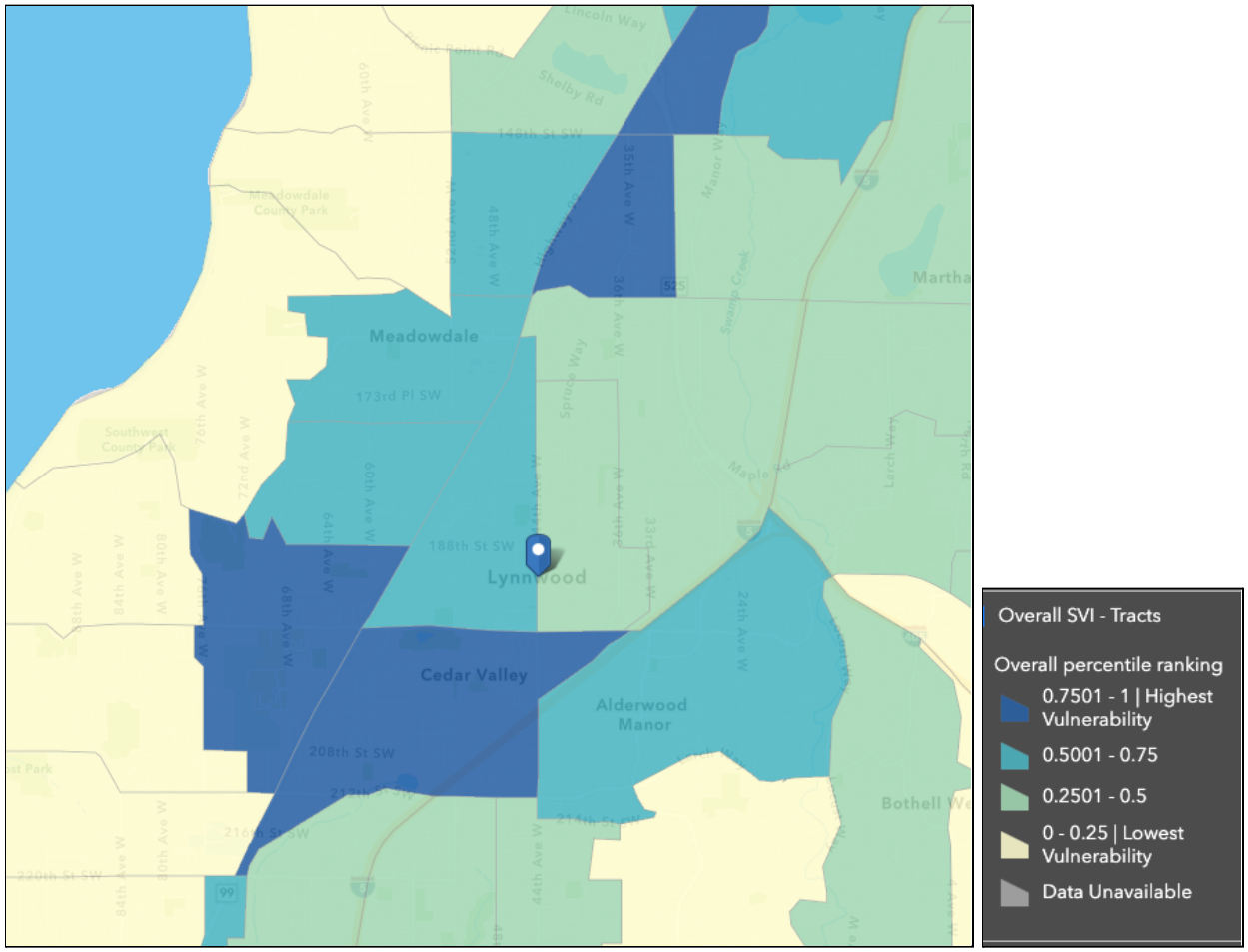
Health Data



Map 5. Obesity Percentage & Lynnwood Parks.

Lower rates of obesity are found in the western and northern portions of the city. Capital value showed the most significant correlation to reduced rates of obesity, while trails, acreage, and access all showed a positive health correlation, but the results were insignificant.

Health Data - CDC Social Vulnerability Index



Map 6. CDC's Social Vulnerability Index & Lynnwood Parks.

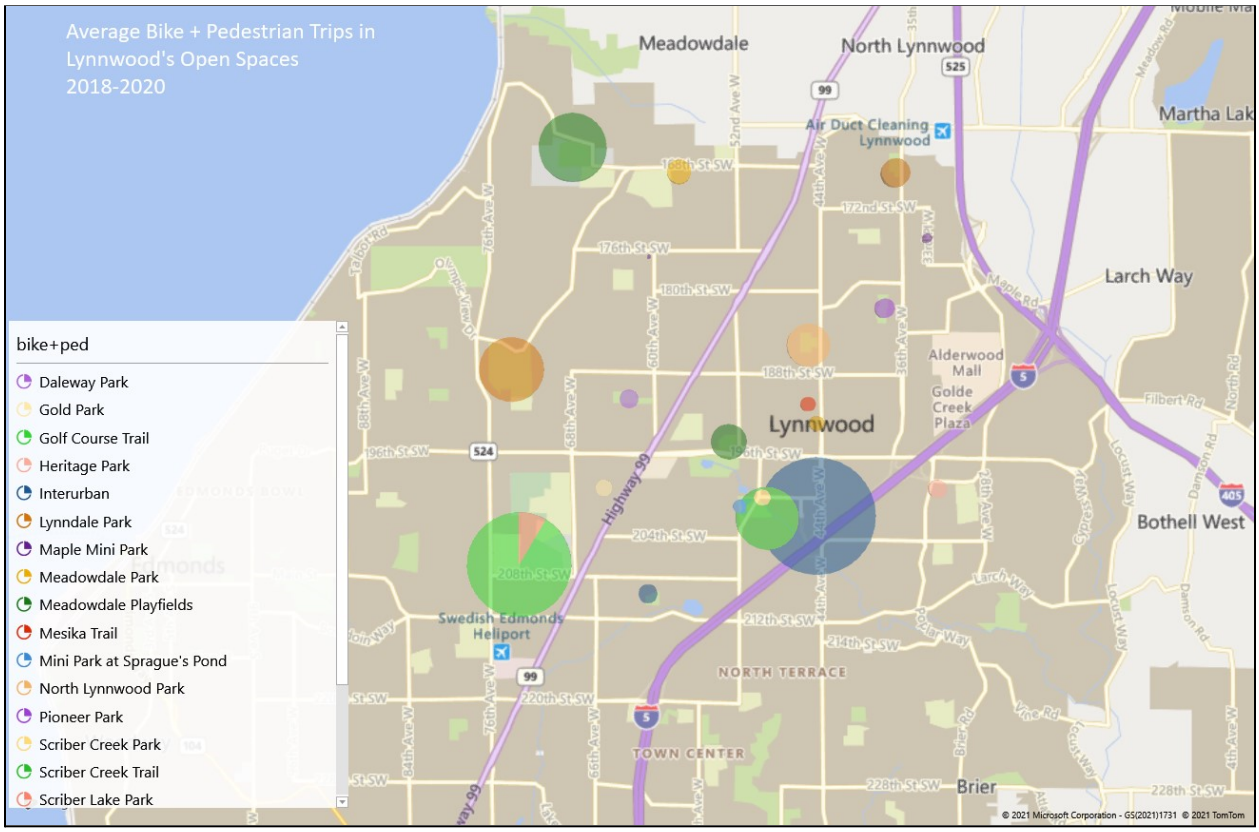
Higher rates of social vulnerability were found in Lynnwood's soutwestern census tracts.[127] Park access showed the highest correlation with social vulnerability, followed by capital value and then acreage and trails.

[127] CDC. (2021). Social Vulnerability Index - GIS Tool. https://cdcarcgis.maps.arcgis.com

4.3.2 Usage Visualizations

In order to quantify criterion four (the ability for each LOS to measure future demand and population changes), we pulled data from the UW Tacoma Team's usage study.[128] Below are several visualizations for the City of Lynnwood.

Total Usage



Map 7. Total Bike + Pedestrian Trips in Lynnwood's Parks & Trails, Yearly Average 2018-2020.

From 2018 to 2020, the top three trails with the most total usages on average in Lynnwood were the Interurban trail (about 575,555 total usage per year), the Golf Course trail (about 416,658 total usage per year), and the Scriber Creek trail (about 163,581 total usage per year). The top three parks/playfields with the most bike trips were Meadowdale playfield (about 193,176 total usage per year), Lynndale park (about 174,237 total usage per year), and North Lynnwood park (about 77,239 total usage per year).[129]

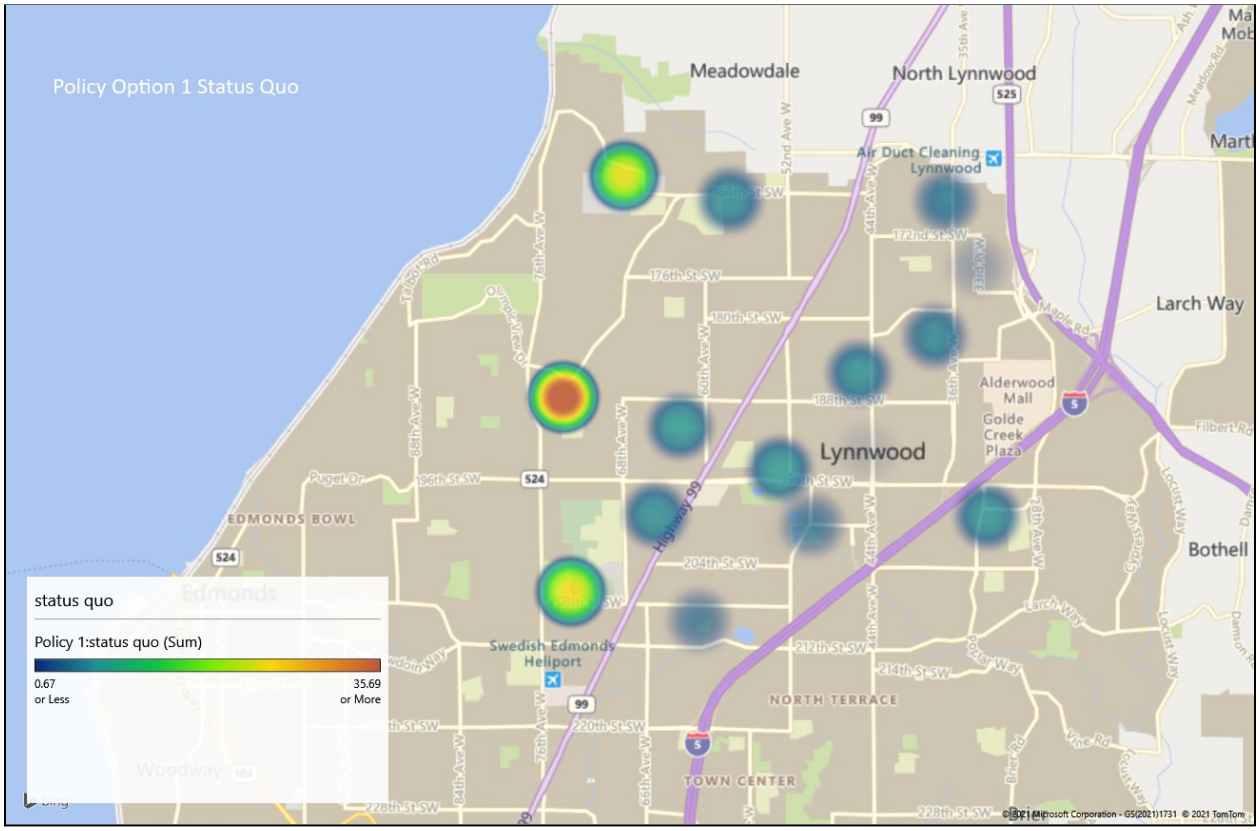
[128] UWT: Gauri Patil, Kevin McInerny, Trishali Ranjan, Monib Sabet. June 2021. Lynnwood Parks & Trails Usage Analysis.

[129] UWT: Gauri Patil, Kevin McInerny, Trishali Ranjan, Monib Sabet. June 2021. Lynnwood Parks & Trails Usage Analysis.

4.3.3 Policy Options Visualizations

Next, we created visualization for three of the four policy options. The individual park level data in the "Policy analysis" spreadsheet was used to create these maps, in an attempt to show how geographic differences influence the Level of Service provided for different measurement options.

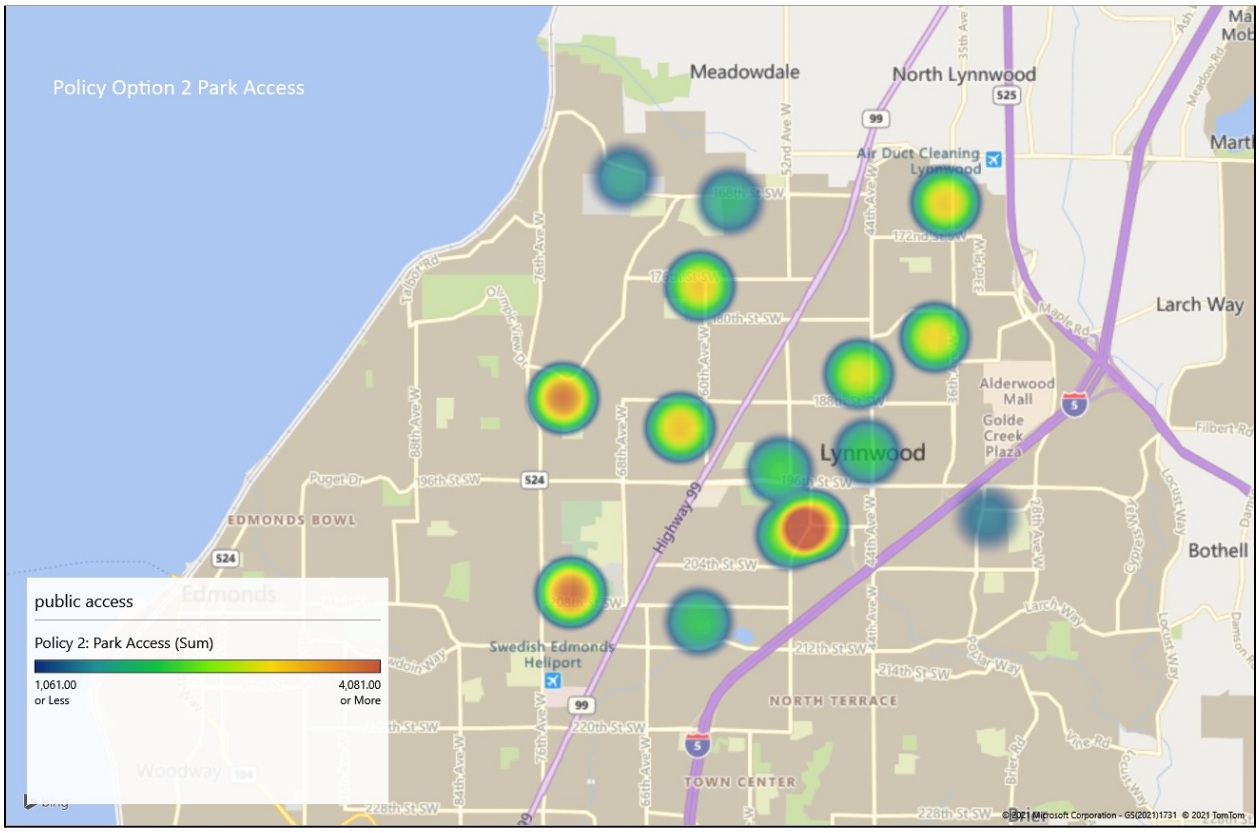
Status Quo (Park Acreage)



Map 8. Policy Option 1: the Status Quo / Park Acreage LOS.

The majority of large acreage parks are located in the west of Lynnwood, which is relatively far away from the city center.

Park Access (residents within ½ mile walk)



Map 9. Policy Option 2: Park Access LOS (Number of Residents within a ½ Mile).

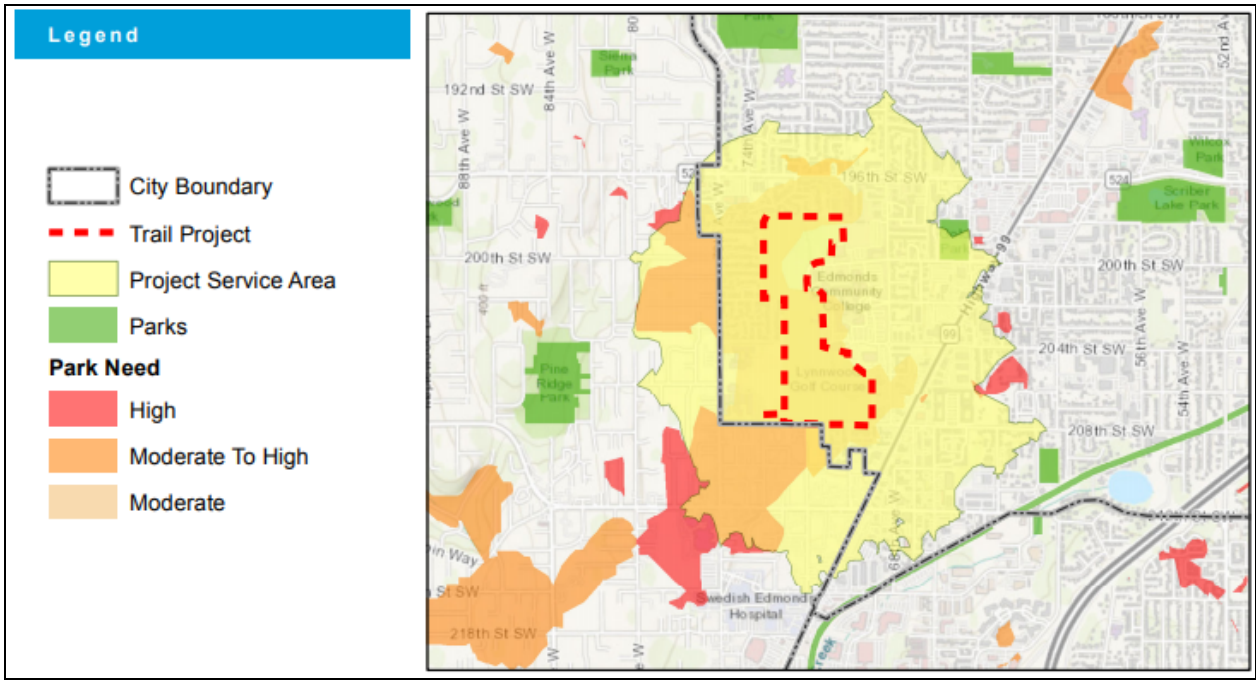
Geographically, the number of people who can easily reach a park within 10 minutes (about ½ mile) is relatively well-distributed, compared with acreage and trails.

Additionally, the Trust for Public Land's database demonstrates the following visuals for park access, *as a percentage* of the entire population.[130] We added the missing Lynnwood Golf Course Trail to show the actual population served at **79.4 percent** of all Lynnwood residents.

City Statistics	Current City Statistics	Impact of new park
City: Lynnwood, WA		
Park Acres	217	
Total Population	39,464	
Served Population	30,240	**31,329**
Percent Served	76.6%	**79.4%**

Table 6. Park Access Increase from the Golf Course Trail.

[130] *Everyone deserves a park within a 10-minute walk of home.* The Trust for Public Land. (n.d.). https://www.tpl.org/city/lynnwood-washington.



Map 10. Visualization of the Park Access Increase from the Golf Course Trail.

Finally for this LOS, the Trust for Public Land also breaks down its access numbers by socio-economic categories. Nearly all demographics based on age, income, and race (Table 7) are represented equally within the 10-minute walk metric (based on the original 76.6% of the population served).[131] [132] For more graphics on access, see **Appendix F.**

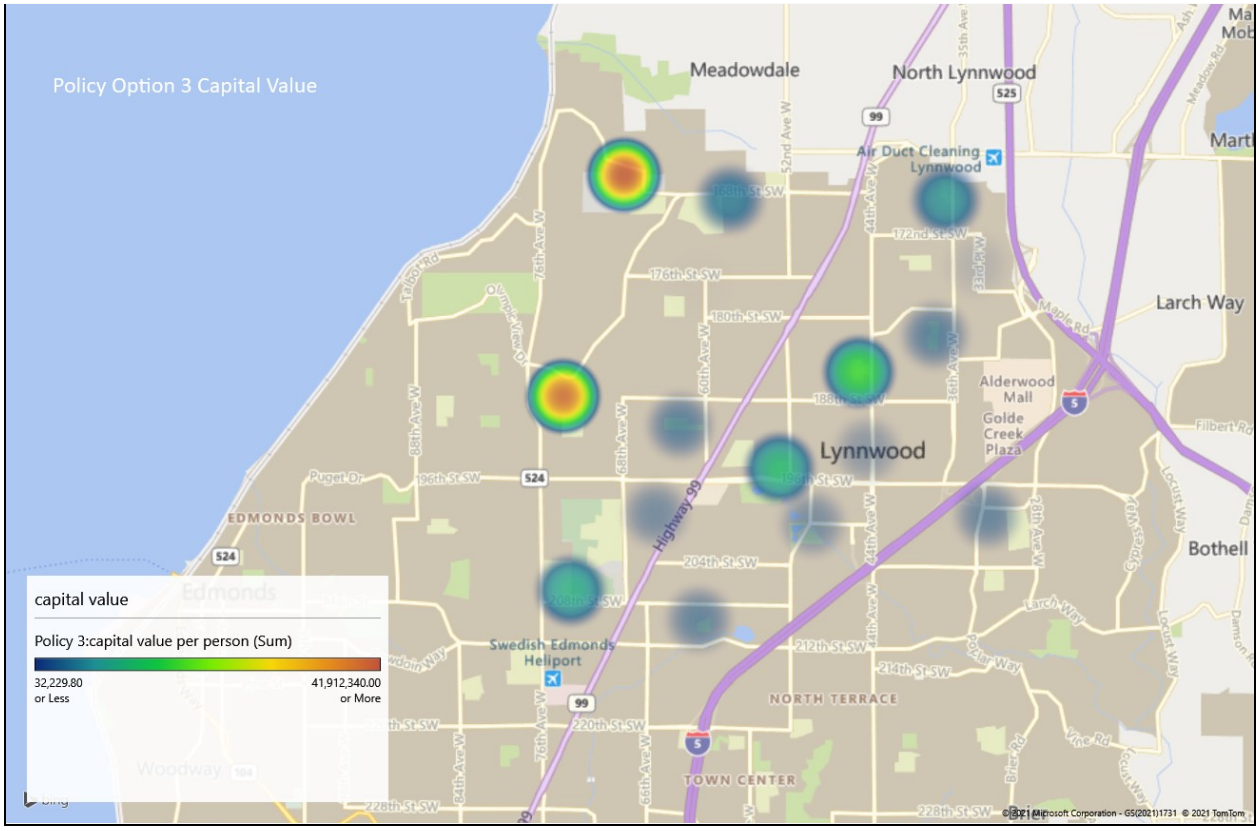
Race/Ethnicity	Total pop. served	New pop. served*
White	2,189	609
Black	414	99
Asian	713	207
Native American	46	13
Pacific Islander	28	7
Other Race	472	82
Mixed Race	243	74
Hispanic**	870	154

** U.S. Census captures Hispanic Origin separate from race

Table 7. Population Served by Parks, Categorized by Race and Ethnicity.

[131] *Park Access Plan* [PDF]. (2020, December). Lynnwood: City of Lynnwood.
[132] *Everyone should have a park within a 10-minute walk of home.* The Trust for Public Land. (n.d.). https://www.tpl.org/city/lynnwood-washington.

Capital Value Per Person



Map 11. Policy Option 3: Capital Value Per Person LOS.

The range of capital value per person in each park is large. The top two parks with the highest capital value per capita are Meadowdale playfields and Lynndale park, both of which are located in the northwest quadrant of Lynnwood.

4.4 Final Scorecards

Based on the policy analysis results, we narrowed in on **park access** and **capital value per person** for our next stage of research. We then reassessed the park system based on these two LOS measurements and scored each park on whether it was above (1), below (-1), or within range (0) of the average for the system. See the "scorecard" spreadsheet for the full assessment. Summary results are included in the tables below and parks are divided by classification.

Overall, this scorecard analysis may help inform the City of Lynnwood where it lacks gaps in parks service, especially given density and equity considerations.

4.4.1 Core Parks

Community Parks	Park Access		Capital Value Per Person		*Total* Score
	Value (# residents within ½ mile)	Score	Value	Score	
Lynndale Park	3,904	1	$10,081.02	1	2
Meadowdale Playfields	1,650	-1	$15,170.00	1	0
Scriber Lake Park	4,025	1	$5,275.50	-1	0
Wilcox Park	2,251	-1	$3,793.37	-1	-2

Table 8. Community Parks Scorecard.

Neighborhood Parks	Park Access		Capital Value Per Person		*Total* Score
	Value (# residents within ½ mile)	Score	Value	Score	
Daleway Park	3,337	1	$2,324.45	1	2
Meadowdale Park	2,747	0	$2,555.03	1	1
North Lynnwood Park	3,077	1	$2,495.78	1	2
Pioneer Park	3,457	1	$1,663.49	-1	0
South Lynnwood Park	2,115	-1	$2,059.13	-1	-2
Spruce Park	3,483	1	$1,646.32	-1	0
Stadler Ridge Park	1,221	-1	$2,460.90	1	0

Table 9. Neighborhood Parks Scorecard.

Mini Parks	Park Access		Capital Value Per Person		*Total* Score
	Value (# residents within ½ mile)	Score	Value	Score	
Maple Mini Park	3,270	1	$264.64	-1	0
Spraque's Pond	2,953	0	$603.34	1	1
Veterans Park	2,473	-1	$701.59	1	0

Table 10. Mini Parks Scorecard.

4.4.2 Special Use Facility Parks

Special Use Facilities	Park Access		Capital Value Per Person		*Total* Score
	Value (# residents within ½ mile)	Score	Value	Score	
Heritage Park & Open Space	1,512	-1	$5,943.16	1	0
Lynndale SkatePark	3,904	1	$587.36	-1	0

Table 11. Special Use Facility Parks Scorecard.

4.4.3 Open Spaces

Open Spaces	Park Access		Capital Value Per Person		*Total* Score
	Value (# residents within ½ mile)	Score	Value	Score	
Gold Park	4,116	1	$1,473.73	-1	0
Scriber Creek Park	3,063	1	$1,273.58	-1	0
Scriber Creek Open Space	2,817	-1	$665.86	-1	-2
Civic Campus Open Space	2,911	0	$6,057.54	0	0
Lund's Gulch Open Space	1,940	-1	$20,829.42	1	0

Table 12. Open Spaces Scorecard.

CHAPTER FIVE: RECOMMENDATION & IMPLEMENTATION

This chapter includes our overall recommendation and implementation considerations. We first present the trade-offs of each policy option, then give our final recommendation and discuss ideas for implementation, and finally we provide a list of our research limitations and potential future work.

5.1 Policy Option Trade-Offs

Below are the summarized trade-offs for each of our proposed policy options. See Chapter 4 for more details. We used bivariate regression analysis to evaluate the ability of each Level of Service (LOS) to measure social health, economic, and environmental equity within the community, as well as the ability to measure future increased demand.

5.1.1 Status Quo (Park Acreage per Resident)

Overall, park acreage per resident as a LOS measurement is able to represent some of the criteria. There is a strong correlation with growth, and a slight correlation with environmental benefits and economic equity. Furthermore, it is unlikely that Lynnwood will be able to maintain a standard acreage LOS as the city's population is projected to increase and park acreage will continue to become more scarce. If the City of Lynnwood continues to use park acreage per resident as an LOS method, it may be forced to continuously lower its ratio of acres per resident, gradually diminishing the intent of the standard.

5.1.2 Park Access (Number of Residents Served within ½ Mile Walk to Park)

Park access is convenient in that it sets the accepted benchmark of a half-mile walk as a universal standard for access to parks and provides a simple ratio of all the residents within that range. Overall, it is useful for a city to strive for a greater percentage of residents to have access to parks and trails compared to a smaller percentage, but the measurement does nothing to account for the general quality, experience, size, density, or even actual walking access of those parks. Compared with other policy options, park access is a relatively ineffective measure, as its only significant correlation is with the social vulnerability index. Additionally, it is an easily manipulatable ratio for densifying cities, which can make the measure counterproductive if proper park and trail planning is not associated with the LOS.

5.1.3 Capital Value Per Person

Capital value per person can appropriately represent most of the criteria. It has a strong correlation with the community's economic, health, and growth data, but shows only a slight

correlation with the environmental measures. Capital value per person can be used as a way to increase equity by measuring and maintaining consistent value among all neighborhoods in Lynnwood. The major weakness of this option is the time and cost to set up and maintain consistent accounting practices that measure the value of Lynnwood's park system with its growing population (see **Appendix C**).

5.1.4 Trail Connectivity (Trail Presence)

Finally, trail presence is relatively weak in representing the criteria. It shows no significant correlation with the community's economic, health, and growth data, but has significant correlation with environmental measures. 5.2.1 contains a further discussion regarding trails.

5.2 Conclusion & Overall Recommendation

Based on our analysis, we recommend a *two-tiered approach* to adopting new LOS measures. In the short-term, we recommend using the percentage of residents served within a half-mile walk to a park or trail LOS. This will allow the city to continue to set goals to reach more citizens in the areas where they are not currently being served by a park or trail. Once the city's service goals are met, Lynnwood should transition to the more long-term capital value per person LOS.

> We recommend that the City of Lynnwood adopt the **half-mile walk** to a park or trail LOS into its future comprehensive parks planning, and prepare to use **capital value per person** as its long-term LOS approach.

Although our findings show park access as relatively weak in representing our criteria, it still demonstrates the number of people served within a 10-minute walk by Lynnwood's parks and trails, which is a crucial indicator for Lynnwood to understand gaps in its system. Additionally, only 79.4 percent of the total population lives within a half-mile walk to the park. With about a fifth of the population not captured in the measure, there is potential for limited or inaccurate analysis of its correlations to the criteria. In essence, LOS metrics like capital value per person *cannot be fully representative* of a city's population until 100 percent of the population has access to a park or trail within a 10-minute walk from their home. As the complementarity between public goods indicates, promoting park access may lead to better usage of the park and unlock its capital values.[133]

Furthermore, the literature review showed that many other growing cities are adopting access as an LOS for ease of replicability and to address equity concerns within their communities (section 2.2.1 & 2.2.7). Feedback from the Lynnwood Parks, Recreation & Cultural Arts (PRCA) Department showed park access as being a very simple and cheap measure to track, requiring no outside consultants or database management needs (**Appendix C**).

[133] Albouy, D., Christensen, P., Sarmiento-Barbieri, I. (2020, February). Unlocking Amenities: Estimating Public Good Complementarity. Journal of Public Economics, 182. Retrieved May 11, from https://www.sciencedirect.com/science/article/pii/S0047272719301720

Capital value per person is the most representative LOS for Lynnwood's PRCA Department, as it demonstrates the highest cumulative ability to measure social health, economic, and environmental equity within the community, and ability to meet demand for future growth. Because the capital value per person LOS method is the *most* expensive and time intensive process to develop (**Appendix C**), it is more effective to first focus on increasing park access by means of creating new trails and park land. This approach is practical for several reasons:

1. As Lynnwood's population continues to increase, the price of land will likely become more expensive in the future.
2. As the population grows and more land is used for housing and development, potential park land will likely become more scarce. It is not unreasonable to imagine in the near future that there will be no land left to readily convert into parks and trails.
3. About a fifth of Lynnwood's population is not yet within a 10-minute walk to a park or trail. While there is no standard stating that 100 percent of a city should be serviced by a park or trail, Lynnwood's current served population (79 percent) seems like a good LOS benchmark and standard; this approach can also be incorporated into park and city planning goals.
4. Capital value per person is essentially a combination of park land and amenity values, and in the short-term expanding land is a much more equitable and economical tactic than focusing on increasing amenities.

5.2.1 Benchmarking

Park Access - Short Term

Currently, about **80 percent** of Lynnwood's population is within a half-mile walk of a park or trail. This may be an ideal starting benchmark for the updated comprehensive plan, with additional percentage increases for every 6-year assessment cycle. The access percent increases should be ambitious enough to hold the PRCA Department accountable, yet flexible and realistic enough to ensure the goals are attainable. Furthermore, Lynnwood could add a **density consideration** or analysis by City quadrant to evaluate park capacity and align park access with equitable park distribution goals. This would mitigate some of the potential downside of this LOS, as outlined in 5.1.2.

Capital Value Per Person - Long Term

The most recent capital value measurement we used came from 2015 inventory data[134] and equated to about $3,783 per person; for every one-person increase to Lynnwood's population there should be $3,783 worth of capital value added to the park system. In the future, the capital inventory will need to be **recalculated** and then divided by the updated population. Furthermore,

[134] For the calculation of capital value per person, we used the inventory of park acreage and amenities within the park system. This LOS measurement shows the combination of park acreage and park amenities. It adds the value of park amenities within the city, which also stands as part of the park quality. As we mentioned in the literature review, promoting park amenities can help increase park usage, provide health benefits to the community, and increase satisfaction and equity among different ethnic and socioeconomic groups.

capital value per person could be **benchmarked** by designated areas, neighborhoods, grids or quadrants, to ensure the assessment outlines where value should be redistributed when needed.

5.2.2 Trail Connectivity Discussion

Due to limited time, we were unable to conduct a separate policy analysis for trails LOS. Instead, we converted trails to a binary variable to note trail presence within a park and therefore analyze it as a subcomponent of park amenities. While a separate trail system analysis may be useful, Lynnwood is already offering above national average trail service,[135] [136] and can opt for a simple common standard of either total trail mileage or trail mileage per 1,000 residents. We recommend the mileage per 1,000 residents because it will ensure adequate service with increased population growth and density, however both methods are used frequently in parks planning (see 2.2.4). Based on a ratio to population, Lynnwood has approximately 0.37 miles of trail / 1,000 residents, which is higher than the current national standard of 0.25.[137] By setting a **new trails LOS benchmark** somewhere between 0.3 and 0.4 miles / 1,000 residents, Lynnwood could maintain its above average service and hold itself accountable, while allowing for some flexibility to meet population growth demands.

5.3 Limitations & Future Work

Our recommendation is based on a comprehensive consideration of the literature review, quantitative policy analysis, and ease of model replicability feedback. We acknowledge the following limitations of our analysis, and propose some possible future work.

First, while gleaning information from academic reports and case examples is useful, all communities have unique demographics, economies, values, needs, and other considerations. What works for one city may not work for Lynnwood. Additionally, our assessment of Lynnwood's community values and needs was based on qualitative and quantitative data that precluded our involvement, and we therefore cannot properly point out or solve errors and biases in data collection. Additionally, this project also lacks the direct perspectives of Lynnwood's residents. Future work could be more participatory and engage citizens in the process of establishing service standards.

Second, there were limitations in our statistical analysis. We used the bivariate method to analyze each LOS measurement and each criterion, meaning we didn't add any control variables in our regressions. Because of this, our policy analysis likely includes some level of omitted variable bias. Given the limited observations in our dataset, conducting multivariable regression might have resulted in an overfit model, which means the regression coefficients might not represent

[135] The City of Lynnwood has 14 miles of trails, which is higher than the national average of 11 but lower than the west coast average of 16 miles.
[136] City of Lynnwood. (2016). 2016-2025 PARC Plan. https://www.lynnwoodwa.gov/files/sharedassets/public/public-works/project-folders/south-lynnwood-park-reno/2016-2025-parks-arts-recreation-conservation-plan.pdf
[137] NRPA: National Recreation and Park Association. (2020). Agency Review. https://www.nrpa.org/siteassets/nrpa-agency-performance-review.pdf

the correlations between our variables.[138] Future work could focus on adding individual-level (resident level) data instead of only using park-level data. With more observations, the city could consider adopting more rigorous regression models, such as multi-level regression, etc. We want to emphasize that our policy analysis was conducted just to see if any simple correlations exist, and while there are definitely gaps in our methodology, the correlations found are still useful for parks planning purposes.

Third, we had to limit the scope of the project due to time constraints. We chose to focus on LOS equity since it is a rapidly growing topic in parks planning, and something we view as very important. Even though our research is not comprehensive, this study may have beneficial implications for future decades of park system planning in the City of Lynnwood. If our recommendation is not adopted, the PRCA Department can still use our findings on LOS standards to highlight the significant strengths and deficiencies of the Lynwood park system on the basis of park acreage, access, capital value, or trail connectivity. Furthermore, our study could help the city prioritize future budget planning and more equitable investments.

Additionally due to time limitations, our research failed to include an assessment of the potential annexation of municipal urban growth areas. Future analysis could focus on analyzing if the recommended LOS measurements would also fit the annexed areas, or if those areas should have their own LOS measures.

Finally, we did not include a discussion of force majeure impact on city parks and public recreation places, such as the COVID-19 pandemic we are currently experiencing, or other natural disasters (or climate change) that will affect the park usage. Future work may need to include this type of risk analysis, and the corresponding prevention and service solutions to help Lynnwood better respond to public emergencies.

5.4 Acknowledgements

We want to acknowledge our client, Deputy Director Sarah Olson, for her continuous feedback, knowledge sharing, and excitement regarding parks and recreation. We greatly appreciated our weekly meetings and gained a crash course in the complexities of city government planning. We also want to acknowledge the UW Tacoma research team for sharing their data with us, and we hope our report compliments their impressive research. Finally, we want to thank our capstone advisor Steve Kosack and our Evans peers for their guidance and thoughtful suggestions on our project. Our team worked across multiple time zones and through a pandemic, and we are proud of our contribution in evaluating Lynnwood's parks level of service standard.

[138] Frost, J. Five Reasons Why Your R-Squared can be Too High. https://statisticsbyjim.com/regression/r-squared-too-high/

APPENDIX

Appendix A. National Park Agency Averages from 2020.[139]

FIGURES	TOP-LINE FINDING	PAGE NO.
PARK FACILITIES		
Figure 1: Residents per Park	There is typically one park for every 2,281 residents.	8
Figure 2: Acres of Parkland per 1,000 Residents	The typical park and recreation agency has 9.9 acres of parkland for every 1,000 residents in the jurisdiction.	8
Figure 3: Outdoor Park and Recreation Facilities — Prevalence and Population per Facility	An overwhelming majority of park and recreation agencies have playgrounds (93.9 percent) and basketball courts (86.5 percent) in their portfolio of outdoor assets.	9
Figure 4: Miles of Trail	The typical park and recreation agency manages or maintains 11 miles of trails for walking, hiking, running and/or biking.	10
Figure 5: Indoor Park and Recreation Facilities — Prevalence and Population per Facility	A majority of agencies offer community centers and recreation centers; two in five agencies offer senior centers.	10

[139] NRPA: National Recreation and Park Association. (2020). Agency Review. https://www.nrpa.org/siteassets/nrpa-agency-performance-review.pdf

Appendix B. Specific Data Sources for the Criteria.

Criterion	Data used to represent criterion	Data source and categories	How we coded for analysis
Health	Obesity %	The Trust for Public Land GIS, data came from CDC 2010 measurements: 5 categories showing 0% to 33% obesity within the population	Coded the rankings as follows: 0 = 0% - 7% 1 = 7% - 9% 2 = 9% - 11% 3 = 11% - 14% 4 = 14% - 33%
	Social vulnerability index	CDC's scoring system based on 14 Census variables, measures the relative social vulnerability of different census tracts, ranked by quartile: 0 - 0.25: lowest vulnerability 0.2501 - 0.5: 0.5001 - 0.75: 0.7501 - 1: highest vulnerability	Maintained the same quartile rankings as the data source (converted to 1 - 4); higher is more vulnerable
Socio-Economics	The low income rate	The Trust for Public Land GIS, measured as the number of citizens in the following categories: Low income Middle income High income	Converted to low income rate %; ideally want park LOS equitably distributed across all income levels
	The % of people of color	The Trust for Public Land GIS, originally Census data, measured as the number of Black, Asian, white, and citizens of other races	% Black, Asian, and other races compared to % white; ideally want park LOS equitably distributed
Environment	Urban heat island effect	The Trust for Public Land GIS: None - no urban heat island Moderate High Very high - most negative impacts	There are no very high urban heat island effects in Lynnwood; removed that category in the codes: 0 = None 1 = Moderate 2 = High
	Air quality	The Trust for Public Land GIS: 1: very low air quality 2: low 3: moderate 4: high 5: very high air quality	Maintained same rankings as data source; higher value means increased air quality
Demand / growth	Parks usage statistics	UW Tacoma Usage Study: total bike and pedestrian usage per park from 2018 - 2020	Averaged the bike and pedestrian usage across the three years, combined for a total average usage; the ideal LOS correlates with use

More Information for the Health Criterion - CDC's Social Vulnerability Index:[140]

Helpful Terms & Facts

Social Vulnerability refers to the resilience of communities (the ability to survive and thrive) when confronted by external stresses on human health, stresses such as natural or human-caused disasters, or disease outbreaks. Reducing social vulnerability can decrease both human suffering and economic loss.

Socially Vulnerable Populations include those who have special needs, such as, but not limited to, people without vehicles, people with disabilities, older adults, and people with limited English proficiency.

Census tracts are subdivisions of counties for which the Census collects statistical data. The CDC/ATSDR SVI ranks each tract on 15 social factors, including poverty, lack of vehicle access, and crowded housing, and groups them into four related themes. Each tract receives a separate ranking for each of the four themes, as well as an overall ranking.

Data Sources: U.S. Census

CDC/ATSDR SVI Themes & Social Factors:

- Socioeconomic status (below poverty, unemployed, income, no high school diploma)
- Household composition & disability (aged 65 or older, aged 17 or younger, older than age 5 with a disability, single-parent households)
- Minority status & language (minority, speak English "less than well")
- Housing type & transportation (multi-unit structures, mobile homes, crowding, no vehicle, group quarters)

See section 4.3.1 for visualizations of the Trust for Public Land's GIS data, and the UWT report for more specific usage analysis.

[140] Hallisey, E., Flanagan, B., Kolling, J., et al. (n.d.). A Social Vulnerability Index (SVI) from the CDC. *Center for Disease Control and Prevention*.

Appendix C. Internal survey sent to Deputy Director Sarah Olson to assess the ease of model replicability for the proposed LOS options.

TIME - please rank the following policy options on the *time it will take to conduct LOS measurements*, every 6 years:

Level of Service Policy Option	Time to measure, rank 1-4 (4 being the most)	Specific time estimate, if applicable
Status Quo (Park Acreage per Resident)	1	15 min
Park Access (Percent of Residents living within ½ Mile Walk to Park)	1	15 min
Capital Value Per Person	4	15 hours? Requires consultant support.
Trail Connectivity (Total Trail Mileage)	2	30 min

COST - please rank the following policy options on the *cost to conduct LOS measurements*, every 6 years:

Level of Service Policy Option	Cost of measurement, rank 1-4 (4 being the most)	Specific cost estimate, if applicable
Status Quo (Park Acreage per Resident)	1	none
Park Access (Percent of Residents living within ½ Mile Walk to Park)	1	none
Capital Value Per Person	4	$20K
Trail Connectivity (Total Trail Mileage)	2	none

DATA - please answer the following questions regarding *LOS data management*:

Level of Service Policy Option	Is maintenance of an internal (parks) database needed? YES or NO	Does the city's financial system (MUNIS) maintain the data? YES or NO	Are outside consultants needed? YES or NO
Status Quo (Park Acreage per Resident)	no	no	no
Park Access (Percent of Residents living within ½ Mile Walk to Park)	no	no	no
Capital Value Per Person	yes	no	yes
Trail Connectivity (Total Trail Mileage)	no	no	no

Appendix D. Park Classification and Amenities Summary.

To evaluate the city's needs and plan for an efficient, cost-effective, and usable park system, Lynnwood PARC Plan classified the parkland into four classifications based on the size and service offered by each park, they are defined as follows: [141]

- Core Parks
    - Community Parks: large parks provide organized play and multiple passive and active recreation facilities. Their size is generally 20-40 acres, and serve residents within a 1-mile driving, walking or biking distance.
    - Neighborhood Parks: parks provide non-organized play and limited active and passive recreation. Their size is generally from 3-7 acres, and serves residents within a ½-mile walking distance with basic park amenities such as pedestrian paths, picnic tables, benches, play equipment, and etc.
    - Mini Parks: small parks that provide limited opportunities for active play and passive recreation. They are less than 1 acre in size and provide limited recreational amenity to residents within a ¼-mile walking distance.
- Special Use Facilities: recreational areas or sites that provide specific or specialized uses. May include golf courses, recreation centers, historical or cultural sites, and etc.
- Open Space: large natural areas, environmental parks and urban greenbelts that are owned or managed by a governmental agency.
- Trails: non-motorized recreation and transportation networks that are separated from the roadways. They have multiple or shared uses, such as pedestrian and bicycle use, as well as single-use.

Below is a summary of the different park types and amenities, based on their geographic location in the city. The community survey of Lynnwood divided the city into four areas based on highway 99 and road 188th street southwest.

Northwest Lynnwood
There is one community park (Meadowdale playfield), one neighborhood park (Meadowdale park), and one open space (Lund's Gulch Open Space) that reside in northwest Lynnwood. In general, parks in this area have basic amenities. Meadowdale playfield has more basic infrastructure, it provides more picnic facilities compared to other parks and open space in this area. The playfields and Meadowdale park both have adequate playground facilities for children and the sports fields, while Lund's Gulch Open Space has its natural views but is undeveloped and lacks other facilities.

Northeast Lynnwood
Northeast Lynnwood has four neighborhood parks, and one mini park. They are North Lynnwood Park, Pioneer Park, Spruce Park, Stadler Ridge Park, and Maple Mini Park. These four neighborhood parks all have comprehensive park amenities, which suggests they could provide more basic services to diverse populations, such as active and passive activities. Whereas Maple Mini Park only provides limited facilities, such as playgrounds, play structure, benches and picnic tables.

Southwest Lynnwood
For southwest Lynnwood, there is one community park (Lynndale Park), one neighborhood park (Daleway Park), one special use park (Lynndale SkatePark) and one open space (Gold Park). Lynndale

[141] City of Lynnwood. (n.d.). 2016 PARC Plan

Park and Daleway Park all have relatively well-equipped facilities, while more sports amenities and natural views are provided in Lynndale Park. The Lynndale SkatePark has a comprehensive basic infrastructure and provides skate facilities. Gold Park, although it has substantial natural views, lacks basic facilities such as restrooms.

Southeast Lynnwood
There are eight parks and open spaces in the southeast, which suggests this neighborhood has the most parks and open spaces compared to other regions in Lynnwood. Specifically, there are two community parks (Scriber Lake Park and Wilcox Park), one neighborhood park (South Lynnwood Park), two mini parks (Spraque's Pond Mini Park and Veterans Park), one special use park (Heritage Park & Open Space) and two open space parks (Scriber Creek Park and Scriber Creek Open Space). Most of them have basic infrastructures, and some have special amenities like pickleball courts and floating docks. This region only has some basic playground facilities for children and limited sports fields, but nearly all of these parks and open spaces have natural views.

Finally, after detailing the basic features of each park's amenities, we used these details in the process of calculating the total capital value for each park.

Appendix E. Statistical Descriptions for Regression Analysis.

Social Health Equity - Each LOS Measurement's Ability in Representing Obesity Rate and Social Vulnerability within the Community

Dependent variable - Obesity Rate

The percentage of residents with obesity in the community. There are five levels, they are 1) obesity Rate from 0% to 7% within the community, 2) obesity Rate from 7% to 9% within the community, 3) obesity Rate from 9% to 11% within the community, 4) obesity Rate from 11% to 14% within the community, 5) obesity Rate from 14% to 33% within the community. They are categorical and logically ordered.

Independent variables	Ologit 0 - Obesity Rate 0% - 7%	Ologit 1 - Obesity Rate 7% - 9%	Ologit 2 - Obesity Rate 9% - 11%	Ologit 3 - Obesity Rate 11% - 14%	Ologit 4 - Obesity Rate 14% - 33%	Ologit Regression
	dy/dx	dy/dx	dy/dx	dy/dx	dy/dx	
Park Acreage	0.0020	0.0043	0.0027	-0.0027	-0.0064	-0.0378
	(0.69)	(0.95)	(0.85)	(-0.82)	(-0.91)	(-0.93)
Park Access	2.58e-07	5.92e-07	3.64e-07	-3.64e-07	-8.49e-07	-4.92e-06
	(0.01)	(0.01)	(0.01)	(-0.01)	(-0.01)	(-0.01)
Capital Value Per Person	0.00001	0.00003*	0.00002	-0.00001	-0.00005*	-0.00029**
	(1.38)	(1.87)	(1.40)	(-0.71)	(-1.83)	(-2.12)
Trail Connectivity	0.0487	0.1349	0.1369	-0.0213	-0.2992	-1.4926
	(0.96)	(1.42)	(1.16)	(-0.19)	(-1.19)	(-1.32)
N	18	18	18	18	18	18

t statistics in parentheses
* p < 0.1, ** p < 0.05, *** p < 0.01

Dependent variable - Social Vulnerability

The level of social vulnerability for residents in the community. There are four levels, they are 1) lowest Level, 2) second Lowest Level, 3) third Quartile Level, 4) highest Level. They are categorical and logically ordered.

Independent variables	Ologit 1 - Social Vulnerability Lowest Level	Ologit 2 - Social Vulnerability Second Lowest Level	Ologit 3 - Social Vulnerability Third Quartile	Ologit 4 - Social Vulnerability Highest Level	Ologit Regression
	dy/dx	dy/dx	dy/dx	dy/dx	
Park Acreage	-0.0011	-0.0031	-0.0010	0.0052	0.0214
	(-0.41)	(-0.44)	(-0.40)	(0.44)	(0.43)
Park Access	-0.00008	-0.00015**	-0.00008*	0.00031***	0.00181***
	(-1.23)	(-2.39)	(-1.80)	(5.51)	(2.61)
Capital Value Per Person	0.00001	0.00003*	0.00001	-0.00005*	-0.00023
	(1.11)	(1.67)	(0.79)	(-1.79)	(-1.58)
Trail connectivity	0.0122	0.0365	0.0136	-0.0624	-0.2513
	(0.25)	(0.24)	(0.20)	(-0.23)	(-0.24)
N	18	18	18	18	18

t statistics in parentheses

* p < 0.1, ** p < 0.05, *** p < 0.01

Economic Equity - Each LOS Measurement's Ability in Representing Low Income Rate and Percentage of People of Color Served by the Park within the Community

Dependent variable - Low Income Rate & Percentage of People of Color Served by the Park

Independent variables	White (%)	Black (%)	Asian (%)	Other Race (%)	Low Income Rate (% of residents with low income)
Park Acreage	0.0045**	-0.0008*	-0.0026*	-0.0012	-0.0027
	(2.31)	(-1.80)	(-1.83)	(-1.06)	(-1.00)
_cons	0.5439	0.0759	0.2252	0.1549	0.3744
	(20.95)	(13.42)	(12.01)	(10.65)	(10.40)
Park Access	0.00001	8.47E-07	-0.00002	8.40E-06	0.00004
	(0.56)	(0.15)	(-1.38)	(0.63)	(1.13)
_cons	0.5384	0.0669	0.2739	0.1207	0.2456
	(6.63)	(3.95)	(5.13)	(2.97)	(2.51)
Capital Value Per Person	1.00e-05***	-2.91e-06**	-6.14e-06	-5.79e-06*	-1.52e-05**
	(2.93)	(-2.70)	(-1.52)	(-2.07)	(-2.25)
_cons	0.5320	0.0792	0.2241	0.1646	0.4027
	(21.05)	(14.74)	(11.12)	(11.78)	(11.91)
Trail connectivity	0.0297	-0.0023	-0.0193	-0.0081	-0.0575
	(0.48)	(-0.18)	(-0.45)	(-0.26)	(-0.76)
_cons	0.5570	0.0714	0.2196	0.1519	0.3995
	(9.87)	(6.07)	(5.65)	(5.34)	(5.78)
N	18	18	18	18	18

t statistics in parentheses
* p < 0.1, ** p < 0.05, *** p < 0.01

Environmental Equity - Each LOS Measurement's Ability in Representing Urban Heat Island Effect and Air Quality within the Community

Dependent variable - Urban Heat Island Effect

The level of urban heat island effect within the community, normally the higher the effect the worse it is for the environment. There are three levels, they are 1) urban heat island effect equals zero within the community, 2) urban heat island effect equals moderate within the community, 3) urban heat island effect equals high within the community. They are categorical and logically ordered.

Independent variables	Ologit 0 - Urban Heat Island Zero	Ologit 1 - Urban Heat Island Moderate	Ologit 2 - Urban Heat Island High	Ologit Regression
	dy/dx	dy/dx	dy/dx	
Park Acreage	0.0135*	0.0032	-0.0167	-0.0761
	(1.65)	(0.61)	(-1.48)	(-1.37)
Park Access	0.00006	0.00001	-0.00007	-0.00030
	(0.60)	(0.43)	(-0.61)	(-0.60)
Capital Value Per Person	0.00004*	0.00001	-0.00005	-0.00023
	(1.77)	(0.66)	(-1.61)	(-1.48)
Trail connectivity	0.3333***	0.4000***	-0.7333***	-17.8040
	(2.74)	(3.16)	(-6.42)	(-0.01)
N	18	18	18	18

t statistics in parentheses
* p < 0.1, ** p < 0.05, *** p < 0.01

Dependent variable - Air Quality

The level of air quality within the community, the higher the score the better the quality for air. There are four levels, they are 1) air quality equals 1, 2) air quality equals 2, 3) air quality equals 3, 4) air quality equals 4. They are categorical and logically ordered.

Independent variables	Ologit 1 - Air Quality Level 1	Ologit 2 - Air Quality Level 2	Ologit 3 - Air Quality Level 3	Ologit 4 - Air Quality Level 4	Ologit Regression
	dy/dx	dy/dx	dy/dx	dy/dx	
Park Acreage	0.0053	0.0002	-0.0016	-0.0039	-0.0401
	(0.89)	(0.05)	(-0.69)	(-0.78)	(-0.87)
Park Access	0.00005	-1.63E-07	-0.00001	-0.00003	-0.00033
	(0.59)	(-0.01)	(-0.55)	(-0.57)	(-0.60)
Capital Value Per Person	8.94E-06	1.56E-07	-2.63E-06	-6.47E-06	-0.00007
	(0.53)	(0.03)	(-0.48)	(-0.51)	(-0.53)
Trail connectivity	-0.2457	0.1086	0.0438	0.0933	1.4248
	(-0.91)	(0.52)	(0.88)	(1.19)	(1.08)
N	18	18	18	18	18

t statistics in parentheses
* p < 0.1, ** p < 0.05, *** p < 0.01

Ability to Meet Demand for Future Growth - Each LOS Measurement's Ability in demonstrating the park usage within the Community

Dependent variable - Park Usage

The average of average pedestrian usage and bike usage of the park from year 2018 to year 2020.

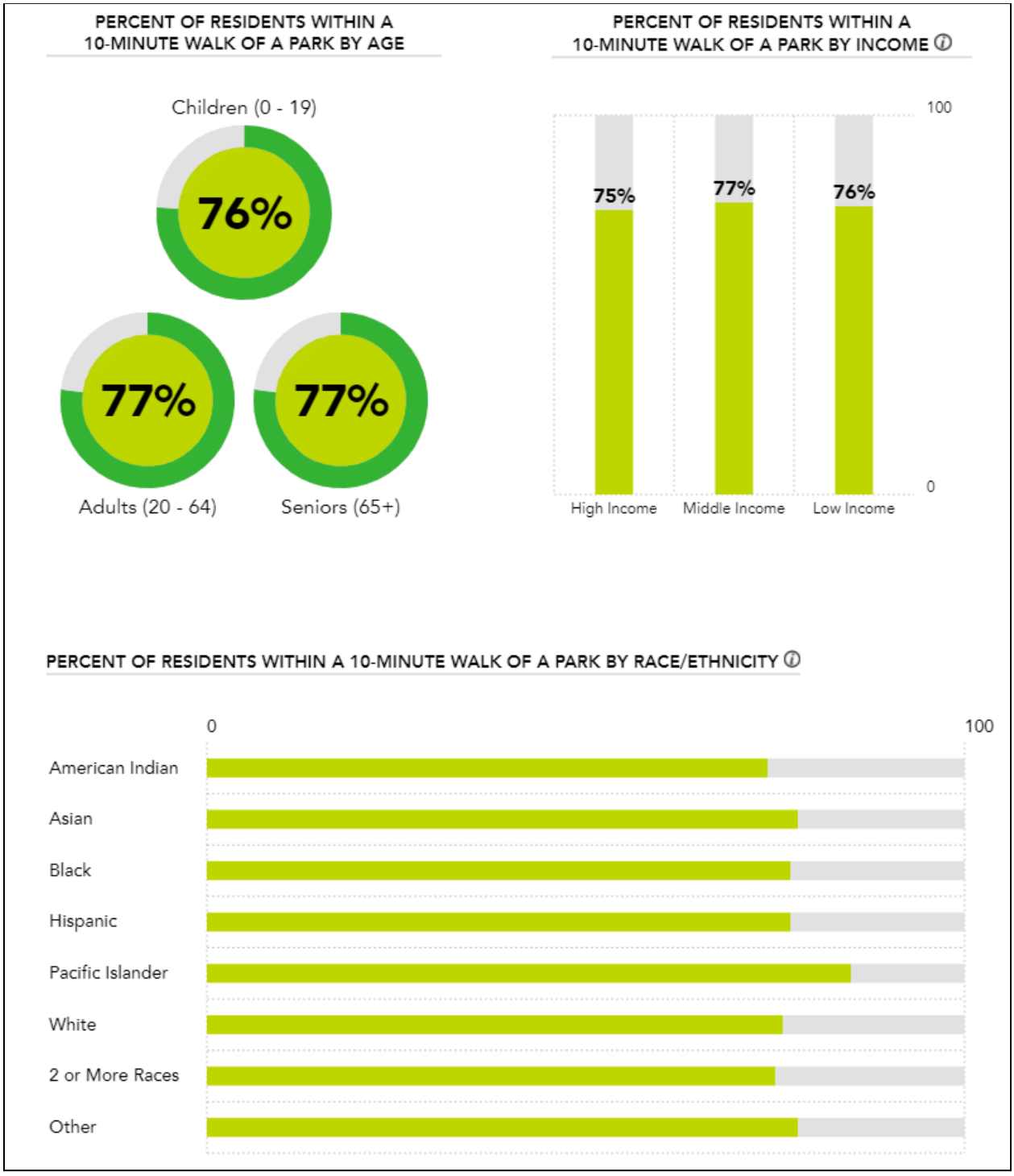
Independent variables	Average park usage
Park Acreage	3668.15***
	(3.07)
_cons	17355.77
	(1.09)
Park Access	9.24
	(0.52)
_cons	21294.36
	(0.39)
Capital Value Per Person - Method 2	11.43***
	(3.72)
_cons	9935.53
	(0.65)
Trail connectivity	33103.27
	(0.81)
_cons	20680.00
	(0.56)
N	18

t statistics in parentheses

* p < 0.1, ** p < 0.05, *** p < 0.01

Appendix F. More Visualizations for Park Access LOS.

Data from the Trust for Public Land.[142]



[142] *Everyone deserves a park within a 10-minute walk of home.* The Trust for Public Land. (n.d.). https://www.tpl.org/city/lynnwood-washington.