Transit-Oriented Development Map for Low Income Housing Tax Credit Allocations

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I. Introduction

This capstone project involves formulating a transit-oriented development map for low income housing tax credit allocations. Graduate students Kory Kramer and David Schmitz worked with project sponsor Tim Parham of the Puget Sound Regional Council (PSRC). Tim is a Senior Planner at PSRC, working within the Growth Management Department. In particular, he works with the Growing Transit Communities Partnership. Prior to the start of the capstone project, a questionnaire was sent to Parham by the professors of the capstone course. One of Parham's answers linked to a map entitled Fixed Transit Infrastructure in King County, which was made by PSRC in 2012 for the Washington State Housing Finance Commission. The purpose of the map was to target areas for low-income housing tax credits in King County. The goal for this capstone project was to generate similar maps for Pierce and Snohomish counties. Ideally, Tim wanted to make these maps available via an online interface through which users would have the capability to view the data at different scales and conduct a certain level of data analysis.

The Puget Sound Regional Council, as described on their website, is a unique government agency and a regional planning agency. On issues such as transportation planning, economic development, and growth management, PSRC is given specific responsibilities under state and federal laws. Ultimately, PSRC assists in helping local jurisdictions and transportation agencies in future planning on aspects that reach across multiple counties.

PSRC members include the counties of King, Kitsap, Pierce, and Snohomish, as well as 72 cities, four port districts, the Muckleshoot Indian Tribe, the Suquamish Tribe, the transit agencies within the four-county area, the Washington State Department of Transportation, and the Washington State Transportation Commission. PSRC provides planning, research, and funding in an effort to maintain a coherent vision throughout the member areas in terms of transportation, economic development, and land use planning. They distribute $180 million in federal funding per year to transportation projects, collect data to support planning, and form a united vision along with steps to succeed.

The low-income housing tax credit (LIHTC) program was created in 1986 as part of Section 42 of the Internal Revenue Code. According to the Washington State Housing Finance Commission, the incentive program encourages construction or rehabilitation of buildings for occupancy by low-income tenants, and does so via a dollar-for-dollar credit which can be used to reduce federal taxes. Developers can also use the benefits to attract investor commitments in exchange for a share of the tax credits. Per Section 42, LIHTCs are allocated at the state level by a state-designated agency. In Washington, the Washington State Housing Finance Commission (WSHFC) is that agency. Primarily, states get an amount of credits annually based on population (WSHFC, 2008). The WSHFC then allocates the credits. By law, the WSHFC is to give preference to projects intended to serve the lowest income tenants for the longest period of time.

The WSHFC has a system wherein a prospective housing project is scored based upon how well it meets a set of 21 allocation criteria as listed on page 46 of the 2012 document 9% Competitive Housing Tax Credit Policies. The total of points in this system is 222, with a minimum of 139 points needed in King County and 134 in all other counties in order for the project to be placed into a Geographic Credit Pool. The three most heavily weighted allocation criteria are (1) additional low-income housing commitment, (2) additional low-income housing use period, and (3) special needs housing commitments.

VISION 2040

In April of 2008, a large group of stakeholders from various jurisdictions and interests helped draft the VISION 2040 document. VISION 2040 was put together in anticipation of substantial growth within the Central Puget Sound region – it is estimated that population will increase from 3.6 million to 5 million people, and employment will expand from 2 million to 3 million jobs by the year 2040 (PSRC, 2009). Given those projections, VISION 2040 seeks to accommodate growth while improving the region's environment and the quality of life. The document sets six regional goals, treating the environment, development patterns, housing, the economy, transportation, and public services. On the surface, this capstone project deals with the transportation and housing components, yet all of the components are intimately intertwined.

VISION 2040 points out that while many other metropolitan areas can expand outward radially, the topography of the Puget Sound region restricts radial expansion and instead redistributes growth northward and southward along or near Puget Sound. Though King County will likely receive the bulk of the expected population growth, Kitsap, Pierce, and Snohomish counties will likely see population and employment increases as well. In addition to accommodating the new growth, the document lays forth a strategy for creating resources and infrastructure to help manage the growth. It strives to preserve the natural environment in the future, but also to have its growth be more compact, walkable, and transit-oriented.

TRANSPORTATION 2040

The May 2010 document Transportation 2040 implements the transportation aspect of VISION 2040. A federal mandate known as SAFETEA-LU (Safe, Accountable, Flexible, and Efficient Transportation Equity Act: A Legacy for Users) required comprehensive planning programs and transportation funding decisions to be linked. Planning factors required by SAFETEA-LU included increasing the accessibility and mobility of people and freight, and also enhancing the integration and connectivity of the transportation system (multimodal) for people and freight. The document identified centers and compact urban communities as areas expected to garner the most growth, and therefore receive priority for Transportation 2040 investments. It calls for supporting the environment while transporting people and freight. It also calls for walkable cities and bike-friendly neighborhoods, and for cleaner and renewable sources of energy. It calls for reducing vehicle miles traveled, reducing delays, improving reliability, and giving more choices to the most transit-dependent users. The document also addresses the need for new strategies in terms of funding (PSRC, 2010).

GROWING TRANSIT COMMUNITIES STRATEGY

The Growing Transit Communities Partnership (GTC) was formed in 2011, consisting of various governments, nonprofit organizations, business groups, and community stakeholders. The coalition aimed to promote "the successful development of thriving and equitable communities within walking distance of current and planned public transit services" in the region. This partnership then amassed research and analysis to find best practices and effective tools to build communities. These efforts were eventually refined and became the Growing Transit Communities Strategy.

The GTC Strategy, released by PSRC in draft form in May 2013, refers specifically to the goal within VISION 2040 having to do with “growth within existing urban areas” in the form of “compact, walkable communities that are linked by transit” (PSRC, 2013a). With billions of dollars set to be used for rapid transit, the opportunity presented itself to place housing, jobs, and services near transit investments, and to benefit adjacent neighborhoods and communities while doing so. The GTC Strategy cited recent market studies showing that within walking distance of transit, the demand was unable to meet the supply in terms of housing and jobs. As such, policies need to be put into place to encourage growth in housing and jobs near transit, and investments in related infrastructure need to be made.

According to the GTC Strategy, 43 percent of the households in the region make less than 80 percent of the area median income. Market-rate housing that is accessible to transit, however, is unaffordable to these 43 percent. Newer investments are threatening to push out lower-cost units, which would be detrimental to low-income households, a large portion of whom are transit-dependent. The demand for subsidized housing is far outpacing the supply. The document also cites an analysis of regional indicators showing that not enough people have access to education, employment, mobility, health, and neighborhood services and amenities. The accessibility of transit communities is seen as a “critical focal point” on the path to better equity among the residents of the region.

After voters approved various measures to fund high-capacity light rail and other investments ($15 billion in all), the GTC Partnership saw “a once-in-a-lifetime opportunity” to help existing communities and meet regional goals in an effort to “make great places for people to live and work.” To do this, the Partnership felt the region had to (1) leverage the transit investment to build sustainable communities, (2) create new resources and tools, and (3) work together across the region and across sectors.

To accomplish those objectives, three main goals were established by the GTC Partnership: bring more of the region’s residents and employment growth near high-capacity transit, make housing choices near high-capacity transit affordable to the full spectrum of incomes, and increase access to opportunity for current and future community members in transit communities (PSRC, 2013a).

TRANSIT-ORIENTED DEVELOPMENT

Sound Transit’s TOD Program Strategic Plan describes transit-oriented development as “compact public and private development that supports transit use by emphasizing pedestrian access, such as by clustering development and mixing land uses and activities at and around transit facilities.” The developments are comprised of public and private projects creating walkable, high-density environments “with a mix of land uses and activities at and around transit facilities.” The area, as constructed, “should encourage people to use transit and foster a healthy, livable environment” (Sound Transit, n.d.).

Further, the Sound Transit definition says “TOD is generally focused on land within approximately one-half mile, or 10- to 15 minute walk, of a transit facility and along corridors that provide key connections to the regional transit system.” Similarly, the Center for Transit-Oriented Development defines TOD as a higher-density mixed-use development within walking distance – or a half-mile – of transit stations. These walksheds are an integral part of this capstone project.

CAPSTONE PROJECT DELIVERABLES

Tim Parham requested maps of TOD walksheds in Snohomish and Pierce counties similar to the 2012 map made for King County, and also liked the idea of an online interface containing the information from the maps. Thus, as part of the deliverables, the project team attempted to create an online interface in addition to the large-format printed maps that not only could be used by Tim to convey to developers which parcels do or do not qualify for LIHTCs, but would also allow him to promote certain areas that are eligible for LIHTCs.

The final specified project deliverables are:

1. 3 foot X 4 foot printed maps of ½-mile walksheds for transit centers, 1 for Pierce County and 1 for Snohomish County.
2. 1 combined map of King, Pierce, and Snohomish, 3 foot X 4 foot, showing ½-mile walksheds.
3. In addition to the printed maps, an online map was noted as the ideal deliverable.
4. Create walksheds Park-and-rides, but in the final product keep them separate. Walksheds in the final products will be classified as having transit-supportive density, not having transit-supportive density, and park-and-rides regardless of the walkshed's density.

II. Design Considerations

Though our project team had what seemed to be clear direction from the project sponsor's initial questionnaire, we scheduled an initial phone conference to make sure that we clearly understood the impetus for the project, what the desired products were, who the users of the final products would be, what the project's context was within PSRC and what its context was regionally. We needed to understand the purpose, who the stakeholders were, and any existing or potential sensitivities before we could proceed.

On July 8, 2013 we held a conference call with Tim Parham. In addition to walking us through much of the project's history and background discussed above, Tim expanded the discussion to include more details about the stakeholders, describing the end-users of the printed and online maps as those who would be applying for the LIHTC. Typically these are non-profit developers who are looking for construction projects. Our understanding is that qualifying for the tax credit can make the difference in the financial viability of a project. Because the developers looking to earn the LIHTC allocation points will be building affordable housing, these companies are answering the call for equitable social and economic development along existing and new transit corridors.

Tim went on to discuss that the way TOD is defined can have a substantial impact on the way development happens in an urbanizing area. As an example, he cited the case of Seattle in general where such a broad definition was used that the result would have been half of the development in the city qualifying as TOD. When trying to incentivize development close to transit centers, we had the sense from this conversation that it would be important to come up with a more focused definition of TOD.

Thus, understanding what TOD is and what components play a part in its definition was a critical piece in designing this project. During this initial conversation, we started to form the base concepts of what key decisions would be influential in designing the TOD Walkshed maps. In addition to understanding the overall concept of TOD, it seemed that we would need to understand each component part. In order to give the reader a sense of the range of interpretations, we offer the following definitions:

> *"A transit-oriented development (TOD) is a mixed-use residential and commercial area designed to maximize access to public transport, and often incorporates features to encourage transit ridership. A TOD neighborhood typically has a center with a transit station or stop (train station, metro station, tram stop, or bus stop), surrounded by relatively high-density development with progressively lower-density development spreading outward from the center. TODs generally are located within a radius of one-quarter to one-half mile (400 to 800 m) from a transit stop, as this is considered to be an appropriate scale for pedestrians" (Wikipedia, 2013).*
>
> *The Regional Planning Association of Connecticut writes that "Transit-oriented development at its simplest is development that's built to take advantage of the ability of people to access it with transit. TOD is a strategy for growth that produces less traffic and lessens impact on roads and highways" (CFE, 2013).*
>
> *The Center for Transit Oriented Development defines TOD as "a type of community development that includes a mixture of housing, office, retail and/or other commercial development amenities integrated into a walkable neighborhood and located within a half-mile of quality public transportation" (CTOD, 2013).*
>
> *PSRC's Growing Transit Communities Strategy defines TOD as "the development of housing, commercial space, services and job opportunities in close proximity to public transportation. Such development is intended to reduce dependency on automobiles, and to better link residences to jobs and services" (PSRC, 2013a). Because PSRC is the authoring organization of VISION 2040 and Transportation 2040, it was good to see that these regional planning documents provided a consistent definition of TOD.*
>
> *Sound Transit's Transit Oriented Development Policy states that "Community TOD strategies support and promote TOD within the larger area around a Sound Transit facility (generally ½ mile, or a 10-15 minute walk, around a transit facility and along corridors that provide key connections to the regional transit system)" (Sound Transit, 2012).*

The above definitions help to identify the components that make up TOD. Our project team determined that these parts are (1) transit centers, since TOD is centered on public transit, (2) the area surrounding a transit center, and (3) characteristics of the area surrounding a transit center. Thus, in order to thoughtfully proceed with the project design, it was important to consider the following questions. What qualifies as a Transit Center (TC)? Exactly how will we define what the walkshed is around each TC? How is transit supportive density defined and how will it be calculated for this project?

In order to help us plan our project strategy, we diagrammed the basic initial workflow seen in Figure 1.

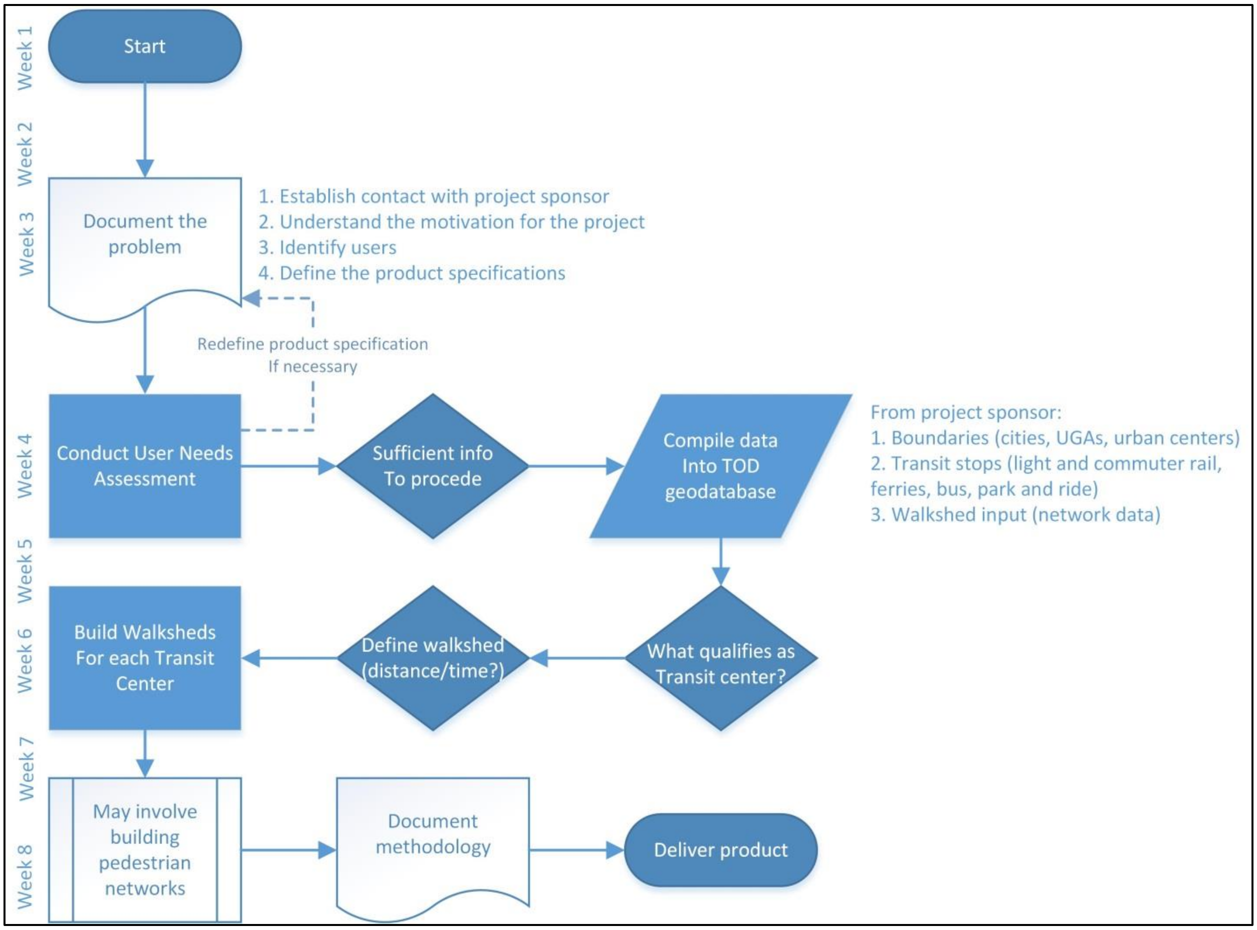

Figure 1. Initial workflow adapted throughout the project

Tim helped us to begin defining TCs by stating that PSRC is looking for fixed transit investments that are not likely to change any time soon. These may take different forms, but there is typically some sort of built infrastructure related to TCs that will be used to generate walksheds which will subsequently be used to award points for LIHTCs. We were told that while the transit data contains all bus stops in addition to light rail, commuter rail, ferry landings, and park-and-rides, it would not be appropriate for every stop to be classified as a TC. While access to a bus stop close to a resident's home enables that person to connect to his or her workplace, stores, and recreation opportunities, and hence is important in creating livable communities, we need to remember that the purpose of TOD is to manage the region's expected growth while improving the environment and quality of life. Qualifying every bus stop as a TOD opportunity does not provide any useful information to planners and investors.

During this phase of the project, we had direction from our project sponsor to focus on light rail, commuter rail, bus rapid transit (BRT), ferry landings, and park-and-rides. We thought about how each of these forms of transit fits into the regional picture and development patterns, and questioned the inclusion of park-and-rides as an appropriate focus to incentivize TOD. Do park-and-rides encourage suburban sprawl, allowing residents of the Puget Sound region to live in less compact areas that have a far greater impact on the environment and larger carbon footprint than urbanized areas? Some might argue that since suburbs already exist, facilitating suburban residents' access to transit is a good decision. Regardless of the underlying philosophies, the fact is that park-and-rides allow development patterns that are wider spread than compact urban centers designed to encourage non-motorized transportation to high-capacity transit hubs. We discussed this topic with our project sponsor and came to the decision to still generate walksheds for park-and-rides, but provide them in a separate layer so that they can be analyzed separately. The user will understand that they are treated differently than other TCs. This was a good start and we will revisit the specifics of data collection and TC determination below in the Design section.

During the first teleconference, Tim said that Stefan Coe, PSRC's GIS Analyst, used a pedestrian network combined with an algorithm to constrain distance based on topography, to create what he called 10-minute slope-constrained walksheds around transit investments in King County. These are the walksheds depicted in the example map provided for the project team in the preliminary questionnaire, seen in Figure 2 below.

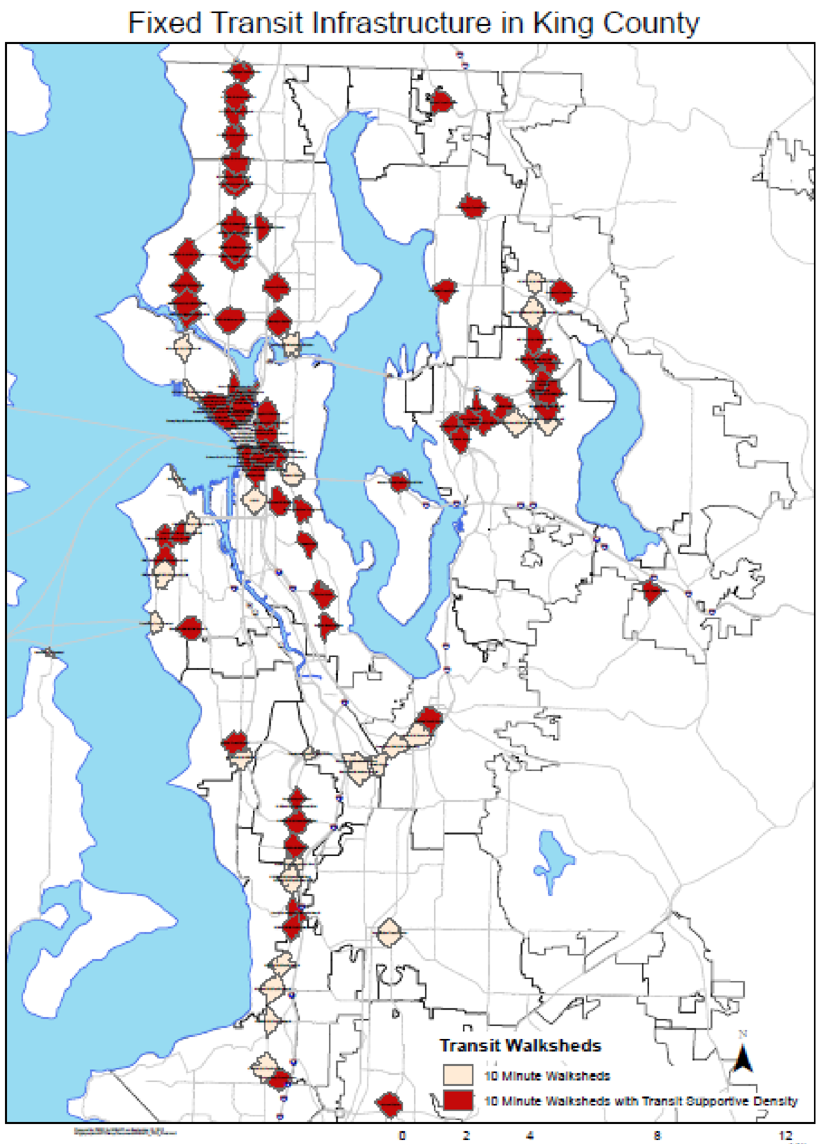

Figure 2. TOD Walkshed map produced by PSRC for King County in 2012. The map differentiates between 10-minute walksheds with Transit Supportive Density (red) and those without (pink). (WSHFC, 2012).

We were interested in exploring the methodology used by PSRC and comparing their walksheds to simple ½-mile walksheds as well as 10-minute walksheds that were not slope-constrained. As part of the design consideration phase, our project team thought that it was important to determine if any standard existed to create walksheds. An online search and literature review resulted in the following definitions of walkshed:

> *Streetswiki defines a walkshed (also known as a pedshed) as "the walkable area around a particular point of interest. The term is frequently used in the context of transit-oriented development, often to predict the patronage of a new or modified transit route. Generally, planners use a distance of one-quarter to one-half mile as an estimate of how far most people are willing to walk, whether to a transit hub or another destination. Research from a variety of sources suggests people will walk farther to heavy rail and trolley stops than to a bus stop, a store, park, or to visit friends. Thus the walkshed is actually quite variable, depending on the trip purpose" (Streetswiki, 2013).*
>
> *PSRC's Growing Transit Communities document defines a walkshed as "the area around a transit center, either measured as one half mile radius, a ten minute walking distance, or a combination of the two. Used to measure the area in which walking or biking can serve as viable transportation options over driving" (PSRC, 2013a).*
>
> *The Regional Plan Association writes, "Another exercise is to review the "walkshed" or "pedshed" of a station- the area from which residents can reach a station by foot in a given amount of time (usually 10-20 minutes) given the existing street network and geographic barriers such as hills and waterways. Although a basic rule of thumb is that transit riders will walk up to ½ mile to reach a train station, in practice the walkshed covers a smaller area due to gaps in the street network. Street extensions and pedestrian paths can open up entire blocks to walkable transit that were once inaccessible, providing additional residents and employers with the benefits of transit" (CFE, 2013).*

Interestingly, the actual term walkshed is not referenced in either the VISION 2040 nor the Transportation 2040 regional planning documents. However, Transportation 2040 states that local jurisdictions "are encouraged to conduct comprehensive sub-area planning for high-capacity transit station areas, typically to cover the area defined by a half- to three-quarter mile walking distance radius around the station site" (PSRC, 2010). In a similar fashion, VISION 2040 provides high-level guidance on what we might reasonably consider a walkshed in stating that "one transit station can serve an area of about one square mile (640 acres), or a half-mile walking radius" (PSRC, 2009).

So there seems to be some loose consensus that a walkshed should be about ½ mile, but may be further depending on the purpose of the walk, or that maybe a 10-20 minute threshold could be appropriate. Yet the literature still lacks consensus on whether the distance is a simple radius or should be constrained to a pedestrian network. These decisions seemed to merit further investigation as they could potentially have a great impact on the number of parcels qualifying for LIHTCs. After all, a ½-mile walking radius covers an area of 503 acres while a typical ½-mile walkshed constrained by a pedestrian network (sidewalks, bike paths, trails, etc.) is around 300 acres. How we chose to define a walkshed, then, seemed like an important design consideration and we wanted some input from our project sponsor before proceeding too far into the project.

In light of the "fuzziness" of both TOD and walkshed definitions, the project team prepared what we called a rapid prototype walksheds map to present during our in-person meeting at PSRC's office on July 19th, 2013. Without having compiled a final version of a three-county transit center dataset, nor having the three-county pedestrian network, the prototype map was to illustrate the concept of using variable walksheds around fixed transit investments. To produce the map, we used three example Sound Transit commuter rail stations and generated variable-distance concentric walksheds along the Pierce County road network. This method is not a new idea. It has been used in past presentations to planners and city councils to help them better understand what areas surrounding a proposed transit center would experience an impact. Figure 3 shows an example using 5- and 10-minute walksheds surrounding different station siting options for Sound Transit's East Link rail alignment.

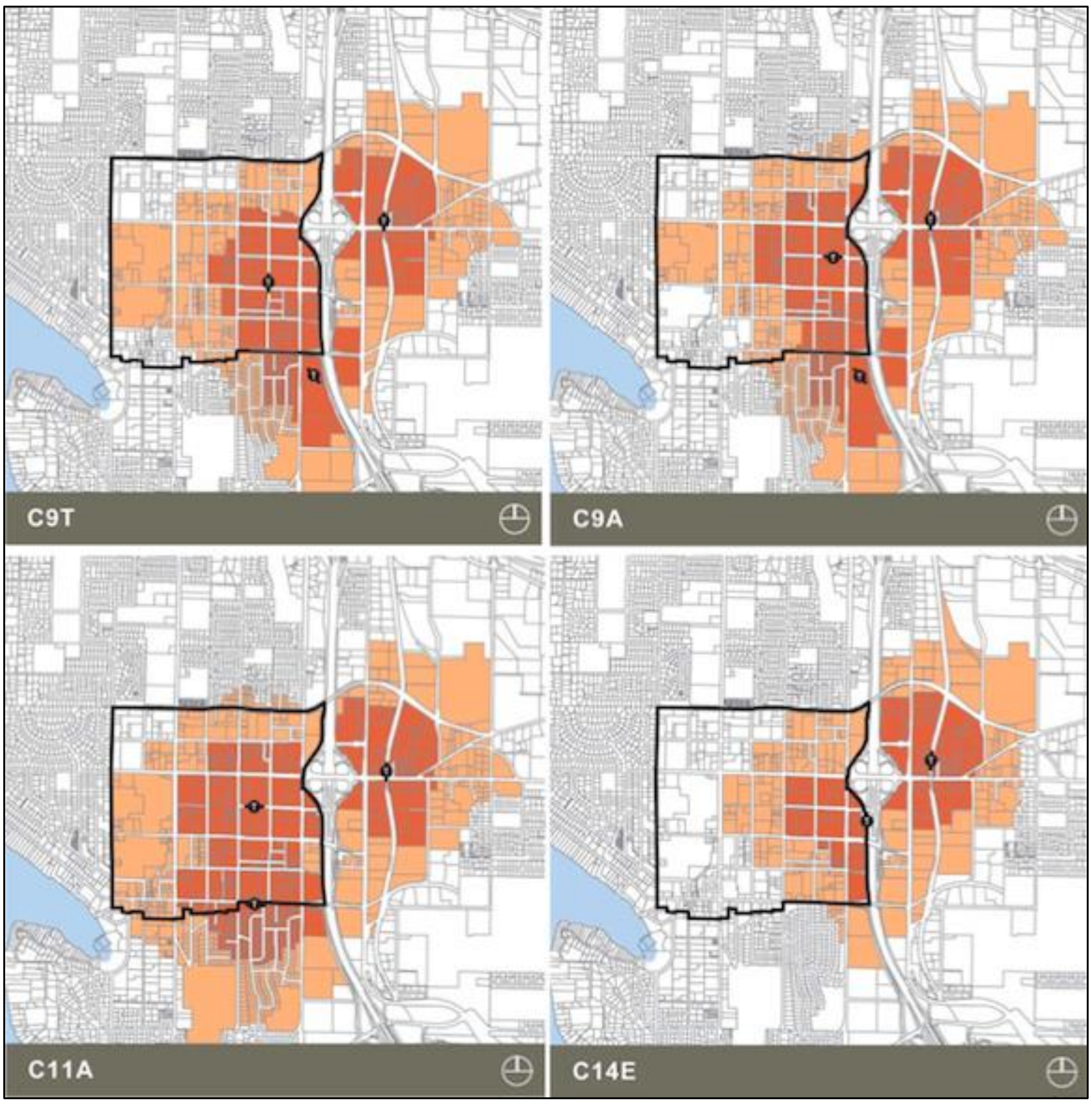

Figure 3. Walkshed for various East Link rail alignments through downtown Bellevue. The darker area represents five minutes of walking distance, while the lighter area represents ten minutes of walking distance. Figure courtesy of Seattle Transit Blog, 2010.

The prototype map (Figure 4) was printed on 11 inch X 17 inch paper and presented to Tim for discussion during our meeting.

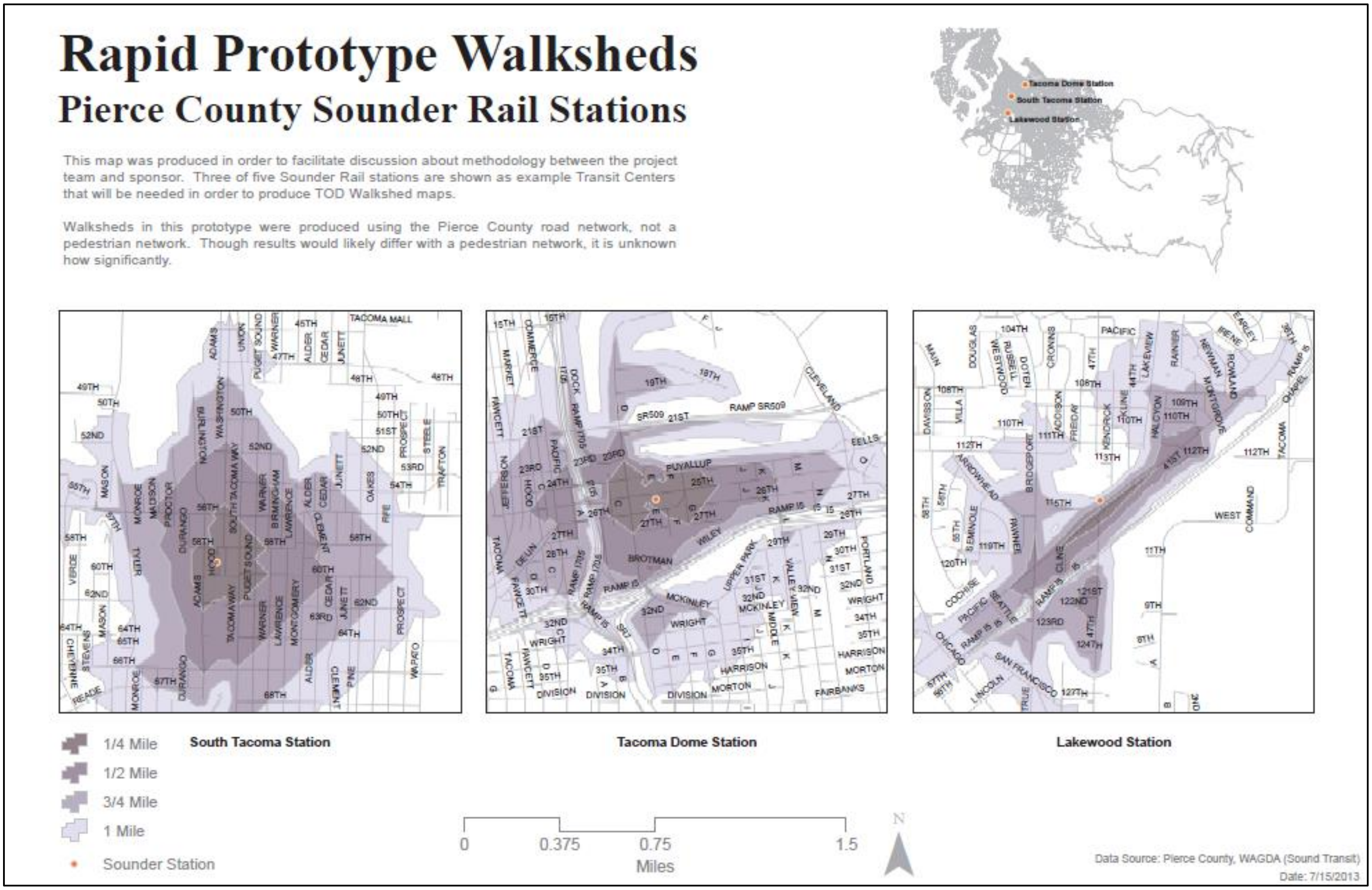

Figure 4. Variable-distance concentric walkshed map presented as a possible solution to address the "fuzziness" of TOD and walkshed definitions.

We discussed the walkshed design consideration with Tim and he said that it would be good to provide a comparison between 10-minute, ½-mile, and ½-mile slope-constrained walksheds so that we could understand the implications of our decision.

Given a network dataset and a set of points, a ½-mile walkshed can easily be generated using the Service Area tool in the ArcGIS Network Analyst extension. Walkshed shapes will differ based on the connectivity of the network, with well-connected, urban environments tending to form diamond-shaped walksheds, and less-connected, less compact land use patterns forming less uniform, far more variable walksheds. A great visual example of this phenomenon is illustrated in the Puget Sound Nearshore Partnership's Future Scenarios document (Figure 5) (PSNP, 2008).

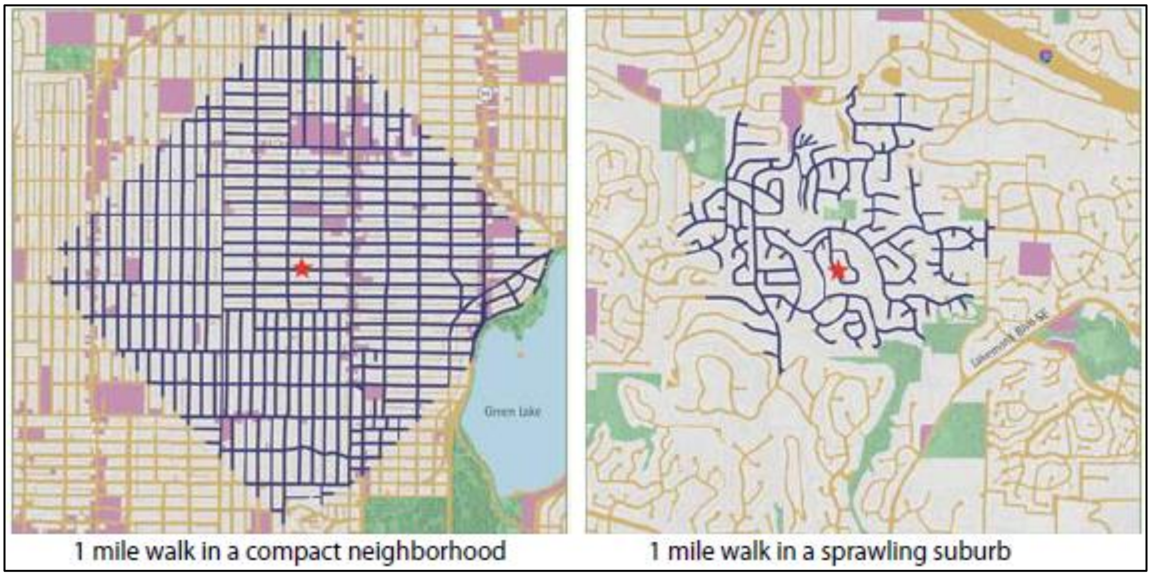

Figure 5. Impact that a connected network has on walkability of a neighborhood. Figure courtesy of PSNP, 2008.

Thus, producing the ½-mile walksheds was a simple matter of utilizing Network Analyst built-in functionality. Next, we needed to compare these walksheds to 10-minute walksheds. In order to generate 10-minute walksheds, we needed to assume an average walking speed. Using the formula distance = rate * time, we would be able to estimate what a 10-minute walkshed would look like. In the absence of significant external factors, humans tend to walk at approximately 3.1 miles/hour (Browning, 2006). Multiple studies corroborate this pace to be an accurate estimate for human walking speed. A 10-minute walkshed would equate to a distance of 3.1 miles/6 = 0.5167 miles or 2,728 feet – just over ½ mile. Based on math alone, 10-minute walksheds will always be larger than ½-mile walksheds. If we were calculating circular walksheds with the radius either being ½ mile (2,640 feet) or 10-minutes (2,728 feet), mathematically, a 10-minute walkshed would be 6.7% larger than a ½-mile walkshed. Due to being bound by the network, however, the 10-minute walksheds in our analysis were 6.36% larger on average with a range of 1.76% larger to 13.89% larger in area. Again, the variation is a result of the unique network configurations around each transit center.

Figure 6 below demonstrates the areal difference in test walksheds. It is easy to assess the impact of using the 10-minute method versus the ½-mile method by comparing the yellow and green layers.

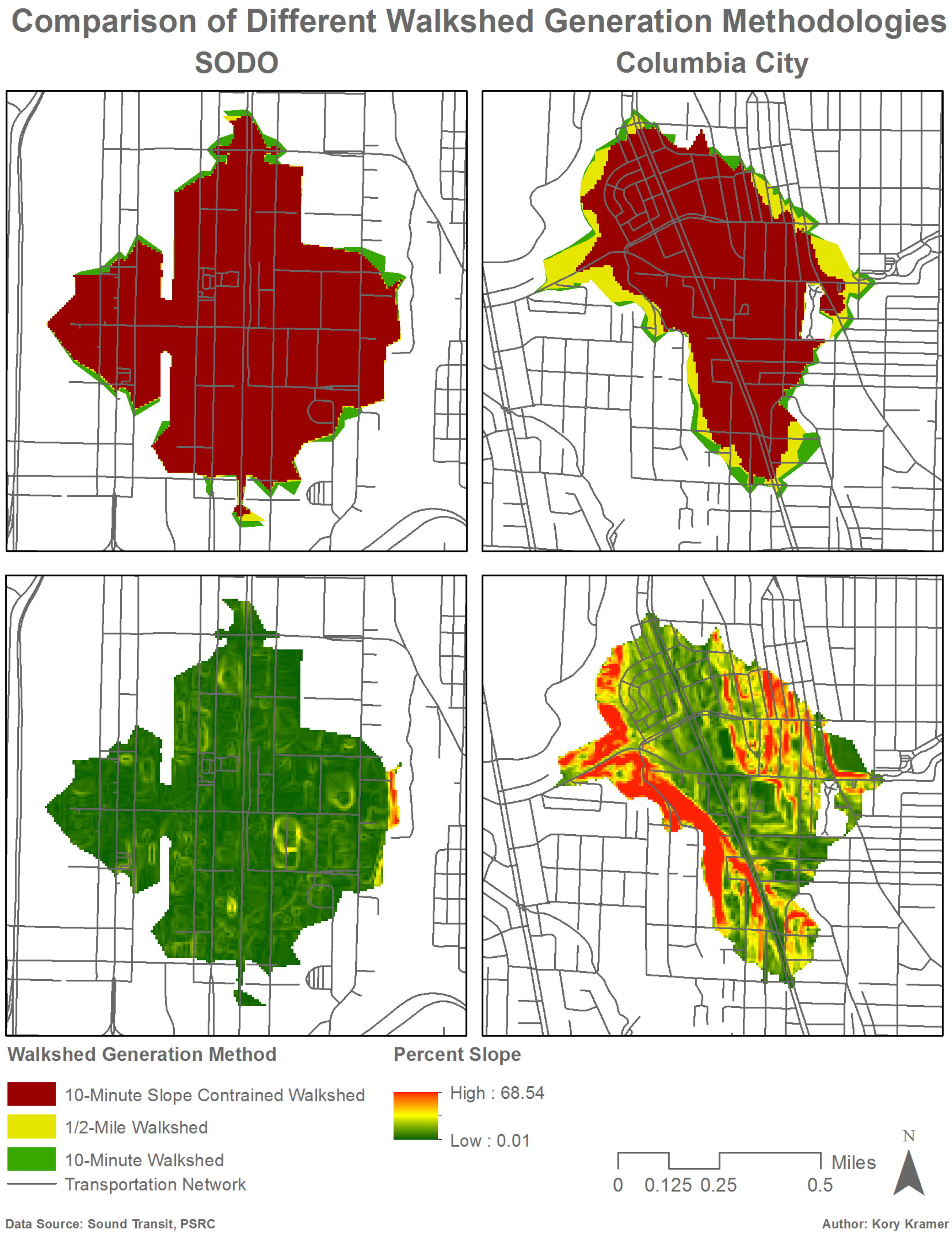

Figure 6. Difference in walksheds generated depending on method. The effect of slope is clear when comparing the SODO station area (flat) to the Columbia City station area (hilly).

To complete the comparison, we needed to replicate Stefan Coe's methodology to generate 10-minute slope-constrained walksheds. Fortunately we had the python script that Stefan used for the King County walksheds (Appendix A). With some tweaking, we were able to run the script to generate the slope-constrained walksheds. As expected, the resulting walksheds were all smaller than the 10-minute walksheds, proportional to the variability in terrain around a transit center; that is, in very flat areas, 10-minute slope-constrained walksheds were very similar to their 10-minute counterparts, while in hilly areas larger differences were seen between the two methods. Illustrative examples are that the SODO slope-constrained walkshed is 0.82% smaller than the 10-minute walkshed, while the Columbia City walkshed saw a reduction of 17% under slope-constrained conditions. The mean reduction was 18.93%, ranging from 0.82% (SODO, Seattle) to 86.35% (Theater District, Tacoma).

We presented our project sponsor with these statistics and graphics similar to those in Figure 6. He responded that he would prefer the slope-constrained walksheds to be consistent with the 2012 methodology used for King County, but that he might need to see more examples in order to make an informed decision. To show more examples, we put together a quick county-wide map shown in Figure 7 below. This map was sent in .pdf format at 33 inches X 44 inches. At the scale in this paper, it is impossible to distinguish the difference between the ½-mile and 10-minute walksheds. However, the difference between the 10-minute slope-constrained (red) and ½-mile (green) is readily apparent.

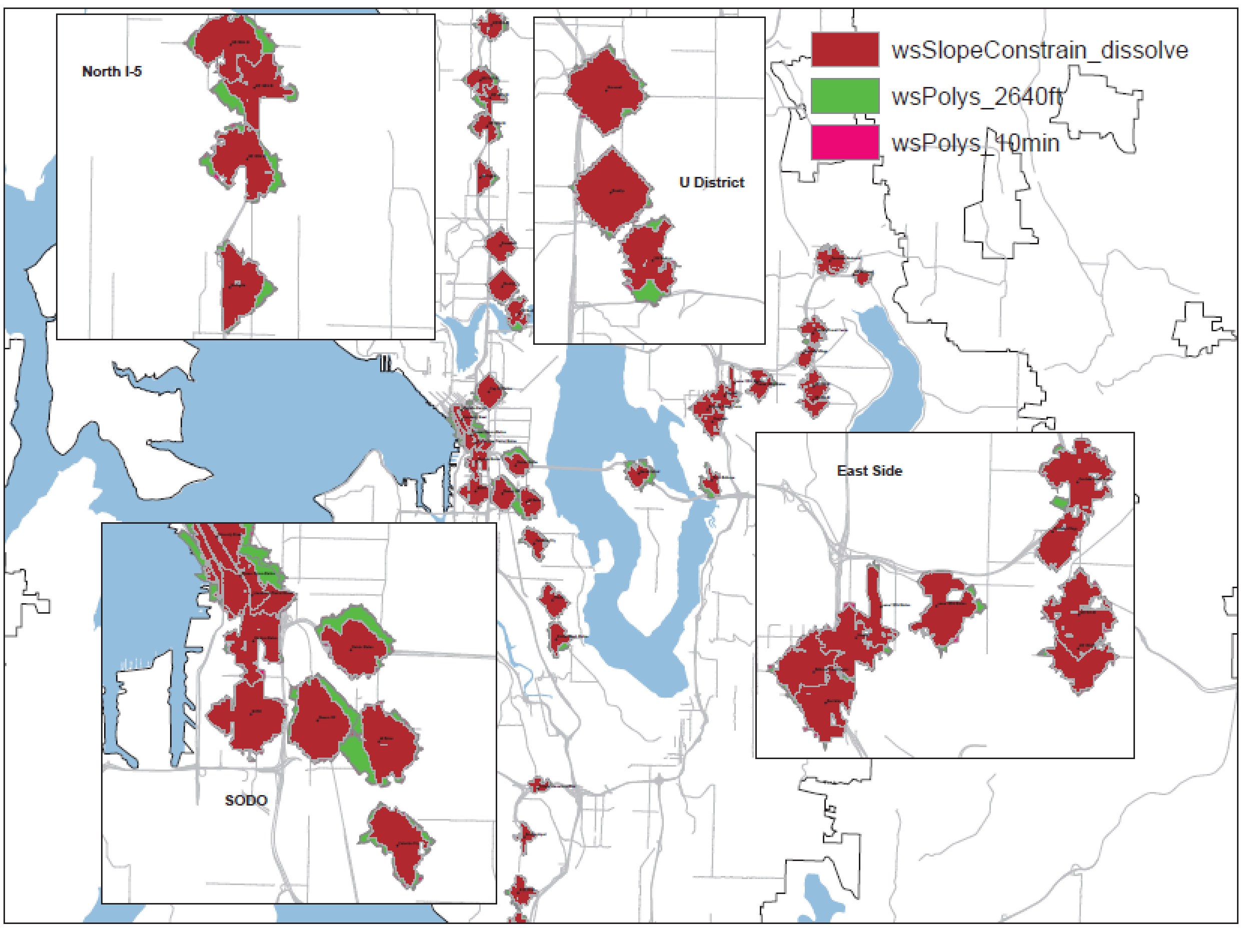

Figure 7. Map comparing the differences in walkshed generation methodology that was sent to the project sponsor in order to make a decision on which method to use for this project.

After considering the above analysis, our recommendation to Tim was to use the simple ½-mile walkshed generation method. None of the working definitions that we found convey that topography should be taken into account, though we do understand that Metro Transit may use such an algorithm to better route pedestrians in their trip planning. Ultimately, we felt that inter-agency consistency through an easy-to-understand methodology that is also easy to explain to decision makers was important. There is also a matter of consistency with PSRC's own documents. In explaining equitable transit communities, the GTC Strategy says, although "*defined by the half-mile walking distances around high-capacity transit stations* (emphasis ours), they exist within the context of larger neighborhoods with existing residents and businesses" (PSRC, 2013a). Ultimately we agreed with Tim to proceed using the ½-mile method.

Does the choice of walkshed methodology deserve so much consideration? While the project team found it insightful to carry out each method and compare the results, we were not convinced that the methodology itself is actually important in terms of the issues this project is trying to address. True, if LIHTCs will be awarded based solely on whether a developable parcel lies inside or outside of a TOD walkshed, then one might choose the method that generates the largest walkshed. Which begs the question, why not choose a ¾-mile or 15-20 minute walkshed? There is certainly peer-reviewed literature out there that would justify this. Then again, there is only so much funding every year for the LIHTC allocations – providing a longer list of qualifying parcels does not produce more money.

In fact, Guerra and Cervero pose a similar question in their 2013 paper, "Is a Half-Mile Circle the Right Standard for TODs?" They argue that there is "surprisingly little evidence to justify any particular catchment area. Why a half mile? Why not a quarter mile or two-fifths of a mile? Is there anything special about a half mile or is this simply a convenient figure that has become an industry standard?" They go on to argue that, as already noted throughout this report, walking preferences vary by "destination, trip purpose, gender, age, land use, safety, weather, and the price and availability of parking." Another interesting finding was that for the purposes of predicting ridership, a "quarter-mile radius generally works best for predicting ridership as a function of jobs, while the half-mile radius works best for predicting ridership as a function of residents."

They conclude that the results of their study do "give some credence to using a half-mile catchment area for TOD planning and confirm that there are advantages in concentrating retail and office developments even closer to stations." And we agree that if considering the promotion of walkable communities, and lowering the combined housing and transportation costs of low income families, then it makes sense to calculate the ½ mile along a network, rather than simply using a radius.

In further considering the project design, it was critical to identify the potential users of the TOD walkshed maps and assess their needs. In meetings with Tim, he said that he would be the only PSRC user of the maps. He described that they were useful when a developer seeking points for the LIHTC called him with the address of a potential development. He would use the maps to respond to the developer as to whether the parcel of the potential development project was inside or outside of a TOD walkshed, which determines whether that developer will benefit from the extra point.

From the very beginning of the project, the fixed, countywide scale of the TOD walksheds seemed to be a factor limiting the usefulness of the maps. As already presented in Figure 2, at the county scale, it is impossible to determine whether an address lies within a particular walkshed unless the map user is extremely familiar with that particular area. Recognizing this limitation, Tim had stated in the original project sponsor questionnaire that "it would be great to create an online interface for the maps similar to this: http://webmap.psrc.org/GTCPropertyInformation/ where the user could search by address to see if their project is in a "TOD walkshed" or not" (Tim Parham, personal communication, June 2013). When asked about who other users of the map might be, Tim said that in fact the developers themselves would ideally use the online map.

This information led the project team to diagram the existing workflow and what an ideal alternative workflow might look like.

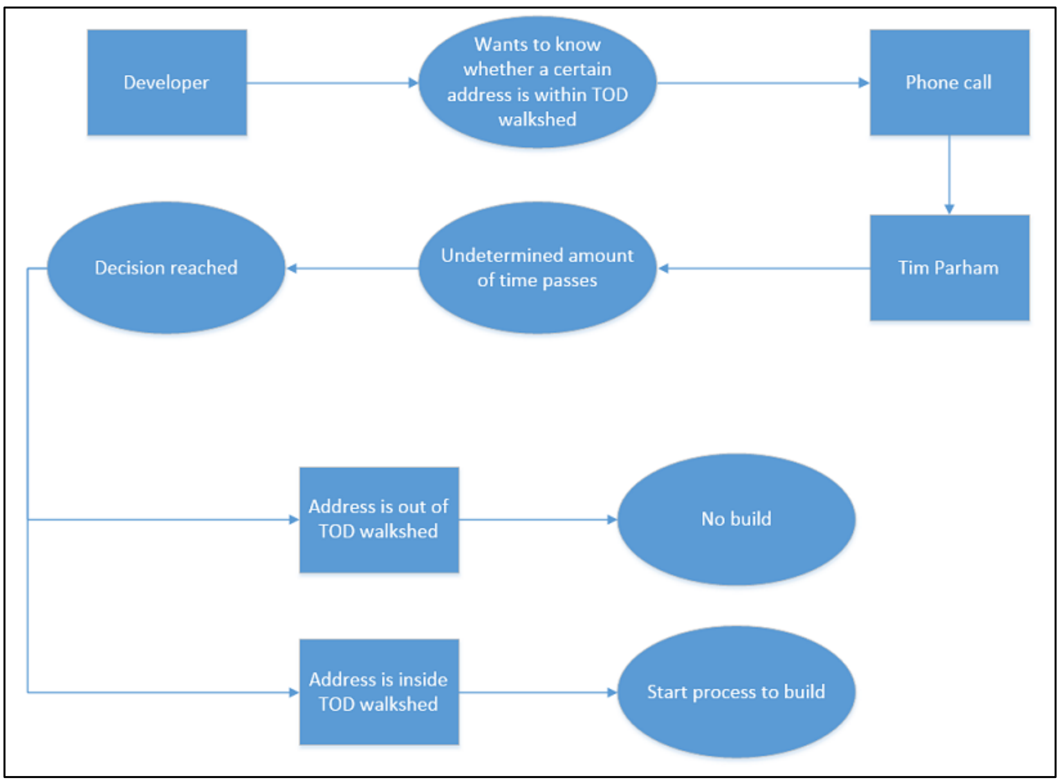

Figure 8. Current workflow that requires a developer to call PSRC for every address.

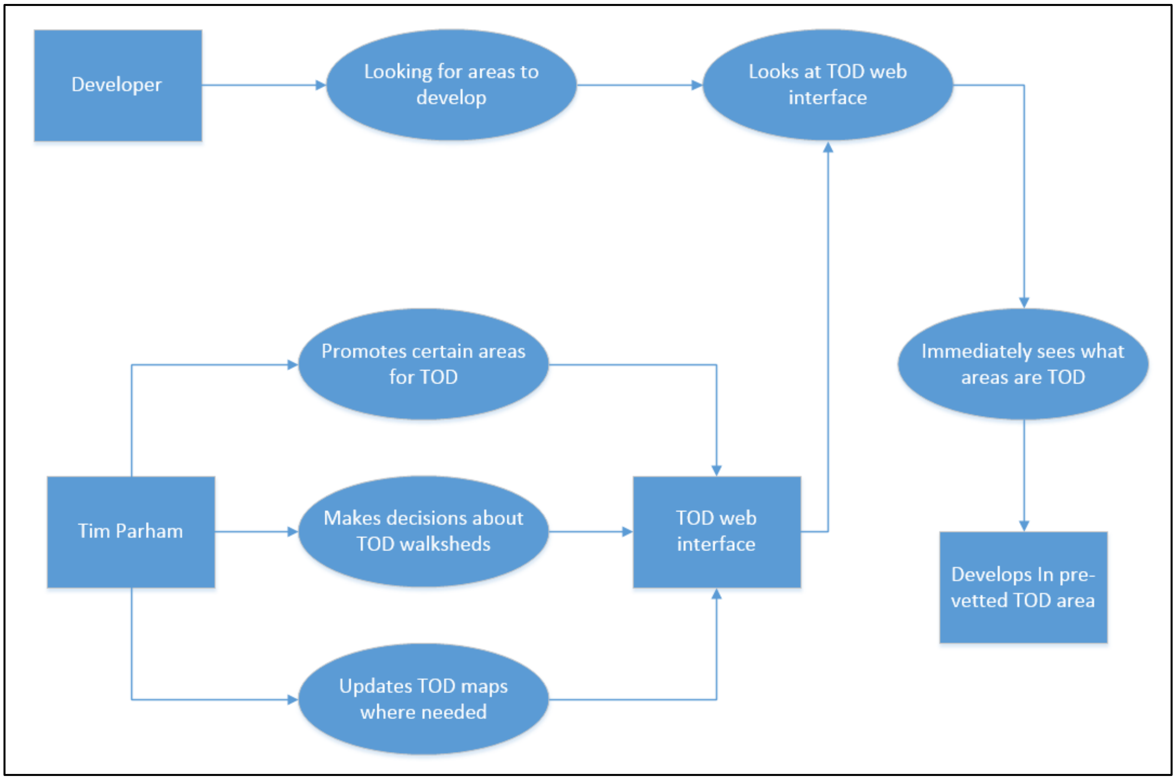

Figure 9. Alternative workflow that leverages online TOD map.

Thus, the project's final product was starting to take shape. It was apparent that, while large-format paper maps might have their place for the overall pattern of transit development in the region, and could play a role in demonstrating that pattern visually to city councils or the WSHFC, the online map is what would ultimately prove useful for decision-making at the individual walkshed scale. With feedback only from Tim until now, we attempted to gain insight from the developer's perspective. Given the time constraints of this eight-week capstone project, we were able to make contact with only one developer, Dan Landes from Shelter Resources, Inc. (SRI). "SRI specializes in utilizing tax-exempt bonds, the Low-Income Housing Tax Credit Program and various other Federal, State, and local resources targeted at generating affordable housing. The principals have financed over 105 multi-family projects using these programs, acting as developers or consultant. They currently have 500 such units under construction or pre-development through SRI or its affiliated companies" (SRI, 2013).

Dan liked the idea of having the online tool available to look up an address or a parcel ID. He stressed the importance, however, that often what is more relevant to a developer than what is there now, is what is planned to be there. For example, the current walkshed surrounding an area where there are already plans to develop may be somewhat small if there are what he calls "megaparcels." These megaparcels lead to big block distances, meaning that sometimes to get from one side of the parcel to the other entails a long, round-about walk. With new plans already in place to create more walkable communities in an area, designing shorter blocks is part of the plan. And this would then change the size of the resulting walkshed. He thought that it would be useful if the user could toggle back and forth between what is currently existing, and what is planned. Dan used the example of the Bel-Red corridor where he knows of at least one unusually constrained instance around 120th St. Station due to the existence of megaparcels. Figure 10 below illustrates what Dan was referring to and compares the effect that network connectivity has on walkshed size. Note the similarity to Figure 5 from the PSNP above.

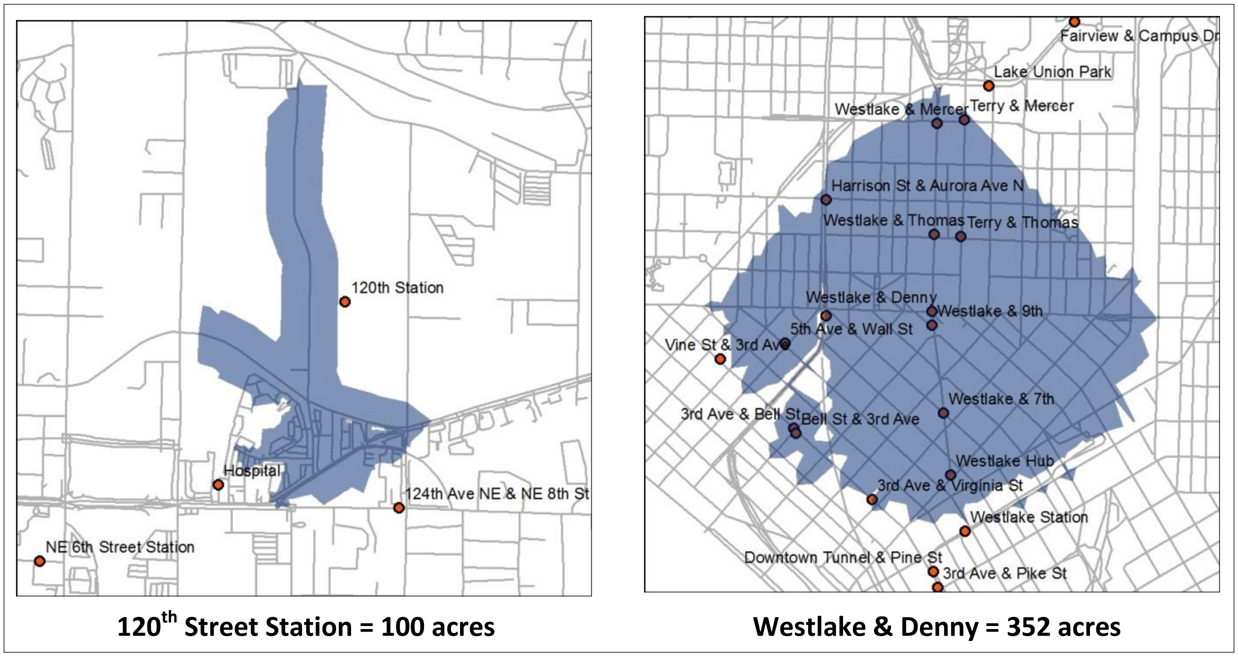

Figure 10. Effect of network connectivity on walkshed size.

We talked about the methodology used to generate the walksheds, and his perspective was that it is still better to use the slope-constrained method. He did not think that it would be advantageous to generate larger walksheds if they encompass too much walking on slopes. He provided an interesting example of the Hilltop neighborhood in Tacoma. He pointed out that this is a low-income area where people have been forced to live as they have not had affordable housing options closer to the downtown business core. His argument was that by generating walksheds that reach into this area, we are possibly justifying the continuation of this segregation by including Hilltop in a downtown station walkshed. His argument was that by constraining the walkshed and then using that to allocate LIHTCs, the result would provide more affordable housing closer to the downtown core. He did acknowledge that perhaps the City of Tacoma might not feel the same as he does, but it was good to get his perspective and think about the impact of walkshed methodology on how LIHTCs may be allocated. This was an interesting insight that reinforced the fact that this project is set in a policy context with real world political consequences. Drawing walksheds around transit centers is easy. The implications of tying social and economic policies to these artificial boundaries merit thoughtful consideration.

We do not mean to imply that these complex issues have not been considered by PSRC. In fact, PSRC has worked with the Center for Transit Oriented Development and other consultants to carry out station area studies and develop a People and Place implementation typology to promote the customization of regional guidelines to the local context surrounding each transit center. We will explore the implementation typology in the Discussion and Recommendations section of this paper. However, at this point in the project's design considerations, we were attempting to synthesize the complexities that we were beginning to encounter when bringing in only one additional stakeholder, with the attempt to design a one-size-fits-all approach to creating TOD walksheds.

In terms of other political perspectives that we had not fully understood or considered, Dan mentioned that Pierce and Snohomish counties are fundamentally different from King County when it comes to LIHTCs. King County enjoys its own allocation region whereas Pierce and Snohomish are pooled with other counties. Dan pointed out that introducing a policy that makes available extra points to places with transit and focusing on TOD will only be applicable in Pierce and Snohomish. This places other counties in that pool at a distinct disadvantage. Perhaps that disadvantage cannot be resolved based on TOD-related LIHTC point allocation, placing it outside the scope of this project; but it will likely need to be balanced with some other concession in the overall allocation of federal and state funding.

Finally, Dan agreed that having a list of parcels within a walkshed would be useful. He thinks that if he were able to see the parcels related to a given walkshed, and some quick summary data like Land Use Designation, Zoning, Size and Owner, he could quickly scan to see which might deserve further research. For example, a parcel zoned as a park or a school would not merit any research. Alternatively, if he knows he needs a minimum square footage, he could just filter out all parcels within the walkshed that do not meet that minimum. He thought this type of functionality could be very useful in a TOD walkshed product.

While we cannot stress how important Dan's input was in furthering the design considerations of the project, the input is more influential at the conceptual level and will find its way into recommendations for future consideration rather than the immediate project design choices. We agree that there is ample room to explore and question the adequacy of applying a one-size-fits-all TOD walkshed generation method, and are particularly interested in the concept of changing the LIHTC allocation system to not only incentivize development within walksheds, but incentivize to a greater extent the amplification of walkable communities over the same land area by breaking down megaparcels with sidewalks and bike paths using low-impact development principles. Unfortunately, this pursuit falls outside the immediate scope of this project and we decided that it would be necessary to proceed using the ½-mile walksheds as agreed upon with Tim.

At this point in the project, we had answered the first two of our three key factors in building the TOD walksheds for the region: (1) what qualifies as a Transit Center (TC), and (2) how to define what the walkshed is around each TC? The third piece of information to consider was how to define and calculate transit supportive density (TSD). In the initial deliverable, TSD calculations were not mentioned. However, in the in-person meeting with Tim, we determined that each walkshed needed to be classified as either having TSD or not having TSD. The implications of this decision are discussed in the Design section.

VISION 2040 states that in order to support high-capacity transit and centers "a minimum of between 20,000 and 25,000 activity units (some combination of employees and residents) within the square mile is needed (or 30 – 50 activity units per acre)" (PSRC, 2009). The calculation assumes that a station area with ½-mile radius around a point is one square mile or 640 acres, when in reality the area is 503 acres, or 21% smaller. However, because the units are normalized by acres, perhaps this anomaly is not important. We also know from Guerra and Cervero (2013) that there is not a linear relationship between the activities in the station area surrounding a walkshed, with employment activities having more explanatory power within ¼ mile and residential activities within ½ mile explaining more about whether an area is likely to support a transit center. Thus, as with most other aspects of this project, the TSD threshold should be viewed as a guideline, not a hard break.

And this is in fact what we determined from conversations with Tim. While the regional vision refers to an ideal density of 30-50 units/acre, in our first meeting with Tim we were told that through the many stakeholder meetings held in King County during the creation of the 2012 TOD map, the agreed upon number for TSD was 20 units/acre. This was the threshold that we ended up using as a guideline when determining whether TC walksheds were TSD or non-TSD.

With each design component in place, we decided with our project sponsor to begin verifying the transit center data and generate the walksheds, during which time he would retrieve and send PSRC's Future Land Use (FLU) data to be able to conduct the TSD analysis once walksheds were built.

III. Design

Building Transit Center and Park-and-ride Layers

To begin the project design, it was necessary to compile Transit Center points and Park-and-ride points. Park-and-rides were not the major focus of the project, and accordingly, were not given nearly the amount of time as Transit Centers. Park-and-ride data was downloaded from the Washington State Department of Transportation and clipped to the Urban Growth Area (UGA) boundary.

Tim provided us with a shapefile called GTC_Station_Nodes_2a that contained the transit centers used for the Growing Transit Communities research. However, this file only contained Sound Transit Link Lightrail points. Of the points included, there were two future alternative alignments provided for the north corridor. Tim suggested that we remove the station points along the western alignment that followed WA-99, and keep only those future stations that followed I-5 north as it looked like this would be the approved future alignment. We needed to compile data from all regional transit agencies to build the transit center dataset. Tim facilitated contact information for the following transit agencies and we began to contact each one to collect their most up-to-date transit center and stop data. Data was collected for Sound Transit, Everett Transit, Community Transit, Metro Transit, and Pierce Transit.

Metro Transit's data was publicly available through King County's GIS Data Portal (http://www5.kingcounty.gov/gisdataportal/) and Pierce Transit's data was publicly available through their website's document page (http://www.piercetransit.org/documents/). Sound Transit, Everett Transit, and Community Transit data was secured through communication with agency representatives.

The methodology used to conflate the data from various sources into one master regional transit center dataset can be found in Appendix B. The conflated data was saved as a feature class in the project team's shared TODWalkshed.gdb and called GTC_Station_Nodes. The final result was 104 transit centers across Pierce, King and Snohomish Counties.

With the first round of transit center data conflation completed, we prepared a map of these points for Tim's review and comment (Figure 11). The map was sent along with the documented methodology.
Tim promptly responded to let us know that it appeared that we had missed King County's Rapid Ride (BRT) stops and that those should be considered as TCs. At a minimum the points used for King County needed to contain those that were used for the 2012 TOD Walkshed map. King County BRT stops must

have initially been overlooked as they are not hosted on the County's GIS data portal, and were not included in data sent to us from Metro Transit's GIS contact. As such, Tim had to send us that data along with the water taxi points that were included in the 2012 map. In a follow-up conversation, Tim asked that we thoroughly review transit plan documents for Snohomish and Pierce County to ensure that we were capturing all existing, proposed, and even potential TCs in those counties.

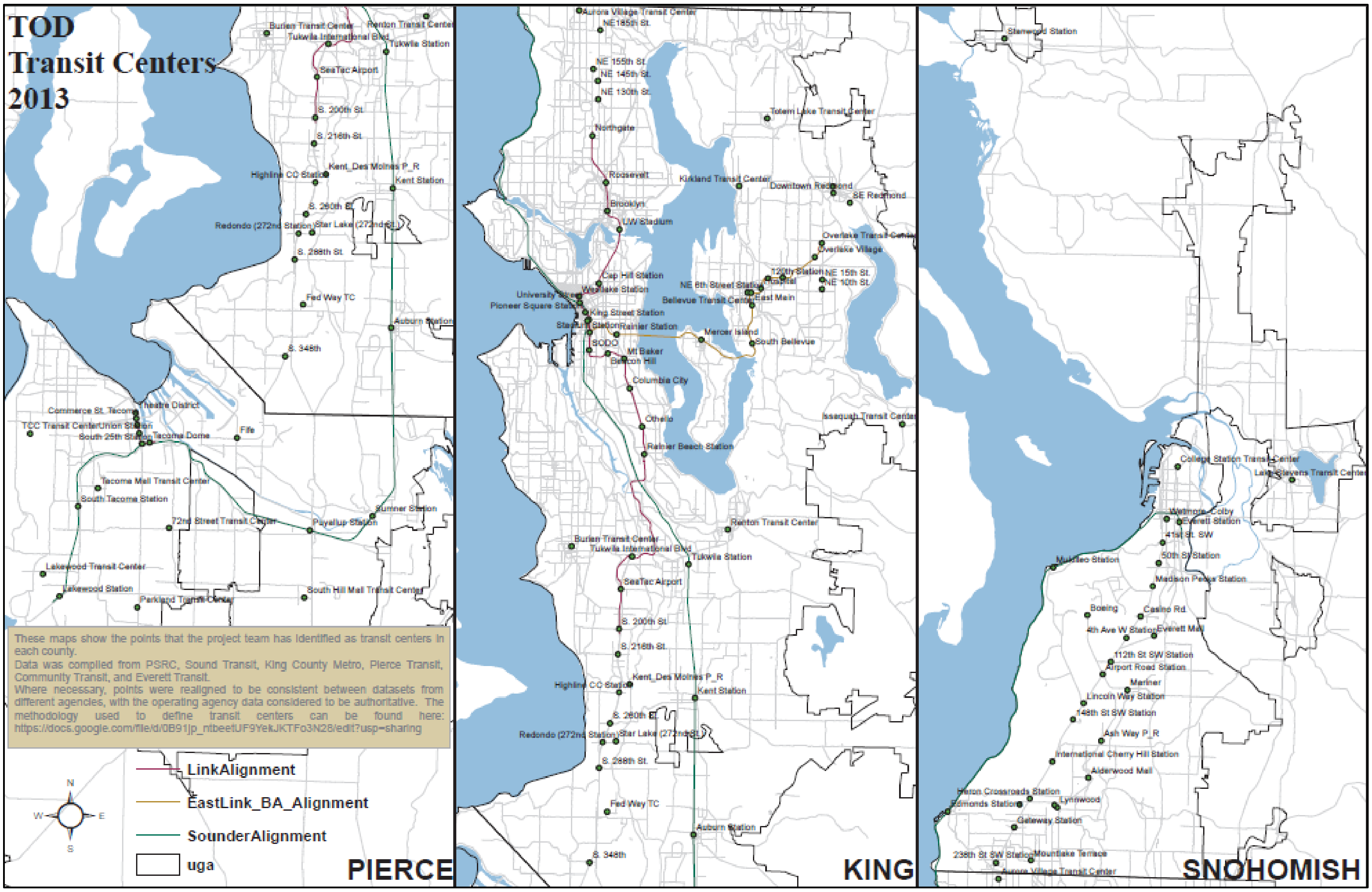

Figure 11. First draft of 2013 Growing Transit Communities transit centers for review and comment by PSRC.

With this direction, we added the King County BRT locations, in most cases using the mean center methodology described in Appendix B to produce one TC point for BRT stops located on opposite sides of the road. This method was used in most cases, though due to nuances in the routes, there were some single points counted as a TC. The South Lake Union (SLU) and First Hill (FH) street cars appeared to be on last year's map so we digitized those locations based on official online maps (FH, 2013; SLU, 2012). It is important to note that the SLU stops exist while the FH stops are not currently installed. For the purpose of this study, we felt that hand-digitizing the street car stops was sufficiently accurate. With this phase complete, there were actually a few additional King County points from the BRT and Sound Transit data that were not included in the 2012 TOD Walkshed map.

Feeling that the King County TCs were now complete, we moved on to review Pierce Transit's Transit Development Plan for 2013-2018 (Pierce Transit, 2013) along with route frequencies. We conducted a similar document and route review for Snohomish County and again compared the data we had from Everett Transit as well as Community Transit and felt that we had accounted for all mentioned transit centers and Swift BRT service locations.

The resulting Growing Transit Communities Transit Center layer used to build TOD walksheds contained 200 points (Appendix C).

The resulting Park-and-ride Lots layer used to build TOD walksheds contained 188 points (Appendix D).

Generating ½-Mile Walksheds

Having agreed to build ½-mile walksheds around each TC and each Park-and-ride, this part of the design process went rather quickly. Walksheds were built using ArcGIS Network Analyst.

A new Service Area was created and facilities were loaded from the appropriate feature class. For example, when creating the transit center walksheds, the GTC_Station_Nodes feature class was loaded as the service area Facilities. When creating park-and-ride walksheds, the park-and-ride feature class was loaded as the service area Facilities.

Once the service area polygons were generated, we checked to make sure that they were all ½-mile polygons. There were two peculiar cases where the walksheds were much smaller than the prescribed 2,640 feet. To figure out what caused this, we had to closely examine the network.

The service area tool is set up to search for the closest piece of the network to each facility. It finds the closest part of the network and then calculates how far it can reach by traversing 2,640 feet along as many connections as possible. However, in the GTC_Station_Node points that we had, Kent Station and Tukwila International Blvd were giving the service area tool some problems. Upon closer inspection, we could see why.

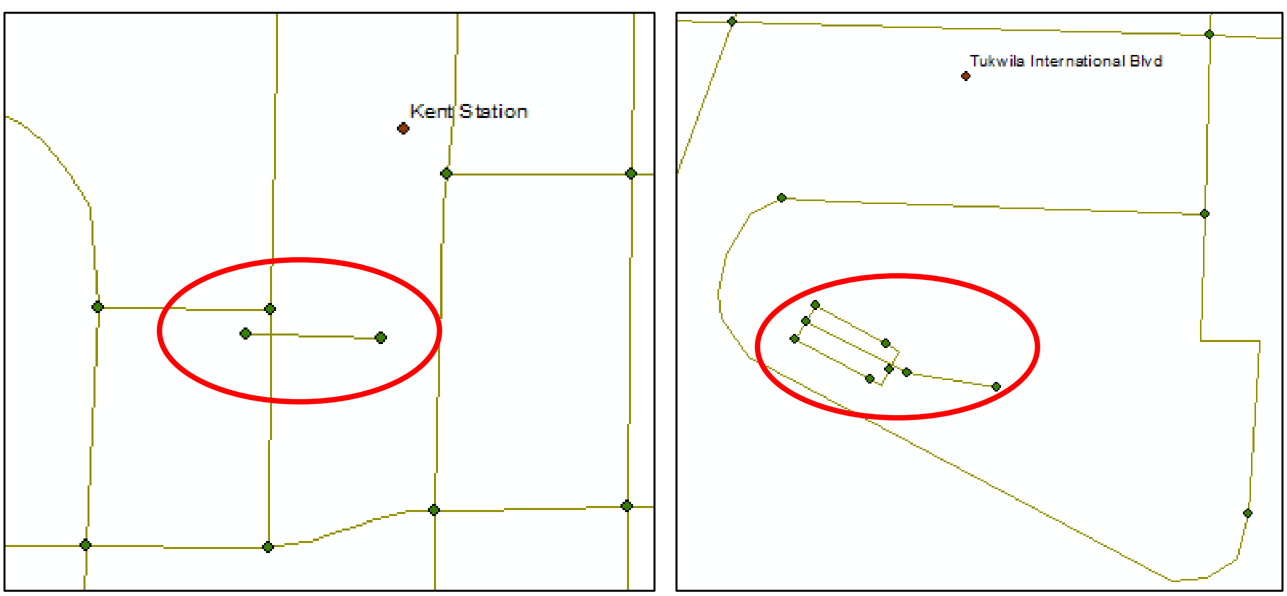

Figure 12. Areas where network disconnectivity caused the service area tool to produce walksheds of less than ½ mile.

Figure 12 shows why the service area tool was not able to calculate walksheds correctly for these two TCs. Note that the figure shows the TC point locations after they were manually corrected. Before correction, the points were closer to the disconnected parts of the network causing the service area tool to essentially draw a 100 meter buffer around the areas circled in red. In both cases, imagery was used to ensure that the newly placed TC points were meaningful and the walkshed generation process was repeated. After placement of these TCs, all 200 walksheds were generated correctly.

There were no issues generating the Park-and-ride walksheds. The procedure described above was carried out to generate ½-mile walksheds around each of the 188 park-and-ride lots.

Calculating Transit-Supportive Density for Transit Center Walksheds

As discussed in the Design Considerations section, in the product specifications from the second meeting with the project sponsor, we noted that transit center walksheds should be categorized as having Transit-supportive Density (TSD) or as not having Transit-supportive Density (non-TSD). We understood the concept that the station areas surrounding TCs need to have a certain level of activity per area either as employment opportunities or residences in order to make a transit center viable.

In order to calculate TSD, we were provided with a parcel shapefile and table called max_dev_cap from PSRC. Parcels were stored as points, and the table could be joined to the shapefile based on a field called 'PIDn'. The max_dev_cap table contained information about present and future development capacity for each parcel in a field called ResMax. Summing the ResMax for all parcels within a walkshed and dividing by the parcels' area results in a TSD number for the walkshed in residential units/acre. Having conducted the calculation, we created a draft online TOD Walkshed map and sent that to Tim.

Tim reviewed the online map we had sent and brought up some questions about certain walksheds. As he is familiar with densities of particular walksheds, his review was important to ensure that our work was as accurate as possible given the available data. He noted that many of the ResMax numbers for parcels were not accurate, having a value of zero when in reality these parcels contained existing units. In order to create a better product, we needed to investigate how to determine whether parcels with a ResMax value of zero contained existing units or whether the zero value was true. Of the 65,528 parcels within the ½-mile walksheds, 10,854, or 16.6%, were listed as having a ResMax of zero. The challenge, then, was to develop a method to assess these parcels.

In correspondence with one of Tim's colleagues, Rebeccah Maskin, also a Senior Planner, we discovered that PSRC had a "parcel-level file of existing units compiled from the assessor data, but controlled to the 2010 census block counts of housing units" (personal communication, August 15, 2013). This sounded like it could be the key to avoiding the need to manually assess 10,854 individual parcels. Using that data, we were able to assign existing units to parcels that were mistakenly given a ResMax value of zero and more accurately determine each walkshed's TSD.

In total, 120 of the transit center walksheds are above the 20 units/acre threshold to be classified as TSD, leaving 80 walksheds as non-TSD (Table 1). We will return to this in the paper's final section as this subject deserves further discussion.

Table 1. Transit-supportive density by walkshed

Walkshed Name	TSD (res. units/acre)	Walkshed Name	TSD (res. units/acre)
Downtown Redmond	198.46	Burien Transit Center	59.53
Redmond Transit Center	186.14	N 130th St & Aurora Ave N	59.40
Downtown Tunnel & Pine St	166.77	Lake Union Park	59.11
Westlake Station	156.68	Broadway & E Terrace St	55.98
Westlake Hub	146.45	Queen Anne Ave N & Denny Way	51.62
Westlake & 7th	137.21	1st Ave N & Denny Way	50.68
Theatre District	135.92	E Yesler & Broadway	50.07
3rd Ave & Pike St	135.05	NE 24th St & 156th Ave NE	50.02
University Street	131.85	Fairview & Campus Dr	49.74
Westlake & 9th	129.38	South 25th Station	49.23
3rd Ave & Spring St	128.61	International District Station	48.60
Westlake & Denny	127.06	King Street Station	48.43
Seneca St & 4th Ave	123.78	Mercer St & Queen Anne Ave N	48.21
3rd Ave & Cherry St	120.39	Kent Station	47.32
Commerce St. Tacoma	120.15	S Jackson St & 7th Ave	47.09
Columbia St & 3rd Ave	117.89	130th Station	46.14
3rd Ave & Virginia St	116.40	Republican St & 1st Ave N	45.37
2nd Ave & Columbia St	115.40	Tacoma Mall Transit Center	44.23
3rd Ave & Seneca St	111.23	Lakewood Station	42.08
Seattle Ferry Landing Pier 50	108.24	College Station Transit Center	41.36
Pioneer Square Station	107.95	NW Market St & 15th Ave NW	40.62
Westlake & Thomas	106.29	Fed Way TC	39.36
Water Taxi Pier 50	104.06	N 145th St & Aurora Ave N	39.08
Bell St & 3rd Ave	103.30	Mt Baker	38.24
Terry & Thomas	103.07	Galer St & Aurora Ave N	38.10
3rd Ave & Bell St	103.06	S 182nd St & International Blvd	36.69
Seattle Ferry Landing Pier 52	102.23	N 160th St & Aurora Ave N	35.70
Aurora Ave N & 7th Ave	99.15	Lynnwood	33.22
5th Ave & Wall St	97.87	1st Ave S & S 156th St	33.21
152nd Ave NE	97.30	S Jackson St & Rainier Ave S	33.17
Convention Center Tacoma	96.58	SW Alaska At & California Ave SW	33.12
Yesler Way & Dilling Way	95.33	Renton Transit Center	32.68
Harrison St & Aurora Ave N	89.49	Rainier Station	32.60
Broadway & Marion St	84.21	S 180th St & International Blvd	32.48
Bellevue Transit Center	83.20	14th Ave S & S Main St	31.97
Broadway & E Pine St	78.17	120th Station	31.79
Union Station	73.66	Everett Station	30.78
NE 6th Street Station	73.51	N 90th St & Aurora Ave N	30.67
Overlake Village	72.52	SW Avalon Way & SW Yancy St	29.46
Lakewood Transit Center	69.97	SW Avalon Way & 35th Ave SW	29.41
Broadway & E Denny Way	67.88	SeaTac Airport	29.17
Terry & Mercer	67.67	N 100th St & Aurora Ave N	28.96
N 135th St & Aurora Ave N	67.00	Aurora Village Transit Center	28.45
Cap Hill Station	64.83	East Main	28.21
Jackson Station	64.40	238th Street	27.69
Vine St & 3rd Ave	63.93	Auburn Station	27.60
Brooklyn	60.97	Lynnwood Transit Center	27.53
Westlake & Mercer	60.17	Gateway/216th Street	27.04
Colby Avenue/Wetmore Avenue	59.82	NE185th St.	26.71
S Jackson St & 5th Ave	59.56	S 190th St & International Blvd	26.70

Table 1 (cont'd)

Walkshed Name	TSD (res. units/acre)	Walkshed Name	TSD (res. units/acre)
S 188th St & International Blvd	26.67	NW 85th St & 15th Ave NW	12.81
Ash Way P_R	26.03	Beacon Hill	12.79
N 175th St & Aurora Ave N	25.37	NE 40th St & 148th Ave	12.49
Casino Road	25.04	Seacrest Park	12.24
Edmonds Stations	24.94	NE 10th St.	12.19
Baker Blvd & Andover Park W	24.75	International/Cherry Hill	12.04
N 45th St & Aurora Ave N	24.40	Tukwila Station	12.02
Everett Mall	24.31	Mariner	11.92
Kirkland Transit Center	24.00	140th Ave NE & NE 8th St	11.56
NE 15th Pl & 156th Ave NE	23.98	Holman Rd NW	11.46
NW Leary Way & 15th Ave NW	23.84	Overlake Transit Center	11.31
N 185th & Aurora Ave N	22.94	148th Street	11.29
Northgate	22.78	S Grady Way	10.92
Totem Lake Transit Center	22.71	Edmonds CC Transit Center	10.71
N 192nd & Aurora Ave N	22.05	Hospital	10.51
NE 15th St.	21.50	Star Lake (272nd St.)	10.39
S. 200th St.	21.41	S 7th St & Rainier Ave S	10.32
Roosevelt	21.13	TCC Transit Center	9.82
Mountlake Terrace	20.50	NE 87th St & 148th Ave NE	9.64
Crossroads/Heron	20.48	S. 288th St.	9.23
Puyallup Station	19.99	124th Ave NE & NE 8th St	8.95
4th Avenue	19.93	Parkland Transit Center	8.82
112th Street	19.90	Redondo (272nd Station)	8.58
N 85th St & Aurora Ave N	19.78	NE 51st St & 148th Ave NE	8.43
NE 155th St.	19.68	Stanwood Station	8.42
Tukwila International Blvd	19.44	SW Barton St & Fauntleroy Way SW	8.11
S 208th St & International Blvd	19.17	Kent_Des Moines P_R	7.95
Othello	18.92	S. 260th St.	7.39
N 105th St & Aurora Ave N	18.67	NE 130th St.	7.34
NE 145th St.	18.43	Fife	7.26
Mercer Island	17.07	SE Redmond	7.23
Rainier Beach Station	17.00	Kent Des Moines Rd & Pacific Hwy S	6.84
41st Street/40th Street	16.77	South Tacoma Station	6.13
Bothell Transit Center	16.63	NE Old Redmond Rd & 148th Ave NE	6.02
Madison Street/Pecks Drive	16.58	UW Stadium	5.77
W Dravus & 15th Ave W	16.46	Elliott Ave W	5.65
SW Findlay St & California Ave SW	16.15	Sumner Station	4.46
Tacoma Dome	16.15	Stadium Station	4.32
50th Street	15.57	Highline CC Station	4.02
62nd Ave S & Southcenter Blvd	15.56	Mukilteo Station	3.84
NW 65th St & 15th Ave NW	15.42	Point Defiance Ferry Landing	3.31
Lincoln Way	15.26	South Hill Mall Transit Center	3.29
SW Barton St	15.05	Lake Stevens Transit Center	3.24
S 312th St & Pacific Hwy S	15.05	South Bellevue	2.20
Fauntleroy Way SW & California Ave SW	14.47	Issaquah Transit Center	1.07
S. 216th St.	14.37	Alderwood Mall	0.38
Columbia City	13.69	S. 348th	0.05
Airport Road	13.69	SODO	0.00
72nd Street Transit Center	13.29	Boeing	0.00
NW 100th St	13.04	Powell Ave SW & SW Grady Way	0.00

IV. Testing and Results

We now had the three necessary components to create the TOD walkshed maps as described in the project's deliverables: Transit Centers and Park-and-ride lot points, a decision to generate ½-mile walksheds (rather than 10-minute or 10-minute slope constrained), and the calculated TSD for each walkshed.

From the beginning of the project, we knew that although the large-format paper maps would have been acceptable deliverables, ideally what would be most useful was an interactive online TOD map. Once we knew that, we focused our efforts on producing the online version first. In fact, throughout the discussions regarding critical decision points, our project team used online maps hosted on the UW Geography Department's ArcGIS Online account to share map content and ideas with our project sponsor.

Once we had conducted the first attempt at TSD calculations, we built the online TOD walkshed map seen in Figure 13 and shared that with Tim for his review and comment.

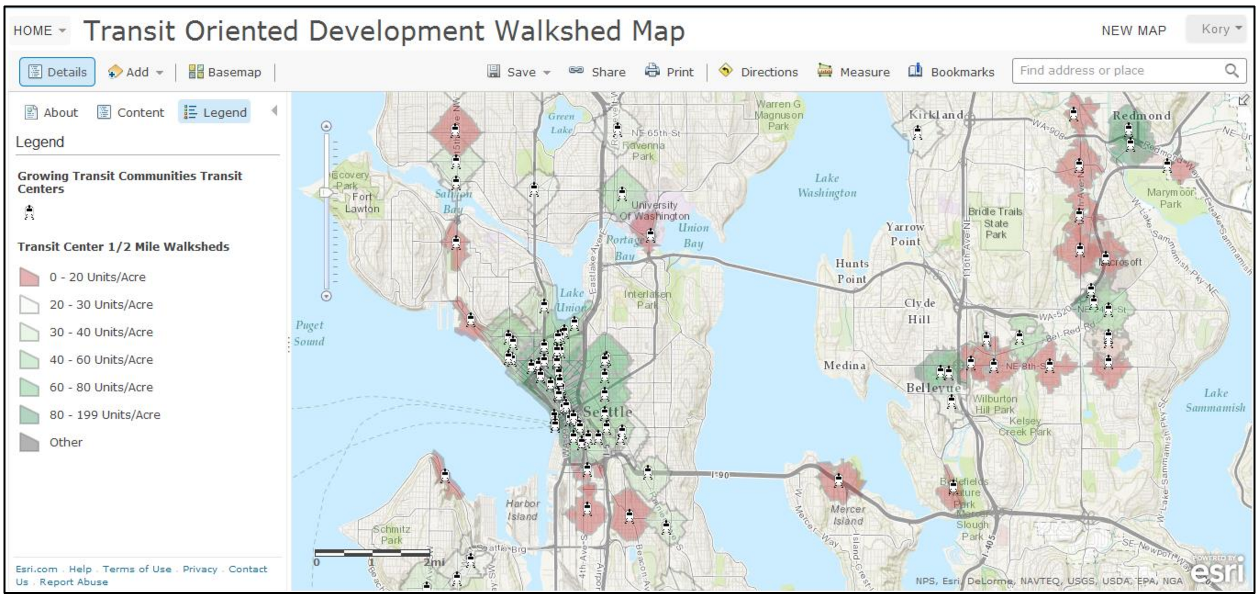

Figure 13. First version of the online TOD walkshed map (http://bit.ly/18CT27b)

Building draft maps on ArcGIS Online helped us learn the nuances of the system while providing a very easy way to share data in an interactive form with Tim. While a large-format .pdf does allow the recipient to zoom in and look more closely at individual walksheds, the user is not able to access the underlying data. Also, there is of course very limited functionality in terms of controlled visibility levels at varying scales as .pdfs are not intended for this type of use.

Using the TOD map from Figure 16, Tim was able to navigate to different walksheds and click on them to see what their TSD numbers were, and zoom in to look at parcel level data. This allowed for a great level of information to be transferred, while providing an intuitive means for rapid assessment. He was very responsive to our communications. While the intent of the original symbology of this map was to show non-TSD walksheds as red, and TSD walksheds as green becoming darker with higher density, initial comments were that the symbology drew too much focus immediately to non-TSD walksheds, and that the 20-30 units/acre class was hard to see as those were colored too lightly. Of course the user has complete control over these settings when viewing in ArcGIS Online, but the cartography should be intuitive and user-friendly from the start. We took Tim's suggestions and built them in to a later version of the online map.

Because the goal of the TOD walkshed project is to provide a tool that helps in the allocation of LIHTCs, the primary focus is not on the walksheds themselves, rather what is happening within the walksheds and around transit centers in terms of planning and development. Ultimately, this tool is helpful in providing information about densities and parcel-level details to planners and developers who are interested in seeking LIHTCs. Thus, we had to design the map to provide this information to the user.

In total, there are 65,528 parcels within the 200 transit center walksheds in Pierce, King and Snohomish counties. We learned early on in testing the online map that it was important to control the visibility of those parcels, only making them visible at the neighborhood scale, or about 1:20,000. This is important not only to avoid map clutter for the user, but we found that if the online map viewer has to draw too many parcels on the screen, a drawing error message regularly pops up (Figure 14).

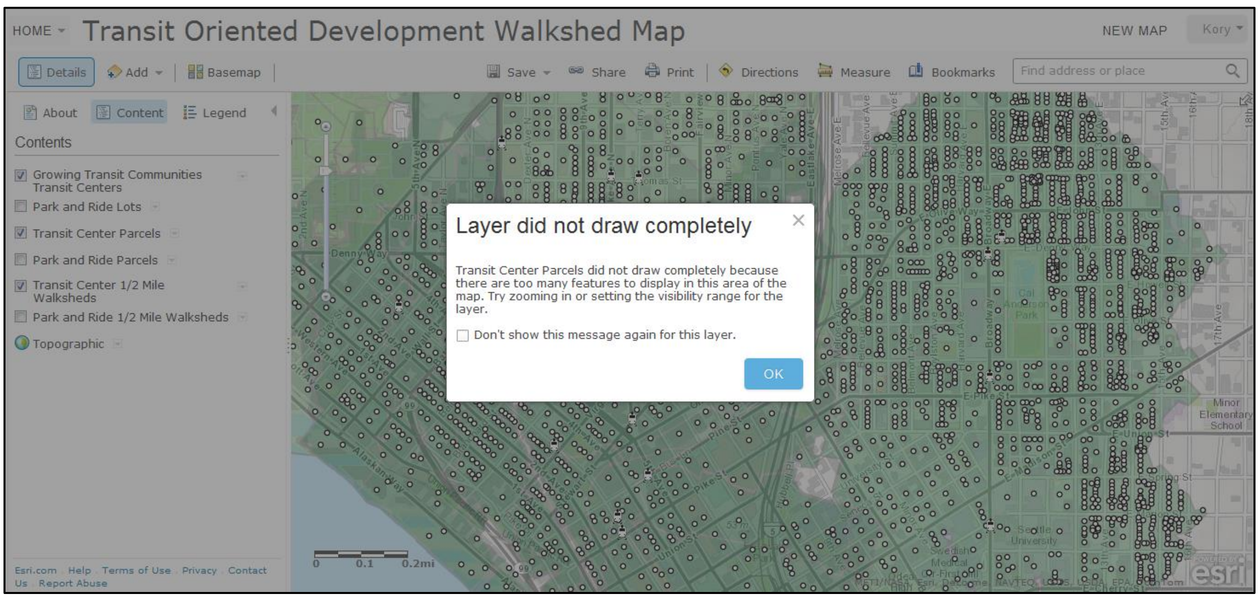

Figure 14. Drawing error message when too many parcels display on the screen at once.

Setting the visibility helps in most cases, but in areas of very dense development (many parcels per area) such as downtown Seattle and Tacoma, this message may still appear. It is resolved by zooming in further to the area of interest.

Figure 15 illustrates the functionality that the user has to retrieve parcel-level information within any walkshed. When the user zooms in to the neighborhood scale or greater, the parcels appear and can be clicked to reveal more information. Here we can see the parcel ID number (PIN), the parcel's square footage, calculated maximum development capacity, land use category and the name of the walkshed. What the user sees in the pop-up is configured by the map author. From input we had received during the conversation with Dan Landes from SRI, it was decided that information such as that shown here would be helpful in an initial screening. For example, a parcel might show up as industrial, or with zero development capacity, so the user would not investigate further and would move on to exploring other parcels.

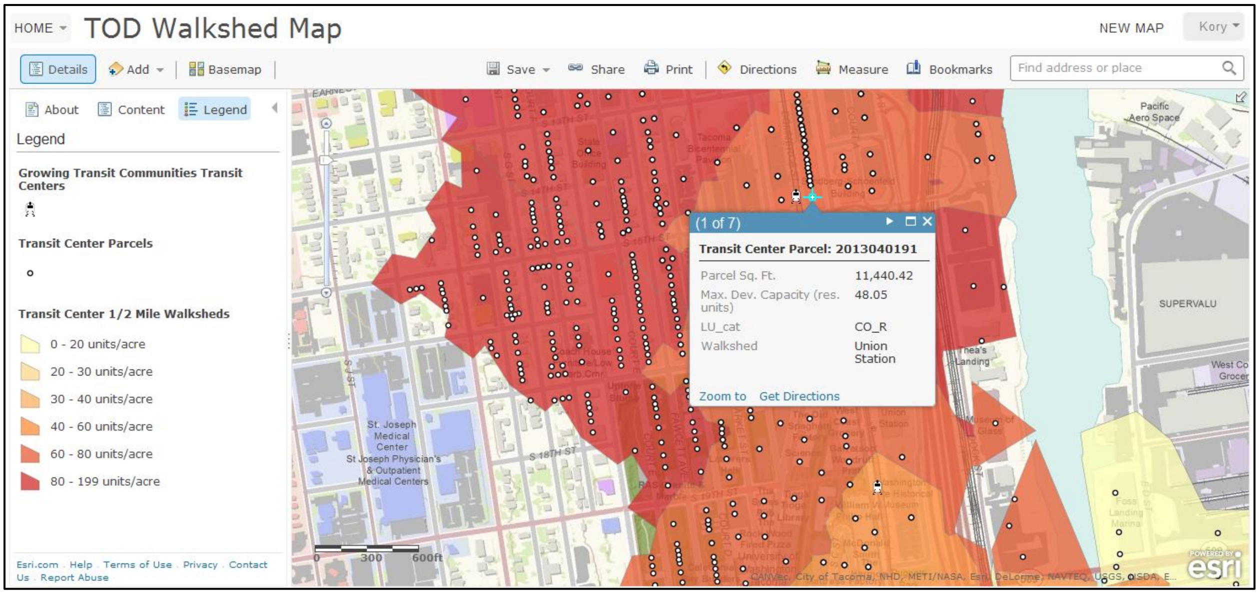

Figure 15. Example of parcel information provided to the user in the TOD Walkshed Map.

An interesting challenge came when we attempted to respond to the desire to produce a list of parcels in any given walkshed. In testing, this can be achieved in ArcMap by using the Identity tool from the Analysis toolbox to associate each parcel with its walkshed. The tool produces an output feature class where each parcel contains a field with the walkshed name. We will call the output feature class parcels_Identity. It is an interesting note that the new parcels_Identity feature class contains 91,438 features even though we know that only 65,528 parcels exist within the 200 walksheds. This is because one parcel may belong to more than one walkshed – this happens when walksheds overlap. If we are to produce a list of all parcels within a walkshed and have the ability to do that for any walkshed that the user chooses, it is necessary to be able to relate a parcel to different walksheds.

Using a table relate in ArcMap, we get the desired effect. The user is able to use the Identify tool to click on the desired walkshed and because the relate exists between that walkshed and the parcels_Identity table, a list of parcels within that walkshed becomes accessible to the user (Figure 16). By clicking on an individual PIN from the list in the Identify window, the user is able to access relevant information. The task became how to achieve similar functionality in the online TOD map.

Wondering if the solution might be as simple as publishing a feature service that contained both feature classes and maintained the table relate, that was our first attempt. However, apparently table relates do not persist through the publishing of a feature service to ArcGIS Online. We needed to explore other options.

After exploring the analysis options offered in ArcGIS Online, it was decided that these did not offer the desired solution. Also, analysis tools are only available to a registered user who has credits available. We needed any user to be able to get the data they needed without being required to sign in or pay to perform analysis. We came up with the following method.

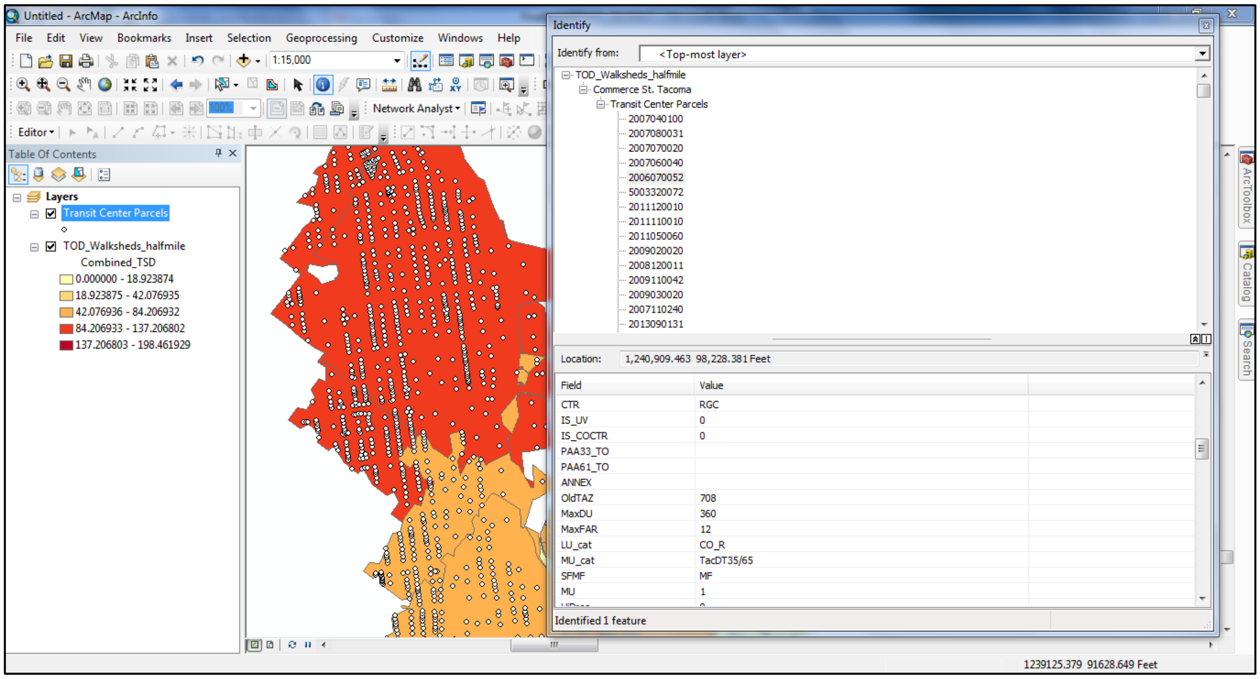

Figure 16. Using a table relate in ArcMap to access information for all parcels in a given walkshed. This figure demonstrates the functionality for the Commerce St. light rail station walkshed in Tacoma.

Any user who has access to the online map is able to show the table of Transit Center parcel data. Notice that in Figure 17 the table is revealed, indicating that there are 91,438 features.

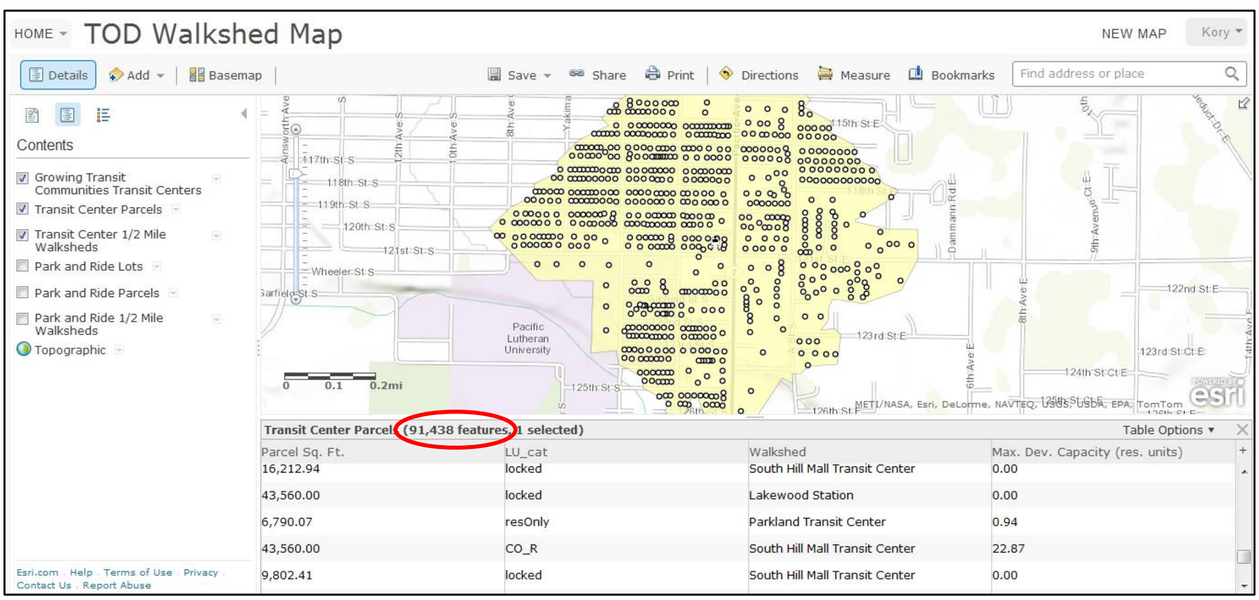

Figure 17. Any user has access to features' tabular data in the online TOD Walkshed Map.

The stated task is to create a table of parcels for a given walkshed. The user is able to apply a filter to tabular data in ArcGIS Online. When we apply a filter in order to determine which parcels are within the Parkland Transit Center walkshed, the result is as seen in Figure 18 - the Parkland walkshed contains 758 parcels. Notice that this functionality is being tested as an anonymous (not signed in) user.

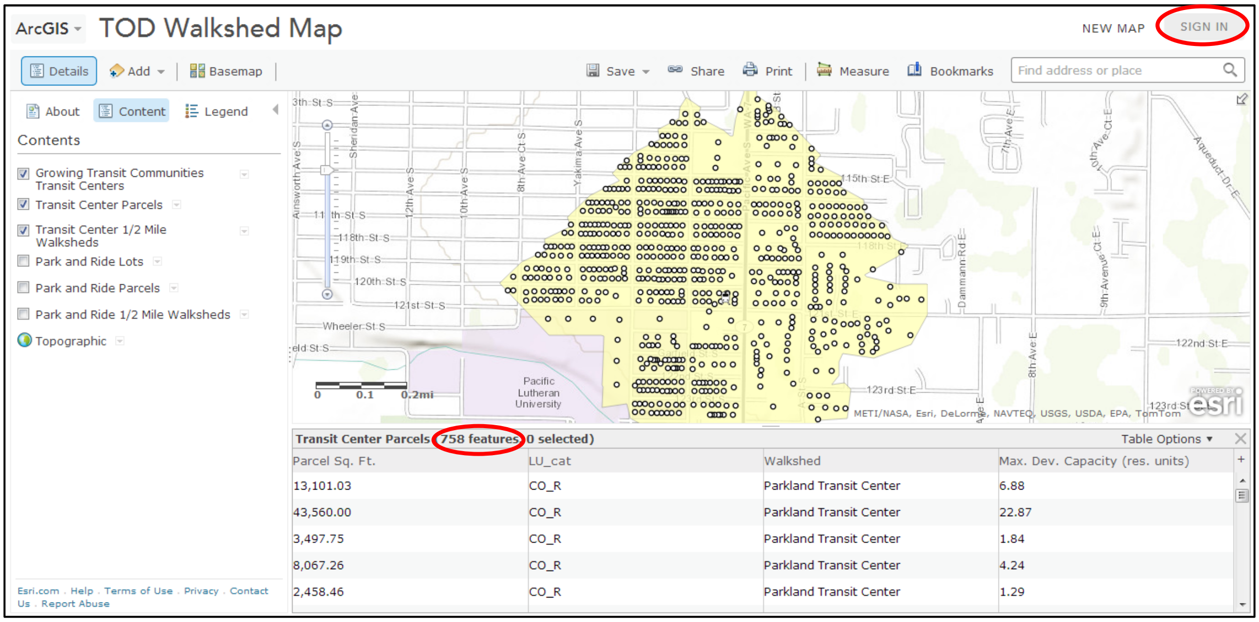

Figure 18. Parkland transit center parcels filtered from all walkshed parcels.

At this point, the user is able to click on any of the field headers and sort the fields in ascending or descending order, as well as retrieve the field's statistics, including the number of values, sum of values, minimum value, maximum value, average value, and standard deviation. We felt that this functionality was likely enough for most users of the tool; however, what was asked for was a list of the parcels.

There is not a built-in function to export the table to Excel, but our testing revealed that if using Mozilla Firefox as the browser, records can be copied and pasted into an Excel spreadsheet, allowing the user to work with the data in a more familiar environment. Interestingly, Chrome and Internet Explorer do not allow the user to highlight records to be copied in such a manner. Table 2 shows an excerpt from the filtered Parkland Transit Center table that was pasted into Excel.

Table 2. Excerpt of Excel table generated from filtered Parkland transit center parcel data in ArcGIS Online.

PIN	Parcel Sq. Ft.	LU_cat	Walkshed	Max. Dev. Capacity (res. units)
6762001590	13,101.03	CO_R	Parkland Transit Center	6.88
319093011	43,560.00	CO_R	Parkland Transit Center	22.87
319093030	3,497.75	CO_R	Parkland Transit Center	1.84
6762001682	8,067.26	CO_R	Parkland Transit Center	4.24
6762001681	2,458.46	CO_R	Parkland Transit Center	1.29
6762001670	9,833.26	CO_R	Parkland Transit Center	5.16
6762001662	4,916.37	resOnly	Parkland Transit Center	0.68

Because the focus of the project was on walksheds surrounding transit centers, the online TOD Walkshed Map defaults to having the Park-and-ride lots, walksheds and parcels switched to not visible. As part of the deliverable, these layers are included and can be turned on by the user. Figure 19 shows the final version of the online TOD Walkshed Map that is accessible to the public. The map below is set to a similar extent as the test version seen in Figure 16 to show the improvement in color choice. Non-TSD walksheds are easily differentiated from TSD walksheds, yet do not draw the most attention. Park-and-ride lots and walksheds have been turned on for demonstration purposes.

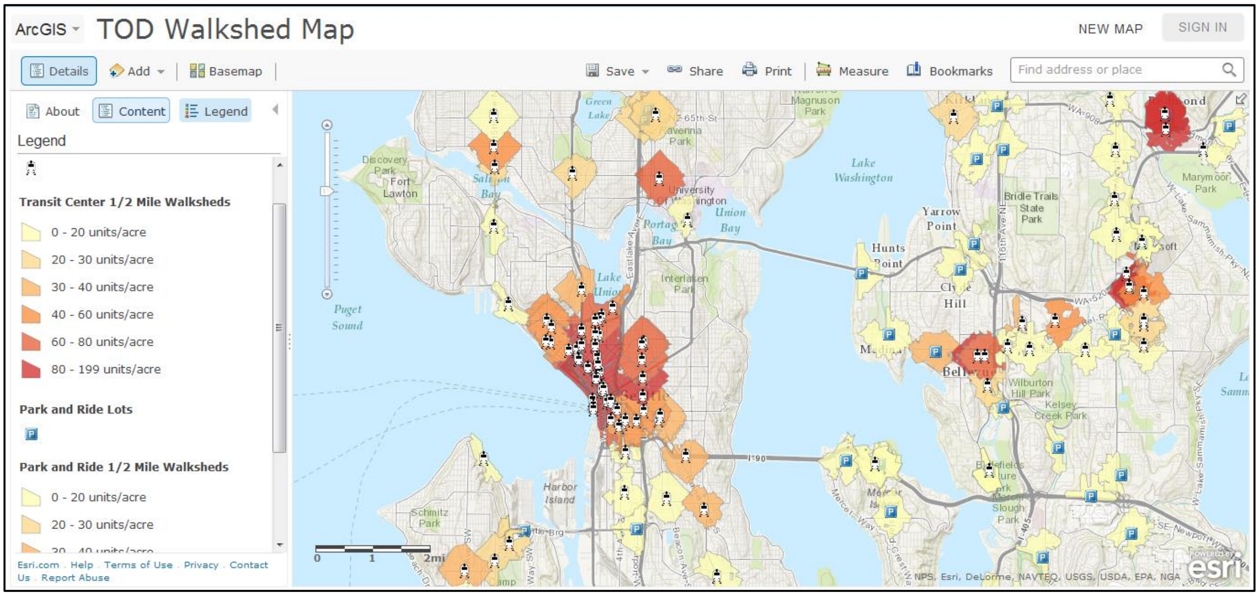

Figure 19. Final version of the online TOD Walkshed Map (http://bit.ly/16uTnev)

With the "ideal" product completed, we went ahead and completed the large-format maps for print. These were delivered to Tim in .pdf format to be printed on PSRC's plotter.

V. Implementation Plan

The primary value of this project will be in sharing the online TOD Walkshed Map with the TOD community as we will demonstrate below. In light of that fact, implementation will involve hosting the map on PSRC's website and then sharing the link with the user community.

Tim Parham is coordinating with Andy Norton, Principal GIS Analyst, who will add a page and a link to the online map on the TOD Fund Subcommittee page of the PSRC website. PSRC does not currently have a protocol for posting maps online, but Tim believes that the organization does have an ArcGIS Online account. If this is the case, Tim will be able to open the publicly shared web map, and use the Save As option to save the map to the organizational account. At that point, PSRC will be able to make updates and share the updated web link with their network of TOD professionals.

Once PSRC has control of the online map, a more integrated way to implement it on their website would be to use the embed code provided by the ArcGIS.com map viewer through the Share option. In order to embed the map, it must first be shared with everybody (public). The web administrator is then able to customize the map's size and tools to include in the user interface such as a scale bar, zoom control, and location search. Some of these, such as location search, are standard in the web viewer and will be important to include if it is decided to embed the map, since the location search feature is an important function of the tool. After making these decisions, ArcGIS.com provides the embed code that needs to be pasted into PSRC's web page where they want the map to appear.

After PSRC has taken over the map hosting, and decided on a sharing method (link or embedded map), Tim will email all Growing Transit Communities Partners and other interested parties, including a variety of stakeholders across the region. The map could potentially be shared with the TOD community through PSRC's September GTC newsletter as well. Tim will ask that King, Pierce, and Snohomish County Housing Development Consortiums share the tool with their members as well.

Because a number of future transit centers were included in this project, it is not likely that this layer will need to be updated as frequently as the walkshed layer. As development happens around station areas, however, the underlying pedestrian networks will change, likely increasing the size of the respective station's walkshed. This layer should be reviewed as development plans become known to PSRC and updated as necessary. If the walkshed criteria becomes an important factor in the allocation of LIHTCs moving forward, it will be important to maintain an up-to-date walkshed layer.

VI. Business Case for Sustainability Management

Placing a financial value on the online TOD Walkshed Map proved to be difficult for the project team. This may partially be due to the fact that using a walkshed criteria in the allocation of tax credits is a relatively new policy. As the developer community becomes more accustomed to searching for credits, perhaps the tool will gain value. In 2012, our project sponsor only had to respond to two inquiries from developers interested in knowing whether their projects fell inside or outside of a walkshed. As TOD gains momentum in the region, and as the tool developed through this project is used and improved by the TOD community, it is likely that it would be providing additional time savings to a staff person who would otherwise need to field inquiries.

In order to get a sense of what value this tool will provide to professionals working with TOD projects, we collected information from Tim, as well as from a housing program manager with the City of Seattle, and a planner with the City of Tacoma.

Ryan Curren, Community Cornerstones Program Manager with the City of Seattle's Office of Housing wrote:

Since 2009 the Seattle Office of Housing has made transit access a priority for investing over $80 million in the development of new affordable housing projects. Each Notice of Funding Availability has a map attached showing the eligible areas for development. The mapped areas are ½ mile buffers from corridors of high frequency transit. This definition does not consider topography or sidewalk conditions.

In 2013 City Council approved amendments to this policy that gives staff more flexibility for assessing the benefits of a project's location. Our office is emphasizing the walkable nature of the project area as well as its proximity to transit. This online tool will allow us to determine whether a project is within a reasonable walking distance given the actual on-the-ground conditions. Walksheds are not a threshold determinate for an investment in affordable housing but they are an excellent proxy for whether a household will have the option of not relying on a car for all their transportation needs.

A print-version map will be useful for illustrating policy and investment options for internal discussions.

Elliott Barnett, an Associate Planner with the City of Tacoma, wrote:

We all know how important walkability is—it is increasingly recognized as being central to planning in almost every way. We base many policy decisions on how walkable a neighborhood is and proximity to services like transit. It would be useful to have a tool to measure walkability, especially one that can easily be tailored to differing queries and criteria. It would also be valuable to make such a tool available online to planning professionals, or generally available.

The TOD Walkshed Map provides a promising methodology to support both regional and local policy analysis. The fact that it uses actual walking routes as opposed to a standard ¼ or ½ mile radius is important. At the regional level, it facilitates understanding of how transit and TOD work together as a system. Using your map I can determine how connected a neighborhood in Tacoma is to a neighborhood elsewhere in the region, and can see how much of the city is not connected in this way. If PSRC, Sound Transit and other regional transportation and planning agencies are not analyzing transit station walksheds, they should be.

At the local level, I imagine the tool could be useful to support subarea planning efforts. Walkability to regional transit is useful information. How about walkability to schools, parks, shopping and other destinations important at the neighborhood level? What about the quality of those routes? Again, since you measure actual routes rather than a standard radius, the tool shows how fine-grained the connectivity is, how many route choices there are, and overall how walkable a neighborhood is. The tool could help to identify barriers to walkability and to prioritize improvements such as new walking routes. If you overlay qualitative measures such as existence of sidewalks or traffic accidents, this could yield important information.

Finally, our project sponsor, Tim Parham, Senior Housing Planner with PSRC wrote:

These maps are an important first step in identifying priority TOD areas in the region. This will help to further discussions about targeting resources such as PSRC distributed resources called for in the Growing Transit Communities Strategy. In addition this will help funders as they consider priorities for distributing loans from a potential Regional Equitable Development Initiative (REDI) Fund. These maps will be a good starting point for all discussions about regional TOD.

It is apparent that the online TOD Walkshed Map will be useful. From these few comments, we see that the tool might be used, at least to an extent, to make decisions about how to distribute funds. These funds are often public funds, and it is important to be able to demonstrate the information that was used to make decisions. The approach that Seattle is taking in terms of using a tool like this to inform decisions, yet not treating the walkshed criteria as a definitive threshold seems like a healthy approach at this stage.

Everyone who used the online map for testing was enthusiastic, and we found that they immediately wanted to share it with co-workers and colleagues. We also see in the feedback above that there are already ideas being generated for how this could be employed for uses other than TOD planning, as well as for improvements to the tool. The strategic value of implementing this tool lies in the information and idea exchange that will drive TOD projects forward.

VII. Discussion and Recommendations

In this project, it is easy to become focused at the walkshed scale and lose sight of the context in which the project is set. As described throughout the Design Considerations and Design sections of the report, we invested a lot of effort deliberating with our project sponsor about critical decisions such as how to define a transit center, what method to use to generate walksheds, and what TSD calculation method would be best. We feel that we have described those decisions clearly, yet there remains much room for discussion. This exercise is nested within a far larger regional sustainability effort that has been in play for many years, and will continue for generations to come. There are complex interactions between humans, our built surroundings, and the natural environment that cannot be ignored when implementing policies such as TOD.

In plain recognition of these complexities, to build the regional TOD framework that is the GTC Strategy, PSRC worked with Strategic Economics and Reconnecting America to conduct studies in 74 existing and future station areas. Strategic Economics, an urban economics and planning consultancy, and Reconnecting America, a transit advocacy and research non-profit, have an ongoing partnership through the national Center for Transit-Oriented Development, and frequently collaborate on planning, policy and implementation efforts related to TOD (Strategic Economics, 2013). Though the study areas were based on light rail locations, the intention was that the results could be applied to similar transit and housing planning scenarios around BRT stops, ferry terminals, and other types of transit locations. The studies resulted in a People Profile (Figure 20) and a Place Profile (Figure 21) that help to group areas into larger categories for planning purposes.

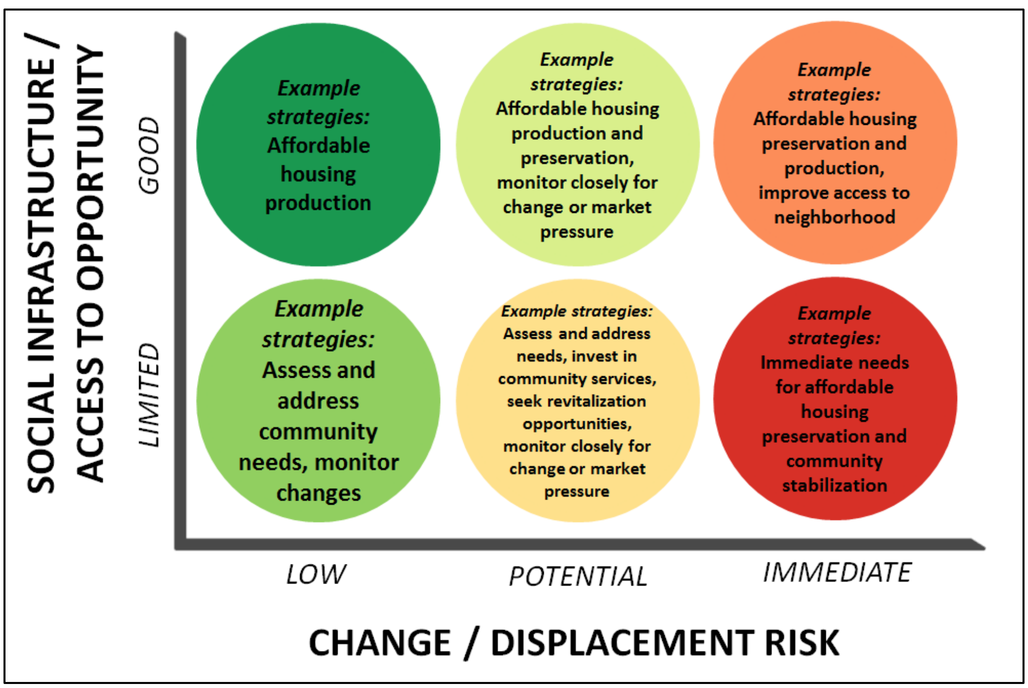

Figure 20. People profile used to partially inform a TOD implementation strategy in station areas.

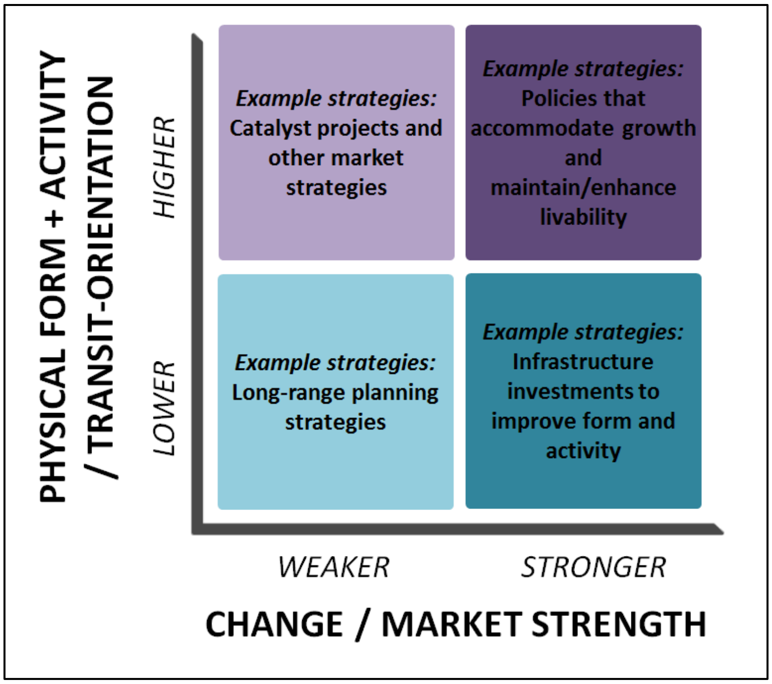

Figure 21. Place profile used to partially inform a TOD implementation strategy in station areas.

By combining a study area's People profile with its Place profile, a general Implementation Approach can be assigned to that area. The GTC Strategy outlines eight Implementation Approaches: (1) Protect and Grow, (2) Expand Housing Choices, (3) Improve Access, (4) Transform and Diversify, (5) Stimulate Demand, (6) Build Urban Places, (7) Enhance Community, and (8) Preserve and Connect (PSRC, 2013a).

Why introduce these concepts here? The purpose of this project was to generate walksheds around transit centers across a three-county region. And though much effort was spent to choose a single approach, we were still attempting to apply one method to 200 stations across a nearly 6,000 square mile region containing more than 3.3 million people. In fact, we were told early on in meetings with our project sponsor, as well as in our conversation with a developer that "not all walksheds are created equal." We can refer back to Figure 5 or Figure 10 and understand that applying the same methodology to different built environments will not always generate the same result.

The authors of Implementing Equitable Transit Communities admonish, "One of the foundational steps in implementing a regional vision for transit-oriented growth and community development is identifying what actions are needed and which tools will work in these different contexts. One size does not fit all" (Strategic Economics, 2013). And PSRC takes that to heart in the writing of the GTC Strategy itself, "No two transit communities are alike. Accordingly, there is no one-size-fits-all approach to the strategies that will help a transit community thrive and grow with equitable outcomes for current and future community members" (2013a). Finally, Ostrom writes that "there is a danger, however, that project planners searching for the 'right' design will try to build a one-size-fits-all project," while ignoring the "importance of matching the rules of a system to the underlying biophysical world and type of human community involved" (2005).

Discussing these concepts here is not done only to suggest thoughts for continual improvement of the TOD Walkshed Map, but also to acknowledge that PSRC already knows and is practicing this type of thinking through GTC work. Just as there will not be a blueprint implementation approach, we should not think that calculating ½-mile walksheds around transit centers will accurately reflect the reality of that transit center, either now or in the future.

Thus, using one methodology to generate walksheds for the transit stations in all three counties should be seen as a general regional guide that is useful at the appropriate scale. Just as PSRC recognizes the need for station area planning before individual projects are programmed, a finer level of walkshed determination that is more appropriate to the characteristics of a specific site (whether due to topography, demographics such as age, cultures, current state of the built environment, or protection of critical areas and wildlife habitat) should be conducted as areas transition from regional planning to local planning and implementation.

To show how this concept is manifested in this project, and again, to demonstrate PSRC's commitment to the public process, we thought that it would be appropriate to share a brief analysis that we conducted. The GTC Strategy document cited throughout this report was a draft released for public comment in May 2013. A public comment period was open from May 1 to June 7, 2013 with a total of 53 comments submitted (PSRC, 2013b). Thirty of the comments were generally supportive of the document, 15 were less than supportive, and eight were unclear or neutral (Table II). The final draft of the Growing Transit Communities Strategy is set to be released in the fall 2013.

Table 3. Classification of public comments on the GTC Strategy Draft

supportive (30)	not supportive (15)	unclear (8)
185th Station Citizen Cmte	Doris Cassan	Day Chapin ("thorough")
City of Bellevue	Cmte on Opposition of Value Capture Financing	City of Fife ("timely", freight mobility)
Community Transit	Concerned about the usuprtion of community voice	City of Mill Creek ("applauds")
Isaac Conlen	Jani Estrada	Jon Morrison Winters (wording)
Enterprise Community Partners	Paul Fraser	City of Pacific (bikesheds)
Equity Network Steering Cmte	Doug Hansen	Annie Peterson (Paine Field)
City of Everett	Pamela Jones	Maria Ramirez (defining equity)
Forterra	Ron Momoda	Jerry Schneider (podcar proponent)
Futurewise	Patricia Paschal	
GTC Affordable Housing Steering Cmte	John Rosselli (Darrington councilman)	
Housing Development Consortium	Tamra Smilanich	
City of Kent	Liza Stacishin	
King County (Executive)	Erik Stanford	
City of Mountlake Terrace	Steve	
Municipal League Foundation	Tom Stowe (Beaux Arts Village councilman)	
Othello Park Alliance		
Pierce County Executive		
Pierce Transit (with concerns)		
City of Redmond		
City of SeaTac		
City of Seattle		
county health departments		
Snohomish County		
Social Venture Partners		
Sound Transit		
City of Tukwila (with concerns)		
University of Washington		
Uptown Urban Center Alliance		
Nancy Wagner		
WSDOT		

The 30 supportive comments generally originated from city governments, county governments, transit authorities, and groups dealing in affordable housing. The 15 non-supportive comments tended to originate from individual citizens, small community groups, and city councilmembers feeling the GTC Strategy draft was either not helping them in any way or that it would put too much burden on a city's comprehensive plan. The remaining eight comments covered a wide spectrum of opinions, perspectives, and ideas, though they were ultimately ambiguous in revealing their stance on the GTC Strategy Draft.

Though the supportive comments outnumbered the non-supportive comments by a 2:1 ratio, there are a few themes which are fairly common throughout the group. They commend PSRC in their effort and on their thoroughness. Though each submission lauded specific items in relation to each group's jurisdiction or sphere of influence, a sizable number of the positive submissions expressed concern over some of the language in the GTC Strategy. Namely, many of the comments stressed concern over some of the recommendations seeming more like mandates to be thrust upon member jurisdictions. Multiple submissions also expressed concern over the promotion of low-income housing and access as opposed to promoting density, which was seen to drive the success of transit. Multiple comments also expressed concern over the availability of funds required to implement the GTC Strategy. Areas not having light rail expressed concern over whether they would be at a competitive disadvantage when transportation funding and grants were awarded. Apart from all the concerns already mentioned, many of the comments offered feedback or adjustments in the wording of particular items within the strategy, with the reasons ranging from cosmetic changes to more substantive changes asking for clarification on specific points.

The 15 non-supportive comments in response to the GTC Strategy Draft had a wide range of concerns. The part of the GTC Strategy generating the most organized opposition dealt with value capture financing. The GTC Strategy Draft defined value capture financing as "various strategies that seek to capture the increase on private property values from public investments to help finance further public improvements in an area," and mentioned tax increment financing, special assessment districts, and land value taxation as common versions of value capture financing (PSRC, 2013a).

We saw earlier in the paper that the relationships between transit and land use vary with distance from a transit center (Guerra and Cervero, 2013). Strategic Economics makes an interesting recommendation when comparing PSRC's station area planning guidelines to those of other Metropolitan Planning Organizations around the country that have "created residential density targets that vary for urban cores, city centers, and suburban areas." They recommend that the GTC partnership take a similar approach and develop "minimum zoned density thresholds that vary by place type and that are among a range of criteria for grant applicants" (2013).

What does this mean for the relevance of the ½-mile TOD Walkshed Map as a tool used in allocating LIHTCs? Figure 22 provides insight into how we might rethink a walkshed tool for planning purposes. We found Sacramento's guidelines to be most interesting given the variable minimum densities associated with varying distances from a transit center. Would it make sense to allocate LIHTCs in a variable manner that more accurately aligns with the desired future development scenario? As we showed in the prototype map in Figure 4, it is technically easy to generate concentric, variable distance walksheds. What needs to be figured out are the underlying rules at play in developing areas in the Puget Sound region given their People and Place profiles.

	Urban Core (Downtown)	City Center	Suburban Center
MTC Station Area Planning Manual	16-60 du/acre	10-30 du/acre	5-20 du/acre
City of San Diego TOD Guidelines		17-30 du/acre (avg) 12 du/acre (min)	13-20 du/acre (avg) 8 du /acre min)
Sacramento Regional Transit Guide to TOD	36 du / acre (min)	¼ mile: 20 du / acre (min) ½ mile: 15 du / acre (min)	¼ mile: 15 du / acre (min) ½ mile: 10 du / acre (min)

Note: San Diego's TOD Design Guidelines provide net densities; they have been converted to gross densities using an average gross-to-net ratio of 0.67.

Figure 22. Sample of gross residential densities from station area planning guidelines. Source: Strategic Economics.

In conclusion, while generating ½-mile walksheds around transit centers provides general guidance to direct development toward higher density communities, helping to avoid sprawl, this method itself should be viewed as an experiment in regional sustainability. In Resilience Practice: Building capacity to absorb disturbance and maintain function, the authors argue that building resilience at the focal scale requires experimentation at finer scales (Walker and Salt, 2012). In the case of Growing Transit Communities, the focal scale is the Central Puget Sound region and the transit center ½-mile walksheds are sub-focal scales. The local jurisdictions should be allowed to experiment with different ways of implementing TOD, under the guiding regional vision. A network of regional planners should take note of which experiments seem to be working well, what the characteristics of the area are, and see if applying the same methods in similar areas produces similar results.

The hypothesis is that by providing incentives such as low-income housing tax credits for development in close proximity to transit, we will see a decrease in vehicle miles traveled, leading to fewer emissions and an improvement in the environment even with an increasing population. Rivers will be cleaner, leading to a cleaner Puget Sound, and working parents who spend less time in traffic will have more time with families. Families will spend less money on transportation which should contribute to a higher quality of life. This is the vision of transit-oriented development. It will be important to tie areas' level of TOD to social and environmental indicators to see if the experiment is working.

Many of the public comments from PSRC member jurisdictions seem to assert the ideas noted here. They understand that transit-oriented development may be an important part of accommodating growth in a way that does not further harm the environment. Yet, they are very clear that they should be allowed to implement strategies in a way appropriate to their communities. This seems like a good start.

Finally, PSRC should make every effort to share the online TOD Walkshed Map with transit agencies, planners, developers, decision makers, and anybody else who is involved in station area planning, conservation, and project-funding. Let them use it, learn from it, ask questions about the assumptions made to produce it, criticize it and suggest improvements. Strategic Economics highly recommended that "PSRC initiate an on-going peer networking exchange for staff at cities working on GTC study areas" (2013). There will undoubtedly be differing opinions about the right course of action and not everybody will agree on choices made. However, the process of working through disagreements and being exposed to different perspectives can often bring about new knowledge. Ostrom writes that conflict can "generate more information that is useful to participants in their efforts to solve challenging problems" (2005).

It has been noted that the TOD policies related to the 2012 work that PSRC moved forward in King County through producing walkshed maps to guide development have been successful. Yet these policies need to be expanded into Pierce and Snohomish counties to maximize the already planned transit investments. We hope that this project's products will be shared as widely as possible and generate other, different, better, unheard of ideas to balance social, economic and environmental needs in the region.

VIII. Glossary

Affordable Housing: Housing whose cost is less than thirty percent of a household's income. Often this term is used specifically to refer to housing that is affordable to households earning less than 80% of area median income.

Bus Rapid Transit: Bus service characterized by 15 minute frequencies at least 18 hours daily. BRT service can go beyond typical core bus routes by including capital infrastructure designed to increase bus speed and provide passenger amenities along its route. Examples of supporting infrastructure include signal queue jumps or other transit signal priority treatments, wider stop spacing, curb bulb-outs at stops, enhanced passenger shelters at stops, and enhanced signage, wayfinding and real-time arrival and departure information.

Equitable transit communities: mixed-use, transit-served neighborhoods that provide housing and transportation choices and greater social and economic opportunity for current and future residents. Although defined by the half-mile walking distances around high-capacity transit stations, they exist within the context of larger neighborhoods with existing residents and businesses.

Growth Management Act: State legislation passed in 1990 to guide planning for growth and development in Washington State. The GMA requires local governments in fast growing and densely populated counties to adopt long-range comprehensive plans that define urban growth areas and address land use, housing, capital facilities, utilities, transportation, and other related elements of local and regional planning. The GMA has been regularly amended to further define requirements and to advance coordination among local governments. (RCW 36.70A).

High Capacity Transit: Transit systems operating, in whole or part, on a fixed guideway, dedicated right-of-way or freeway/express facility, designed to carry a large number of riders at higher speeds than conventional transit. Examples include express bus on HOV lanes, passenger ferry service, and light and heavy rail systems.

Light Rail: An electric powered rail transit system that can operate on a variety of rights-of-way, ranging from mixed traffic on-street to fully grade separated. Generally characterized by narrow station spacing (every ½ to 1 mile), slower average operating speeds, and shorter train units (with less capacity) than heavy rail.

Park-and-Ride: An access mode to transit and other HOV-modes in which patrons drive private automobiles or ride bicycles to a transit station, stop, or carpool/vanpool waiting area and park the vehicle in the area provided for that purpose (park-and-ride lots, commuter parking lots, bicycle rack or locker).

Transit-dependent: Individual(s) dependent on public transit to meet personal mobility needs (e.g., unable to drive, not a car owner, not licensed to drive).

Transit-Oriented Development: The development of housing, commercial space, services, and job opportunities in close proximity to public transportation. Such development is intended to reduce dependency on automobiles, and to better link residences to jobs and services.

Transit Station Area: The area around a high-capacity transit station, defined by a one-half mile radius or the area that can be reached by foot in ten minutes or less.

Transit Supportive Density: A concentration of housing and jobs within a defined area of land sufficient to support the frequent use of a given mode of public transit. The specific density that is considered transit supportive will vary based on the transit mode, location within a transit system, and mix of uses.

Walkshed: The area around a transit center, either measured as one half mile radius, a ten minute walking distance, or a combination of the two. Used to measure the area in which walking or biking can serve as viable transportation options over driving.

IX. References

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Appendix A. Python Script used to produce 10-minute slope-constrained walksheds

```
# Import arcpy module
import arcpy
from arcpy import env
env.workspace="C:\Users\Kory\Documents\PMPGIS\GEOG569\PSRC_Data\TODWal
kshed.gdb"
env.overwriteOutput = True
from arcpy.sa import *
arcpy.CheckOutExtension("Spatial")

# Local variables:
wsPolys = "wsPolys_2640ft"
wsPoly = "wsPoly"
wsPoint = "wsPoint"
wsPoints = "GTC_Station_Nodes"
PSRC30ft=
"C:\Users\Kory\Documents\PMPGIS\GEOG569\PSRC_Data\TODWalkshed.gdb\PSRC
30ft_UGACLIP"
Slope_Raster = "slope2"
Divide_Raster = "devide"
Cost_Raster = "reclass"
Path_Distance_Raster = "Dist"
Backlink_Location = "backlink"
v1_2_Mile_Walking_Buffer = "outRast"
test = "test"

# Process: Make Feature Layer
print 'MFL'

env.extent = wsPolys
env.mask = wsPolys
# Process: Slope
if arcpy.Exists(Slope_Raster):
    arcpy.Delete_management(Slope_Raster)
arcpy.gp.Slope_sa(PSRC30ft, Slope_Raster, "PERCENT_RISE", "1") # this
will be called slope2 in the output

# Process: Reclassify
if arcpy.Exists(Cost_Raster):
    arcpy.Delete_management(Cost_Raster)
if arcpy.Exists(Divide_Raster):
    arcpy.Delete_management(Divide_Raster)
arcpy.CalculateStatistics_management(Slope_Raster)

scalarVar = 5
outDivide = Raster(Slope_Raster)/ scalarVar
outDivide.save(Divide_Raster) # this will be called devide in the
output

#if slope is <=5, set cost to 1, otherwise cost = Slope/5
```

```
outReclass = Con(Slope_Raster, 1, Divide_Raster, "VALUE <= 5")
outReclass.save(Cost_Raster) # Cost_Raster is called reclass in the
output

#Go through each Standard Walkshed Poly
rows = arcpy.SearchCursor(wsPolys)
row = rows.next()
pointrows = arcpy.SearchCursor(wsPoints)
pointrow = pointrows.next()
while row:
    wsName = row.Name
    delimitedField = arcpy.AddFieldDelimiters(env.workspace, "NAME")
    expression = delimitedField + " = '" + wsName + "'"
    wsPtName = pointrow.Name
    pointexpression = delimitedField + " = '" + wsPtName + "'"
    #Save walkshed and point to a temp FC
    arcpy.FeatureClassToFeatureClass_conversion(wsPolys,
env.workspace, wsPoly, expression)
    arcpy.FeatureClassToFeatureClass_conversion(wsPoints,
env.workspace, wsPoint, pointexpression)

# Process: Path Distance
    env.extent = wsPoly
    env.mask = wsPoly
    #Apply PathDistance- The path distance tools create an output
raster in which each cell is assigned the accumulative cost from the
cheapest source cell
    arcpy.gp.PathDistance_sa(wsPoint, Path_Distance_Raster,
Cost_Raster, "", "", "BINARY 1 0", "", "BINARY 1 -30 30", "",
Backlink_Location)

    inTrueRaster = 1
    inFalseConstant = 0
    whereClause = "VALUE <= 2640"

# Execute Con, Select Cells that have a PathDistance <=2640
    outCon = Con(Raster(Path_Distance_Raster)<= 2640, 1, 0)#
inTrueRaster, inFalseConstant, whereClause)

# Save the outputs
    s = wsName
    newname, sep, tail = wsName.partition(':')
    s = s.replace(' ', '')
    fcname, sep, tail = s.partition(':')
    print fcname

outCon.save("C:\Users\Kory\Documents\PMPGIS\GEOG569\PSRC_Data\TODWalks
hed.gdb\outraster")

# Convert from raster to features
    outFC = fcname + '_merge'
    print outFC
```

```
    arcpy.CreateFeatureclass_management(env.workspace, outFC,
"POLYGON", wsPoly, "DISABLED", "DISABLED",
"C:\Users\Kory\Documents\PMPGIS\GEOG569\PSRC_Data\TODWalkshed.gdb\Tran
sit")

arcpy.RasterToPolygon_conversion("C:\Users\Kory\Documents\PMPGIS\GEOG5
69\PSRC_Data\TODWalkshed.gdb\outraster",
"C:\Users\Kory\Documents\PMPGIS\GEOG569\PSRC_Data\TODWalkshed.gdb\\" +
outFC, "NO_SIMPLIFY", "Value")
    arcpy.AddField_management(outFC, "Name", "TEXT", "", "", 50)
    cur = arcpy.UpdateCursor(outFC)

#Add the name of this WS to the Name field
    for row2 in cur:
        row2.Name = newname
        cur.updateRow(row2)
    row = rows.next()
    pointrow = pointrows.next()

#Merge all features into one FeatureClass
env.extent = wsPolys
fcs = arcpy.ListFeatureClasses("*merge*")
print fcs
arcpy.CreateFeatureclass_management(env.workspace, "wsConstrain",
"POLYGON", outFC, "DISABLED", "DISABLED",
"C:\Users\Kory\Documents\PMPGIS\GEOG569\PSRC_Data\TODWalkshed.gdb\Tran
sit")
arcpy.Merge_management(fcs, "wsConstrain")
```

Appendix B. Documentation of transit center designation and data conflation

Starting with the feature class from PSRC called GTC_Station_Nodes_2a, we removed the Light Rail Link stations along the Aurora/WA-99 corridor per Tim's suggestion – the new route will run along the I-5 corridor.

Sound Transit East Link Data Corrections

With the feature class received from Sound Transit called EastLink, we compared PSRC's east corridor light rail points to Sound Transit's. In most cases, the GTC_Station_Nodes_2a feature class already contained the station point, but we edited the point to match Sound Transit's most up-to-date location. Points that were moved included: Rainier Station, Mercer Island Station, South Bellevue Station, East Main Station, Hospital Station, 120th Station, 130th Station, and Overlake Village Station. Note that we left Overlake Transit Center Station where it currently is in the GTC_Station_Nodes_2a feature class because it currently exists and is in the correct location.

The data received from Sound Transit contained NE 6th Street Station which was not in the GTC_Station_Nodes_2a feature class. This station was added to the master GTC_Station_Nodes feature class.

Sound Transit Link Data Corrections

The Sound Transit data contained the Boeing Access Road stop, but was noted as Deferred and not planned. We did NOT bring this point into the GTC_Station_Nodes feature class. In most cases, the points were already existing in the GTC_Station_Nodes_2a feature class but did not line up correctly with the points received from Sound Transit. The GTC points were edited and snapped to the most recent Sound Transit data. GTC points that were moved included: Theatre District, Commerce Street, Convention Center, Union Station, South 25th, Tacoma Dome [ST data did not contain any points between S. 200th Street and Tacoma Dome; therefore, we kept the GTC_Station_Nodes_2a points given by PSRC], S. 200th Street, SeaTac, Tukwila International Blvd, Rainier Beach Station, Othello, Columbia City, Mount Baker, Beacon Hill, SODO, Stadium, International District, Pioneer Square, University Street, Westlake, Capitol Hill, UW Stadium, Brooklyn, Roosevelt, and Northgate. The Sound Transit Link data did not continue beyond Northgate. It is important to note that while many points were shifted, in most cases these were small distances, and only done to align with the Sound Transit data which we consider the authoritative data for the location of Link stations.

Sound Transit Proposed Data Corrections

The data that ST calls "proposed" includes stations from NE 130th to Lynnwood. Following the same methodology as above, GTC points that were moved to align with ST data include: NE 130th St, NE 145th St, NE 155th St, NE 185th St (moved to the closest of 2 proposed stations), Mountlake Terrace GTC point moved to coincide with ST 236th St SW station, and Lynnwood moved to closest of 4 ST options.

Note that we removed Lynnwood Urban Center which seemed that it was the centroid of the urban center. With the Lynnwood Urban Center stop relatively close to the proposed ST Lynnwood stop, it seemed unlikely that both would be built based on the proposed spacing of other stations in the north corridor. The point can be re-inserted if needed to create walksheds. There were no ST proposed stops beyond Lynnwood. Therefore, with the exception of the Lynnwood Urban Center stop, we kept the PSRC GTC stops.

Sound Transit Sounder Commuter Rail Data Corrections

In the GTC data points, we moved Everett Station to align with the Sounder rail stop. The GTC_Station_Nodes_2a data did not contain any of the other commuter rail stops; therefore, these stops were added: Mukilteo Station, Edmonds Station, King Street Station, Tukwila Station, Kent Station, Auburn Station, Sumner Station, and Puyallup Station.

King County Transit Center Data Additions

Some of the King County transit centers were already accounted for in the GTC_Station_Nodes_2a feature class. Those that were not were added, including the following: Aurora Village TC, Totem Lake TC, Kirkland TC, Redmond TC, Issaquah TC. The Bellevue TC GTC point was moved to coincide with the King County data as we consider King County to be the authoritative source for the location of their transit centers.

Snohomish County Community Transit (CT) Data

Due to a conversation with Jeff Anderson, GIS Program Coordinator with CT, we added all of the Bus Rapid Transit (BRT) stops that were not already accounted for in the GTC_Station_Nodes_2a feature class. Because these stops typically have a Northbound and Southbound stop, in order to create a single point that will be used to generate walksheds, we took the geographic mean center of each BRT pair. The point at the mean center was added to the GTC_Station_Nodes feature class (see the example below from Pierce County's Tacoma Community College Transit Center). After accounting for the BRT stops, we added other transit centers such as Stanwood Station and Lake Stevens Transit Center.

Pierce Transit (PT) Data

From the PT data, we selected everything with a description of TC or Transit Center. These points included TCC Transit Center, Tacoma Mall Transit Center, 72nd Street Transit Center, Lakewood Transit Center, Parkland Transit Center, and South Hill Mall Transit Center. The same methodology of calculating the geographic mean center was used to describe a single point for each transit center.

Everett Transit Data

Based on Everett Transit's online map (http://digital.nexsitepublishing.com/i/76708) we found that the three transit centers are College Station, Everett Station, and Everett Mall. Because the latter two TCs were already included in the GTC_Station_Nodes_2a feature class, the only point added was College Station Transit Center.

Illustration of how the Mean Center tool was used to create a single point that will be used to generate a single walkshed for Transit Centers.

Appendix C. List of 2013 Growing Transit Communities Transit Centers

ID	NAME	ID	NAME
1	Bellevue Transit Center	57	41st Street/40th Street
2	Convention Center Tacoma	58	Alderwood Mall
3	Theatre District	59	Kent_Des Moines P_R
4	Tacoma Dome	60	NE 130th St.
5	Union Station	61	NE 155th St.
6	Overlake Transit Center	62	NE 10th St.
7	Downtown Redmond	63	NE 15th St.
8	South 25th Station	64	Commerce St. Tacoma
9	Northgate	65	NE 6th Street Station
10	Roosevelt	66	Mukilteo Station
11	Brooklyn	67	Edmonds Station
12	UW Stadium	68	King Street Station
13	Capitol Hill Station	69	Tukwila Station
14	Westlake Station	70	Kent Station
15	University Street	71	Auburn Station
16	Pioneer Square Station	72	Sumner Station
17	International District Station	73	Puyallup Station
18	Stadium Station	74	South Tacoma Station
19	SODO	75	Lakewood Station
20	Beacon Hill	76	Aurora Village Transit Center
21	Mt Baker	77	Totem Lake Transit Center
22	Othello	78	Kirkland Transit Center
23	Rainier Beach Station	79	Redmond Transit Center
24	Tukwila International Blvd	80	Issaquah Transit Center
25	SeaTac Airport	81	Renton Transit Center
26	Mercer Island	82	Burien Transit Center
27	South Bellevue	83	238th Street
28	130th Station	84	Gateway/216th Street
29	Columbia City	85	Crossroads/Heron
30	120th Station	86	International/Cherry Hill
31	S. 200th St.	87	148th Street
32	Rainier Station	88	Lincoln Way
33	East Main	89	Airport Road
34	Hospital	90	112th Street
35	Overlake Village	91	4th Avenue
36	SE Redmond	92	Madison Street/Pecks Drive
37	Everett Station	93	50th Street
38	Mariner	94	Stanwood Station
39	NE 145th St.	95	Lake Stevens Transit Center
40	Ash Way P_R	96	Lynnwood Transit Center
41	Lynnwood	97	Edmonds CC Transit Center
42	Mountlake Terrace	98	South Hill Mall Transit Center
43	Redondo (272nd Station)	99	Parkland Transit Center
44	Highline CC Station	100	Lakewood Transit Center
45	Fed Way TC	101	72nd Street Transit Center
46	Star Lake (272nd St.)	102	Tacoma Mall Transit Center
47	Fife	103	TCC Transit Center
48	S. 348th	104	College Station Transit Center
49	S. 288th St.	105	Seacrest Park
50	S. 260th St.	106	Water Taxi Pier 50
51	S. 216th St.	107	N 192nd & Aurora Ave N
52	NE185th St.	108	N 185th & Aurora Ave N
53	Casino Road	109	N 175th St & Aurora Ave N
54	Colby Avenue/Wetmore Avenue	110	N 160th St & Aurora Ave N
55	Boeing	111	N 145th St & Aurora Ave N
56	Everett Mall	112	N 135th St & Aurora Ave N

ID	NAME	ID	NAME
113	N 130th St & Aurora Ave N	157	S 180th St & International Blvd
114	N 105th St & Aurora Ave N	158	S 182nd St & International Blvd
115	N 100th St & Aurora Ave N	159	S 190th St & International Blvd
116	N 90th St & Aurora Ave N	160	S 208th St & International Blvd
117	N 85th St & Aurora Ave N	161	Kent Des Moines Rd & Pacific Hwy S
118	N 45th St & Aurora Ave N	162	S 312th St & Pacific Hwy S
119	NW Leary Way & 15th Ave NW	163	62nd Ave S & Southcenter Blvd
120	NW Market St & 15th Ave NW	164	Baker Blvd & Andover Park W
121	NW 65th St & 15th Ave NW	165	Powell Ave SW & SW Grady Way
122	NW 85th St & 15th Ave NW	166	S 7th St & Rainier Ave S
123	Holman Rd NW	167	S Grady Way
124	NW 100th St	168	Bothell Transit Center
125	W Dravus & 15th Ave W	169	NE 87th St & 148th Ave NE
126	Galer St & Aurora Ave N	170	NE Old Redmond Rd & 148th Ave NE
127	Harrison St & Aurora Ave N	171	NE 51st St & 148th Ave NE
128	Elliott Ave W	172	NE 40th St & 148th Ave
129	Mercer St & Queen Anne Ave N	173	152nd Ave NE
130	Republican St & 1st Ave N	174	NE 24th St & 156th Ave NE
131	1st Ave N & Denny Way	175	NE 15th Pl & 156th Ave NE
132	Queen Anne Ave N & Denny Way	176	140th Ave NE & NE 8th St
133	Vine St & 3rd Ave	177	124th Ave NE & NE 8th St
134	5th Ave & Wall St	178	Jackson Station
135	Aurora Ave N & 7th Ave	179	S Jackson St & 5th Ave
136	3rd Ave & Bell St	180	S Jackson St & 7th Ave
137	Bell St & 3rd Ave	181	S Jackson St & Rainier Ave S
138	3rd Ave & Virginia St	182	14th Ave S & S Main St
139	Downtown Tunnel & Pine St	183	E Yesler & Broadway
140	3rd Ave & Pike St	184	Broadway & E Terrace St
141	3rd Ave & Spring St	185	Broadway & Marion St
142	Seneca St & 4th Ave	186	Broadway & E Pine St
143	3rd Ave & Seneca St	187	Broadway & E Denny Way
144	2nd Ave & Columbia St	188	Fairview & Campus Dr
145	3rd Ave & Cherry St	189	Lake Union Park
146	Columbia St & 3rd Ave	190	Terry & Mercer
147	Yesler Way & Dilling Way	191	Terry & Thomas
148	SW Avalon Way & SW Yancy St	192	Westlake & Denny
149	SW Avalon Way & 35th Ave SW	193	Westlake & 7th
150	SW Alaska At & California Ave SW	194	Westlake Hub
151	SW Findlay St & California Ave SW	195	Westlake & 9th
152	Fauntleroy Way SW & California Ave S	196	Westlake & Thomas
153	SW Barton St & Fauntleroy Way SW	197	Westlake & Mercer
154	SW Barton St	198	Point Defiance Ferry Landing
155	1st Ave S & S 156th St	199	Seattle Ferry Landing Pier 50
156	S 188th St & International Blvd	200	Seattle Ferry Landing Pier 52

Appendix D. List of 2013 Growing Transit Communities Park-and-rides

ID	NAME	ID	NAME
1	North Seattle Park and Ride	48	Ash Way Park and Ride
2	Holy Spirit Lutheran Church	49	Mill Creek Community Church
3	Auburn Park and Ride	50	Burien Church of God
4	Northgate Transit Center	51	Tibbetts Lot
5	Bothell Park and Ride	52	Monroe Foursquare Church
6	Issaquah Transit Center	53	I-5 and Hwy 531 Park and Ride
7	South Kirkland Park and Ride	54	Bethel Lutheran Church
8	SR 512 Lakewood	55	Monroe Park and Ride
9	Kent United Methodist Church	56	Issaquah Highlands Park and Ride
10	Community Bible Fellowship	57	Nativity Lutheran Church
11	SR 908 / Kirkland Way Park and Ride	58	Smokey Point Community Church
12	Lakewood Station	59	Hope Community Church
13	Redwood Family Church	60	Mays Pond Clubhouse
14	Family Life Center Church of God	61	Woodinville Park and Ride
15	South Everett Freeway Station	62	Korean Zion Presbyterian Church
16	Beverly Park First Baptist Church	63	Shoreline Park and Ride
17	Gold Bar Park and Ride	64	Aurora Church of the Nazarene
18	SR 18 /Auburn-Black Diamond Rd	65	Normandy Park Congregational Church
19	Kent Covenant Church	66	Thornten Place Garage
20	Bellevue Christian Reformed Church	67	Edmonds Ferry Terminal
21	Lamb of God Lutheran Church	68	Marysville I Park and Ride
22	Newport Covenant Church	69	Lynnwood Transit Center
23	South Purdy	70	Bellevue Foursquare Church
24	Kingsgate Park and Ride	71	Edgewood Baptist Church
25	Sunset Park	72	South Renton Park and Ride
26	Puyallup Train Station	73	Cornerstone United Methodist Church
27	Marysville at Cedar and Grove	74	Burien Transit Center
28	Mariner Park and Ride	75	Edmonds Station
29	Fairwood Assembly of God	76	Ebenezer Lutheran Church
30	72nd St Transit Center	77	Edmonds Park and Ride
31	Tukwila Interurban Investment	78	Seattle Meditation Center
32	Tukwila Park and Ride	79	Twin Lakes Park and Ride
33	DuPont	80	Canyon Park Park and Ride
34	Eastgate Park and Ride	81	East Hill Friends Church
35	Korean Covenant Church of Kirkland	82	First Baptist Church of Mountlake Terrace
36	Shoreline United Methodist Church	83	Redmond Ridge Park and Ride
37	Prince of Peace Lutheran Church	84	Sammamish Hills Lutheran Church
38	North Jackson Park Park and Ride	85	Auburn Surface Lot a Auburn Station
39	Sunrise United Methodist Church	86	Auburn Garage at Auburn Station
40	Aurora Village Transit Center	87	MapleValley
41	Eastgate Congregational Church	88	Renton Transit Center Park and Ride Garage
42	Brickyard Road	89	Kent - Des Moines Park and Ride
43	Overlake Transit Center	90	Bethesda Lutheran Church
44	New Life Church at Renton	91	Edmonds Lutheran Church
45	Snohomish Park and Ride	92	St. Matthew Lutheran Church Park and Ride
46	Sacred Heart Church	93	City View Church
47	Redmond Park and Ride	94	St. Andrew's Lutheran Church

ID	NAME	ID	NAME
95	Overlake Park and Ride	142	Sonrise Evangelical Free Church
96	Maple Valley Town Square	143	North Creek Presbyterian Church
97	St. Columba's Episcopal Church	144	Bethany Bible Church
98	Lake Meridian Park and Ride	145	Renton City Municipal Garage
99	South Bellevue Park and Ride	146	Greenlake Park and Ride
100	Stanwood Park and Pool	147	TCC Transit Center
101	Star Lake Park and Ride	148	Northwest University 6710 Building
102	Martha Lake Covenant Church	149	North Gig Harbor Kimball Drive
103	All Saints Lutheran Church	150	Calvary Christian Assembly Church
104	Redondo Heights Park and Ride	151	McCollum Park Park and Ride
105	Brier Park and Ride	152	Marysville Ash Avenue Park and Ride
106	Northgate Mall Garage	153	Puyallup Fair's Red Lot
107	Kennydale United Methodist Church	154	Our Savior Baptist Church
108	Parkland Transit Center	155	Houghton Park and Ride
109	Kent Surface Lot at Kent Station	156	Mercer Island United Methodist Church
110	Kent Garage at Kent Station	157	Wilburton Park and Ride
111	South Sammamish Park and Ride	158	Narrows/Skyline
112	St.Luke's Lutheran Church	159	Tukwila Surface Lot at Tukila Station
113	Granite Falls	160	Kenmore Park and Ride
114	Swamp Creek	161	Kenmore Community Church
115	Federal Way Transit Center	162	Bear Creek Park and Ride
116	Everett Station	163	Mercer Island Park and Ride
117	Federal Way/S 320th St	164	Sumner Train Station
118	Black Diamond Masonic Lodge	165	St. Thomas Episcopal Church
119	South Hill	166	Edmonds Lutheran Church (Lynnwood Parish)
120	Church by the Side of the Road	167	South Mercer Center, LLC @ Mercer Island QFC
121	Spokane/Airport Park and Ride	168	Korean United Presbyterian Church
122	Snoqualmie Community Park	169	Olson Place SW/Myers Way Park and Ride
123	Southwest Spokane St	170	South Federal Way Park and Ride
124	Mercer Island Presbyterian Church	171	Kent / James St Park and Ride
125	Renton Fred Meyer	172	Eastmont Park and Ride
126	Tukwila International Blvd. Station	173	Arlington Assembly of God
127	South Tacoma Sounder Station	174	Bonney Lake SR 410
128	Northgate TC Extension, Carpool	175	Lake Stevens Transit Center
129	Northgate TC Extension	176	Sultan Park and Ride
130	Klahanie#1 Park and Ride	177	Holy Cross Lutheran Church
131	Center Street	178	Grace Lutheran Church
132	Newport Hills Park and Ride	179	Holy Family Church
133	St. Luke's Lutheran Church	180	Tibbetts Valley Park Park and Ride
134	South Tacoma - East I North Side	181	Peasley Canyon Park and Ride
135	Marysville United Methodist Church	182	Temporary Evergreen Point Bridge
136	South Tacoma - East II South Side	183	North Bend Park and Ride
137	South Tacoma West	184	Arlington Park and Ride
138	Newport Hills Community Church	185	Klahanie #3 Park and Ride
139	5th Ave NE/NE 133rd St	186	Duvall Park and Ride
140	Mountlake Terrace Park and Ride	187	Meridian & 176th St Park and Ride (Future)
141	Tacoma Dome Station	188	Pacific Ave and SR7 (Future)