FROG POND AREA PLAN
Creating a great community

WILSONVILLE
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FROG POND AREA PLAN

A Concept Plan for Three New Neighborhoods in East Wilsonville

Technical Appendix

Final Area Plan

Approved by the Wilsonville City Council November 16, 2015

Prepared by APG

A VISION FOR FROG POND IN 2035

The Frog Pond Area in 2035 is a Wilsonville community with attractive and connected neighborhoods. The community's hallmarks are its walkable and active streets, variety of quality homes, and connected trails and open spaces. Frog Pond's excellent schools and parks are focal points of the community. Frog Pond is "just a short bike, walk, or bus trip" from all parts of Wilsonville – a highly valued part of the larger city.

Funding for the Frog Pond Area Plan was provided by a Metro Community Planning and Development Grant and the City of Wilsonville.

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Appendix A. Buildable Lands Inventory

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Frog Pond / Advance Road Buildable Lands

Inventory Methodology

Draft April 24, 2014

The following methodology describes the steps taken to conduct a buildable land inventory.

- Committed land = property occupied by improvements that are not likely to redevelop upon annexation and rezoning (see detailed definition below)
- Unbuildable land = land unbuildable due to presence of natural resources and/or steep slopes
- Partially Constrained land = land with natural resources that may limit, but not preclude, development
- Buildable land = Total area of tax lots in the study area minus committed land, unbuildable land, and the portion of partially constrained land assumed to be constrained.

Category A. LAND COMMITTED TO EXISTING DEVELOPMENT

1. Inventory and map partially vacant and developed land

- Identify lots determined to be "vacant" in Metro's RLIS developed lands data layer. Assign each taxlot the code "0".
- Identify lots determined to be "developed" or "partially vacant" in Metro's RLIS developed lands data layer.
    - Differentiate between residential structures (which might be retained and resold) and farm structures (which are unlikely to be retained at the time of development). Based on staff review of aerial photography, site visits, and local knowledge.
    - If a developed tax lot contains ½ acre or more that is vacant or occupied with only farm structures, the lot is considered to be partially vacant and partially developed. The occupied portion, which includes buildings, landscaped yards, etc., is considered to be developed, while the remaining portion is considered vacant.
    - Determine the potential for retention of existing buildings on developed and partially developed land.
        - Building value is used as a proxy to determine whether existing structure would be likely to remain if a developed or partially developed property were redeveloped with urban uses.
            - Lots where improvement value > $160,000, the area developed with residential structures and uses (including yard) is defined as Committed. Code the lot as "1" if fully developed (less than ½ acre of land that is vacant or occupied with only farm structures) and "2" if partially developed (½ acre or more of land that is vacant or occupied with only farm structures).
            - Lots where improvement value < $160,000, it is assumed that the existing improvements would be replaced with urban uses at the time of development,

and existing development is not considered to be a constraint. Code the lot as "3".

- Adjustments may be made where specific information is available from a property owner about structures that will be demolished or where other circumstances, such as historic buildings, apply.

- Identify land encumbered with BPA powerline easements. Code as "4".
- Identify public property being held for park and school development in the Advance Road area. Code as "5".

Based on the above steps, each taxlot was assigned a code:
0 = undeveloped
1 = fully developed, with development assumed to remain
2 = partially developed, with some development assumed to remain
3 = fully or partially developed, with all development assumed to be redeveloped
4 = land encumbered with powerline easements
5 = public property being held for park and school development in the Advance Road area

Land defined as Committed:

- Lots coded as 1, 4, and 5
- For taxlots coded as 2, the developed area identified in Metro's developed lands layer, or the area of the home and surrounding yard, was used to calculate the area committed to existing development.

Category B. Natural resources & steep slopes

Identify land constrained by natural resources and steep slopes.

1. Unbuildable

The following areas are considered unbuildable for the purposes of this planning study.

- Water bodies: RLIS streams layer, as refined by PHS fieldwork
- Potentially significant wetlands: PHS mapping (2014 field work).[1] Within the study area, PHS' assessment is that only one of the mapped wetlands (wetland #10, 1.99 acres) would qualify as a significant wetland.

[1] Within the study area Pacific Habitat Services (PHS) determined the location of all wetlands regardless of size or quality. All mapped wetlands were determined by application of the required methodology outlined in the Regional Supplement of the Corps of Engineers Wetland Delineation Manual (1987 Manual). The quality/condition of wetlands was not assessed for this inventory by applying a characterization tool, such as the Oregon Freshwater Wetland Assessment Methodology (OFWAM), though the likelihood for wetlands greater than one-half acre in size meeting criteria for significance was addressed through application of the City's significance criteria (City code Section 4.139.09.02 Development Review Board (DRB) Process; Adding Wetlands). For more information, see PHS' Wetland Inventory Results memorandum dated April 8, 2014.

- Slopes over 25%: RLIS data, which is derived from LIDAR survey data
- Vegetated riparian corridors of streams and wetlands: Vegetated corridors around water bodies and wetlands throughout the study area were mapped by PHS following City of Wilsonville standards for determining buffer widths based on type and size of water body and adjacent land.[2] Although City of Wilsonville SROZ regulations and review processes address encroachments into vegetated corridors, for the purposes of the BLI, no encroachments are assumed.[3]

2. Constrained:

For the purposes of this planning study, the following areas are considered constrained and able to accommodate 80% of its development potential. This

- **Non-significant, potentially jurisdictional wetlands:** Isolated non-riparian wetlands mapped by PHS, deemed to not be significant. None of these wetlands are located within floodplains, have intact hydrologic or water quality control functions and are within ¼ mile of a water quality limited stream. Such wetlands will not be regulated by the City but may be subject to federal and state permitting requirements that are out of the City and the property owners' control. To acknowledge for this process and uncertainty, it is assumed for the purposes of this study that the development capacity of this land is reduced by 20%.

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[2] The boundaries of tree groves and riparian areas were identified and mapped based upon the limits of the drip line of trees within the resource area as based on aerial photographs of the inventory area. Though the City of Wilsonville does have significance criteria for wildlife habitat based upon the presence of wildlife habitat, the potential for water quality protection, ecological integrity, connectivity to other habitats, and resource uniqueness, these criteria were not applied to the mapped resource areas. Similarly, the nine elements identified as importation in stream-riparian ecosystems were not assessed for the identified and mapped riparian corridors.

[3] Mapped Significant Resource Overlay Zone (SROZ – includes Metro Functional Plan Title 3 and 13 land, land with greater than 25% slope, and 100-year floodplain). Development constraints on this land are outlined in Wilsonville Development Code Section 4.139. Encroachments are generally limited to 2% of the SROZ mapped area except in cases where all or nearly all of the lot is mapped as SROZ.

Outcomes of Analysis:

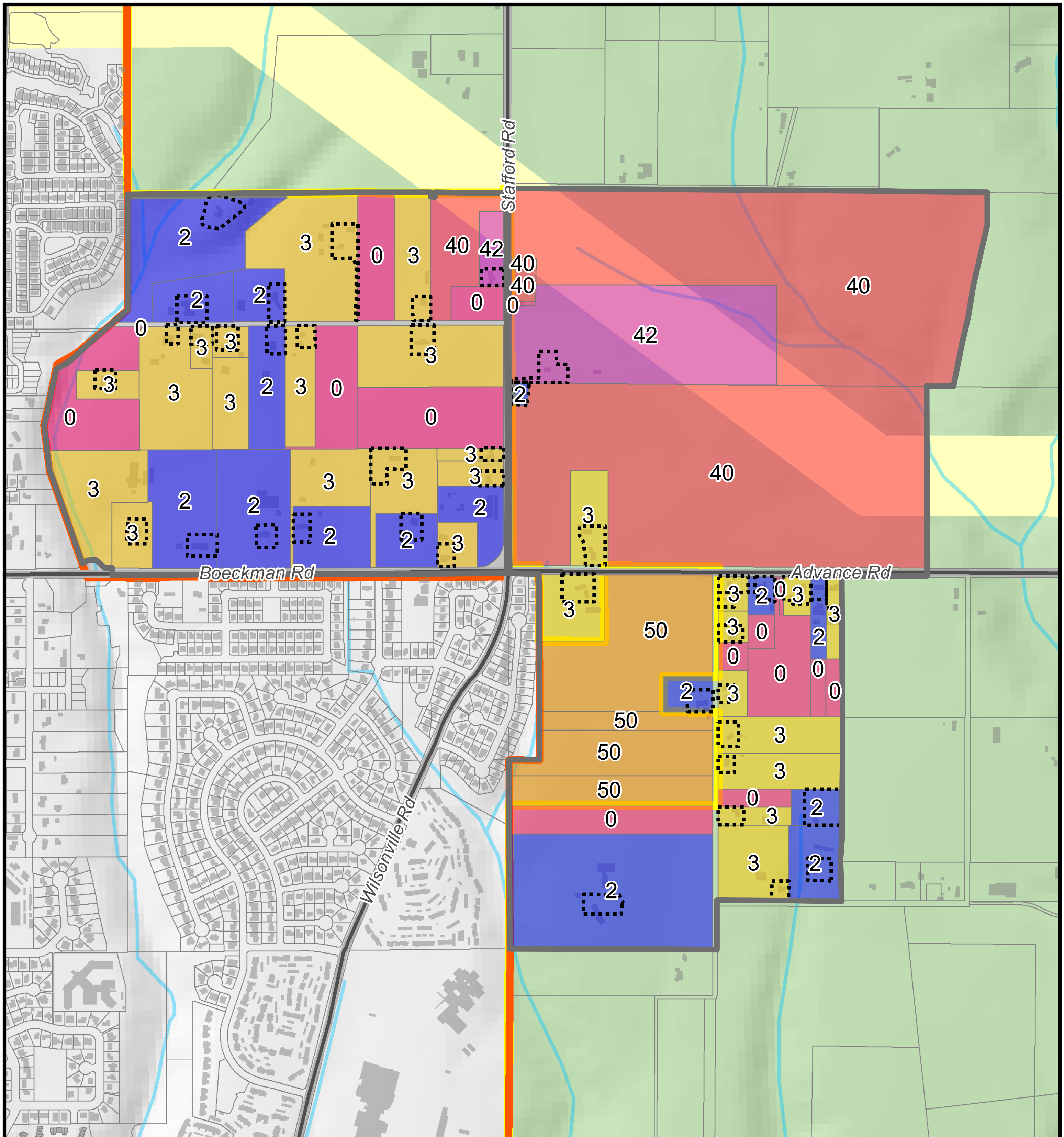
1. Summary of Unbuildable and Buildable Land

	Area (Gross Acres)		
	UGB	**Urban Reserve**	**Total**
TOTAL	**179.4**	**315.8**	**495.2**
UNBUILDABLE LAND			
Committed [a]	**12**	**90**	**102**
Unbuildable (stream corridor/ adjacent wetland / adjacent riparian buffer/ >25% slope)	**24.1**	**36.6**	**60.7**
Buildable but challenging • *Acreage of all non-significant wetlands* • 20% of the total acreage of non-significant wetlands [b]	 *17.7* **3.5**	 *5.4* **1.1**	 *23.1* **4.6**
Subtotal Unbuildable [c]	**53.8**	**123.6**	**177.4**
BUILDABLE LAND (Total acreage, minus Unbuildable)	**125.6**	**192.2**	**317.8**

Notes:

a. *Committed land includes the BPA easement, improvements valued >$160,000, land held for planned schools and parks, and potentially historic sites*
b. *This line lists the 20% of the land that is unbuildable due to constraints of wetland fill permitting. This is an assumption, to acknowledge the challenge of permitting and possible mitigation of potentially jurisdictional wetlands.*
c. *Some areas of land are categorized in more than one "unbuildable" category. The Subtotal, therefore, is the amount of land classified as "unbuildable" for any reason.*

2. Map showing the same categories



Frog Pond Planning Project

City of Wilsonville

Buildable Land Inventory A: Land Committed to Existing Development

Residential Structures and Yards

BPA Transmission Lines

StudyAreaTaxlots

- 0 Undeveloped
- 2 Full or Partial Dev, Some Remain Imp. Val. > 160K
- 3 Full or Partial Dev, Replace All Imp. Val. < 160K
- 4,0 Vacant with BPA
- 4,2 Partial Dev with BPA
- 5,0 Vacant Future Park and School

WILSONVILLE GIS Geographic Information Systems

4/24/2014

0 0.25 Miles

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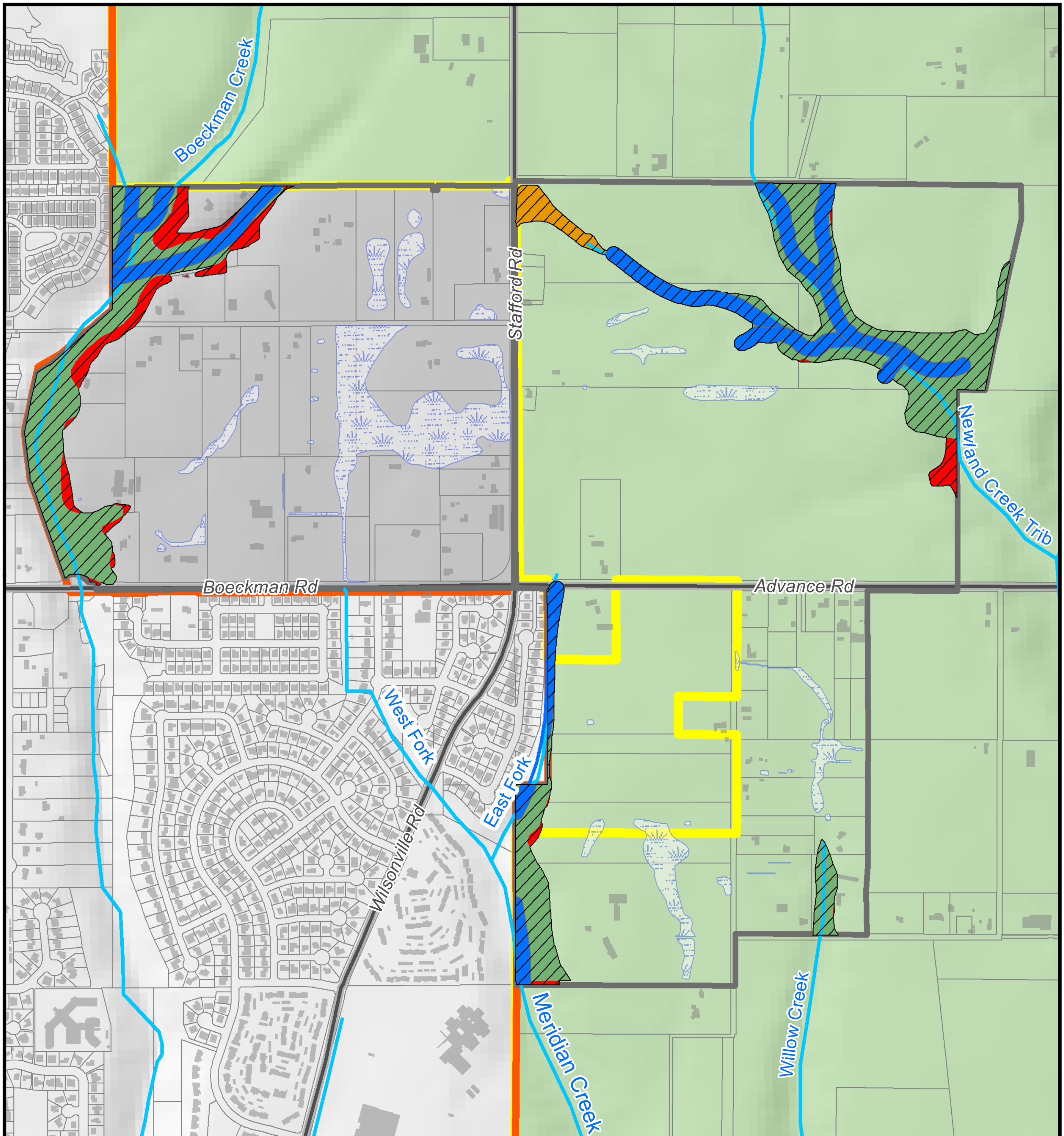

Frog Pond Planning Project

City of Wilsonville

Buildable Land Inventory B: Natural Resources and Steep Slopes

SROZ Components in Order Drawn (25% Slope Drawn First)

- DRAFT SROZ
- Streams + 50 ft
- Riparian
- Significant Wetland + 50 ft
- 25% +Slope
- Streams
- Non-Significant Wetland
- City Limits
- UGB

WILSONVILLE GIS Geographic Information Systems

4/24/2014

Feet
0 500

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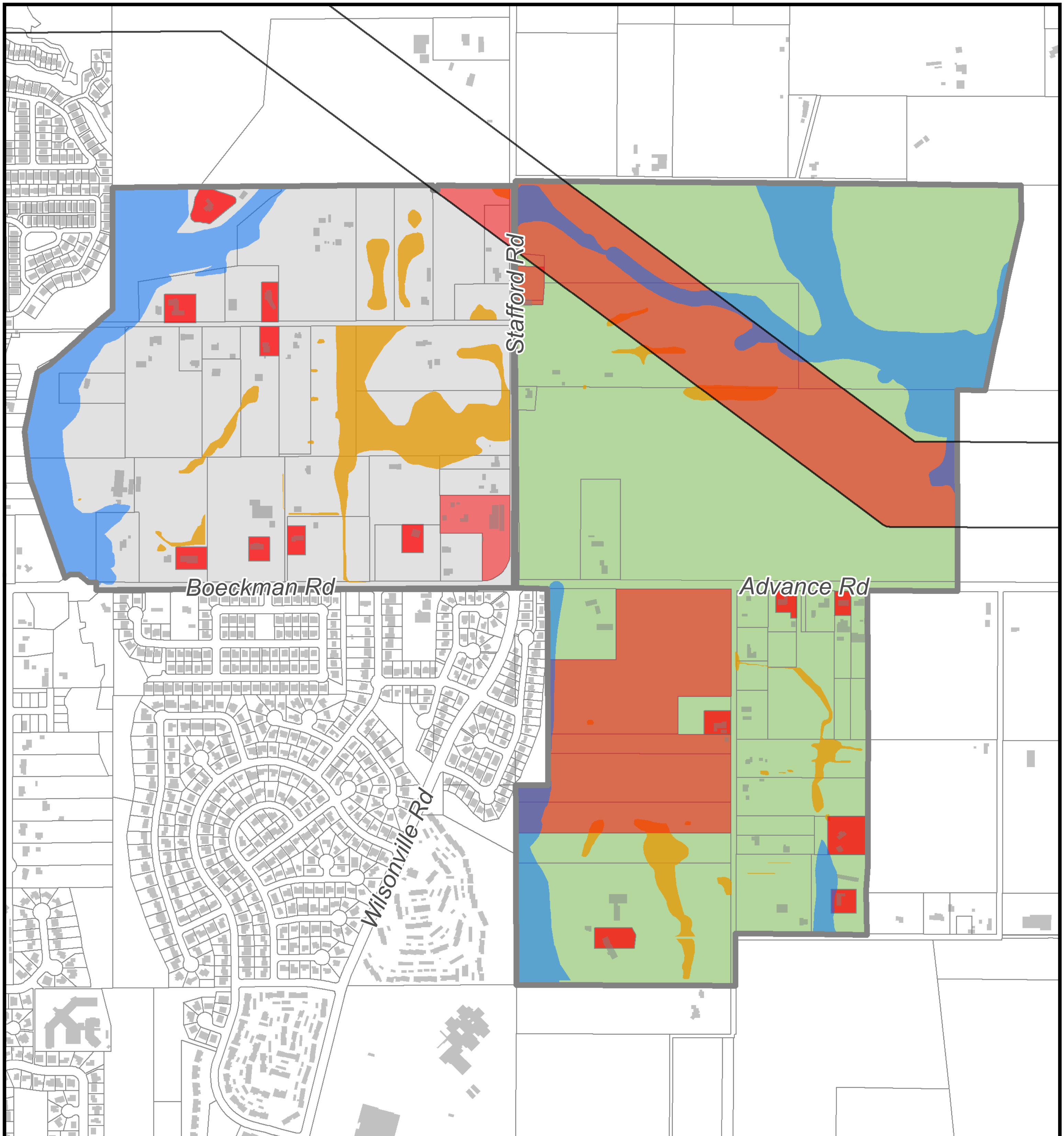

Frog Pond Planning Project

City of Wilsonville

Buildable Land Inventory

Constrained Land

- Study Area
- Frog Pond UGB Entirely Unconstrained
- Frog Pond Reserve Entirely Unconstrained
- Committed
- Unbuildable
- Buildable but Challenging

WILSONVILLE GIS Geographic Information Systems

4/23/2014

Feet
0 500

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Appendix B. Opportunities and Constraints

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Memorandum

Date: April 30, 2014

To: Katie Mangle, City of Wilsonville

From: Joe Dills, Becky Hewitt, and Andrew Parish, Angelo Planning Group

Cc: Frog Pond Planning Project Task Force

Re: Frog Pond Area Plan - Opportunities and Constraints

Introduction

This memorandum summarizes initial opportunities and constraints mapping and observations for the Frog Pond Area Plan.[1] It was prepared in a four step process: (1) A site visit to the project area held on March 19, 2014; (2) compilation and review of background documents; (3) a project team work session held on April 9, 2014; and (4) preparation of this memorandum and graphics by Angelo Planning Group (APG), with review by the project team. Project team members and background documents are listed in Appendix A.

Six opportunities and constraints maps and diagram sheets have been prepared and attached to this memo. They are:

- Regional Context – Natural Areas
- Regional Context – Urban and Rural Areas
- City Context
- Planning Area
- City Diagrams
- Planning Area Scale Comparisons

Observations about each of the above are summarized below.

[1] The City of Wilsonville is embarking on a process to create a plan for the Frog Pond area east of Wilsonville. Planning for the combined 497-acre area will define expectations for the types of buildings, land uses, transportation, parks, and utilities that will be developed over time. The area is presumed to be developed as primarily residential neighborhoods. The City will complete a Concept Plan for the Frog Pond area by May 2015. For more information, see www.ci.wilsonville.or.us/frogpond.

The Regional Context – Natural Areas

The City of Wilsonville as a whole and the Frog Pond planning area in particular are surrounded by a rich array of natural areas, parks, agricultural lands, and rural open spaces. The Willamette River corridor in particular has many green spaces along its banks near the planning area, including Corral Creek Natural Area, Memorial Park, Mollala River State Park, Weber Farm Natural Area, Hebb Park, and several natural areas downstream of Canby which lead to Willamette Falls. The Willamette River lies under a mile from the southern boundary of the planning area. The Natural Areas map (Exhibit 1) also illustrates the significant green spaces on the west side of Wilsonville that are a short bike ride away from Frog Pond, including Graham Oaks Nature Park and the Coffee Creek wetlands.

Table 1. Natural Areas Map Observations

Map Item	Description
NA-1	The rural edge along the planning area is where city and country come together. The area is a mix of active farming and rural living.
NA-2	Pete's Mountain provides the eastern horizon as viewed from Frog Pond.
NA-3	The ridge north of Ellingsen Road provides the northern horizon as viewed from Frog Pond. Both the northern and eastern horizons are secondary as compared to the prominence of the tree groves within the planning area.
NA-4 through NA-7	The Frog Pond area is "framed" by four tributaries that connect to other green spaces and nearby destinations: Boeckman Creek, Meridian Creek, Willow Creek, and Newland Creek. Three of these (Boeckman Creek, Meridian Creek, and Newland Creek) lead to public parks along the Willamette River (Memorial Park, Willamette Meridian Landing, and Willamette River Greenway, respectively).

The Regional Context – Urban and Rural Areas

Today, Wilsonville is both part of the region and its own distinct city. Travelling south from Tualatin on I-5 or Boones Ferry Road, the pattern of developed and undeveloped areas reinforces this distinction. The journey along SW 65th Avenue or SW Stafford Road is even more striking – there is countryside and rural housing for swaths between east Tualatin, West Linn, and the Frog Pond area. The regional context map of urban and rural areas (Exhibit 2) illustrates: (1) that the current "countryside north of Wilsonville" will likely evolve into planned urban communities as the urban reserves develop over the next 40 to 50 years, and (2) that the "country-edge" along the east side of SW Stafford Road to the north of Kahle Road is a key urban-rural transitional area. It is an "Undesignated Area" adjacent to Urban Reserves and Rural Reserves.[2] The map also reveals that the City of Canby is only two miles from Frog

[2] Urban Reserve areas are meant to provide land for future expansions of the Urban Growth Boundary (UGB) over the next 50 years, as needed. Rural Reserve areas are not eligible for inclusion in the UGB for the next 50 years –

Pond as the crow flies and but much further by road or ferry due to the Willamette, Pudding and Mollalla Rivers.

Table 2. Urban and Rural Areas Map Observations

Map Item	Description
UR-1	The Frog Pond area enjoys excellent access to I-5 and I-205 via Wilsonville Road, Elligsen Road, and Stafford Road. The downside of this access is that these routes become congested when used as cut-through routes, which happens when there is an incident or severe congestion on one of the interstates. Frog Pond is a cross-roads location and gateway to Wilsonville.
UR-2	The urban reserve area north of Frog Pond is part of the largest contiguous block of urban reserve land in the Metro region. In total, urban reserves 4A through 4G total close to 8,000 acres, roughly half of which is between Frog Pond and I-205 with the remainder north of I-205.
UR-3	The Urban and Rural Areas map shows how the land is categorized for regional planning and growth management purposes. It shows existing cities, areas planned to urbanize, and areas planned to remain rural. It clearly illustrates Frog Pond's position as the urban-rural transition area for east Wilsonville. The southern boundary and a portion of the eastern boundary of the planning area form a rural edge where, in the future, the city and country will meet.[3] The adjacent rural reserve areas are home to a mix of active farming and rural living. Special attention will need to be given to this edge to ensure compatibility with the rural areas.
UR-4	Wilsonville's "20-Year Look"[4] identifies priorities for the City's UGB expansion areas. The Frog Pond Urban Reserve within the planning area (identified as 4H, and formerly referred to as the Advance Road Urban Reserve) is one of them, as are the Elligsen Road Urban Reserve (4G) to the north of the Frog Pond UGB area and the Wilsonville Southwest Urban Reserve (5H) on the southwest corner of the city. Preparation of the Frog Pond Area Plan provides an opportunity to establish the vision for street networks, green space linkage, trails, neighborhood frameworks, and other elements that will help connect and integrate future urban planning for a livable east Wilsonville.

their agricultural / forest status is protected for that time. Undesignated areas may be considered for future UGB expansion, but are not a priority.

[3] Urban Reserve areas are meant to provide land for future expansions of the Urban Growth Boundary (UGB) over the next 50 years, as needed. Rural Reserve areas are not eligible for inclusion in the UGB for the next 50 years – their agricultural / forest status is protected for that time. Undesignated areas may be considered for future UGB expansion, but are not a priority.

[4] "20-Year Look at Where Wilsonville Might Grow", Planning Division Staff Report, July 14, 2008. http://www.ci.wilsonville.or.us/DocumentCenter/View/781

Map Item	Description
UR-5	Some of the land to the north and east of the Frog Pond Urban Reserve is "undesignated" – neither urban reserve nor rural reserve (see footnote 3). These edges will need to be sensitive to rural uses, but not preclude future connections if the undesignated areas are someday urbanized.

City Context

The City context map illustrates Frog Pond's proximity to, and opportunity for becoming an extension of, the existing city. Discussions by the project team focused on connections – how can Frog Pond become a new, great, livable, and well-connected part of the city? The Town Center, for example, is under a mile away and will be very easy to access when the Canyon Creek Road extension to Vlahos Drive is completed this year. The Town Center is just one of several key areas east of I-5 that are within a short bike ride, SMART bus trip, or drive from Frog Pond.

Table 3. City Context Map Observations

Map Item	Description
C-1	The combined Boeckman Creek corridor, BPA corridor, and new connections could potentially be combined into a continuous greenway connection encircling the Frog Pond area.
C-2	A new collector street from Parkway Ave (adjacent to I-5) to Stafford Road at or near Weidemann Road is identified in the City's Transportation System Plan (TSP) (the location / alignment is conceptual only). This project is not included on the City's "Higher Priority Projects" list, so timing is long-term. When constructed, this new collector will improve connectivity between the Frog Pond area and the city's northeast employment areas. Opportunities for bicycle and pedestrian connections could provide interim links. The area east of Boeckman Creek has only three arterial street connections (Wilsonville Road, Boeckman Road, and Ellingsen Road) to the rest of Wilsonville. There are no local street connections between these arterials because of the creek corridor. In unconstrained circumstances, a city might have 15 to 20 local street connections supplementing three links in the arterial network. So, in this instance, connectivity is comparatively low. Please see the City Context – Streets diagram for an illustration of this constraint.
C-3, C-4, C- 5	Sites with infill and redevelopment potential in east Wilsonville include: portions of the Town Center, which can accommodate additional vertical mixed-use growth (C-5); vacant land owned by Mentor Graphics, which has both residential and industrial/employment Comprehensive Plan designations on it (C-3); and small infill sites on the west side of Boeckman Creek (along Canyon Creek Road S, south of Boeckman Road) designated for residential use (C-4).

Map Item	Description
C-6	Additional pedestrian connections across Boeckman Creek north of Boeckman Road are desirable in order to provide better access to adjacent employers, including Xerox and Mentor Graphics. In addition, the Boeckman Creek Trail connection south of Boeckman Road will improve east-west connectivity for trail users in east Wilsonville.
C-7	Stafford Road is a gateway to east Wilsonville. Currently a County facility, as development occurs it will be improved and transferred to City jurisdiction. There is an opportunity and need to slow traffic speeds, provide safe pedestrian crossings, safe routes to schools, manage storm water, and provide an aestheticly pleasing entrance/gateway to the city through the design of Stafford Road through and adjacent to Frog Pond.
C-8	The intersection at Boeckman Road/Stafford Road/Wilsonville Road/Advance Road is a key crossroads location for the community. With the existing church close to the northwest corner of this intersection and the future school and park sites close to the southeast corner, this area could become an important civic node in the future.
C-9	Boeckman Road provides a direct link to Wilsonville's west side, including employment areas near the highway and Villebois. When the "Boeckman Dip" is widened and reconstructed, bicycle and pedestrian connections to the west side of the city will be much easier and safer (see P-10).
C-10	The planning area has good access to Memorial Park along the Willamette River via Wilsonville Road. This is the city's oldest and largest park and contains both active and passive use areas that serve the entire community. Amenities include an extensive trail system, athletic fields and courts, a dog park, and a community garden.
C-11	The extension of Canyon Creek Road to Vlahos Drive and Town Center Loop East will provide a more direct connection from the planning area to the Town Center. Construction is anticipated to begin in June or July 2014. Canyon Creek Road is identified as a minor arterial in the Wilsonville 2013 Transportation System Plan.

Planning Area Opportunities and Constraints

The 497-acre study area is a logical and intuitive extension of the City of Wilsonville. Historically, it was part of the Wilsonville area's early settlement pattern, with some key gathering places for the rural farming community, such as the Grange Hall (originally the Frog Pond School) and the Frog Pond church (immediately south of the study area). Physically, it is adjacent to key streets, existing neighborhoods, and known natural areas. Even the shape of the study area wraps around the edge of the community. The study area is naturally comprised of three parts: Frog Pond UGB area, Frog Pond Urban Reserve North, and Frog Pond Urban Reserve South. Dimensionally, each of these areas is approximately ¼ mile from center to edge, a comfortable 5 to 10 minute walking distance. There is an opportunity to design three distinct-yet-connected neighborhoods within these areas (see the scale comparison diagrams in Exhibit 6 for examples of built and highly walkable neighborhoods with comparable geographic areas).

The tree groves within the planning area provide a key visual asset, and are a link to the historic character of the area. To the extent that existing, mature trees can be retained and protected as annexation and development occurs, it will contribute to the character and desirability of new neighborhoods. The city has existing annexation policies that incentivize (but do not mandate) tree retention.

Likely future connection points to existing transportation, water and sewer systems are identified on Exhibit 4. Roadway connections will likely align with existing connections along Boeckman Road or meet spacing standards along Stafford Road. City water and sanitary sewer services do not extend into the planning area at this time; however, water and sewer connection points are available along Boeckman Road as well as on the west side of Meridian Creek.

Table 4. Planning Area Map Observations

Map Item	Description
P-1	The area adjacent to the Boeckman Creek riparian area is an opportunity for a major open space edge that is visually and physically accessible from the Frog Pond neighborhood.
P-2	The BPA powerlines create a visual and noise impact (the power lines buzz). No structures are allowed and vegetation must be low-growing. Typical opportunities include street connections, paths, horse trails, community gardens, sports fields, storm water management, and environmental restoration in the wetland area north of the Grange (the original site of a frog pond, according to local residents).
P-3	The proximity of the future primary and middle schools' site to the existing Wilsonville High School and Boeckman Creek Primary School, and their separation by Meridian Creek, creates both a challenge and an opportunity. A trail connection is planned to link the two school campuses. It may be possible that such a link could also be designed to provide for a sewer line connection to the future schools site.
P-4	The planned extension of the Boeckman Creek trail to and through the planning area will link the area to Memorial Park. Its future location (either along the creek or the top of bank) is an opportunity to be explored in the plan. Access to the creek itself is steep in many places and there may be a need for switchbacks and bridges.
P-5	There is opportunity for open space and trail connections between Boeckman Creek, the north edge of the Frog Pond UGB area, the BPA Corridor, the planned middle and primary schools site, and Meridian Creek.
P-6	The intersection at Boeckman Road/Stafford Road/Wilsonville Road/Advance Road is a key crossroads location for the community. With the existing church close to the northwest corner of this intersection and the future school and park sites close to the southeast corner, this area could become an important civic node in the future (see also C-8).

Map Item	Description
P-7	The City's 10-acre community park (which will be co-located with the future primary and middle schools) will be a city-wide asset as well as an amenity for the adjacent neighborhoods. Pedestrian safety near the park should be prioritized in street design.
P-8	Existing transit (Wilsonville's SMART system) serves the area, although service is limited at present. Buses running along Boeckman Road and Wilsonville Road (line 4) connect to the Town Center, Boeckman Creek Primary School, Wilsonville High School, and the WES station, as well as to other bus lines further west on Boeckman Road linking to major employers east of I-5 and lines connecting to other parts of the city.
P-9	Additional pedestrian connections across Boeckman Creek north of Boeckman Road are desirable in order to provide better access to adjacent employers, including Xerox and Mentor Graphics (see also C-6).
P-10	The future Boeckman Road bridge across Boeckman Creek will reduce the "dip" of Boeckman Road and likely include trail access to the future Boeckman Creek trail. This project will enhance bicycle and pedestrian access to the planning area and improve safety for motorists, cyclists, and pedestrians on Boeckman Road.
P-11	There is an existing pedestrian accessway from one of the neighborhoods west of Boeckman Creek that leads to the creek. There may be an opportunity to provide a pedestrian link from the planning area across Boeckman Creek to connect to this point.
P-12 and P-13	The historic Frog Pond Grange Hall is within the planning area, and the historic Frog Pond Church is adjacent to the south. These structures are important parts of the community's history and help create a sense of place for the area.

City Context Diagrams and Planning Area Scale Comparisons

Three diagrams are provided to display an "x-ray" view of the major systems within the City and their relationship to the planning area: streets; natural areas and parks; and, buildings (see Exhibit 5).

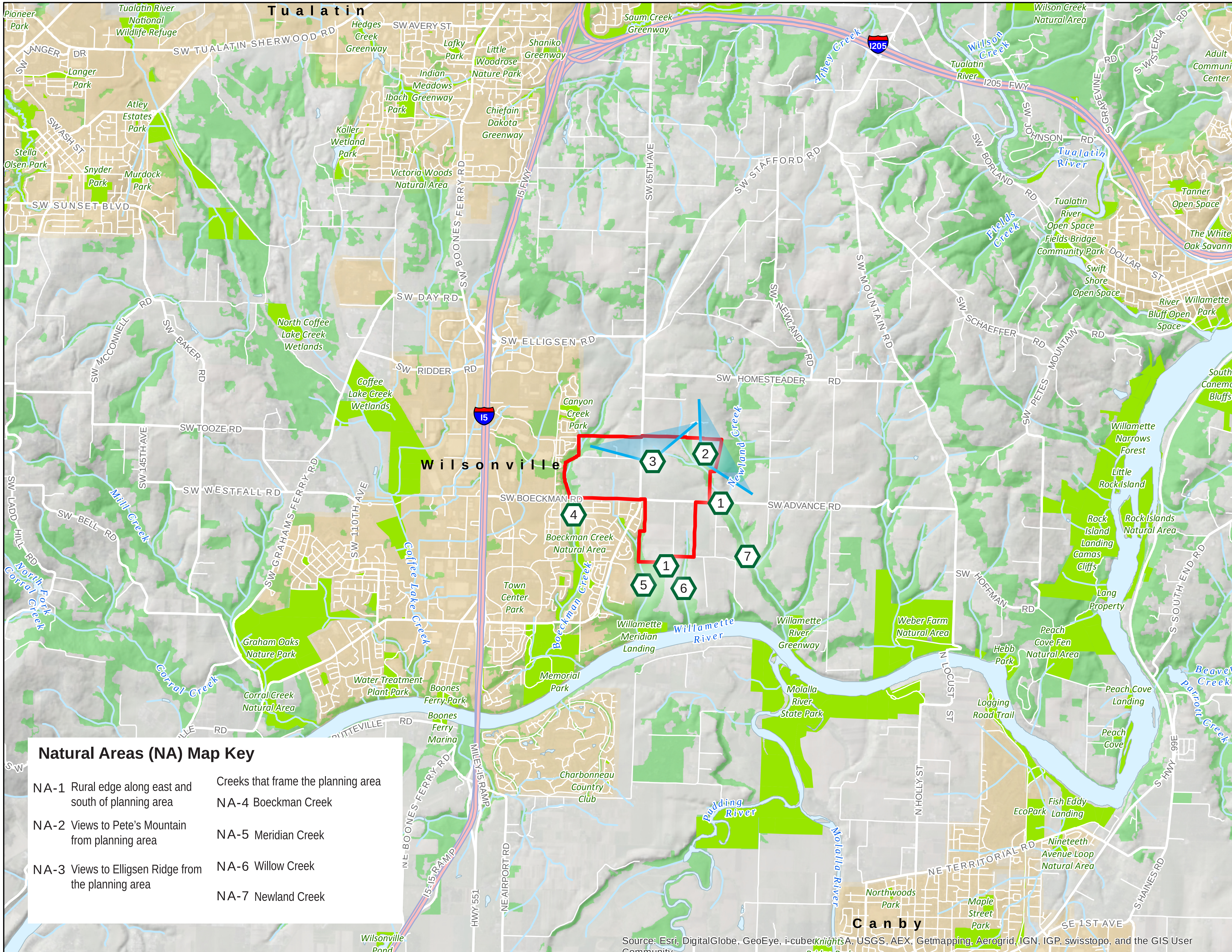
Two planning area scale comparisons illustrate the potential for creating walkable neighborhoods in the Frog Pond area (see Exhibit 6). The 180-acre Frog Pond UGB area is approximately the size of the built portion of Villebois and Ladd's Addition in Southeast Portland.

Frog Pond Area Plan

Opportunities & Constraints

Exhibit 1: Regional Context - Natural Areas

- Planning Area
- Rivers and Streams
- Parks and Natural Areas
- Forested Area
- City Limits



Natural Areas (NA) Map Key

NA-1 Rural edge along east and south of planning area

NA-2 Views to Pete's Mountain from planning area

NA-3 Views to Elligsen Ridge from the planning area

Creeks that frame the planning area

NA-4 Boeckman Creek

NA-5 Meridian Creek

NA-6 Willow Creek

NA-7 Newland Creek

Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Miles: 0 0.25 0.5 1

Prepared By: Angelo Planning Group

Date: 4/30/2014

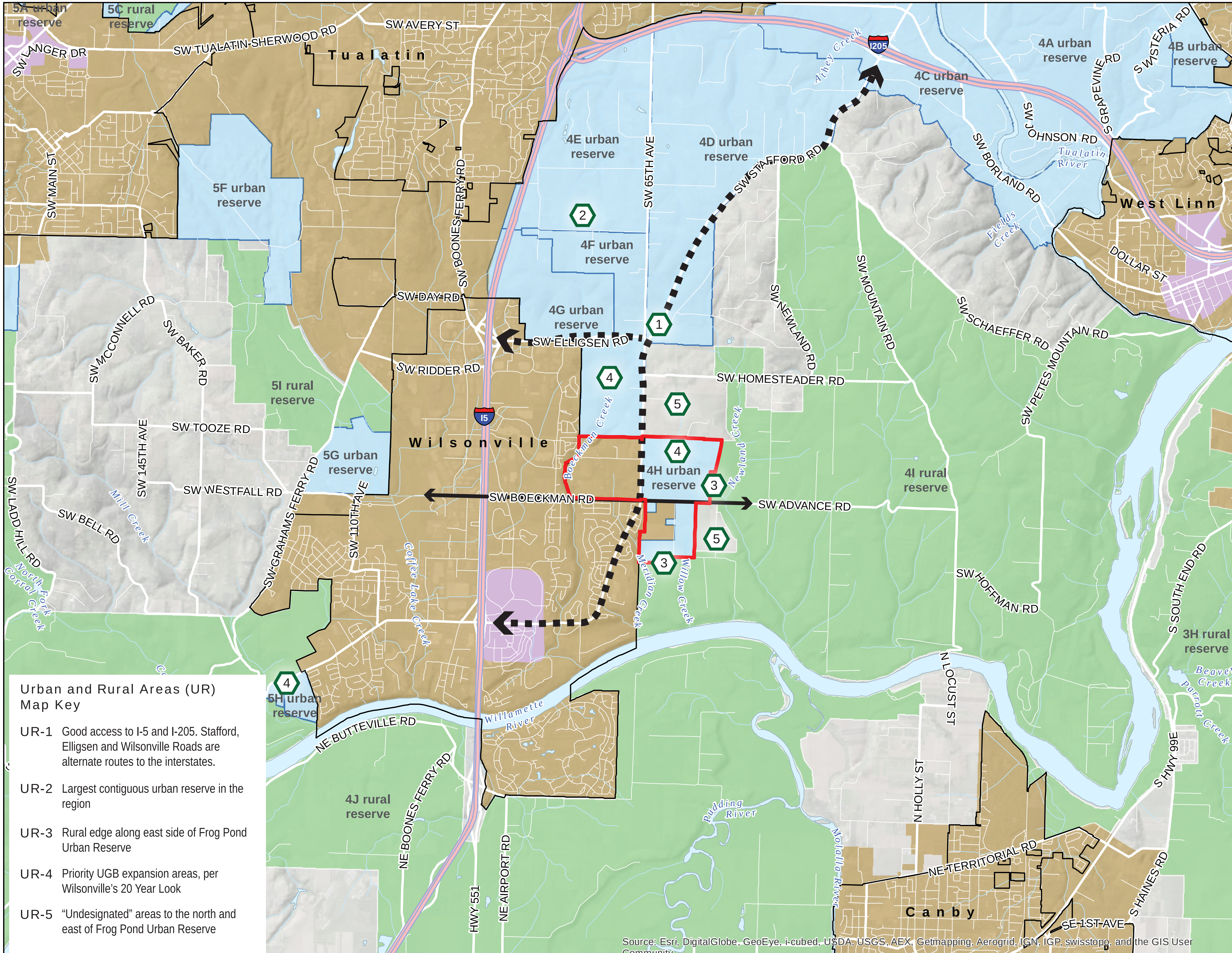
Coordinate System: NAD 1983 HARN State Plane Oregon North FIPS 3601

Disclaimer: *This map is intended for informational purposes only. While this map represents the best data available at the time of publication, the City of Wilsonville makes no claims, representations, or warranties as to its accuracy or completeness. Metadata available upon request.*

Frog Pond Area Plan

Opportunities & Constraints

Exhibit 2: Regional Context - Urban and Rural Areas



- Planning Area
- City Limits
- Rivers and Streams
- UGB
- Town Center *
- Rural Reserves
- Urban Reserves
- Undesignated Land
- Freeway access from planning area
- Local access from planning area

* As designated on Metro 2040 Growth Concept Map

0 0.25 0.5 1 Miles

Prepared By: Angelo Planning Group

Date: 4/30/2014

Coordinate System:
NAD 1983 HARN State Plane Oregon North FIPS 3601

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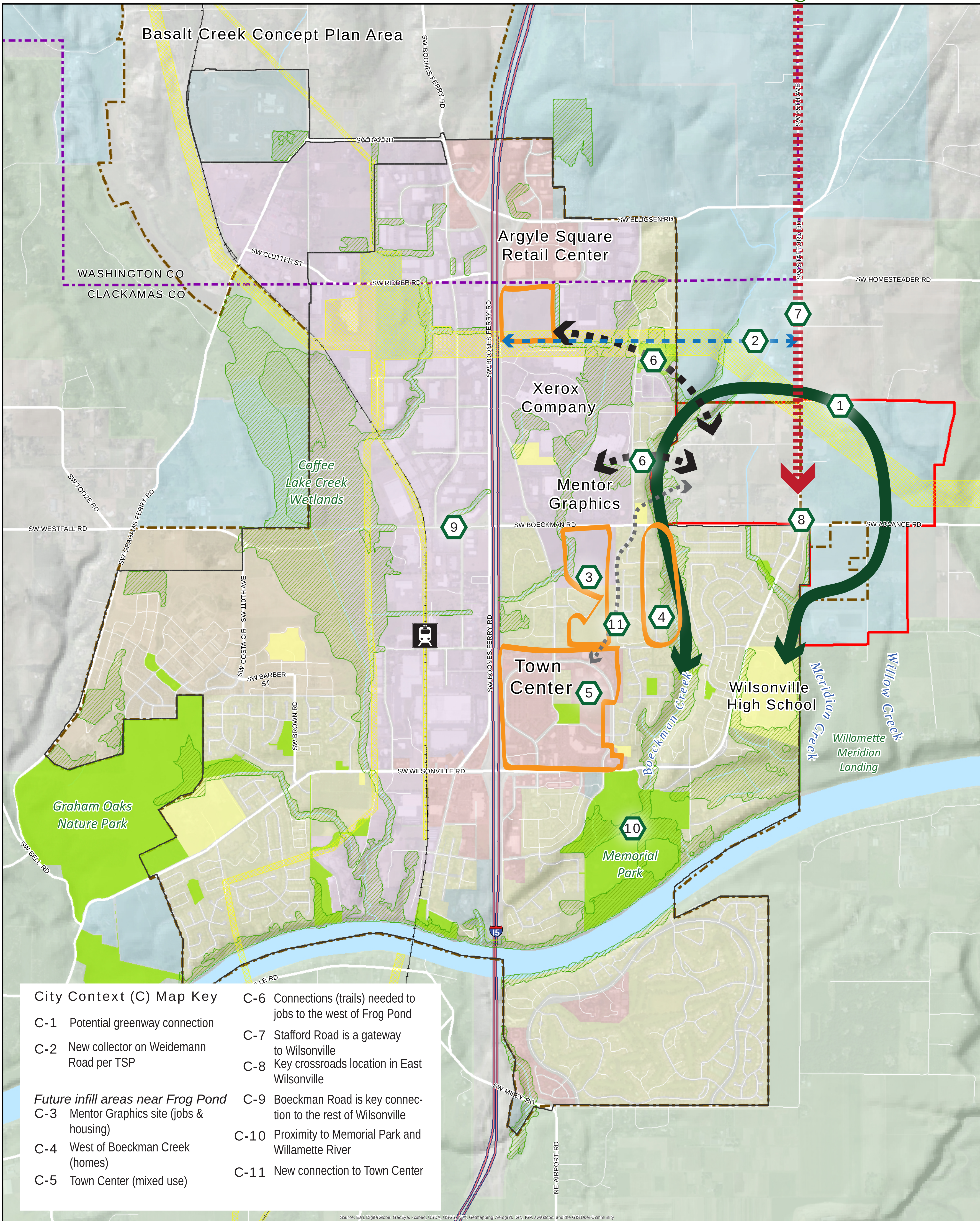


Opportunities & Constraints
Exhibit 3: City Context

Land Use

- Commercial
- Industrial
- Public
- Residential
- Village
- Parks
- Significant Resources Overlay Zone
- BPA Easement
- Rural reserves
- Urban reserves
- School
- Planning Area
- Freeways
- Railroad
- County Boundary
- UGB
- City Limits
- WES Station
- Infill potential near Frog Pond

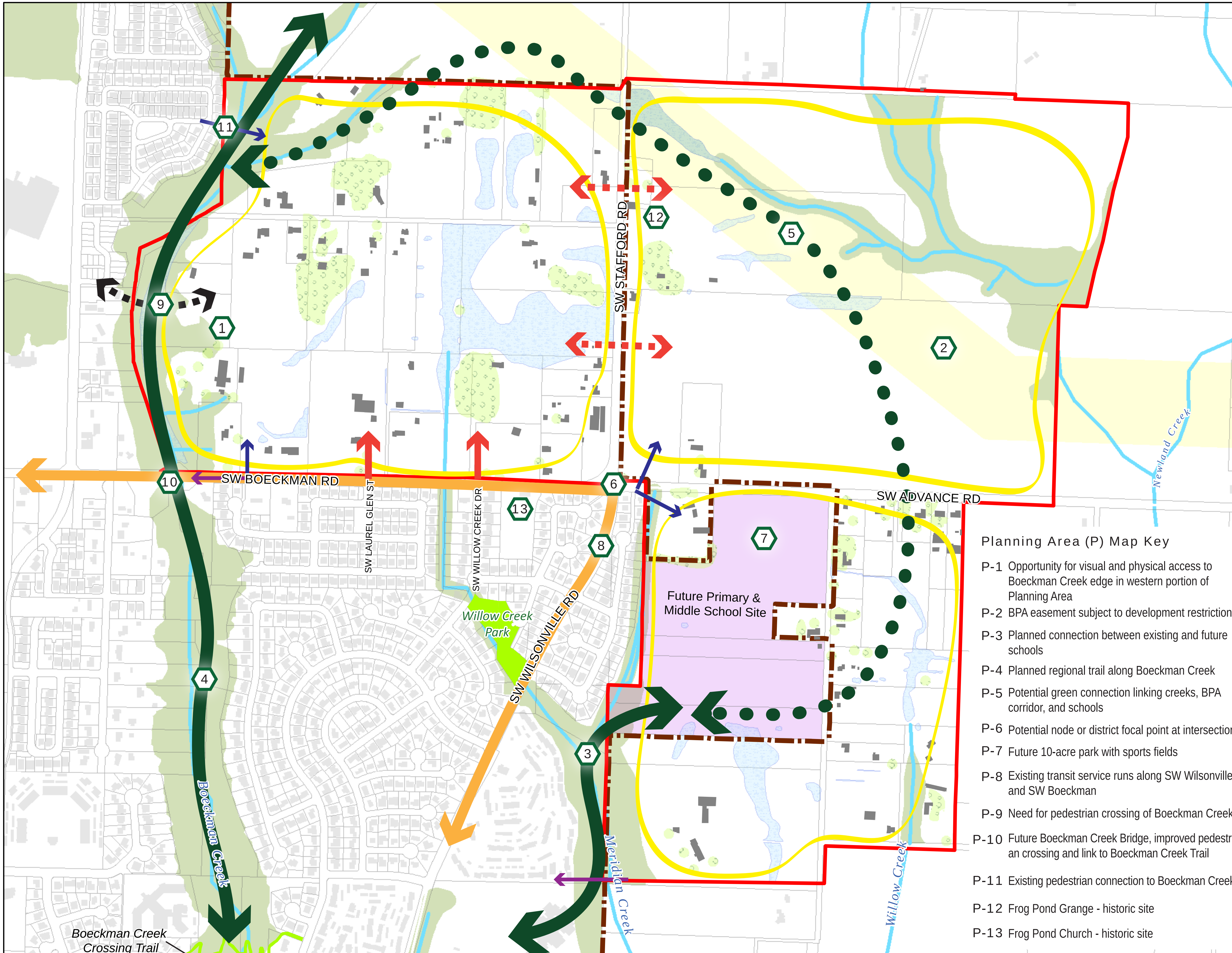
0 1,000 2,000 4,000 Feet

Coordinate System:
NAD 1983 HARN State Plane Oregon North FIPS 3601

Prepared By: Angelo Planning Group

Date: 4/30/2014

Disclaimer:
This map is intended for informational purposes only. While this map represents the best data available at the time of publication, the City of Wilsonville makes no claims, representations, or warranties as to its accuracy or completeness. Metadata available upon request.



Frog Pond Area Plan

Opportunities & Constraints

Exhibit 4: Planning Area

- Building Footprints
- Planning Area
- UGB
- Parks
- Streams
- Tree Groves
- Wetlands*
- Taxlots
- Future Primary & Middle School Site
- Significant Natural Resources
- BPA Easement
- Potential access point based on 1000' spacing
- Access to align with existing roads
- Planned Trail Connection
- Conceptual Future Trail Connection
- Transit Connection
- Potential Water Connection
- Potential Sewer Connection
- Conceptual neighborhood with roughly 1/4 mile radius

*Jurisdictional, likely not locally significant

Feet: 0 250 500 1,000

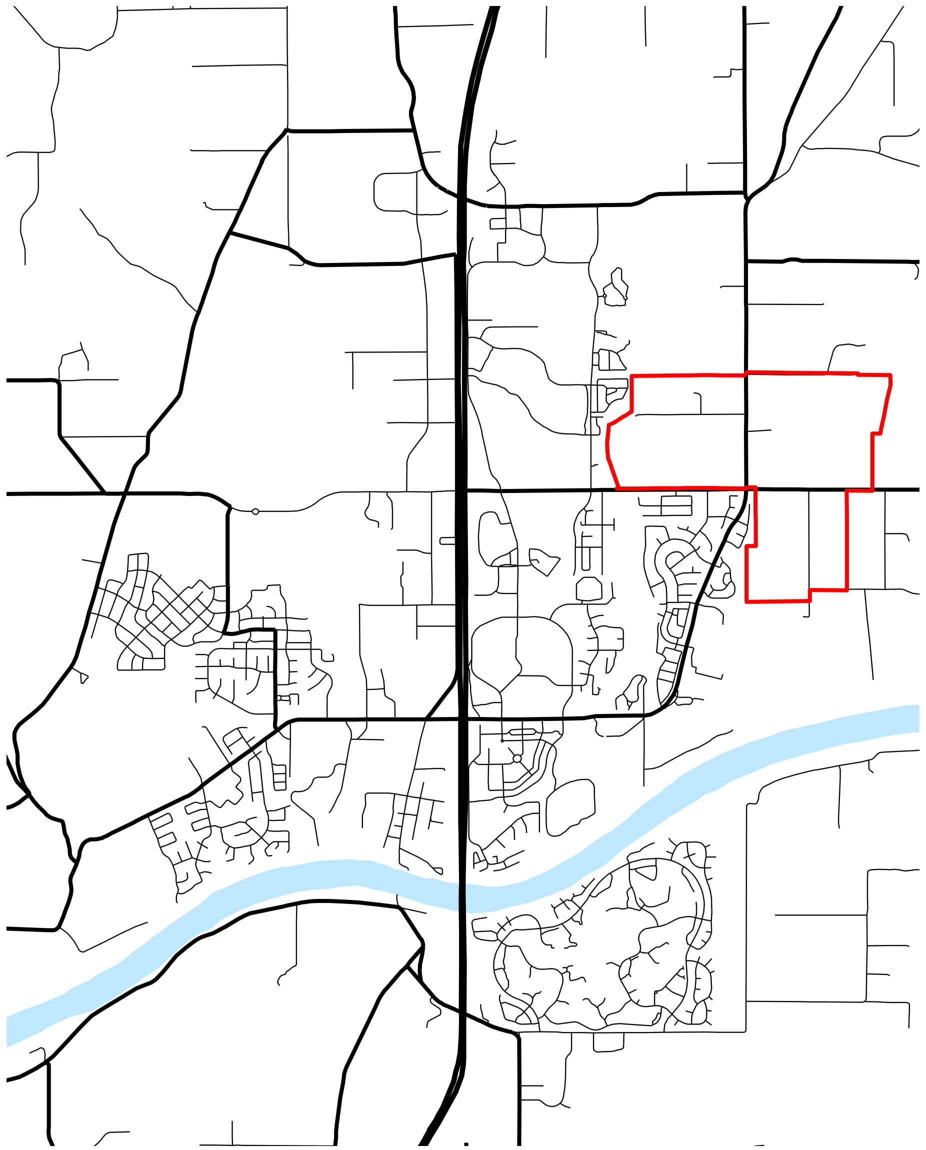
Prepared By: Angelo Planning Group

Date: 4/30/2014

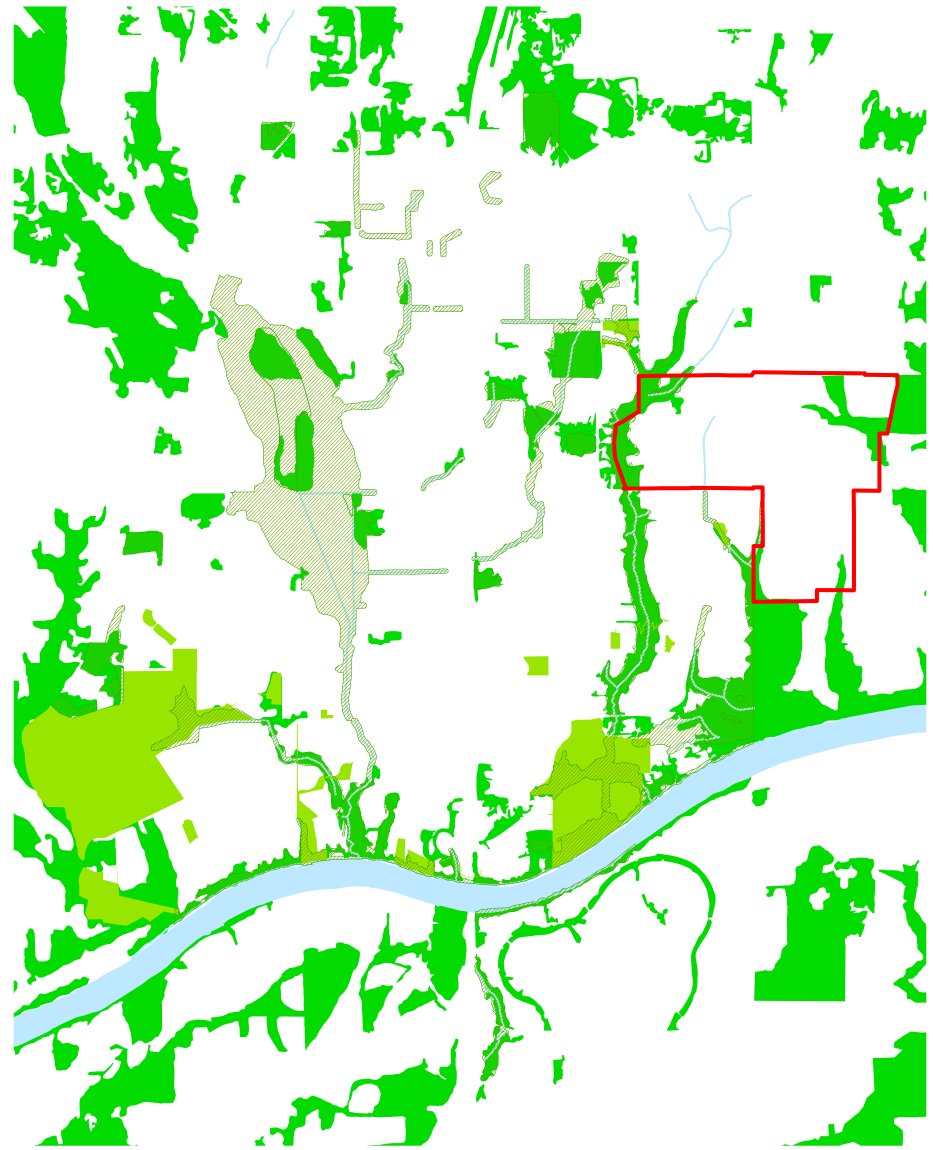
Coordinate System: *NAD 1983 HARN State Plane Oregon North FIPS 3601*

Disclaimer: *This map is intended for informational purposes only. While this map represents the best data available at the time of publication, the City of Wilsonville makes no claims, representations, or warranties as to its accuracy or completeness. Metadata available upon request.*

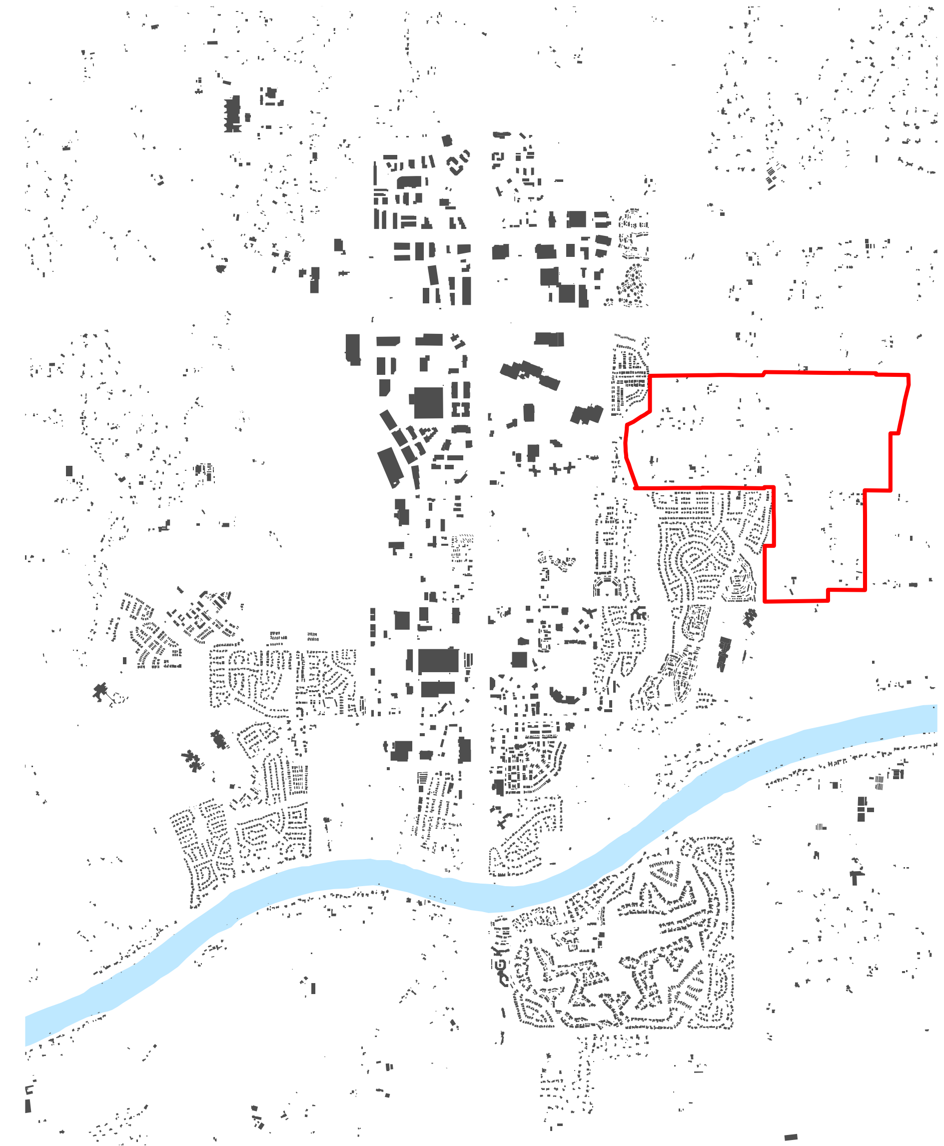
Opportunities and Constraints
Exhibit 5: City Context - Diagrams



Streets

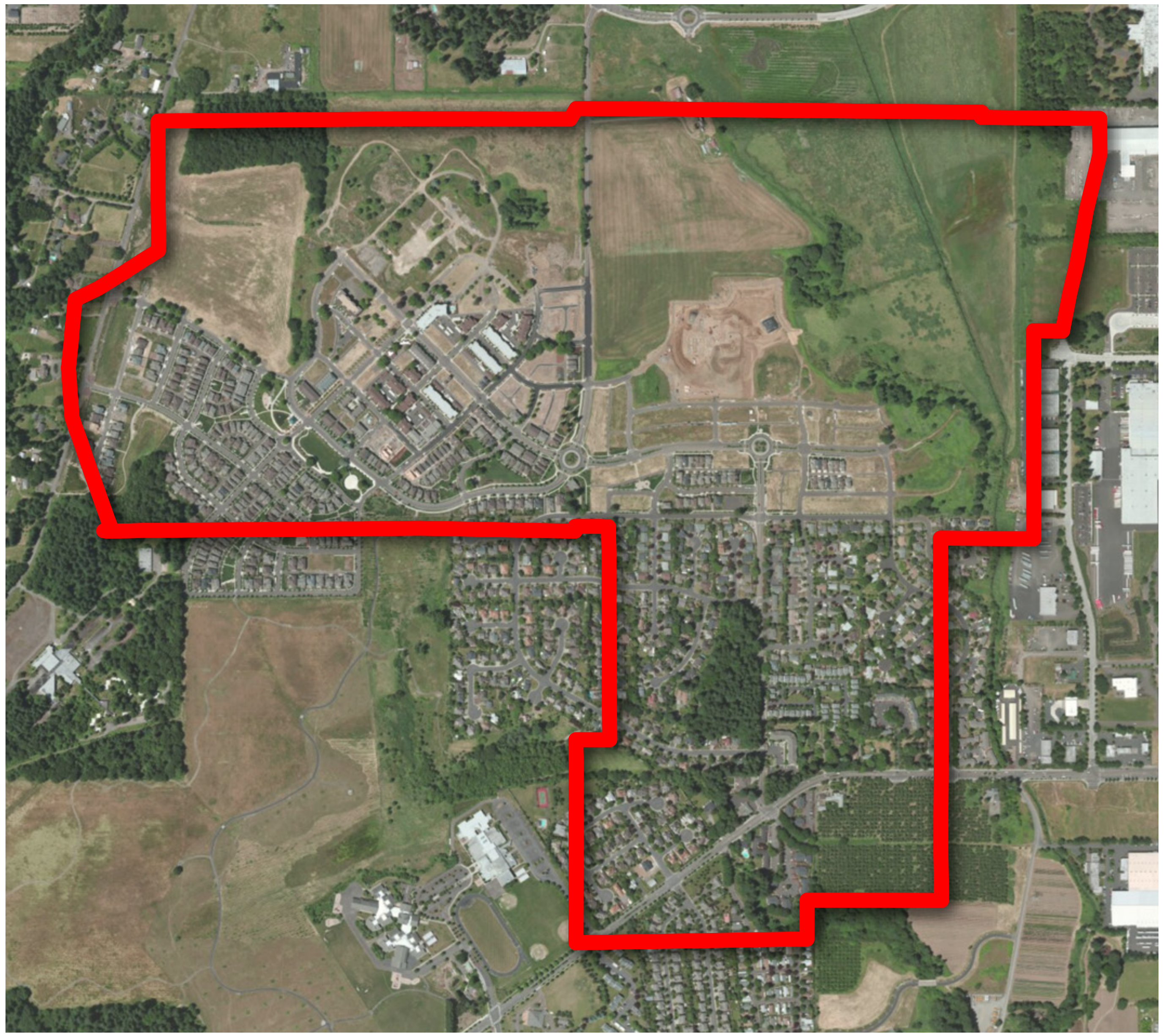


Natural Areas & Parks

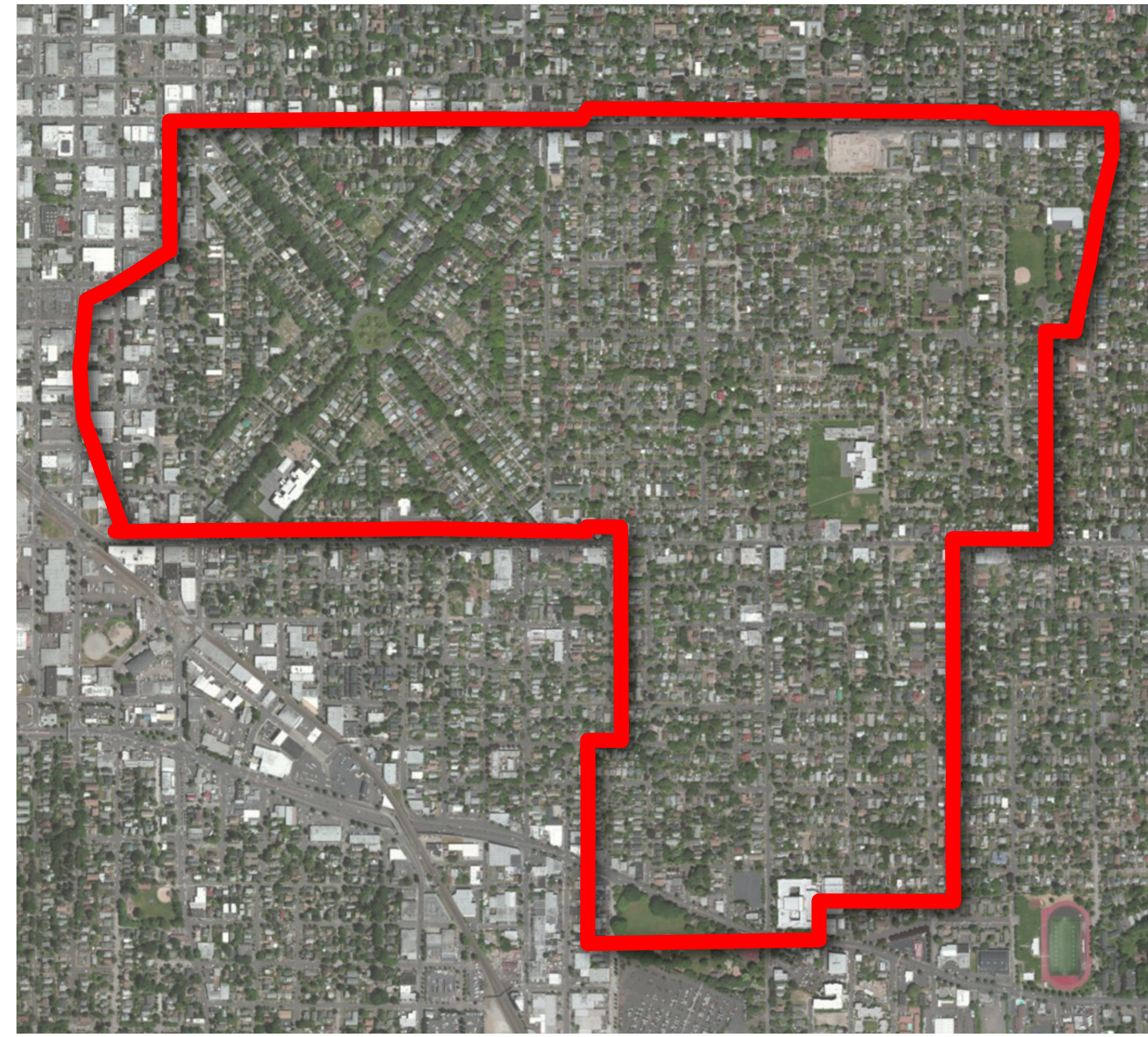


Buildings

Exhibit 6: Planning Area Scale Comparison



Frog Pond planning area compared to Wilsonville's Villebois and vicinity



Frog Pond planning area compared to SE Portland's Ladd's Addition and vicinity

Appendix A

Project Team Members

Consultant Team

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Andrew Parish, Angelo Planning Group

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Nancy Kraushaar, Community Development Director

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Kerry Rappold, Natural Resources Program Manager

City of Wilsonville Background Documents Consulted

Bicycle and Pedestrian Master Plan (2006)

Parks and Recreation Master Plan (2007)

Transit Master Plan (2008)

Transportation System Plan (2013)

20-Year Look at Where Wilsonville Might Grow (2008)

Comprehensive Plan (2013)

Water System Master Plan (2012)

Appendix C. Market Study

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FROG POND AREA PLAN

MARKET ANALYSIS

PREPARED FOR

City of WILSONVILLE OREGON

PREPARED BY

LELAND CONSULTING GROUP

People Places Prosperity

August 2014

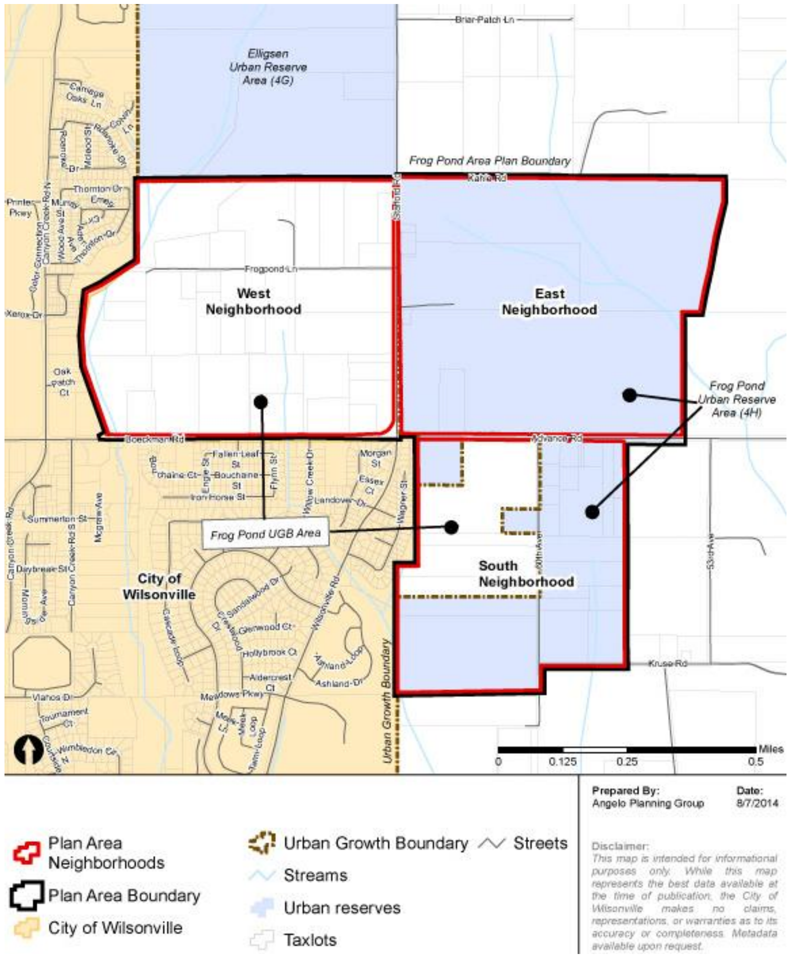
Contents

Introduction and Executive Summary

This market analysis is one component of the Frog Pond Area Plan, which the City of Wilsonville has initiated in order to establish a vision for the area, and to define expectations for the type of community that the 495-acre Frog Pond Area will become in the future. Leland Consulting Group (LCG), the authors of this report, is part of a consultant team led by Angelo Planning Group, which has been engaged by the City of Wilsonville to manage parts of the Frog Pond Area Plan. Through a process that will involve Wilsonville's citizens and elected officials, the Frog Pond Area Plan will ultimately identify the types of development (housing, neighborhood retail, parks, etc.), supporting infrastructure, regulatory framework, and a series of implementation steps needed to realize the plan. This executive summary provides key findings of the market analysis, while details are contained in the body of the report beginning on page 7.

The purpose of this market analysis is to provide the City and Frog Pond Area Plan participants with information about the types of residential and commercial real estate that are likely to be in demand and market feasible in the Frog Pond study area. The market analysis takes into account the project's goals to (1) create a concept plan for the entire 495-acre Frog Pond Area shown in Figure 1 below; and (2) create more specific master plan recommendations for the 179-acre "West Neighborhood" portion that is within the Urban Growth Boundary (UGB). Development within the West Neighborhood will occur first, and development within the East and South Neighborhoods will occur later if they are brought into the UGB by Metro. The real estate market is of critical importance to the future of the entire Frog Pond Area, since this new community will be shaped by both the private sector (e.g., land owners, developers, new residents, retail tenants) and the public sector (through planning, regulation, provision of infrastructure, annexation, and other actions).

Figure 1. The Frog Pond Area



Source: City of Wilsonville, Angelo Planning Group.

Demographic context. Wilsonville is one of the Portland region's fastest growing cities. Metro has projected that the city's households will grow at 1.8 percent annually through 2035, faster than the region and other nearby cities such as Tualatin and Sherwood. The city may also grow faster than this rate: between 2000 and 2012, Wilsonville's households grew at a rate of 2.8 percent per year, despite the recession. Therefore, there will almost certainly be demand for housing, and potentially commercial development, in Wilsonville and Frog Pond during the next two decades.

Wilsonville's residents are more likely to have a bachelor's or advanced degree than residents of the region, they earn slightly more than households regionwide, and they are more likely to work in white collar jobs. Wilsonville has large shares of both young adults and senior residents, while the city has a smaller share of households headed by middle-aged adults compared to the region.

Analysis by Metro, the State of Oregon, and the US Census Bureau indicate that America's demographics are changing, and growth in the Frog Pond market area is likely to include a wide variety of household types. The most dramatic growth will come in the 65+ senior population, whose numbers will increase by 93 percent between 2015 and 2035. By comparison, no other age group is expected to grow by more than 29 percent during that time period. In addition, "non-traditional" household types such as families with children, couples, single-parent households, and single-person households will be important components of growth and therefore will shape real estate demand in

Frog Pond. Sixty-eight percent of Wilsonville's current households are one or two people; such smaller households have been growing as a share of the country's population since the 1970s, a trend that is expected to continue. Wilsonville's recently adopted Residential Land Study (RLS) documents many of these projections and sets the stage for this market analysis.

The Frog Pond Area. Past policies adopted by the City of Wilsonville and Metro call for the Frog Pond Area to be developed primarily as a residential community, though ancillary commercial development may take place in Frog Pond. These policy decisions directly influence this market analysis. As shown in Figure 1, the Frog Pond Area contains two main sub-areas. The first is the West Neighborhood, which is located west of Stafford Road and is 179 gross acres in size. The second is the East and South Neighborhoods combined, located east of Stafford Road. With the exception of the planned school property, the East and South Neighborhoods are outside the UGB, will therefore develop later, and are 316 gross acres in size. Together the two areas comprise 495 gross acres.

Frog Pond has a number of positive features including easy access to natural areas, existing and planned schools and parks, jobs, retail services, and major transportation infrastructure. Developers interviewed as part of this study consistently view Wilsonville in general and Frog Pond in particular as a desirable location for future residential and commercial development, though they did not consistently point out any specific advantages that Frog Pond has compared to other Wilsonville locations.

Housing market analysis. Based on the RLS, demographic projections, past housing built in Wilsonville, and other factors, Leland Consulting Group recommends that Frog Pond be developed as a community that contains a relatively broad mix of housing types including a variety of detached single-family, attached single-family, and multifamily homes. In total, LCG projects that Frog Pond is likely to be built out with between 2,200 and 2,700 homes. This report proposes a series of housing development principles on page 23, followed by two housing development scenarios for the West Neighborhood, and two for the East and South Neighborhoods, in order to provide alternative development options. The primary housing type should be single-family detached homes within a variety of lot sizes, since such homes continue to be the choice of most American households. Because one and two-person households make up the majority of market area households, and because of the dramatic growth of the senior population, LCG recommends that the program contain a significant share of small lot single-family homes (lots between 2,500 and 4,000 square feet), as well as multifamily and attached housing. Developers generally support a diversity of housing within a large community such as Frog Pond, since such a broad mix of housing will accommodate a wider segment of the population, and therefore speed sales and absorption.

Recent surveys and research by the National Association of Realtors (NAR), Urban Land Institute (ULI), and others show that the amenities associated with complete and walkable neighborhoods are important in addition to the home itself. These popular amenities include shops within an easy walk, places to walk for exercise, public transportation, and sidewalks. Such features should be taken into account in the design of the community.

There is no single "correct" development program for the purposes of this study. Rather, the development scenarios described above provide a range of reasonable expectations. The actual housing program should be influenced by the community's goals and vision, public policy set by the City, and this Frog Pond Area Plan process. In addition to market considerations, development alternatives with more housing will generate more public revenues, particularly through systems development charges, which fund community infrastructure such as roads, sewer, and water lines, and reduce the funding required from elsewhere in the city.

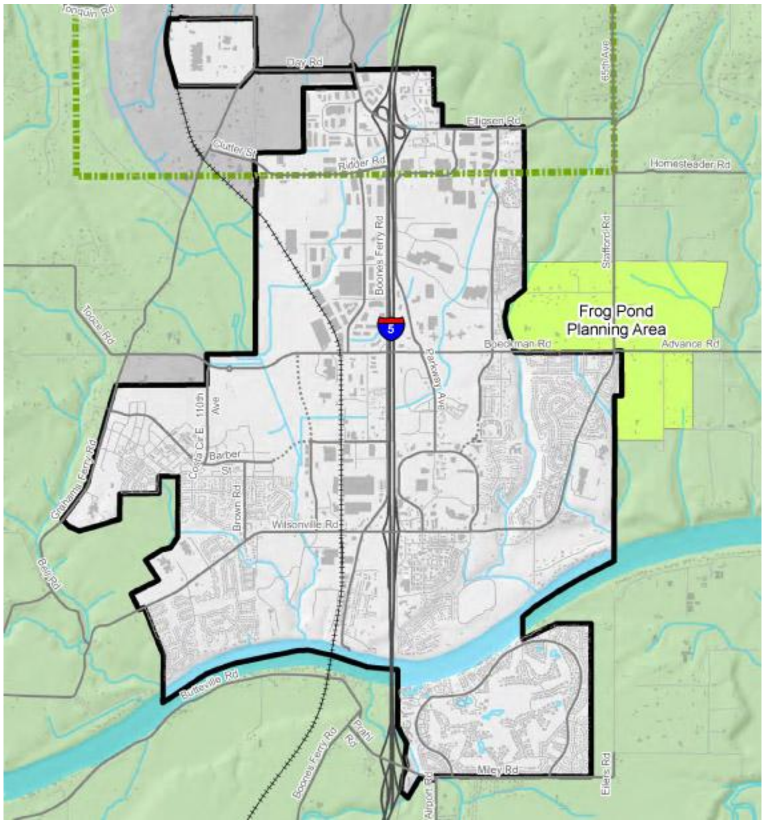
Retail market analysis. The Frog Pond Area community will build out along the edge of an existing urbanized city and region. As mentioned above, nearby goods and services are an amenity that residents will want; however, “retail follows rooftops”—in other words, significant retail development only takes place when there is a significant population of likely shoppers in the area. As a potential retail location, Frog Pond benefits from being situated along two arterial roads, Boeckman/Advance Roads and Stafford/Wilsonville Roads, which will provide some drive-by traffic. Retail in Frog Pond can also serve some adjacent existing communities to the west and southwest.

Based on an evaluation of current and projected future retail spending, LCG projects that Frog Pond could *potentially* support a small to medium-size grocery-anchored retail center (60,000 square feet or more) at full project build out in approximately 2035. If such a grocery-anchored center cannot be attracted, Frog Pond could support a smaller center of between 10,000 and 30,000 square feet. A variety of factors will affect retail feasibility, particularly whether or not other retail is built near Frog Pond during the next 20 years, the number of homes in the area, and retail development formats in the future. Regardless of the size and scale of retail, the focus should be on establishing a retail/commercial hub development that provides some goods and services for local residents, while also creating a gateway, center, sense of place, and social hub for the area.

Demographic Context

Figure 2 below shows the Frog Pond Planning Area and the City of Wilsonville. Frog Pond is well located: It is proximate to both urban amenities such as employment centers, retail areas, major transportation routes, and parks. It is also adjacent to attractive rural lands to the north, east, and south. The area's specific attributes including natural areas are evaluated in more detail on page 21.

Figure 2. City of Wilsonville and Frog Pond Area



Source: City of Wilsonville.

Information Sources

The population and demographic projections on the following pages make use of a number of information sources, including demographic forecasts prepared by Metro, Portland's regional government; ESRI Business Analyst, a private third-party data provider; the State of Oregon's Office of Economic Analysis, which produces the official long-term population forecasts for all of the State's counties; the US Census; and the City of Wilsonville Residential Lands Study (2014) and permitting database. In addition to these data sources, LCG consulted recent research on housing preferences completed by the National Association of Realtors, the Urban Land Institute (ULI), and others. The purpose of the Residential Land Study (RLS), completed in compliance with Statewide Planning Goal 10, is to inventory Wilsonville's existing residential land, project future demand for housing and residential land, and to help Wilsonville's decision makers develop policies to guide housing development in the city over the next 20 years, from 2014 to 2034. While the Residential Land Study's findings and recommendations apply citywide, it also contains some high level guidance specifically for the Frog Pond Area, which is referenced in this report.

Population and Household Forecast

Demographics are fundamental to estimating market demand for residential and commercial real estate. The types of housing and commercial goods forecasted to be in demand in the future in Wilsonville and Frog Pond will depend on the types of people and households who live there in the future.

Table 1 shows the household growth projected by Metro (the Portland regional government) for the 2010 to 2035 time period for the Cities of Wilsonville, Tualatin, and Sherwood, the “Frog Pond market area,” and the three primary metro-area counties. The market area encompasses the three cities and the areas immediately around them. This area was defined based on interviews with developers, who stated that it is the area that future Frog Pond residents are most likely to be drawn from. A map of the market area is shown on the following page. Some key takeaways from this demographic projection are:

Wilsonville is projected to grow quickly. As shown in Table 1, Metro projects the number of households in Wilsonville to grow at a rate of 1.8 percent annually between 2010 and 2035. Metro projects Wilsonville will grow at faster rate than other nearby cities such as Tualatin, Sherwood, Tigard, West Linn, and Lake Oswego, and at a faster rate than the region as a whole. While Metro’s projections show rapid growth for Wilsonville, they may actually underestimate the pace of growth: The Residential Land Study documents that Wilsonville’s “average annual population growth between 1990 and 2012 was nearly 5% and 3.2% between 2000 and 2012.”

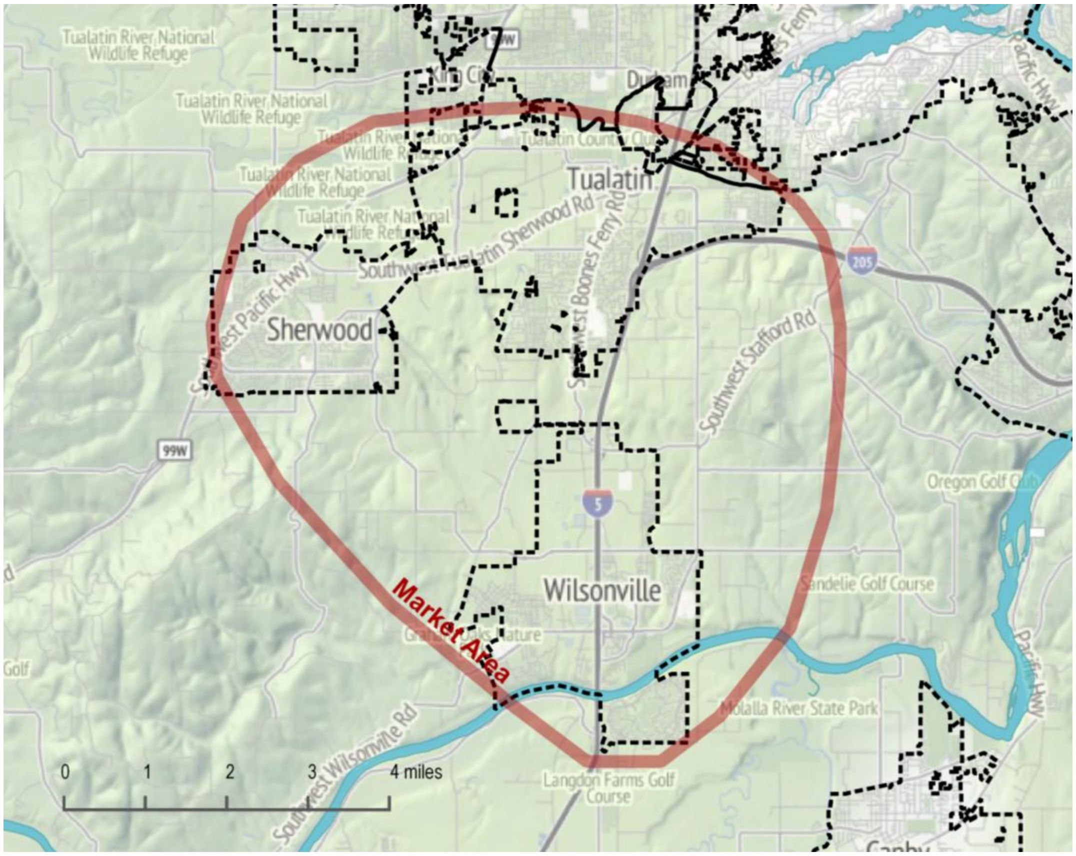
Regardless of the exact rate, household growth is the key driver of demand for new housing, as well as a key driver of commercial development. This means that there will be demand over the next 20 years for housing in the Frog Pond Area, and that it makes sense to conduct this Concept Plan process now in order to prepare for that demand.

Table 1. Demographic Forecasts for Wilsonville and the Metro Region

Jurisdiction	Households			
	2010	2035	Change	CAGR
City of Wilsonville	8,011	12,530	4,519	1.8%
City of Tualatin	10,000	11,170	1,170	0.4%
City of Sherwood	6,316	7,269	953	0.6%
Frog Pond Market Area	**27,825**	**38,704**	**10,879**	**1.3%**
Clackamas County	146,324	208,437	62,113	1.4%
Multnomah County	304,649	442,546	137,897	1.5%
Washington County	202,647	289,592	86,945	1.4%
Three County Total	**653,620**	**940,575**	**286,955**	**1.5%**

Source: Metroscope Gamma Forecasts, Published Feb 07, 2013, http://www.oregonmetro.gov/regional-2035-forecast-distribution. Note that Metro’s projections shown in Table 1 include the Frog Pond West Neighborhood, but not Frog Pond East or South, since those neighborhoods are currently outside the UGB.

Figure 3. Frog Pond Primary Market Area



Source: Leland Consulting Group.

Wilsonville's Current Demographic Characteristics

Table 2 and Table 3 on the following page summarize key demographic attributes of Wilsonville, the Frog Pond market area, and the Portland region (Metropolitan Statistical Area or MSA). The data is for 2014 except where noted. Some key takeaways from this demographic analysis are:

- Wilsonville has a higher percentage of young adult residents (aged 24 to 34) and older residents (aged 65+) than the market area or region. Conversely, a slightly smaller percentage of Wilsonville's population is middle-aged (aged 35 to 64) than the market area or region.
- Fifty-nine percent of Wilsonville's households are "family households"—those with two or more related family members living together—compared with 68 and 64 percent in the market area and region, respectively.
- Wilsonville has a larger share (68 percent) of one and two-person households than the market area or region.

Table 2. Demographic Summary

Key: Lower — Higher Compared to the other geographical areas shown below.

Demographic figures are for 2014 except where otherwise noted.

Demographic Attribute	City of Wilsonville	Frog Pond Market Area	Portland MSA
Comparison to Portland MSA:	More 25 - 34 and 65+ HHs Fewer family HHs Smaller HHs More 1 and 2 person HHs Slightly higher HH and Per Capita Incomes	More children, 35 - 54 HHs More family HHs Larger HHs More 1 and 2 person HHs Higher HH and Per Capita Incomes	NA
Population By Age			
0 to 24	31%	34%	32%
25 - 34	16%	13%	15%
35 - 44	14%	15%	14%
45 to 54	13%	14%	14%
55 to 64	11%	12%	13%
65 +	15%	11%	13%
Family Households (2010 Census)	59%	68%	64%
Median Age	37.0	36.6	37.5
Household Size (Average)	2.32	2.57	2.52
Household by Size (2010 Census)			
1 and 2 person households	68%	58%	61%
3 and 4 person households	25%	32%	29%
5 + person households	7%	10%	10%

Source: ESRI Business Analyst, Leland Consulting Group.

Table 3 shows that:

- Both Wilsonville and the market area have a high percentage of residents (70 and 69 percent respectively) that are employed in “white collar” jobs, compared with 63 percent regionwide. This reflects a high earning demographic of professional, technical, and management workers and bodes well for the city’s long-term economic health.
- Incomes—particularly household incomes—are very high in the market area. Wilsonville household incomes are lower than the market area but slightly higher than the region. The high incomes in the market area reflects the high number of professional, technical, and management employees who perform their work in the market area or commute to those jobs elsewhere.
- Educational attainment follows a similar pattern to incomes. Forty-one percent of residents of the market area have a bachelor’s degree or higher, which is slightly more than Wilsonville, and significantly more than the region.
- The median home value in Wilsonville is slightly higher than the market area, and significantly higher than the region.
- These demographic attributes, along with the long-term population growth forecast by Metro, also demonstrate that housing demand is likely to be strong in Frog Pond during the next two decades.

Table 3. Demographic Summary (Continued)

Demographic Attribute	City of Wilsonville	Frog Pond Market Area	Portland MSA
Occupation			
"White Collar"	70%	69%	63%
"Blue Collar"	14%	14%	20%
Median Household Income	$59,812	$70,256	$57,441
Per Capita Income	$31,995	$33,336	$30,135
Education and Employment			
Less than High School	8%	8%	9%
High School or Equivalent	20%	18%	22%
Associate's or Some College	32%	33%	34%
Bachelor's or Advanced Degree	39%	41%	34%
Median Home Value	$349,927	$337,289	$275,516
Housing Tenure			
Owner Occupied Housing Units	43%	55%	56%
Renter Occupied Housing Units	51%	40%	38%

Source: ESRI Business Analyst, Leland Consulting Group.

Tapestry Segments

"Tapestry segments" are a series of demographic categories developed by ESRI, a national third-party demographic information provider that describe groups of people based on their lifestyles, attitudes, purchasing patterns, and interests. The benefit of Tapestry segments is that they go beyond raw numbers and begin to describe groups of people in everyday language. Tapestry segments can also sometimes be overly simplistic, and because they are created at the national level, some aspects of different segments may not apply locally. ESRI uses information from the US Census, Bureau of Labor, and other private sector data sources to create Tapestry segments.

As shown in Table 4 below, the City of Wilsonville is dominated by three main Tapestry segments—Enterprising Professionals, Silver and Gold, and Up and Coming Families—which together comprise 95 percent of the city's total population. ESRI estimates that the Enterprising Professionals group alone accounts for 65 percent of the city's population, and is therefore 34 times more prevalent than in the nation at large. Attributes of the top three Tapestry segments are summarized below; additional information about them is included in the appendix.

Table 4. City of Wilsonville's Primary Tapestry Segments

Tapestry Segment	Percent of Households		
	City of Wilsonville	United States	Prevalence Compared to US
Enterprising Professionals	65%	2%	34
Silver and Gold	19%	1%	19
Up and Coming Families	12%	4%	3
Urban Chic	4%	1%	3
Exurbanites	1%	3%	0
All others	0%	89%	NA

Source: ESRI, Leland Consulting Group.

Enterprising Professionals (65%)

- Young, educated, single, married, working professionals, residents of Enterprising Professionals neighborhoods have a median age of 33.2 years.
- Forty-three percent of the households are singles who live alone or share housing with roommates, and 43 percent are married couple families.
- With an annual household growth of 1.95 percent per year since 2000, the households in this segment comprise approximately two percent of total U.S. households.
- Enterprising Professionals residents move frequently to find growth opportunities and better jobs, especially in cities such as Chicago, Atlanta, and Seattle.
- Forty-six percent of the households are located in the South, 29 percent are in the West, and 20 percent are in the Midwest.
- They prefer to own instead of rent in newer neighborhoods of townhouses or apartments. The median home value is $239,007.
- For those who rent, the average gross rent is 36 percent higher than the U.S. average.

Silver and Gold (19%)

- With a median age of 61.3 years, Silver and Gold residents are the second oldest of the Tapestry segments.
- More than 70 percent are aged 55 years or older.
- Most residents have retired from professional occupations. Half of the households are composed of married couples without children.
- Residents of these neighborhoods are not ethnically diverse; 93 percent of them are Caucasian.
- One-fourth of this Tapestry segment is located in the West, mainly in California and Arizona. Neighborhoods are exclusive with a home ownership rate of 81 percent.
- The median home value is $290,103. Silver and Gold ranks second of the Tapestry segments for the percentage of seasonal housing owners.
- Because these seniors have moved to newer single-family homes, they are not living in the homes where they raised their children.

Up and Coming Families (12%)

- With an annual household growth rate of 1.69 percent, Up and Coming Families represents Tapestry's second highest household growth market.
- A mix of Generation Xers and Baby Boomers with a median age of 32.8 years, this segment is the youngest of Tapestry's affluent family markets.
- Residents of these neighborhoods are young, affluent families with younger children.
- Eighty percent of the households are families. Most of the residents are Caucasian; however, diversity is increasing as the segment grows.
- Most residents live in new single-family housing in the suburban outskirts of midsized metropolitan areas with populations higher than 250,000, with a median home value of $193,161. More than half the housing units were built in the last 10 years.
- Homeownership is at 80 percent.

Long-Term Demographic Trends

Two long-term demographic trends that are expected to have a significant impact on real estate demand at Frog Pond are described below. These are the aging of the Baby Boom generation, and the trend towards household diversity and decreasing household size.

Many other demographic trends are also affecting our communities today. For example, one is "Generation Y"—young Americans now in their 20s and early 30s. This is a large generation and is a major driver of the recent apartment market boom. However, over the 20-plus year build out of Frog Pond, the two trends identified above are expected to have the most significant impact.

Aging Baby Boomers

The figures below show the demographic trend that is variously called the aging of the Baby Boomers or the "silver tsunami," which is expected to have a significant impact on housing demand. As Baby Boomers (those born between 1946 and 1964) retire and begin to consider selling their homes and relocating within or beyond the metropolitan region, they are expected to have a major impact on housing markets, as they always have had throughout their lifespan. Many will be selling medium and large-size single-family homes and looking for smaller homes with lower maintenance and upkeep, and the freedom to "lock and leave" home to visit family and friends, and vacation elsewhere.

Figure 4 highlights several points. The population of Washington and Clackamas Counties for all age categories is growing between 2015 and 2035—the period during which Frog Pond is expected to build out—creating demand for housing that meets the needs of all of these groups. The 65+ population will grow by the largest amount. The effect of this growth will be even more pronounced since these are relatively small households and thus more housing units are needed to serve the same population. The population of the 35 to 64 age category, and their children, under 19, will also grow significantly. This group is likely to re-occupy many of the single-family homes now in the market area, and new homes in Frog Pond. The size of the 20 to 34 age group is not expected to increase much. This is because Generation Y / Millennials, now in their 20s and early 30s, make up a large age cohort, and the cohort behind them is expected to be smaller.

Figure 4. Forecasted Net Population Change by Age Group, 2015 to 2035

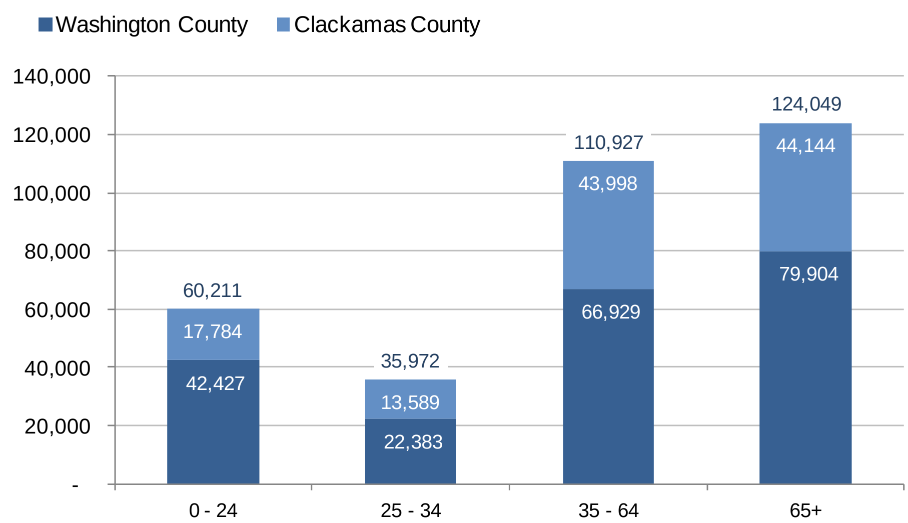
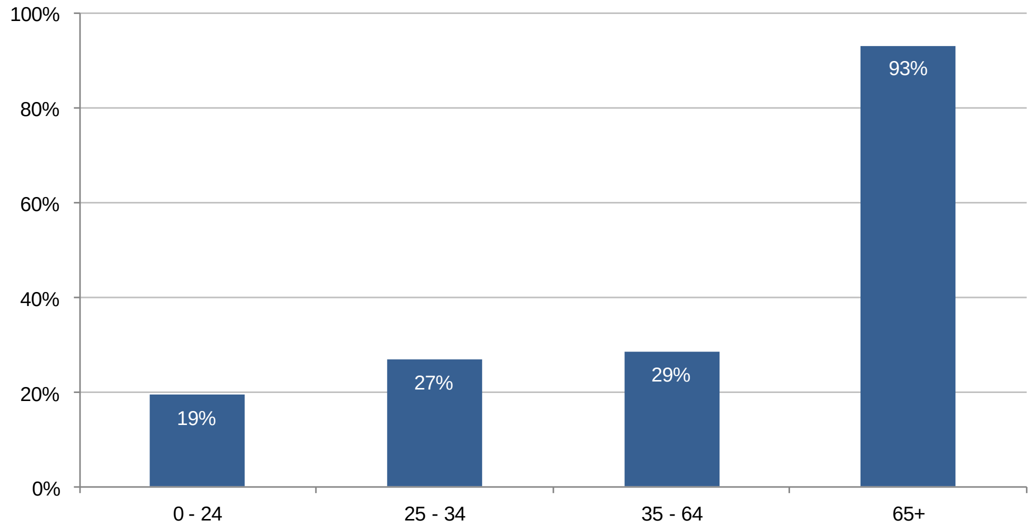


Figure 5 shows that, as a percentage of the current population, the growth in the 65+ age group will be far, far greater than growth in other age groups. While the numerical increase (shown in Figure 4) is only slightly greater than the increase in other population groups, the percent increase is far greater. Therefore, the impacts this age group will have on housing, healthcare, and other parts of society is likely to be greater. This local impact of the Baby Boom generation is consistent with the impact anticipated nationwide.

Figure 5. Forecasted Percent Population Increase by Age Group, 2015 to 2035

Washington and Clackamas Counties combined.



Source for both figures: Long-term Oregon State's County Population Forecast, 2010-2050, Office of Economic Analysis, State of Oregon, 2013; Leland Consulting Group.

Research on 65+ aged households tends to reach several broad conclusions. The following are some of the key findings from a Portland State University study on age-related housing demand shifts:[1]

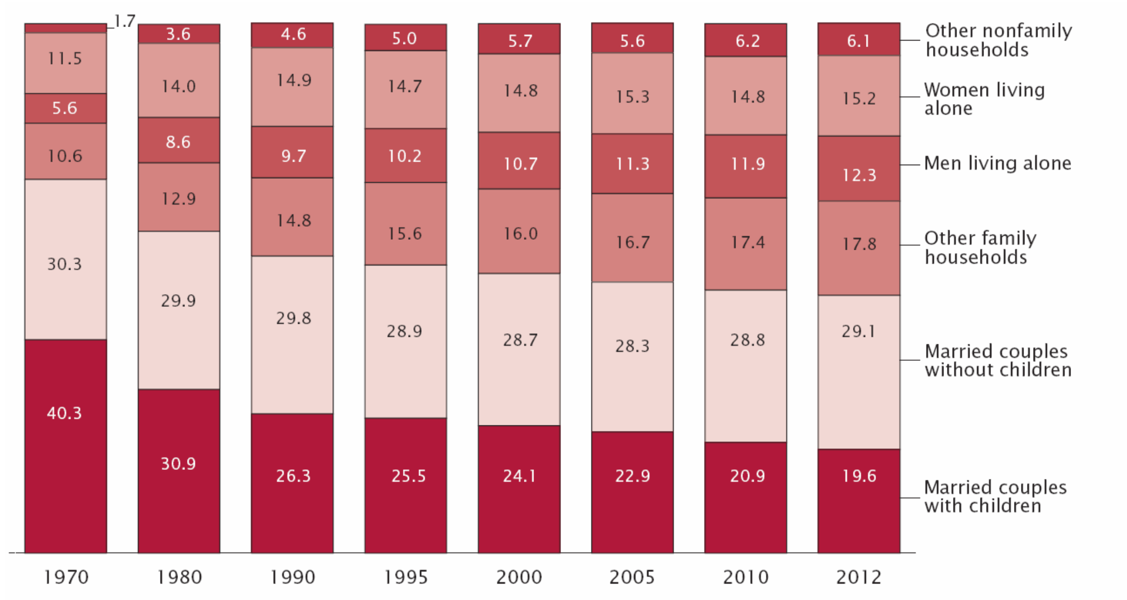
- "Middle-aged and older adults' clear preferences for suburban living must be acknowledged and plans developed to make suburban areas more pedestrian friendly and homes retrofitted or designed initially to better meet the needs of older adults."
- "With respect to features within the residence, there is a preference for a full bath and a bedroom on the main level as well as an entrance without steps."
- "When older householders do move, they are more likely to move into higher density housing than middle-age adults."
- "There are a number of indications… that baby boomers are more likely than younger adults to have a preference for more walkable locations, public transit, and higher density living."

[1] *Age-Related Shifts in Housing and Transportation Demand. A Multidisciplinary Study Conducted for Metro*, Portland State University, College of Urban and Public Affairs. 2006; excerpts from pages 1 and 44.

Increasing Household Diversity and Non-Traditional Households

When thinking about population growth, there can be a tendency to assume that this growth will be driven by "traditional" family households that consist of a married couple with children. However, as Figure 6 shows, this type of household has been becoming less prevalent over time, while most other "non-traditional" household types have increased as a share of the population over time. The other household types tend to be smaller than families with children, and tend to be open to a wider variety of housing types. One writer has identified four demographic "S groups" that have seen the highest rate of growth in recent decades and are expected to continue growing in the coming decades: seniors, singles, single-parent households, and starter households (e.g., the married couples without children shown below, and unmarried couples). This national trend is consistent with the Portland region: As shown in Table 2, the percentage of one-and two-person households is 68 percent in the City of Wilsonville, and 58 percent in the market area.

Figure 6. Households by Type as a Percent of All Households, United States, 1970 to 2012



Source: US Census Bureau.

Community Preferences

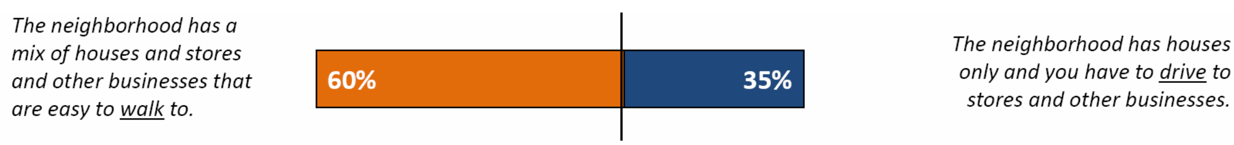
Real estate and home buying is all about "location, location, location"—in other words, the community, city, or neighborhood in which a given home is located. Since 2004, the National Association of Realtors (NAR) has conducted a nationwide poll to better understand what Americans are looking for in their future homes and communities. This is the most robust, widely-applicable survey instrument available to suggest how housing demand is evolving. One important focus of this poll is testing Americans' interest in the features of what are variously called "walkable communities," "complete communities," or "traditional neighborhood development." Such communities tend to be pedestrian friendly—parks, schools, shops and businesses are located within walking (and driving) distance of homes—and contain a range of different housing types where households of different ages and sizes can live—single-family homes, townhouses, and multifamily housing.

Figure 7 shows how people responded when asked, "Do you think there is too much, too little, or the right amount of each of the following in the area close to where you live?" Respondents most often felt that there are too few features such as safe routes for walking and biking, public transit, a diversity of housing, and shops and restaurants within an easy walk.

Figure 7. Which Neighborhood Amenities are in Demand?

Figure 8 shows how people responded when asked to select the house where they would prefer to live when provided with two community options. By nearly a two-to-one margin, Americans prefer a neighborhood where they can walk to stores and businesses. The preference is significantly more pronounced among those who recently purchased a home or are currently in the market.

Figure 8. Community Preferences



Source, both figures: National Community Preference Survey, National Association of Realtors, October 2013.

The Urban Land Institute (ULI) is another organization that routinely evaluates home buyer and renter preferences. The ULI is a national professional association for developers, homebuilders, planners, and other land use professionals. Some key findings published by the ULI in the organization's *Residential Futures: Thought-Provoking Ideas on What's Next for Master-Planned Communities* (2012) are listed below. These are consistent with findings from Realtor's surveys and respond to the question, "What do buyers need in terms of housing and community?"

- Home buyers are, "looking for value (affordability), walkability, shopping, restaurants, services, good schools, and a sense of community."
- "Single-use zoning is out and mixed use is in, along with living close to services and jobs. The typical master planned community offering, including schools, parks, and pools, is still important, especially to first-time buyers. Couple that with a scarcity of resources, living near where you work and shop is in, long commutes are out."
- Home buyers "want safety, good schools, and proximity to employment, which usually entails less than a 30-minute commute. Financial security related to the home purchase means that the community is on stable ground and the builder is viable. Buyers want to feel that the housing value is permanent and appreciation is likely over time."

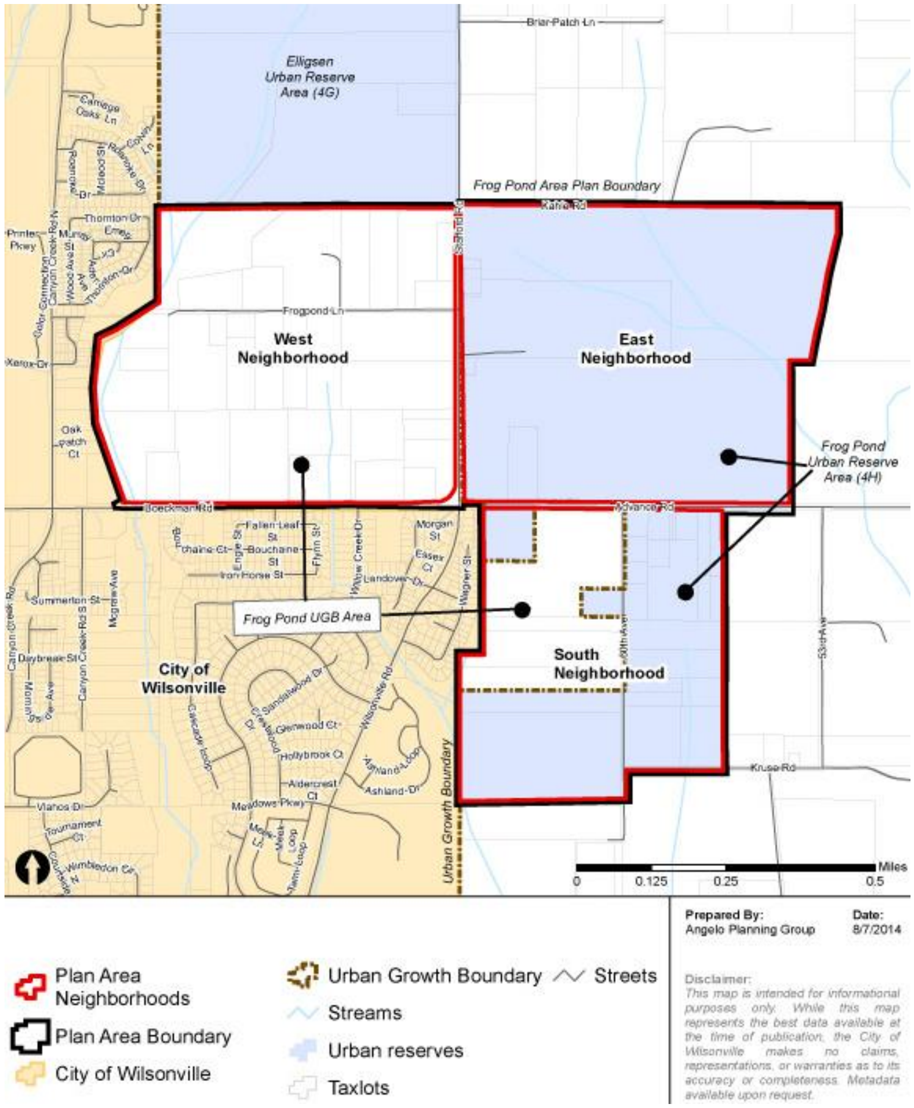
The Frog Pond Area

This market analysis addresses the Frog Pond Area (or "study area") as shown in Figure 9.
In some sections of this report, the study area is divided into two parts: the West Neighborhood (or Frog Pond West), which is the land west of Stafford Road; and the East and South Neighborhoods, The entire Frog Pond Area is 495 gross acres. The City's 20-Year Look process has identified the entire Frog Pond Area as the top priority area for future residential development. Metro has supported this policy direction by designating the larger area as Urban Reserve 4H during its 2009 Urban Reserves designation process.

The West Neighborhood is 179.4 gross acres in size. It is currently located outside of the city's boundaries and inside the UGB. Because it is within the UGB, the West Neighborhood can be concept planned, annexed by the City, zoned, and then developed within the next few years. Developers and/or the City will also need to extend infrastructure to the area in advance of or concurrently with development. The intent of the City's current concept and master planning process is to set the stage for the near-term development of the West Neighborhood.

The Residential Land Study found that the development of the Frog Pond West Neighborhood is fundamental to the city's ability to accommodate future housing demand. In addition, based on discussions with Wilsonville's decision makers conducted during the Residential Land Study, and their desire to achieve a more balanced housing mix and the results of the housing needs analysis, the study recommends that Wilsonville plan for the Frog Pond West Neighborhood to be "developed predominantly with single-family detached housing." Specifically, the housing needs assessment modeling conducted for the Residential Land Study assumed that the housing would develop at densities between 5.0 and 8.5 dwelling units per gross acre in the West Neighborhood.

Figure 9. The Frog Pond Area



Source: City of Wilsonville, Angelo Planning Group.

The East and South Neighborhoods are larger—315.8 gross acres. With the exception of the future school property, both of these neighborhoods are currently outside both the city and UGB boundaries, but have been identified by the Metro regional government and the City as a residential Urban Reserve—an area that will be built out, primarily to accommodate housing growth, within the next 50 years. Because of the city's rapid and projected future population growth, Wilsonville may seek to bring the East and South Neighborhoods into the UGB sooner rather than later. For the purposes of this market analysis, LCG has assumed that development can begin in the East and South Neighborhoods in the year 2022; however, the actual date will depend on decisions made by the City of Wilsonville, Metro, and others.

The Residential Land Study concludes that Wilsonville may need residential land by 2032 or sooner, depending on the city's population growth rate in the coming decades. For this reason, the East and South Neighborhoods are being concept planned along with the West Neighborhood. Because of the Urban Reserve status, it is not a question of if the area will be built out with mainly housing, but when.

The Residential Land Study does not offer any specific density or land use recommendations for the East and South Neighborhoods.

Given the amount of time it takes to get a new area to be development-ready (i.e., brought into the UGB, planned, and services extended to the area), Wilsonville should begin discussions about bringing the East and South Neighborhoods into the UGB as part of the next cycle of UGB expansion discussions.

Key Features of the Frog Pond Area

The following are some of the key features of the study area that are most relevant to this market analysis and the future development of the area:

- **Natural areas,** including Boeckman Creek and various tree stands throughout. The area also benefits from views to ridgelines to the north and west. These natural features limit the amount of development that can take place, but can also be unique sources of identity, pride, and land value for the new community if they are properly integrated into the overall concept plan.
- **Schools.** The West Linn-Wilsonville School District currently owns properties in Frog Pond and is planning to build two schools there, a primary school and a middle school. The City will be building a 10-acre community park adjacent to these schools. These schools, along with the high quality of the School District, will increase the desirability of the future community, particularly for families. The concept plan should carefully consider how "safe routes to school" can be designed throughout the community. In addition to its South Neighborhood properties, the School District also owns several parcels in the West Neighborhood, but has not announced specific plans for these properties, which could be retained and developed by the School District, or sold.
- **The City of Wilsonville** has a good reputation in the marketplace for high-quality communities and development. Villebois' carefully integrated parks, homes, schools, and public realm distinguish it from almost all other suburban residential communities in the Portland region.
- **Proximity to jobs.** Wilsonville is known for the significant number of jobs within the city, as well as its accessibility to most Portland metro area employment centers and Salem. The planning area is also within a half-mile of the Mentor Graphics headquarters, Xerox, and other white collar offices, which will drive interest in Frog Pond.
- **Proximity to services and shopping.** The subject area is approximately two miles from the Wilsonville Town Center, and 2.5 miles from the Argyle Square regional shopping center at Elligsen Road. Both commercial centers offer a wide variety of goods and services.
- **Transportation access.** Advance Road/Boeckman Road bisects the area running east to west, and Stafford Road/Wilsonville Road bisects the area running north to south. Both roads currently carry about 5,000 cars per day and are significant transportation routes for travelers going to and from Wilsonville. Certain land uses, including retail, office/commercial, and apartments, benefit from higher exposure, and any such uses should be located near these main roads. The roads will carry more traffic in the future as development increases. SMART bus service connects the subject area to the Town Center and to the WES commuter train station.
- **Property ownership.** Assuming that one desired outcome of the concept plan is the establishment of a cohesive, integrated plan that knits the entire study area together and results in a whole greater than its parts, the fragmented property ownership is likely to present some challenges. Fragmented property ownership can prevent key gateway properties from being developed, empower hold-out owners to demand above-market land prices, and limit the potential for area-wide solutions to issues such as storm water management and transportation.

Buildable Land in the Frog Pond Area

The City of Wilsonville conducted a buildable lands inventory in order to better understand what parts of the study area are likely to remain in natural or undeveloped conditions, become infrastructure such as roads, or be buildable land where new residential and commercial development could take place. A summary of that inventory is shown in Table 5 below. The key figures used in this analysis are the gross buildable area (318 acres) and net buildable area (243 acres) shown at the bottom of the table. The new buildable area is the amount of land on which LCG expects that residential or commercial development can take place.

Table 5. Buildable Land Inventory

Land Category	Frog Pond Neighborhood (Acres)		
	West	East & South	Total
Total Area	**179**	**316**	**495**
Unbuildable			
Committed [a]	12	90	102
Unbuildable (stream corridor/ adjacent wetland / adjacent riparian buffer/ >25% slope)	24	37	61
Buildable but challenging			
Acreage of all non-significant wetlands	18	5	23
20% of the total acreage of non-significant wetlands [b]	4	1	5
Subtotal [c]	54	124	177
Gross Buildable (Total acreage less unbuildable)	**126**	**192**	**318**
Infrastructure and Amenities			
Internal Roads [d]	23	35	57
Stormwater Management	5	3	8
Parks [e]	5	5	10
Subtotal	33	42	75
Net Buildable			
Retail/Commercial	2	5	7
Residential	91	145	236
Net Buildable	**93**	**150**	**243**

Source: City of Wilsonville, Leland Consulting Group. Notes: a: Committed land includes the BPA easement, residential developments valued greater than $160,000, land held for planned schools and parks, the church property, and the Grange hall. b: This line lists the 20 percent of the land that is unbuildable due to constraints of wetland fill permitting. This is an assumption, to acknowledge the challenge of permitting and possible mitigation of potentially jurisdictional wetlands. c: Some areas of land are categorized in more than one "unbuildable" category. The Subtotal, therefore, is the amount of land classified as "unbuildable" for any reason. d: LCG estimate. e: Land that will be used for the Urban Growth Area community park is included in the "Committed" land above.

Housing Market Analysis

Residential Land Study Findings and Recommendations

Wilsonville's Residential Land Study was adopted in May 2014 and provides a framework for this market analysis, due to its extensive analysis of Wilsonville's household types, demographics, current and future housing, and other information. The Residential Land Study provides the following information that guides this market analysis:

- The types of housing that will be in demand, both citywide and in the study area; and
- Conceptual housing development targets that can be used as a starting point for planning in the study area.

Some of the Residential Land Study's key findings and recommendations that are relevant to the study area are summarized below.

Planning for balance. Wilsonville is planning for a complete, balanced community. The Wilsonville Comprehensive Plan includes a balanced portfolio of different housing types that are well-designed and will be developed across the community to serve different people at different points in their lives.

Future housing demand. The Residential Lands Study projects that the following housing will be needed in the Wilsonville planning area between 2014 and 2034 period. The projection is based on Metro's population growth forecasts as well as other assumptions. While the forecast for Wilsonville shows a need for all types of housing, the Study concludes that the supply of land available for multifamily development is sufficient. To balance the city's housing supply, the Study recommends planning for predominantly single-family housing in the Frog Pond Area.

Table 6. Forecast of Needed Housing Units by Mix and Density, Wilsonville, 2014 to 2034

Housing Type	Needed New Housing Units (2014 - 2034)	
	Number of new new dwellings	Percent of new dwellings
Single Family Detached	1,875	50%
Single Family Attached	375	10%
Multifamily	1,499	40%
Total	3,749	100%
Annual Average	187	

Source: Wilsonville Residential Lands Study, American Community Survey.

The complete Residential Land Study, background technical reports, and associated public records, can be found online at http://or-wilsonville.civicplus.com/335/2014-Residential-Land-Study.

Housing Types

In order to illustrate potential development scenarios within the Frog Pond Area, this market analysis uses five different housing types, as shown in Table 7 below. These are broad categories, and there can be significant variation in home design, layout, site size, and other factors within these types. These housing types are key parts of the "palette" with which stakeholders can paint the Frog Pond Area during later phases of the Concept Plan process. These housing types are based on housing recently built in Wilsonville, housing proposed for other comparable new development areas, and the definitions used in the Residential Land Study.

Table 7. Housing Types

Housing Type	Lot Size			Net
	Low	Average	High	Density
Large Lot Single Family	6,000	**7,500**	8,500	6.0
Medium Lot Single Family	4,000	**5,000**	6,000	7.5
Small Lot Single Family	2,500	**3,500**	4,000	11.0
Attached Single Family: Townhomes and Duplexes	1,000	**2,250**	2,500	16.0
Multifamily: Apts, Condos, and Senior Housing	NA	**NA**	NA	25.0

Large Lot Single-Family

Medium Lot Single-Family

Small Lot Single-Family

Single-Family Attached

Multifamily

The major change from the types defined by the Residential Land Study is that three different types of single-family detached housing are used here rather than one, in order to provide a more nuanced view of housing demand and on-the-ground development.

The housing densities shown in Table 7 and used elsewhere in this report are *net* densities: the number of units that are located on a given area of *net buildable land*. As shown in Table 5, net buildable land is the amount of land available after deductions have been made for natural areas, slopes, public and private roads, parks, and stormwater retention has been deducted from the *gross area*. Buildable land can also be defined as the parcel upon which residential dwellings are constructed, including any open space (e.g., yard) provided on that parcel. The definitions used here are consistent with the Oregon Administrative Rules and the Residential Land Study.

Residential Density in Wilsonville

Table 8 and Table 9 below show excerpts from the Residential Land Study that document the density of recent (2000 to 2012) residential development in Wilsonville. This analysis is useful because it provides Frog Pond Concept Plan stakeholders with a range of built examples of residential density that can be compared to the Frog Pond development scenarios presented later in this report. Table 8 shows the densities of different housing types, while Table 9 shows the densities within different plan (Comprehensive Plan and Zoning) designations.

The analysis shows a range of potential residential densities. Unsurprisingly, the lowest density housing type built in Wilsonville between 2000 and 2012 were single-family homes, with a density of 7.6 dwelling units per net acre; the net density of multifamily housing is 18.5. The weighted average (total) net density for these two housing types combined is 12.4. Table 9 shows that, across all housing types built within residential zones in the city between 2000 and 2012, the density is 10.8 dwelling units per net acre. In village-designated areas (Villebois), the density is 18.0 dwelling units per net acre.

Table 8. Residential Development Density by Housing Type, Wilsonville, 2000 to 2012

Housing Type	Net Density
Single Family	7.6
Multifamily	18.5
Total	12.4

Source: Wilsonville Residential Land Study, adapted from Table 3-5, May 2014.

Table 9. Residential Development Density by Plan Designation, Wilsonville, 2000 to 2012

Plan Designation	Net Density
Residential	10.8
Village (Villebois)	18.0

Source: Wilsonville Residential Land Study, adapted from Table 3-4, May 2014.

Recent Housing Permits in Wilsonville

In order to inform this market analysis and potential development programs for Frog Pond, LCG reviewed residential permits issued by the City of Wilsonville between 2000 and 2012, the same time period that was evaluated for the Residential Land Study. The summary results of this analysis are shown in the two tables below. Table 10 shows data for permits granted citywide between 2000 and 2012. Table 11 shows permits granted in Villebois during the same time period. Villebois is shown since it is a currently-developing “greenfield” community that is similar in size to Frog Pond, and therefore is likely to be comparable in some ways.

It is important to make several notes about this data in order to understand its applicability to Frog Pond. Past permitting may or may not be a good predictor of future housing demand. The data is likely to reflect some conditions that may or may not be in place at Frog Pond. For example, zoning and lot sizes citywide and in Villebois may or may not be similar to those imposed at Frog Pond. In addition, economic and demographic conditions such as the great recession and the rapid entry of Generation Y into the housing market may create distortions in this data which will not be replicated in the future. Nevertheless, this data can inform planning for Frog Pond.

Several trends emerge from this analysis. First, there have been more permits issued for multifamily housing than any of the other housing types; this is true both citywide and in Villebois. Second, a large share of permitting at Villebois has been within the small lot single-family housing type. This is likely due to a combination of factors, including market demand and the size of lots available to builders, defined by the Villebois Village Concept Plan and subsequent documents.

Table 10. City of Wilsonville Residential Permits, 2000 to 2012

Housing Type	Total Permits	
	Number	Percent
Large Lot Single Family	260	9%
Medium Lot Single Family	298	10%
Small Lot Single Family	356	12%
Attached Single Family	56	2%
Multifamily	1,892	66%
Total	**2,862**	**100%**

Source: City of Wilsonville permit database, Leland Consulting Group.

Table 11. Villebois Permits, 2000 to 2012

Housing Type	Total Permits	
	Number	Percent
Large Lot Single Family	74	8%
Medium Lot Single Family	75	8%
Small Lot Single Family	309	35%
Attached Single Family	56	6%
Multifamily	380	43%
Total	**894**	**100%**

Source: City of Wilsonville permit database, Leland Consulting Group.

Third, attached single-family homes made up a higher share of permitting in Villebois than the city as a whole. Finally, large and medium lot single-family housing both made up a similar and modest share of all permitting citywide and in Villebois.

Housing Demand Summary

Based on the review of local, regional, and national demographics trends, the Residential Land Study, emerging community preferences, and other factors, LCG has used the following principles in creating a series of development scenarios for Frog Pond:

- **General housing preferences.** Across all household types, there is a general preference for detached single-family homes and for walkable communities in which goods, services, amenities, and community meeting places are within easy walking, biking, or driving distance. People's ideal housing preferences are typically moderated by their home buying budget, location of work, school and relatives, and other factors.

- **Housing diversity.** Housing mix and diversity is important in a large area such as Frog Pond. LCG recommends that a range of housing types be included in the Frog Pond concept planning, since there is a correspondingly wide range of households—old and young, large and small. A large area should be appeal to a wide variety of households. This will speed sales and thus the financial viability of the area.

- **Flexibility.** Flexibility is important to developers. Future Comprehensive Plan and Zoning regulation should ideally allow flexibility in Frog Pond, since housing demand in 2035 is by nature difficult to predict, and developers will want some ability to adjust to changes in demand.

- **65+ households.** The greatest amount of household growth in Washington and Clackamas Counties, and other relevant geographical regions is expected to come from households aged 65 and older. This is a dramatic shift from past demographic patterns. Age 65 and older households who move will likely demand a mix of housing, but will tend towards homes that are lower maintenance, somewhat higher density, and have many amenities close by. Many in this age group will still desire detached single-family homes, though others will be interested in attached and multifamily housing.

- **Families with children.** There will also be significant household growth in the 35 to 65 age cohort. Within this broad cohort, married couples with children ("traditional households") are expected to tend to seek single-family detached housing, within a variety of lot sizes.

- **Non-traditional households**—including singles, single-parent, and married couple households without children—have grown consistently and dramatically since the 1970s and are expected to continue to grow. These tend to be one and two-person households, and LCG expects that they will exhibit a broad range of housing preferences, across detached and attached single-family and multifamily housing types. Because of their smaller size, they will tend to seek medium and smaller size homes.

- **Policy.** The Residential Land Study recommends that the Frog Pond West Neighborhood be "developed predominantly with single-family detached housing." However, it also recognizes that this Concept Plan process will ultimately determine the set of land uses at Frog Pond, and it does not set specific expectations for the East and South Neighborhoods.

- **Compatibility.** Housing in Frog Pond should be somewhat compatible with the densities and housing types that have been historically developed in Wilsonville's neighborhoods.

Based on these principles, Table 12 below summarizes LCG's high level forecast of likely housing demand in the Frog Pond Area during the next two decades.

The level of demand within each housing type is reflected by the length of the blue bars at right—the longer the bar, the greater the demand. This reflects a general, high level assessment of demand; the specific quantitative implications (i.e., the number of units likely to be built) are discussed in the following pages.

Table 12. Housing Demand Summary

Housing Type		Household Type			
	Lot Size Average	Boomers	Familes with Children	Couples, Single Parents, Non Family HHs	Combined All Households
Large Lot Single Family	7,500				
Medium Lot Single Family	5,000				
Small Lot Single Family	3,500				
Attached Single Family: Townhomes & Duplexes	2,250				
Multifamily: Apts, Condos, and Senior Housing	NA				

Source: Leland Consulting Group.

Housing Development Scenarios

Two housing development programs, or scenarios, for both the West Neighborhood, and the East and South Neighborhoods combined, are shown below, along with a brief summary of the rationale behind each. These housing scenarios will be used by the Frog Pond team—including the City, Angelo Planning Group, and the public—to inform Concept Plan (physical design) alternatives for the area. The scenarios may also be used to test the capacity of transportation, sewer, and water infrastructure, and for other elements of the Concept Plan process. LCG expects that they may be revised later in the planning process.

There is no single correct housing program for Frog Pond. Rather, there are multiple ways that housing at Frog Pond can meet the demand for housing that will be expressed by a variety of different household types that will consider moving to the area in the coming decades. Communities such as Villebois, Charbonneau, and Wilsonville's other neighborhoods each represent a somewhat different approach to appealing to potential residents.

West Neighborhood

The two tables below show Development Scenarios 1 and 2 for the Frog Pond West Neighborhood.

Scenario 1 is approximately the same density (7.7 dwelling units per net acre) as the average density of all single-family housing built in Wilsonville between 2000 and 2012 (see page 25). Ninety-four percent of the housing is single-family detached, which meets the Residential Land Study policy guidance. Nearly 60 percent of all housing is medium lot single-family, with lots between 4,000 and 6,000 square feet, which can be considered a "standard" residential lot. One drawback of this scenario is that the density may be too low to generate the revenues (through lot sales and systems development charges) necessary to build the highquality infrastructure expected in a complete, walkable community.

Scenario 2 has more housing diversity and is slightly denser. The overall density (10.6 dwelling units per net acre) is similar to all housing (including single and multifamily) built in residential-designated land in Wilsonville between 2000 and 2012 (see page 25). Sixty-nine percent of all housing is single-family detached, which should meet the intent of the Residential Land Study policy guidance. This scenario is more likely to achieve the principles of housing diversity and fostering a walkable community than Scenario 1. It is also more likely to meet the housing needs of 65+ and non-traditional households through the provision of more small lot single-family homes, as well as a greater share of attached and multifamily homes. This scenario would likely accommodate a single market rate or age-restricted multifamily project, which tend to start at about 150 units in size.

Table 13. West Neighborhood: Development Scenario 1

Housing Type	Lot Size	Net	Units		Net Acres	
	Average	Density	#	%	#	%
Large Lot Single Family	7,500	6.0	155	22%	25	28%
Medium Lot Single Family	5,000	7.5	410	59%	55	60%
Small Lot Single Family	3,500	11.0	90	13%	8	9%
Attached Single Family	2,250	16.0	45	6%	3	3%
Multifamily	NA	25.0	-	0%	-	0%
Total			700	100%	**91**	100%
Average		**7.7**				

Table 14. West Neighborhood: Development Scenario 2

Housing Type	Lot Size	Net	Units		Net Acres	
	Average	Density	#	%	#	%
Large Lot Single Family	7,500	6.0	65	7%	11	12%
Medium Lot Single Family	5,000	7.5	245	25%	33	36%
Small Lot Single Family	3,500	11.0	360	37%	33	36%
Attached Single Family	2,250	16.0	115	12%	7	8%
Multifamily	NA	25.0	180	19%	7	8%
Total			965	100%	**91**	100%
Average		**10.6**				

Source: Leland Consulting Group.

East and South Neighborhoods

The two tables below show Development Scenarios 1 and 2 for the Frog Pond East and South Neighborhoods.

Scenario 1 is approximately the same density (10.5 dwelling units per net acre) as all housing (including single and multifamily) built in residential-designated land in Wilsonville between 2000 and 2012 (see page 25). The majority (72 percent) of all housing is single-family detached, which is likely to be consistent and compatible with the Residential Land Study policy guidance for Frog Pond West. This scenario also provides some housing diversity and will meet the demands of some 65+ and non-traditional households through the provision of small lot single-family, single-family attached, and multifamily homes. By providing a significant share of these more compact housing types, this scenario should be able to foster a walkable community.

Scenario 2 is similar in terms of density (12.0 dwelling units per net acre) as all housing (including single and multifamily) built in Wilsonville between 2000 and 2012; this includes housing built in residential-designated land and in village-designated (Villebois) land. A majority (63 percent) of all housing is single-family detached, which is likely to be consistent and compatible with the Residential Land Study policy guidance for Frog Pond West. This scenario also provides more housing diversity than Scenario 1, which will meet the demands of some 65+ and non-traditional households through the provision of small lot single-family, single-family attached, and multifamily homes. This significant number of more compact housing types could be clustered in the center of the neighborhood around shops and open space in order to create a small retail and social hub for Frog Pond, putting more services within walking distance. This scenario would likely accommodate several market rate or age-restricted multifamily projects, which tend to start at about 150 units in size.

Table 15. East and South Neighborhoods: Development Scenario 1

Housing Type	Lot Size	Net	Units		Net Acres	
	Average	Density	#	%	#	%
Large Lot Single Family	7,500	6.0	45	3%	7	5%
Medium Lot Single Family	5,000	7.5	435	29%	58	40%
Small Lot Single Family	3,500	11.0	620	41%	57	39%
Attached Single Family	2,250	16.0	280	18%	17	12%
Multifamily	NA	25.0	145	10%	6	4%
Total			1,525	100%	**145**	100%
Average		**10.5**				

Table 16. East and South Neighborhoods: Development Scenario 2

Housing Type	Lot Size Average	Net Density	Units #	Units %	Net Acres #	Net Acres %
Large Lot Single Family	7,500	6.0	35	2%	6	4%
Medium Lot Single Family	5,000	7.5	360	21%	48	33%
Small Lot Single Family	3,500	11.0	700	40%	64	44%
Attached Single Family	2,250	16.0	280	16%	17	12%
Multifamily	NA	25.0	365	21%	15	10%
Total			1,740	100%	**145**	103%
Average		**12.0**				

Source: Leland Consulting Group.

Frog Pond Area: All Neighborhoods Combined

Table 17 shows the results of combining the scenarios for both areas. The total number of housing units likely to be built in the area ranges from about 2,200 to 2,700.

Table 17. Development Scenarios for Entire Frog Pond Area

Housing Type	UGB Area		Urban Reserve		Entire Study Area	
	Low 1	High 2	Low 1	High 2	Low	High
Large Lot Single Family	155	65	45	35	200	100
Medium Lot Single Family	410	245	435	360	845	605
Small Lot Single Family	90	360	620	700	710	1,060
Attached Single Family	45	115	280	280	325	395
Multifamily	-	180	145	365	145	545
Total	**700**	**965**	**1,525**	**1,740**	**2,225**	**2,705**

Source: Leland Consulting Group.

A combination of these scenarios, or a variation on them, could be implemented. During this Concept Plan process, a preferred scenario should be selected based on this market analysis, the land planning process, input from the public and other stakeholders, transportation and infrastructure analysis, and other factors.

Absorption

Housing absorption—the rate of housing construction and sales—at Frog Pond will depend on a number of factors, including the actual rate of population and household growth in the metropolitan and market areas, economic conditions, when the areas are served with infrastructure and available for development, and the sales pace at Villebois, which will both complement and compete with Frog Pond.

Because of these variables, LCG created two different absorption forecasts, a "goal" or aggressive forecast, and a conservative forecast as shown in Table 18 below. The goal reflects developers' and potentially the City's desire for relatively quick absorption, and a build out of between nine and 13 years for the West Neighborhood, and 15 to 17 years for the East and South Neighborhoods. This goal forecast is only achievable if Wilsonville's population and households continues to grow at the same pace as the city grew during the 2000 to 2012 period (2.8 percent per year). If the city grows at the slower rate projected by Metro (1.8 percent per year), the conservative absorption rate is more likely.

Table 18. Frog Pond Absorption Forecasts

Neighborhood	Dwelling Units		Goal		Conservative	
	Scenario 1	Scenario 2	Absorption	Years to Buildout	Absorption	Years to Buildout
West	700	965	75	9 to 13	60	12 to 16
East and South	1,525	1,740	100	15 to 17	60	25 to 29
Total	**2,225**	**2,705**	**175**		**120**	

At peak development levels, when the West, East, and South Neighborhoods are developing and selling at the same time, LCG projects that annual absorption will be between 120 and 175 units per year. For purposes of comparison, about 125 homes were sold at Villebois in 2013, and there should be well over 200 sold at Villebois in 2014. However, the sales rate during the recession was much slower, generally between 40 and 80 units per year.

Assuming that the East and South Neighborhoods are available for development in 2022, the peak development and sales period for Frog Pond would take place between 2022 and 2032. Assuming that development begins in the West Neighborhood in 2017, it will be fully developed by about 2032.

Absorption is important for several reasons. A faster build out increases developers' return on investment, land values, and the systems development charges and other public revenues that help to fund infrastructure.

Retail Market Analysis

Figure 10 shows the Frog Pond Area and the key retail/commercial nodes that are located nearby. The commercial cluster to the north at the Elligsen Road interchange is anchored by Target and Costco; the cluster to the south includes retail centers on both sides of I-5 around Wilsonville Road, and includes anchor retailers such as Fred Meyer and Albertsons. One benefit that both of these clusters have over Frog Pond is the very high traffic, visibility, and access that comes with their location near I-5, and along major high volume arterial roads.

Figure 10. Frog Pond Retail Context

Source: Leland Consulting Group.

Retail at Frog Pond will need to consider these other retail centers, and establish an effective role and niche in order to compete effectively.

Frog Pond's location at the "crossroads" of Wilsonville/Stafford and Boeckman/Advance Roads is positive for potential retail, since retailers depend on visibility and accessibility to customers. "Interior" retail locations such as the retails centers at Villebois and Charbonneau can struggle due to lower levels of drive-by traffic, visibility, and access. Average daily traffic (ADT) levels of about 5,000 on the two arterials are shown on Figure 10. These are too low today to attract retail development, however, they will increase in the future as housing development takes place and the region grows and they reflect significant pass through traffic already. The City's Transportation System Plan forecasts that ADT on these two roads will approximately double in the next 20 years.

Figure 10 also shows the primary retail market area, within the dashed white line. This includes the Frog Pond study area, as well as some built out residential areas to the northwest, west, and southwest. There are currently about 1,150 households living in these existing neighborhoods, and these households are the most likely potential shoppers in addition to those living in Frog Pond proper.

Taking into account this existing stock of about 1,150 households and the approximately 2,500 new households likely to ultimately reside at Frog Pond, there will be about 3,650 households in the primary market area at full project build out in 2035. Retail spending from these households could be supplemented by drive-by shoppers, and by employees who work to the west. However, these secondary markets (drive-by and employees) are already well served by retail to the north and south, and close to those centers.

Types of Retail Centers

Retail is typically built in a series of standard formats, and while these vary somewhat, they maintain general consistency in terms of anchor tenants, size (square footage), trade area, and other features. Several types of retail centers are summarized below. A corner store, convenience center, or neighborhood center are the most appropriate types of retail for Frog Pond. The 3,650 households projected in the primary market area at Frog Pond suggests that a convenience center would likely be feasible, and a grocery-anchored neighborhood center would be a stretch. While neighborhood centers often have a two-mile trade area, such a large trade area is unlikely in this case given the competitive retailers nearby to the north and south.

Table 19. Types of Retail Centers

Retail Center Type	Gross Retail Area	Dwellings Necessary To Support	Average Trade Area	Anchor Tenants
Corner Store	1,500 - 3,000	1,000	Neighborhood	Corner store
Convenience Center	10,000 - 30,000	2,000	1 mile radius	Specialty food or pharmacy
Neighborhood Center	60,000 - 90,000	6 - 8,000	2 mile radius	Supermarket and pharmacy
Community Center	100,000 - 400,000	20,000+	5 mile radius	Junior department store

Sources: Urban Land Institute, Leland Consulting Group.

Corner stores and convenience centers may not be as desirable as a full neighborhood center. They often do not create the same sense of place or have the same quality of design as a neighborhood center, and they do not fulfill the full range of daily needs, particularly in terms of food.
Larger regional and lifestyle center information is not shown, since those center types already exist at large freeway interchanges to the north and south and require very high volume transportation infrastructure, and are therefore not appropriate for Frog Pond.

Retail Demand

Retail demand was evaluated for two different future years and is shown in the two tables below. Table 20 shows retail demand in 2025, when the Frog Pond Area will be about halfway to full build out. In 2025, a typical grocery-anchored neighborhood center could not be supported. A typical grocery store is between 40,000 and 60,000 square feet, and this model shows support for only 27,200 square feet. A grocery is the anchor tenant for neighborhood centers, and developers will not build the rest of the center if the anchor is not feasible.

Table 20. Retail Demand and Supportable Retail Area: 2025

Retail Type	Future Demand (Retail Potential) $ million	Current Supply (Retail Sales) $ million	Spending Gap $ million	Sales PSF	Capture Rate	Net New Demand Square feet
Furniture & Home Furnishings Stores	$1.6	$0.2	$1.4	$275	10%	500
Electronics & Appliance Stores	$2.1	$1.2	$0.9	$325	10%	300
Bldg Materials, Garden Equip. & Supply Stores	$2.2	-	$2.2	$325	10%	700
Grocery Stores / Food and Beverage	$13.7	-	$13.7	$400	80%	27,200
Health & Personal Care Stores	$3.9	-	$3.9	$350	15%	1,650
Gasoline Stations	$6.7	-	$6.7	$1,200	10%	600
Clothing & Clothing Accessories Stores	$4.4	$0.2	$4.2	$300	10%	1,400
Sporting Goods, Hobby, Book & Music Stores	$2.0	$0.1	$1.9	$275	10%	700
General Merchandise Stores	$13.5	-	$13.5	$275	10%	4,900
Miscellaneous Store Retailers	$2.5	0.53	$1.9	$225	20%	1,800
Food Services & Drinking Places	$8.2	$1.2	$7.0	$325	20%	4,400
Total						**44,150**

Sources: ESRI Business Analyst, Leland Consulting Group.

Table 21 shows retail demand in 2035, when the Frog Pond Area is expected to be near completion.

Table 21. Retail Demand and Supportable Retail Area: 2035

Retail Type	Future Demand (Retail Potential) $ million	Current Supply (Retail Sales) $ million	Spending Gap $ million	Sales PSF	Capture Rate	Net New Demand Square feet
Furniture & Home Furnishings Stores	$2.5	$0.2	$2.3	$275	10%	800
Electronics & Appliance Stores	$3.2	$1.2	$2.0	$325	10%	600
Bldg Materials, Garden Equip. & Supply Stores	$3.4	-	$3.4	$325	10%	1,000
Grocery Stores / Food and Beverage	$21.0	-	$21.0	$400	80%	42,400
Health & Personal Care Stores	$6.1	-	$6.1	$350	15%	2,550
Gasoline Stations	$10.4	-	$10.4	$1,200	10%	900
Clothing & Clothing Accessories Stores	$6.8	$0.2	$6.6	$300	10%	2,200
Sporting Goods, Hobby, Book & Music Stores	$3.1	$0.1	$3.0	$275	10%	1,100
General Merchandise Stores	$20.8	-	$20.8	$275	10%	7,600
Miscellaneous Store Retailers	$3.8	0.53	$3.3	$225	20%	3,000
Food Services & Drinking Places	$12.6	$1.2	$11.4	$325	20%	7,000
Total						**69,150**

Sources: ESRI Business Analyst, Leland Consulting Group.

In 2035, a typical grocery-anchored neighborhood center is *potentially* feasibly. The anchor grocery store is closer to feasibility, and the total square footage in demand is within the typical range of neighborhood centers shown in Table 19. This level of demand is close to the point at which retail developers, in many years, would likely conduct a closer and more detailed feasibility analysis that takes into account the strength of the competitive retail centers, household demographics, traffic patterns, potential tenants, and other factors at that time. Retail is a dynamic type of development, and formats can change significantly over a decade. For example, large stores selling videos, compact discs, and books were commonplace in neighborhood retail centers a decade ago; now they have all but disappeared; photo developers and travel agencies are also rare today.

Retail feasibility will depend on what if any retail is developed in other locations. For example, a new retail center located to the west of the Frog Pond Area on Boeckman Road would absorb demand from Frog Pond and potentially preclude new development in the study area. This analysis assumes that no new retail is built within a one-mile radius of the Boeckman and Wilsonville Road intersection.

Retailer developers may decide to wait until after 2035 to build significant retail, when additional Urban Reserve Areas such as the Elligsen Urban Reserve Area to the north may enter the UGB. Finally, buildable land will be necessary to accommodate new retail development.

Retail development in edge locations such as Frog Pond is challenging and requires the right mix of pass-by traffic and visibility, a dearth of strong competition in the primary market area, and adequate population. This also underscores the adage that “retail follows rooftops” and gets developed only when there is sufficient housing to support it.

Retail as Place Making

While it is often difficult to attract retail to new communities on the edge of metropolitan regions, retail often helps to achieve the goal of building a “complete community” where residents can easily meet their daily needs on foot or by car. Such local-serving retail also provides a social hub and community-building function, and drives faster housing sales since this is seen as a top amenity by many prospective residents (see Community Preferences on page 17).

There are few good examples of successful, small-scale, local-serving retail in suburban locations. One example is at NorthWest Crossing, a master planned community on edge of the Bend metro area. Northwest Crossing contains about 35,000 square feet of retail, and though the space has for some periods had high vacancy rates, it provides a strong sense of place, and both a gateway and center for the community. The Northwest Crossing retail area is pictured below hosting a farmers market.

Appendices

Selected References

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Wilsonville Demographic Tapestry Segments

As shown in Table 22 below, the City of Wilsonville is dominated by three main tapestry segments—Enterprising Professionals, Silver and Gold, and Up and Coming Families—which together comprise 95 of the city's total population. ESRI estimates that the Enterprising Professionals group alone accounts for 65 percent of the city's population, and is therefore 34 times more prevalent than in the nation at large.

Table 22. City of Wilsonville's Primary Tapestry Segments

Tapestry Segment	Percent of Households		
	City of Wilsonville	United States	Prevalence Compared to US
Enterprising Professionals	65%	2%	34
Silver and Gold	19%	1%	19
Up and Coming Families	12%	4%	3
Urban Chic	4%	1%	3
Exurbanites	1%	3%	0
All others	0%	89%	NA

Source: ESRI, Leland Consulting Group.

Enterprising Professionals

65% of Wilsonville Population

Demographic

- Young, educated, single, married, working professionals, residents of Enterprising Professionals neighborhoods have a median age of 33.2 years.
- Forty-three percent of the households are singles who live alone or share housing with roommates, and 43 percent are married couple families.
- With an annual household growth of 1.95 percent per year since 2000, the households in this segment comprise approximately two percent of total U.S. households.
- The diversity of the population is similar to that of the U.S. Most of the residents are Caucasian; however, 12.4 percent are Asian.

Socioeconomic

- Median household income is $61,151.
- Ninety percent of the households earn income from wages and salaries; 39 percent receive income from investments.
- This is an educated group: approximately half of the population aged 25 years and older hold a bachelor's or graduate degree; more than three in four have attended college.
- These working professionals are employed in various jobs, especially in management, finance, computer, sales, and office/administrative support.

Residential

- Enterprising Professionals residents move frequently to find growth opportunities and better jobs, especially in cities such as Chicago, Atlanta, and Seattle.
- Forty-six percent of the households are located in the South, 29 percent are in the West, and 20 percent are in the Midwest.
- They prefer to own instead of rent in newer neighborhoods of townhouses or apartments. The median home value is $239,007.
- For those who rent, the average gross rent is 36 percent higher than the U.S. average.

Preferences

- They are young and mobile with growing consumer clout.
- Those who rent hold renter's insurance policies.
- They rely on cell phones and e-mail to stay in touch.
- They go online to download videos and music, track their investments, and shop for items, including personal computers and software.
- They own laptops, video game systems, and digital camcorders. They love to travel abroad and in the U.S. often.
- They play video games, visit theme parks, jog, and swim. They read computer, science, and technology magazines and listen to alternative, public-all-talk, and sports radio.
- They eat out at Cheesecake Factory and Chili's Grill and Bar. They shop for groceries at stores such as Publix and Albertson's.

Silver and Gold

19% of Wilsonville Population

Demographic

- With a median age of 61.3 years, Silver and Gold residents are the second oldest of the Tapestry segments.
- More than 70 percent are aged 55 years or older.
- Most residents have retired from professional occupations. Half of the households are composed of married couples without children.
- This segment is small, less than one percent of all U.S. households; however, annual household growth is 0.66 percent since 2000. Residents of these neighborhoods are not ethnically diverse; 93 percent of them are Caucasian.

Socioeconomic

- These are wealthy, educated seniors. Their median household income is $62,157.
- Fifty-six percent of the households still earn wages or salaries, half collect Social Security benefits, 63 percent receive investment income, and 35 percent collect retirement income.
- The percentage of those who work from home is higher than the U.S. worker percentage; nearly one-fourth of employed residents are self-employed, also higher than the U.S. level.

Residential

- Their affluence enables them to relocate to sunnier climates. More than 60 percent of these households are in the South, mainly in Florida.
- One-fourth of this Tapestry segment is located in the West, mainly in California and Arizona. Neighborhoods are exclusive with a home ownership rate of 81 percent.
- The median home value is $290,103. Silver and Gold ranks second of the Tapestry segments for the percentage of seasonal housing owners.
- Because these seniors have moved to newer single-family homes, they are not living in the homes where they raised their children.

Preferences

- Silver and Gold residents have the free time and resources to pursue their interests.
- They travel domestically and abroad including cruise vacations. They are also interested in home improvement and remodeling projects.
- Although they own the tools and are interested in home improvement and remodeling projects, they are more likely to contract for remodeling and housecleaning services.
- Active in their communities, they join civic clubs, participate in local civic issues, and write to newspaper or magazine editors. They prefer to shop by phone from catalogs such as L.L. Bean and Lands’ End.
- Golf is more a way of life than just a leisure pursuit. They play golf, attend tournaments, and watch The Golf Channel. They also go to horse races, bird watching, saltwater fishing, and power boating. They eat out, attend classical music performances, and relax with a glass of wine.
- Favorite restaurants include Outback Steakhouse, Cracker Barrel, and Applebee’s. Silver and Gold residents are avid readers of biography and mystery books and watch numerous news programs and news channels such as Fox News and CNN. Favorite non-news programs include detective dramas.

Up and Coming Families

12% of Wilsonville Population

Demographic

- With an annual household growth rate of 1.69 percent, Up and Coming Families represents Tapestry's second highest household growth market.
- A mix of Generation Xers and Baby Boomers with a median age of 32.8 years, this segment is the youngest of Tapestry's affluent family markets.
- Residents of these neighborhoods are young, affluent families with younger children.
- Eighty percent of the households are families. Most of the residents are white; however, diversity is increasing as the segment grows.

Socioeconomic

- Beginning their careers, residents of Up and Coming Families are earning above-average incomes. The median household income is $73,906, higher than the national median.
- Two-thirds of the residents aged 25 years and older have attended college; more than one in five holds a bachelor's degree.
- Ninety-one percent of households earn income from wages and salaries.
- Although half of the households have children, they also have working parents.

Residential

- In the suburban outskirts of midsized metropolitan areas with populations higher than 250,000, approximately half of Up and Coming Families neighborhoods are concentrated in the South, the other half in the West and Midwest.
- Most residents live in new single-family housing; with a median home value of $193,161. More than half the housing units were built in the last 10 years.
- Homeownership is at 80 percent.

Preferences

- Family and home dictate the products these residents buy.
- Many are beginning or expanding their families, so baby equipment, children's clothing, and toys are essential purchases.
- Because many are first-time homeowners, basic household furniture and lawn fertilizer, weed control, and insecticide products are important.
- Car loans and mortgage payments are major household budget items. They are most likely to own or lease an SUV or a minivan.
- They eat out at family restaurants, especially on the weekends, and buy fast food at the drive-through or for takeout.
- They play softball, take the kids to the zoo, and visit theme parks (generally Sea World or Disney World) where they make good use of their digital camera or camcorder.
- They rent comedy, family, and action/adventure DVDs. Cable station favorites include Country Music Channel, ESPN News, The Learning Channel, and the Disney Channel. They listen to country, soft rock, and contemporary hit radio.

Appendix D. Transportation Analyses

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MEMORANDUM

DATE: August 8, 2014

TO: Project Team

FROM: Scott Mansur, P.E., PTOE
Brad Coy, P.E.
Halston Tuss, E.I.T.

SUBJECT: **Frog Pond Area Plan Existing and Baseline Transportation Analysis** P14033-000

This memorandum documents traffic analysis performed in association with the Frog Pond Area Plan in Wilsonville, Oregon. An executive summary is provided. The following sections of this memorandum document the existing traffic conditions (2014), future traffic conditions (2035), and a sensitivity analysis of the I-5 interchange areas (2035). The year 2035 was selected for future analysis to be consistent with the Metro Regional Transportation Plan (RTP) and Wilsonville Transportation System Plan (TSP)[1] horizon year. The Frog Pond Area Plan map identifying the project limits and sub-areas is attached in the Appendix.

Executive Summary

To determine existing and future baseline transportation conditions for the Frog Pond Area Plan, a high-level transportation analysis was performed. The analysis focused on the major intersections within the project vicinity and at the City's two I-5 interchange areas (i.e., Wilsonville Road and Elligsen Road). This includes the 12 existing intersections and three potential new access points most likely to be impacted by the Master Plan area. In addition, a sensitivity analysis was performed to determine what effect varying amounts of land use development would have on the City's two I-5 interchange areas.

The existing conditions analysis was based on recent 2014 traffic counts and existing geometries, while the future baseline analysis was based on traffic forecasts for the 2035 horizon year and improved intersection geometries associated with all High Priority Projects included in Wilsonville's TSP. The future land use assumptions are consistent with the Metro "Gamma" model, which was used to update the travel demand model that was previously developed for the Wilsonville TSP. The future sensitivity analysis scenarios accounted for (1) no growth and (2) full build-out of the study area, which includes the Frog Pond Urban Growth Boundary (UGB) area and Urban Reserve Area (URA).

Intersection traffic operations were analyzed for the weekday p.m. peak hour under each existing and future scenario to evaluate how well the study intersections meet desired performance levels as required by the City of Wilsonville, Clackamas County, and Oregon Department of Transportation (ODOT). All intersections currently meet operating standards and targets, and most are expected to continue to meet standards and targets in the

[1] *Wilsonville Transportation System Plan*, Adopted by Council (Ordinance 718), June 17, 2013.

future assuming the completion of the High Priority Projects identified in the TSP. The main exceptions are the access points, which were analyzed as stop controlled intersections. Although the completion of High Priority Projects identified in the Wilsonville TSP are assumed for the future scenario, the following are essential prior to development of the Frog Pond Area:

- Signalized intersection at SW Boeckman Road/SW Canyon Creek Road
- Signalized intersection at SW Advance Road-Boeckman Road/SW Stafford Road-Wilsonville Road
- Roundabout combining the existing intersections of SW Elligsen Road/SW 65th Avenue and SW Stafford Road/SW 65th Avenue.

With the significant amount of traffic accessing Stafford Road and Boeckman Road, a traffic signal, roundabout, or other traffic control improvements may be needed at key access points to these future development areas. These improvement alternatives will be evaluated as part of future transportation analysis for this project.

The Wilsonville Road/I-5 Southbound Entrance Ramp meter was found to be overcapacity with the addition of future 2035 traffic volumes. Additional coordination with ODOT will be necessary to determine future operations of the I-5 Southbound Ramp meter and the impacts to Wilsonville Road as future growth occurs.

Existing Traffic Conditions (2014)

Existing traffic conditions were evaluated for the study area and include traffic volumes; intersection operations; bike, pedestrian, transit, and trail conditions and needs; and collision history.

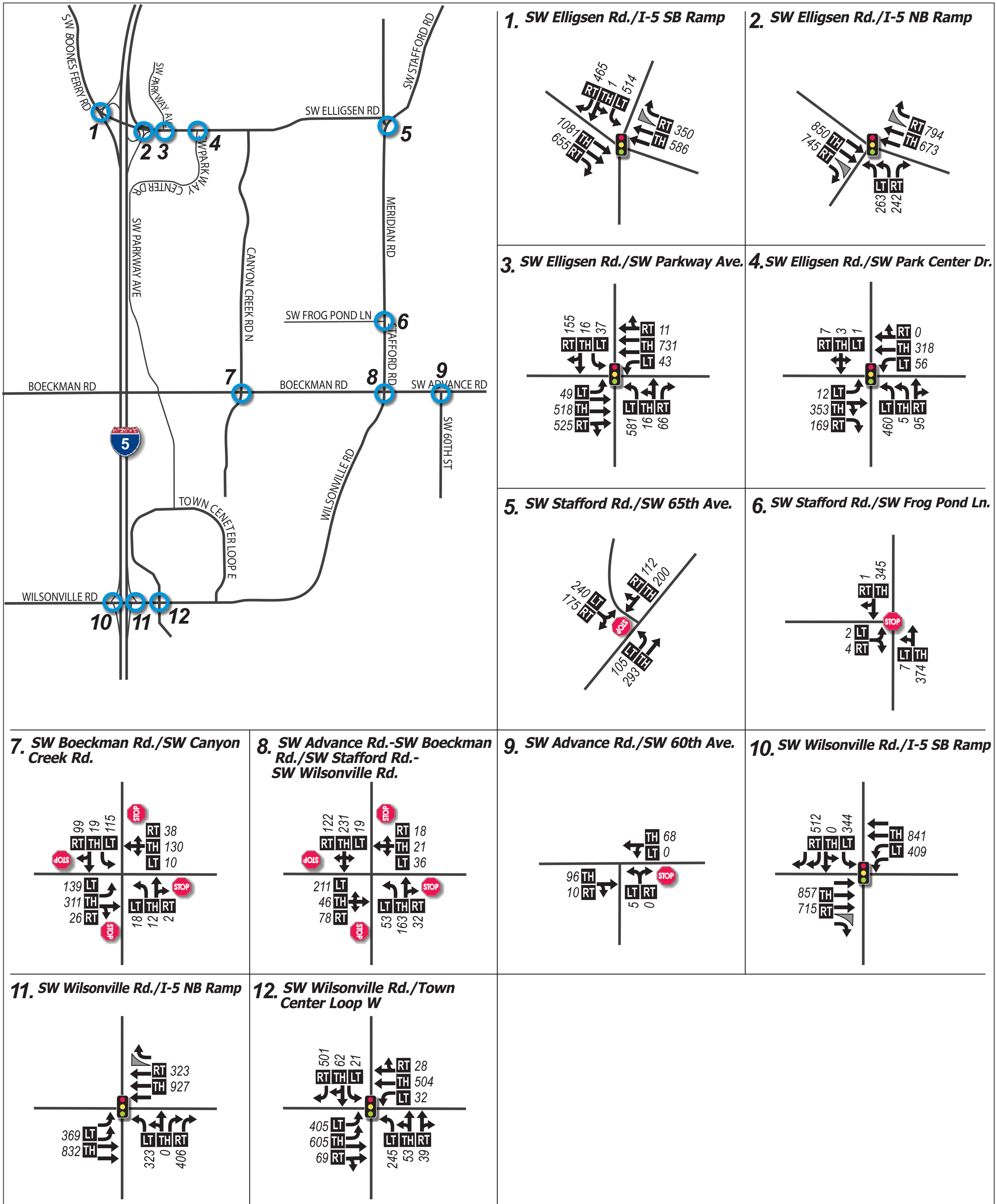
Existing Traffic Volumes

Traffic counts were collected for the p.m. peak period (4:00 to 6:00 p.m.) at the following study intersections[2]:

- SW Advance Road-Boeckman Road/SW Stafford Road-Wilsonville Road
- SW Stafford Road/SW 65th Avenue
- SW Stafford Road/Frog Pond Lane
- SW Advance Road/SW 60th Avenue
- SW Boeckman Road/SW Canyon Creek Road
- SW Wilsonville Road/Town Center Loop West
- SW Wilsonville Road/I-5 Northbound Ramp
- SW Wilsonville Road/I-5 Southbound Ramp
- SW Elligsen Road/SW Parkway Center Drive
- SW Elligsen Road/SW Parkway Avenue
- SW Elligsen Road/I-5 Northbound Ramp
- SW Elligsen Road/I-5 Southbound Ramp

The p.m. peak hour traffic volumes (i.e., the highest hourly volumes during the peak period) are shown in Figure 1, and detailed peak period counts are provided in the appendix.

[2] SW Wilsonville Road interchange area counts collected October 30, 2012, SW Elligsen Road counts collected February 12, 2014, and remaining study intersections collected April 16, 2014



LEGEND

- # - Study Intersection
- Traffic Signal
- STOP - Stop Sign
- ← - Lane Configuration
- 000 - PM Peak Hour Traffic Volumes
- LT TH RT (Left•Thru•Right) - Volume Turn Movement

DKS

No Scale

Figure 1

2014 EXISTING PM PEAK HOUR TRAFFIC VOLUMES

Existing Intersection Operations

Intersection operations were analyzed for the p.m. peak hour to evaluate whether the transportation network currently operates within desired performance levels as required by the City of Wilsonville, Clackamas County, and ODOT. Intersections are the focus of the analysis because they are the controlling bottlenecks of traffic flow and the ability of a roadway system to carry traffic efficiently is nearly always diminished in their vicinity.

The existing p.m. peak hour intersection operations at the study intersection were determined based on the *2000 Highway Capacity Manual* methodology.[3] Table 1 lists the estimated average delay (in seconds), level of service (LOS), and volume to capacity (v/c) ratio for each study intersection.[4] As shown, all intersections currently meet operating standards and targets with exception of SW Stafford Road/SW 65th Avenue.

Table 1: 2014 Existing P.M. Peak Hour Intersection Operating Conditions

Intersection	Jurisdiction	Operating Standard or Target	PM Peak Hour			Meets Standard or Target?
			Delay (sec)	*LOS*	*V/C*	
Signalized						
SW Elligsen Rd/I-5 SB Ramp	ODOT	0.85 V/C	15.8	B	0.59	Yes
SW Elligsen Rd/I-5 NB Ramp	ODOT	0.85 V/C	8.7	A	0.53	Yes
SW Elligsen Rd/SW Parkway Ave	Wilsonville	LOS D	24.8	C	0.47	Yes
SW Elligsen Rd/SW Park Center Dr	Wilsonville	LOS D	26.7	C	0.53	Yes
SW Wilsonville Rd/I-5 SB Ramp	ODOT	0.85 V/C	23.1	C	0.61	Yes
SW Wilsonville Rd/I-5 NB Ramp	ODOT	0.85 V/C	20.9	C	0.47	Yes
SW Wilsonville Rd/Town Center Loop W	Wilsonville	LOS D	33.5	C	0.66	Yes
Unsignalized All-Way Stop						
SW Advance Rd-Boeckman Rd/ SW Stafford Rd-Wilsonville Rd	Wilsonville	LOS D	17.3	C	0.68	Yes
SW Boeckman Rd/SW Canyon Creek Rd	Wilsonville	LOS D	11.9	B	0.57	Yes
Unsignalized Two-Way Stop						
SW Stafford Rd/SW 65th Ave	Clackamas Co.	LOS D	**<u>>50</u>**	**<u>A/F</u>**	**<u>1.19</u>**	**<u>No</u>**
SW Stafford Rd/SW Frog Pond Ln	Clackamas Co.	LOS D	12.5	A/B	0.23	Yes
SW Advance Rd/SW 60th Ave	Clackamas Co.	LOS D	9.9	A/A	0.08	Yes

Signalized Intersections:	Unsignalized Intersections:
LOS = Level of Service of Intersection V/C = Volume-to-Capacity Ratio of Intersection **<u>Bold Underlined</u>** values do not meet standards.	LOS = Level of Service of Major Street/Minor Street V/C = Volume-to-Capacity Ratio of Worst Movement **<u>Bold Underlined</u>** values do not meet standards.

[3] *2000 Highway Capacity Manual*, Transportation Research Board, Washington DC, 2000.

[4] Level of service (LOS) is a “report card” rating (A through F) based on the average delay experienced by vehicles at the intersection. The volume to capacity (v/c) ratio is a decimal representation (typically between 0.00 and 1.00) of the proportion of capacity that is being used at a turn movement, approach leg, or intersection. Additional explanations of these commonly used performance measures are provided in the appendix.

Bike, Pedestrian, Transit, and Trail Conditions and Needs

Bike, pedestrian, transit, and trail conditions and needs were considered for the study area, with particular emphasis on connectivity to Wilsonville's neighborhoods, trails, parks, schools, and Town Center.

In the Frog Pond Area, Wilsonville's transportation system provides limited multimodal connectivity. For example, Boeckman Road has a significant "dip" that would benefit from a new bridge. Because they are on the urban fringe and adjacent to undeveloped land, the nearby roadways also lack of sidewalks, bike lanes, and bus stops in many places. In addition, South Metro Area Regional Transit (SMART) Route 4 runs along Wilsonville Road and Boeckman Road, but only provides limited service in the study area.

The Wilsonville Transportation System Plan (TSP) identifies various multimodal improvement projects that are intended to address the deficiencies. These projects are shown in Figure 2 and include urban upgrades to Boeckman Road and Stafford Road (including bike lanes, sidewalks, and transit stop improvements) as well as new multi-use trails through Frog Pond (including the Boeckman Creek Trail) and enhanced pedestrian crossings of Canyon Creek Road. Further information is provided in the TSP regarding connectivity needs and planned improvements for all modes.

Coordination will also be needed with SMART and TriMet to provide transit service to the area. The study area west of Stafford Road is in the SMART service district, and the area east of Stafford Road in the TriMet service district.

One current project the City is constructing nearby that will improve connectivity is the Canyon Creek Road Extension. This multimodal corridor improvement provides an important piece of the connection between Town Center Loop and the Frog Pond Area.

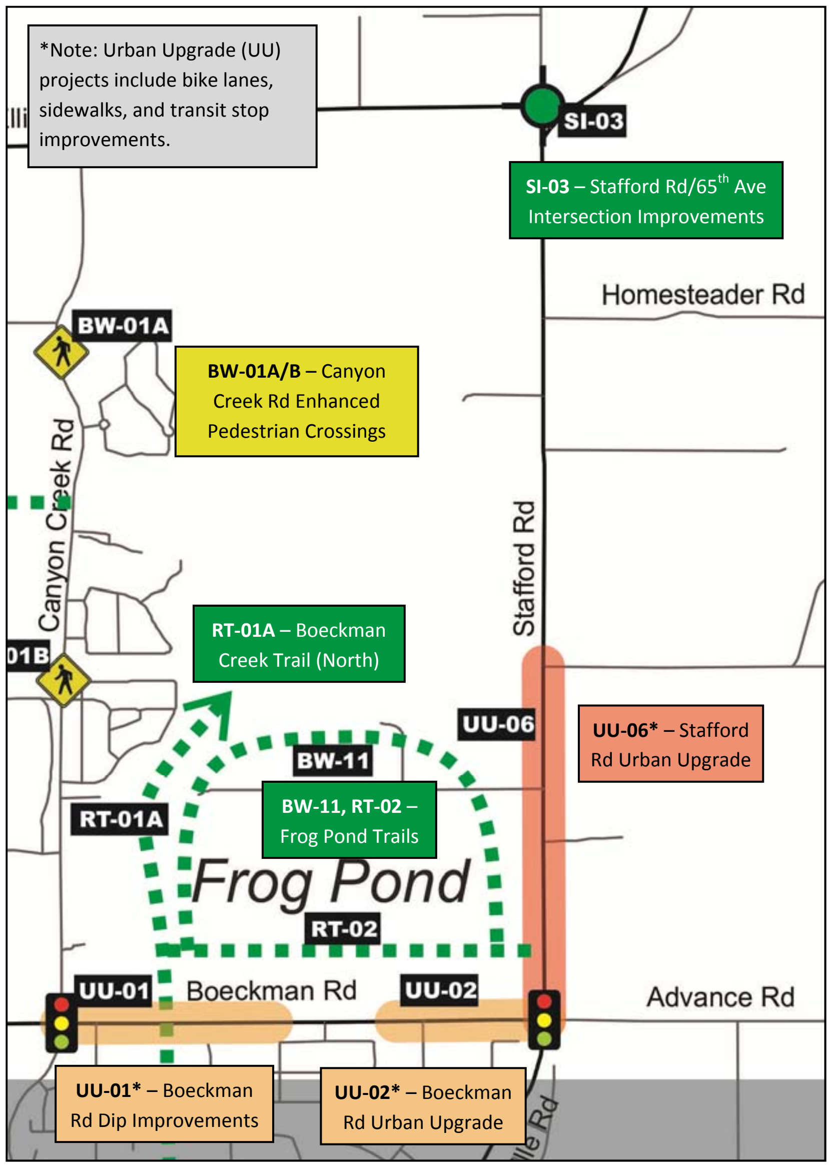


Figure 2: High Priority Projects in Vicinity of Frog Pond Area (from Wilsonville TSP Figure 5-4)

Collision History

Three years of collision records (2010-2012) for the study area were obtained from the ODOT collision database. There were 116 total collisions among all study intersections. As shown in Table 2, there were no intersections that had collision rates in excess of 1.0 collision per million entering vehicles, a common transportation threshold used to identify intersections that require a more detailed safety evaluation.

Table 2: Collision History (2010-2012)

Intersection	Collisions (by Severity)				Collision Rate[b]
	Fatal	*Injury*	*PDO*[a]	*Total*	
SW Elligsen Road/I-5 Southbound Ramp	0	8	9	17	0.43
SW Elligsen Road/I-5 Northbound Ramp	0	9	9	18	0.46
SW Elligsen Road/SW Parkway Avenue	0	1	6	7	0.23
SW Elligsen Road/SW Parkway Center Drive	0	0	1	1	0.06
SW Stafford Road/SW 65th Avenue	0	1	5	6	0.49
SW Stafford Road/Frog Pond Lane	0	0	1	1	0.12
SW Boeckman Road/SW Canyon Creek Road	0	1	0	1	0.10
SW Advance Road-Boeckman Road/SW Stafford Road-Wilsonville Road	0	3	1	4	0.35
SW Advance Road/SW 60th Avenue	0	0	0	0	0.00
SW Wilsonville Road/I-5 Southbound Ramp	0	13	10	23	0.57
SW Wilsonville Road/I-5 Northbound Ramp	0	9	11	20	0.57
SW Wilsonville Road/Town Center Loop West	0	2	16	18	0.64

[a] PDO = Property damage only.
[b] Collision Rate for intersections = average annual collisions per million entering vehicles (MEV); MEV estimates based on p.m. peak-hour traffic count and applicable factors.

Future Traffic Conditions (2035)

Future traffic conditions were evaluated for the study area and include traffic volumes and intersection operations.

Future Traffic Volumes

Future traffic volumes were forecasted for the study intersections using a travel forecast model developed specifically for Wilsonville. The model applies trip generation and trip distribution data directly taken from the Metro Gamma regional travel demand forecast model, but adds additional detail to better represent local travel conditions and routing within Wilsonville. This is the same approach used for the Wilsonville Transportation System Plan (TSP) update; however, the Wilsonville TSP forecast model was prepared in 2011 using the Metro “Beta” model. Since then, Metro has updated their land use and trip generation assumptions to include enhanced modeling methodologies such as peak spreading.

Figure 3 shows the p.m. peak hour traffic volumes for the study intersections and preliminary Frog Pond access points based on the Metro “Gamma” model assumptions. Because the forecasts are consistent with the current Metro land use assumptions, this scenario is referred to as the 2035 Baseline scenario. This scenario is considered a starting point for the Frog Pond Area Plan process, which may result in revised land use recommendations for the project vicinity. It should be noted that the Metro “Gamma” model was used for this study since it represents the latest regionally approved Metroscope land use for Wilsonville and the Region. This model was completed by Metro, in collaboration with the City, after the City’s TSP was approved and includes additional land use assumptions adopted by Metro after the TSP was approved. Using the Metro “Gamma” model is consistent with the guidelines set forth in the Transportation Planning Rule.

Future Intersection Operations

Intersection traffic operations under the future 2035 Baseline scenario were analyzed for the p.m. peak hour to evaluate whether the transportation network is expected to remain within desired performance levels as required by the City of Wilsonville, Clackamas County, and ODOT. This future scenario assumes improved intersection geometries associated with all High Priority Projects included in Wilsonville’s TSP. Specific High Priority Projects near the Frog Pond Area include installation of signalized intersections at SW Boeckman Road/SW Canyon Creek Road and SW Advance Road-SW Boeckman Road/ SW Stafford Road-SW Wilsonville Road, as well as a roundabout combining the existing intersections of SW Elligsen Road/SW 65th Avenue and SW Stafford Road/SW 65th Avenue.

Table 3 lists the estimated average delay (in seconds), level of service (LOS), and volume to capacity (v/c) ratio that each study intersection and future access is expected to experience. As shown, all intersections are expected to meet operating standards and targets with exception of the SW Stafford Road/SW Frog Pond Lane and SW Stafford Road/SW Kahle Rd intersections that were analyzed as access points to the Frog Pond area. It is likely that a single traffic signal at one of the failing intersections would be sufficient to serve the capacity for both locations if there is adequate internal connectivity and circulation design that puts priority on the signalized access. The access locations and necessary traffic control improvements will be analyzed further in future memorandums as Area Plan circulation concepts are developed and refined.

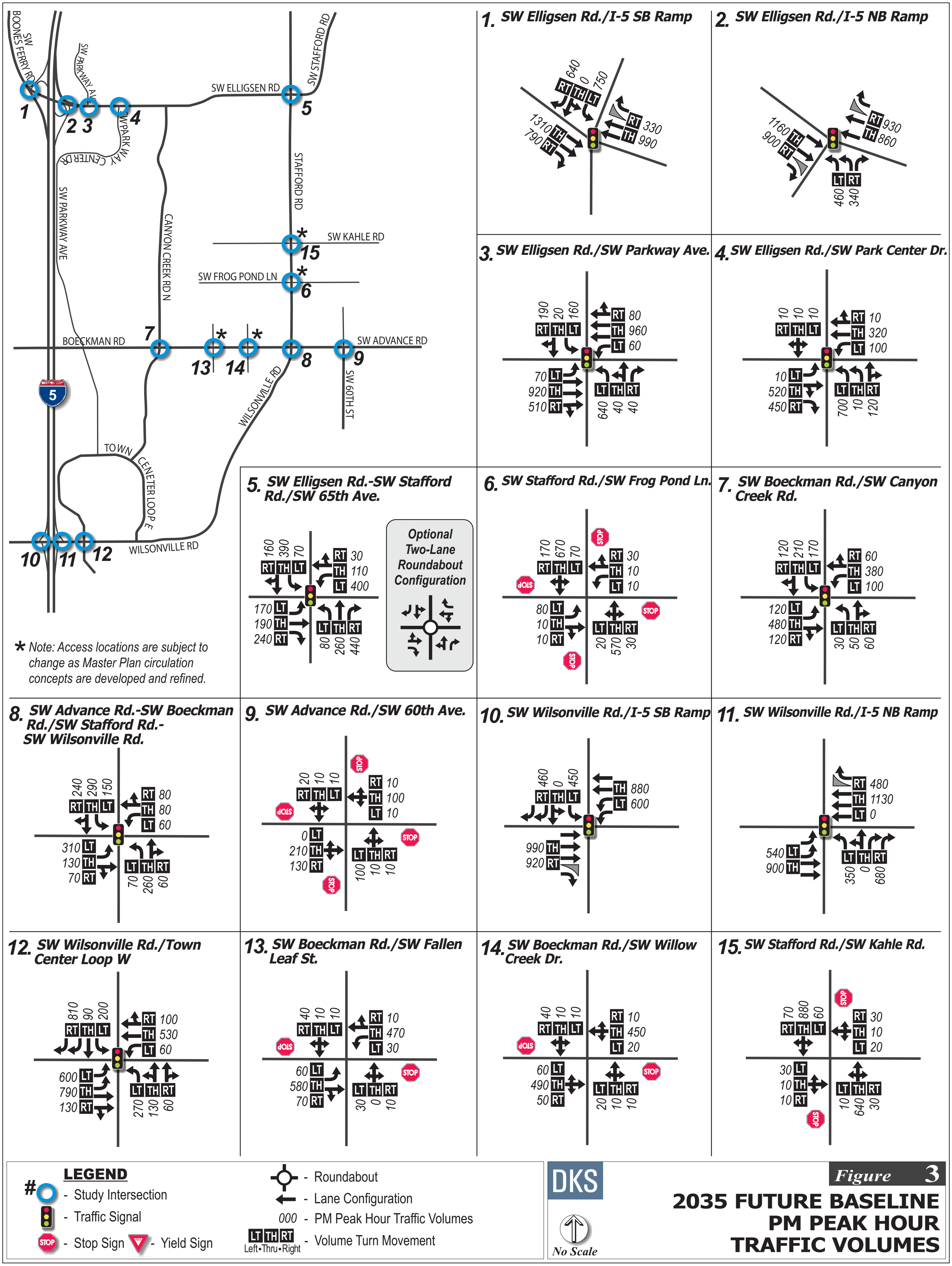


Figure 3

2035 FUTURE BASELINE PM PEAK HOUR TRAFFIC VOLUMES

DKS

Table 3: Future 2035 Baseline P.M. Peak Hour Intersection Operating Conditions

Intersection	Jurisdiction	Operating Standard or Target	PM Peak Hour			Meets Standard or Target?
			Delay	*LOS*	*V/C*	
Signalized						
SW Elligsen Rd/I-5 SB Ramp	ODOT	0.90 V/C[a]	24.2	C	0.90	Yes
SW Elligsen Rd/I-5 NB Ramp	ODOT	0.90 V/C[a]	12.7	B	0.70	Yes
SW Elligsen Rd/SW Parkway Ave	Wilsonville	LOS D	36.5	D	0.78	Yes
SW Elligsen Rd/SW Park Center Dr	Wilsonville	LOS D	32.0	C	0.83	Yes
SW Boeckman Rd/SW Canyon Creek Rd	Wilsonville	LOS D	10.8	B	0.65	Yes
SW Advance Rd-Boeckman Rd/ SW Stafford Rd-Wilsonville Rd	Wilsonville	LOS D	20.6	C	0.63	Yes
SW Wilsonville Rd/I-5 SB Ramp	ODOT	0.90 V/C[a]	30.7	C	0.85	Yes
SW Wilsonville Rd/I-5 NB Ramp	ODOT	0.90 V/C[a]	22.6	C	0.59	Yes
SW Wilsonville Rd/Town Center Loop W	Wilsonville	LOS D	39.9	D	0.82	Yes
Unsignalized Two-Way Stop						
SW Stafford Rd/SW Frog Pond Ln	Clackamas Co.[b]	LOS D	**<u>>50</u>**	**<u>B/F</u>**	**<u>1.64</u>**	**No**
SW Advance Rd/SW 60th Ave	Clackamas Co.[b]	LOS D	17.9	A/C	0.34	Yes
SW Stafford Rd/SW Kahle Rd	Clackamas Co.[b]	LOS D	**<u>>50</u>**	**<u>A/F</u>**	**<u>1.14</u>**	**No**
SW Boeckman Rd/SW Fallen Leaf St	Wilsonville	LOS D	20.2	A/C	0.16	Yes
SW Boeckman Rd/SW Willow Creek Dr	Wilsonville	LOS D	17.5	A/C	0.15	Yes
SW Elligsen Rd/SW Stafford Rd/SW 65th Ave (Two Traffic Control Options)						
Traffic Signal	Clackamas Co.	LOS D	45.6	D	0.89	Yes
Roundabout (2-Lane)	Clackamas Co.	LOS D	17.8	C	0.76	Yes

Signalized Intersections:	Unsignalized Intersections:
LOS = Level of Service of Intersection	LOS = Level of Service of Major Street/Minor Street
V/C = Volume-to-Capacity Ratio of Intersection	V/C = Volume-to-Capacity Ratio of Worst Movement
<u>Bold Underlined</u> values do not meet standards.	**<u>Bold Underlined</u>** values do not meet standards.

[a] The typical ODOT mobility target for interchange ramps is a 0.85 v/c ratio. However, when the interchange vicinity is fully developed and adequate storage is available on the interchange ramp to prevent queues from backing up on the main line, then the target can be increased to a 0.90 v/c ratio. This is the case for the both I-5 interchange areas in Wilsonville.
[b] With annexation of Frog Pond, these intersections will be transferred from Clackamas County to the City of Wilsonville.

Sensitivity Analysis of I-5 Interchange Areas

Sensitivity analysis was performed to determine what effect the projected maximum reasonable build out of the study area would have on the City's two I-5 interchange areas, which include northbound and southbound ramps at SW Wilsonville Road and SW Elligsen Road. This analysis will help determine whether the City's two I-5 interchange areas are expected to have adequate capacity to accommodate future land use growth from this project and what possible mitigations (if any) may be needed.

There were two sensitivity analysis scenarios in addition to the 2035 Baseline scenario described previously. The "2035 Area Plan" scenario assumes the full study area build out, while the "2035 No Build" scenario assumes no development in the study area and is based on 2010 land use levels for that area (but 2035 land use levels for all other areas). Table 4 shows the land use assumptions for the study area based on the 2035 Baseline, No Build, and Area Plan[5] scenarios.

Table 4: Land Use Estimates for Future 2035 Scenarios

Future 2035 Scenario	Households	Employees		
		Retail	*Non-Retail*	*Total*
No Growth	46	0	18	18
Baseline (Metro "Gamma" Model)	1,785	25	491	516
Area Plan	2,812	188	183	371

Table 5 shows the operating standards at the two interchange operations under the three future 2035 scenarios. As shown, development within the study area is projected to result in minor differences of the expected estimated average delay, level of service (LOS), and volume to capacity (v/c) ratio at the two I-5 interchange areas (some slight increases, some slight decreases). However, the interchange area intersections would all still operate within ODOT's mobility targets.

Table 5: I-5 Interchange Operations for 2035 Future Models

Intersection	No Build PM Peak Hour			Baseline PM Peak Hour			Area Plan PM Peak Hour		
	Delay	*LOS*	*V/C*	*Delay*	*LOS*	*V/C*	*Delay*	*LOS*	*V/C*
SW Elligsen Road Interchange Area									
I-5 SB Ramp[a]	24.5	C	0.89	24.2	C	0.90	24.5	C	0.90
I-5 NB Ramp[a]	12.4	B	0.67	12.7	B	0.70	12.8	B	0.66
SW Wilsonville Road Interchange Area									
I-5 SB Ramp[a]	30.2	C	0.84	30.7	C	0.85	29.6	C	0.83
I-5 NB Ramp[a]	22.7	C	0.58	22.6	C	0.59	22.5	C	0.58

Signalized Intersections:
LOS = Level of Service of Intersection
V/C = Volume-to-Capacity Ratio of Intersection

[a] The typical ODOT mobility target for interchange ramps is a 0.85 v/c ratio. However, when the interchange vicinity is fully developed and adequate storage is available on the interchange ramp to prevent queues from backing up on the main line, then the target can be increased to a 0.90 v/c ratio. This is the case for both I-5 interchange areas in Wilsonville.

The primary reason why the Area Plan scenario results only in minor changes to the I-5 interchange ramp operating conditions is because the Area Plan is not dependent upon I-5 for interstate access, and as congestion

[5] The "Area Plan" scenario land use assumptions were intentionally selected to be as high as the team believed could be feasible for the Frog Pond area in order to test the "reasonable worst case" impact to the I-5 interchange. They do not represent recommendations and will not be the starting point for the creation of land use and transportation options in later stages of the project.

on I-5 increases, alternatives routes are expected to be utilized by more drivers. Due to the proximity of the project area to Stafford Road and I-205, less than 10 percent of Area Plan trips are expected to use I-5 during the p.m. peak hour. While approximately 40% of Area Plan trips are expected use Stafford Road to access I-205, only 3% are expected to access I-5 at the Elligsen Road interchange and 5% are expected to use the Wilsonville Road interchange. These small volumes make up a relatively small share of total traffic volumes at the interchanges.

Another key factor is the ratio of Wilsonville's residential units and employment. As Wilsonville continues to increase residential levels within the City, more residential and employment trips are expected to begin and end within the Wilsonville City Limits. Therefore, in the long term the I-5 interchanges are not expected to be significantly affected by the trips generated by the Area Plan development.

Wilsonville Road/I-5 Southbound Entrance Ramp Meter Operations

The Wilsonville Road/I-5 Southbound Entrance Ramp currently carries approximately 1,120 vehicles during typical weekday peak hour operations. ODOT ramp metering operations allow for a desired capacity of 1,260 and a theoretical maximum of 1,400 vehicles per hour.[6] The 2035 I-5 southbound ramp volumes with the Frog Pond Area Plan are estimated to be approximately 1,500 that would exceed the desired ODOT ramp meter capacity. Further coordination with ODOT will be necessary to determine future operations of the I-5 southbound ramp meter and the impacts to Wilsonville Road.

[6] Coordination with Tiffany Slauter, ODOT Traffic Signal Engineer, June, 2013.

Appendix

Frog Pond Area Plan Boundary and Sub-Areas Map

Existing PM Peak Period Traffic Counts

Collision Data

Level of Service Descriptions

HCM Analysis – Existing

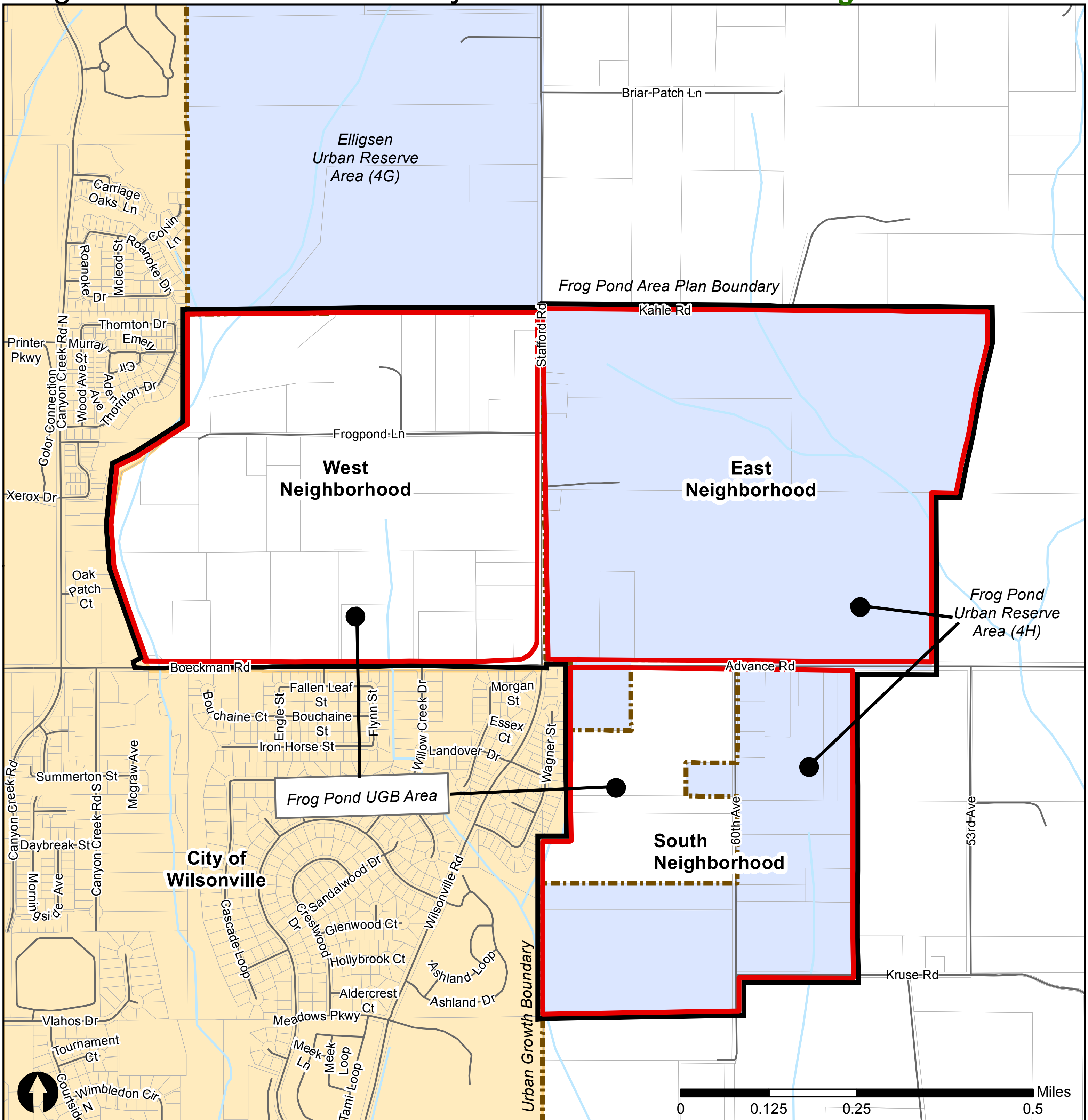
HCM Analysis – 2035 Baseline

HCM Analysis – 2035 Area Plan

Frog Pond Area Plan Boundary and Sub-Areas Map

Frog Pond Area Plan Boundary and Sub-Areas

Frog Pond Area Plan



Plan Area Neighborhoods

Plan Area Boundary

City of Wilsonville

Urban Growth Boundary

Streams

Urban reserves

Taxlots

Streets

Prepared By:
Angelo Planning Group

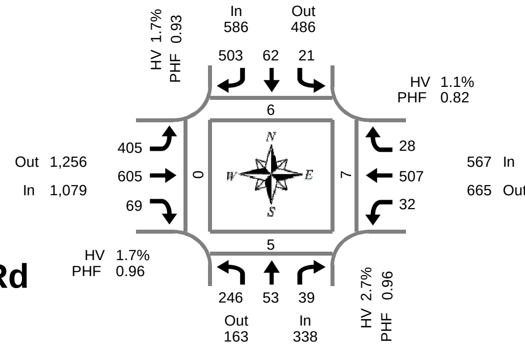
Date:
8/7/2014

Disclaimer:
This map is intended for informational purposes only. While this map represents the best data available at the time of publication, the City of Wilsonville makes no claims, representations, or warranties as to its accuracy or completeness. Metadata available upon request.

Existing PM Peak Period Traffic Counts

Total Vehicle Summary

Clay Carney
(503) 833-2740



Town Center Loop W & SW Wilsonville Rd

Tuesday, October 30, 2012
4:00 PM to 6:00 PM

Peak Hour Summary
4:10 PM to 5:10 PM

5-Minute Interval Summary
4:00 PM to 6:00 PM

Interval	Northbound				Southbound				Eastbound				Westbound				Interval	Pedestrians			
Start	Town Center Loop W				Town Center Loop W				SW Wilsonville Rd				SW Wilsonville Rd					Crosswalk			
Time	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	Total	North	South	East	West
4:00 PM	14	7	1	0	3	5	54	0	32	47	9	0	0	43	2	0	217	0	0	2	0
4:05 PM	20	5	2	0	1	4	27	0	21	31	4	0	7	47	3	0	172	1	0	1	0
4:10 PM	18	9	3	0	3	5	44	0	33	59	7	0	5	57	2	0	245	0	3	1	0
4:15 PM	25	5	3	0	0	4	31	0	42	46	6	0	1	42	2	0	207	0	0	0	0
4:20 PM	15	2	3	0	1	8	44	0	30	53	4	0	1	47	3	0	211	1	0	1	0
4:25 PM	23	5	3	0	2	6	52	0	27	60	4	0	4	22	3	0	211	1	1	1	0
4:30 PM	18	8	3	0	0	5	39	0	37	53	9	0	1	57	4	0	234	0	0	0	0
4:35 PM	20	3	3	0	2	4	33	0	41	45	5	0	2	41	3	0	202	0	0	0	0
4:40 PM	12	4	7	0	3	7	50	0	26	55	6	0	2	58	4	0	234	2	0	1	0
4:45 PM	21	8	4	0	3	3	40	0	38	50	6	0	5	46	0	0	224	1	0	0	0
4:50 PM	21	3	1	0	1	7	38	0	28	46	4	0	3	31	2	0	185	1	0	0	0
4:55 PM	24	0	4	0	2	3	51	0	36	45	10	0	2	45	1	0	223	0	0	0	0
5:00 PM	22	3	3	0	3	3	36	0	33	48	3	0	1	38	3	0	196	0	0	1	0
5:05 PM	27	3	2	0	1	7	45	0	34	45	5	0	5	23	1	0	198	0	1	2	0
5:10 PM	18	4	4	0	2	2	30	0	23	52	6	0	2	54	2	0	199	0	0	0	0
5:15 PM	19	5	3	0	1	8	32	0	31	48	5	0	1	36	3	0	192	1	1	0	0
5:20 PM	15	2	4	0	0	4	45	0	23	48	4	0	1	36	5	0	187	1	0	5	0
5:25 PM	24	9	0	0	2	3	41	0	39	58	4	0	5	35	4	0	224	0	0	1	0
5:30 PM	22	1	3	0	4	6	29	0	33	51	12	0	2	42	4	0	209	0	0	0	0
5:35 PM	25	6	2	0	3	4	29	0	28	46	6	0	1	51	4	0	205	0	0	0	0
5:40 PM	26	5	2	0	2	2	33	0	33	66	9	0	3	37	2	0	220	0	0	0	0
5:45 PM	16	4	4	0	4	6	35	0	31	55	3	0	1	47	2	0	208	0	1	0	0
5:50 PM	25	8	5	0	2	3	29	0	37	56	3	0	3	26	0	0	197	0	0	2	0
5:55 PM	17	4	4	0	2	0	31	0	30	64	4	0	4	37	3	0	200	1	0	0	0
Total Survey	487	113	73	0	47	109	918	0	766	1,227	138	0	62	998	62	0	5,000	10	7	18	0

15-Minute Interval Summary
4:00 PM to 6:00 PM

Interval	Northbound				Southbound				Eastbound				Westbound				Interval	Pedestrians			
Start	Town Center Loop W				Town Center Loop W				SW Wilsonville Rd				SW Wilsonville Rd					Crosswalk			
Time	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	Total	North	South	East	West
4:00 PM	52	21	6	0	7	14	125	0	86	137	20	0	12	147	7	0	634	1	3	4	0
4:15 PM	63	12	9	0	3	18	127	0	99	159	14	0	6	111	8	0	629	2	1	2	0
4:30 PM	50	15	13	0	5	16	122	0	104	153	20	0	5	156	11	0	670	2	0	1	0
4:45 PM	66	11	9	0	6	13	129	0	102	141	20	0	10	122	3	0	632	2	0	0	0
5:00 PM	67	10	9	0	6	12	111	0	90	145	14	0	8	115	6	0	593	0	1	3	0
5:15 PM	58	16	7	0	3	15	118	0	93	154	13	0	7	107	12	0	603	2	1	6	0
5:30 PM	73	12	7	0	9	12	91	0	94	163	27	0	6	130	10	0	634	0	0	0	0
5:45 PM	58	16	13	0	8	9	95	0	98	175	10	0	8	110	5	0	605	1	1	2	0
Total Survey	487	113	73	0	47	109	918	0	766	1,227	138	0	62	998	62	0	5,000	10	7	18	0

Peak Hour Summary
4:10 PM to 5:10 PM

By Approach	Northbound				Southbound				Eastbound				Westbound				Total
	Town Center Loop W				Town Center Loop W				SW Wilsonville Rd				SW Wilsonville Rd				
	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes	
Volume	338	163	501	0	586	486	1,072	0	1,079	1,256	2,335	0	567	665	1,232	0	2,570
%HV	2.7%				1.7%				1.7%				1.1%				1.7%
PHF	0.96				0.93				0.96				0.82				0.96

Pedestrians			
Crosswalk			
North	South	East	West
6	5	7	0

By Movement	Northbound				Southbound				Eastbound				Westbound				Total
	Town Center Loop W				Town Center Loop W				SW Wilsonville Rd				SW Wilsonville Rd				
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	
Volume	246	53	39	338	21	62	503	586	405	605	69	1,079	32	507	28	567	2,570
%HV	2.4%	5.7%	0.0%	2.7%	0.0%	3.2%	1.6%	1.7%	0.7%	1.8%	5.8%	1.7%	0.0%	1.2%	0.0%	1.1%	1.7%
PHF	0.84	0.83	0.70	0.96	0.66	0.82	0.93	0.93	0.96	0.91	0.86	0.96	0.80	0.81	0.64	0.82	0.96

Rolling Hour Summary
4:00 PM to 6:00 PM

Interval	Northbound				Southbound				Eastbound				Westbound				Interval	Pedestrians			
Start	Town Center Loop W				Town Center Loop W				SW Wilsonville Rd				SW Wilsonville Rd					Crosswalk			
Time	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	Total	North	South	East	West
4:00 PM	231	59	37	0	21	61	503	0	391	590	74	0	33	536	29	0	2,565	7	4	7	0
4:15 PM	246	48	40	0	20	59	489	0	395	598	68	0	29	504	28	0	2,524	6	2	6	0
4:30 PM	241	52	38	0	20	56	480	0	389	593	67	0	30	500	32	0	2,498	6	2	10	0
4:45 PM	264	49	32	0	24	52	449	0	379	603	74	0	31	474	31	0	2,462	4	2	9	0
5:00 PM	256	54	36	0	26	48	415	0	375	637	64	0	29	462	33	0	2,435	3	3	11	0

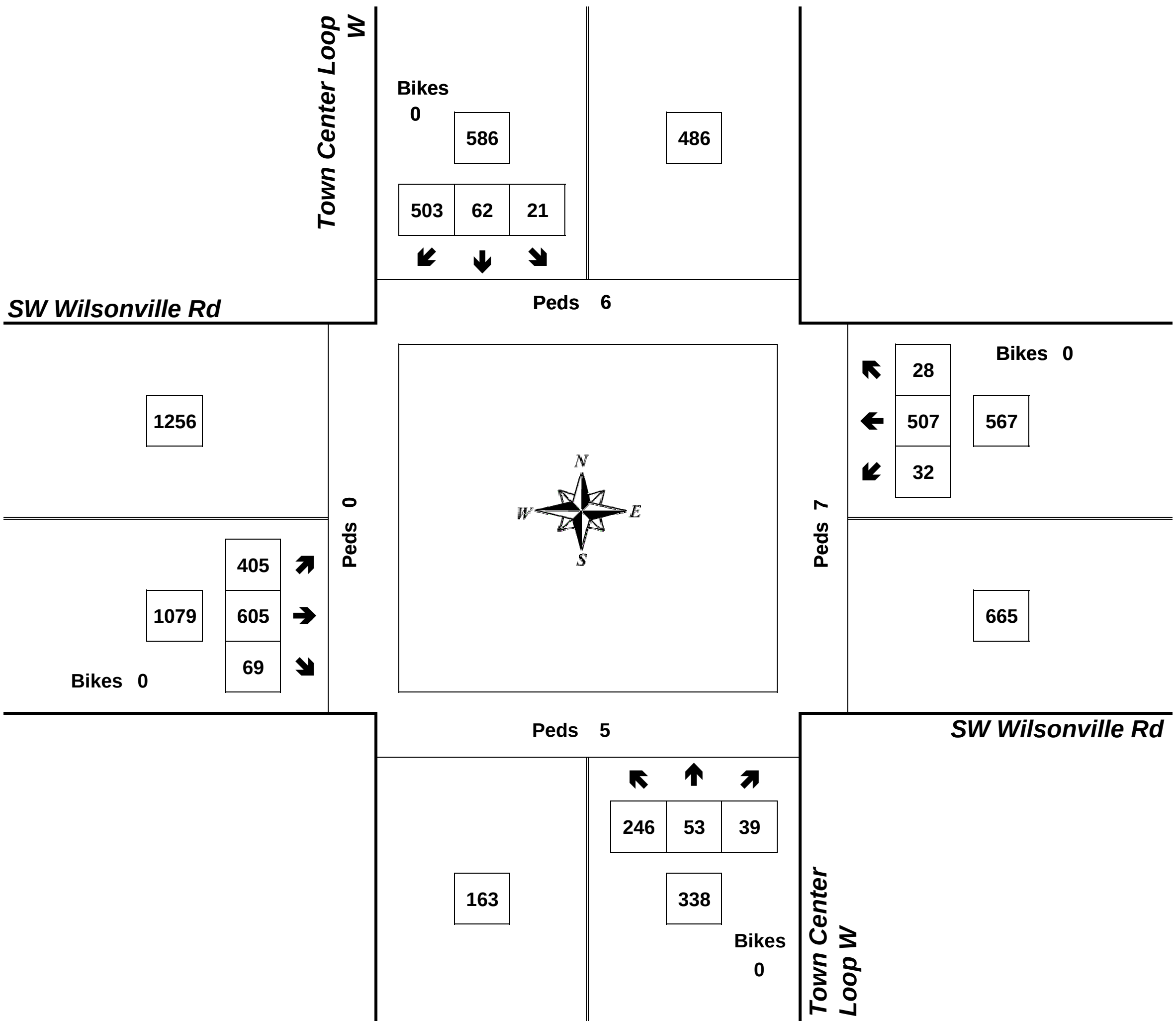
Peak Hour Summary

All Traffic Data Services Inc.

Clay Carney
(503) 833-2740

Town Center Loop W & SW Wilsonville Rd

4:10 PM to 5:10 PM
Tuesday, October 30, 2012



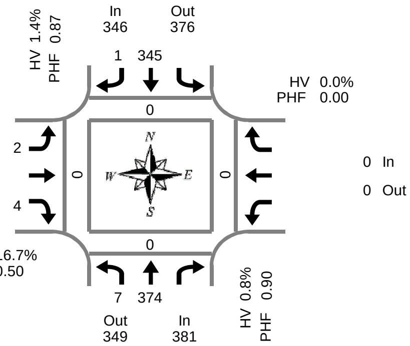
Approach	PHF	HV%	Volume
EB	0.96	1.7%	1,079
WB	0.82	1.1%	567
NB	0.96	2.7%	338
SB	0.93	1.7%	586
Intersection	0.96	1.7%	2,570

Count Period: 4:00 PM to 6:00 PM

Total Vehicle Summary

All Traffic Data Services Inc.

Clay Carney
(503) 833-2740



Peak Hour Summary
4:35 PM to 5:35 PM

SW Stafford Rd & SW Frog Pond Ln

Wednesday, February 12, 2014
4:00 PM to 6:00 PM

5-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound SW Stafford Rd				Southbound SW Stafford Rd				Eastbound SW Frog Pond Ln				Westbound SW Frog Pond Ln				Interval Total	Pedestrians Crosswalk			
	L	T		Bikes		T	R	Bikes	L		R	Bikes				Bikes		North	South	East	West
4:00 PM	0	21		0		20	1	0	0		0	0				0	42	0	0	0	0
4:05 PM	0	35		0		26	0	0	0		2	0				0	63	0	0	0	0
4:10 PM	1	27		0		29	0	0	1		0	0				0	58	0	0	0	0
4:15 PM	0	33		0		18	0	0	0		0	0				0	51	0	0	0	0
4:20 PM	0	17		0		30	0	0	0		0	0				0	47	0	0	0	0
4:25 PM	0	38		0		18	0	0	1		0	0				0	57	0	0	0	0
4:30 PM	0	38		0		19	0	0	0		0	0				0	57	0	0	0	0
4:35 PM	0	34		0		28	1	0	0		0	0				0	63	0	0	0	0
4:40 PM	1	27		0		26	0	0	0		0	0				0	54	0	0	0	0
4:45 PM	1	33		0		27	0	0	0		2	0				0	63	0	0	0	0
4:50 PM	1	31		0		24	0	0	0		0	0				0	56	0	0	0	0
4:55 PM	0	19		0		31	0	0	0		1	0				0	51	0	0	0	0
5:00 PM	2	31		0		20	0	0	2		0	0				0	55	0	0	0	0
5:05 PM	0	27		0		36	0	0	0		0	0				0	63	0	0	0	0
5:10 PM	0	40		0		20	0	0	0		0	0				0	60	0	0	0	0
5:15 PM	1	34		0		34	0	0	0		0	0				0	69	0	0	0	0
5:20 PM	0	31		0		31	0	0	0		0	0				0	62	0	0	0	0
5:25 PM	0	37		0		35	0	0	0		0	0				0	72	0	0	0	0
5:30 PM	1	30		0		33	0	0	0		1	0				0	65	0	0	0	0
5:35 PM	1	22		0		30	1	0	0		1	0				0	55	0	0	0	0
5:40 PM	2	29		0		28	0	0	0		0	0				0	59	0	0	0	0
5:45 PM	0	31		0		28	0	0	0		0	0				0	59	0	0	0	0
5:50 PM	0	22		0		28	0	0	0		1	0				0	51	0	0	0	0
5:55 PM	1	22		0		19	0	0	0		0	0				0	42	0	0	0	0
Total Survey	12	709		0		638	3	0	4		8	0				0	1,374	0	0	0	0

15-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound SW Stafford Rd				Southbound SW Stafford Rd				Eastbound SW Frog Pond Ln				Westbound SW Frog Pond Ln				Interval Total	Pedestrians Crosswalk			
	L	T		Bikes		T	R	Bikes	L		R	Bikes				Bikes		North	South	East	West
4:00 PM	1	83		0		75	1	0	1		2	0				0	163	0	0	0	0
4:15 PM	0	88		0		66	0	0	1		0	0				0	155	0	0	0	0
4:30 PM	1	99		0		73	1	0	0		0	0				0	174	0	0	0	0
4:45 PM	2	83		0		82	0	0	0		3	0				0	170	0	0	0	0
5:00 PM	2	98		0		76	0	0	2		0	0				0	178	0	0	0	0
5:15 PM	1	102		0		100	0	0	0		0	0				0	203	0	0	0	0
5:30 PM	4	81		0		91	1	0	0		2	0				0	179	0	0	0	0
5:45 PM	1	75		0		75	0	0	0		1	0				0	152	0	0	0	0
Total Survey	12	709		0		638	3	0	4		8	0				0	1,374	0	0	0	0

Peak Hour Summary
4:35 PM to 5:35 PM

By Approach	Northbound SW Stafford Rd				Southbound SW Stafford Rd				Eastbound SW Frog Pond Ln				Westbound SW Frog Pond Ln				Total	Pedestrians Crosswalk			
	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes		North	South	East	West
Volume	381	349	730	0	346	376	722	0	6	8	14	0	0	0	0	0	733	0	0	0	0
%HV	0.8%				1.4%				16.7%				0.0%				1.2%				
PHF	0.90				0.87				0.50				0.00				0.90				

By Movement	Northbound SW Stafford Rd				Southbound SW Stafford Rd				Eastbound SW Frog Pond Ln				Westbound SW Frog Pond Ln				Total
	L	T		Total		T	R	Total	L		R	Total				Total	
Volume	7	374		381		345	1	346	2		4	6				0	733
%HV	28.6%	0.3%	NA	0.8%	NA	1.4%	0.0%	1.4%	0.0%	NA	25.0%	16.7%	NA	NA	NA	0.0%	1.2%
PHF	0.58	0.89		0.90		0.86	0.25	0.87	0.25		0.33	0.50				0.00	0.90

Rolling Hour Summary
4:00 PM to 6:00 PM

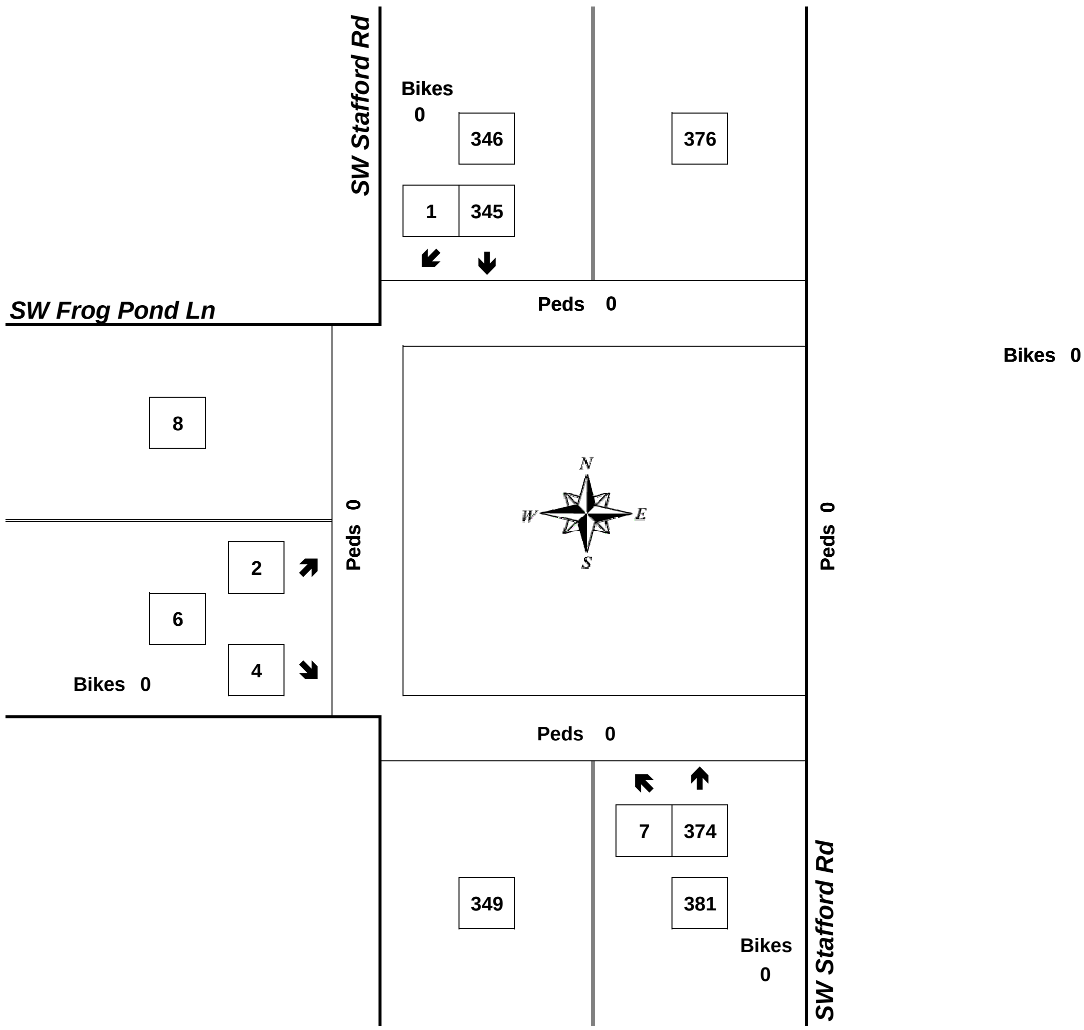
Interval Start Time	Northbound SW Stafford Rd				Southbound SW Stafford Rd				Eastbound SW Frog Pond Ln				Westbound SW Frog Pond Ln				Interval Total	Pedestrians Crosswalk			
	L	T		Bikes		T	R	Bikes	L		R	Bikes				Bikes		North	South	East	West
4:00 PM	4	353		0		296	2	0	2		5	0				0	662	0	0	0	0
4:15 PM	5	368		0		297	1	0	3		3	0				0	677	0	0	0	0
4:30 PM	6	382		0		331	1	0	2		3	0				0	725	0	0	0	0
4:45 PM	9	364		0		349	1	0	2		5	0				0	730	0	0	0	0
5:00 PM	8	356		0		342	1	0	2		3	0				0	712	0	0	0	0

Peak Hour Summary

All Traffic Data Services Inc.
Clay Carney
(503) 833-2740

SW Stafford Rd & SW Frog Pond Ln

4:35 PM to 5:35 PM
Wednesday, February 12, 2014



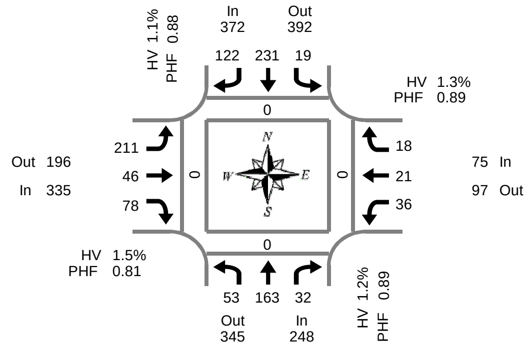
Approach	PHF	HV%	Volume
EB	0.50	16.7%	6
WB	0.00	0.0%	0
NB	0.90	0.8%	381
SB	0.87	1.4%	346
Intersection	0.90	1.2%	733

Count Period: 4:00 PM to 6:00 PM

Total Vehicle Summary

All Traffic Data Services Inc.

Clay Carney
(503) 833-2740



Peak Hour Summary
4:45 PM to 5:45 PM

SW Stafford Rd & Boeckman Rd

Wednesday, February 12, 2014
4:00 PM to 6:00 PM

5-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start	Northbound SW Stafford Rd				Southbound SW Stafford Rd				Eastbound Boeckman Rd				Westbound Boeckman Rd				Interval	Pedestrians Crosswalk			
Time	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	Total	North	South	East	West
4:00 PM	3	13	1	0	1	8	6	0	12	2	6	0	2	0	0	0	54	0	0	0	0
4:05 PM	2	15	5	0	3	17	6	0	19	3	1	0	3	1	1	0	76	0	0	0	0
4:10 PM	5	13	2	0	1	17	9	0	12	5	5	0	0	2	1	0	72	0	0	0	0
4:15 PM	2	17	2	0	1	24	6	0	8	7	8	0	5	7	0	0	87	0	0	0	0
4:20 PM	5	12	4	0	2	13	4	0	13	1	1	0	2	4	1	0	62	0	0	0	0
4:25 PM	1	20	0	0	1	22	4	0	16	1	5	0	5	1	1	0	77	0	0	0	0
4:30 PM	1	14	3	0	1	15	2	0	18	5	4	0	3	3	1	0	70	0	0	0	0
4:35 PM	1	20	2	0	2	22	4	0	23	5	5	0	0	2	1	0	87	0	0	0	0
4:40 PM	3	17	4	0	2	12	5	0	9	1	5	0	6	2	0	0	66	0	0	0	0
4:45 PM	7	11	3	0	0	16	12	0	20	4	2	0	4	1	3	0	83	0	0	0	0
4:50 PM	4	18	1	0	1	19	14	0	15	4	3	0	2	5	0	0	86	0	0	0	0
4:55 PM	5	14	5	0	2	21	6	0	18	2	8	0	2	2	0	0	85	0	0	0	0
5:00 PM	7	13	1	0	0	20	7	0	15	3	7	0	1	3	4	0	81	0	0	0	0
5:05 PM	4	10	1	0	4	15	10	0	19	4	9	0	3	3	0	0	82	0	0	0	0
5:10 PM	2	13	2	0	4	17	11	0	21	5	4	0	2	0	0	0	81	0	0	0	0
5:15 PM	6	14	4	0	4	14	9	0	23	6	9	0	3	3	2	0	97	0	0	0	0
5:20 PM	4	13	4	0	1	18	9	0	20	3	9	0	7	0	1	0	89	0	0	0	0
5:25 PM	4	16	5	0	0	20	16	0	21	5	8	0	4	0	1	0	100	0	0	0	0
5:30 PM	3	13	4	0	2	27	7	0	16	3	7	0	3	1	4	0	90	0	0	0	0
5:35 PM	2	16	2	0	1	20	13	0	11	0	9	0	3	1	1	0	79	0	0	0	0
5:40 PM	5	12	0	0	0	24	8	0	12	7	3	0	2	2	2	0	77	0	0	0	0
5:45 PM	5	14	0	0	2	21	7	0	14	2	8	0	2	1	1	0	77	0	0	0	0
5:50 PM	4	16	3	0	1	21	5	0	9	6	9	0	0	1	0	0	75	0	0	0	0
5:55 PM	0	8	2	0	0	22	4	0	16	6	12	0	2	2	0	0	74	0	0	0	0
Total Survey	85	342	60	0	36	445	184	0	380	90	147	0	66	47	25	0	1,907	0	0	0	0

15-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start	Northbound SW Stafford Rd				Southbound SW Stafford Rd				Eastbound Boeckman Rd				Westbound Boeckman Rd				Interval	Pedestrians Crosswalk			
Time	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	Total	North	South	East	West
4:00 PM	10	41	8	0	5	42	21	0	43	10	12	0	5	3	2	0	202	0	0	0	0
4:15 PM	8	49	6	0	4	59	14	0	37	9	14	0	12	12	2	0	226	0	0	0	0
4:30 PM	5	51	9	0	5	49	11	0	50	11	14	0	9	7	2	0	223	0	0	0	0
4:45 PM	16	43	9	0	3	56	32	0	53	10	13	0	8	8	3	0	254	0	0	0	0
5:00 PM	13	36	4	0	8	52	28	0	55	12	20	0	6	6	4	0	244	0	0	0	0
5:15 PM	14	43	13	0	5	52	34	0	64	14	26	0	14	3	4	0	286	0	0	0	0
5:30 PM	10	41	6	0	3	71	28	0	39	10	19	0	8	4	7	0	246	0	0	0	0
5:45 PM	9	38	5	0	3	64	16	0	39	14	29	0	4	4	1	0	226	0	0	0	0
Total Survey	85	342	60	0	36	445	184	0	380	90	147	0	66	47	25	0	1,907	0	0	0	0

Peak Hour Summary
4:45 PM to 5:45 PM

By Approach	Northbound SW Stafford Rd				Southbound SW Stafford Rd				Eastbound Boeckman Rd				Westbound Boeckman Rd				Total	Pedestrians Crosswalk			
	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes		North	South	East	West
Volume	248	345	593	0	372	392	764	0	335	196	531	0	75	97	172	0	1,030	0	0	0	0
%HV	1.2%				1.1%				1.5%				1.3%				1.3%				
PHF	0.89				0.88				0.81				0.89				0.90				

By Movement	Northbound SW Stafford Rd				Southbound SW Stafford Rd				Eastbound Boeckman Rd				Westbound Boeckman Rd				Total
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	
Volume	53	163	32	248	19	231	122	372	211	46	78	335	36	21	18	75	1,030
%HV	3.8%	0.6%	0.0%	1.2%	15.8%	0.4%	0.0%	1.1%	1.4%	0.0%	2.6%	1.5%	2.8%	0.0%	0.0%	1.3%	1.3%
PHF	0.83	0.91	0.62	0.89	0.40	0.81	0.85	0.88	0.82	0.77	0.75	0.81	0.64	0.53	0.64	0.89	0.90

Rolling Hour Summary
4:00 PM to 6:00 PM

Interval Start	Northbound SW Stafford Rd				Southbound SW Stafford Rd				Eastbound Boeckman Rd				Westbound Boeckman Rd				Interval	Pedestrians Crosswalk			
Time	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	Total	North	South	East	West
4:00 PM	39	184	32	0	17	206	78	0	183	40	53	0	34	30	9	0	905	0	0	0	0
4:15 PM	42	179	28	0	20	216	85	0	195	42	61	0	35	33	11	0	947	0	0	0	0
4:30 PM	48	173	35	0	21	209	105	0	222	47	73	0	37	24	13	0	1,007	0	0	0	0
4:45 PM	53	163	32	0	19	231	122	0	211	46	78	0	36	21	18	0	1,030	0	0	0	0
5:00 PM	46	158	28	0	19	239	106	0	197	50	94	0	32	17	16	0	1,002	0	0	0	0

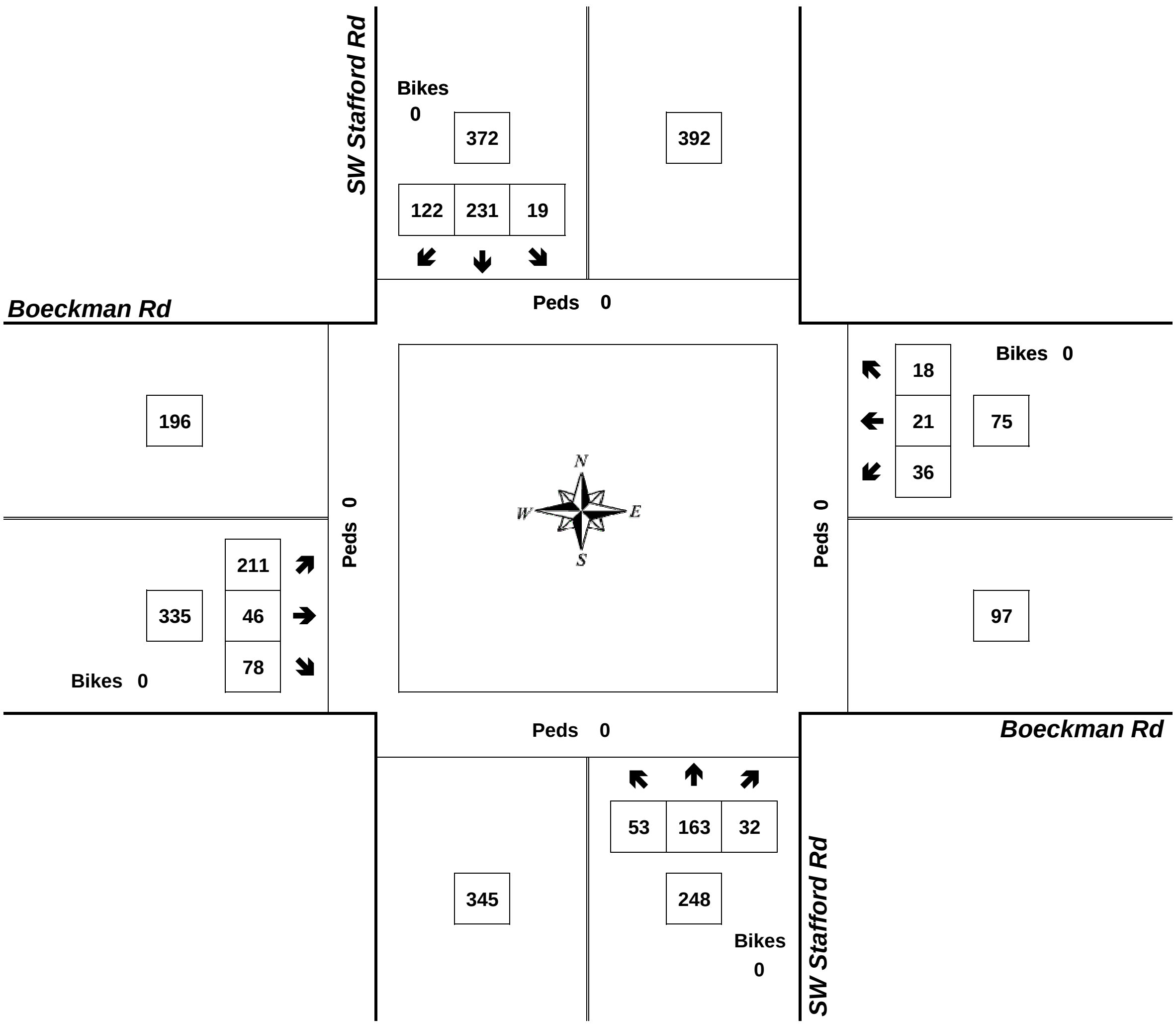
Peak Hour Summary

All Traffic Data Services Inc.

Clay Carney
(503) 833-2740

SW Stafford Rd & Boeckman Rd

4:45 PM to 5:45 PM
Wednesday, February 12, 2014



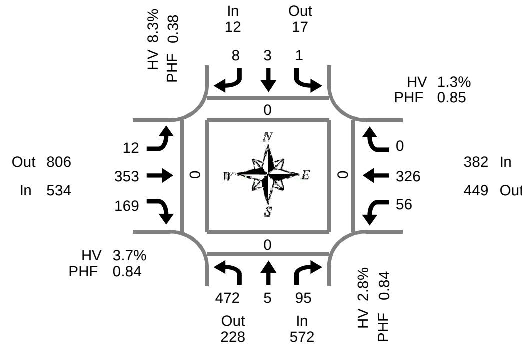
Approach	PHF	HV%	Volume
EB	0.81	1.5%	335
WB	0.89	1.3%	75
NB	0.89	1.2%	248
SB	0.88	1.1%	372
Intersection	0.90	1.3%	1,030

Count Period: 4:00 PM to 6:00 PM

Total Vehicle Summary

All Traffic Data
Services Inc.

Clay Carney
(503) 833-2740



Peak Hour Summary
_4:35 PM to 5:35 PM_

SW Parkway Center & SW Elligsen Rd

Wednesday, April 16, 2014
4:00 PM to 6:00 PM

5-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound SW Parkway Center				Southbound SW Parkway Center				Eastbound SW Elligsen Rd				Westbound SW Elligsen Rd				Interval Total	Pedestrians Crosswalk			
	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes		North	South	East	West
4:00 PM	38	1	6	0	0	1	0	0	0	30	12	0	3	25	0	0	116	0	0	0	0
4:05 PM	33	0	5	0	0	1	2	0	0	28	15	0	7	25	0	0	116	0	0	0	0
4:10 PM	25	1	7	0	0	0	0	0	4	21	19	0	8	31	0	0	116	0	0	0	0
4:15 PM	28	1	9	0	0	1	0	0	2	18	10	0	5	14	0	0	88	0	0	0	0
4:20 PM	29	1	5	0	1	0	3	0	2	29	8	0	6	16	0	1	100	0	0	0	0
4:25 PM	35	0	4	0	0	0	0	0	2	29	15	0	4	25	0	0	114	0	0	0	0
4:30 PM	34	1	9	0	0	1	1	0	3	28	15	0	3	17	0	0	112	0	0	0	0
4:35 PM	57	0	10	0	0	1	0	0	1	20	12	0	7	16	0	0	124	0	0	0	0
4:40 PM	44	0	11	0	0	0	0	0	0	33	13	0	5	25	0	0	131	0	0	0	0
4:45 PM	35	0	9	0	0	1	1	0	1	24	13	0	4	27	0	0	115	0	0	0	0
4:50 PM	24	0	4	0	0	0	0	0	4	27	17	0	4	20	0	0	100	0	0	0	0
4:55 PM	30	0	9	0	0	0	0	0	1	35	15	0	3	22	0	0	115	0	0	0	0
5:00 PM	36	0	10	0	0	0	2	0	1	29	15	0	3	30	0	0	126	0	0	0	0
5:05 PM	62	0	5	0	0	0	2	0	2	22	13	0	3	39	0	0	148	0	0	0	0
5:10 PM	47	1	10	0	1	1	2	0	1	34	15	0	2	35	0	0	149	0	0	0	0
5:15 PM	30	1	5	0	0	0	0	0	1	40	10	0	2	30	0	0	119	0	0	0	0
5:20 PM	41	1	6	0	0	0	0	0	0	40	18	0	7	22	0	0	135	0	0	0	0
5:25 PM	28	0	8	0	0	0	0	0	0	25	12	1	5	31	0	0	109	0	0	0	0
5:30 PM	38	2	8	0	0	0	1	0	0	24	16	0	11	29	0	0	129	0	0	0	0
5:35 PM	27	0	8	0	0	0	1	0	3	32	15	0	3	27	0	0	116	0	1	0	0
5:40 PM	32	0	9	0	0	1	0	0	4	38	16	0	3	18	0	0	121	0	0	0	0
5:45 PM	25	0	5	0	0	0	1	0	0	16	13	0	5	29	0	0	94	0	0	0	0
5:50 PM	24	0	4	0	0	0	1	0	1	28	8	0	1	13	0	0	80	0	0	0	0
5:55 PM	18	0	5	0	0	0	0	0	1	34	14	0	2	17	0	0	91	0	0	0	0
Total Survey	820	10	171	0	2	8	17	0	34	684	329	1	106	583	0	1	2,764	0	1	0	0

15-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound SW Parkway Center				Southbound SW Parkway Center				Eastbound SW Elligsen Rd				Westbound SW Elligsen Rd				Interval Total	Pedestrians Crosswalk			
	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes		North	South	East	West
4:00 PM	96	2	18	0	0	2	2	0	4	79	46	0	18	81	0	0	348	0	0	0	0
4:15 PM	92	2	18	0	1	1	3	0	6	76	33	0	15	55	0	1	302	0	0	0	0
4:30 PM	135	1	30	0	0	2	1	0	4	81	40	0	15	58	0	0	367	0	0	0	0
4:45 PM	89	0	22	0	0	1	1	0	6	86	45	0	11	69	0	0	330	0	0	0	0
5:00 PM	145	1	25	0	1	1	6	0	4	85	43	0	8	104	0	0	423	0	0	0	0
5:15 PM	99	2	19	0	0	0	0	0	1	105	40	1	14	83	0	0	363	0	0	0	0
5:30 PM	97	2	25	0	0	1	2	0	7	94	47	0	17	74	0	0	366	0	1	0	0
5:45 PM	67	0	14	0	0	0	2	0	2	78	35	0	8	59	0	0	265	0	0	0	0
Total Survey	820	10	171	0	2	8	17	0	34	684	329	1	106	583	0	1	2,764	0	1	0	0

Peak Hour Summary
4:35 PM to 5:35 PM

By Approach	Northbound SW Parkway Center				Southbound SW Parkway Center				Eastbound SW Elligsen Rd				Westbound SW Elligsen Rd				Total	Pedestrians Crosswalk			
	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes		North	South	East	West
Volume	572	228	800	0	12	17	29	0	534	806	1,340	1	382	449	831	0	1,500	0	0	0	0
%HV	2.8%				8.3%				3.7%				1.3%				2.8%				
PHF	0.84				0.38				0.84				0.85				0.89				

By Movement	Northbound SW Parkway Center				Southbound SW Parkway Center				Eastbound SW Elligsen Rd				Westbound SW Elligsen Rd				Total
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	
Volume	472	5	95	572	1	3	8	12	12	353	169	534	56	326	0	382	1,500
%HV	2.5%	0.0%	4.2%	2.8%	0.0%	0.0%	12.5%	8.3%	16.7%	0.6%	9.5%	3.7%	1.8%	1.2%	0.0%	1.3%	2.8%
PHF	0.81	0.42	0.79	0.84	0.25	0.38	0.33	0.38	0.50	0.77	0.90	0.84	0.61	0.78	0.00	0.85	0.89

Rolling Hour Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound SW Parkway Center				Southbound SW Parkway Center				Eastbound SW Elligsen Rd				Westbound SW Elligsen Rd				Interval Total	Pedestrians Crosswalk			
	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes		North	South	East	West
4:00 PM	412	5	88	0	1	6	7	0	20	322	164	0	59	263	0	1	1,347	0	0	0	0
4:15 PM	461	4	95	0	2	5	11	0	20	328	161	0	49	286	0	1	1,422	0	0	0	0
4:30 PM	468	4	96	0	1	4	8	0	15	357	168	1	48	314	0	0	1,483	0	0	0	0
4:45 PM	430	5	91	0	1	3	9	0	18	370	175	1	50	330	0	0	1,482	0	1	0	0
5:00 PM	408	5	83	0	1	2	10	0	14	362	165	1	47	320	0	0	1,417	0	1	0	0

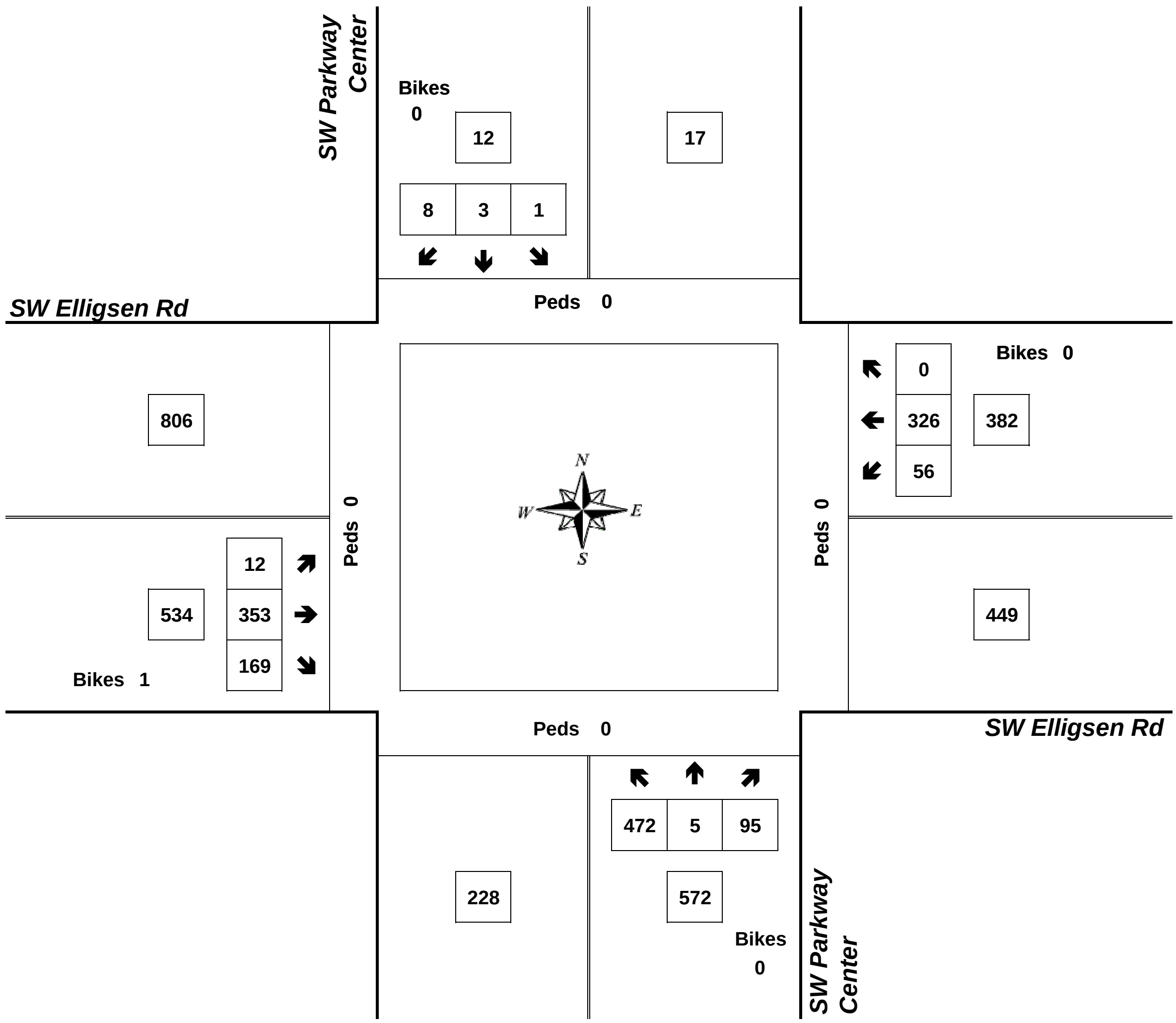
Peak Hour Summary

All Traffic Data Services Inc.

Clay Carney
(503) 833-2740

SW Parkway Center & SW Elligsen Rd

4:35 PM to 5:35 PM
Wednesday, April 16, 2014

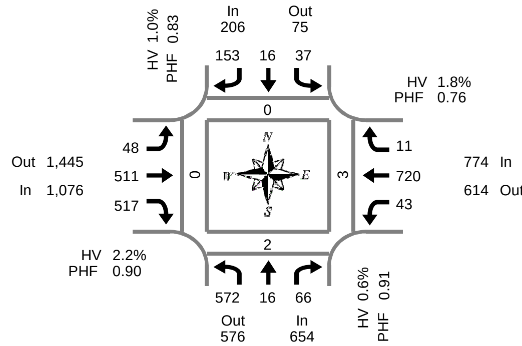


Approach	PHF	HV%	Volume
EB	0.84	3.7%	534
WB	0.85	1.3%	382
NB	0.84	2.8%	572
SB	0.38	8.3%	12
Intersection	0.89	2.8%	1,500

Count Period: 4:00 PM to 6:00 PM

Total Vehicle Summary

Clay Carney
(503) 833-2740



Peak Hour Summary
4:45 PM to 5:45 PM

SW Parkway Ave & SW Elligsen Rd

Wednesday, April 16, 2014
4:00 PM to 6:00 PM

5-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound SW Parkway Ave				Southbound SW Parkway Ave				Eastbound SW Elligsen Rd				Westbound SW Elligsen Rd				Interval Total	Pedestrians Crosswalk			
	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes		North	South	East	West
4:00 PM	30	0	4	0	3	0	16	0	4	45	36	0	4	64	0	0	206	0	0	0	0
4:05 PM	39	0	6	0	3	0	8	0	5	38	36	0	1	55	3	0	194	0	0	1	0
4:10 PM	54	0	6	0	2	3	7	0	11	34	45	0	6	44	3	0	215	0	0	0	0
4:15 PM	46	1	4	0	3	3	16	0	4	28	41	0	0	36	0	0	182	0	0	0	0
4:20 PM	34	2	7	0	2	0	8	0	1	39	26	0	0	48	1	1	168	0	0	0	0
4:25 PM	40	0	6	0	7	1	10	0	4	40	46	0	3	55	2	0	214	0	0	0	0
4:30 PM	48	0	5	0	5	4	25	0	6	26	44	0	1	44	1	0	209	0	0	0	0
4:35 PM	37	0	4	0	0	0	9	0	5	52	30	0	5	76	0	0	218	0	0	0	0
4:40 PM	41	1	2	0	3	2	6	0	4	34	36	0	3	63	0	0	195	0	1	1	0
4:45 PM	55	3	3	0	2	1	10	0	5	42	42	0	2	66	2	0	233	0	0	0	0
4:50 PM	48	2	7	0	3	0	16	0	8	37	37	0	2	37	2	0	199	0	0	0	0
4:55 PM	55	0	3	0	6	4	10	0	3	43	45	0	2	37	0	0	208	0	0	0	0
5:00 PM	26	0	5	0	3	0	19	0	4	38	44	0	0	86	0	0	225	0	0	0	0
5:05 PM	51	1	7	0	2	1	17	1	5	33	36	0	4	85	0	0	242	0	0	1	0
5:10 PM	46	1	9	0	5	2	13	0	7	33	37	0	4	73	3	0	233	0	0	0	0
5:15 PM	38	1	7	0	3	2	12	0	2	72	39	0	5	73	2	0	256	0	1	0	0
5:20 PM	57	1	7	0	3	1	11	0	5	35	40	0	5	45	1	0	211	0	1	1	0
5:25 PM	36	0	6	0	5	1	16	0	4	29	53	1	7	49	0	0	206	0	0	0	0
5:30 PM	57	2	4	0	0	0	7	0	2	52	51	0	4	69	1	0	249	0	0	1	0
5:35 PM	49	3	4	0	2	4	13	0	3	51	48	0	4	51	0	0	232	0	0	0	0
5:40 PM	54	2	4	0	3	0	9	0	0	46	45	0	4	49	0	0	216	0	0	0	0
5:45 PM	48	0	2	0	1	1	11	0	4	32	28	0	7	48	1	0	183	0	0	0	0
5:50 PM	47	1	7	0	1	1	8	0	3	29	43	0	1	36	0	0	177	0	0	0	0
5:55 PM	55	1	7	0	4	2	10	0	4	34	31	0	3	29	1	0	181	0	0	0	0
Total Survey	1,091	22	126	0	71	33	287	1	103	942	959	1	77	1,318	23	1	5,052	0	3	5	0

15-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound SW Parkway Ave				Southbound SW Parkway Ave				Eastbound SW Elligsen Rd				Westbound SW Elligsen Rd				Interval Total	Pedestrians Crosswalk			
	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes		North	South	East	West
4:00 PM	123	0	16	0	8	3	31	0	20	117	117	0	11	163	6	0	615	0	0	1	0
4:15 PM	120	3	17	0	12	4	34	0	9	107	113	0	3	139	3	1	564	0	0	0	0
4:30 PM	126	1	11	0	8	6	40	0	15	112	110	0	9	183	1	0	622	0	1	1	0
4:45 PM	158	5	13	0	11	5	36	0	16	122	124	0	6	140	4	0	640	0	0	0	0
5:00 PM	123	2	21	0	10	3	49	1	16	104	117	0	8	244	3	0	700	0	0	1	0
5:15 PM	131	2	20	0	11	4	39	0	11	136	132	1	17	167	3	0	673	0	2	1	0
5:30 PM	160	7	12	0	5	4	29	0	5	149	144	0	12	169	1	0	697	0	0	1	0
5:45 PM	150	2	16	0	6	4	29	0	11	95	102	0	11	113	2	0	541	0	0	0	0
Total Survey	1,091	22	126	0	71	33	287	1	103	942	959	1	77	1,318	23	1	5,052	0	3	5	0

Peak Hour Summary
4:45 PM to 5:45 PM

By Approach	Northbound SW Parkway Ave				Southbound SW Parkway Ave				Eastbound SW Elligsen Rd				Westbound SW Elligsen Rd				Total	Pedestrians Crosswalk			
	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes		North	South	East	West
Volume	654	576	1,230	0	206	75	281	1	1,076	1,445	2,521	1	774	614	1,388	0	2,710	0	2	3	0
%HV	0.6%				1.0%				2.2%				1.8%				1.6%				
PHF	0.91				0.83				0.90				0.76				0.93				

By Movement	Northbound SW Parkway Ave				Southbound SW Parkway Ave				Eastbound SW Elligsen Rd				Westbound SW Elligsen Rd				Total
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	
Volume	572	16	66	654	37	16	153	206	48	511	517	1,076	43	720	11	774	2,710
%HV	0.5%	6.3%	0.0%	0.6%	0.0%	6.3%	0.7%	1.0%	2.1%	3.9%	0.6%	2.2%	0.0%	1.9%	0.0%	1.8%	1.6%
PHF	0.89	0.57	0.72	0.91	0.77	0.80	0.78	0.83	0.75	0.86	0.85	0.90	0.63	0.74	0.46	0.76	0.93

Rolling Hour Summary
4:00 PM to 6:00 PM

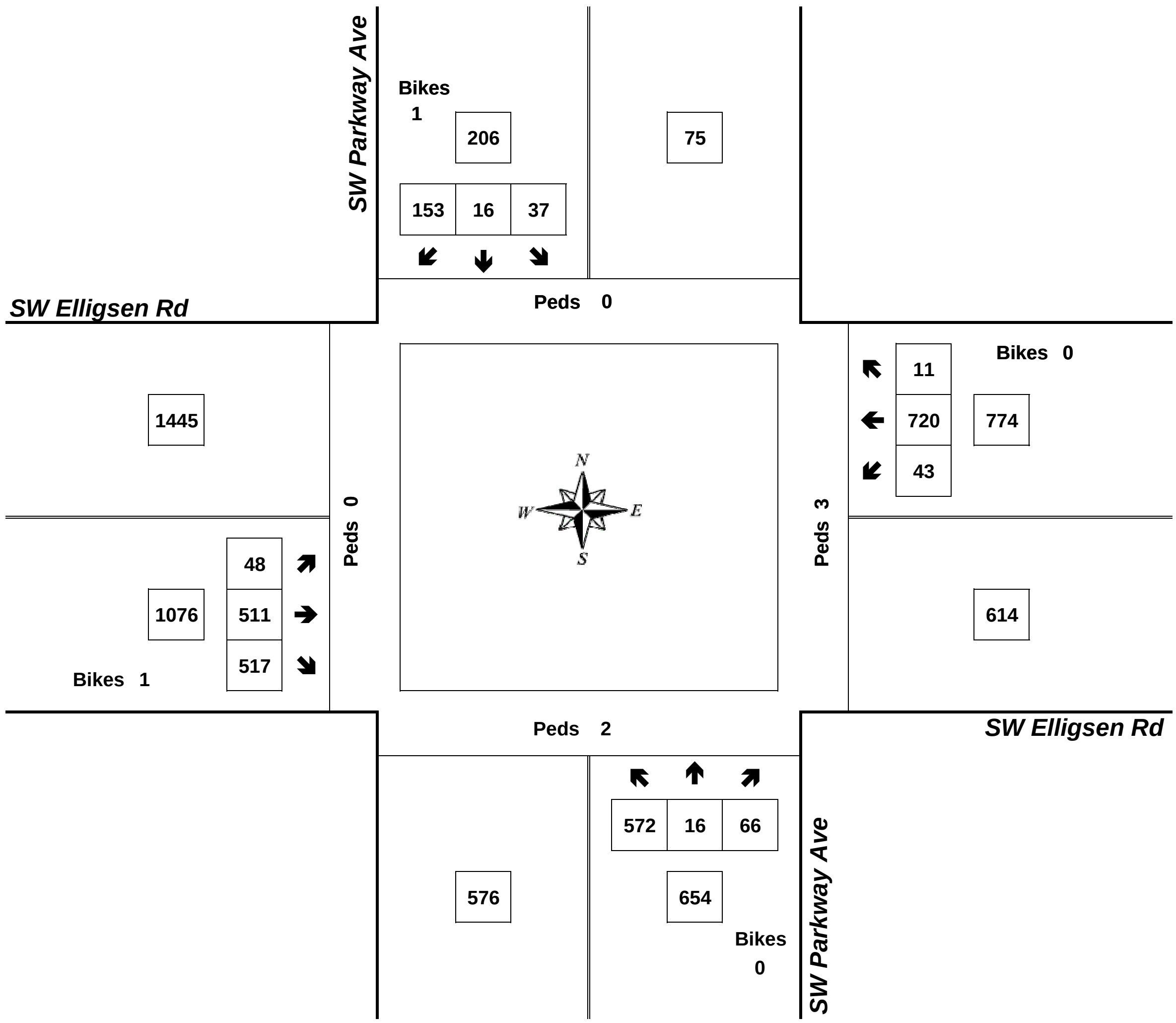
Interval Start Time	Northbound SW Parkway Ave				Southbound SW Parkway Ave				Eastbound SW Elligsen Rd				Westbound SW Elligsen Rd				Interval Total	Pedestrians Crosswalk			
	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes		North	South	East	West
4:00 PM	527	9	57	0	39	18	141	0	60	458	464	0	29	625	14	1	2,441	0	1	2	0
4:15 PM	527	11	62	0	41	18	159	1	56	445	464	0	26	706	11	1	2,526	0	1	2	0
4:30 PM	538	10	65	0	40	18	164	1	58	474	483	1	40	734	11	0	2,635	0	3	3	0
4:45 PM	572	16	66	0	37	16	153	1	48	511	517	1	43	720	11	0	2,710	0	2	3	0
5:00 PM	564	13	69	0	32	15	146	1	43	484	495	1	48	693	9	0	2,611	0	2	3	0

Peak Hour Summary

All Traffic Data Services Inc.
Clay Carney
(503) 833-2740

SW Parkway Ave & SW Elligsen Rd

4:45 PM to 5:45 PM
Wednesday, April 16, 2014



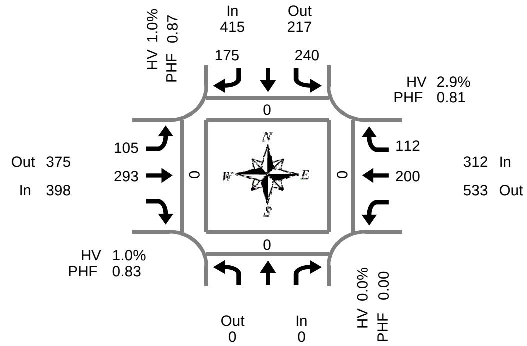
Approach	PHF	HV%	Volume
EB	0.90	2.2%	1,076
WB	0.76	1.8%	774
NB	0.91	0.6%	654
SB	0.83	1.0%	206
Intersection	0.93	1.6%	2,710

Count Period: 4:00 PM to 6:00 PM

Total Vehicle Summary

All Traffic Data Services Inc.

Clay Carney
(503) 833-2740



SW 65th Ave & SW Stafford Rd

Wednesday, April 16, 2014
4:00 PM to 6:00 PM

Peak Hour Summary
4:35 PM to 5:35 PM

5-Minute Interval Summary
4:00 PM to 6:00 PM

Interval	Northbound				Southbound				Eastbound				Westbound					Pedestrians			
Start	SW 65th Ave				SW 65th Ave				SW Stafford Rd				SW Stafford Rd				Interval	Crosswalk			
Time				Bikes	L		R	Bikes	L	T		Bikes		T	R	Bikes	Total	North	South	East	West
4:00 PM				0	15		11	0	7	10		0		20	15	0	78	0	0	0	0
4:05 PM				0	22		13	0	10	20		0		20	3	0	88	0	0	0	0
4:10 PM				0	20		11	0	4	29		0		20	8	1	92	0	0	0	0
4:15 PM				0	17		7	0	5	22		0		12	8	0	71	0	0	0	0
4:20 PM				0	17		16	0	9	24		0		12	7	0	85	0	0	0	0
4:25 PM				0	18		13	0	8	28		0		18	10	0	95	0	0	0	0
4:30 PM				0	22		12	0	9	19		0		16	6	0	84	0	0	0	0
4:35 PM				0	19		10	0	9	23		0		22	13	0	96	0	0	0	0
4:40 PM				0	17		15	0	9	20		0		13	10	0	84	0	0	0	0
4:45 PM				0	20		10	0	6	25		0		19	6	0	86	0	0	0	0
4:50 PM				0	18		20	0	1	20		0		20	10	0	89	0	0	0	0
4:55 PM				0	17		19	0	12	10		0		17	4	0	79	0	0	0	0
5:00 PM				0	25		9	0	6	32		0		12	7	0	91	0	0	0	0
5:05 PM				0	19		16	0	13	28		0		10	11	0	97	0	0	0	0
5:10 PM				0	21		16	0	10	28		0		16	4	0	95	0	0	0	0
5:15 PM				0	23		15	0	8	33		0		16	12	0	107	0	0	0	0
5:20 PM				0	26		18	0	10	28		0		21	11	0	114	0	0	0	0
5:25 PM				0	17		14	0	9	22		0		20	16	0	98	0	0	0	0
5:30 PM				0	18		13	0	12	24		0		14	8	0	89	0	0	0	0
5:35 PM				0	14		12	0	9	28		0		21	5	0	89	0	0	0	0
5:40 PM				0	22		10	0	8	22		0		15	11	0	88	0	0	0	0
5:45 PM				0	13		12	0	9	18		0		14	6	0	72	0	0	0	0
5:50 PM				0	4		10	0	8	17		0		16	8	0	63	0	0	0	0
5:55 PM				0	16		13	0	7	18		0		13	1	0	68	0	0	0	0
Total Survey				0	440		315	0	198	548		0		397	200	1	2,098	0	0	0	0

15-Minute Interval Summary
4:00 PM to 6:00 PM

Interval	Northbound				Southbound				Eastbound				Westbound					Pedestrians			
Start	SW 65th Ave				SW 65th Ave				SW Stafford Rd				SW Stafford Rd				Interval	Crosswalk			
Time				Bikes	L		R	Bikes	L	T		Bikes		T	R	Bikes	Total	North	South	East	West
4:00 PM				0	57		35	0	21	59		0		60	26	1	258	0	0	0	0
4:15 PM				0	52		36	0	22	74		0		42	25	0	251	0	0	0	0
4:30 PM				0	58		37	0	27	62		0		51	29	0	264	0	0	0	0
4:45 PM				0	55		49	0	19	55		0		56	20	0	254	0	0	0	0
5:00 PM				0	65		41	0	29	88		0		38	22	0	283	0	0	0	0
5:15 PM				0	66		47	0	27	83		0		57	39	0	319	0	0	0	0
5:30 PM				0	54		35	0	29	74		0		50	24	0	266	0	0	0	0
5:45 PM				0	33		35	0	24	53		0		43	15	0	203	0	0	0	0
Total Survey				0	440		315	0	198	548		0		397	200	1	2,098	0	0	0	0

Peak Hour Summary
4:35 PM to 5:35 PM

By Approach	Northbound				Southbound				Eastbound				Westbound				Total	Pedestrians			
	SW 65th Ave				SW 65th Ave				SW Stafford Rd				SW Stafford Rd					Crosswalk			
	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes		North	South	East	West
Volume	0	0	0	0	415	217	632	0	398	375	773	0	312	533	845	0	1,125	0	0	0	0
%HV	0.0%				1.0%				1.0%				2.9%				1.5%				
PHF	0.00				0.87				0.83				0.81				0.88				

By Movement	Northbound				Southbound				Eastbound				Westbound				Total
	SW 65th Ave				SW 65th Ave				SW Stafford Rd				SW Stafford Rd				
				Total	L		R	Total	L	T		Total		T	R	Total	
Volume				0	240		175	415	105	293		398		200	112	312	1,125
%HV	NA	NA	NA	0.0%	1.7%	NA	0.0%	1.0%	1.0%	1.0%	NA	1.0%	NA	2.5%	3.6%	2.9%	1.5%
PHF				0.00	0.86		0.89	0.87	0.85	0.82		0.83		0.88	0.72	0.81	0.88

Rolling Hour Summary
4:00 PM to 6:00 PM

Interval	Northbound				Southbound				Eastbound				Westbound					Pedestrians			
Start	SW 65th Ave				SW 65th Ave				SW Stafford Rd				SW Stafford Rd				Interval	Crosswalk			
Time				Bikes	L		R	Bikes	L	T		Bikes		T	R	Bikes	Total	North	South	East	West
4:00 PM				0	222		157	0	89	250		0		209	100	1	1,027	0	0	0	0
4:15 PM				0	230		163	0	97	279		0		187	96	0	1,052	0	0	0	0
4:30 PM				0	244		174	0	102	288		0		202	110	0	1,120	0	0	0	0
4:45 PM				0	240		172	0	104	300		0		201	105	0	1,122	0	0	0	0
5:00 PM				0	218		158	0	109	298		0		188	100	0	1,071	0	0	0	0

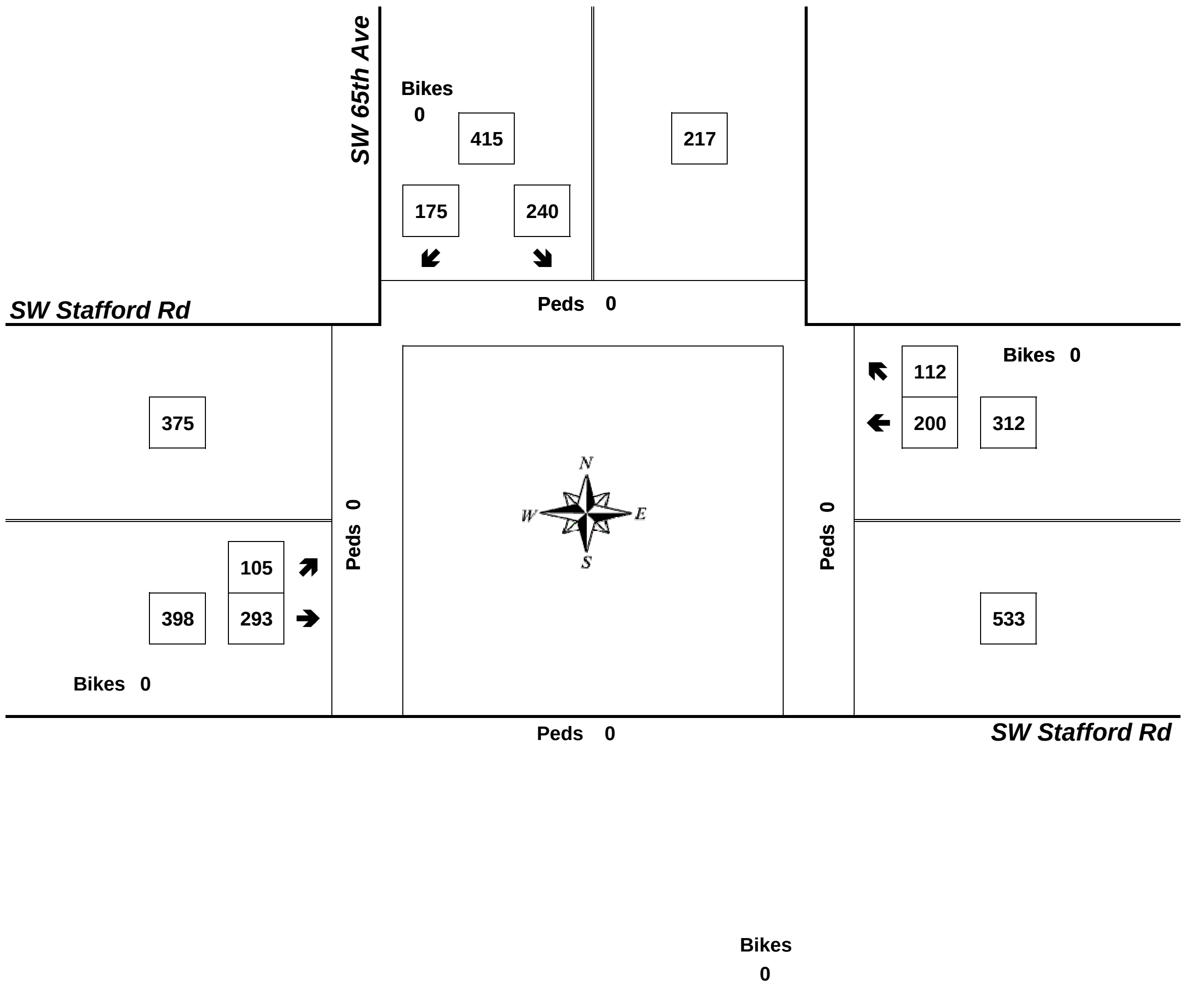
Peak Hour Summary

All Traffic Data
Services Inc.

Clay Carney
(503) 833-2740

SW 65th Ave & SW Stafford Rd

4:35 PM to 5:35 PM
Wednesday, April 16, 2014

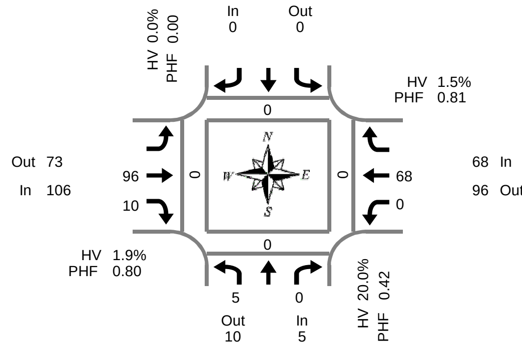


Approach	PHF	HV%	Volume
EB	0.83	1.0%	398
WB	0.81	2.9%	312
NB	0.00	0.0%	0
SB	0.87	1.0%	415
Intersection	0.88	1.5%	1,125

Count Period: 4:00 PM to 6:00 PM

Total Vehicle Summary

Clay Carney
(503) 833-2740



Peak Hour Summary
4:30 PM to 5:30 PM

SW 60th Ave & SW Advance Rd

Wednesday, February 12, 2014
4:00 PM to 6:00 PM

5-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound SW 60th Ave L		R	Bikes	Southbound SW 60th Ave			Bikes	Eastbound SW Advance Rd	T	R	Bikes	Westbound SW Advance Rd L	T		Bikes	Interval Total	Pedestrians Crosswalk North	South	East	West
4:00 PM	1		0	0				0		5	0	0	0	6		0	12	0	0	0	0
4:05 PM	1		0	0				0		13	0	0	0	1		0	15	0	0	0	0
4:10 PM	1		0	0				0		8	2	0	0	8		0	19	0	0	0	0
4:15 PM	0		0	0				0		5	2	0	0	7		0	14	0	0	0	0
4:20 PM	0		0	0				0		2	1	0	0	7		0	10	0	0	0	0
4:25 PM	1		0	0				0		4	1	0	0	6		0	12	0	0	0	0
4:30 PM	0		0	0				0		8	1	0	0	3		0	12	0	0	0	0
4:35 PM	1		0	0				0		10	1	0	0	5		0	17	0	0	0	0
4:40 PM	1		0	0				0		3	2	0	0	8		0	14	0	0	0	0
4:45 PM	1		0	0				0		6	1	0	0	4		0	12	0	0	0	0
4:50 PM	1		0	0				0		8	0	0	0	6		0	15	0	0	0	0
4:55 PM	1		0	0				0		6	1	0	0	3		0	11	0	0	0	0
5:00 PM	0		0	0				0		6	0	0	0	10		0	16	0	0	0	0
5:05 PM	0		0	0				0		9	1	0	0	2		0	12	0	0	0	0
5:10 PM	0		0	0				0		10	0	0	0	6		0	16	0	0	0	0
5:15 PM	0		0	0				0		13	0	0	0	6		0	19	0	0	0	0
5:20 PM	0		0	0				0		7	0	0	0	8		0	15	0	0	0	0
5:25 PM	0		0	0				0		10	3	0	0	7		0	20	0	0	0	0
5:30 PM	1		0	0				0		3	1	0	0	2		0	7	0	0	0	0
5:35 PM	3		0	0				0		4	0	0	0	6		0	13	0	0	0	0
5:40 PM	0		1	0				0		4	0	0	1	3		0	9	0	0	0	0
5:45 PM	0		0	0				0		9	1	0	0	2		0	12	0	0	0	0
5:50 PM	0		0	0				0		7	0	0	0	2		0	9	0	0	0	0
5:55 PM	0		0	0				0		2	2	0	1	4		0	9	0	0	0	0
Total Survey	13		1	0				0		162	20	0	2	122		0	320	0	0	0	0

15-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound SW 60th Ave L		R	Bikes	Southbound SW 60th Ave			Bikes	Eastbound SW Advance Rd	T	R	Bikes	Westbound SW Advance Rd L	T		Bikes	Interval Total	Pedestrians Crosswalk North	South	East	West
4:00 PM	3		0	0				0		26	2	0	0	15		0	46	0	0	0	0
4:15 PM	1		0	0				0		11	4	0	0	20		0	36	0	0	0	0
4:30 PM	2		0	0				0		21	4	0	0	16		0	43	0	0	0	0
4:45 PM	3		0	0				0		20	2	0	0	13		0	38	0	0	0	0
5:00 PM	0		0	0				0		25	1	0	0	18		0	44	0	0	0	0
5:15 PM	0		0	0				0		30	3	0	0	21		0	54	0	0	0	0
5:30 PM	4		1	0				0		11	1	0	1	11		0	29	0	0	0	0
5:45 PM	0		0	0				0		18	3	0	1	8		0	30	0	0	0	0
Total Survey	13		1	0				0		162	20	0	2	122		0	320	0	0	0	0

Peak Hour Summary
4:30 PM to 5:30 PM

By Approach	Northbound SW 60th Ave In	Out	Total	Bikes	Southbound SW 60th Ave In	Out	Total	Bikes	Eastbound SW Advance Rd In	Out	Total	Bikes	Westbound SW Advance Rd In	Out	Total	Bikes	Total
Volume	5	10	15	0	0	0	0	0	106	73	179	0	68	96	164	0	179
%HV	20.0%				0.0%				1.9%				1.5%				2.2%
PHF	0.42				0.00				0.80				0.81				0.83

Pedestrians Crosswalk North	South	East	West
0	0	0	0

By Movement	Northbound SW 60th Ave L		R	Total	Southbound SW 60th Ave			Total	Eastbound SW Advance Rd	T	R	Total	Westbound SW Advance Rd L	T		Total	Total
Volume	5		0	5				0		96	10	106	0	68		68	179
%HV	20.0%	NA	0.0%	20.0%	NA	NA	NA	0.0%	NA	1.0%	10.0%	1.9%	0.0%	1.5%	NA	1.5%	2.2%
PHF	0.42		0.00	0.42				0.00		0.75	0.63	0.80	0.00	0.81		0.81	0.83

Rolling Hour Summary
4:00 PM to 6:00 PM

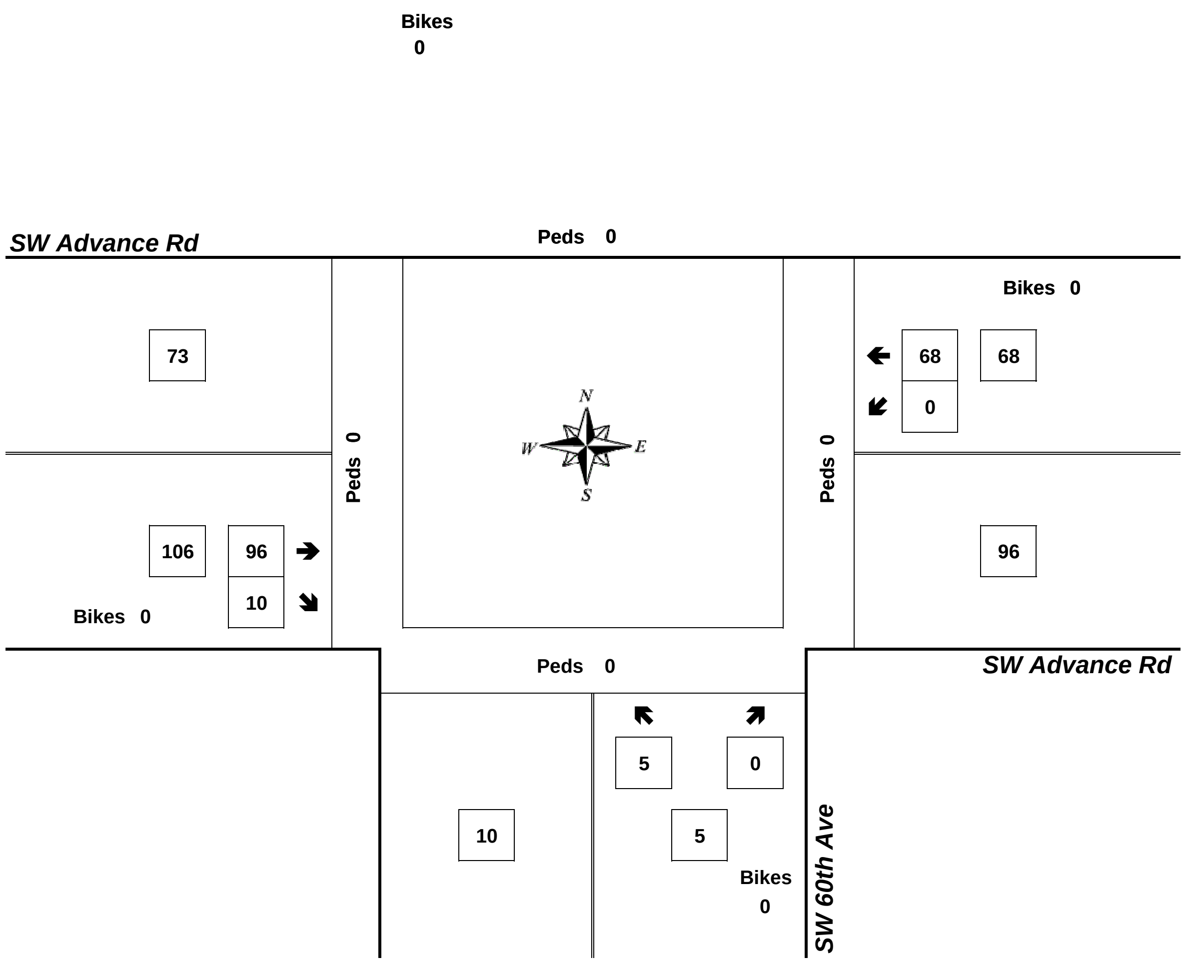
Interval Start Time	Northbound SW 60th Ave L		R	Bikes	Southbound SW 60th Ave			Bikes	Eastbound SW Advance Rd	T	R	Bikes	Westbound SW Advance Rd L	T		Bikes	Interval Total	Pedestrians Crosswalk North	South	East	West
4:00 PM	9		0	0				0		78	12	0	0	64		0	163	0	0	0	0
4:15 PM	6		0	0				0		77	11	0	0	67		0	161	0	0	0	0
4:30 PM	5		0	0				0		96	10	0	0	68		0	179	0	0	0	0
4:45 PM	7		1	0				0		86	7	0	1	63		0	165	0	0	0	0
5:00 PM	4		1	0				0		84	8	0	2	58		0	157	0	0	0	0

Peak Hour Summary

All Traffic Data Services Inc.
Clay Carney
(503) 833-2740

SW 60th Ave & SW Advance Rd

4:30 PM to 5:30 PM
Wednesday, February 12, 2014



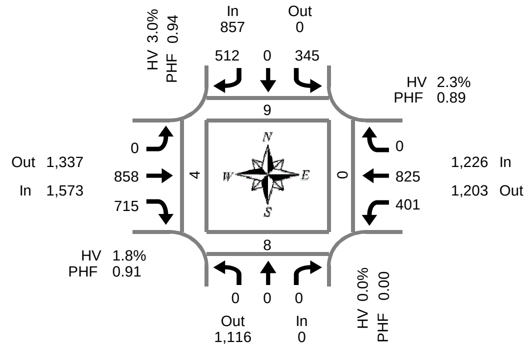
Approach	PHF	HV%	Volume
EB	0.80	1.9%	106
WB	0.81	1.5%	68
NB	0.42	20.0%	5
SB	0.00	0.0%	0
Intersection	0.83	2.2%	179

Count Period: 4:00 PM to 6:00 PM

Total Vehicle Summary

All Traffic Data Services Inc.

Clay Carney
(503) 833-2740



Peak Hour Summary
4:25 PM to 5:25 PM

I-5 SB Ramps & SW Wilsonville Rd

Tuesday, October 30, 2012
4:00 PM to 6:00 PM

5-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound I-5 SB Ramps L	T	R	Bikes	Southbound I-5 SB Ramps L	T	R	Bikes	Eastbound SW Wilsonville Rd L	T	R	Bikes	Westbound SW Wilsonville Rd L	T	R	Bikes	Interval Total	Pedestrians Crosswalk North	South	East	West
4:00 PM	0	0	0	0	27	0	50	0	0	77	54	0	40	60	0	0	308	1	0	0	0
4:05 PM	0	0	0	0	32	0	19	0	0	64	56	0	37	41	0	0	249	23	2	0	17
4:10 PM	0	0	0	0	22	0	45	0	0	68	47	0	38	77	0	0	297	1	0	0	0
4:15 PM	0	0	0	0	38	0	48	0	0	68	42	0	40	56	0	0	292	0	2	0	0
4:20 PM	0	0	0	0	26	0	45	0	0	70	39	0	36	65	0	0	281	2	1	0	0
4:25 PM	0	0	0	0	32	0	48	0	0	69	39	0	36	56	0	0	280	0	0	0	0
4:30 PM	0	0	0	0	41	0	37	0	0	83	55	0	40	60	0	0	316	1	0	0	0
4:35 PM	0	0	0	0	30	0	39	0	0	71	69	0	35	63	0	0	307	1	3	0	1
4:40 PM	0	0	0	0	23	0	34	0	0	62	48	0	38	87	0	0	292	1	2	0	0
4:45 PM	0	0	0	0	25	0	28	0	0	65	77	0	36	78	0	0	309	0	1	0	0
4:50 PM	0	0	0	0	26	0	44	0	0	69	63	0	35	69	0	0	306	2	1	0	2
4:55 PM	0	0	0	0	25	0	53	0	0	69	80	0	28	81	0	0	336	0	0	0	0
5:00 PM	0	0	0	0	32	0	45	0	0	63	73	0	28	62	0	0	303	2	0	0	0
5:05 PM	0	0	0	0	28	0	40	0	0	84	63	0	35	78	0	0	328	0	1	0	0
5:10 PM	0	0	0	0	25	0	44	0	0	72	48	0	32	62	0	0	283	0	0	0	0
5:15 PM	0	0	0	0	27	0	46	0	0	73	58	0	29	63	0	0	296	2	0	0	0
5:20 PM	0	0	0	0	31	0	54	0	0	78	42	0	29	66	0	0	300	0	0	0	1
5:25 PM	0	0	0	0	38	0	55	0	0	54	39	0	35	58	0	0	279	0	0	0	0
5:30 PM	0	0	0	0	34	0	37	0	0	80	45	0	26	59	0	0	281	0	1	0	0
5:35 PM	0	0	0	0	36	0	36	0	0	65	59	0	34	85	0	0	315	0	0	0	0
5:40 PM	0	0	0	0	28	0	37	0	0	75	40	0	37	59	0	0	276	0	0	0	0
5:45 PM	0	0	0	0	24	0	27	0	0	73	34	0	32	66	0	0	256	0	0	0	1
5:50 PM	0	0	0	0	45	0	34	0	0	84	33	0	36	61	0	0	293	1	2	0	0
5:55 PM	0	0	0	0	28	0	31	0	0	72	46	0	16	68	0	0	261	1	0	0	0
Total Survey	0	0	0	0	723	0	976	0	0	1,708	1,249	0	808	1,580	0	0	7,044	38	16	0	22

15-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound I-5 SB Ramps L	T	R	Bikes	Southbound I-5 SB Ramps L	T	R	Bikes	Eastbound SW Wilsonville Rd L	T	R	Bikes	Westbound SW Wilsonville Rd L	T	R	Bikes	Interval Total	Pedestrians Crosswalk North	South	East	West
4:00 PM	0	0	0	0	81	0	114	0	0	209	157	0	115	178	0	0	854	25	2	0	17
4:15 PM	0	0	0	0	96	0	141	0	0	207	120	0	112	177	0	0	853	2	3	0	0
4:30 PM	0	0	0	0	94	0	110	0	0	216	172	0	113	210	0	0	915	3	5	0	1
4:45 PM	0	0	0	0	76	0	125	0	0	203	220	0	99	228	0	0	951	2	2	0	2
5:00 PM	0	0	0	0	85	0	129	0	0	219	184	0	95	202	0	0	914	2	1	0	0
5:15 PM	0	0	0	0	96	0	155	0	0	205	139	0	93	187	0	0	875	2	0	0	1
5:30 PM	0	0	0	0	98	0	110	0	0	220	144	0	97	203	0	0	872	0	1	0	0
5:45 PM	0	0	0	0	97	0	92	0	0	229	113	0	84	195	0	0	810	2	2	0	1
Total Survey	0	0	0	0	723	0	976	0	0	1,708	1,249	0	808	1,580	0	0	7,044	38	16	0	22

Peak Hour Summary
4:25 PM to 5:25 PM

By Approach	Northbound I-5 SB Ramps In	Out	Total	Bikes	Southbound I-5 SB Ramps In	Out	Total	Bikes	Eastbound SW Wilsonville Rd In	Out	Total	Bikes	Westbound SW Wilsonville Rd In	Out	Total	Bikes	Total
Volume	0	1,116	1,116	0	857	0	857	0	1,573	1,337	2,910	0	1,226	1,203	2,429	0	3,656
%HV	0.0%				3.0%				1.8%				2.3%				2.2%
PHF	0.00				0.94				0.91				0.89				0.95

Pedestrians Crosswalk North	South	East	West
9	8	0	4

By Movement	Northbound I-5 SB Ramps L	T	R	Total	Southbound I-5 SB Ramps L	T	R	Total	Eastbound SW Wilsonville Rd L	T	R	Total	Westbound SW Wilsonville Rd L	T	R	Total	Total
Volume	0	0	0	0	345	0	512	857	0	858	715	1,573	401	825	0	1,226	3,656
%HV	0.0%	0.0%	0.0%	0.0%	0.9%	0.0%	4.5%	3.0%	0.0%	1.7%	1.8%	1.8%	0.2%	3.3%	0.0%	2.3%	2.2%
PHF	0.00	0.00	0.00	0.00	0.84	0.00	0.89	0.94	0.00	0.94	0.81	0.91	0.89	0.88	0.00	0.89	0.95

Rolling Hour Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound I-5 SB Ramps L	T	R	Bikes	Southbound I-5 SB Ramps L	T	R	Bikes	Eastbound SW Wilsonville Rd L	T	R	Bikes	Westbound SW Wilsonville Rd L	T	R	Bikes	Interval Total	Pedestrians Crosswalk North	South	East	West
4:00 PM	0	0	0	0	347	0	490	0	0	835	669	0	439	793	0	0	3,573	32	12	0	20
4:15 PM	0	0	0	0	351	0	505	0	0	845	696	0	419	817	0	0	3,633	9	11	0	3
4:30 PM	0	0	0	0	351	0	519	0	0	843	715	0	400	827	0	0	3,655	9	8	0	4
4:45 PM	0	0	0	0	355	0	519	0	0	847	687	0	384	820	0	0	3,612	6	4	0	3
5:00 PM	0	0	0	0	376	0	486	0	0	873	580	0	369	787	0	0	3,471	6	4	0	2

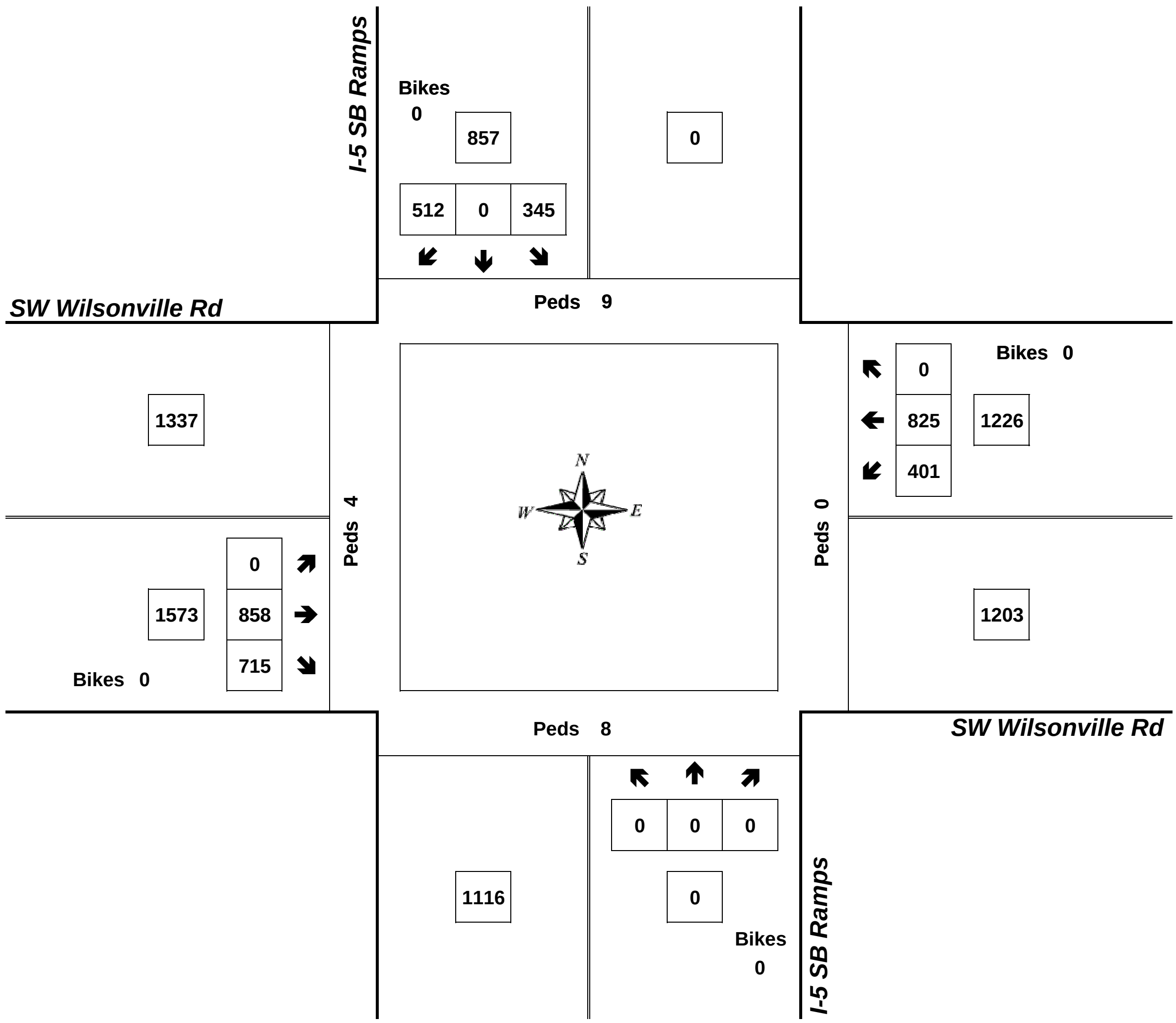
Peak Hour Summary

All Traffic Data Services Inc.

Clay Carney
(503) 833-2740

I-5 SB Ramps & SW Wilsonville Rd

4:25 PM to 5:25 PM
Tuesday, October 30, 2012



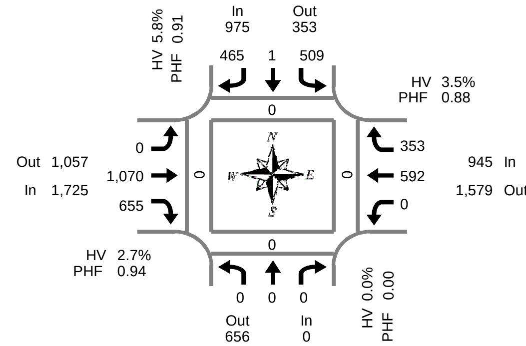
Approach	PHF	HV%	Volume
EB	0.91	1.8%	1,573
WB	0.89	2.3%	1,226
NB	0.00	0.0%	0
SB	0.94	3.0%	857
Intersection	0.95	2.2%	3,656

Count Period: 4:00 PM to 6:00 PM

Total Vehicle Summary

All Traffic Data Services Inc.

Clay Carney
(503) 833-2740



I-5 SB Ramps & SW Elligsen Rd

Wednesday, April 16, 2014
4:00 PM to 6:00 PM

Peak Hour Summary
4:25 PM to 5:25 PM

5-Minute Interval Summary
4:00 PM to 6:00 PM

Interval	Northbound I-5 SB Ramps				Southbound I-5 SB Ramps				Eastbound SW Elligsen Rd				Westbound SW Elligsen Rd				Interval	Pedestrians Crosswalk			
Start Time	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	Total	North	South	East	West
4:00 PM	0	0	0	0	47	0	44	0	0	100	55	0	0	49	26	0	321	0	0	0	0
4:05 PM	0	0	0	0	44	0	42	0	0	115	58	0	0	45	31	0	335	0	0	0	0
4:10 PM	0	0	0	0	41	0	41	0	0	97	64	0	0	41	30	0	314	0	0	0	0
4:15 PM	0	0	0	0	36	0	52	0	0	73	72	0	0	32	23	0	288	0	0	0	0
4:20 PM	0	0	0	0	37	0	44	0	0	62	44	0	0	43	24	1	254	0	0	0	0
4:25 PM	0	0	0	0	39	0	36	0	0	86	69	0	0	57	22	0	309	0	0	0	0
4:30 PM	0	0	0	0	36	0	42	0	0	113	39	0	0	46	29	0	305	0	0	0	0
4:35 PM	0	0	0	0	37	0	37	0	0	96	55	0	0	43	33	0	301	0	0	0	0
4:40 PM	0	0	0	0	39	0	33	0	0	89	56	0	0	43	19	0	279	0	0	0	0
4:45 PM	0	0	0	0	41	0	47	0	0	78	60	0	0	49	48	0	323	0	0	0	0
4:50 PM	0	0	0	0	50	0	48	0	0	69	54	0	0	38	28	0	287	0	0	0	0
4:55 PM	0	0	0	0	47	1	34	0	0	85	51	0	0	62	19	0	299	0	0	0	0
5:00 PM	0	0	0	0	41	0	33	0	0	91	52	0	0	53	32	0	302	0	0	0	0
5:05 PM	0	0	0	0	42	0	36	0	0	99	44	0	0	64	27	0	312	0	0	0	0
5:10 PM	0	0	0	0	50	0	41	0	0	97	61	0	0	46	45	0	340	0	0	0	0
5:15 PM	0	0	0	0	46	0	31	0	0	90	65	0	0	50	22	0	304	0	0	0	0
5:20 PM	0	0	0	0	41	0	47	0	0	77	49	2	0	41	29	0	284	0	0	0	0
5:25 PM	0	0	0	0	45	0	38	0	0	54	48	0	0	52	22	0	259	0	0	0	0
5:30 PM	0	0	0	0	45	0	35	0	0	72	50	0	0	48	25	0	275	0	0	0	0
5:35 PM	0	0	0	0	38	0	24	0	0	84	39	0	0	49	20	0	254	0	0	0	0
5:40 PM	0	0	0	0	48	0	42	0	0	63	25	0	0	49	23	0	250	0	0	0	0
5:45 PM	0	0	0	0	36	0	42	0	0	63	24	0	0	45	21	0	231	0	0	0	0
5:50 PM	0	0	0	0	41	0	36	0	0	52	35	0	0	50	27	0	241	0	0	0	0
5:55 PM	0	0	0	0	55	0	34	0	0	58	38	0	0	42	18	0	245	0	0	0	0
Total Survey	0	0	0	0	1,022	1	939	0	0	1,963	1,207	2	0	1,137	643	1	6,912	0	0	0	0

15-Minute Interval Summary
4:00 PM to 6:00 PM

Interval	Northbound I-5 SB Ramps				Southbound I-5 SB Ramps				Eastbound SW Elligsen Rd				Westbound SW Elligsen Rd				Interval	Pedestrians Crosswalk			
Start Time	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	Total	North	South	East	West
4:00 PM	0	0	0	0	132	0	127	0	0	312	177	0	0	135	87	0	970	0	0	0	0
4:15 PM	0	0	0	0	112	0	132	0	0	221	185	0	0	132	69	1	851	0	0	0	0
4:30 PM	0	0	0	0	112	0	112	0	0	298	150	0	0	132	81	0	885	0	0	0	0
4:45 PM	0	0	0	0	138	1	129	0	0	232	165	0	0	149	95	0	909	0	0	0	0
5:00 PM	0	0	0	0	133	0	110	0	0	287	157	0	0	163	104	0	954	0	0	0	0
5:15 PM	0	0	0	0	132	0	116	0	0	221	162	2	0	143	73	0	847	0	0	0	0
5:30 PM	0	0	0	0	131	0	101	0	0	219	114	0	0	146	68	0	779	0	0	0	0
5:45 PM	0	0	0	0	132	0	112	0	0	173	97	0	0	137	66	0	717	0	0	0	0
Total Survey	0	0	0	0	1,022	1	939	0	0	1,963	1,207	2	0	1,137	643	1	6,912	0	0	0	0

Peak Hour Summary
4:25 PM to 5:25 PM

By Approach	Northbound I-5 SB Ramps				Southbound I-5 SB Ramps				Eastbound SW Elligsen Rd				Westbound SW Elligsen Rd				Total	Pedestrians Crosswalk			
	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes		North	South	East	West
Volume	0	656	656	0	975	353	1,328	0	1,725	1,057	2,782	2	945	1,579	2,524	0	3,645	0	0	0	0
%HV	0.0%				5.8%				2.7%				3.5%				3.8%				
PHF	0.00				0.91				0.94				0.88				0.95				

By Movement	Northbound I-5 SB Ramps				Southbound I-5 SB Ramps				Eastbound SW Elligsen Rd				Westbound SW Elligsen Rd				Total
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	
Volume	0	0	0	0	509	1	465	975	0	1,070	655	1,725	0	592	353	945	3,645
%HV	0.0%	0.0%	0.0%	0.0%	2.4%	0.0%	9.7%	5.8%	0.0%	3.0%	2.3%	2.7%	0.0%	4.2%	2.3%	3.5%	3.8%
PHF	0.00	0.00	0.00	0.00	0.92	0.25	0.90	0.91	0.00	0.90	0.94	0.94	0.00	0.83	0.85	0.88	0.95

Rolling Hour Summary
4:00 PM to 6:00 PM

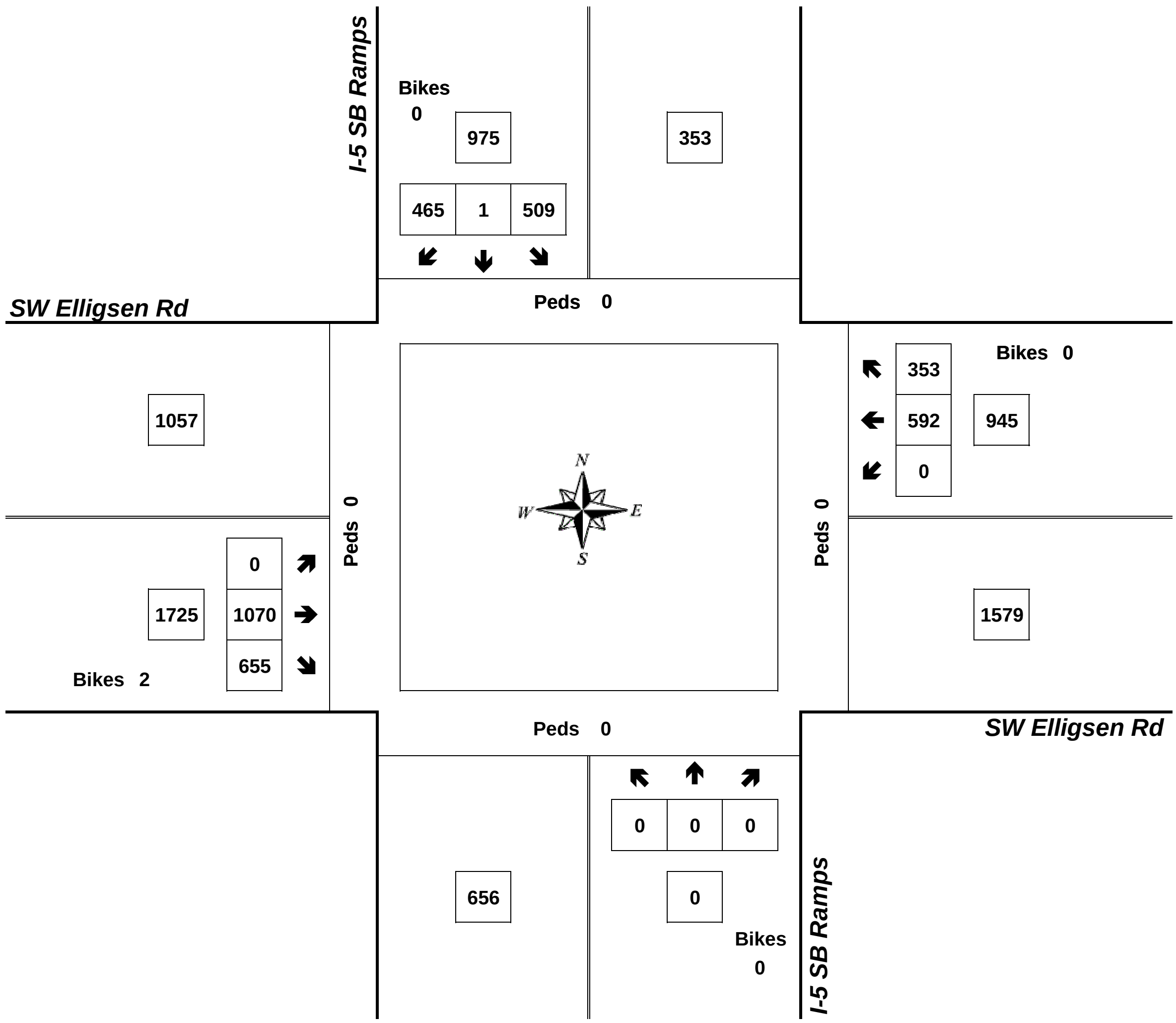
Interval	Northbound I-5 SB Ramps				Southbound I-5 SB Ramps				Eastbound SW Elligsen Rd				Westbound SW Elligsen Rd				Interval	Pedestrians Crosswalk			
Start Time	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	Total	North	South	East	West
4:00 PM	0	0	0	0	494	1	500	0	0	1,063	677	0	0	548	332	1	3,615	0	0	0	0
4:15 PM	0	0	0	0	495	1	483	0	0	1,038	657	0	0	576	349	1	3,599	0	0	0	0
4:30 PM	0	0	0	0	515	1	467	0	0	1,038	634	2	0	587	353	0	3,595	0	0	0	0
4:45 PM	0	0	0	0	534	1	456	0	0	959	598	2	0	601	340	0	3,489	0	0	0	0
5:00 PM	0	0	0	0	528	0	439	0	0	900	530	2	0	589	311	0	3,297	0	0	0	0

Peak Hour Summary

All Traffic Data Services Inc.
Clay Carney
(503) 833-2740

I-5 SB Ramps & SW Elligsen Rd

4:25 PM to 5:25 PM
Wednesday, April 16, 2014

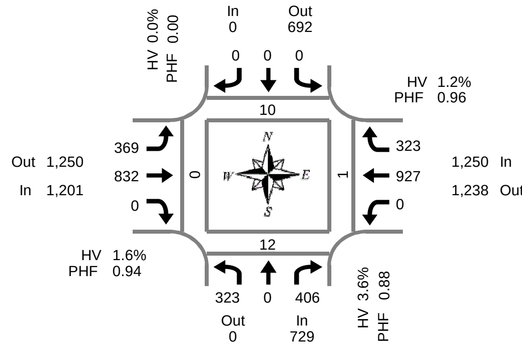


Approach	PHF	HV%	Volume
EB	0.94	2.7%	1,725
WB	0.88	3.5%	945
NB	0.00	0.0%	0
SB	0.91	5.8%	975
Intersection	0.95	3.8%	3,645

Count Period: 4:00 PM to 6:00 PM

Total Vehicle Summary

All Traffic Data Services Inc.
Clay Carney
(503) 833-2740



Peak Hour Summary
4:15 PM to 5:15 PM

I-5 NB Ramps & SW Wilsonville Rd

Tuesday, October 30, 2012
4:00 PM to 6:00 PM

5-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound I-5 NB Ramps				Southbound I-5 NB Ramps				Eastbound SW Wilsonville Rd				Westbound SW Wilsonville Rd				Interval Total	Pedestrians Crosswalk			
	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes		North	South	East	West
4:00 PM	22	0	22	0	0	0	0	0	36	55	0	0	0	73	29	0	237	0	18	18	0
4:05 PM	18	0	16	0	0	0	0	0	38	74	0	0	0	77	25	0	248	19	3	2	0
4:10 PM	16	0	35	0	0	0	0	0	27	75	0	0	0	67	31	0	251	1	0	0	0
4:15 PM	32	0	34	0	0	0	0	0	24	67	0	0	0	79	36	0	272	0	2	0	0
4:20 PM	26	0	26	0	0	0	0	0	27	77	0	0	0	80	24	0	260	2	1	0	0
4:25 PM	16	0	28	0	0	0	0	0	24	69	0	0	0	73	20	0	230	0	0	0	0
4:30 PM	18	0	45	0	0	0	0	0	37	68	0	0	0	75	33	0	276	1	1	0	0
4:35 PM	25	0	37	0	0	0	0	0	30	88	0	0	0	74	24	0	278	2	2	0	0
4:40 PM	39	0	44	0	0	0	0	0	31	61	0	0	0	82	26	0	283	0	0	0	0
4:45 PM	25	0	35	0	0	0	0	0	36	60	0	0	0	86	35	0	277	1	3	1	0
4:50 PM	30	0	27	0	0	0	0	0	25	60	0	0	0	78	11	0	231	2	0	0	0
4:55 PM	32	0	35	0	0	0	0	0	26	72	0	0	0	82	22	0	269	0	2	0	0
5:00 PM	19	0	29	0	0	0	0	0	29	64	0	0	0	78	38	0	257	2	0	0	0
5:05 PM	29	0	38	0	0	0	0	0	36	78	0	0	0	69	29	0	279	0	1	0	0
5:10 PM	32	0	28	0	0	0	0	0	44	68	0	0	0	71	25	0	268	0	0	0	0
5:15 PM	27	0	34	0	0	0	0	0	38	65	0	0	0	71	28	0	263	1	0	0	0
5:20 PM	25	0	30	0	0	0	0	0	32	49	0	0	0	69	20	0	225	2	0	0	0
5:25 PM	25	0	37	0	0	0	0	0	24	84	0	0	0	62	26	0	258	0	2	0	0
5:30 PM	26	0	34	0	0	0	0	0	36	79	0	0	0	63	31	0	269	0	0	0	0
5:35 PM	25	0	38	0	0	0	0	0	31	71	0	0	0	83	29	0	277	0	0	0	0
5:40 PM	32	0	34	0	0	0	0	0	30	73	0	0	0	74	24	2	267	1	0	1	0
5:45 PM	31	0	39	0	0	0	0	0	27	71	0	0	0	70	22	0	260	1	0	0	0
5:50 PM	26	0	33	0	0	0	0	0	34	82	0	0	0	75	26	0	276	1	2	0	0
5:55 PM	28	0	31	0	0	0	0	0	36	89	0	0	0	52	16	0	252	0	0	0	0
Total Survey	624	0	789	0	0	0	0	0	758	1,699	0	0	0	1,763	630	2	6,263	36	37	22	0

15-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound I-5 NB Ramps				Southbound I-5 NB Ramps				Eastbound SW Wilsonville Rd				Westbound SW Wilsonville Rd				Interval Total	Pedestrians Crosswalk			
	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes		North	South	East	West
4:00 PM	56	0	73	0	0	0	0	0	101	204	0	0	0	217	85	0	736	20	21	20	0
4:15 PM	74	0	88	0	0	0	0	0	75	213	0	0	0	232	80	0	762	2	3	0	0
4:30 PM	82	0	126	0	0	0	0	0	98	217	0	0	0	231	83	0	837	3	3	0	0
4:45 PM	87	0	97	0	0	0	0	0	87	192	0	0	0	246	68	0	777	3	5	1	0
5:00 PM	80	0	95	0	0	0	0	0	109	210	0	0	0	218	92	0	804	2	1	0	0
5:15 PM	77	0	101	0	0	0	0	0	94	198	0	0	0	202	74	0	746	3	2	0	0
5:30 PM	83	0	106	0	0	0	0	0	97	223	0	0	0	220	84	2	813	1	0	1	0
5:45 PM	85	0	103	0	0	0	0	0	97	242	0	0	0	197	64	0	788	2	2	0	0
Total Survey	624	0	789	0	0	0	0	0	758	1,699	0	0	0	1,763	630	2	6,263	36	37	22	0

Peak Hour Summary
4:15 PM to 5:15 PM

By Approach	Northbound I-5 NB Ramps				Southbound I-5 NB Ramps				Eastbound SW Wilsonville Rd				Westbound SW Wilsonville Rd				Total	Pedestrians Crosswalk			
	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes		North	South	East	West
Volume	729	0	729	0	0	692	692	0	1,201	1,250	2,451	0	1,250	1,238	2,488	0	3,180	10	12	1	0
%HV	3.6%				0.0%				1.6%				1.2%				1.9%				
PHF	0.88				0.00				0.94				0.96				0.95				

By Movement	Northbound I-5 NB Ramps				Southbound I-5 NB Ramps				Eastbound SW Wilsonville Rd				Westbound SW Wilsonville Rd				Total
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	
Volume	323	0	406	729	0	0	0	0	369	832	0	1,201	0	927	323	1,250	3,180
%HV	6.2%	0.0%	1.5%	3.6%	0.0%	0.0%	0.0%	0.0%	3.0%	1.0%	0.0%	1.6%	0.0%	0.8%	2.5%	1.2%	1.9%
PHF	0.86	0.00	0.81	0.88	0.00	0.00	0.00	0.00	0.85	0.92	0.00	0.94	0.00	0.94	0.88	0.96	0.95

Rolling Hour Summary
4:00 PM to 6:00 PM

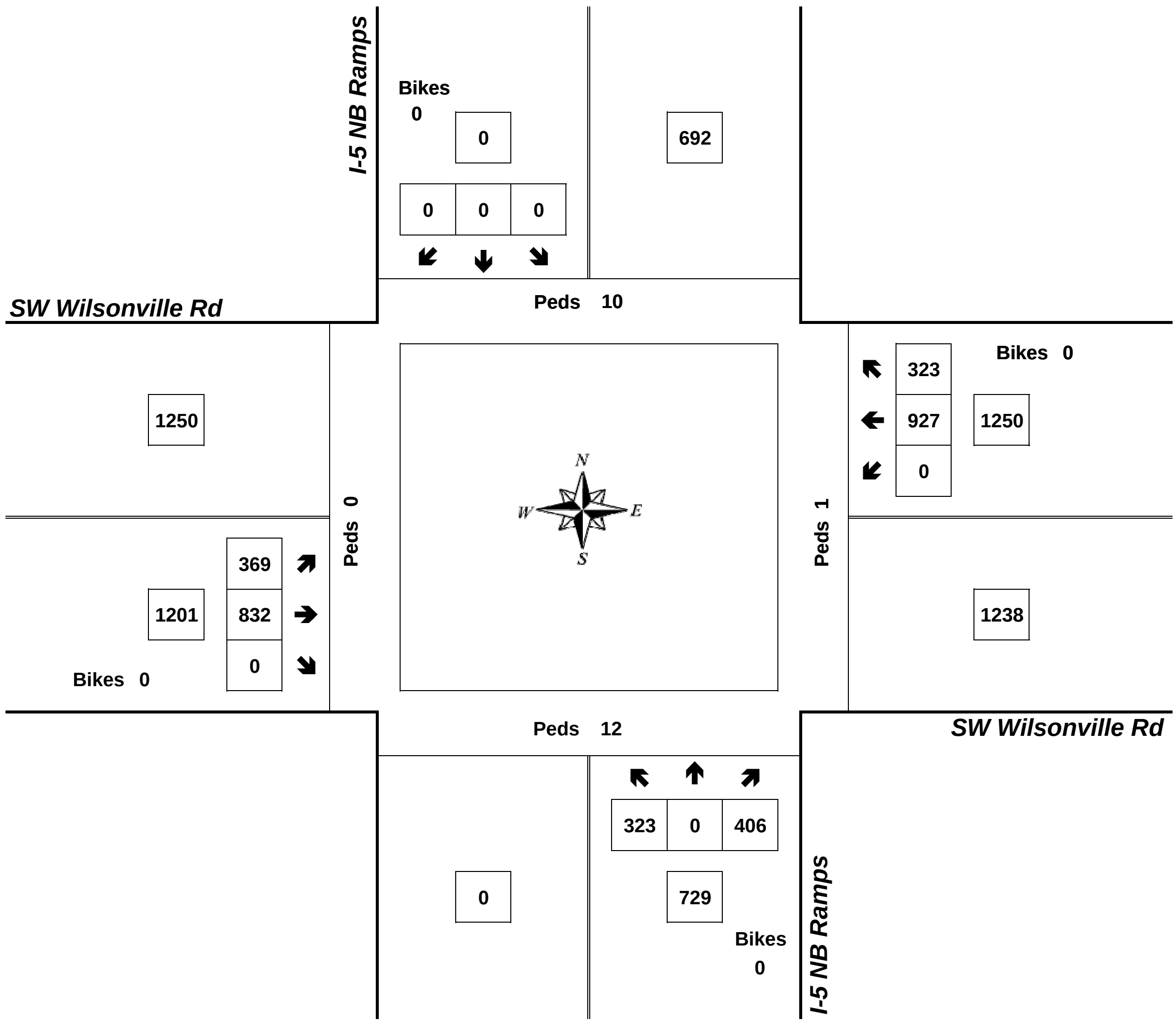
Interval Start Time	Northbound I-5 NB Ramps				Southbound I-5 NB Ramps				Eastbound SW Wilsonville Rd				Westbound SW Wilsonville Rd				Interval Total	Pedestrians Crosswalk			
	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes		North	South	East	West
4:00 PM	299	0	384	0	0	0	0	0	361	826	0	0	0	926	316	0	3,112	28	32	21	0
4:15 PM	323	0	406	0	0	0	0	0	369	832	0	0	0	927	323	0	3,180	10	12	1	0
4:30 PM	326	0	419	0	0	0	0	0	388	817	0	0	0	897	317	0	3,164	11	11	1	0
4:45 PM	327	0	399	0	0	0	0	0	387	823	0	0	0	886	318	2	3,140	9	8	2	0
5:00 PM	325	0	405	0	0	0	0	0	397	873	0	0	0	837	314	2	3,151	8	5	1	0

Peak Hour Summary

All Traffic Data Services Inc.
Clay Carney
(503) 833-2740

I-5 NB Ramps & SW Wilsonville Rd

4:15 PM to 5:15 PM
Tuesday, October 30, 2012

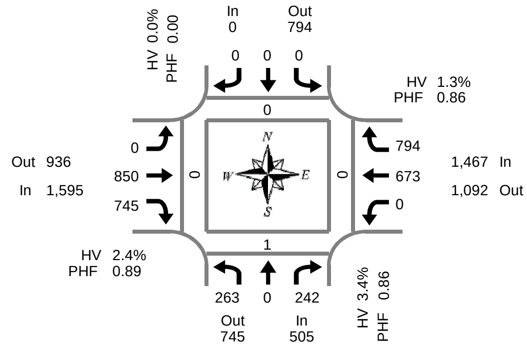


Approach	PHF	HV%	Volume
EB	0.94	1.6%	1,201
WB	0.96	1.2%	1,250
NB	0.88	3.6%	729
SB	0.00	0.0%	0
Intersection	0.95	1.9%	3,180

Count Period: 4:00 PM to 6:00 PM

Total Vehicle Summary

All Traffic Data Services Inc.
Clay Carney
(503) 833-2740



Peak Hour Summary
4:45 PM to 5:45 PM

I-5 NB Ramps & SW Elligsen Rd

Wednesday, April 16, 2014
4:00 PM to 6:00 PM

5-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound I-5 NB Ramps L	T	R	Bikes	Southbound I-5 NB Ramps L	T	R	Bikes	Eastbound SW Elligsen Rd L	T	R	Bikes	Westbound SW Elligsen Rd L	T	R	Bikes	Interval Total	Pedestrians Crosswalk North	South	East	West
4:00 PM	26	0	17	0	0	0	0	0	0	69	45	0	0	48	59	0	264	0	0	0	0
4:05 PM	22	0	13	0	0	0	0	0	0	74	36	0	0	57	49	0	251	0	0	0	0
4:10 PM	17	0	21	0	0	0	0	0	0	65	51	0	0	54	50	0	258	0	0	0	0
4:15 PM	20	0	19	0	0	0	0	0	0	52	55	0	0	47	50	0	243	0	0	0	0
4:20 PM	23	0	18	0	0	0	0	0	0	45	49	0	0	35	55	1	225	0	0	0	0
4:25 PM	19	0	17	0	0	0	0	0	0	81	43	0	0	55	54	0	269	0	0	0	0
4:30 PM	19	0	21	0	0	0	0	0	0	66	56	0	0	60	59	0	281	0	0	0	0
4:35 PM	28	0	16	0	0	0	0	0	0	63	72	0	0	39	82	0	300	0	0	0	0
4:40 PM	21	0	12	0	0	0	0	0	0	67	77	0	0	48	58	0	283	0	0	0	0
4:45 PM	28	0	25	0	0	0	0	0	0	72	47	0	0	72	67	0	311	0	0	0	0
4:50 PM	20	0	19	0	0	0	0	0	0	62	64	0	0	45	54	0	264	0	0	0	0
4:55 PM	30	0	24	0	0	0	0	0	0	71	55	0	0	57	49	0	286	0	0	0	0
5:00 PM	17	0	19	0	0	0	0	0	0	70	69	0	0	63	68	0	306	0	0	0	0
5:05 PM	23	0	10	0	0	0	0	0	0	72	52	0	0	70	80	1	307	0	0	0	0
5:10 PM	17	0	19	0	0	0	0	0	0	75	75	0	0	61	82	0	329	0	1	0	0
5:15 PM	27	0	19	0	0	0	0	0	0	86	44	0	0	53	71	0	300	0	0	0	0
5:20 PM	30	0	20	0	0	0	0	0	0	65	51	0	0	51	64	0	281	0	0	0	0
5:25 PM	20	0	22	0	0	0	0	0	0	57	61	0	0	45	56	0	261	0	0	0	0
5:30 PM	20	0	34	0	0	0	0	0	0	74	68	0	0	49	69	0	314	0	0	0	0
5:35 PM	10	0	14	0	0	0	0	0	0	78	83	0	0	58	70	0	313	0	0	0	0
5:40 PM	21	0	17	0	0	0	0	0	0	68	76	0	0	49	64	0	295	0	0	0	0
5:45 PM	18	0	11	0	0	0	0	0	0	56	44	0	0	48	59	0	236	0	0	0	0
5:50 PM	30	0	14	0	0	0	0	0	0	59	40	0	0	44	46	0	233	0	0	0	0
5:55 PM	22	0	20	0	0	0	0	0	0	68	41	0	0	45	49	0	245	0	0	0	0
Total Survey	528	0	441	0	0	0	0	0	0	1,615	1,354	0	0	1,253	1,464	2	6,655	0	1	0	0

15-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound I-5 NB Ramps L	T	R	Bikes	Southbound I-5 NB Ramps L	T	R	Bikes	Eastbound SW Elligsen Rd L	T	R	Bikes	Westbound SW Elligsen Rd L	T	R	Bikes	Interval Total	Pedestrians Crosswalk North	South	East	West
4:00 PM	65	0	51	0	0	0	0	0	0	208	132	0	0	159	158	0	773	0	0	0	0
4:15 PM	62	0	54	0	0	0	0	0	0	178	147	0	0	137	159	1	737	0	0	0	0
4:30 PM	68	0	49	0	0	0	0	0	0	196	205	0	0	147	199	0	864	0	0	0	0
4:45 PM	78	0	68	0	0	0	0	0	0	205	166	0	0	174	170	0	861	0	0	0	0
5:00 PM	57	0	48	0	0	0	0	0	0	217	196	0	0	194	230	1	942	0	1	0	0
5:15 PM	77	0	61	0	0	0	0	0	0	208	156	0	0	149	191	0	842	0	0	0	0
5:30 PM	51	0	65	0	0	0	0	0	0	220	227	0	0	156	203	0	922	0	0	0	0
5:45 PM	70	0	45	0	0	0	0	0	0	183	125	0	0	137	154	0	714	0	0	0	0
Total Survey	528	0	441	0	0	0	0	0	0	1,615	1,354	0	0	1,253	1,464	2	6,655	0	1	0	0

Peak Hour Summary
4:45 PM to 5:45 PM

By Approach	Northbound I-5 NB Ramps In	Out	Total	Bikes	Southbound I-5 NB Ramps In	Out	Total	Bikes	Eastbound SW Elligsen Rd In	Out	Total	Bikes	Westbound SW Elligsen Rd In	Out	Total	Bikes	Total	Pedestrians Crosswalk North	South	East	West
Volume	505	745	1,250	0	0	794	794	0	1,595	936	2,531	0	1,467	1,092	2,559	1	3,567	0	1	0	0
%HV	3.4%				0.0%				2.4%				1.3%				2.1%				
PHF	0.86				0.00				0.89				0.86				0.95				

By Movement	Northbound I-5 NB Ramps L	T	R	Total	Southbound I-5 NB Ramps L	T	R	Total	Eastbound SW Elligsen Rd L	T	R	Total	Westbound SW Elligsen Rd L	T	R	Total	Total
Volume	263	0	242	505	0	0	0	0	0	850	745	1,595	0	673	794	1,467	3,567
%HV	3.0%	0.0%	3.7%	3.4%	0.0%	0.0%	0.0%	0.0%	0.0%	1.6%	3.2%	2.4%	0.0%	1.5%	1.1%	1.3%	2.1%
PHF	0.84	0.00	0.80	0.86	0.00	0.00	0.00	0.00	0.00	0.91	0.82	0.89	0.00	0.87	0.85	0.86	0.95

Rolling Hour Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound I-5 NB Ramps L	T	R	Bikes	Southbound I-5 NB Ramps L	T	R	Bikes	Eastbound SW Elligsen Rd L	T	R	Bikes	Westbound SW Elligsen Rd L	T	R	Bikes	Interval Total	Pedestrians Crosswalk North	South	East	West
4:00 PM	273	0	222	0	0	0	0	0	0	787	650	0	0	617	686	1	3,235	0	0	0	0
4:15 PM	265	0	219	0	0	0	0	0	0	796	714	0	0	652	758	2	3,404	0	1	0	0
4:30 PM	280	0	226	0	0	0	0	0	0	826	723	0	0	664	790	1	3,509	0	1	0	0
4:45 PM	263	0	242	0	0	0	0	0	0	850	745	0	0	673	794	1	3,567	0	1	0	0
5:00 PM	255	0	219	0	0	0	0	0	0	828	704	0	0	636	778	1	3,420	0	1	0	0

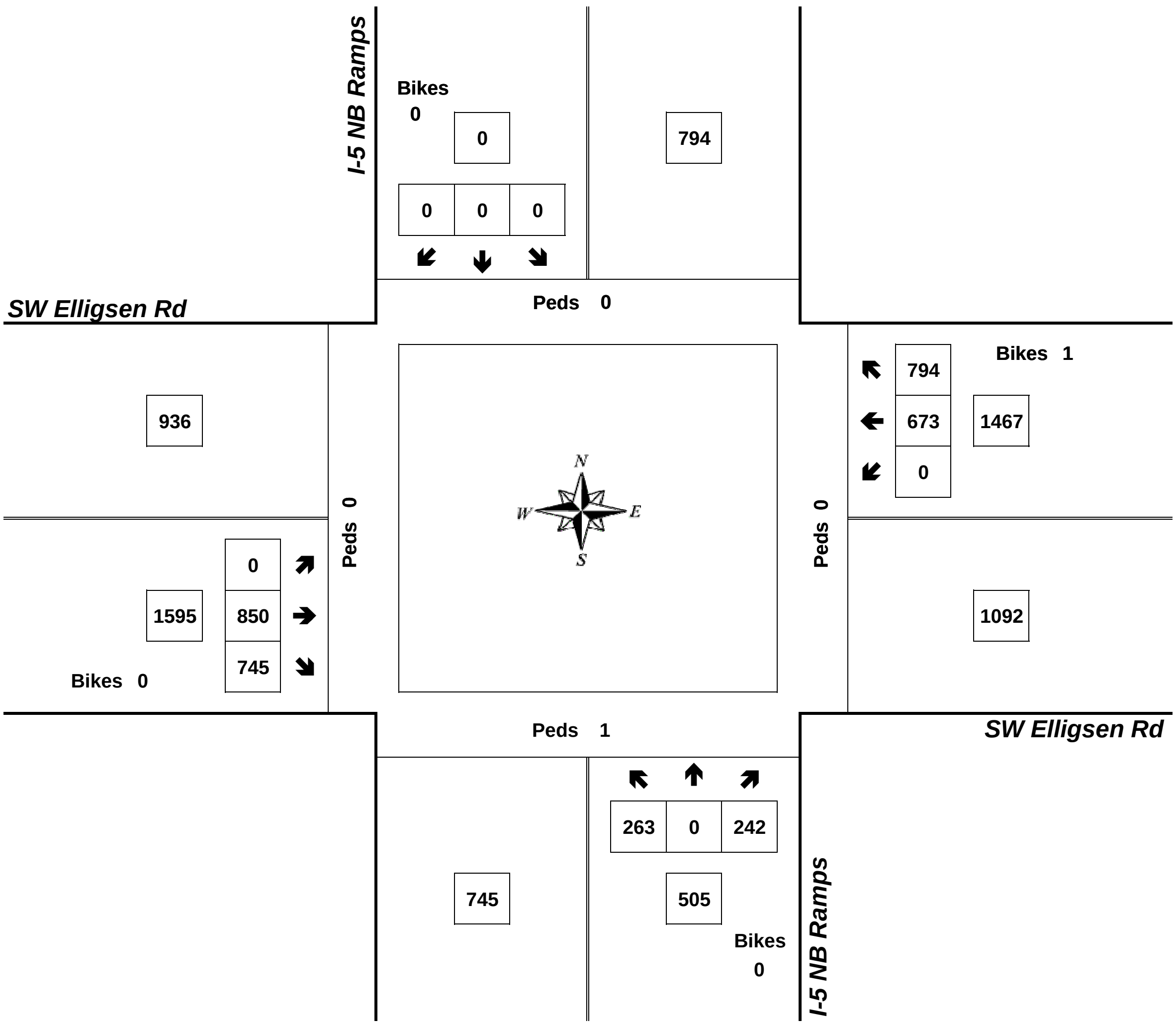
Peak Hour Summary

All Traffic Data Services Inc.

Clay Carney
(503) 833-2740

I-5 NB Ramps & SW Elligsen Rd

4:45 PM to 5:45 PM
Wednesday, April 16, 2014



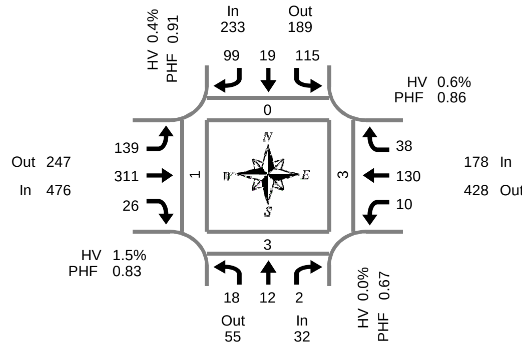
Approach	PHF	HV%	Volume
EB	0.89	2.4%	1,595
WB	0.86	1.3%	1,467
NB	0.86	3.4%	505
SB	0.00	0.0%	0
Intersection	0.95	2.1%	3,567

Count Period: 4:00 PM to 6:00 PM

Total Vehicle Summary

All Traffic Data Services Inc.

Clay Carney
(503) 833-2740



Peak Hour Summary
4:55 PM to 5:55 PM

Canyon Creek Rd & Boeckman Rd

Wednesday, February 12, 2014
4:00 PM to 6:00 PM

5-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound Canyon Creek Rd				Southbound Canyon Creek Rd				Eastbound Boeckman Rd				Westbound Boeckman Rd				Interval Total	Pedestrians Crosswalk			
	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes		North	South	East	West
4:00 PM	0	0	0	0	2	2	8	0	9	20	0	0	1	8	1	0	51	0	0	0	0
4:05 PM	0	0	0	0	7	1	3	0	9	23	0	0	0	11	1	0	55	0	1	0	0
4:10 PM	1	0	0	0	8	1	9	0	15	15	3	0	0	15	6	0	73	0	0	0	0
4:15 PM	3	1	0	0	5	0	4	0	3	20	3	0	0	14	1	0	54	0	0	0	0
4:20 PM	1	1	0	0	6	1	10	0	11	17	3	0	0	14	1	0	65	0	1	0	0
4:25 PM	0	0	0	0	8	2	4	0	5	20	2	0	0	7	3	0	51	0	0	0	0
4:30 PM	2	1	0	0	5	1	8	0	5	30	1	0	0	6	2	0	61	0	0	0	0
4:35 PM	1	0	0	0	11	0	7	0	10	22	3	0	1	9	1	0	65	0	0	0	0
4:40 PM	1	0	0	0	6	1	5	0	9	15	2	0	0	6	5	0	50	0	0	0	1
4:45 PM	0	1	0	0	9	2	10	0	10	20	1	0	2	11	4	0	70	0	0	0	0
4:50 PM	0	2	0	0	12	0	4	0	12	28	1	0	0	19	2	0	80	0	1	0	0
4:55 PM	2	2	0	0	11	1	10	0	5	20	2	0	1	6	6	0	66	0	0	0	0
5:00 PM	3	2	0	0	9	1	10	0	10	24	1	0	2	14	3	0	79	0	0	2	0
5:05 PM	0	3	0	0	8	0	8	0	10	38	1	0	0	13	2	0	83	0	1	0	0
5:10 PM	0	0	0	0	12	2	14	0	8	30	0	0	0	11	3	0	80	0	1	0	0
5:15 PM	0	1	0	0	9	0	9	0	16	31	2	0	1	14	4	0	87	0	0	0	0
5:20 PM	3	0	0	0	10	1	4	0	15	30	2	0	0	13	1	0	79	0	0	0	1
5:25 PM	1	0	0	0	6	1	3	0	17	28	3	1	1	13	5	0	78	0	0	0	0
5:30 PM	1	0	0	0	8	1	6	0	11	26	4	0	0	11	2	0	70	0	0	0	0
5:35 PM	3	2	0	0	13	3	12	0	11	19	2	0	2	11	5	0	83	0	0	1	0
5:40 PM	3	0	1	0	5	2	6	0	12	18	3	0	1	6	3	0	60	0	0	0	0
5:45 PM	1	0	1	0	11	4	6	0	12	25	2	0	0	9	2	0	73	0	1	0	0
5:50 PM	1	2	0	0	13	3	11	0	12	22	4	0	2	9	2	0	81	0	0	0	0
5:55 PM	0	2	0	0	6	0	10	0	13	16	6	1	0	9	2	0	64	0	0	0	0
Total Survey	27	20	2	0	200	30	181	0	250	557	51	2	14	259	67	0	1,658	0	6	3	2

15-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound Canyon Creek Rd				Southbound Canyon Creek Rd				Eastbound Boeckman Rd				Westbound Boeckman Rd				Interval Total	Pedestrians Crosswalk			
	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes		North	South	East	West
4:00 PM	1	0	0	0	17	4	20	0	33	58	3	0	1	34	8	0	179	0	1	0	0
4:15 PM	4	2	0	0	19	3	18	0	19	57	8	0	0	35	5	0	170	0	1	0	0
4:30 PM	4	1	0	0	22	2	20	0	24	67	6	0	1	21	8	0	176	0	0	0	1
4:45 PM	2	5	0	0	32	3	24	0	27	68	4	0	3	36	12	0	216	0	1	0	0
5:00 PM	3	5	0	0	29	3	32	0	28	92	2	0	2	38	8	0	242	0	2	2	0
5:15 PM	4	1	0	0	25	2	16	0	48	89	7	1	2	40	10	0	244	0	0	0	1
5:30 PM	7	2	1	0	26	6	24	0	34	63	9	0	3	28	10	0	213	0	0	1	0
5:45 PM	2	4	1	0	30	7	27	0	37	63	12	1	2	27	6	0	218	0	1	0	0
Total Survey	27	20	2	0	200	30	181	0	250	557	51	2	14	259	67	0	1,658	0	6	3	2

Peak Hour Summary
4:55 PM to 5:55 PM

By Approach	Northbound Canyon Creek Rd				Southbound Canyon Creek Rd				Eastbound Boeckman Rd				Westbound Boeckman Rd				Total	Pedestrians Crosswalk			
	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes		North	South	East	West
Volume	32	55	87	0	233	189	422	0	476	247	723	1	178	428	606	0	919	0	3	3	1
%HV	0.0%				0.4%				1.5%				0.6%				1.0%				
PHF	0.67				0.91				0.83				0.86				0.92				

By Movement	Northbound Canyon Creek Rd				Southbound Canyon Creek Rd				Eastbound Boeckman Rd				Westbound Boeckman Rd				Total
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	
Volume	18	12	2	32	115	19	99	233	139	311	26	476	10	130	38	178	919
%HV	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.0%	0.4%	2.2%	1.3%	0.0%	1.5%	0.0%	0.0%	2.6%	0.6%	1.0%
PHF	0.64	0.43	0.25	0.67	0.93	0.53	0.77	0.91	0.72	0.79	0.72	0.83	0.83	0.81	0.79	0.86	0.92

Rolling Hour Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound Canyon Creek Rd				Southbound Canyon Creek Rd				Eastbound Boeckman Rd				Westbound Boeckman Rd				Interval Total	Pedestrians Crosswalk			
	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes		North	South	East	West
4:00 PM	11	8	0	0	90	12	82	0	103	250	21	0	5	126	33	0	741	0	3	0	1
4:15 PM	13	13	0	0	102	11	94	0	98	284	20	0	6	130	33	0	804	0	4	2	1
4:30 PM	13	12	0	0	108	10	92	0	127	316	19	1	8	135	38	0	878	0	3	2	2
4:45 PM	16	13	1	0	112	14	96	0	137	312	22	1	10	142	40	0	915	0	3	3	1
5:00 PM	16	12	2	0	110	18	99	0	147	307	30	2	9	133	34	0	917	0	3	3	1

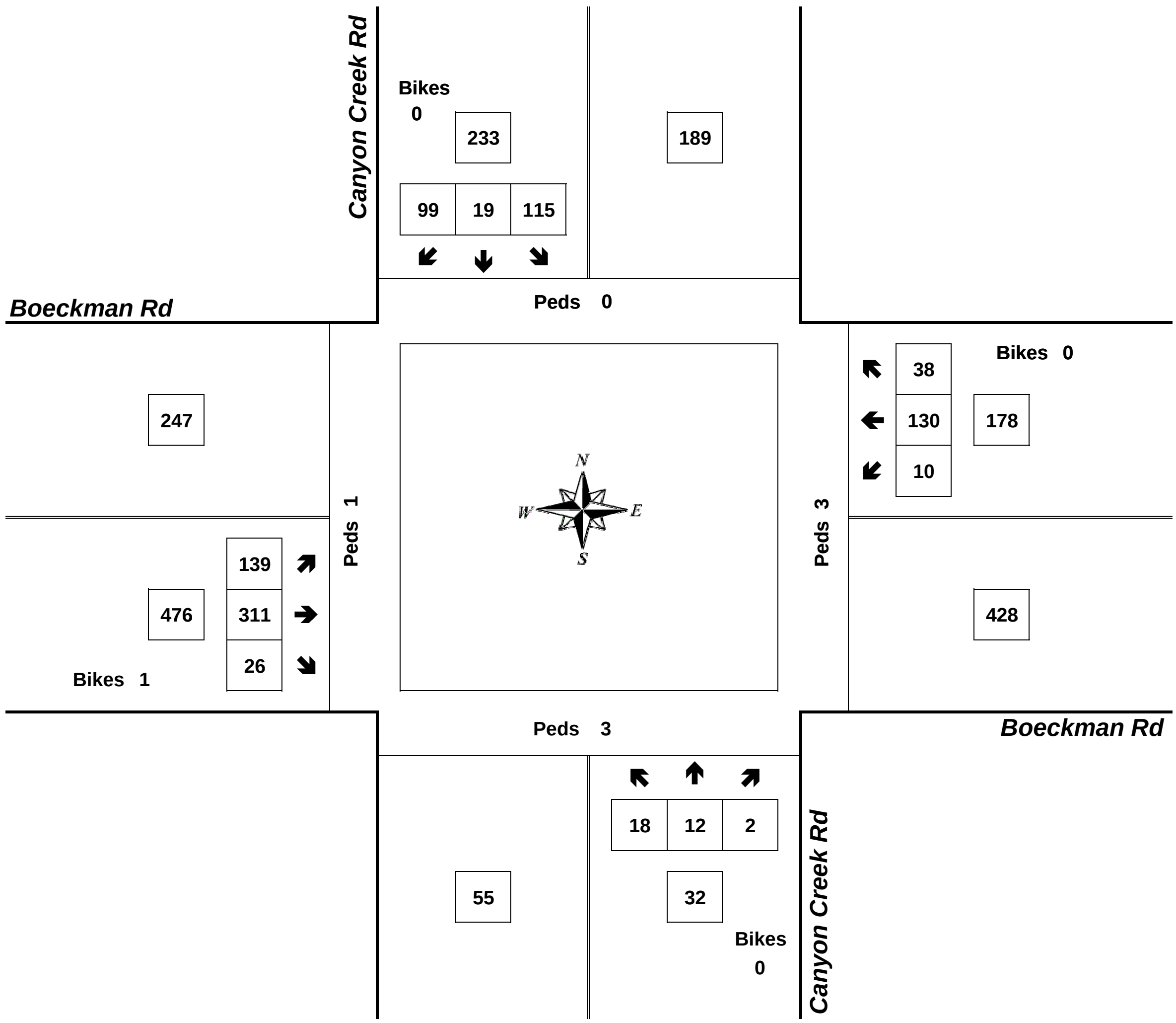
Peak Hour Summary

All Traffic Data Services Inc.

Clay Carney
(503) 833-2740

Canyon Creek Rd & Boeckman Rd

4:55 PM to 5:55 PM
Wednesday, February 12, 2014



Approach	PHF	HV%	Volume
EB	0.83	1.5%	476
WB	0.86	0.6%	178
NB	0.67	0.0%	32
SB	0.91	0.4%	233
Intersection	0.92	1.0%	919

Count Period: 4:00 PM to 6:00 PM

Collision Data

General Data					Type				Conditions				Vehicle 1			Vehicle 2		
Crash ID	Crash Date	Hour	Major	Minor	Road Character	Crash Type	Collision Type	Severity Type	Weather	Road Surface	Light	Cause 1	Vehicle Type	Vehicle Movement	From - To	Vehicle Type	Vehicle Movement	From - To
1357675	2/8/2010	20	SW ELLIGSEN RD	SW PARKWAY AVE	ALLEY	BIKE	TURN	INJB	FOG	DRY	DARK-NO ST LIGHTS	NON-MOTORIST - NOT VISBL	PSNGR CAR	TURN-L	S to W			
1359048	1/20/2010	18	SW ELLIGSEN RD	I-5 SB RAMP	INTER	S-OTHER	TURN	INJC	RAIN	WET	DARK-NO ST LIGHTS	INATTENTION	PSNGR CAR	TURN-R	NE to NW	PSNGR CAR	TURN-R	NE to NW
1360791	1/18/2010	8	SW ELLIGSEN RD	I-5 SB RAMP	CURVE	S-1STOP	REAR	INJC	CLEAR	DRY	DAYLIGHT	CARELESS	PSNGR CAR	STRGHT	NE to SW	PSNGR CAR	STOP	NE to SW
1361631	2/19/2010	18	SW ELLIGSEN RD	I-5 NB RAMP	INTER	S-1STOP	REAR	INJC	CLEAR	DRY	DARK-NO ST LIGHTS	OTHR IMPROPER DRIVING	PSNGR CAR	TURN-R	S to E	PSNGR CAR	TURN-R	S to E
1364625	4/9/2010	7	SW ELLIGSEN RD	I-5 SB RAMP	INTER	S-1STOP	REAR	PDO	CLEAR	DRY	DAYLIGHT	FOLLOW TOO CLOSE	PSNGR CAR	STRGHT	NE to SW	PSNGR CAR	STOP	NE to SW
1368204	5/3/2010	16	SW ELLIGSEN RD	I-5 NB RAMP	INTER	S-1STOP	REAR	PDO	CLEAR	DRY	DAYLIGHT	FOLLOW TOO CLOSE	PSNGR CAR	STRGHT	S to N	PSNGR CAR	STOP	S to N
1368605	5/11/2010	18	SW ELLIGSEN RD	I-5 SB RAMP	INTER	S-1STOP	REAR	INJC	CLEAR	DRY	DAYLIGHT	FOLLOW TOO CLOSE	PSNGR CAR	STRGHT	N to S	PSNGR CAR	STOP	N to S
1370803	5/25/2010	17	SW ELLIGSEN RD	I-5 NB RAMP	INTER	ANGL-OTH	TURN	PDO	RAIN	WET	DAYLIGHT	DISREGARD TRAF SIG	PSNGR CAR	STRGHT	W to E	PSNGR CAR	TURN-L	S to W
1372524	6/9/2010	10	SW ELLIGSEN RD	I-5 NB RAMP	STRGHT	S-1STOP	REAR	INJC	RAIN	WET	DAYLIGHT	TOO FAST FOR COND	PSNGR CAR	STRGHT	S to N	PSNGR CAR	STOP	S to N
1374334	7/1/2010	23	SW ELLIGSEN RD	I-5 SB RAMP	INTER	S-1STOP	REAR	INJC	RAIN	WET	DARK-NO ST LIGHTS	TOO FAST FOR COND	PSNGR CAR	STRGHT	N to S	PSNGR CAR	STOP	N to S
1375973	7/21/2010	16	SW ELLIGSEN RD	SW PARKWAY AVE	INTER	ANGL-OTH	TURN	PDO	CLEAR	DRY	DAYLIGHT	DISREGARD TRAF SIG	PSNGR CAR	TURN-L	S to W	PSNGR CAR	STRGHT	W to E
1375975	7/17/2010	18	SW ELLIGSEN RD	I-5 NB RAMP	INTER	S-1STOP	REAR	PDO	CLEAR	DRY	DAYLIGHT	FOLLOW TOO CLOSE	UNKNOWN	STRGHT	SW to NE	PSNGR CAR	STOP	SW to NE
1376627	8/2/2010	12	SW ELLIGSEN RD	I-5 SB RAMP	STRGHT	S-1STOP	REAR	INJC	CLEAR	DRY	DAYLIGHT	FOLLOW TOO CLOSE	PSNGR CAR	STRGHT	N to S	PSNGR CAR	STOP	N to S
1379302	8/13/2010	8			CURVE	NON-COLL	NCOL	PDO	CLEAR	WET	DAYLIGHT	OTHR IMPROPER DRIVING	SEMI TOW	STRGHT	S to N			
1394534	1/12/2010	9	SW ELLIGSEN RD	SW PARKWAY AVE	INTER	ANGL-STP	TURN	PDO	CLOUDY	WET	DAYLIGHT	FATIGUE	PSNGR CAR	TURN-L	S to W	PSNGR CAR	STOP	W to E
1396394	10/15/2010	16			STRGHT	S-1STOP	REAR	PDO	CLEAR	DRY	DAYLIGHT	FOLLOW TOO CLOSE	PSNGR CAR	STRGHT	N to S	PSNGR CAR	STOP	N to S
1398605	12/6/2010	15	SW ELLIGSEN RD	I-5 NB RAMP	INTER	ANGL-OTH	TURN	PDO	CLEAR	DRY	DAYLIGHT	DISREGARD TRAF SIG	PSNGR CAR	TURN-L	S to W	PSNGR CAR	STRGHT	E to W
1398853	12/4/2010	11	SW ELLIGSEN RD	I-5 NB RAMP	INTER	S-1STOP	REAR	PDO	CLEAR	DRY	DAYLIGHT	FOLLOW TOO CLOSE	PSNGR CAR	STRGHT	S to N	PSNGR CAR	STOP	S to N
1399734	12/30/2010	12	SW ELLIGSEN RD	I-5 NB RAMP	INTER	O-1STOP	BACK	PDO	CLEAR	DRY	DAYLIGHT	OTHR IMPROPER DRIVING	PSNGR CAR	BACK	N to S	PSNGR CAR	STOP	N to S
1369569	5/12/2010	15	SW STAFFORD RD	SW 65th AVE	INTER	ANGL-OTH	TURN	PDO	CLEAR	DRY	DAYLIGHT	NO YIELD	PSNGR CAR	TURN-L	NW to NE	PSNGR CAR	TURN-L	SW to NW
1398393	11/18/2010	17	WILSONVILLE RD/B(	STAFFORD RD/ADVAN	INTER	ANGL-OTH	ANGL	INJC	RAIN	WET	DARK-ST LIGHTS	PASSED STOP SIGN	PSNGR CAR	STRGHT	S to N	PSNGR CAR	STRGHT	W to E
1399007	12/11/2010	18	WILSONVILLE RD/B(	STAFFORD RD/ADVAN	INTER	ANGL-OTH	ANGL	INJB	CLOUDY	DRY	DARK-ST LIGHTS	PASSED STOP SIGN	PSNGR CAR	STRGHT	N to S	PSNGR CAR	STRGHT	W to E
1399184	11/30/2010	17	WILSONVILLE RD/B(	STAFFORD RD/ADVAN	INTER	ANGL-OTH	ANGL	PDO	RAIN	WET	DARK-ST LIGHTS	NO YIELD	PSNGR CAR	STRGHT	E to W	PSNGR CAR	STRGHT	N to S
1361372	1/29/2010	15	WILSONVILLE RD	I-5 NB RAMP	INTER	S-1STOP	REAR	PDO	CLEAR	DRY	DAYLIGHT	FOLLOW TOO CLOSE	PSNGR CAR	STRGHT	SW to NE	PSNGR CAR	STOP	SW to NE
1362423	3/17/2010	9	WILSONVILLE RD	I-5 NB RAMP	INTER	S-1STOP	REAR	INJC	CLEAR	DRY	DAYLIGHT	FOLLOW TOO CLOSE	PSNGR CAR	STRGHT	S to N	PSNGR CAR	STOP	S to E
1364555	4/6/2010	11			INTER	S-1STOP	REAR	INJC	RAIN	WET	DAYLIGHT	FOLLOW TOO CLOSE	PSNGR CAR	STRGHT	E to W	PSNGR CAR	STOP	E to W
1365097	4/15/2010	13	WILSONVILLE RD	I-5 NB RAMP	INTER	S-1STOP	REAR	PDO	CLEAR	DRY	DAYLIGHT	FOLLOW TOO CLOSE	PSNGR CAR	STRGHT	S to N	PSNGR CAR	STOP	S to N
1370604	5/19/2010	15	WILSONVILLE RD	I-5 NB RAMP	STRGHT	S-1STOP	SS-O	PDO	RAIN	WET	DAYLIGHT	IMPROPER LANE CHANGE	PSNGR CAR	STRGHT	E to W	PSNGR CAR	STOP	E to W
1371841	6/1/2010	8	WILSONVILLE RD	I-5 SB RAMP	INTER	S-1STOP	REAR	PDO	CLEAR	DRY	DAYLIGHT	FOLLOW TOO CLOSE	PSNGR CAR	STRGHT	NE to SW	PSNGR CAR	STOP	NE to SW
1375220	7/9/2010	15			STRGHT	S-STRGHT	SS-O	PDO	CLEAR	DRY	DAYLIGHT	IMPROPER LANE CHANGE	PSNGR CAR	STRGHT	N to S	PSNGR CAR	STRGHT	N to S
1376635	7/26/2010	22	WILSONVILLE RD	I-5 SB RAMP	INTER	S-1STOP	REAR	INJC	CLEAR	DRY	DARK-NO ST LIGHTS	INATTENTION	PSNGR CAR	STRGHT	E to W	PSNGR CAR	STOP	E to W
1389941	10/12/2010	11	WILSONVILLE RD	I-5 NB RAMP	INTER	BIKE	TURN	INJC	CLEAR	DRY	DAYLIGHT	NO YIELD	PSNGR CAR	TURN-R	S to E			
1391501	10/17/2010	12	WILSONVILLE RD	I-5 SB RAMP	INTER	S-1STOP	REAR	PDO	CLEAR	DRY	DAYLIGHT	FOLLOW TOO CLOSE	PSNGR CAR	STRGHT	NE to SW	PSNGR CAR	STOP	NE to SW
1394116	11/1/2010	18	WILSONVILLE RD	I-5 SB RAMP	INTER	S-1STOP	REAR	INJC	RAIN	WET	DUSK	FOLLOW TOO CLOSE	PSNGR CAR	STRGHT	W to E	PSNGR CAR	STOP	W to E
1397254	11/10/2010	6	WILSONVILLE RD	I-5 SB RAMP	INTER	S-1STOP	REAR	INJC	RAIN	WET	DARK-NO ST LIGHTS	TOO FAST FOR COND	PSNGR CAR	STRGHT	N to S	PSNGR CAR	STOP	N to S
1357005	1/22/2010	12	WILSONVILLE RD	TOWN CENTER LOOP \	STRGHT	S-STRGHT	SS-O	PDO	RAIN	WET	DAYLIGHT	IMPROPER LANE CHANGE	PSNGR CAR	STRGHT	E to W	PSNGR CAR	STRGHT	E to W
1359742	2/22/2010	14	WILSONVILLE RD	TOWN CENTER LOOP \	INTER	ANGL-OTH	TURN	PDO	CLEAR	DRY	DAYLIGHT	DISREGARD TRAF SIG	PSNGR CAR	TURN-R	N to W	PSNGR CAR	STRGHT	W to E
1370665	5/20/2010	12	WILSONVILLE RD	TOWN CENTER LOOP \	INTER	S-1STOP	REAR	INJC	CLOUDY	DRY	DAYLIGHT	INATTENTION	PSNGR CAR	STRGHT	E to W	PSNGR CAR	STOP	E to W
1383646	9/7/2010	11	WILSONVILLE RD	TOWN CENTER LOOP \	INTER	S-1STOP	REAR	PDO	CLOUDY	DRY	DAYLIGHT	FOLLOW TOO CLOSE	PSNGR CAR	STRGHT	E to W	PSNGR CAR	STOP	E to W
1386821	9/25/2010	12	WILSONVILLE RD	TOWN CENTER LOOP \	STRGHT	S-STRGHT	SS-O	PDO	CLEAR	DRY	DAYLIGHT	IMPROPER LANE CHANGE	PSNGR CAR	STRGHT	W to E	PSNGR CAR	STRGHT	W to E
1390014	10/11/2010	14	WILSONVILLE RD	TOWN CENTER LOOP \	STRGHT	S-STRGHT	SS-O	PDO	CLEAR	DRY	DAYLIGHT	IMPROPER LANE CHANGE	PSNGR CAR	STRGHT	E to W	PSNGR CAR	STRGHT	E to W
1395031	2/8/2010	17	WILSONVILLE RD	TOWN CENTER LOOP \	INTER	O-1TURN	TURN	PDO	CLEAR	DRY	DAYLIGHT	IMPROPER TURN	PSNGR CAR	STRGHT	E to W	PSNGR CAR	U-TURN	W to W
1406840	1/7/2011	6	SW ELLIGSEN RD	I-5 NB RAMP	INTER	ANGL-OTH	TURN	INJB	RAIN	WET	DARK-NO ST LIGHTS	DISREGARD TRAF SIG	PSNGR CAR	STRGHT	W to E	PSNGR CAR	TURN-L	S to W
1409087	2/13/2011	12	SW ELLIGSEN RD	I-5 NB RAMP	CURVE	S-STRGHT	REAR	PDO	CLEAR	DRY	DAYLIGHT	TOO FAST FOR COND	PSNGR CAR	STRGHT	SE to NW	PSNGR CAR	STRGHT	SE to NW
1409091	4/8/2011	6	SW ELLIGSEN RD	I-5 SB RAMP	INTER	ANGL-OTH	TURN	PDO	CLEAR	DRY	DAYLIGHT	DISREGARD TRAF SIG	PSNGR CAR	TURN-L	NE to SE	PSNGR CAR	STRGHT	SE to NW
1411218	3/12/2011	14	SW ELLIGSEN RD	I-5 NB RAMP	INTER	ANGL-OTH	TURN	INJC	CLOUDY	DRY	DAYLIGHT	DISREGARD TRAF SIG	PSNGR CAR	STRGHT	W to E	PSNGR CAR	TURN-L	S to W
1416148	5/12/2011	8	SW ELLIGSEN RD	I-5 SB RAMP	BRIDGE	S-1STOP	REAR	INJC	CLEAR	DRY	DAYLIGHT	FOLLOW TOO CLOSE	PSNGR CAR	STRGHT	NE to SW	PSNGR CAR	STOP	NE to SW
1420954	6/23/2011	18	SW ELLIGSEN RD	SW PARKWAY AVE	GRADE	S-1STOP	REAR	PDO	CLEAR	DRY	DAYLIGHT	FOLLOW TOO CLOSE	PSNGR CAR	STRGHT	S to N	PSNGR CAR	STOP	S to N
1423583	7/11/2011	14	SW ELLIGSEN RD	I-5 SB RAMP	INTER	S-OTHER	TURN	PDO	CLEAR	DRY	DAYLIGHT	FOLLOW TOO CLOSE	PSNGR CAR	TURN-R	E to NW	PSNGR CAR	TURN-R	E to NW
1425802	7/17/2011	10	SW ELLIGSEN RD	I-5 SB RAMP	INTER	S-OTHER	TURN	PDO	RAIN	WET	DAYLIGHT	FOLLOW TOO CLOSE	PSNGR CAR	TURN-R	NE to NW	PSNGR CAR	TURN-R	NE to NW
1427544	7/29/2011	11	SW ELLIGSEN RD	I-5 NB RAMP	INTER	S-OTHER	TURN	INJC	CLEAR	DRY	DAYLIGHT	FOLLOW TOO CLOSE	TRUCK	TURN-R	SW to E	PSNGR CAR	TURN-R	SW to E
1433315	8/21/2011	14	SW ELLIGSEN RD	I-5 SB RAMP	INTER	S-OTHER	TURN	PDO	CLEAR	DRY	DAYLIGHT	FOLLOW TOO CLOSE	PSNGR CAR	TURN-R	E to NW	PSNGR CAR	TURN-R	E to NW
1441024	11/10/2011	12			GRADE	S-STRGHT	SS-O	INJC	CLEAR	DRY	DAYLIGHT	IMPROPER LANE CHANGE	PSNGR CAR	STRGHT	W to E	PSNGR CAR	STRGHT	W to E
1441026	11/10/2011	12	SW ELLIGSEN RD	I-5 SB RAMP	INTER	S-1STOP	REAR	INJC	CLEAR	DRY	DAYLIGHT	FOLLOW TOO CLOSE	PSNGR CAR	STRGHT	NW to SE	PSNGR CAR	STOP	NW to SE
1443144	11/23/2011	7	SW ELLIGSEN RD	SW PARKWAY AVE	INTER	O-1TURN	TURN	PDO	RAIN	WET	DAYLIGHT	NO YIELD	PSNGR CAR	STRGHT	E to W	PSNGR CAR	TURN-L	W to N
1445451	12/7/2011	14	SW ELLIGSEN RD	SW PARKWAY AVE	ALLEY	O-1STOP	BACK	PDO	CLEAR	DRY	DAYLIGHT	OTHR IMPROPER DRIVING	PSNGR CAR	BACK	W to E	PSNGR CAR	STOP	E to W
1446505	12/16/2011	15	SW ELLIGSEN RD	SW PARKWAY AVE	INTER	S-1STOP	REAR	PDO	CLOUDY	DRY	DAYLIGHT	TOO FAST FOR COND	PSNGR CAR	STRGHT	S to N	PSNGR CAR	STOP	S to N
1401471	1/22/2011	2	SW STAFFORD RD	SW 65th AVE	CURVE	FIX OBJ	FIX	PDO	FOG	UNKNOWN	DARK-ST LIGHTS	TOO FAST FOR COND	PSNGR CAR	STRGHT	UN to UN			
1418213	5/29/2011	14	SW STAFFORD RD	SW 65th AVE	INTER	ANGL-OTH	TURN	INJB	CLOUDY	DRY	DAYLIGHT	NO YIELD	PSNGR CAR	TURN-L	W to N	PSNGR CAR	STRGHT	N to S

1423015	7/8/2011	1	SW STAFFORD RD	SW 65th AVE	CURVE	FIX OBJ	FIX	PDO	CLEAR	DRY	DARK-NO ST LIGHTS	TOO FAST FOR COND	PSNGR CAR	STRGHT	N to S			
1415362	4/20/2011	15	WILSONVILLE RD/BO	STAFFORD RD/ADVAN	INTER	ANGL-OTH	TURN	INJC	CLEAR	DRY	DAYLIGHT	PASSED STOP SIGN	PSNGR CAR	STRGHT	N to S	PSNGR CAR	TURN-L	W to N
1419047	6/6/2011	7	SW STAFFORD RD	SW FROG POND LN	STRGHT	S-1STOP	REAR	PDO	CLEAR	DRY	DAYLIGHT	TOO FAST FOR COND	PSNGR CAR	STRGHT	N to S	PSNGR CAR	STOP	N to S
1407098	2/16/2011	18	WILSONVILLE RD	I-5 SB RAMP	INTER	S-1STOP	REAR	INJC	SNOW	ICE	DARK-NO ST LIGHTS	FOLLOW TOO CLOSE	PSNGR CAR	STRGHT	N to S	PSNGR CAR	STOP	N to S
1407994	2/1/2011	10	WILSONVILLE RD	I-5 SB RAMP	INTER	S-1STOP	REAR	INJC	CLEAR	DRY	DAYLIGHT	FOLLOW TOO CLOSE	PSNGR CAR	STRGHT	NE to SW	PSNGR CAR	STOP	NE to SW
1408253	1/26/2011	18	WILSONVILLE RD	I-5 SB RAMP	INTER	S-1STOP	REAR	INJC	FOG	DRY	DARK-NO ST LIGHTS	FOLLOW TOO CLOSE	PSNGR CAR	STRGHT	N to S	PSNGR CAR	STOP	N to S
1414227	4/5/2011	20			STRGHT	S-1STOP	REAR	INJC	RAIN	WET	DARK-NO ST LIGHTS	FOLLOW TOO CLOSE	PSNGR CAR	STRGHT	NE to SW	PSNGR CAR	STOP	NE to SW
1415544	4/8/2011	17			STRGHT	S-STRGHT	SS-O	PDO	UNKNOWN	UNKNOWN	DUSK	IMPROPER LANE CHANGE	UNKNOWN	STRGHT	UN to UN	PSNGR CAR	STRGHT	UN to UN
1418800	6/4/2011	14	WILSONVILLE RD	I-5 NB RAMP	INTER	S-1STOP	REAR	INJC	CLEAR	DRY	DAYLIGHT	FOLLOW TOO CLOSE	PSNGR CAR	STRGHT	W to E	PSNGR CAR	STOP	W to E
1423486	7/11/2011	16	WILSONVILLE RD	I-5 SB RAMP	INTER	S-1STOP	REAR	PDO	UNKNOWN	UNKNOWN	DAYLIGHT	FOLLOW TOO CLOSE	PSNGR CAR	STRGHT	NE to SW	PSNGR CAR	STOP	NE to SW
1427705	7/30/2011	15	WILSONVILLE RD	I-5 SB RAMP	STRGHT	S-1STOP	REAR	PDO	CLEAR	DRY	DAYLIGHT	FOLLOW TOO CLOSE	PSNGR CAR	STRGHT	W to E	PSNGR CAR	STOP	W to E
1428380	8/6/2011	12	WILSONVILLE RD	I-5 NB RAMP	STRGHT	S-1STOP	REAR	PDO	CLEAR	DRY	DAYLIGHT	FOLLOW TOO CLOSE	PSNGR CAR	STRGHT	SE to NW	PSNGR CAR	STOP	SE to NW
1428939	8/3/2011	8	WILSONVILLE RD	I-5 SB RAMP	STRGHT	S-1STOP	REAR	INJC	CLEAR	DRY	DAYLIGHT	FOLLOW TOO CLOSE	PSNGR CAR	STRGHT	NE to SW	PSNGR CAR	STOP	NE to SW
1431937	8/16/2011	6	WILSONVILLE RD	I-5 NB RAMP	STRGHT	S-1STOP	REAR	PDO	UNKNOWN	UNKNOWN	DAYLIGHT	FOLLOW TOO CLOSE	PSNGR CAR	STRGHT	W to E	PSNGR CAR	STOP	W to E
1436108	9/2/2011	20	WILSONVILLE RD	I-5 SB RAMP	INTER	ANGL-OTH	TURN	PDO	CLEAR	DRY	DUSK	DISREGARD TRAF SIG	PSNGR CAR	STRGHT	E to W	PSNGR CAR	TURN-L	NE to E
1437080	9/13/2011	16			STRGHT	S-1STOP	REAR	PDO	CLEAR	DRY	DAYLIGHT	FOLLOW TOO CLOSE	PSNGR CAR	STRGHT	W to E	PSNGR CAR	STOP	W to E
1437157	9/18/2011	6	WILSONVILLE RD	I-5 SB RAMP	INTER	ANGL-OTH	TURN	INJC	CLOUDY	DRY	DAWN	DISREGARD TRAF SIG	SCHL BUS	TURN-L	NE to E	PSNGR CAR	STRGHT	W to E
1438929	10/8/2011	19	WILSONVILLE RD	I-5 NB RAMP	INTER	ANGL-OTH	TURN	INJC	CLEAR	DRY	DARK-NO ST LIGHTS	DISREGARD TRAF SIG	PSNGR CAR	STRGHT	E to W	PSNGR CAR	TURN-L	SW to W
1438942	10/4/2011	19			STRGHT	S-STRGHT	SS-O	PDO	RAIN	WET	DARK-ST LIGHTS	IMPROPER LANE CHANGE	SEMI TOW	STRGHT	N to S	PSNGR CAR	STRGHT	N to S
1439064	10/5/2011	9	WILSONVILLE RD	I-5 SB RAMP	INTER	S-1STOP	REAR	PDO	CLEAR	DRY	DAYLIGHT	FOLLOW TOO CLOSE	PSNGR CAR	STRGHT	NE to SW	PSNGR CAR	STOP	NE to SW
1444996	12/12/2011	9	WILSONVILLE RD	I-5 SB RAMP	INTER	S-1STOP	REAR	PDO	FOG	UNKNOWN	DAYLIGHT	FOLLOW TOO CLOSE	PSNGR CAR	STRGHT	N to S	PSNGR CAR	STOP	N to S
1402489	2/10/2011	9	WILSONVILLE RD	TOWN CENTER LOOP W	INTER	S-1STOP	REAR	PDO	CLEAR	DRY	DAYLIGHT	FOLLOW TOO CLOSE	PSNGR CAR	STRGHT	W to E	PSNGR CAR	STOP	W to E
1409961	3/5/2011	14	WILSONVILLE RD	TOWN CENTER LOOP W	INTER	S-1STOP	REAR	INJA	CLEAR	DRY	DAYLIGHT	FOLLOW TOO CLOSE	PSNGR CAR	STRGHT	W to E	PSNGR CAR	STOP	W to E
1417347	4/15/2011	17	WILSONVILLE RD	TOWN CENTER LOOP W	INTER	S-1STOP	SS-O	PDO	CLEAR	DRY	DAYLIGHT	OTHR IMPROPER DRIVING	PSNGR CAR	STRGHT	W to E	PSNGR CAR	STOP	W to E
1441120	11/4/2011	17	WILSONVILLE RD	TOWN CENTER LOOP W	INTER	S-OTHER	TURN	PDO	CLOUDY	DRY	DUSK	IMPROPER TURN	PSNGR CAR	TURN-R	N to W	PSNGR CAR	TURN-R	N to W
1441796	11/16/2011	8	WILSONVILLE RD	TOWN CENTER LOOP W	INTER	S-1STOP	REAR	PDO	CLOUDY	WET	DAYLIGHT	FOLLOW TOO CLOSE	PSNGR CAR	STRGHT	E to W	PSNGR CAR	STOP	E to W
1450351	1/11/2012	12			INTER	S-1STOP	REAR	PDO	CLEAR	DRY	DAYLIGHT	FOLLOW TOO CLOSE	PSNGR CAR	STRGHT	W to E	PSNGR CAR	STOP	W to E
1455123	2/15/2012	14	SW ELLIGSEN RD	I-5 NB RAMP	INTER	S-OTHER	TURN	INJC	CLEAR	DRY	DAYLIGHT	FOLLOW TOO CLOSE	UNKNOWN	TURN-R	SW to E	PSNGR CAR	TURN-R	SW to E
1456242	2/6/2012	9	SW ELLIGSEN RD	I-5 NB RAMP	INTER	S-1STOP	REAR	PDO	CLEAR	DRY	DAYLIGHT	FOLLOW TOO CLOSE	PSNGR CAR	STRGHT	S to N	PSNGR CAR	STOP	S to N
1463446	5/23/2012	17	SW ELLIGSEN RD	I-5 NB RAMP	INTER	S-1STOP	REAR	INJC	CLEAR	DRY	DAYLIGHT	FOLLOW TOO CLOSE	PSNGR CAR	STRGHT	S to N	PSNGR CAR	STOP	S to N
1473656	8/31/2012	8	SW ELLIGSEN RD	I-5 SB RAMP	INTER	S-1STOP	REAR	PDO	CLEAR	DRY	DAYLIGHT	FOLLOW TOO CLOSE	SEMI TOW	STRGHT	NE to SW	PSNGR CAR	STOP	NE to SW
1473975	6/13/2012	11	SW ELLIGSEN RD	I-5 NB RAMP	INTER	S-OTHER	TURN	INJC	CLEAR	DRY	DAYLIGHT	OTHR IMPROPER DRIVING	PSNGR CAR	TURN-R	SW to E	PSNGR CAR	TURN-R	SW to E
1478229	7/20/2012	15	SW ELLIGSEN RD	I-5 NB RAMP	INTER	S-OTHER	TURN	INJC	CLEAR	DRY	DAYLIGHT	FOLLOW TOO CLOSE	UNKNOWN	TURN-R	SW to E	PSNGR CAR	TURN-R	SW to E
1483755	8/25/2012	16	SW ELLIGSEN RD	I-5 NB RAMP	INTER	S-OTHER	TURN	PDO	CLEAR	DRY	DAYLIGHT	FOLLOW TOO CLOSE	PSNGR CAR	TURN-R	SW to E	PSNGR CAR	TURN-R	SW to E
1486519	11/12/2012	8			GRADE	S-STRGHT	SS-O	INJC	CLEAR	DRY	DAYLIGHT	IMPROPER LANE CHANGE	PSNGR CAR	STRGHT	N to S	PSNGR CAR	STRGHT	N to S
1492444	12/11/2012	17	SW ELLIGSEN RD	I-5 SB RAMP	INTER	S-1STOP	REAR	PDO	RAIN	WET	DARK-NO ST LIGHTS	FOLLOW TOO CLOSE	PSNGR CAR	STRGHT	SE to NW	PSNGR CAR	STOP	SE to NW
1495247	11/6/2012	11	SW ELLIGSEN RD	I-5 SB RAMP	INTER	S-1STOP	REAR	PDO	RAIN	WET	DAYLIGHT	OTHR IMPROPER DRIVING	PSNGR CAR	STRGHT	NE to SW	PSNGR CAR	STOP	NE to SW
1495809	12/8/2012	13	SW ELLIGSEN RD	I-5 SB RAMP	INTER	S-OTHER	TURN	PDO	CLEAR	DRY	DAYLIGHT	OTHR IMPROPER DRIVING	PSNGR CAR	TURN-R	NE to NW	UNKNOWN	STOP	NE to SW
1496804	12/18/2012	6	SW ELLIGSEN RD	I-5 SB RAMP	STRGHT	S-1STOP	REAR	INJC	SNOW	SNOW	DARK-NO ST LIGHTS	FOLLOW TOO CLOSE	PSNGR CAR	STRGHT	NE to SW	PSNGR CAR	STOP	NE to SW
1454628	1/25/2012	11	SW ELLIGSEN RD	SW PARKWAY CENTER	INTER	S-1TURN	TURN	PDO	CLEAR	WET	DAYLIGHT	DISREGARD TRAF CNTRL DEV	PSNGR CAR	STRGHT	W to E	PSNGR CAR	TURN-R	W to S
1463155	3/13/2012	20	SW STAFFORD RD	SW 65th AVE	INTER	ANGL-OTH	TURN	PDO	CLOUDY	WET	DUSK	NO YIELD	PSNGR CAR	TURN-R	W to SW	PSNGR CAR	STRGHT	NE to SW
1490566	10/17/2012	9	SW STAFFORD RD	SW 65th AVE	CURVE	O-1STOP	SS-M	PDO	CLEAR	DRY	DAYLIGHT	DROVE LEFT OF CENTER	PSNGR CAR	STRGHT	SE to NW	PSNGR CAR	STOP	NW to SE
1455884	2/3/2012	18			STRGHT	ANIMAL	OTH	PDO	CLEAR	DRY	DARK-ST LIGHTS	OTHER	PSNGR CAR	STRGHT	N to S			
1486281	9/15/2012	8	BOECKMAN RD	CANYON CREEK RD	INTER	ANGL-OTH	ANGL	INJB	CLEAR	DRY	DAYLIGHT	PASSED STOP SIGN	PSNGR CAR	STRGHT	W to E	PSNGR CAR	STRGHT	S to N
1452162	1/11/2012	17	WILSONVILLE RD	I-5 SB RAMP	INTER	O-1TURN	TURN	INJC	CLEAR	DRY	DARK-NO ST LIGHTS	FOLLOW TOO CLOSE	PSNGR CAR	TURN-L	E to S	PSNGR CAR	STRGHT	W to E
1455326	1/24/2012	15	WILSONVILLE RD	I-5 SB RAMP	INTER	S-1STOP	REAR	INJC	CLEAR	DRY	DAYLIGHT	FOLLOW TOO CLOSE	PSNGR CAR	STRGHT	N to S	PSNGR CAR	STOP	N to S
1455479	1/31/2012	14	WILSONVILLE RD	I-5 NB RAMP	INTER	S-1STOP	REAR	PDO	CLEAR	DRY	DAYLIGHT	FOLLOW TOO CLOSE	PSNGR CAR	STRGHT	E to W	PSNGR CAR	STOP	E to W
1460212	2/29/2012	18	WILSONVILLE RD	I-5 NB RAMP	INTER	O-1TURN	TURN	PDO	RAIN	WET	DARK-NO ST LIGHTS	DISREGARD TRAF SIG	PSNGR CAR	TURN-L	W to N	PSNGR CAR	STRGHT	E to W
1462511	3/8/2012	14	WILSONVILLE RD	I-5 NB RAMP	INTER	S-1STOP	REAR	INJC	CLEAR	DRY	DAYLIGHT	FOLLOW TOO CLOSE	PSNGR CAR	STRGHT	E to W	PSNGR CAR	STOP	E to W
1462871	3/11/2012	20	WILSONVILLE RD	I-5 SB RAMP	STRGHT	S-1STOP	REAR	INJC	RAIN	WET	DUSK	TOO FAST FOR COND	PSNGR CAR	STRGHT	E to W	PSNGR CAR	STOP	E to W
1468662	5/1/2012	14			STRGHT	S-STRGHT	REAR	INJC	CLEAR	DRY	DAYLIGHT	TOO FAST FOR COND	PSNGR CAR	STRGHT	SE to NW	PSNGR CAR	STOP	SE to NW
1469298	4/20/2012	18	WILSONVILLE RD	I-5 SB RAMP	INTER	S-OTHER	TURN	PDO	CLEAR	DRY	DAYLIGHT	IMPROPER TURN	PSNGR CAR	TURN-L	N to E	PSNGR CAR	TURN-L	N to E
1470716	4/26/2012	16	WILSONVILLE RD	I-5 NB RAMP	STRGHT	S-STRGHT	REAR	PDO	UNKNOWN	UNKNOWN	DAYLIGHT	FOLLOW TOO CLOSE	PSNGR CAR	STRGHT	S to N	PSNGR CAR	STRGHT	S to N
1476694	7/10/2012	12	WILSONVILLE RD	I-5 SB RAMP	INTER	S-1STOP	REAR	PDO	CLEAR	DRY	DAYLIGHT	FOLLOW TOO CLOSE	PSNGR CAR	STRGHT	W to E	PSNGR CAR	STOP	W to E
1480152	8/4/2012	14	WILSONVILLE RD	I-5 NB RAMP	INTER	ANGL-OTH	TURN	INJC	CLEAR	DRY	DAYLIGHT	NO YIELD	PSNGR CAR	STRGHT	W to E	PSNGR CAR	TURN-L	S to W
1480971	7/25/2012	16	WILSONVILLE RD	I-5 NB RAMP	STRGHT	S-1STOP	REAR	INJC	CLEAR	DRY	DAYLIGHT	FOLLOW TOO CLOSE	PSNGR CAR	STRGHT	W to E	PSNGR CAR	STOP	W to E
1481406	8/9/2012	21	WILSONVILLE RD	I-5 NB RAMP	STRGHT	OTH OBJ	FIX	PDO	CLEAR	DRY	DAYLIGHT	OTHR IMPROPER DRIVING	PSNGR CAR	STRGHT	S to N			
1484509	9/2/2012	11	WILSONVILLE RD	I-5 NB RAMP	INTER	S-OTHER	TURN	INJC	CLEAR	DRY	DAYLIGHT	IMPROPER TURN	PSNGR CAR	TURN-L	S to W	PSNGR CAR	TURN-L	S to W
1484962	9/5/2012	13	WILSONVILLE RD	I-5 NB RAMP	INTER	O-OTHER	TURN	PDO	CLEAR	DRY	DAYLIGHT	IMPROPER TURN	PSNGR CAR	TURN-L	W to N	PSNGR CAR	TURN-R	E to N
1488782	10/3/2012	15	WILSONVILLE RD	I-5 NB RAMP	STRGHT	S-1STOP	REAR	PDO	CLEAR	DRY	DAYLIGHT	FOLLOW TOO CLOSE	PSNGR CAR	STRGHT	E to W	PSNGR CAR	STOP	E to W
1490444	10/15/2012	17	WILSONVILLE RD	I-5 SB RAMP	INTER	S-1STOP	REAR	PDO	RAIN	WET	DUSK	FOLLOW TOO CLOSE	PSNGR CAR	STRGHT	N to S	PSNGR CAR	STOP	N to S
1490591	10/18/2012	13	WILSONVILLE RD	I-5 SB RAMP	STRGHT	S-1STOP	REAR	INJC	CLEAR	DRY	DAYLIGHT	FOLLOW TOO CLOSE	PSNGR CAR	STRGHT	N to S	PSNGR CAR	STOP	N to S
1496222	12/15/2012	12	WILSONVILLE RD	I-5 NB RAMP	INTER	ANGL-OTH	TURN	INJC	RAIN	WET	DAYLIGHT	DISREGARD TRAF SIG	PSNGR CAR	STRGHT	E to W	PSNGR CAR	TURN-L	S to W

1497333	12/27/2012	13	WILSONVILLE RD	I-5 SB RAMP	INTER	S-1STOP	REAR	INJC	CLOUDY	DRY	DAYLIGHT	FOLLOW TOO CLOSE	PSNGR CAR	STRGHT	W to E	PSNGR CAR	STOP	W to E
1499688	11/21/2012	15			STRGHT	S-1STOP	REAR	INJC	CLEAR	WET	DAYLIGHT	FOLLOW TOO CLOSE	PSNGR CAR	STRGHT	E to W	PSNGR CAR	STOP	E to W
1461395	3/5/2012	16	WILSONVILLE RD	TOWN CENTER LOOP \	STRGHT	S-STRGHT	SS-O	PDO	CLEAR	UNKNOWN	DAYLIGHT	IMPROPER LANE CHANGE	PSNGR CAR	STRGHT	N to S	PSNGR CAR	STRGHT	N to S
1466602	4/7/2012	12	WILSONVILLE RD	TOWN CENTER LOOP \	INTER	S-1STOP	REAR	PDO	CLEAR	DRY	DAYLIGHT	FOLLOW TOO CLOSE	PSNGR CAR	STRGHT	N to S	PSNGR CAR	STOP	N to S
1467440	4/10/2012	16	WILSONVILLE RD	TOWN CENTER LOOP \	STRGHT	S-STRGHT	SS-O	PDO	CLEAR	DRY	DAYLIGHT	IMPROPER LANE CHANGE	PSNGR CAR	STRGHT	E to W	PSNGR CAR	STRGHT	E to W
1471722	5/31/2012	18	WILSONVILLE RD	TOWN CENTER LOOP \	INTER	S-1TURN	TURN	PDO	CLEAR	DRY	DAYLIGHT	DISREGARD TRAF CNTRL DEV	PSNGR CAR	STRGHT	N to S	PSNGR CAR	TURN-R	N to W
1481279	11/28/2012	19	WILSONVILLE RD	TOWN CENTER LOOP \	INTER	S-1STOP	REAR	PDO	RAIN	WET	DARK-ST LIGHTS	FOLLOW TOO CLOSE	PSNGR CAR	STRGHT	E to W	PSNGR CAR	STOP	E to W
1484512	9/2/2012	15	WILSONVILLE RD	TOWN CENTER LOOP \	INTER	S-OTHER	TURN	PDO	CLEAR	DRY	DAYLIGHT	IMPROPER TURN	PSNGR CAR	TURN-L	W to N	PSNGR CAR	TURN-L	W to N

Level of Service Descriptions

TRAFFIC LEVELS OF SERVICE

Analysis of traffic volumes is useful in understanding the general nature of traffic in an area, but by itself indicates neither the ability of the street network to carry additional traffic nor the quality of service afforded by the street facilities. For this, the concept of *level of service* has been developed to subjectively describe traffic performance. Level of service can be measured at intersections and along key roadway segments.

Level of service categories are similar to report card ratings for traffic performance. Intersections are typically the controlling bottlenecks of traffic flow and the ability of a roadway system to carry traffic efficiently is generally diminished in their vicinities. Levels of Service A, B and C indicate conditions where traffic moves without significant delays over periods of peak travel demand. Level of service D and E are progressively worse peak hour operating conditions and F conditions represent where demand exceeds the capacity of an intersection. Most urban communities set level of service D as the minimum acceptable level of service for peak hour operation and plan for level of service C or better for all other times of the day. The *Highway Capacity Manual* provides level of service calculation methodology for both intersections and arterials.[1] The following two sections provide interpretations of the analysis approaches.

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1 *2000 Highway Capacity Manual*, Transportation Research Board, Washington D.C., 2000, Chapters 16 and 17.

UNSIGNALIZED INTERSECTIONS (Two-Way Stop Controlled)

Unsignalized intersection level of service is reported for the major street and minor street (generally, left turn movements). The method assesses available and critical gaps in the traffic stream which make it possible for side street traffic to enter the main street flow. The *2000 Highway Capacity Manual* describes the detailed methodology. It is not unusual for an intersection to experience level of service E or F conditions for the minor street left turn movement. It should be understood that, often, a poor level of service is experienced by only a few vehicles and the intersection as a whole operates acceptably.

Unsignalized intersection levels of service are described in the following table.

Level of Service	Expected Delay	(Sec/Veh)
A	Little or no delay	0-10.0
B	Short traffic delay	>10.1-15.0
C	Average traffic delays	>15.1-25.0
D	Long traffic delays	>25.1-35.0
E	Very long traffic delays	>35.1-50.0
F	Extreme delays potentially affecting other traffic movements in the intersection	> 50

Source: 2000 *Highway Capacity Manual*, Transportation Research Board Washington, D.C.

SIGNALIZED INTERSECTIONS

For signalized intersections, level of service is evaluated based upon average vehicle delay experienced by vehicles entering an intersection. Control delay (or signal delay) includes initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay. In previous versions of this chapter of the HCM (1994 and earlier), delay included only stopped delay. As delay increases, the level of service decreases. Calculations for signalized and unsignalized intersections are different due to the variation in traffic control. The *2000 Highway Capacity Manual* provides the basis for these calculations.

Level of Service	Delay (secs.)	Description
A	$\leq$10.00	**Free Flow/Insignificant Delays:** No approach phase is fully utilized by traffic and no vehicle waits longer than one red indication. Most vehicles do not stop at all. Progression is extremely favorable and most vehicles arrive during the green phase.
B	10.1-20.0	**Stable Operation/Minimal Delays:** An occasional approach phase is fully utilized. Many drivers begin to feel somewhat restricted within platoons of vehicles. This level generally occurs with good progression, short cycle lengths, or both.
C	20.1-35.0	**Stable Operation/Acceptable Delays:** Major approach phases fully utilized. Most drivers feel somewhat restricted. Higher delays may result from fair progression, longer cycle lengths, or both. Individual cycle failures may begin to appear at this level, and the number of vehicles stopping is significant.
D	35.1-55.0	**Approaching Unstable/Tolerable Delays:** The influence of congestion becomes more noticeable. Drivers may have to wait through more than one red signal indication. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high v/c ratios. The proportion of vehicles not stopping declines, and individual cycle failures are noticeable.
E	55.1-80.0	**Unstable Operation/Significant Delays:** Volumes at or near capacity. Vehicles may wait though several signal cycles. Long queues form upstream from intersection. These high delay values generally indicate poor progression, long cycle lengths, and high v/c ratios. Individual cycle failures are a frequent occurrence.
F	$\geq$80.0	**Forced Flow/Excessive Delays:** Represents jammed conditions. Queues may block upstream intersections. This level occurs when arrival flow rates exceed intersection capacity, and is considered to be unacceptable to most drivers. Poor progression, long cycle lengths, and v/c ratios approaching 1.0 may contribute to these high delay levels.

Source: *2000 Highway Capacity Manual*, Transportation Research Board, Washington D.C.

HCM Analysis – Existing

1: Boones Ferry Road & I-5 SB Off Ramp

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↱		↑↑	↱				↰	↰↑	↱
Volume (vph)	0	1081	655	0	586	350	0	0	0	514	1	465
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0				4.0	4.0	4.0
Lane Util. Factor		0.95	1.00		0.95	1.00				0.95	0.95	1.00
Frpb, ped/bikes		1.00	0.99		1.00	1.00				1.00	1.00	1.00
Flpb, ped/bikes		1.00	1.00		1.00	1.00				1.00	1.00	1.00
Frt		1.00	0.85		1.00	0.85				1.00	1.00	0.85
Flt Protected		1.00	1.00		1.00	1.00				0.95	0.95	1.00
Satd. Flow (prot)		3505	1564		3471	1583				1681	1686	1468
Flt Permitted		1.00	1.00		1.00	1.00				0.95	0.95	1.00
Satd. Flow (perm)		3505	1564		3471	1583				1681	1686	1468
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	1138	689	0	617	368	0	0	0	541	1	489
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	167
Lane Group Flow (vph)	0	1138	689	0	617	368	0	0	0	270	272	322
Confl. Bikes (#/hr)			2									
Heavy Vehicles (%)	0%	3%	2%	0%	4%	2%	0%	0%	0%	2%	0%	10%
Turn Type			Free			Free				Split		Prot
Protected Phases		2			6					4	4	4
Permitted Phases			Free			Free						
Actuated Green, G (s)		67.9	105.0		67.9	105.0				28.1	28.1	28.1
Effective Green, g (s)		68.9	105.0		68.9	105.0				28.1	28.1	28.1
Actuated g/C Ratio		0.66	1.00		0.66	1.00				0.27	0.27	0.27
Clearance Time (s)		5.0			5.0					4.0	4.0	4.0
Vehicle Extension (s)		3.0			3.0					3.0	3.0	3.0
Lane Grp Cap (vph)		2300	1564		2278	1583				450	451	393
v/s Ratio Prot		c0.32			0.18					0.16	0.16	c0.22
v/s Ratio Perm			0.44			0.23						
v/c Ratio		0.49	0.44		0.27	0.23				0.60	0.60	0.82
Uniform Delay, d1		9.2	0.0		7.5	0.0				33.5	33.6	36.1
Progression Factor		1.00	1.00		1.14	1.00				1.00	1.00	1.00
Incremental Delay, d2		0.8	0.9		0.3	0.3				2.2	2.3	12.5
Delay (s)		10.0	0.9		8.9	0.3				35.7	35.9	48.6
Level of Service		A	A		A	A				D	D	D
Approach Delay (s)		6.5			5.7			0.0			41.9	
Approach LOS		A			A			A			D	

Intersection Summary			
HCM Average Control Delay	15.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	51.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

2: Sw Elligsen Rd & I-5 NB Ramp

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↱		↑↑	↱	↰↰		↱			
Volume (vph)	0	850	745	0	673	794	263	0	242	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	4.0		5.0	4.0	4.0		4.0			
Lane Util. Factor		0.95	1.00		0.95	1.00	0.97		1.00			
Frpb, ped/bikes		1.00	0.98		1.00	0.98	1.00		1.00			
Flpb, ped/bikes		1.00	1.00		1.00	1.00	1.00		1.00			
Frt		1.00	0.85		1.00	0.85	1.00		0.85			
Flt Protected		1.00	1.00		1.00	1.00	0.95		1.00			
Satd. Flow (prot)		3539	1536		3574	1566	3400		1553			
Flt Permitted		1.00	1.00		1.00	1.00	0.95		1.00			
Satd. Flow (perm)		3539	1536		3574	1566	3400		1553			
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	895	784	0	708	836	277	0	255	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	122	0	0	0
Lane Group Flow (vph)	0	895	784	0	708	836	277	0	133	0	0	0
Confl. Peds. (#/hr)			1	1								
Confl. Bikes (#/hr)						1						
Heavy Vehicles (%)	0%	2%	3%	0%	1%	1%	3%	0%	4%	0%	0%	0%
Turn Type			Free			Free	custom		custom			
Protected Phases		2			6		8					
Permitted Phases			Free			Free	8		8			
Actuated Green, G (s)		80.6	105.0		80.6	105.0	15.4		15.4			
Effective Green, g (s)		80.6	105.0		80.6	105.0	15.4		15.4			
Actuated g/C Ratio		0.77	1.00		0.77	1.00	0.15		0.15			
Clearance Time (s)		5.0			5.0		4.0		4.0			
Vehicle Extension (s)		3.0			3.0		3.0		3.0			
Lane Grp Cap (vph)		2717	1536		2743	1566	499		228			
v/s Ratio Prot		0.25			0.20		0.08					
v/s Ratio Perm			0.51			c0.53			0.09			
v/c Ratio		0.33	0.51		0.26	0.53	0.56		0.58			
Uniform Delay, d1		3.8	0.0		3.5	0.0	41.6		41.8			
Progression Factor		0.86	1.00		1.63	1.00	1.00		1.00			
Incremental Delay, d2		0.3	1.1		0.2	1.2	1.3		3.8			
Delay (s)		3.6	1.1		6.0	1.2	43.0		45.6			
Level of Service		A	A		A	A	D		D			
Approach Delay (s)		2.4			3.4			44.2			0.0	
Approach LOS		A			A			D			A	

Intersection Summary			
HCM Average Control Delay	8.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	0.0
Intersection Capacity Utilization	46.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	49	518	525	43	731	11	581	16	66	37	16	155
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	5.0	5.0	4.5	5.0		5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.91		0.95	0.95	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	0.99	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85	1.00	0.86	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00	0.95	1.00	
Satd. Flow (prot)	1770	3471	1599	1805	5075		1698	1702	1615	1805	1596	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00	0.95	1.00	
Satd. Flow (perm)	1770	3471	1599	1805	5075		1698	1702	1615	1805	1596	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	53	557	565	46	786	12	625	17	71	40	17	167
RTOR Reduction (vph)	0	0	149	0	1	0	0	0	53	0	155	0
Lane Group Flow (vph)	53	557	416	46	797	0	319	323	18	40	29	0
Confl. Peds. (#/hr)			2	2					3	3		
Confl. Bikes (#/hr)			1									1
Heavy Vehicles (%)	2%	4%	1%	0%	2%	0%	1%	6%	0%	0%	6%	1%
Turn Type	Prot		pt+ov	Prot			Split		Prot	Split		
Protected Phases	5	2	2 8	1	6		8	8	8	4	4	
Permitted Phases												
Actuated Green, G (s)	7.2	45.0	77.3	5.6	43.4		27.3	27.3	27.3	7.6	7.6	
Effective Green, g (s)	7.2	45.0	77.3	5.6	43.4		27.3	27.3	27.3	7.6	7.6	
Actuated g/C Ratio	0.07	0.43	0.74	0.05	0.41		0.26	0.26	0.26	0.07	0.07	
Clearance Time (s)	4.5	5.0		4.5	5.0		5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	121	1488	1177	96	2098		441	443	420	131	116	
v/s Ratio Prot	c0.03	c0.16	0.26	0.03	0.16		0.19	c0.19	0.01	c0.02	0.02	
v/s Ratio Perm												
v/c Ratio	0.44	0.37	0.35	0.48	0.38		0.72	0.73	0.04	0.31	0.25	
Uniform Delay, d1	47.0	20.4	4.9	48.3	21.4		35.4	35.5	29.1	46.2	46.0	
Progression Factor	1.05	1.02	2.65	1.36	0.48		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	2.4	0.7	0.2	3.6	0.5		5.8	5.9	0.0	1.3	1.1	
Delay (s)	51.9	21.5	13.3	69.0	10.8		41.2	41.4	29.1	47.5	47.1	
Level of Service	D	C	B	E	B		D	D	C	D	D	
Approach Delay (s)		18.9			14.0			40.1			47.2	
Approach LOS		B			B			D			D	

Intersection Summary			
HCM Average Control Delay	24.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	14.5
Intersection Capacity Utilization	67.0%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	12	353	169	56	318	0	460	5	95	1	3	7
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.5	5.5	5.0	5.5		5.0	5.0			5.0	
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95		0.97	1.00			1.00	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00			1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00			1.00	
Frt	1.00	0.99	0.85	1.00	1.00		1.00	0.86			0.91	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00			1.00	
Satd. Flow (prot)	1543	1767	1408	1770	3574		3400	1571			1594	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00			1.00	
Satd. Flow (perm)	1543	1767	1408	1770	3574		3400	1571			1594	
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	13	397	190	63	357	0	517	6	107	1	3	8
RTOR Reduction (vph)	0	1	40	0	0	0	0	84	0	0	8	0
Lane Group Flow (vph)	13	415	131	63	357	0	517	29	0	0	4	0
Confl. Bikes (#/hr)			1									
Heavy Vehicles (%)	17%	1%	9%	2%	1%	0%	3%	0%	4%	0%	0%	12%
Turn Type	Prot		pt+ov	Prot			Split			Split		
Protected Phases	5	2	2 8	1	6		8	8		4	4	
Permitted Phases												
Actuated Green, G (s)	1.6	52.5	80.5	8.0	58.9		22.5	22.5			1.5	
Effective Green, g (s)	1.6	52.5	80.5	8.0	58.9		22.5	22.5			1.5	
Actuated g/C Ratio	0.02	0.50	0.77	0.08	0.56		0.21	0.21			0.01	
Clearance Time (s)	5.0	5.5		5.0	5.5		5.0	5.0			5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0			3.0	
Lane Grp Cap (vph)	24	884	1079	135	2005		729	337			23	
v/s Ratio Prot	0.01	c0.23	0.09	c0.04	0.10		c0.15	0.02			c0.00	
v/s Ratio Perm												
v/c Ratio	0.54	0.47	0.12	0.47	0.18		0.71	0.09			0.18	
Uniform Delay, d1	51.3	17.2	3.2	46.5	11.2		38.2	33.0			51.1	
Progression Factor	1.26	0.88	5.99	1.00	1.00		1.00	1.00			1.00	
Incremental Delay, d2	21.9	1.7	0.0	2.5	0.2		3.2	0.1			3.7	
Delay (s)	86.8	16.9	18.9	49.0	11.4		41.4	33.1			54.9	
Level of Service	F	B	B	D	B		D	C			D	
Approach Delay (s)		19.0			17.1			39.9			54.9	
Approach LOS		B			B			D			D	

Intersection Summary			
HCM Average Control Delay	26.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	20.5
Intersection Capacity Utilization	61.4%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	240	175	105	293	200	112
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	273	199	119	333	227	127
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	862	291	355			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	862	291	355			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	7	74	90			
cM capacity (veh/h)	293	753	1210			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1
Volume Total	472	119	333	355
Volume Left	273	119	0	0
Volume Right	199	0	0	127
cSH	395	1210	1700	1700
Volume to Capacity	1.19	0.10	0.20	0.21
Queue Length 95th (ft)	473	8	0	0
Control Delay (s)	140.4	8.3	0.0	0.0
Lane LOS	F	A		
Approach Delay (s)	140.4	2.2		0.0
Approach LOS	F			

Intersection Summary			
Average Delay	52.5		
Intersection Capacity Utilization	57.2%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	2	4	7	374	345	1
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	2	4	8	416	383	1
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	815	384	384			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	815	384	384			
tC, single (s)	6.4	6.5	4.4			
tC, 2 stage (s)						
tF (s)	3.5	3.5	2.5			
p0 queue free %	99	99	99			
cM capacity (veh/h)	347	616	1041			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	7	423	384
Volume Left	2	8	0
Volume Right	4	0	1
cSH	490	1041	1700
Volume to Capacity	0.01	0.01	0.23
Queue Length 95th (ft)	1	1	0
Control Delay (s)	12.5	0.2	0.0
Lane LOS	B	A	
Approach Delay (s)	12.5	0.2	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	0.2		
Intersection Capacity Utilization	35.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	139	311	26	10	130	38	18	12	2	115	19	99
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	151	338	28	11	141	41	20	13	2	125	21	108

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total (vph)	151	366	193	20	15	125	128
Volume Left (vph)	151	0	11	20	0	125	0
Volume Right (vph)	0	28	41	0	2	0	108
Hadj (s)	0.53	-0.04	-0.11	0.50	-0.10	0.50	-0.57
Departure Headway (s)	6.2	5.6	5.9	7.3	6.7	6.9	5.8
Degree Utilization, x	0.26	0.57	0.32	0.04	0.03	0.24	0.21
Capacity (veh/h)	563	629	586	444	479	487	575
Control Delay (s)	10.1	14.5	11.6	9.5	8.7	10.9	9.2
Approach Delay (s)	13.2		11.6	9.1		10.0	
Approach LOS	B		B	A		B	

Intersection Summary			
Delay	11.9		
HCM Level of Service	B		
Intersection Capacity Utilization	50.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	211	46	78	36	21	18	53	163	32	19	231	122
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	234	51	87	40	23	20	59	181	36	21	257	136

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1
Volume Total (vph)	372	83	59	217	413
Volume Left (vph)	234	40	59	0	21
Volume Right (vph)	87	20	0	36	136
Hadj (s)	0.01	-0.02	0.57	-0.10	-0.17
Departure Headway (s)	6.1	6.9	7.3	6.6	5.9
Degree Utilization, x	0.63	0.16	0.12	0.40	0.68
Capacity (veh/h)	550	427	456	493	585
Control Delay (s)	19.2	11.2	10.1	12.8	20.3
Approach Delay (s)	19.2	11.2	12.2		20.3
Approach LOS	C	B	B		C

Intersection Summary			
Delay	17.3		
HCM Level of Service	C		
Intersection Capacity Utilization	66.7%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↱			↰↑	Y	
Volume (veh/h)	96	10	0	68	5	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.83	0.83	0.83	0.83	0.83	0.83
Hourly flow rate (vph)	116	12	0	82	6	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			128		204	122
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			128		204	122
tC, single (s)			4.1		6.6	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.7	3.3
p0 queue free %			100		99	100
cM capacity (veh/h)			1471		746	935

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	128	82	6
Volume Left	0	0	6
Volume Right	12	0	0
cSH	1700	1471	746
Volume to Capacity	0.08	0.00	0.01
Queue Length 95th (ft)	0	0	1
Control Delay (s)	0.0	0.0	9.9
Lane LOS			A
Approach Delay (s)	0.0	0.0	9.9
Approach LOS			A

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	15.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑	↱	↰↰	↑↑					↰	↰↑	↱↱
Volume (vph)	0	857	715	409	841	0	0	0	0	344	0	512
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0	4.0	4.0
Lane Util. Factor		0.91	1.00	0.97	0.95					0.95	0.95	0.88
Frpb, ped/bikes		1.00	0.97	1.00	1.00					1.00	1.00	0.98
Flpb, ped/bikes		1.00	1.00	1.00	1.00					1.00	1.00	1.00
Frt		1.00	0.85	1.00	1.00					1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95	0.95	1.00
Satd. Flow (prot)		5085	1535	3502	3505					1698	1698	2671
Flt Permitted		1.00	1.00	0.95	1.00					0.95	0.95	1.00
Satd. Flow (perm)		5085	1535	3502	3505					1698	1698	2671
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	902	753	431	885	0	0	0	0	362	0	539
RTOR Reduction (vph)	0	0	269	0	0	0	0	0	0	0	0	144
Lane Group Flow (vph)	0	902	484	431	885	0	0	0	0	181	181	395
Confl. Peds. (#/hr)	9		8	8		9	4					4
Heavy Vehicles (%)	0%	2%	2%	0%	3%	0%	0%	0%	0%	1%	0%	4%
Turn Type			Perm	Prot						Split		custom
Protected Phases		2		1	6					4	4	5
Permitted Phases			2		6							4
Actuated Green, G (s)		62.1	62.1	18.9	74.5					17.0	17.0	23.5
Effective Green, g (s)		62.1	62.1	18.9	74.5					17.0	17.0	23.5
Actuated g/C Ratio		0.56	0.56	0.17	0.68					0.15	0.15	0.21
Clearance Time (s)		4.0	4.0	4.0	4.0					4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0					3.0	3.0	3.0
Lane Grp Cap (vph)		2871	867	602	2374					262	262	668
v/s Ratio Prot		0.18		c0.12	0.25					c0.11	0.11	0.03
v/s Ratio Perm			c0.32									0.11
v/c Ratio		0.31	0.56	0.72	0.37					0.69	0.69	0.59
Uniform Delay, d1		12.7	15.2	43.0	7.7					44.0	44.0	38.9
Progression Factor		1.00	1.00	0.61	1.57					1.00	1.00	1.00
Incremental Delay, d2		0.3	2.6	3.9	0.4					7.6	7.6	1.4
Delay (s)		13.0	17.8	30.2	12.5					51.6	51.6	40.3
Level of Service		B	B	C	B					D	D	D
Approach Delay (s)		15.2			18.3			0.0			44.9	
Approach LOS		B			B			A			D	

Intersection Summary			
HCM Average Control Delay	23.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	77.1%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	369	832	0	0	927	323	323	0	406	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0			
Lane Util. Factor	0.97	0.95			0.91	1.00	0.95	0.95	0.88			
Frpb, ped/bikes	1.00	1.00			1.00	0.97	1.00	1.00	0.98			
Flpb, ped/bikes	1.00	1.00			1.00	1.00	1.00	1.00	1.00			
Frt	1.00	1.00			1.00	0.85	1.00	1.00	0.85			
Flt Protected	0.95	1.00			1.00	1.00	0.95	0.95	1.00			
Satd. Flow (prot)	3400	3574			5136	1537	1618	1618	2767			
Flt Permitted	0.95	1.00			1.00	1.00	0.95	0.95	1.00			
Satd. Flow (perm)	3400	3574			5136	1537	1618	1618	2767			
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	388	876	0	0	976	340	340	0	427	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	141	0	0	116	0	0	0
Lane Group Flow (vph)	388	876	0	0	976	199	170	170	311	0	0	0
Confl. Peds. (#/hr)	10		12	12		10			1	1		
Heavy Vehicles (%)	3%	1%	0%	0%	1%	2%	6%	0%	1%	0%	0%	0%
Turn Type	Prot					Perm	Split		custom			
Protected Phases	5	2			6		8	8	1			
Permitted Phases		2				6			8			
Actuated Green, G (s)	17.3	75.9			64.5	64.5	16.2	16.2	22.1			
Effective Green, g (s)	17.3	75.9			64.5	64.5	16.2	16.2	22.1			
Actuated g/C Ratio	0.16	0.69			0.59	0.59	0.15	0.15	0.20			
Clearance Time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0			
Vehicle Extension (s)	2.3	4.9			4.9	4.9	2.3	2.3	3.0			
Lane Grp Cap (vph)	535	2466			3012	901	238	238	657			
v/s Ratio Prot	c0.11	c0.25			0.19		c0.11	0.11	0.03			
v/s Ratio Perm						0.13			0.09			
v/c Ratio	0.73	0.36			0.32	0.22	0.71	0.71	0.47			
Uniform Delay, d1	44.1	7.0			11.6	10.8	44.7	44.7	38.8			
Progression Factor	0.67	1.16			0.77	1.41	1.00	1.00	1.00			
Incremental Delay, d2	4.2	0.4			0.2	0.4	8.7	8.7	0.5			
Delay (s)	33.9	8.5			9.2	15.7	53.4	53.4	39.4			
Level of Service	C	A			A	B	D	D	D			
Approach Delay (s)		16.3			10.8			45.6			0.0	
Approach LOS		B			B			D			A	

Intersection Summary			
HCM Average Control Delay	20.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	77.1%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	405	605	69	32	504	28	245	53	39	21	62	501
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	0.95		1.00	0.95		0.91	0.91		1.00	0.95	0.95
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	0.99		1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.98		1.00	0.99		1.00	0.97		1.00	0.88	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	0.97		0.95	1.00	1.00
Satd. Flow (prot)	2540	3458		1805	2650		1610	3165		1805	1558	1504
Flt Permitted	0.95	1.00		0.95	1.00		0.95	0.97		0.95	1.00	1.00
Satd. Flow (perm)	2540	3458		1805	2650		1610	3165		1805	1558	1504
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	422	630	72	33	525	29	255	55	41	22	65	522
RTOR Reduction (vph)	0	7	0	0	3	0	0	17	0	0	124	246
Lane Group Flow (vph)	422	695	0	33	551	0	127	207	0	22	176	41
Confl. Peds. (#/hr)	6		5	5		6			7	7		
Heavy Vehicles (%)	1%	2%	6%	0%	1%	0%	2%	6%	0%	0%	3%	2%
Turn Type	Prot			Prot			Split			Split		Perm
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases												4
Actuated Green, G (s)	29.6	61.2		4.2	35.8		12.2	12.2		15.4	15.4	15.4
Effective Green, g (s)	29.6	61.7		4.2	36.3		12.2	12.2		15.9	15.9	15.9
Actuated g/C Ratio	0.27	0.56		0.04	0.33		0.11	0.11		0.14	0.14	0.14
Clearance Time (s)	4.0	4.5		4.0	4.5		4.0	4.0		4.5	4.5	4.5
Vehicle Extension (s)	2.5	4.3		2.5	4.3		2.5	2.5		2.5	2.5	2.5
Lane Grp Cap (vph)	683	1940		69	875		179	351		261	225	217
v/s Ratio Prot	c0.17	0.20		0.02	c0.21		c0.08	0.07		0.01	c0.11	
v/s Ratio Perm												0.03
v/c Ratio	0.62	0.36		0.48	0.63		0.71	0.59		0.08	0.78	0.19
Uniform Delay, d1	35.2	13.3		51.8	31.2		47.2	46.5		40.7	45.4	41.4
Progression Factor	0.82	0.63		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.3	0.5		3.8	3.4		11.3	2.2		0.1	15.6	0.3
Delay (s)	30.1	8.9		55.6	34.6		58.5	48.7		40.8	60.9	41.7
Level of Service	C	A		E	C		E	D		D	E	D
Approach Delay (s)		16.8			35.8			52.3			51.1	
Approach LOS		B			D			D			D	

Intersection Summary			
HCM Average Control Delay	33.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	62.8%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	0	0	0	0	0	0
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	0	0	0			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0	0	0			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	100	100			
cM capacity (veh/h)	1023	1085	1623			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	0	0	0
Volume Left	0	0	0
Volume Right	0	0	0
cSH	1700	1700	1700
Volume to Capacity	0.00	0.00	0.00
Queue Length 95th (ft)	0	0	0
Control Delay (s)	0.0	0.0	0.0
Lane LOS	A		
Approach Delay (s)	0.0	0.0	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	0.0%	ICU Level of Service	A
Analysis Period (min)	15		

DKS

HCM Analysis – 2035 Baseline

1: I-5 SB On Ramp/I-5 SB Off Ramp & Boones Ferry Road/Sw Elligsen Rd

2035 Future (Baseline PM Peak)

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1310	790	0	990	330	0	0	0	750	0	640
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0				4.0	4.0	4.0
Lane Util. Factor		0.95	1.00		0.95	1.00				0.95	0.95	1.00
Frpb, ped/bikes		1.00	0.99		1.00	1.00				1.00	1.00	1.00
Flpb, ped/bikes		1.00	1.00		1.00	1.00				1.00	1.00	1.00
Frt		1.00	0.85		1.00	0.85				1.00	1.00	0.85
Flt Protected		1.00	1.00		1.00	1.00				0.95	0.95	1.00
Satd. Flow (prot)		3505	1564		3471	1583				1681	1681	1468
Flt Permitted		1.00	1.00		1.00	1.00				0.95	0.95	1.00
Satd. Flow (perm)		3505	1564		3471	1583				1681	1681	1468
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	1379	832	0	1042	347	0	0	0	789	0	674
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	26
Lane Group Flow (vph)	0	1379	832	0	1042	347	0	0	0	394	395	648
Confl. Bikes (#/hr)			2									
Heavy Vehicles (%)	0%	3%	2%	0%	4%	2%	0%	0%	0%	2%	0%	10%
Turn Type		NA	Free		NA	Free				Split	NA	Prot
Protected Phases		2			6					4	4	4
Permitted Phases			Free			Free						
Actuated Green, G (s)		47.5	105.0		47.5	105.0				48.5	48.5	48.5
Effective Green, g (s)		48.5	105.0		48.5	105.0				48.5	48.5	48.5
Actuated g/C Ratio		0.46	1.00		0.46	1.00				0.46	0.46	0.46
Clearance Time (s)		5.0			5.0					4.0	4.0	4.0
Vehicle Extension (s)		3.0			3.0					3.0	3.0	3.0
Lane Grp Cap (vph)		1618	1564		1603	1583				776	776	678
v/s Ratio Prot		c0.39			0.30					0.23	0.23	c0.44
v/s Ratio Perm			0.53			0.22						
v/c Ratio		0.85	0.53		0.65	0.22				0.51	0.51	0.96
Uniform Delay, d1		25.1	0.0		21.7	0.0				19.9	19.9	27.2
Progression Factor		1.00	1.00		1.15	1.00				1.00	1.00	1.00
Incremental Delay, d2		5.9	1.3		1.9	0.3				0.5	0.5	24.0
Delay (s)		31.0	1.3		26.9	0.3				20.4	20.4	51.2
Level of Service		C	A		C	A				C	C	D
Approach Delay (s)		19.8			20.2			0.0			34.6	
Approach LOS		B			C			A			C	

Intersection Summary			
HCM 2000 Control Delay	24.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	73.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

2: I-5 NB Off Ramp/I-5 NB Ramp & Sw Elligsen Rd/Elligsen Road

2035 Future (Baseline PM Peak)

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1160	900	0	860	930	460	0	340	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	4.0		5.0	4.0	4.0		4.0			
Lane Util. Factor		0.95	1.00		0.95	1.00	0.97		1.00			
Frpb, ped/bikes		1.00	0.98		1.00	0.98	1.00		1.00			
Flpb, ped/bikes		1.00	1.00		1.00	1.00	1.00		1.00			
Frt		1.00	0.85		1.00	0.85	1.00		0.85			
Flt Protected		1.00	1.00		1.00	1.00	0.95		1.00			
Satd. Flow (prot)		3539	1536		3574	1566	3400		1553			
Flt Permitted		1.00	1.00		1.00	1.00	0.95		1.00			
Satd. Flow (perm)		3539	1536		3574	1566	3400		1553			
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	1221	947	0	905	979	484	0	358	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	37	0	0	0
Lane Group Flow (vph)	0	1221	947	0	905	979	484	0	321	0	0	0
Confl. Peds. (#/hr)			1	1								
Confl. Bikes (#/hr)						1						
Heavy Vehicles (%)	0%	2%	3%	0%	1%	1%	3%	0%	4%	0%	0%	0%
Turn Type		NA	Free		NA	Free	custom		custom			
Protected Phases		2			6		8					
Permitted Phases			Free			Free	8		8			
Actuated Green, G (s)		68.0	105.0		68.0	105.0	28.0		28.0			
Effective Green, g (s)		68.0	105.0		68.0	105.0	28.0		28.0			
Actuated g/C Ratio		0.65	1.00		0.65	1.00	0.27		0.27			
Clearance Time (s)		5.0			5.0		4.0		4.0			
Vehicle Extension (s)		3.0			3.0		3.0		3.0			
Lane Grp Cap (vph)		2291	1536		2314	1566	906		414			
v/s Ratio Prot		0.34			0.25		0.14					
v/s Ratio Perm			0.62			c0.62			c0.21			
v/c Ratio		0.53	0.62		0.39	0.63	0.53		0.78			
Uniform Delay, d1		10.0	0.0		8.7	0.0	32.9		35.6			
Progression Factor		1.48	1.00		1.06	1.00	1.00		1.00			
Incremental Delay, d2		0.6	1.3		0.4	1.4	0.6		8.8			
Delay (s)		15.3	1.3		9.6	1.4	33.5		44.4			
Level of Service		B	A		A	A	C		D			
Approach Delay (s)		9.2			5.3			38.2			0.0	
Approach LOS		A			A			D			A	

Intersection Summary			
HCM 2000 Control Delay	12.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	60.6%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

3: Parkway Ave & Elligsen Road/Sw Elligsen Rd

2035 Future (Baseline PM Peak)

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	70	920	510	60	960	80	640	40	40	160	20	190
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	5.0	5.0	4.5	5.0		5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.91		0.95	0.95	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	0.99	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	0.86	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.96	1.00	0.95	1.00	
Satd. Flow (prot)	1770	3471	1599	1805	5034		1698	1702	1615	1805	1598	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.96	1.00	0.95	1.00	
Satd. Flow (perm)	1770	3471	1599	1805	5034		1698	1702	1615	1805	1598	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	75	989	548	65	1032	86	688	43	43	172	22	204
RTOR Reduction (vph)	0	0	183	0	8	0	0	0	32	0	180	0
Lane Group Flow (vph)	75	989	365	65	1110	0	365	366	11	172	46	0
Confl. Peds. (#/hr)			2	2					3	3		
Confl. Bikes (#/hr)			1									1
Heavy Vehicles (%)	2%	4%	1%	0%	2%	0%	1%	6%	0%	0%	6%	1%
Turn Type	Prot	NA	pt+ov	Prot	NA		Split	NA	Prot	Split	NA	
Protected Phases	5	2	2 8	1	6		8	8	8	4	4	
Permitted Phases												
Actuated Green, G (s)	8.6	39.2	70.0	8.0	38.6		25.8	25.8	25.8	12.5	12.5	
Effective Green, g (s)	8.6	39.2	70.0	8.0	38.6		25.8	25.8	25.8	12.5	12.5	
Actuated g/C Ratio	0.08	0.37	0.67	0.08	0.37		0.25	0.25	0.25	0.12	0.12	
Clearance Time (s)	4.5	5.0		4.5	5.0		5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	144	1295	1066	137	1850		417	418	396	214	190	
v/s Ratio Prot	c0.04	c0.28	0.23	0.04	0.22		0.21	c0.22	0.01	c0.10	0.03	
v/s Ratio Perm												
v/c Ratio	0.52	0.76	0.34	0.47	0.60		0.88	0.88	0.03	0.80	0.24	
Uniform Delay, d1	46.2	28.8	7.6	46.5	26.9		38.1	38.1	30.1	45.1	42.0	
Progression Factor	1.02	1.02	4.65	1.00	0.71		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	2.9	3.7	0.2	1.9	1.1		18.1	18.1	0.0	19.2	0.7	
Delay (s)	49.8	33.3	35.3	48.2	20.3		56.2	56.2	30.1	64.3	42.6	
Level of Service	D	C	D	D	C		E	E	C	E	D	
Approach Delay (s)		34.7			21.8			54.7			52.0	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM 2000 Control Delay	36.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	19.5
Intersection Capacity Utilization	76.9%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

4: Parkway Center Dr/Parkway Center Drive & Sw Elligsen Rd/.

2035 Future (Baseline PM Peak)

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	10	520	450	100	320	10	700	10	120	10	10	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.5	5.5	5.0	5.5		5.0	5.0			5.0	
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95		0.97	1.00			1.00	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00			1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00			1.00	
Frt	1.00	0.99	0.85	1.00	1.00		1.00	0.86			0.95	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00			0.98	
Satd. Flow (prot)	1543	1753	1408	1770	3559		3400	1578			1716	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00			0.98	
Satd. Flow (perm)	1543	1753	1408	1770	3559		3400	1578			1716	
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	11	584	506	112	360	11	787	11	135	11	11	11
RTOR Reduction (vph)	0	3	119	0	2	0	0	102	0	0	11	0
Lane Group Flow (vph)	11	632	336	112	369	0	787	44	0	0	22	0
Confl. Bikes (#/hr)			1									
Heavy Vehicles (%)	17%	1%	9%	2%	1%	0%	3%	0%	4%	0%	0%	12%
Turn Type	Prot	NA	pt+ov	Prot	NA		Split	NA		Split	NA	
Protected Phases	5	2	2 8	1	6		8	8		4	4	
Permitted Phases												
Actuated Green, G (s)	0.8	46.1	77.6	8.8	54.1		26.0	26.0			3.6	
Effective Green, g (s)	0.8	46.1	77.6	8.8	54.1		26.0	26.0			3.6	
Actuated g/C Ratio	0.01	0.44	0.74	0.08	0.52		0.25	0.25			0.03	
Clearance Time (s)	5.0	5.5		5.0	5.5		5.0	5.0			5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0			3.0	
Lane Grp Cap (vph)	11	769	1040	148	1833		841	390			58	
v/s Ratio Prot	0.01	c0.36	0.24	c0.06	0.10		c0.23	0.03			c0.01	
v/s Ratio Perm												
v/c Ratio	1.00	0.82	0.32	0.76	0.20		0.94	0.11			0.39	
Uniform Delay, d1	52.1	25.9	4.7	47.1	13.8		38.7	30.6			49.6	
Progression Factor	1.31	0.31	2.80	1.00	1.00		1.00	1.00			1.00	
Incremental Delay, d2	222.4	6.7	0.1	19.6	0.2		17.3	0.1			4.2	
Delay (s)	290.6	14.6	13.3	66.6	14.0		56.0	30.7			53.8	
Level of Service	F	B	B	E	B		E	C			D	
Approach Delay (s)		16.8			26.2			52.0			53.8	
Approach LOS		B			C			D			D	

Intersection Summary			
HCM 2000 Control Delay	32.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	20.5
Intersection Capacity Utilization	82.7%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰	↑↱		↰	↑	↱	↰	↑↱	
Volume (vph)	170	190	240	400	110	30	80	260	440	70	390	160
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85	1.00	0.96	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1900	1615	1805	1839		1787	1881	1615	1805	1771	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1900	1615	1805	1839		1787	1881	1615	1805	1771	
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	193	216	273	455	125	34	91	295	500	80	443	182
RTOR Reduction (vph)	0	0	115	0	8	0	0	0	83	0	13	0
Lane Group Flow (vph)	193	216	158	455	151	0	91	295	417	80	612	0
Heavy Vehicles (%)	2%	0%	0%	0%	0%	0%	1%	1%	0%	0%	2%	4%
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA	pm+ov	Prot	NA	
Protected Phases	7	4		3	8		5	2	3	1	6	
Permitted Phases			4						2			
Actuated Green, G (s)	17.0	16.8	16.8	30.8	30.6		8.0	42.9	73.7	7.9	42.8	
Effective Green, g (s)	17.0	16.8	16.8	30.8	30.6		8.0	42.9	73.7	7.9	42.8	
Actuated g/C Ratio	0.15	0.15	0.15	0.27	0.27		0.07	0.37	0.64	0.07	0.37	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	263	279	237	485	491		124	705	1096	124	662	
v/s Ratio Prot	0.11	c0.11		c0.25	0.08		c0.05	0.16	0.10	0.04	c0.35	
v/s Ratio Perm			0.10						0.16			
v/c Ratio	0.73	0.77	0.67	0.94	0.31		0.73	0.42	0.38	0.65	0.93	
Uniform Delay, d1	46.5	47.0	46.1	40.9	33.4		52.2	26.5	9.6	51.9	34.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	10.1	12.6	6.9	25.9	0.4		20.0	0.4	0.2	11.0	18.8	
Delay (s)	56.7	59.5	53.0	66.8	33.8		72.1	26.9	9.8	62.8	53.1	
Level of Service	E	E	D	E	C		E	C	A	E	D	
Approach Delay (s)		56.1			58.2			21.9			54.2	
Approach LOS		E			E			C			D	

Intersection Summary			
HCM 2000 Control Delay	45.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	114.4	Sum of lost time (s)	16.0
Intersection Capacity Utilization	80.2%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↑↱		↰	↑↱		↰	↑↱	
Volume (veh/h)	80	10	10	10	10	30	20	570	30	70	670	170
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	89	11	11	11	11	33	22	633	33	78	744	189
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1711	1706	839	1611	1783	650	933			667		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1711	1706	839	1611	1783	650	933			667		
tC, single (s)	7.1	6.5	6.5	7.1	6.5	6.2	4.4			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.5	3.5	4.0	3.3	2.5			2.2		
p0 queue free %	0	86	97	83	85	93	96			92		
cM capacity (veh/h)	54	82	333	67	73	473	634			932		

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	89	22	11	44	22	667	78	933
Volume Left	89	0	11	0	22	0	78	0
Volume Right	0	11	0	33	0	33	0	189
cSH	54	131	67	200	634	1700	932	1700
Volume to Capacity	1.64	0.17	0.17	0.22	0.04	0.39	0.08	0.55
Queue Length 95th (ft)	208	15	14	21	3	0	7	0
Control Delay (s)	479.4	38.0	69.0	28.1	10.9	0.0	9.2	0.0
Lane LOS	F	E	F	D	B		A	
Approach Delay (s)	391.1		36.3		0.4		0.7	
Approach LOS	F		E					

Intersection Summary			
Average Delay	24.9		
Intersection Capacity Utilization	70.0%	ICU Level of Service	C
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis
7: SW Canyon Creek Rd & Boeckman Rd

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	120	480	120	100	380	60	30	50	60	170	210	120
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	0.99		1.00	1.00		1.00	0.98		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		0.99	1.00	
Frt	1.00	0.97		1.00	0.98		1.00	0.92		1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1818		1805	1854		1803	1717		1792	1775	
Flt Permitted	0.39	1.00		0.25	1.00		0.42	1.00		0.68	1.00	
Satd. Flow (perm)	735	1818		467	1854		800	1717		1284	1775	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	130	522	130	109	413	65	33	54	65	185	228	130
RTOR Reduction (vph)	0	13	0	0	9	0	0	43	0	0	31	0
Lane Group Flow (vph)	130	639	0	109	469	0	33	76	0	185	327	0
Confl. Peds. (#/hr)			3	3			1		3	3		1
Confl. Bikes (#/hr)			1									
Heavy Vehicles (%)	2%	1%	0%	0%	0%	3%	0%	0%	0%	0%	0%	1%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	21.8	21.8		21.8	21.8		14.8	14.8		14.8	14.8	
Effective Green, g (s)	21.8	21.8		21.8	21.8		14.8	14.8		14.8	14.8	
Actuated g/C Ratio	0.49	0.49		0.49	0.49		0.33	0.33		0.33	0.33	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	359	888		228	906		265	569		426	589	
v/s Ratio Prot		c0.35			0.25			0.04			c0.18	
v/s Ratio Perm	0.18			0.23			0.04			0.14		
v/c Ratio	0.36	0.72		0.48	0.52		0.12	0.13		0.43	0.55	
Uniform Delay, d1	7.1	9.0		7.6	7.8		10.4	10.4		11.6	12.2	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.6	2.8		1.6	0.5		0.2	0.1		0.7	1.1	
Delay (s)	7.7	11.8		9.2	8.3		10.6	10.5		12.3	13.3	
Level of Service	A	B		A	A		B	B		B	B	
Approach Delay (s)		11.1			8.5			10.5			13.0	
Approach LOS		B			A			B			B	

Intersection Summary			
HCM 2000 Control Delay	10.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	44.6	Sum of lost time (s)	8.0
Intersection Capacity Utilization	73.1%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
8: Wilsonville Rd/SW Stafford Rd & Boeckman Rd/SW Advance Rd

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	310	130	70	60	80	80	70	260	60	150	290	240
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.95		1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1787	1781		1752	1900	1615	1736	1831		1556	1900	1615
Flt Permitted	0.45	1.00		0.62	1.00	1.00	0.52	1.00		0.26	1.00	1.00
Satd. Flow (perm)	846	1781		1143	1900	1615	951	1831		434	1900	1615
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	344	144	78	67	89	89	78	289	67	167	322	267
RTOR Reduction (vph)	0	18	0	0	0	80	0	9	0	0	0	150
Lane Group Flow (vph)	344	204	0	67	89	9	78	347	0	167	322	117
Heavy Vehicles (%)	1%	0%	3%	3%	0%	0%	4%	1%	0%	16%	0%	0%
Turn Type	pm+pt	NA		pm+pt	NA	Perm	pm+pt	NA		pm+pt	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8		8	2			6		6
Actuated Green, G (s)	29.5	20.1		12.6	7.2	7.2	26.1	20.6		34.7	25.2	25.2
Effective Green, g (s)	29.5	20.1		12.6	7.2	7.2	26.1	20.6		34.7	25.2	25.2
Actuated g/C Ratio	0.41	0.28		0.17	0.10	0.10	0.36	0.29		0.48	0.35	0.35
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	584	495		245	189	161	403	522		365	663	563
v/s Ratio Prot	c0.15	0.11		0.02	0.05		0.01	c0.19		c0.06	0.17	
v/s Ratio Perm	c0.09			0.03		0.01	0.06			0.16		0.07
v/c Ratio	0.59	0.41		0.27	0.47	0.06	0.19	0.67		0.46	0.49	0.21
Uniform Delay, d1	15.8	21.2		25.6	30.7	29.4	15.4	22.8		12.3	18.4	16.5
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.5	0.6		0.6	1.9	0.1	0.2	3.2		0.9	0.6	0.2
Delay (s)	17.3	21.8		26.2	32.6	29.6	15.7	26.0		13.2	19.0	16.7
Level of Service	B	C		C	C	C	B	C		B	B	B
Approach Delay (s)		19.1			29.7			24.1			16.9	
Approach LOS		B			C			C			B	

Intersection Summary			
HCM 2000 Control Delay	20.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	72.2	Sum of lost time (s)	16.0
Intersection Capacity Utilization	60.4%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis — Wilsonville TSP
9: SW 60th Ave & SW Advance Rd — 2035 Future (Baseline PM Peak)

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥			✥			✥	
Volume (veh/h)	10	210	130	10	100	10	100	10	10	10	10	20
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Hourly flow rate (vph)	12	253	157	12	120	12	120	12	12	12	12	24
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	133			410			536	512	331	524	584	127
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	133			410			536	512	331	524	584	127
tC, single (s)	4.1			4.1			7.3	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.7	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			99			70	97	98	97	97	97
cM capacity (veh/h)	1465			1160			402	460	715	444	418	929

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	422	145	145	48
Volume Left	12	12	120	12
Volume Right	157	12	12	24
cSH	1465	1160	422	588
Volume to Capacity	0.01	0.01	0.34	0.08
Queue Length 95th (ft)	1	1	37	7
Control Delay (s)	0.3	0.8	17.9	11.7
Lane LOS	A	A	C	B
Approach Delay (s)	0.3	0.8	17.9	11.7
Approach LOS			C	B

Intersection Summary			
Average Delay	4.5		
Intersection Capacity Utilization	41.5%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis — Wilsonville TSP
10: I-5 SB & Wilsonville Rd — 2035 Future (Baseline PM Peak)

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑	↱	↰↰	↑↑					↰	↰↑	↱↱
Volume (vph)	0	990	920	600	880	0	0	0	0	450	0	460
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0	4.0	4.0
Lane Util. Factor		0.91	1.00	0.97	0.95					0.95	0.95	0.88
Frpb, ped/bikes		1.00	0.97	1.00	1.00					1.00	1.00	0.98
Flpb, ped/bikes		1.00	1.00	1.00	1.00					1.00	1.00	1.00
Frt		1.00	0.85	1.00	1.00					1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95	0.95	1.00
Satd. Flow (prot)		5085	1535	3502	3505					1698	1698	2667
Flt Permitted		1.00	1.00	0.95	1.00					0.95	0.95	1.00
Satd. Flow (perm)		5085	1535	3502	3505					1698	1698	2667
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	1042	968	632	926	0	0	0	0	474	0	484
RTOR Reduction (vph)	0	0	303	0	0	0	0	0	0	0	0	124
Lane Group Flow (vph)	0	1042	665	632	926	0	0	0	0	237	237	360
Confl. Peds. (#/hr)	9		8	8		9	4					4
Heavy Vehicles (%)	0%	2%	2%	0%	3%	0%	0%	0%	0%	1%	0%	4%
Turn Type		NA	Perm	Prot	NA					Split	NA	custom
Protected Phases		2		1	6					4	4	5
Permitted Phases			2		6							4
Actuated Green, G (s)		51.8	51.8	25.5	71.1					20.7	20.7	26.9
Effective Green, g (s)		51.8	51.8	25.5	71.1					20.7	20.7	26.9
Actuated g/C Ratio		0.47	0.47	0.23	0.65					0.19	0.19	0.24
Clearance Time (s)		4.0	4.0	4.0	4.0					4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0					3.0	3.0	3.0
Lane Grp Cap (vph)		2394	722	811	2265					319	319	749
v/s Ratio Prot		0.20		c0.18	0.26					c0.14	0.14	0.03
v/s Ratio Perm			c0.43									0.11
v/c Ratio		0.44	0.92	0.78	0.41					0.74	0.74	0.48
Uniform Delay, d1		19.4	27.2	39.6	9.3					42.1	42.1	35.6
Progression Factor		1.00	1.00	0.61	1.53					1.00	1.00	1.00
Incremental Delay, d2		0.6	19.0	4.4	0.5					9.0	9.0	0.5
Delay (s)		19.9	46.2	28.6	14.8					51.2	51.2	36.1
Level of Service		B	D	C	B					D	D	D
Approach Delay (s)		32.6			20.4			0.0			43.5	
Approach LOS		C			C			A			D	

Intersection Summary			
HCM 2000 Control Delay	30.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	97.8%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

11: I-5 NB & Wilsonville Rd

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	540	900	0	0	1130	480	350	0	680	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0			
Lane Util. Factor	0.97	0.95			0.91	1.00	0.95	0.95	0.88			
Frpb, ped/bikes	1.00	1.00			1.00	0.97	1.00	1.00	0.99			
Flpb, ped/bikes	1.00	1.00			1.00	1.00	1.00	1.00	1.00			
Frt	1.00	1.00			1.00	0.85	1.00	1.00	0.85			
Flt Protected	0.95	1.00			1.00	1.00	0.95	0.95	1.00			
Satd. Flow (prot)	3400	3574			5136	1537	1618	1618	2780			
Flt Permitted	0.95	1.00			1.00	1.00	0.95	0.95	1.00			
Satd. Flow (perm)	3400	3574			5136	1537	1618	1618	2780			
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	568	947	0	0	1189	505	368	0	716	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	240	0	0	83	0	0	0
Lane Group Flow (vph)	568	947	0	0	1189	265	184	184	633	0	0	0
Confl. Peds. (#/hr)	10		12	12		10			1	1		
Heavy Vehicles (%)	3%	1%	0%	0%	1%	2%	6%	0%	1%	0%	0%	0%
Turn Type	Prot	NA			NA	Perm	Split	NA	custom			
Protected Phases	5	2			6		8	8	1			
Permitted Phases		2				6			8			
Actuated Green, G (s)	23.1	66.0			57.8	57.8	17.1	17.1	32.0			
Effective Green, g (s)	23.1	66.0			57.8	57.8	17.1	17.1	32.0			
Actuated g/C Ratio	0.21	0.60			0.53	0.53	0.16	0.16	0.29			
Clearance Time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0			
Vehicle Extension (s)	2.3	4.9			4.9	4.9	2.3	2.3	3.0			
Lane Grp Cap (vph)	714	2144			2698	807	251	251	909			
v/s Ratio Prot	c0.17	c0.26			0.23		0.11	0.11	c0.09			
v/s Ratio Perm						0.17			0.13			
v/c Ratio	0.80	0.44			0.44	0.33	0.73	0.73	0.70			
Uniform Delay, d1	41.2	12.0			16.1	15.0	44.3	44.3	34.7			
Progression Factor	0.47	0.65			0.84	1.55	1.00	1.00	1.00			
Incremental Delay, d2	5.4	0.6			0.4	0.8	9.6	9.6	2.3			
Delay (s)	24.9	8.4			13.8	24.0	53.9	53.9	37.0			
Level of Service	C	A			B	C	D	D	D			
Approach Delay (s)		14.6			16.9			42.8			0.0	
Approach LOS		B			B			D			A	

Intersection Summary			
HCM 2000 Control Delay	22.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	97.8%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

12: Town Center Lp West & Wilsonville Rd

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	600	790	130	60	530	100	270	130	60	200	90	810
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	0.95		1.00	0.95		0.91	0.91		1.00	1.00	0.88
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	0.99		1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.98		1.00	0.98		1.00	0.97		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	0.98		0.95	1.00	1.00
Satd. Flow (prot)	2540	3428		1805	2650		1610	3166		1805	1845	2787
Flt Permitted	0.95	1.00		0.95	1.00		0.95	0.98		0.95	1.00	1.00
Satd. Flow (perm)	2540	3428		1805	2650		1610	3166		1805	1845	2787
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	625	823	135	62	552	104	281	135	62	208	94	844
RTOR Reduction (vph)	0	10	0	0	13	0	0	20	0	0	0	740
Lane Group Flow (vph)	625	948	0	62	643	0	160	298	0	208	94	104
Confl. Peds. (#/hr)	6		5	5		6			7	7		
Heavy Vehicles (%)	1%	2%	6%	0%	1%	0%	2%	6%	0%	0%	3%	2%
Turn Type	Prot	NA		Prot	NA		Split	NA		Split	NA	Perm
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases												4
Actuated Green, G (s)	29.1	56.7		7.3	34.9		16.0	16.0		13.0	13.0	13.0
Effective Green, g (s)	29.1	57.2		7.3	35.4		16.0	16.0		13.5	13.5	13.5
Actuated g/C Ratio	0.26	0.52		0.07	0.32		0.15	0.15		0.12	0.12	0.12
Clearance Time (s)	4.0	4.5		4.0	4.5		4.0	4.0		4.5	4.5	4.5
Vehicle Extension (s)	2.5	4.3		2.5	4.3		2.5	2.5		2.5	2.5	2.5
Lane Grp Cap (vph)	671	1782		119	852		234	460		221	226	342
v/s Ratio Prot	c0.25	0.28		0.03	c0.24		c0.10	0.09		c0.12	0.05	
v/s Ratio Perm												0.04
v/c Ratio	0.93	0.53		0.52	0.75		0.68	0.65		0.94	0.42	0.30
Uniform Delay, d1	39.5	17.5		49.7	33.4		44.6	44.3		47.9	44.6	44.0
Progression Factor	0.83	0.67		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	17.4	1.0		3.1	6.2		7.3	2.8		44.2	0.9	0.4
Delay (s)	50.1	12.6		52.8	39.6		51.9	47.1		92.0	45.5	44.3
Level of Service	D	B		D	D		D	D		F	D	D
Approach Delay (s)		27.4			40.7			48.7			53.1	
Approach LOS		C			D			D			D	

Intersection Summary			
HCM 2000 Control Delay	39.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	70.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

13: SW Stafford Rd & Kahle Rd

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Volume (veh/h)	30	10	10	20	10	30	10	640	30	60	880	70
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	33	11	11	22	11	33	11	711	33	67	978	78
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1939	1917	1017	1917	1939	728	1056			744		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1939	1917	1017	1917	1939	728	1056			744		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	8	82	96	44	81	92	98			92		
cM capacity (veh/h)	36	61	289	39	59	424	660			863		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	56	67	756	1122
Volume Left	33	22	11	67
Volume Right	11	33	33	78
cSH	49	80	660	863
Volume to Capacity	1.14	0.83	0.02	0.08
Queue Length 95th (ft)	125	105	1	6
Control Delay (s)	307.8	146.5	0.5	2.4
Lane LOS	F	F	A	A
Approach Delay (s)	307.8	146.5	0.5	2.4
Approach LOS	F	F		

Intersection Summary			
Average Delay	14.9		
Intersection Capacity Utilization	97.2%	ICU Level of Service	F
Analysis Period (min)	15		

14: Fallen Leaf St & Boeckman Rd

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Volume (veh/h)	60	580	70	30	470	10	30	0	10	10	10	40
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	67	644	78	33	522	11	33	0	11	11	11	44
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		TWLTL			TWLTL							
Median storage veh)		2			2							
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	533			722			1461	1417	683	1422	1450	528
vC1, stage 1 conf vol							817	817		594	594	
vC2, stage 2 conf vol							644	600		828	856	
vCu, unblocked vol	533			722			1461	1417	683	1422	1450	528
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)							6.1	5.5		6.1	5.5	
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	94			96			87	100	98	96	96	92
cM capacity (veh/h)	1034			880			249	289	449	263	277	550

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	789	567	44	67
Volume Left	67	33	33	11
Volume Right	78	11	11	44
cSH	1034	880	280	409
Volume to Capacity	0.06	0.04	0.16	0.16
Queue Length 95th (ft)	5	3	14	14
Control Delay (s)	1.6	1.0	20.2	15.5
Lane LOS	A	A	C	C
Approach Delay (s)	1.6	1.0	20.2	15.5
Approach LOS			C	C

Intersection Summary			
Average Delay	2.6		
Intersection Capacity Utilization	68.3%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	60	490	50	20	450	10	20	10	10	10	10	40
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	67	544	56	22	500	11	22	11	11	11	11	44
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		TWLTL			None							
Median storage veh)		2										
Upstream signal (ft)					1022							
pX, platoon unblocked												
vC, conflicting volume	511			600			1306	1261	572	1272	1283	506
vC1, stage 1 conf vol							706	706		550	550	
vC2, stage 2 conf vol							600	556		722	733	
vCu, unblocked vol	511			600			1306	1261	572	1272	1283	506
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)							6.1	5.5		6.1	5.5	
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	94			98			92	97	98	96	97	92
cM capacity (veh/h)	1054			977			285	325	519	304	324	567

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	667	533	44	67
Volume Left	67	22	22	11
Volume Right	56	11	11	44
cSH	1054	977	333	446
Volume to Capacity	0.06	0.02	0.13	0.15
Queue Length 95th (ft)	5	2	11	13
Control Delay (s)	1.6	0.6	17.5	14.5
Lane LOS	A	A	C	B
Approach Delay (s)	1.6	0.6	17.5	14.5
Approach LOS			C	B

Intersection Summary			
Average Delay	2.4		
Intersection Capacity Utilization	64.7%	ICU Level of Service	C
Analysis Period (min)	15		

Intersection	
Intersection Delay, s/veh	17.8
Intersection LOS	C

Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	2	2	2	2
Adj Approach Flow, veh/h	657	599	859	676
Demand Flow Rate, veh/h	670	611	877	689
Vehicles Circulating, veh/h	965	567	484	666
Vehicles Exiting, veh/h	213	295	885	478
Follow-Up Headway, s	3.186	3.186	3.186	3.186
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	22.4	21.3	12.4	17.2
Approach LOS	C	C	B	C

Lane	Left	Bypass	Left	Bypass	Left	Bypass	Left	Bypass
Designated Moves	LT	R	LT	R	LT	R	LT	R
Assumed Moves	LT	R	LT	R	LT	R	LT	R
RT Channelized		Yield		Yield		Yield		Yield
Lane Util	1.000		1.000		1.000		1.000	
Critical Headway, s	4.113		4.113		4.113		4.113	
Entry Flow, veh/h	404	266	577	34	378	499	512	177
Cap Entry Lane, veh/h	575	466	760	701	805	841	709	913
Entry HV Adj Factor	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980
Flow Entry, veh/h	396	261	566	33	370	489	502	174
Cap Entry, veh/h	563	457	745	687	789	825	694	895
V/C Ratio	0.703	0.571	0.759	0.048	0.469	0.593	0.722	0.194
Control Delay, s/veh	23.6	20.7	22.2	5.7	10.9	13.5	21.1	6.0
LOS	C	C	C	A	B	B	C	A
95th %tile Queue, veh	6	3	7	0	3	4	6	1

DKS

HCM Analysis – 2035 Area Plan

HCM Signalized Intersection Capacity Analysis — 2035 Future (Concept Plan PM Peak)
1: Boones Ferry Road & I-5 SB Off Ramp

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↱		↑↑	↱				↰	↰↓	↱
Volume (vph)	0	1330	780	0	980	330	0	0	0	770	0	630
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0				4.0	4.0	4.0
Lane Util. Factor		0.95	1.00		0.95	1.00				0.95	0.95	1.00
Frpb, ped/bikes		1.00	0.99		1.00	1.00				1.00	1.00	1.00
Flpb, ped/bikes		1.00	1.00		1.00	1.00				1.00	1.00	1.00
Frt		1.00	0.85		1.00	0.85				1.00	1.00	0.85
Flt Protected		1.00	1.00		1.00	1.00				0.95	0.95	1.00
Satd. Flow (prot)		3505	1564		3471	1583				1681	1681	1468
Flt Permitted		1.00	1.00		1.00	1.00				0.95	0.95	1.00
Satd. Flow (perm)		3505	1564		3471	1583				1681	1681	1468
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	1400	821	0	1032	347	0	0	0	811	0	663
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	27
Lane Group Flow (vph)	0	1400	821	0	1032	347	0	0	0	405	406	636
Confl. Bikes (#/hr)			2									
Heavy Vehicles (%)	0%	3%	2%	0%	4%	2%	0%	0%	0%	2%	0%	10%
Turn Type			Free			Free				Split		Prot
Protected Phases		2			6					4	4	4
Permitted Phases			Free			Free						
Actuated Green, G (s)		48.0	105.0		48.0	105.0				48.0	48.0	48.0
Effective Green, g (s)		49.0	105.0		49.0	105.0				48.0	48.0	48.0
Actuated g/C Ratio		0.47	1.00		0.47	1.00				0.46	0.46	0.46
Clearance Time (s)		5.0			5.0					4.0	4.0	4.0
Vehicle Extension (s)		3.0			3.0					3.0	3.0	3.0
Lane Grp Cap (vph)		1636	1564		1620	1583				768	768	671
v/s Ratio Prot		c0.40			0.30					0.24	0.24	c0.43
v/s Ratio Perm			0.53			0.22						
v/c Ratio		0.86	0.52		0.64	0.22				0.53	0.53	0.95
Uniform Delay, d1		24.9	0.0		21.3	0.0				20.4	20.4	27.3
Progression Factor		1.00	1.00		1.28	1.00				1.00	1.00	1.00
Incremental Delay, d2		6.0	1.3		1.8	0.3				0.7	0.7	22.6
Delay (s)		30.8	1.3		29.1	0.3				21.0	21.1	49.9
Level of Service		C	A		C	A				C	C	D
Approach Delay (s)		19.9			21.8			0.0			34.0	
Approach LOS		B			C			A			C	

Intersection Summary			
HCM Average Control Delay	24.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	72.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis — 2035 Future (Concept Plan PM Peak)
2: Sw Elligsen Rd & I-5 NB Ramp

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↱		↑↑	↱	↰↰		↱			
Volume (vph)	0	1210	890	0	860	920	450	0	340	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	4.0		5.0	4.0	4.0		4.0			
Lane Util. Factor		0.95	1.00		0.95	1.00	0.97		1.00			
Frpb, ped/bikes		1.00	0.98		1.00	0.98	1.00		1.00			
Flpb, ped/bikes		1.00	1.00		1.00	1.00	1.00		1.00			
Frt		1.00	0.85		1.00	0.85	1.00		0.85			
Flt Protected		1.00	1.00		1.00	1.00	0.95		1.00			
Satd. Flow (prot)		3539	1536		3574	1566	3400		1553			
Flt Permitted		1.00	1.00		1.00	1.00	0.95		1.00			
Satd. Flow (perm)		3539	1536		3574	1566	3400		1553			
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	1274	937	0	905	968	474	0	358	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	32	0	0	0
Lane Group Flow (vph)	0	1274	937	0	905	968	474	0	326	0	0	0
Confl. Peds. (#/hr)			1	1								
Confl. Bikes (#/hr)						1						
Heavy Vehicles (%)	0%	2%	3%	0%	1%	1%	3%	0%	4%	0%	0%	0%
Turn Type			Free			Free	custom		custom			
Protected Phases		2			6		8					
Permitted Phases			Free			Free	8		8			
Actuated Green, G (s)		67.6	105.0		67.6	105.0	28.4		28.4			
Effective Green, g (s)		67.6	105.0		67.6	105.0	28.4		28.4			
Actuated g/C Ratio		0.64	1.00		0.64	1.00	0.27		0.27			
Clearance Time (s)		5.0			5.0		4.0		4.0			
Vehicle Extension (s)		3.0			3.0		3.0		3.0			
Lane Grp Cap (vph)		2278	1536		2301	1566	920		420			
v/s Ratio Prot		0.36			0.25		0.14					
v/s Ratio Perm			0.61			c0.62			c0.21			
v/c Ratio		0.56	0.61		0.39	0.62	0.52		0.78			
Uniform Delay, d1		10.4	0.0		8.9	0.0	32.5		35.4			
Progression Factor		1.44	1.00		1.09	1.00	1.00		1.00			
Incremental Delay, d2		0.7	1.2		0.3	1.3	0.5		8.7			
Delay (s)		15.7	1.2		10.1	1.3	33.0		44.1			
Level of Service		B	A		B	A	C		D			
Approach Delay (s)		9.5			5.5			37.7			0.0	
Approach LOS		A			A			D			A	

Intersection Summary			
HCM Average Control Delay	12.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	62.0%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

3: Elligsen Road & Parkway Ave

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	180	910	460	60	890	70	630	30	40	160	20	260
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	5.0	5.0	4.5	5.0		5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.91		0.95	0.95	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	0.99	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	0.86	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.96	1.00	0.95	1.00	
Satd. Flow (prot)	1770	3471	1599	1805	5037		1698	1702	1615	1805	1593	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.96	1.00	0.95	1.00	
Satd. Flow (perm)	1770	3471	1599	1805	5037		1698	1702	1615	1805	1593	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	194	978	495	65	957	75	677	32	43	172	22	280
RTOR Reduction (vph)	0	0	165	0	8	0	0	0	33	0	220	0
Lane Group Flow (vph)	194	978	330	65	1024	0	352	357	10	172	82	0
Confl. Peds. (#/hr)			2	2					3	3		
Confl. Bikes (#/hr)			1									1
Heavy Vehicles (%)	2%	4%	1%	0%	2%	0%	1%	6%	0%	0%	6%	1%
Turn Type	Prot		pt+ov	Prot			Split		Prot	Split		
Protected Phases	5	2	2 8	1	6		8	8	8	4	4	
Permitted Phases												
Actuated Green, G (s)	14.6	39.4	70.0	8.0	32.8		25.6	25.6	25.6	12.5	12.5	
Effective Green, g (s)	14.6	39.4	70.0	8.0	32.8		25.6	25.6	25.6	12.5	12.5	
Actuated g/C Ratio	0.14	0.38	0.67	0.08	0.31		0.24	0.24	0.24	0.12	0.12	
Clearance Time (s)	4.5	5.0		4.5	5.0		5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	246	1302	1066	138	1573		414	415	394	215	190	
v/s Ratio Prot	c0.11	c0.28	0.21	0.04	0.20		0.21	c0.21	0.01	c0.10	0.05	
v/s Ratio Perm												
v/c Ratio	0.79	0.75	0.31	0.47	0.65		0.85	0.86	0.03	0.80	0.43	
Uniform Delay, d1	43.7	28.5	7.4	46.5	31.2		37.9	38.0	30.2	45.0	42.9	
Progression Factor	0.91	0.99	3.71	0.99	0.74		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	13.2	3.4	0.1	1.8	1.5		15.3	16.4	0.0	18.8	1.6	
Delay (s)	52.9	31.8	27.4	47.9	24.4		53.2	54.4	30.2	63.9	44.5	
Level of Service	D	C	C	D	C		D	D	C	E	D	
Approach Delay (s)		32.9			25.8			52.4			51.5	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM Average Control Delay	36.9	HCM Level of Service	D
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	14.5
Intersection Capacity Utilization	80.7%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

4: Sw Elligsen Rd & Parkway Center Drive

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	10	590	510	90	310	10	700	10	130	10	10	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.5	5.5	5.0	5.5		5.0	5.0			5.0	
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95		0.97	1.00			1.00	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00			1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00			1.00	
Frt	1.00	0.99	0.85	1.00	1.00		1.00	0.86			0.95	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00			0.98	
Satd. Flow (prot)	1543	1753	1408	1770	3559		3400	1576			1716	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00			0.98	
Satd. Flow (perm)	1543	1753	1408	1770	3559		3400	1576			1716	
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	11	663	573	101	348	11	787	11	146	11	11	11
RTOR Reduction (vph)	0	3	133	0	2	0	0	110	0	0	11	0
Lane Group Flow (vph)	11	717	383	101	357	0	787	47	0	0	22	0
Confl. Bikes (#/hr)			1									
Heavy Vehicles (%)	17%	1%	9%	2%	1%	0%	3%	0%	4%	0%	0%	12%
Turn Type	Prot		pt+ov	Prot			Split			Split		
Protected Phases	5	2	2 8	1	6		8	8		4	4	
Permitted Phases												
Actuated Green, G (s)	0.8	46.5	78.0	8.4	54.1		26.0	26.0			3.6	
Effective Green, g (s)	0.8	46.5	78.0	8.4	54.1		26.0	26.0			3.6	
Actuated g/C Ratio	0.01	0.44	0.74	0.08	0.52		0.25	0.25			0.03	
Clearance Time (s)	5.0	5.5		5.0	5.5		5.0	5.0			5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0			3.0	
Lane Grp Cap (vph)	12	776	1046	142	1834		842	390			59	
v/s Ratio Prot	0.01	c0.41	0.27	c0.06	0.10		c0.23	0.03			c0.01	
v/s Ratio Perm												
v/c Ratio	0.92	0.92	0.37	0.71	0.19		0.93	0.12			0.38	
Uniform Delay, d1	52.1	27.6	4.8	47.1	13.7		38.7	30.6			49.6	
Progression Factor	1.24	0.38	4.40	1.00	1.00		1.00	1.00			1.00	
Incremental Delay, d2	177.2	14.3	0.2	15.5	0.2		17.2	0.1			4.0	
Delay (s)	241.8	24.8	21.1	62.6	13.9		55.8	30.8			53.6	
Level of Service	F	C	C	E	B		E	C			D	
Approach Delay (s)		25.2			24.6			51.7			53.6	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM Average Control Delay	34.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	20.5
Intersection Capacity Utilization	87.6%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis | 2035 Future (Concept Plan PM Peak)

5: Sw Elligsen Rd & SW 65th Ave | Wilsonville TSP

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰	↑↱		↰	↑	↱	↰	↑↱	
Volume (vph)	160	190	300	420	100	30	80	270	440	60	410	150
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85	1.00	0.96	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1900	1615	1805	1835		1787	1881	1615	1805	1779	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1900	1615	1805	1835		1787	1881	1615	1805	1779	
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	182	216	341	477	114	34	91	307	500	68	466	170
RTOR Reduction (vph)	0	0	144	0	9	0	0	0	88	0	11	0
Lane Group Flow (vph)	182	216	197	477	139	0	91	307	412	68	625	0
Heavy Vehicles (%)	2%	0%	0%	0%	0%	0%	1%	1%	0%	0%	2%	4%
Turn Type	Prot		Perm	Prot			Prot		pm+ov	Prot		
Protected Phases	7	4		3	8		5	2	3	1	6	
Permitted Phases			4						2			
Actuated Green, G (s)	16.6	17.0	17.0	32.1	32.5		8.0	43.9	76.0	7.8	43.7	
Effective Green, g (s)	16.6	17.0	17.0	32.1	32.5		8.0	43.9	76.0	7.8	43.7	
Actuated g/C Ratio	0.14	0.15	0.15	0.27	0.28		0.07	0.38	0.65	0.07	0.37	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	252	277	235	496	511		122	707	1106	121	666	
v/s Ratio Prot	0.10	0.11		c0.26	0.08		c0.05	0.16	0.10	0.04	c0.35	
v/s Ratio Perm			c0.12						0.15			
v/c Ratio	0.72	0.78	0.84	0.96	0.27		0.75	0.43	0.37	0.56	0.94	
Uniform Delay, d1	47.9	48.1	48.5	41.7	32.9		53.4	27.2	9.4	52.8	35.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	9.8	13.0	22.0	30.7	0.3		21.7	0.4	0.2	5.9	20.8	
Delay (s)	57.7	61.1	70.5	72.4	33.2		75.1	27.6	9.6	58.7	56.1	
Level of Service	E	E	E	E	C		E	C	A	E	E	
Approach Delay (s)		64.6			63.1			22.4			56.3	
Approach LOS		E			E			C			E	

Intersection Summary			
HCM Average Control Delay	49.5	HCM Level of Service	D
HCM Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	116.8	Sum of lost time (s)	16.0
Intersection Capacity Utilization	82.6%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis | 2035 Future (Concept Plan PM Peak)

6: SW Frog Pond Ln & SW Stafford Rd | Wilsonville TSP

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↑↱		↰	↑↱		↰	↑↱	
Volume (veh/h)	60	10	10	30	10	60	20	590	80	250	580	140
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	67	11	11	33	11	67	22	656	89	278	644	156
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	2050	2067	722	1961	2100	700	800			744		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2050	2067	722	1961	2100	700	800			744		
tC, single (s)	7.1	6.5	6.5	7.1	6.5	6.2	4.4			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.5	3.5	4.0	3.3	2.5			2.2		
p0 queue free %	0	69	97	0	68	85	97			68		
cM capacity (veh/h)	20	36	391	27	35	443	716			872		

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	67	22	33	78	22	744	278	800
Volume Left	67	0	33	0	22	0	278	0
Volume Right	0	11	0	67	0	89	0	156
cSH	20	67	27	165	716	1700	872	1700
Volume to Capacity	3.35	0.33	1.25	0.47	0.03	0.44	0.32	0.47
Queue Length 95th (ft)	Err	31	99	56	2	0	34	0
Control Delay (s)	Err	84.2	475.2	44.9	10.2	0.0	11.0	0.0
Lane LOS	F	F	F	E	B		B	
Approach Delay (s)	7520.3		174.0		0.3		2.8	
Approach LOS	F		F					

Intersection Summary			
Average Delay	338.0		
Intersection Capacity Utilization	69.7%	ICU Level of Service	C
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis — 2035 Future (Concept Plan PM Peak)
7: Boeckman Rd & SW Canyon Creek Rd — Wilsonville TSP

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	110	540	110	90	370	60	40	50	60	190	210	120
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	0.98		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		0.99	1.00	
Frt	1.00	0.97		1.00	0.98		1.00	0.92		1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1827		1805	1853		1803	1717		1792	1775	
Flt Permitted	0.41	1.00		0.21	1.00		0.41	1.00		0.68	1.00	
Satd. Flow (perm)	759	1827		397	1853		781	1717		1283	1775	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	120	587	120	98	402	65	43	54	65	207	228	130
RTOR Reduction (vph)	0	11	0	0	8	0	0	44	0	0	32	0
Lane Group Flow (vph)	120	696	0	98	459	0	43	75	0	207	326	0
Confl. Peds. (#/hr)			3	3			1		3	3		1
Confl. Bikes (#/hr)			1									
Heavy Vehicles (%)	2%	1%	0%	0%	0%	3%	0%	0%	0%	0%	0%	1%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	23.3	23.3		23.3	23.3		15.2	15.2		15.2	15.2	
Effective Green, g (s)	23.3	23.3		23.3	23.3		15.2	15.2		15.2	15.2	
Actuated g/C Ratio	0.50	0.50		0.50	0.50		0.33	0.33		0.33	0.33	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	380	915		199	928		255	561		419	580	
v/s Ratio Prot		c0.38			0.25			0.04			c0.18	
v/s Ratio Perm	0.16			0.25			0.06			0.16		
v/c Ratio	0.32	0.76		0.49	0.49		0.17	0.13		0.49	0.56	
Uniform Delay, d1	6.9	9.4		7.7	7.7		11.1	11.0		12.6	12.9	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.5	3.8		1.9	0.4		0.3	0.1		0.9	1.3	
Delay (s)	7.4	13.1		9.6	8.1		11.5	11.1		13.5	14.2	
Level of Service	A	B		A	A		B	B		B	B	
Approach Delay (s)		12.3			8.4			11.2			13.9	
Approach LOS		B			A			B			B	

Intersection Summary			
HCM Average Control Delay	11.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	46.5	Sum of lost time (s)	8.0
Intersection Capacity Utilization	75.2%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis — 2035 Future (Concept Plan PM Peak)
8: Boeckman Rd & SW Stafford Rd — Wilsonville TSP

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	390	180	70	70	80	90	70	280	80	110	260	200
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.96		1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1787	1805		1752	1900	1615	1736	1822		1556	1900	1615
Flt Permitted	0.45	1.00		0.59	1.00	1.00	0.48	1.00		0.25	1.00	1.00
Satd. Flow (perm)	846	1805		1086	1900	1615	869	1822		411	1900	1615
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	433	200	78	78	89	100	78	311	89	122	289	222
RTOR Reduction (vph)	0	12	0	0	0	90	0	11	0	0	0	145
Lane Group Flow (vph)	433	266	0	78	89	10	78	390	0	122	289	77
Heavy Vehicles (%)	1%	0%	3%	3%	0%	0%	4%	1%	0%	16%	0%	0%
Turn Type	pm+pt			pm+pt		Perm	pm+pt			pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8		8	2			6		6
Actuated Green, G (s)	33.5	24.2		12.5	7.2	7.2	27.9	22.5		31.1	24.1	24.1
Effective Green, g (s)	33.5	24.2		12.5	7.2	7.2	27.9	22.5		31.1	24.1	24.1
Actuated g/C Ratio	0.45	0.32		0.17	0.10	0.10	0.37	0.30		0.41	0.32	0.32
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	658	582		228	182	155	386	547		277	611	519
v/s Ratio Prot	c0.20	0.15		0.02	0.05		0.01	c0.21		c0.04	0.15	
v/s Ratio Perm	c0.10			0.03		0.01	0.06			0.14		0.05
v/c Ratio	0.66	0.46		0.34	0.49	0.06	0.20	0.71		0.44	0.47	0.15
Uniform Delay, d1	15.3	20.2		27.3	32.2	30.8	15.6	23.4		15.2	20.4	18.1
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	2.4	0.6		0.9	2.1	0.2	0.3	4.4		1.1	0.6	0.1
Delay (s)	17.7	20.7		28.2	34.2	31.0	15.9	27.7		16.3	20.9	18.3
Level of Service	B	C		C	C	C	B	C		B	C	B
Approach Delay (s)		18.9			31.2			25.8			19.1	
Approach LOS		B			C			C			B	

Intersection Summary			
HCM Average Control Delay	22.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	64.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis — 2035 Future (Concept Plan PM Peak)
9: SW Advance Rd &

Wilsonville TSP

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	170	230	10	80	10	130	10	10	60	60	20
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Hourly flow rate (vph)	0	205	277	12	96	12	157	12	12	72	72	24
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	108			482			530	476	343	488	608	102
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	108			482			530	476	343	488	608	102
tC, single (s)	4.1			4.1			7.3	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.7	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			99			57	98	98	85	82	97
cM capacity (veh/h)	1495			1091			361	485	704	472	408	958

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	482	120	181	169
Volume Left	0	12	157	72
Volume Right	277	12	12	24
cSH	1495	1091	380	475
Volume to Capacity	0.00	0.01	0.48	0.36
Queue Length 95th (ft)	0	1	62	40
Control Delay (s)	0.0	0.9	22.8	16.7
Lane LOS		A	C	C
Approach Delay (s)	0.0	0.9	22.8	16.7
Approach LOS			C	C

Intersection Summary			
Average Delay	7.4		
Intersection Capacity Utilization	44.7%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis — 2035 Future (Concept Plan PM Peak)
10: Wilsonville Rd & I-5 SB

Wilsonville TSP

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1000	900	600	880	0	0	0	0	440	0	470
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0	4.0	4.0
Lane Util. Factor		0.91	1.00	0.97	0.95					0.95	0.95	0.88
Frpb, ped/bikes		1.00	0.97	1.00	1.00					1.00	1.00	0.98
Flpb, ped/bikes		1.00	1.00	1.00	1.00					1.00	1.00	1.00
Frt		1.00	0.85	1.00	1.00					1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95	0.95	1.00
Satd. Flow (prot)		5085	1535	3502	3505					1698	1698	2667
Flt Permitted		1.00	1.00	0.95	1.00					0.95	0.95	1.00
Satd. Flow (perm)		5085	1535	3502	3505					1698	1698	2667
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	1053	947	632	926	0	0	0	0	463	0	495
RTOR Reduction (vph)	0	0	301	0	0	0	0	0	0	0	0	124
Lane Group Flow (vph)	0	1053	646	632	926	0	0	0	0	231	232	371
Confl. Peds. (#/hr)	9		8	8		9	4					4
Heavy Vehicles (%)	0%	2%	2%	0%	3%	0%	0%	0%	0%	1%	0%	4%
Turn Type			Perm	Prot						Split		custom
Protected Phases		2		1	6					4	4	5
Permitted Phases			2		6							4
Actuated Green, G (s)		52.1	52.1	25.5	71.4					20.4	20.4	26.6
Effective Green, g (s)		52.1	52.1	25.5	71.4					20.4	20.4	26.6
Actuated g/C Ratio		0.47	0.47	0.23	0.65					0.19	0.19	0.24
Clearance Time (s)		4.0	4.0	4.0	4.0					4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0					3.0	3.0	3.0
Lane Grp Cap (vph)		2408	727	812	2275					315	315	742
v/s Ratio Prot		0.21		c0.18	0.26					0.14	c0.14	0.03
v/s Ratio Perm			c0.42									0.11
v/c Ratio		0.44	0.89	0.78	0.41					0.73	0.74	0.50
Uniform Delay, d1		19.2	26.3	39.6	9.2					42.2	42.3	36.0
Progression Factor		1.00	1.00	0.62	1.55					1.00	1.00	1.00
Incremental Delay, d2		0.6	15.2	4.4	0.5					8.5	8.7	0.5
Delay (s)		19.8	41.5	28.8	14.8					50.8	50.9	36.5
Level of Service		B	D	C	B					D	D	D
Approach Delay (s)		30.1			20.5			0.0			43.4	
Approach LOS		C			C			A			D	

Intersection Summary			
HCM Average Control Delay	29.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	96.3%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

11: Wilsonville Rd & I-5 NB

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰↰	↑↑			↑↑↑	↱	↰	↰↑	↱↱			
Volume (vph)	520	920	0	0	1130	480	350	0	710	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0			
Lane Util. Factor	0.97	0.95			0.91	1.00	0.95	0.95	0.88			
Frpb, ped/bikes	1.00	1.00			1.00	0.97	1.00	1.00	0.99			
Flpb, ped/bikes	1.00	1.00			1.00	1.00	1.00	1.00	1.00			
Frt	1.00	1.00			1.00	0.85	1.00	1.00	0.85			
Flt Protected	0.95	1.00			1.00	1.00	0.95	0.95	1.00			
Satd. Flow (prot)	3400	3574			5136	1537	1618	1618	2781			
Flt Permitted	0.95	1.00			1.00	1.00	0.95	0.95	1.00			
Satd. Flow (perm)	3400	3574			5136	1537	1618	1618	2781			
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	547	968	0	0	1189	505	368	0	747	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	236	0	0	77	0	0	0
Lane Group Flow (vph)	547	968	0	0	1189	269	184	184	670	0	0	0
Confl. Peds. (#/hr)	10		12	12		10			1	1		
Heavy Vehicles (%)	3%	1%	0%	0%	1%	2%	6%	0%	1%	0%	0%	0%
Turn Type	Prot					Perm	Split		custom			
Protected Phases	5	2			6		8	8	1			
Permitted Phases		2				6			8			
Actuated Green, G (s)	22.4	64.6			58.5	58.5	17.1	17.1	33.4			
Effective Green, g (s)	22.4	64.6			58.5	58.5	17.1	17.1	33.4			
Actuated g/C Ratio	0.20	0.59			0.53	0.53	0.16	0.16	0.30			
Clearance Time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0			
Vehicle Extension (s)	2.3	4.9			4.9	4.9	2.3	2.3	3.0			
Lane Grp Cap (vph)	692	2099			2731	817	252	252	946			
v/s Ratio Prot	c0.16	c0.27			0.23		0.11	0.11	c0.11			
v/s Ratio Perm						0.17			0.14			
v/c Ratio	0.79	0.46			0.44	0.33	0.73	0.73	0.71			
Uniform Delay, d1	41.6	12.8			15.7	14.6	44.3	44.3	34.0			
Progression Factor	0.48	0.70			0.81	1.47	1.00	1.00	1.00			
Incremental Delay, d2	5.4	0.7			0.4	0.7	9.5	9.5	2.5			
Delay (s)	25.4	9.7			13.1	22.3	53.7	53.7	36.4			
Level of Service	C	A			B	C	D	D	D			
Approach Delay (s)		15.4			15.8			42.1			0.0	
Approach LOS		B			B			D			A	

Intersection Summary			
HCM Average Control Delay	22.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	96.3%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

12: Wilsonville Rd & Town Center Lp West

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰↰	↑↱		↰	↑↱		↰	↰↑↱		↰	↑	↱↱
Volume (vph)	620	820	130	60	550	90	270	130	60	200	90	790
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	0.95		1.00	0.95		0.91	0.91		1.00	1.00	0.88
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	0.99		1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.98		1.00	0.98		1.00	0.97		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	0.98		0.95	1.00	1.00
Satd. Flow (prot)	2540	3432		1805	2650		1610	3166		1805	1845	2787
Flt Permitted	0.95	1.00		0.95	1.00		0.95	0.98		0.95	1.00	1.00
Satd. Flow (perm)	2540	3432		1805	2650		1610	3166		1805	1845	2787
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	646	854	135	62	573	94	281	135	62	208	94	823
RTOR Reduction (vph)	0	10	0	0	11	0	0	20	0	0	0	722
Lane Group Flow (vph)	646	979	0	62	656	0	160	298	0	208	94	101
Confl. Peds. (#/hr)	6		5	5		6			7	7		
Heavy Vehicles (%)	1%	2%	6%	0%	1%	0%	2%	6%	0%	0%	3%	2%
Turn Type	Prot			Prot			Split			Split		Perm
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases												4
Actuated Green, G (s)	29.1	56.7		7.3	34.9		16.0	16.0		13.0	13.0	13.0
Effective Green, g (s)	29.1	57.2		7.3	35.4		16.0	16.0		13.5	13.5	13.5
Actuated g/C Ratio	0.26	0.52		0.07	0.32		0.15	0.15		0.12	0.12	0.12
Clearance Time (s)	4.0	4.5		4.0	4.5		4.0	4.0		4.5	4.5	4.5
Vehicle Extension (s)	2.5	4.3		2.5	4.3		2.5	2.5		2.5	2.5	2.5
Lane Grp Cap (vph)	672	1785		120	853		234	461		222	226	342
v/s Ratio Prot	c0.25	0.29		0.03	c0.25		c0.10	0.09		c0.12	0.05	
v/s Ratio Perm												0.04
v/c Ratio	0.96	0.55		0.52	0.77		0.68	0.65		0.94	0.42	0.30
Uniform Delay, d1	39.9	17.7		49.6	33.6		44.6	44.3		47.8	44.6	43.9
Progression Factor	0.83	0.64		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	22.3	1.0		2.8	6.6		7.3	2.8		42.7	0.9	0.4
Delay (s)	55.3	12.4		52.4	40.2		51.9	47.1		90.5	45.5	44.3
Level of Service	E	B		D	D		D	D		F	D	D
Approach Delay (s)		29.4			41.3			48.7			52.9	
Approach LOS		C			D			D			D	

Intersection Summary			
HCM Average Control Delay	40.6	HCM Level of Service	D
HCM Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	71.4%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

13: SW 65th Ave &

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥			✥			✥	
Volume (veh/h)	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	0	0	0	0	0	0	0			0		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	0	0	0	0	0	0	0			0		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	100	100			100		
cM capacity (veh/h)	1023	896	1085	1023	896	1085	1623			1623		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	0	0	0	0
Volume Left	0	0	0	0
Volume Right	0	0	0	0
cSH	1700	1700	1700	1700
Volume to Capacity	0.00	0.00	0.00	0.00
Queue Length 95th (ft)	0	0	0	0
Control Delay (s)	0.0	0.0	0.0	0.0
Lane LOS	A	A		
Approach Delay (s)	0.0	0.0	0.0	0.0
Approach LOS	A	A		

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	0.0%	ICU Level of Service	A
Analysis Period (min)	15		

14: Boeckman Rd &

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥			✥			✥	
Volume (veh/h)	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		TWLTL			TWLTL							
Median storage veh)		2			2							
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	0			0			0	0	0	0	0	0
vC1, stage 1 conf vol							0	0		0	0	
vC2, stage 2 conf vol							0	0		0	0	
vCu, unblocked vol	0			0			0	0	0	0	0	0
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)							6.1	5.5		6.1	5.5	
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			100	100	100	100	100	100
cM capacity (veh/h)	1623			1623			1023	896	1085	1023	896	1085

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	0	0	0	0
Volume Left	0	0	0	0
Volume Right	0	0	0	0
cSH	1700	1700	1700	1700
Volume to Capacity	0.00	0.00	0.00	0.00
Queue Length 95th (ft)	0	0	0	0
Control Delay (s)	0.0	0.0	0.0	0.0
Lane LOS			A	A
Approach Delay (s)	0.0	0.0	0.0	0.0
Approach LOS			A	A

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	0.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Volume (veh/h)	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		TWLTL			None							
Median storage veh)		2										
Upstream signal (ft)					1022							
pX, platoon unblocked												
vC, conflicting volume	0			0			0	0	0	0	0	0
vC1, stage 1 conf vol							0	0		0	0	
vC2, stage 2 conf vol							0	0		0	0	
vCu, unblocked vol	0			0			0	0	0	0	0	0
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)							6.1	5.5		6.1	5.5	
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			100	100	100	100	100	100
cM capacity (veh/h)	1623			1623			1023	896	1085	1023	896	1085

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	0	0	0	0
Volume Left	0	0	0	0
Volume Right	0	0	0	0
cSH	1700	1700	1700	1700
Volume to Capacity	0.00	0.00	0.00	0.00
Queue Length 95th (ft)	0	0	0	0
Control Delay (s)	0.0	0.0	0.0	0.0
Lane LOS			A	A
Approach Delay (s)	0.0	0.0	0.0	0.0
Approach LOS			A	A

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	0.0%	ICU Level of Service	A
Analysis Period (min)	15		

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MEMORANDUM

DATE: September 24, 2014

TO: Project Team

FROM: Scott Mansur, P.E., PTOE
Brad Coy, P.E.
Halston Tuss, E.I.T.

SUBJECT: **Frog Pond Area Plan – Future Transportation Analysis** P14033-000

The Frog Pond Area Plan, led by the City of Wilsonville, will establish a vision for the 500-acre Frog Pond area, and define expectations for the type of community it will be in the future. The project team has developed a set of three land use and transportation alternatives for consideration by the Frog Pond Planning Task Force, the public, stakeholders, and city policy-makers. This memorandum is one of several that are intended to provide information on the performance of the three alternatives to enable the Task Force, public, and policy-makers to make informed recommendations and decisions about a preferred alternative.

This memorandum provides information about the transportation performance and tradeoffs associated with the three land use and transportation alternatives currently being considered for the Frog Pond Area Plan. The purpose is to inform the development of a preferred alternative by local stakeholders and decision-makers. The preferred alternative is expected to take the best elements from each of the three alternatives now being studied and combine them to develop an area plan that will best implement the vision statement and guiding principles for the project.

The sections of this memorandum include the executive summary, descriptions of the land use and transportation alternatives, and a transportation evaluation and comparison of alternatives.

Executive Summary

There are three land use and transportation alternatives currently being evaluated for the Frog Pond Area Plan. The primary factor that differentiates these alternatives is the arrangement and density of residential land use (high, medium, low) and the location of a neighborhood commercial center. In addition, there are two street frameworks being considered (grid, organic). Additional details regarding these three alternatives are provided in the *Alternatives Evaluation Summary* memorandum associated with this project.[1]

To understand how the transportation system would be affected by the three alternatives, various aspects were considered and analyzed. These include traffic volumes and operations, functional classifications, street design, multimodal connectivity, transit routing and coverage area, and planning level cost estimates.

[1] Draft Alternatives Evaluation Summary, September 11, 2014 .

Traffic Volumes and Operations

Future traffic forecasts were performed for a 2035 horizon year based on Metro population and land use assumptions for the region, with the exception of the Frog Pond Area Plan, which was revised based on the proposed land uses. The majority of traffic growth between 2014 and 2035 is expected to occur to the north of Frog Pond because of additional growth in the area and the increasing importance of the Stafford Road connection to I-205.

Future intersection operations were analyzed for the site accesses and major intersections in the Frog Pond Area vicinity, and Stafford Road can perform adequately as a three-lane roadway; however, it will be approaching its capacity and the City should be prepared to widen it to 5 lanes in the future. To accommodate safe and efficient operations for traffic turning into and out of the East and West Neighborhoods, it is important to have a traffic signal at one of the Stafford Road accesses. Because of the high volumes to and from the north and desired traffic signal spacing, the preferred signal location is the middle access (rather than the south access). This middle access provides good connectivity to the heart of the East and West Neighborhoods and aligns with Collector streets as assumed in the Option A and C grid street framework. Even with the traffic signal, the unsignalized access north of the signal is expected to exceed the City of Wilsonville's level of service D performance standard due to increased delay. Therefore, drivers wanting to turn left onto Stafford Road are likely to reroute to the signalized access.

Intersection operations were also analyzed at key off-site study intersections, including both I-5 interchange areas, the Stafford Road/65th Avenue/Elligsen Road junction, and other key east side intersections. With the completion of all High Priority Projects identified in the Wilsonville TSP, these areas are expected to meet applicable mobility targets and operating standards through the year 2035 as required by the City of Wilsonville, Clackamas County, and the Oregon Department of Transportation (ODOT). This analysis assumes growth consistent with Metro forecasts, build out of the current Wilsonville urban growth boundary, and a Maximum Build Out scenario for the Frog Pond Area that exceeds the amount of growth identified in any of the three land use alternatives currently under consideration.

Functional Classifications and Street Design

As a Major Arterial, Stafford Road is envisioned to eventually become a five-lane roadway. While a three-lane roadway is expected to provide adequate capacity over the 20-year planning horizon, Stafford Road would be approaching its three-lane capacity limit. By acquiring adequate right-of-way for the future five-lane facility consistent with the Major Arterial classification and designing a three-lane roadway that can easily be widened, the City would ensure it can support future development in its northeast area and also can have improved access to the future growth areas.

Only a portion of Advance Road is currently in the City's urban growth boundary (UGB), and the Wilsonville TSP currently designates this section as a Collector street. As a Collector, Advance Road can accommodate a greater amount of access, which would be beneficial if a retail development was located at the corner of the Advance Road-Boeckman Road/SW Stafford Road-Wilsonville Road intersection, and also allows more points of connection to the future park and school site. As a Collector, the standard would also support on-street parking, which may be beneficial to the City adjacent to the proposed park and retail areas. The Collector classification would include lower design speeds and a better pedestrian environment that will be beneficial to the high level of pedestrian activity that would be expected near the park and schools.

The major streets through the East, West, and South Neighborhoods are being proposed as Collectors, which would include bike facilities (dedicated bike lanes or shared lanes) and on-street parking.

Multimodal Connectivity

Both the grid and organic street frameworks have very similar transportation networks with basic features that support multimodal connectivity. A mix of streets, bicycle facilities, and trails connect to the various land uses within the Frog Pond area (including the school site south of Advance Road, which should have safe routes connecting to the adjacent neighborhoods) and take advantage of natural and man-made features (including regional trails along Boeckman Creek and the BPA corridor). In addition, urban upgrades (including adding sidewalks, bike lanes, center turn lanes) are needed for Boeckman Road, Stafford Road, and Advance Road in conjunction with the development to fill in the pedestrian and bicycle network and connect to adjacent parts of Wilsonville.

The street networks for all three options connect internally as well as to Boeckman Road, Stafford Road, and Advance Road at locations that will help distribute traffic while also providing convenient access to the signalized access on Stafford Road (particularly for those needing to make a left turn during peak congestion periods) and connections to the existing neighborhood to the south. The layout of the grid network does a particularly good job of providing internal connections that support circulation and access. Because the neighborhood Collector is located farther north in the grid network, it also provides better transit coverage on the north end of Frog Pond.

Planning Level Cost Estimates

Planning level cost estimates were prepared for the transportation improvements associated with the Frog Pond Area Plan. No substantial differences exist between the transportation network and improvement needs of the three alternatives; therefore, the same cost estimates are considered applicable. The pie chart in Figure 1 at right shows the estimated breakdown in costs between the various funding sources (FP = Frog Pond). Detailed project cost breakdowns are provided in Table 7 and in the appendix.

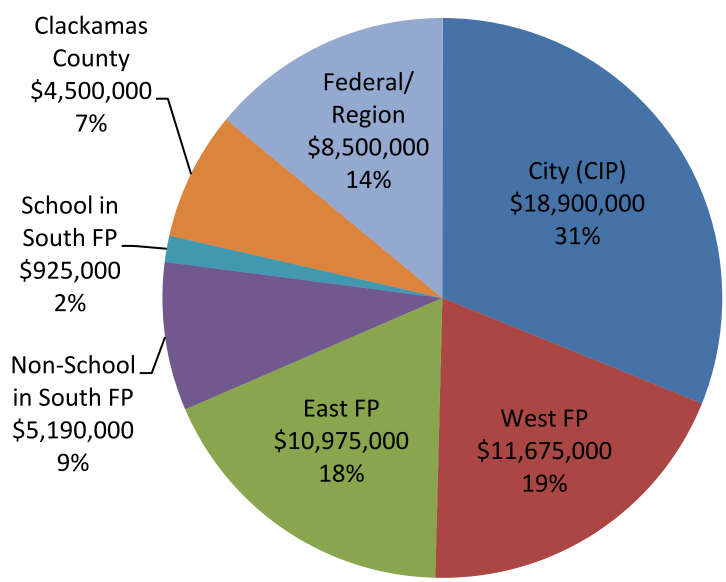

Figure 1: Cost Breakdown of Transportation Improvements by Funding Source or Proportionate Share of Frog Pond Neighborhood

Descriptions of Land Use and Transportation Alternatives

There are three land use and transportation alternatives currently being evaluated. The primary factor that differentiates these alternatives is the arrangement and density of residential land use (high, medium, low) and the location of a neighborhood commercial center. In addition, there are two street frameworks being considered (grid, organic). While the street framework is independent from the land uses, each alternative assumes one of the street frameworks to facilitate analysis. Table 1 lists the land use assumptions and street framework being analyzed for the three alternatives.

Table 1: Land Use and Transportation Alternatives Being Analyzed

Alternative	Residential Land Use	Households	Employees			Street Framework
			Retail	*Non-Retail*	*Total*	
Option A	Low	1,773	150	123	273	Grid
Option B	Medium	2,357	150	123	273	Organic
Option C	High	2,742	150	123	273	Grid

Additional details regarding these three alternatives are provided in the *Alternatives Evaluation Summary* memorandum associated with this project.[2] This memo also includes figures showing the three alternatives, along with their assumed land uses and street framework.

Transportation Evaluation and Comparison of Alternatives

The three land use and transportation alternatives were evaluated for multiple transportation-related considerations, including the following:

- Traffic volumes and operations (project vicinity)
- Traffic volumes and operations (off-site intersections and I-5 Interchange areas)
- Functional classifications
- Street design (Arterial and Collector roadways)
- Multimodal connectivity
- Transit routing and coverage area

Traffic Volumes and Operations (Project Vicinity)

Future traffic volumes and operations were evaluated for the three alternatives to determine how well the City's transportation system would support the long term build-out of the Frog Pond area and whether there would be different improvement needs depending on the area's land use densities and street framework. Based on the analysis provided in the existing and baseline transportation analysis memorandum,[3] it was determined that a traffic signal would be needed to accommodate safe and efficient operations at the primary Stafford Road access point into the East and West Frog Pond Neighborhoods, particularly to serve the left turning traffic into

[2] Draft Alternatives Evaluation Summary, September 11, 2014 .
[3] *Frog Pond Area Plan Existing and Baseline Transportation Analysis*, DKS Associates August 8, 2014.

and out of the site. Therefore, the analysis in this memorandum assumes a traffic signal but considers two different locations for its placement based on the street frameworks previously discussed.

For analysis purposes, the Frog Pond Area Plan is assumed to experience full build-out by the year 2035, which is the future horizon year for both the Metro Regional Transportation Plan (RTP)[4] and the Wilsonville Transportation System Plan (TSP).[5] The future 2035 traffic volumes were forecasted for the study area using a travel forecast model developed specifically for Wilsonville. The model applies trip generation and trip distribution data directly taken from the Metro Gamma regional travel demand forecast model, but adds additional detail to better represent local travel conditions and routing within Wilsonville. In particular, revisions were made to the model's land use assumptions for the transportation analysis zones (TAZs) that comprise the Frog Pond Area Plan to account for the three proposed land use alternatives. In addition, the neighborhood street network and location of the previously mentioned traffic signal on Stafford Road were accounted for in the trip routing estimates.

The p.m. peak hour traffic volumes, lane geometries, and intersection operating conditions are shown in the following figures:

- Figure 2 (Low with grid street network)
- Figure 3 (Medium with organic street network)
- Figure 4 (High with grid street network).

These figures also show the location of Collector roads with neighborhood characteristics (i.e. bike facilities and on-street parking) throughout the Frog Pond area to provide multimodal connectivity and serve as the backbone for traffic, bicycles and pedestrians entering and exiting each of the neighborhood areas.

Table 2 provides the intersection operating conditions in table format for each of the three alternatives. The installation of a traffic signal at the SW Advance Road-Boeckman Road/SW Stafford Road-Wilsonville Road intersection and the widening of Stafford Road to three lanes (a travel lane in each direction plus a center turn lane) are identified in the Wilsonville TSP as High Priority Projects and are also accounted for in the analysis.

As shown on the figures and in Table 2, the unsignalized accesses along Stafford Road (particularly north of the signalized access) are expected to exceed the City's level of service D performance standard. The primary reason is the high through volumes that contribute to the delay experienced by side street vehicles turning left. Providing left-turn lanes on the side street approaches would be one way to help reduce delays; however, it is not expected to be sufficient to achieve LOS D operations at all accesses during the p.m. peak hour.

Because one of the accesses along Stafford Road would be signalized, it is likely that many of the residents and drivers familiar with the area would choose to turn left at the traffic signal during the peak periods, particularly with Collector/Local Street connectivity that provides good access to the heart of the East and West Neighborhoods. Traffic routing to this signal was assumed in the analysis; however, even a few left-turning vehicles at some of the other accesses would trigger delays that exceed the City's standard. One potential

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[4] *Regional Transportation Plan*, Adopted by Metro Council (Exhibit A to Ordinance No. 14-1340), July 17, 2014.
[5] *Wilsonville Transportation System Plan*, Adopted by Council (Ordinance 718), June 17, 2013.

option to eliminate failing left turns would be to force traffic to use the traffic signal by installing a median that only allows right-out movements. However, this limits connectivity for all modes of travel and may not be necessary as lower delays would be experienced during off-peak hours.

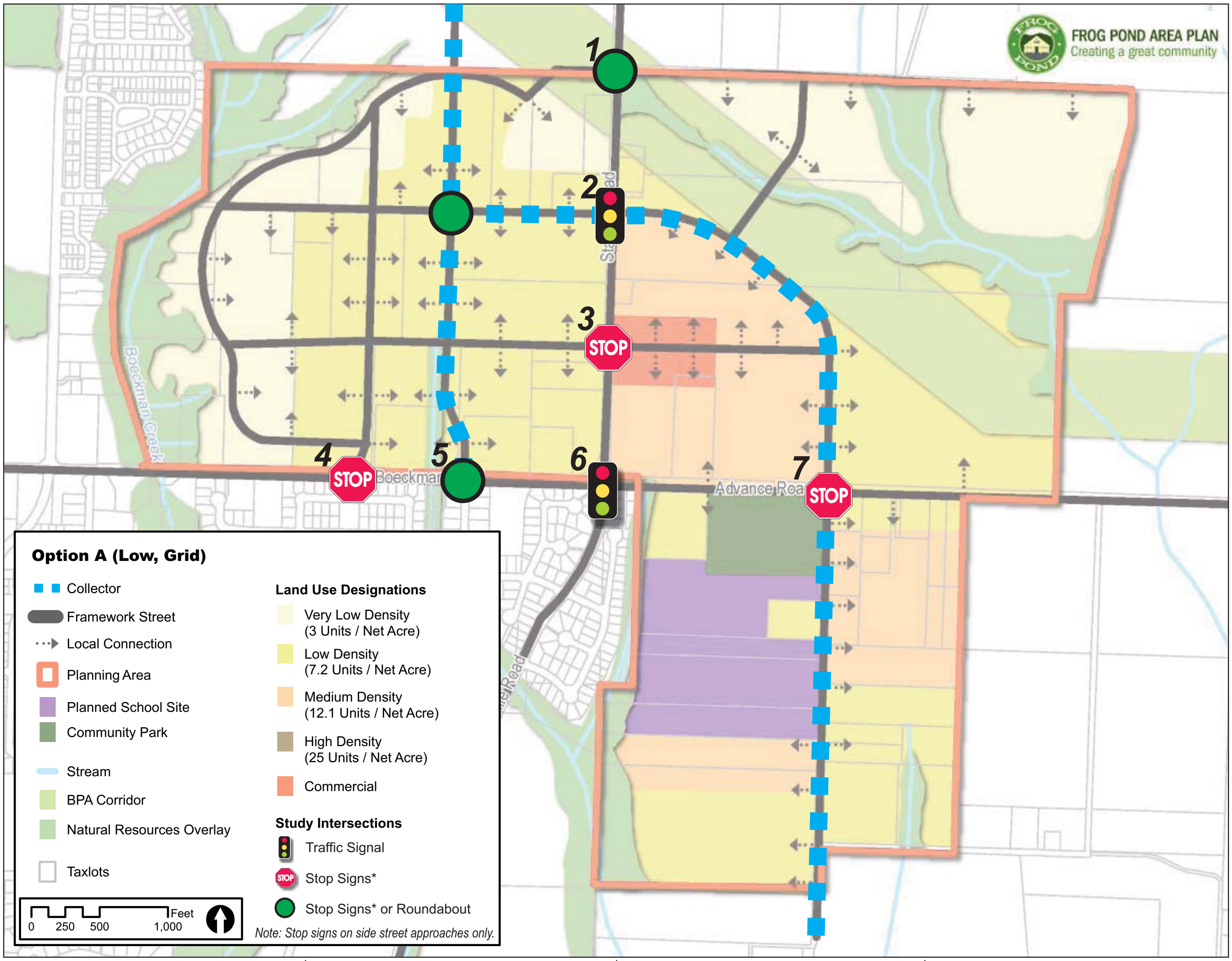
Another option that could be considered further to reduce delay to side street traffic would be to install roundabouts at key access points (except where the traffic signal is recommended) as well as at the intersection of two Collector streets in the West Neighborhood (see locations shown on Figure 2, Figure 3, and Figure 4). There are many tradeoffs associated with roundabouts that should be considered when determining whether to select them as the preferred traffic control at any of the potential locations. Some of the advantages and disadvantages are listed below:

Advantages of Installing a Roundabout

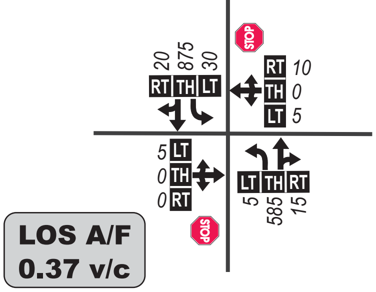
- Roundabouts can help reduce delay for side street traffic because no approach is given more priority than another. Therefore, it is likely that the northern access points onto Stafford Road would no longer be expected to operate at LOS F in the future scenarios.
- A roundabout at the northern access point on Stafford Road would provide a clear gateway between the rural and urban environment. This location is under the BPA power line easement and would have underutilized land available to accommodate the larger footprint that roundabouts require.
- Roundabouts can help to slow traffic speeds on the roadway. Typical circulating speeds for a roundabout are 25 miles per hour (mph), which would help to calm traffic in the vicinity of the new development area.

Disadvantages of Installing a Roundabout

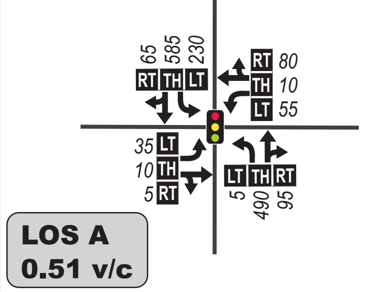
- Because all approaches are treated the same and must yield to traffic within the roundabout, this would introduce delay for traffic on the major approach.
- Roundabouts are more difficult for large trucks to navigate and may result in complaints from the freight community and farmers.
- Roundabouts can be difficult for pedestrians and bicyclists to cross because there is no exclusive stop phase. The lack of straight paths and clear turns can also be difficult for the vision impaired.
- Roundabouts require a larger footprint, which would require additional right-of-way dedication from the developers.
- Roundabouts are significantly more expensive than the alternative being considered for these locations (i.e., unsignalized intersections that would only require the installation of a few stop signs).
- Using different traffic control on SW Stafford Road and Boeckman Road can create uncertainty and negatively affect user expectation, which affects safety. This disadvantage does not affect the potential location within the West Neighborhood.



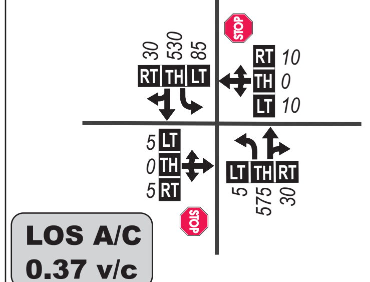
1. Stafford Rd/Kahle Rd



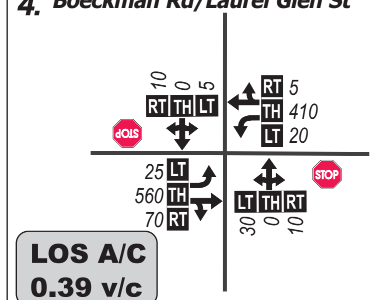
2. Stafford Rd/Frog Pond Ln



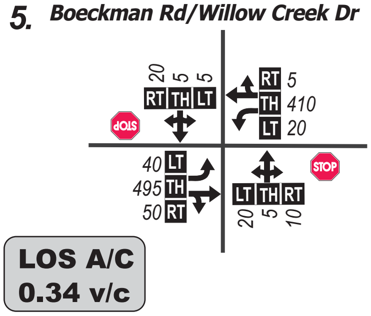
3. Stafford Rd/South Access



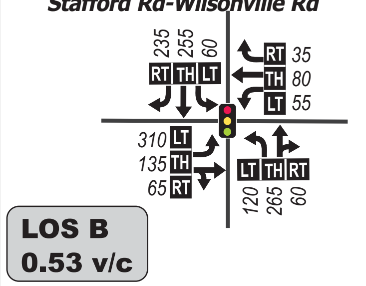
4. Boeckman Rd/Laurel Glen St



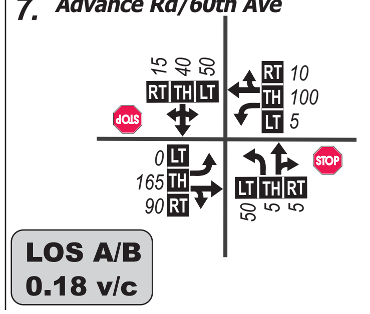
5. Boeckman Rd/Willow Creek Dr



6. Advance Rd-Boeckman Rd/ Stafford Rd-Wilsonville Rd



7. Advance Rd/60th Ave



LEGEND (Operations)

LOS A/A 0.00 v/c - Level of Service - Volume-to-Capacity

Signalized Intersections

- Level of Service of Intersection
- Volume-to-Capacity of Intersection

Stop Controlled Intersections

- Level of Service of Major/Minor Street
- Volume-to-Capacity of Worst Movement

LEGEND (Traffic Control and Volumes)

- Traffic Signal
- Stop Sign
- Lane Configuration

000 - PM Peak Hour Traffic Volumes

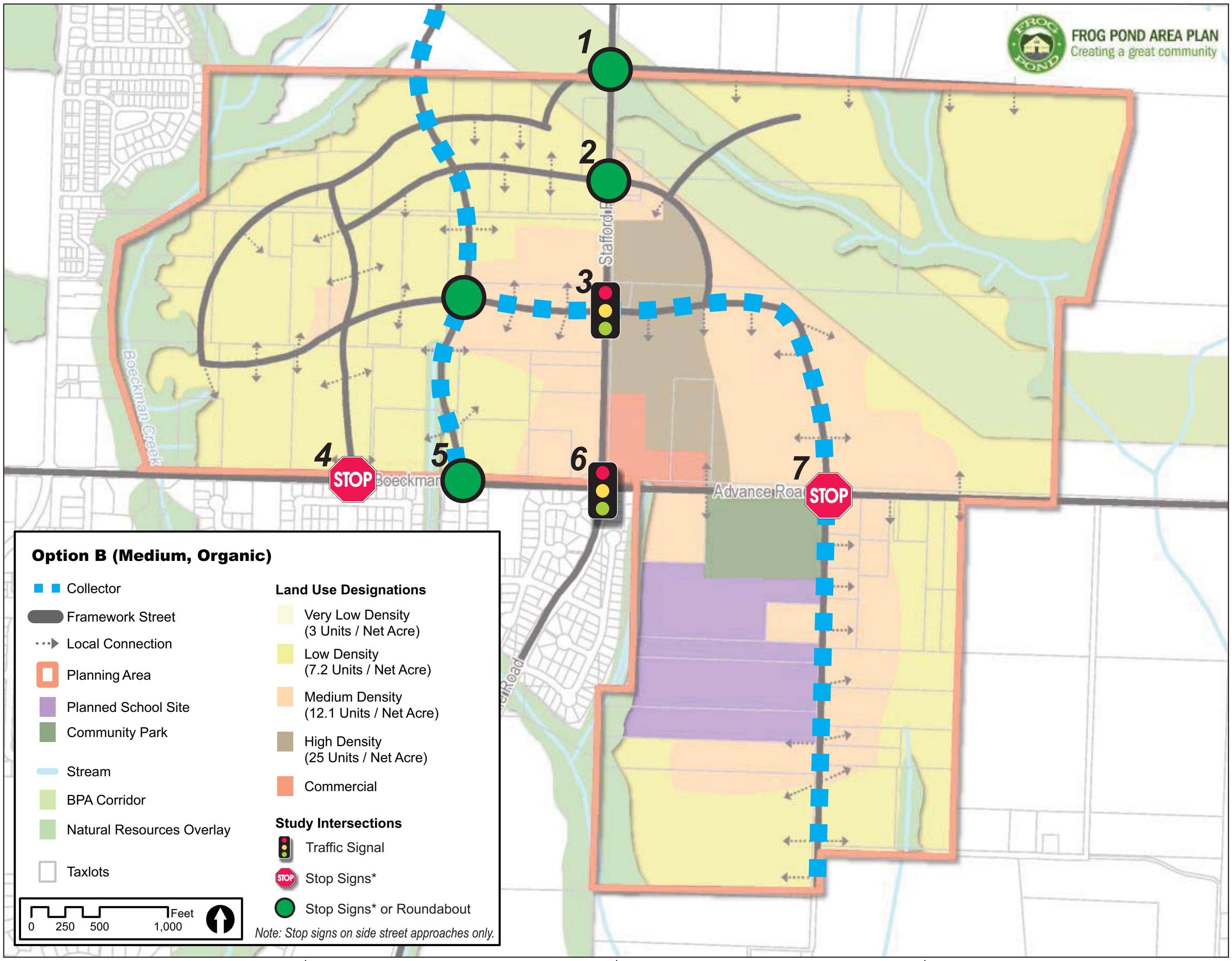
LT TH RT - Volume Turn Movement
Left•Thru•Right

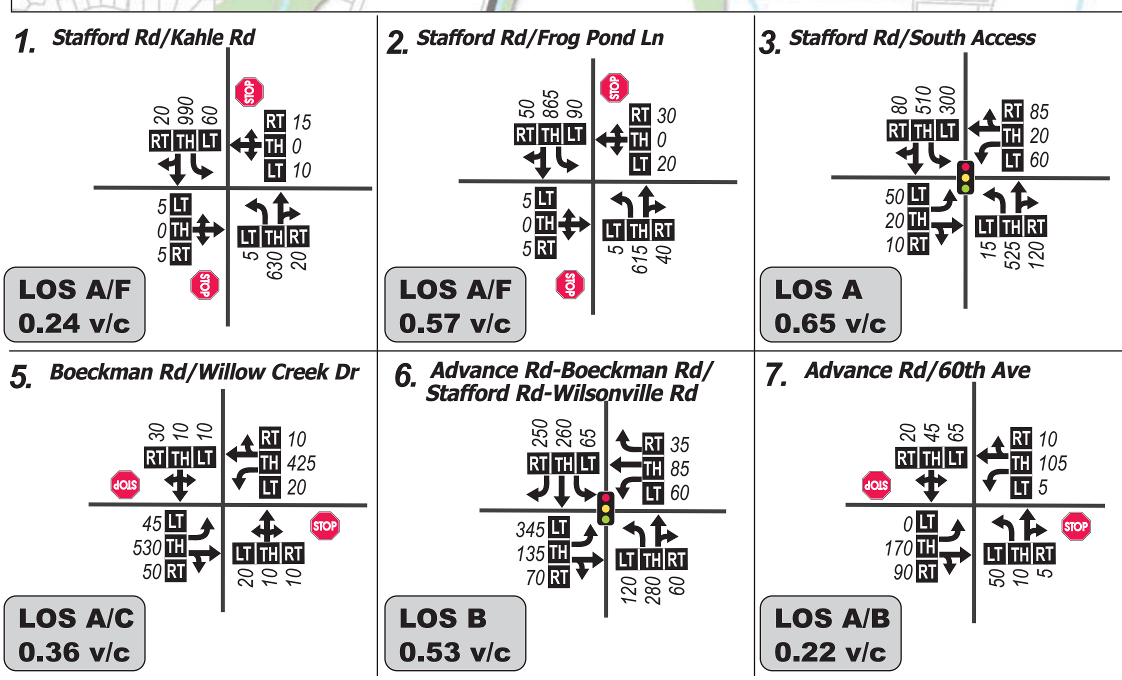
DKS

No Scale

Figure 2

OPTION A (LOW, GRID)
2035 PM PEAK HOUR TRAFFIC VOLUMES AND OPERATIONS





LEGEND (Operations)

LOS A/A 0.00 v/c - Level of Service - Volume-to-Capacity

Signalized Intersections

- Level of Service of Intersection
- Volume-to-Capacity of Intersection

Stop Controlled Intersections

- Level of Service of Major/Minor Street
- Volume-to-Capacity of Worst Movement

LEGEND (Traffic Control and Volumes)

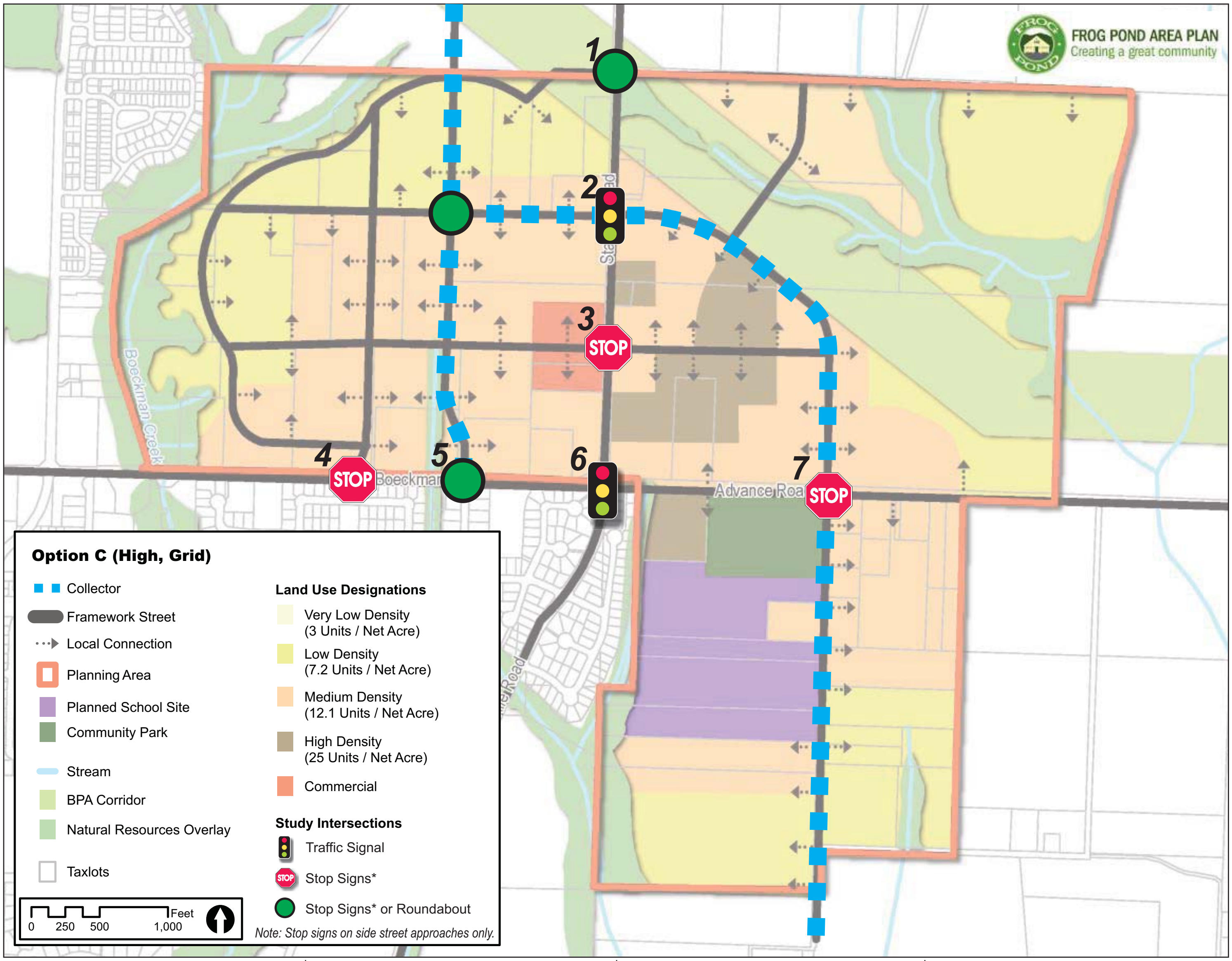
- Traffic Signal
- Stop Sign
- Lane Configuration
000 - PM Peak Hour Traffic Volumes
LT TH RT (Left•Thru•Right) - Volume Turn Movement

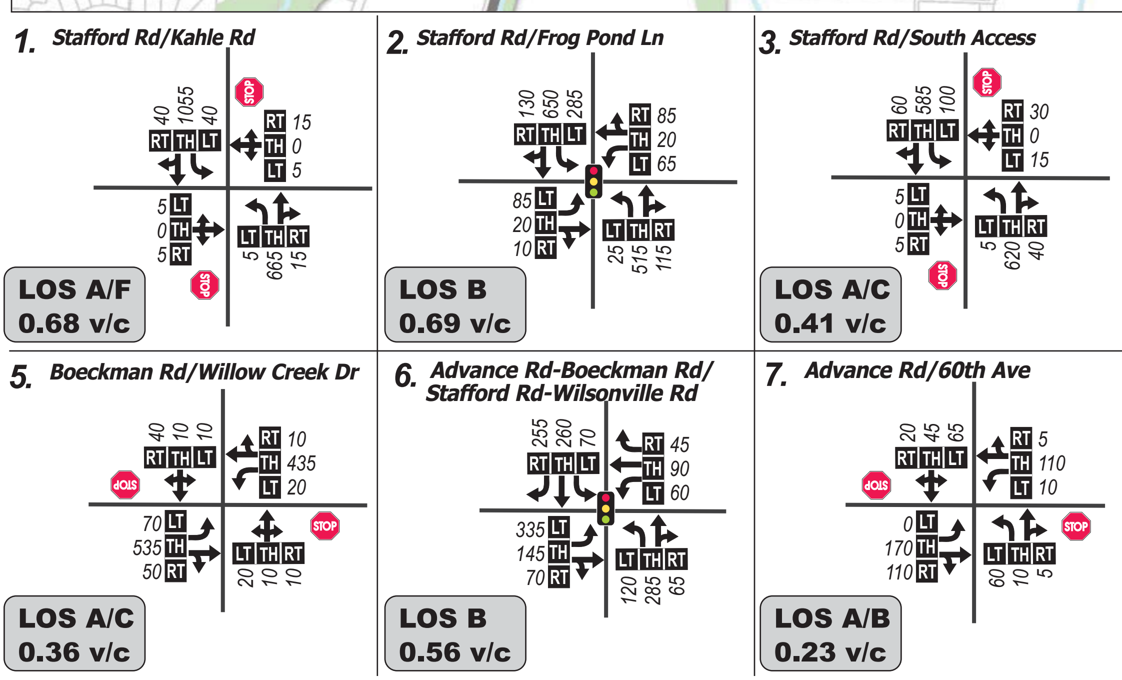
DKS

No Scale

Figure 3

OPTION B (MEDIUM, ORGANIC)
2035 PM PEAK HOUR TRAFFIC VOLUMES AND OPERATIONS





LEGEND (Operations)

LOS A/A - Level of Service
0.00 v/c - Volume-to-Capacity

Signalized Intersections
- Level of Service of Intersection
- Volume-to-Capacity of Intersection

Stop Controlled Intersections
- Level of Service of Major/Minor Street
- Volume-to-Capacity of Worst Movement

LEGEND (Traffic Control and Volumes)

- Traffic Signal
- Stop Sign
- Lane Configuration
000 - PM Peak Hour Traffic Volumes
LT TH RT - Volume Turn Movement (Left•Thru•Right)

DKS

No Scale

Figure 4

OPTION C (HIGH, GRID)
2035 PM PEAK HOUR TRAFFIC VOLUMES AND OPERATIONS

Table 2: 2035 P.M. Peak Hour Intersection Operating Conditions (Low, Medium, High)

Intersection[a]	Traffic Control	Operating Standard	PM Peak Hour			Meets Standard?
			Delay	*LOS*	*V/C*	
Option A (Low, Grid)						
1) Stafford Rd/Kahle Rd (North)	Two-Way Stop	LOS D	**55.1**	**A/F**	**0.37**	**No**
2) Stafford Rd/Frog Pond Ln (Center)	Signalized	LOS D	9.3	A	0.51	Yes
3) Stafford Rd/South Access	Two-Way Stop	LOS D	23.0	A/C	0.37	Yes
4) Boeckman Rd/Laurel Glen St (West)	Two-Way Stop	LOS D	15.8	A/C	0.39	Yes
5) Boeckman Rd/Willow Creek Dr (East)	Two-Way Stop	LOS D	15.0	A/C	0.34	Yes
6) Advance Rd-Boeckman Rd/ Stafford Rd-Wilsonville Rd	Signalized	LOS D	18.2	B	0.53	Yes
7) Advance Rd/60th Ave	Two-Way Stop	LOS D	12.5	A/B	0.18	Yes
Option B (Medium, Organic)						
1) Stafford Rd/Kahle Rd (North)	Two-Way Stop	LOS D	**53.3**	**A/F**	**0.24**	**No**
2) Stafford Rd/Frog Pond Ln (Center)	Two-Way Stop	LOS D	**55.6**	**A/F**	**0.57**	**No**
3) Stafford Rd/South Access	Signalized	LOS D	6.9	A	0.65	Yes
4) Boeckman Rd/Laurel Glen St (West)	Two-Way Stop	LOS D	17.2	A/C	0.41	Yes
5) Boeckman Rd/Willow Creek Dr (East)	Two-Way Stop	LOS D	16.1	A/C	0.36	Yes
6) Advance Rd-Boeckman Rd/ Stafford Rd-Wilsonville Rd	Signalized	LOS D	19.6	B	0.53	Yes
7) Advance Rd/60th Ave	Two-Way Stop	LOS D	12.7	A/B	0.22	Yes
Option C (High, Grid)						
1) Stafford Rd/Kahle Rd (North)	Two-Way Stop	LOS D	**59.4**	**A/F**	**0.68**	**No**
2) Stafford Rd/Frog Pond Ln (Center)	Signalized	LOS D	14.7	B	0.69	Yes
3) Stafford Rd/South Access	Two-Way Stop	LOS D	23.5	A/C	0.41	Yes
4) Boeckman Rd/Laurel Glen St (West)	Two-Way Stop	LOS D	18.9	A/C	0.43	Yes
5) Boeckman Rd/Willow Creek Dr (East)	Two-Way Stop	LOS D	17.3	A/C	0.36	Yes
6) Advance Rd-Boeckman Rd/ Stafford Rd-Wilsonville Rd	Signalized	LOS D	19.8	B	0.56	Yes
7) Advance Rd/60th Ave	Two-Way Stop	LOS D	13.4	A/B	0.23	Yes

Signalized Intersections:	Two-Way Stop Intersections:
Delay = Average Stopped Delay per Vehicle (sec) LOS = Level of Service of Intersection V/C = Volume-to-Capacity Ratio of Intersection	Delay = Average Stopped Delay per Vehicle (sec) at Worst Movement (typically a minor movement) LOS = Level of Service of Major Street/Minor Street V/C = Volume-to-Capacity Ratio of Worst Movement

[a] Intersection numbers correspond with volume figures: Figure 2, Figure 3, and Figure 4.

Traffic Volumes and Operations (Nearby Intersections and I-5 Interchange Areas)

Traffic volumes and operations were also analyzed for a few key nearby intersections as well as Wilsonville's two I-5 interchange areas. Analysis at the interchange ramps was performed previously as a sensitivity analysis in the existing and baseline transportation analysis memorandum[6] to determine the expected effects of the projected maximum reasonable build out of the Frog Pond study area. Table 3 shows the land use assumptions for the "Maximum Build Out" scenario, which was intentionally selected to be as high as the team believed could be feasible for the Frog Pond area in order to test "reasonable worst case" impacts. These land use assumptions are similar to—but slightly higher than—the land use assumptions in Option C (High); therefore, it is sufficiently conservative to apply the results to all three alternatives.

Table 3: Land Use Estimates for Future 2035 Scenarios

Future 2035 Scenario	Households	Employees		
		Retail	*Non-Retail*	*Total*
Maximum Build Out	2,812	188	183	371

Table 4 provides the operating conditions for the Maximum Build Out scenario at both the highway interchanges (as previously reported) and other key nearby intersections that were not evaluated in the previous sensitivity analysis. It lists the estimated average delay, level of service (LOS), and volume to capacity (v/c) ratio at each off-site study intersection based on the *2000 Highway Capacity Manual* methodology.[7] This analysis assumes improved intersection geometries associated with all High Priority Projects included in Wilsonville's TSP. Specific High Priority Projects include installation of signalized intersections at Boeckman Road/Canyon Creek Road and a traffic signal or roundabout combining the existing intersections of Stafford Road/65th Avenue and Elligsen Road/65th Avenue.

As shown in Table 4, all off-site study intersections are expected to meet applicable mobility targets and operating standards through the year 2035 as required by the City of Wilsonville, Clackamas County, and the Oregon Department of Transportation (ODOT). This analysis assumes completion of all High Priority Projects from the Wilsonville TSP, growth consistent with Metro forecasts, build out of the current Wilsonville urban growth boundary, and a Maximum Build Out scenario for the Frog Pond Area that exceeds the amount of growth identified in any of the three land use alternatives currently under consideration.

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[6] *Frog Pond Area Plan Existing and Baseline Transportation Analysis*, DKS Associates August 8, 2014.
[7] *2000 Highway Capacity Manual*, Transportation Research Board, Washington DC, 2000.

Table 4: 2035 P.M. Peak Hour Intersection Operating Conditions (Maximum Build Out Scenario)

Intersection	Jurisdiction	Operating Standard or Target	PM Peak Hour			Meets Standard or Target?
			Delay	*LOS*	*V/C*	
Signalized						
Elligsen Rd/I-5 SB Ramp	ODOT	0.90 V/C[a]	24.5	C	0.90	Yes
Elligsen Rd/I-5 NB Ramp	ODOT	0.90 V/C[a]	12.8	B	0.66	Yes
Wilsonville Rd/I-5 SB Ramp	ODOT	0.85 V/C	29.6	C	0.83	Yes
Wilsonville Rd/I-5 NB Ramp	ODOT	0.85 V/C	22.5	C	0.58	Yes
Elligsen Rd/Parkway Ave	Wilsonville	LOS D	36.9	D	0.77	Yes
Elligsen Rd/Park Center Dr	Wilsonville	LOS D	34.8	C	0.88	Yes
Boeckman Rd/Canyon Creek Rd	Wilsonville	LOS D	11.6	B	0.68	Yes
Wilsonville Rd/Town Center Loop W	Wilsonville	LOS D	40.6	D	0.86	Yes
Stafford Rd/65th Ave/ Elligsen Rd (Two Traffic Control Options)						
Traffic Signal	Clackamas Co.	LOS D	49.5	D	0.91	Yes
Roundabout (2-Lane)	Clackamas Co.	LOS D	20.0	C	0.79	Yes

Signalized Intersections:
Delay = Average Stopped Delay per Vehicle (sec)
LOS = Level of Service of Intersection
V/C = Volume-to-Capacity Ratio of Intersection
Bold Underlined values do not meet standards.

Two-Way Stop Intersections:
Delay = Average Stopped Delay per Vehicle (sec) at Worst Movement (typically a minor movement)
LOS = Level of Service of Major Street/Minor Street
V/C = Volume-to-Capacity Ratio of Worst Movement
Bold Underlined values do not meet standards.

[a] The typical ODOT mobility target for interchange ramps is a 0.85 v/c ratio. However, when the interchange vicinity is fully developed and adequate storage is available on the interchange ramp to prevent queues from backing up on the mainline, then the target can be increased to a 0.90 v/c ratio. Queuing analysis was performed (see Table 5) to ensure this is the case at the Elligsen Road/I-5 interchange, and it is likely the case for the Wilsonville Road/I-5 interchange as well.

In addition, queuing analysis was performed for the p.m. peak hours under the 2035 full build scenario to determine the 95th percentile queues at the Elligsen Road/I-5 interchange ramps. The 95th percentile queue is the queue length for a given intersection movement that has only a 5% chance of being exceeded during the peak traffic hour. This analysis was performed to ensure that adequate storage is available on the interchange off-ramp to prevent queues from backing up on the I-5 mainline. This analysis is important because the applicable ODOT mobility target can be increased from 0.85 v/c to 0.90 v/c when this condition is met and the interchange area is fully developed. Table 5 provides the results of the queuing analysis, and shows that the 95th percentile queues can be accommodated by the existing ramp lengths.

Table 5: Future 2035 PM Peak Hour Queuing Estimates for Elligsen Road I-5 Off Ramps

Intersection Approach	Movements	Number of Lanes	Ramp Storage Length	95th Percentile Queue of Longest Movement
Elligsen Rd/I-5 SB Ramp	Left, Through-Left, Right	3	700 ft	525 ft
Elligsen Rd/I-5 NB Ramp	Left, Left, Right	3	575 ft	425 ft

Functional Classifications

The Wilsonville Transportation System Plan (TSP)[8] identifies the functional classifications of the major study area roadways, and Figure 5 shows the Frog Pond Area vicinity. Stafford Road is a Major Arterial, Boeckman Road is a Minor Arterial, and Advance Road is a Collector.

Now that this area is being master planned, some of these classifications may benefit from being changed depending on the desired cross sections (including number of travel lanes, presence of on-street parking, etc.) and access spacing standards. Because Boeckman Road has been developed along its entire south side and portions of the roadway have already been improved with sidewalks and bike lanes, it will be difficult to make changes to its cross section and access spacing; however, now is the ideal time to make any desired revisions to functional classification for Advance Road and Stafford Road. Additional discussion and analysis of cross sections and access will be provided later in this memorandum and should be used as the basis for any functional classification changes.

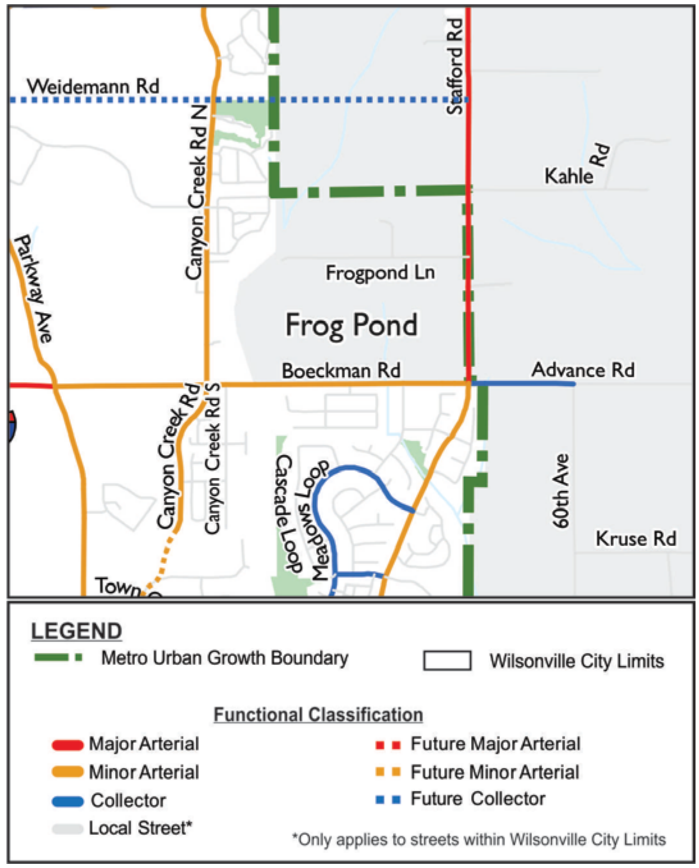

Figure 5: Wilsonville Functional Classifications in Frog Pond Area Vicinty (Image clipped from TSP)

Another importation functional classification consideration for the Frog Pond Area relates to internal roadways. Similar to how Meadows Loop is a designated Collector street that runs through the neighborhood south of the Frog Pond area, at least one Collector street is recommended through each of the Frog Pond neighborhoods. Figure 2, Figure 3, and Figure 4, which were discussed previously, show the recommended Collectors for each of the three alternatives. These Collectors would have neighborhood design characteristics that would include bike facilities (shared lanes or dedicated bike lanes) and on-street parking. They would also be alley loaded to limit the number of driveways accessing the Collector street.

The purpose of the Collectors is to provide convenient multimodal access into the heart of each neighborhood. These roadways will include bike facilities within and between neighborhoods. They should also be designed to support a transit route and bus stops so that South Metro Area Regional Transit (SMART) is able to provide high quality transit service to the residents and businesses. To best serve these purposes, the Collectors should be continuous streets that allow through movements to have priority.

[8] *Wilsonville Transportation System Plan*, Adopted by Council (Ordinance 718), June 17, 2013.

Street Design (Arterial and Collector Roadways)

One of the desired outcomes of developing the Frog Pond Area Plan is to determine what the preferred street design is for the arterial and collector roadways. These roadways include Boeckman Road, Stafford Road, Advance Road, and the Collector roadways that serve the Frog Pond Area Plan. Prior to an area developing, it is important for the City to acquire the necessary right-of-way to accommodate the full future cross-section. This will ensure that additional changes, such as widening, can occur as the future need arises. Depending on the preferred cross-section and access spacing, it may be beneficial to change some of the functional classifications for the roadways fronting the Frog Pong Area.

The Wilsonville TSP designates the functional classifications for all of its existing roadways and planned roadway extensions. Each functional classification has corresponding cross-section and access spacing standards. The functional classifications for each of these roadways are provided previously in this memorandum and listed again in Table 6. This table also lists the access spacing standards that correspond with each functional classification. These standards particularly limit the number of accesses that would be provided on major arterials, such as Stafford Road. By having limited access, Stafford Road can better serve the higher traffic volumes it is expected to experience. Boeckman Road, as a Minor Arterial, also benefits from a reduced number of accesses so it can serve vehicles traveling between the Frog Pond Area and land uses to the west.

Table 6: City of Wilsonville Access Spacing Standards (Wilsonville TSP)

Functional Classification	Applicable Study Area Roadways	Access Spacing Standards[a]		What Does This Mean for the Study Area?
		Desired[b]	*Minimum*	
Major Arterial	Stafford Road	1,320 ft	1,000 ft	2-3 access points spaced approximately 900 to 1,000 feet apart along site frontage, preferably at Collector streets and other higher use streets (variances may be granted but will likely include turn restrictions)
Minor Arterial	Boeckman Road	1,000 ft	600 ft	Up to 3 access points spaced 600 feet apart along site frontage, preferably at Collector streets and/or aligned with existing streets to the south (variances may be granted but will likely include turn restrictions)
Collector	Advance Road	300 ft	100 ft	Preferably no more than 7 access points spaced 300 feet apart along site frontage with driveway access more easily provided
	Primary roadways through Frog Pond Area Plan neighborhoods	300 ft	100 ft	Up to 2 access points per 300-foot block, preferably to shared alleyways, retail sites, and apartments rather than private driveways

[a] Spacing is measured from centerline to centerline on Major Arterials and Minor Arterials and between adjacent curb returns on Collectors and Local Streets

[b] Desired Access Spacing shall be adhered to unless otherwise approved by the City Engineer. Reasons for deviating from Desired Access Spacing include aligning with existing driveways, topography, property limitations, and other safety related issues as identified in a transportation study.

While a street's functional classification does not dictate which street elements to include, it does facilitate the selection of multimodal facilities and widths that will help ensure the roadway can meet its intended multimodal function both now and in the future. Figure 6, Figure 7, and Figure 8 show the standard corridor cross-sections for Major Arterials, Minor Arterials, and Collectors, respectively. In addition, Figure 9 shows the buffered bike lane and two-way cycle track bicycle facility options. Roadway cross-section design elements include travel lanes, curbs, planter strips, sidewalks on both sides of the road, and bicycle facilities consistent with designated bikeways, walkways, and shared-use trails. Low impact development (LID) standards may also be used throughout the City at the City's discretion.

As a Major Arterial, Stafford Road is envisioned to eventually become a five-lane roadway. The operations analysis presented previously in this memorandum shows that a three-lane roadway would still be expected to provide adequate capacity to serve Frog Pond Area Plan through the 2035 planning horizon. Therefore, a three-lane roadway is considered sufficient in the short-term; however, Stafford Road would be approaching its three-lane capacity limit in the long-term. By acquiring adequate right-of-way for the future five-lane facility and designing a three-lane roadway that can easily be widened to five lanes, the City would ensure it can support future development without impacting established development in its northeast area and also can have improved access to the future growth areas.

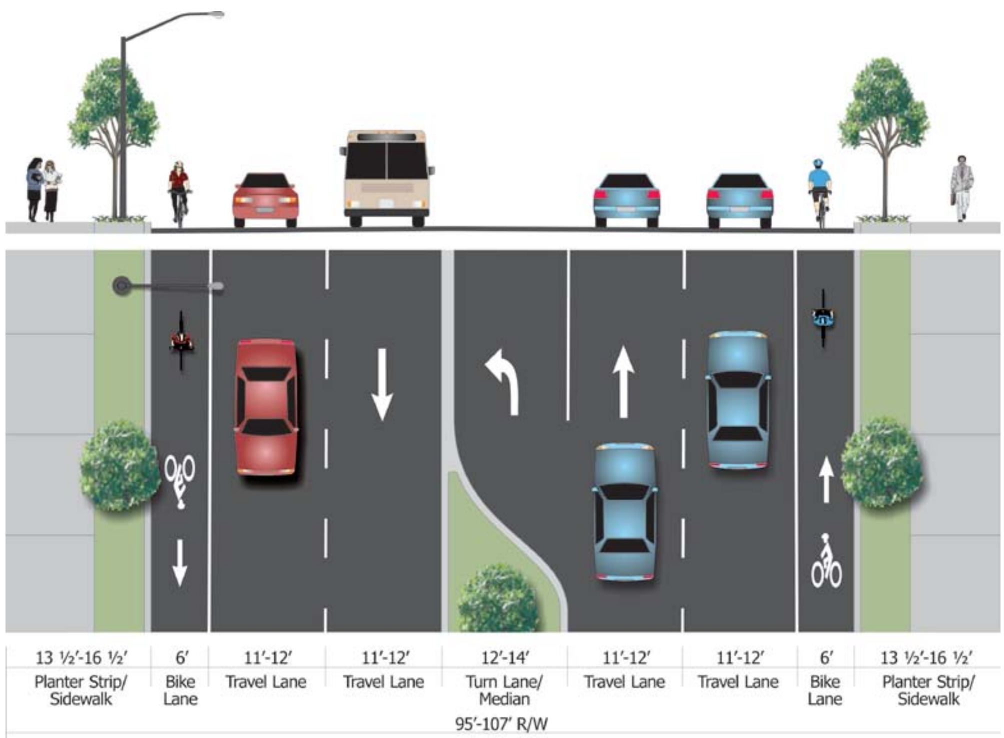

Figure 6: Major Arterial Cross-Section (Wilsonville TSP)

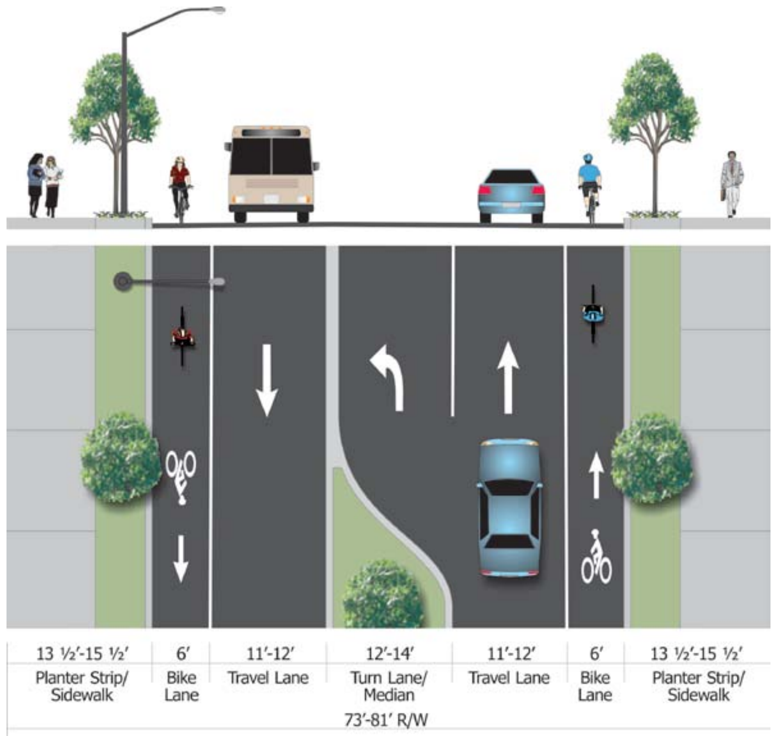

Figure 7: Minor Arterial Cross-Section (Wilsonville TSP)

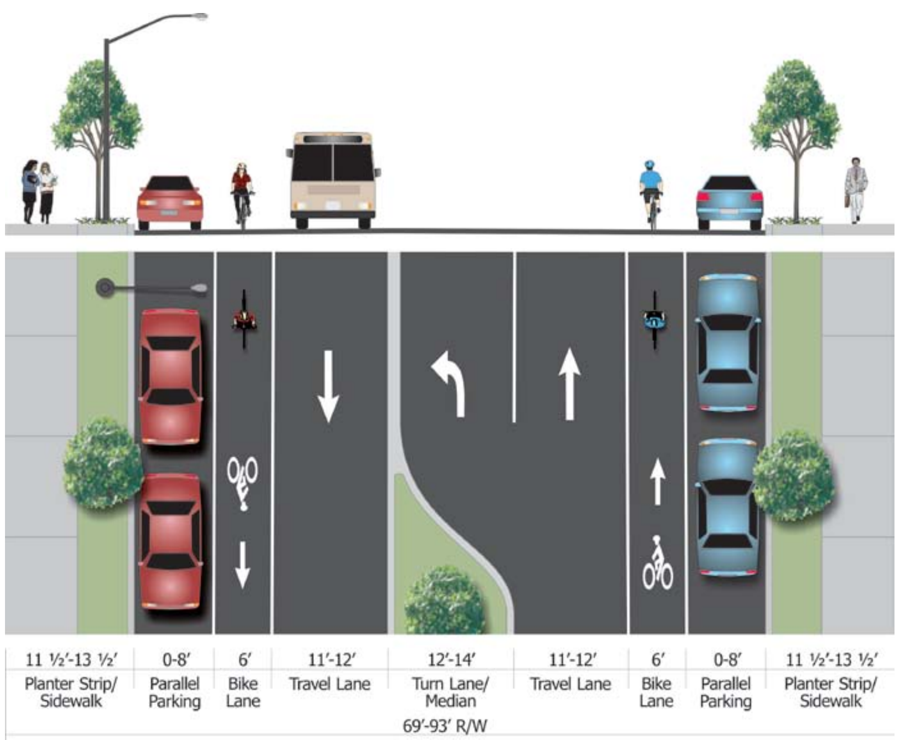

Figure 8: Collector Cross-Section (Wilsonville TSP)

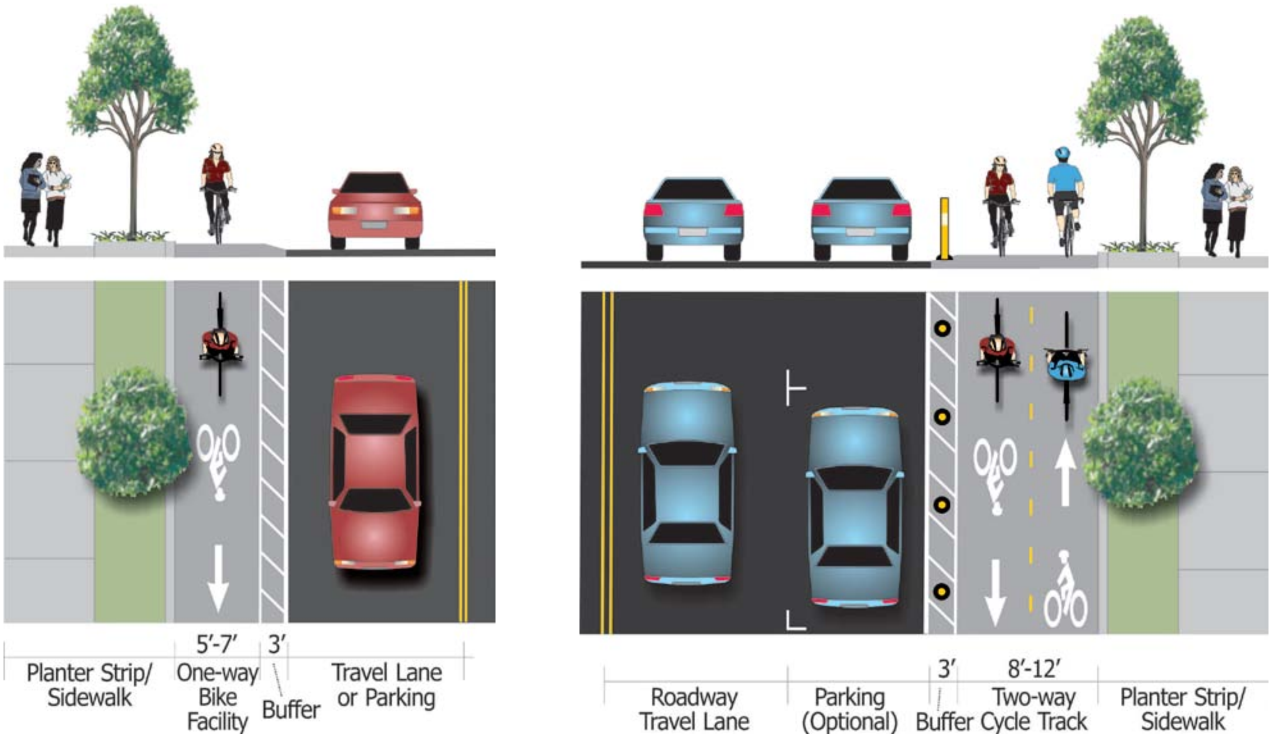

Figure 9: Buffered Bike Lane and Two-Way Cycle Track Bicycle Facility Options (Wilsonville TSP)

Only a portion of Advance Road is included in the City's urban growth boundary (UGB), and the Wilsonville TSP currently designates this section as a Collector street. If a substantial future development area was expected to be built east of the Frog Pond Area, then it may be beneficial to reclassify Advance Road as a Minor Arterial and provide additional capacity to serve greater traffic volumes. However, future urban growth to the east of the Frog Pond Area is highly unlikely during the planning horizon because much of the land to the east is designated Rural Reserve, which precludes its addition to the UGB for 50 years. As a Collector, Advance Road can accommodate a greater amount of access, which would be beneficial if a retail development was located at the corner of the Advance Road-Boeckman Road/SW Stafford Road-Wilsonville Road intersection, and also allows more points of connection to the future park and school site. As a Collector, the standard would also support on-street parking, which may be beneficial to the City adjacent to the proposed park. The Collector classification would include lower design speeds and a better pedestrian environment than an Arterial. These qualities will be beneficial to the high level of pedestrian activity near the park and schools.

The major streets through the East, West, and South Neighborhoods are being proposed as Collectors, which would include bike facilities (dedicated bike lanes or shared lanes) and on-street parking. It will be beneficial to have a consistent cross-section for all the Collector streets and to make the Collector a continuous through street where the side streets have stopped approaches. This would allow the streets to meet user expectation and to better collect traffic and utilize the capacity provided by the proposed traffic signal at the intersection of the Collector roadway and Stafford Road. One of the main challenges in the West Neighborhood is where there are east-west Collector roadway tees into the Collector roadway that runs north-south. As a four-legged intersection, this means the west leg would have a different cross-section from the east leg. Some options to address this could be to have a roundabout, remove the west leg so it is just a three-legged intersection, or provide sharrows on the west leg so there is some parity with the east leg's bike lane.

Multimodal Connectivity

The City of Wilsonville highly values providing transportation system connectivity within and between its neighborhoods. Bicyclists, pedestrians, and transit riders benefit from closely spaced facilities because they are the most affected by distance. Good connectivity consists of the following:

- Direct connections between neighborhoods, schools, transit stops, retail centers, employment centers, and recreational areas that decrease out of direction travel
- Connected streets that help distribute traffic
- Walking and biking facilities
- Through streets that penetrate neighborhoods and accommodate transit routes

Figure 10 and Figure 11 show bicycle and pedestrian circulation diagrams for the grid and organic street frameworks, respectively. Both the grid and organic street frameworks have very similar transportation networks with basic features that support multimodal connectivity and are expected to facilitate travel choices between the various travel modes (i.e., walking, biking, taking transit, driving).

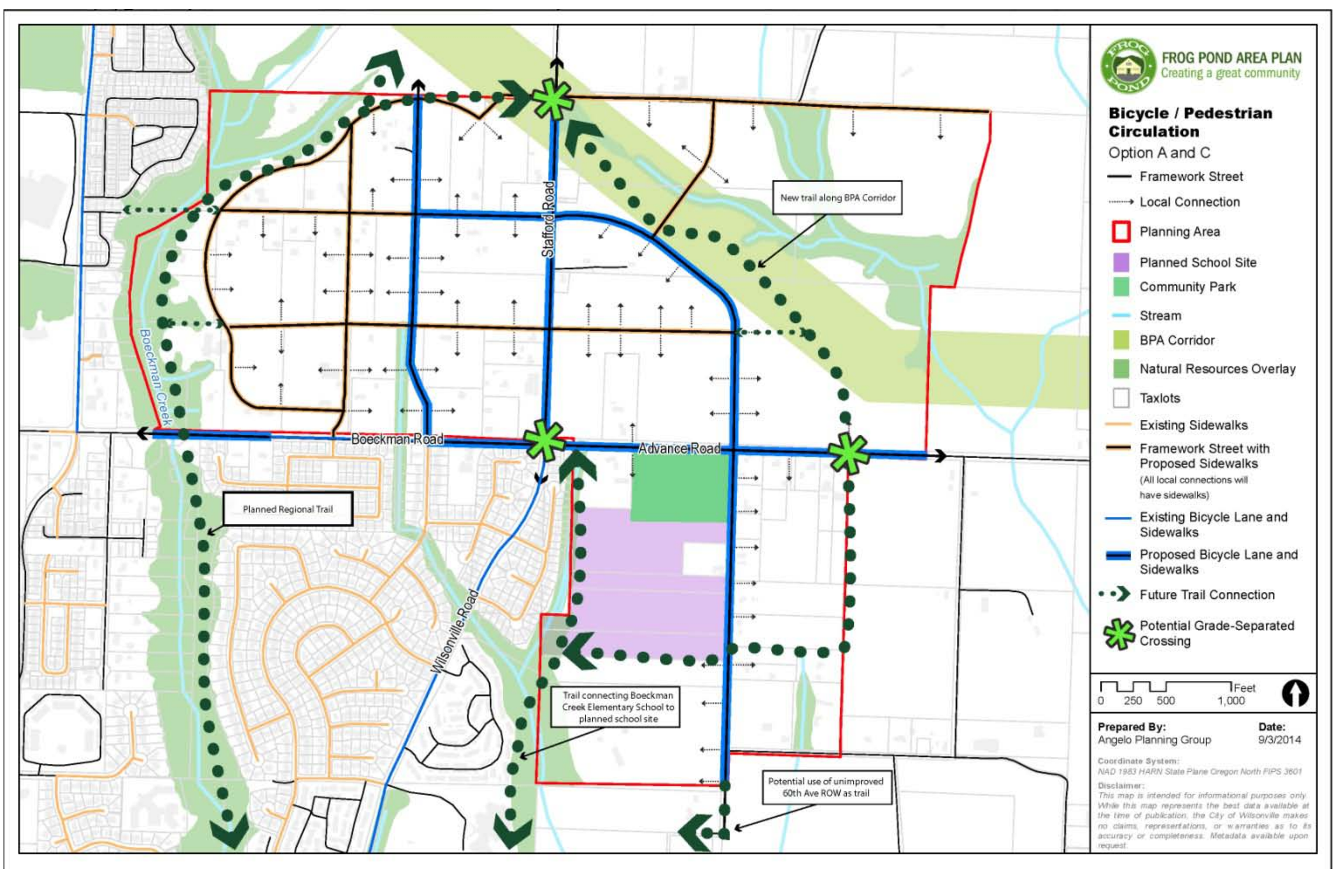

Figure 10: Bicycle and Pedestrian Circulation Diagram for Grid Network (Options A and C)

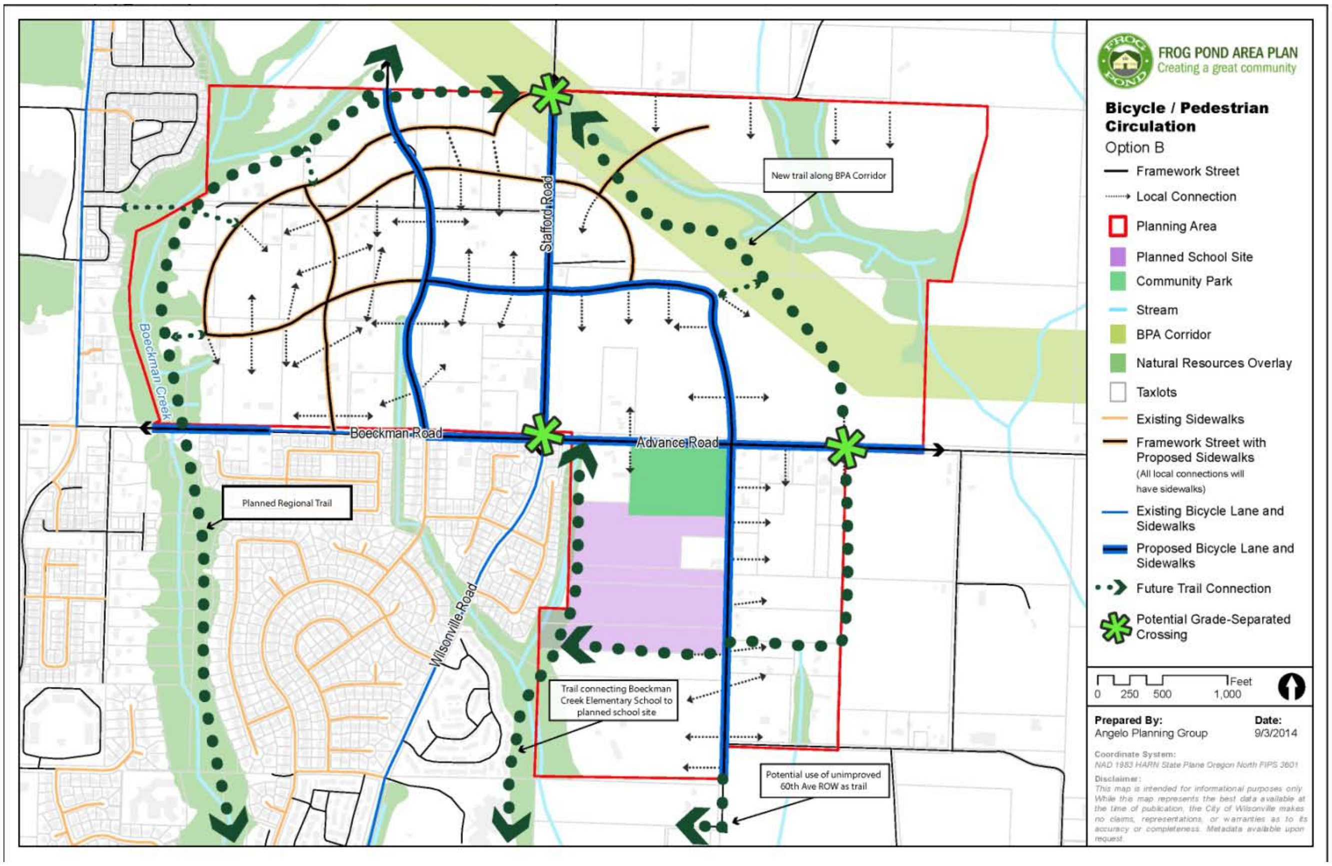

Figure 11: Bicycle and Pedestrian Circulation Diagram for Organic Network (Option B)

A mix of streets, bicycle facilities, and trails are shown on the figures that connect to the various land uses within the Frog Pond area (including the school site south of Advance Road, which should have safe routes connecting to the adjacent neighborhoods) and take advantage of natural and man-made features (including regional trails along Boeckman Creek and the BPA corridor). In addition, urban upgrades (including adding sidewalks, bike lanes, center turn lanes) are needed for Boeckman Road, Stafford Road, and Advance Road in conjunction with the development to fill in the pedestrian and bicycle network and connect to adjacent parts of Wilsonville. A new bridge on Boeckman Road over Boeckman Creek, where there is currently a geometric deficiency, would also improve connectivity between the Frog Pond Area and other neighborhoods to the west.

The street networks are also shown to connect internally as well as to Boeckman Road, Stafford Road, and Advance Road at locations that will help distribute traffic while also providing convenient access to the signalized access on Stafford Road (particularly for those needing to make a left turn during peak congestion periods) and connections to the existing neighborhood to the south. The figures also show arrows that represent potential local roadway connections. These connections occur approximately every 300 feet, which is important to meet City of Wilsonville standards for bicycle and pedestrian facility spacing guidelines.

The layout of the grid network does a particularly good job of providing internal connections that support circulation and access. The straight, regularly spaced roads provide clear expectations that can help reduce uncertainty regarding the most direct route for walking or biking. However, the organic framework may contribute to a more pleasant walking and biking experience because the roadway curvature can help reduce motor vehicle speeds and add an aesthetic value for some pedestrians (others prefer a direct and convenient walking route). If the curvature of the organic network is desired, then one option may be to adapt the layout of the grid network but add curvature where appropriate.

Each of the different facilities serving the various travel modes should also be connected together at convenient locations in ways that support multimodal access and travel choices, especially to the planned school site, existing schools along Wilsonville Road, and the commercial area along Stafford Road. These trails are intended to accommodate both school and non-school users. The trails are also planned to connect to and cross the street system at either grade separated crossings or at intersections rather than midblock to avoid the need for special crossing treatments that stop traffic or create additional vehicle/pedestrian conflicts.

One important consideration is how to best accommodate pedestrians crossing Stafford Road, Boeckman Road, and Advance Road. The greatest amount of protection can be provided through grade separated crossings, which are recommended for each of the major trail crossings of these roadways. Providing grade separated crossings will improve both safety and the travel experience of trail users and drivers. In addition, pedestrian crossings will be accommodated at the proposed traffic signals at the Boeckman Road/Advance Road/Stafford Road/Wilsonville Road intersection and the signalized access point on Stafford Road. These signals should include clearly marked crosswalks, pedestrian countdown timers, and consideration for signal phasing to eliminate vehicle/pedestrian conflicts arising from vehicles turning left during a permitted phase. In addition, by locating the retail uses adjacent to the traffic signal on Stafford Road, access for both vehicles and pedestrians crossing the street can be best accommodated.

Transit Routing and Coverage Area

Transit routing and coverage are also important considerations for the Frog Pond Area Plan. Figure 12 and Figure 13 show the potential transit routing and coverage for the grid and organic street networks, respectively. The figures also show the existing transit route (Route 4) that uses Wilsonville Road and Boeckman Road. The potential transit routing assumptions through the Frog Pond Area are based on the potential use of Collector streets through the West and East Neighborhoods and the traffic signal on Stafford Road. It is important to ensure that these Collector streets and any required turn movements can accommodate transit vehicles. Coordination should also be performed with South Metro Area Regional Transit (SMART) and TriMet to identify any transit-related needs they have for the area. The study area west of Stafford Road (West Neighborhood) is currently in the SMART service district, while the areas east of Stafford Road and Wilsonville Road (East and South Neighborhoods) are in the TriMet service district. However, it is recommended that the area all be transferred to SMART, who will be better able to serve the development area.

The transit coverage areas are based on the assumption that pedestrians typically find it convenient to take transit when they are able to walk less than one-quarter mile to access a transit stop. A comparison of the grid and organic street networks shows that when the transit route is farther to the north and the signalized crossing is near Frog Pond Lane, the Frog Pond Area Plan experiences greater transit coverage on the north end. Otherwise, there are very few differences.

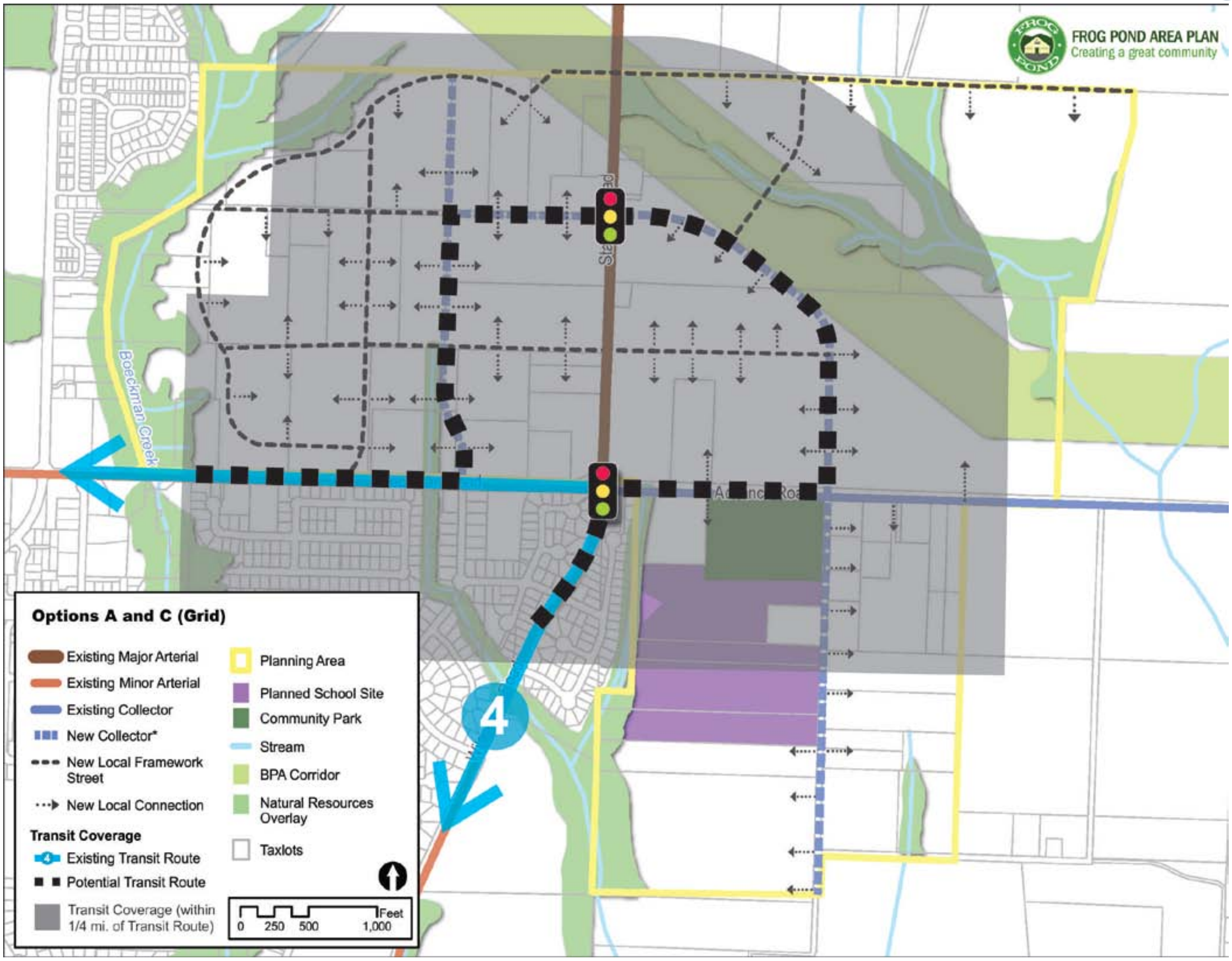

Figure 12: Potential Transit Routing and Coverage for Grid Network (Options A and C)

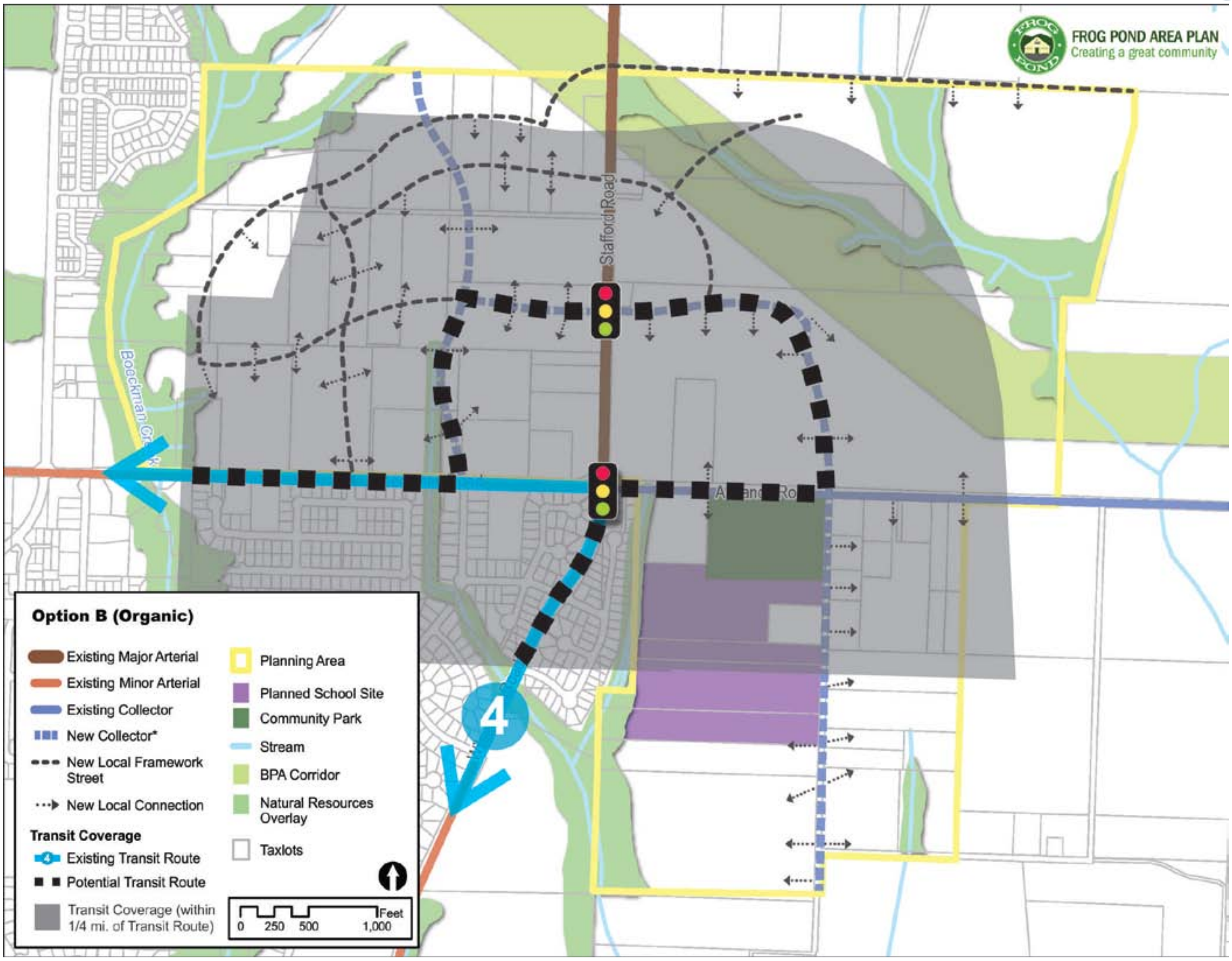

Figure 13: Potential Transit Routing and Coverage for Organic Network (Option B)

Transportation Costs

Planning level cost estimates have been prepared for the transportation improvements associated with the Frog Pond Area Plan. No substantial differences exist between the transportation network and improvement needs of the three alternatives; therefore, the same cost estimates are considered applicable. Table 7 lists the costs, which were primarily based on costs provided in the Wilsonville TSP. However, revisions were made to the funding source breakdown estimates as well as to the total cost of Project UU-01, which now includes a bridge, and Project UU-P1, which now extends a half-mile farther to the east to include the development area. The neighborhood Collector cost estimates were also newly prepared because they were not accounted for in the TSP. The City's portion of the neighborhood Collector cost is based on the assumption that the City would be responsible to pay for the cross-section overage associated with the inclusion of bike lanes on both sides of the road. Additional improvement project cost assumptions are provided in the appendix.

Table 7: Planning Level Transportation Costs Associated with Frog Pond Area Plan

Project	Planning Level Cost Estimate	Funding Source or Potential Proportionate Share Breakdown (FP = Frog Pond)						
		City (CIP)	*West FP*	*East FP*	*Non-School in South FP*	*School in South FP*	*Clackamas County*	*Federal/ Region*
UU-01 Boeckman Road Bridge Improvements (Option A)	$12,200,000	$3,700,000	-	-	-	-	-	$8,500,000
UU-02 (Part 1) Boeckman Road Urban Upgrade	$1,600,000	$800,000	$800,000	-	-	-	-	-
UU-02 (Part 2) Boeckman/ Stafford Traffic Signal	$500,000	-	$70,000	$180,000	$125,000	$125,000	-	-
UU-06 Stafford Road Urban Upgrade (3 lane plus extra ROW)	$4,200,000	-	$2,100,000	$2,100,000	-	-	-	-
Future Stafford Rd Upgrade to 5 lanes	$6,825,000	$6,825,000	-	-	-	-	-	-
Potential Single-Lane Roundabout on Stafford Road	$600,000	-	$300,000	$300,000	-	-	-	-
Widening Potential Roundabout to Dual Lanes with 5-Lane Upgrade	$400,000	-	$200,000	$200,000	-	-	-	-
UU-P1 Advance Road Urban Upgrade (Extended to Full Site Frontage)	$4,350,000	$1,000,000	-	$1,175,000	$2,175,000	-	-	-
RT-01A Boeckman Creek Trail (West Neighborhood)	$850,000	$570,000	$280,000	-	-	-	-	-
BPA Easement Trail (East Neighborhood)	$670,000	$450,000	-	$220,000	-	-	-	-
South Neighborhood Trail	$700,000	$460,000	-	-	$240,000	-	-	-
LT-P5 New School Site Trail (South Neighborhood)	$700,000	$700,000	-	-	-	-	-	-
SI-03 Stafford Rd/65th Ave Intersection Improvements	$5,500,000	$1,000,000	-	-	-	-	$4,500,000	-
West Neighborhood Collectors	$9,510,000	$1,585,000	$7,925,000	-	-	-	-	-
East Neighborhood Collectors	$8,160,000	$1,360,000	-	$6,800,000	-	-	-	-
South Neighborhood Collectors	$3,900,000	$450,000	-	-	$2,650,000	$800,000	-	-
Total	**$60,665,000**	**$18,900,000**	**$11,675,000**	**$10,975,000**	**$5,190,000**	**$925,000**	**$4,500,000**	**$8,500,000**

MEMORANDUM

DKS
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DATE: October 7, 2015

TO: Project Team

FROM: Scott Mansur, P.E., PTOE
Halston Tuss, E.I.T.

SUBJECT: **Frog Pond Area Plan – Transportation Analysis Update** P14033-000

The Frog Pond Area Plan, led by the City of Wilsonville, establishes a vision for the 500-acre Frog Pond area, and defines expectations for the type of community it will be in the future. The project team previously developed and evaluated a set of three land use and transportation alternatives (See Table 1 below) for consideration by the Frog Pond Planning Task Force, the public, stakeholders, and city policy-makers. The *Frog Pond Area Plan – Future Transportation Analysis* memorandum[1] provided information on the performance of the three alternatives. Since that time, there has been considerable public testimony from citizens, neighbors, property owners, and stakeholder interviews. Furthermore, there has been coordination with City staff and elected officials and feedback from the Technical Advisory Committee that has led to a draft recommendation for a preferred land use alternative estimate of 1,932 households.

Current Future Forecast

Previously, three future land use and transportation alternatives were evaluated for the Frog Pond Area Plan as part of the *Frog Pond Area Plan – Future Transportation Analysis* memorandum. The primary factor that differentiated these prior alternatives is the arrangement and density of residential land use (high, medium, low) and the location of a neighborhood commercial center. In addition, there were two street frameworks being considered (grid, organic). Table 1 lists the land use assumptions and street framework for the three prior alternatives. Additional details regarding these three alternatives are provided in the *Alternatives Evaluation Summary* memorandum associated with this project.[2]

Table 1: Prior Land Use and Transportation Alternatives

Alternative	Residential Land Use	Households	Employees			Street Framework
			Retail	*Non-Retail*	*Total*	
Option A	Low	1,773	150	123	273	Grid
Option B	Medium	2,357	150	123	273	Organic
Option C	High	2,742	150	123	273	Grid

[1] *Frog Pond Area Plan – Future Transportation Analysis*, DKS Associates, September 24, 2014.
[2] Draft Alternatives Evaluation Summary, September 11, 2014 .

The current recommended land use forecast for Frog Pond includes 1,932 households and a grid street framework, an approximate 30% reduction in households compared to the previous worst case shown above (Option C with 2,742 households). Additionally, the retail land use was reduced by 36%. Table 2 lists the land use assumptions and street framework being analyzed in this memorandum for the updated future forecast.

Table 2: Prior Land Use and Transportation Alternatives

Alternative	Residential Land Use	Households	Employees			Street Framework
			Retail	*Non-Retail*	*Total*	
Current Future Forecast	Low	1,932	95	123	218	Grid

Transportation Evaluation and Comparison of Alternatives

The updated land use and transportation alternatives were evaluated for multiple transportation-related considerations, including the following:

- Traffic volumes and operations (project vicinity)
- Traffic volumes and operations (off-site intersections and I-5 Interchange areas)

Traffic Volumes and Operations (Project Vicinity)

Future traffic volumes and operations were evaluated for the updated future land use to determine how the City's transportation system would operate based on the reduced land use currently assumed in the Frog Pond plan. The analysis in this memorandum assumes the transportation framework and study intersection control from the current Frog Pond Concept Plan.[3]

For analysis purposes, the Frog Pond Area Plan is assumed to experience full build-out by the year 2035, which is the future horizon year for both the Metro Regional Transportation Plan (RTP)[4] and the Wilsonville Transportation System Plan (TSP).[5] The future 2035 traffic volumes were forecasted for the study area using a travel forecast model developed specifically for Wilsonville. The model applies trip generation and trip distribution data directly from the Metro Gamma regional travel demand forecast model, but adds additional detail to replicate local travel conditions and routing within Wilsonville. In particular, revisions were made to the model's land use assumptions for the transportation analysis zones (TAZs) that comprise the Frog Pond Area Plan to account for the three proposed land use alternatives. It should be noted that the future 2035 model assumes all street improvement projects assumed in the financially constrained project list as identified in the City's TSP.[6] In addition, the neighborhood street network and location of the previously mentioned traffic signal on Stafford Road were accounted for in the trip routing estimates.

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[3] *Frog Pond Area Plan*, Angelo Planning Group, September 2, 2015.

[4] *Regional Transportation Plan*, Adopted by Metro Council (Exhibit A to Ordinance No. 14-1340), July 17, 2014.

[5] *Wilsonville Transportation System Plan*, Adopted by Council (Ordinance 718), June 17, 2013.

[6] Figure 5-7: Additional Planned Projects, *Wilsonville Transportation System Plan*, Adopted by Council (Ordinance 718), June 17, 2013.

The p.m. peak hour traffic volumes, lane geometries, and intersection operating conditions are shown in Figure 1

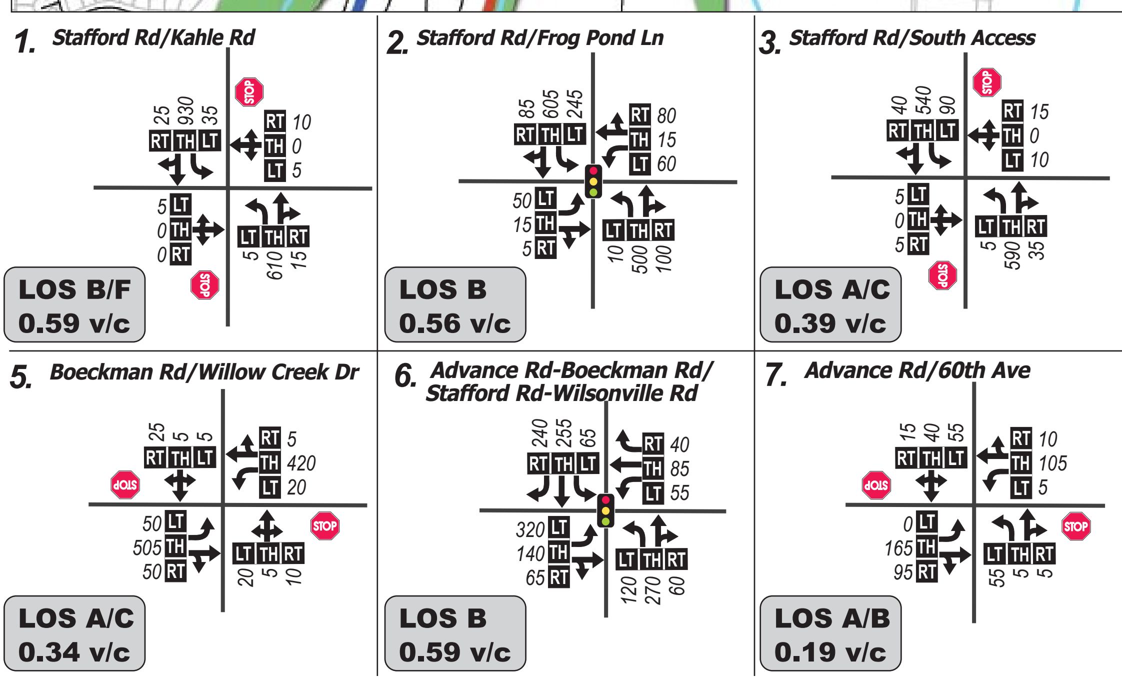
Table 3 provides the intersection operating conditions in table format for the updated Frog Pond land use. The installation of a traffic signal at the SW Advance Road-Boeckman Road/SW Stafford Road-Wilsonville Road intersection and the widening of Stafford Road to three lanes (a travel lane in each direction plus a center turn lane) are identified in the Wilsonville TSP as High Priority Projects and are accounted for in the analysis.

As shown on the figures and in Table 3, the unsignalized intersection of Stafford Road/Kahle Road is expected to exceed the City's level of service D performance standard. The primary reason is the high through volumes that contribute to the delay experienced by side street vehicles turning left. Providing left-turn lanes on the side street approaches would be one way to help reduce delays; however, it is not expected to be sufficient to achieve LOS D operations.

Because one of the accesses along Stafford Road would be signalized, it is likely that many of the residents and drivers familiar with the area would choose to turn left at the traffic signal during the peak periods, particularly with Collector/Local Street connectivity that provides good access to the heart of the East and West Neighborhoods. Traffic routing to this signal was assumed in the analysis; however, even a few left-turning vehicles at some of the other accesses would trigger delays that exceed the City's standard. One potential option to eliminate failing left turns would be to force traffic to use the traffic signal by installing a median that only allows right-out movements. However, this limits connectivity for all modes of travel and may not be necessary, as lower delays would be experienced during off-peak hours.

Another option that could be considered further to reduce delay at Stafford Road/Kahle Road would be to install a roundabout. There are many tradeoffs associated with roundabouts that should be considered when determining whether to select them as the preferred traffic control at any of the potential locations. Some of the advantages and disadvantages were described in the prior *Frog Pond Area Plan – Future Transportation Analysis* memorandum.[7]

[7] *Frog Pond Area Plan – Future Transportation Analysis*, DKS Associates, September 24, 2014.



LEGEND (Operations)

LOS A/A - Level of Service
0.00 v/c - Volume-to-Capacity

Signalized Intersections

- Level of Service of Intersection
- Volume-to-Capacity of Intersection

Stop Controlled Intersections

- Level of Service of Major/Minor Street
- Volume-to-Capacity of Worst Movement

LEGEND (Traffic Control and Volumes)

- Traffic Signal
- Stop Sign
- Lane Configuration

000 - PM Peak Hour Traffic Volumes

LT TH RT - Volume Turn Movement
Left•Thru•Right

DKS

No Scale

Figure 1

FUTURE FROG POND BUILDOUT
PM PEAK HOUR TRAFFIC
VOLUMES AND OPERATIONS

Table 3: 2035 P.M. Peak Hour Intersection Operating Conditions (Current Land Use)

Intersection[a]	Traffic Control	Operating Standard	PM Peak Hour			Meets Standard?
			Delay	*LOS*	*V/C*	
Option A (Low, Grid)						
1) Stafford Rd/Kahle Rd (North)	Two-Way Stop	LOS D	**64.8**	**B/F**	**0.59**	**No**
2) Stafford Rd/Frog Pond Ln (Center)	Signalized	LOS D	10.8	B	0.56	Yes
3) Stafford Rd/South Access	Two-Way Stop	LOS D	19.9	A/C	0.39	Yes
4) Boeckman Rd/Laurel Glen St (West)	Two-Way Stop	LOS D	16.6	A/C	0.40	Yes
5) Boeckman Rd/Willow Creek Dr (East)	Two-Way Stop	LOS D	15.5	A/C	0.34	Yes
6) Advance Rd-Boeckman Rd/ Stafford Rd-Wilsonville Rd	Signalized	LOS D	18.5	B	0.59	Yes
7) Advance Rd/60th Ave	Two-Way Stop	LOS D	13.1	A/B	0.19	Yes

Signalized Intersections:
Delay = Average Stopped Delay per Vehicle (sec)
LOS = Level of Service of Intersection
V/C = Volume-to-Capacity Ratio of Intersection

Two-Way Stop Intersections:
Delay = Average Stopped Delay per Vehicle (sec) at Worst Movement (typically a minor movement)
LOS = Level of Service of Major Street/Minor Street
V/C = Volume-to-Capacity Ratio of Worst Movement

[a] Intersection numbers correspond with Figure 1.

Traffic Volumes and Operations (Nearby Intersections and I-5 Interchange Areas)

Traffic volumes and operations were also analyzed for a few key nearby intersections as well as Wilsonville's two I-5 interchange areas based on the land use assumptions for the current buildout scenario. Table 4 provides the operating conditions for the current buildout scenario at both the highway interchanges (as previously reported) and other key nearby intersections that were not evaluated in the previous sensitivity analysis. It lists the estimated average delay, level of service (LOS), and volume to capacity (v/c) ratio at each off-site study intersection based on the *2000 Highway Capacity Manual* methodology.[8] This analysis assumes improved intersection geometries associated with all High Priority Projects included in Wilsonville's TSP.

As shown in Table 4, all off-site study intersections are expected to meet applicable mobility targets and operating standards through the year 2035 as required by the City of Wilsonville, Clackamas County, and the Oregon Department of Transportation (ODOT).

[8] *2000 Highway Capacity Manual*, Transportation Research Board, Washington DC, 2000.

Table 4: 2035 P.M. Peak Hour Intersection Operating Conditions

Intersection	Jurisdiction	Operating Standard or Target	PM Peak Hour			Meets Standard or Target?
			Delay	*LOS*	*V/C*	
Signalized						
Elligsen Rd/I-5 SB Ramp	ODOT	0.90 V/C[a]	24.5	C	0.90	Yes
Elligsen Rd/I-5 NB Ramp	ODOT	0.90 V/C[a]	12.8	B	0.70	Yes
Wilsonville Rd/I-5 SB Ramp	ODOT	0.85 V/C	29.6	C	0.83	Yes
Wilsonville Rd/I-5 NB Ramp	ODOT	0.85 V/C	22.6	C	0.60	Yes
Elligsen Rd/Parkway Ave	Wilsonville	LOS D	37.0	D	0.81	Yes
Elligsen Rd/Park Center Dr	Wilsonville	LOS D	34.6	C	0.87	Yes
Boeckman Rd/Canyon Creek Rd	Wilsonville	LOS D	10.9	B	0.66	Yes
Wilsonville Rd/Town Center Loop W	Wilsonville	LOS D	40.5	D	0.83	Yes
Stafford Rd/65th Ave/ Elligsen Rd (Two Traffic Control Options)						
Traffic Signal	Clackamas Co.	LOS D	41.0	D	0.84	Yes
Roundabout (2-Lane)	Clackamas Co.	LOS D	15.9	C	0.79	Yes

Signalized Intersections:	Two-Way Stop Intersections:
Delay = Average Stopped Delay per Vehicle (sec) LOS = Level of Service of Intersection V/C = Volume-to-Capacity Ratio of Intersection	Delay = Average Stopped Delay per Vehicle (sec) at Worst Movement (typically a minor movement) LOS = Level of Service of Major Street/Minor Street V/C = Volume-to-Capacity Ratio of Worst Movement

[a] The typical ODOT mobility target for interchange ramps is a 0.85 v/c ratio. However, when the interchange vicinity is fully developed and adequate storage is available on the interchange ramp to prevent queues from backing up on the mainline, then the target can be increased to a 0.90 v/c ratio.

Analysis conducted as part of the Future Transportation Analysis memorandum at the Elligsen Road/I-5 interchange ramps found that queuing was not to be an issue.[9] Since the current traffic volumes have been reduced, as the number of households and retail has been reduced, queuing is still not expected to be an issue.

[9] *Frog Pond Area Plan – Future Transportation Analysis*, DKS Associates, September 24, 2014.

Appendix E. Infrastructure Analysis

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MSA
Murray, Smith & Associates, Inc.
Engineers/Planners

121 S.W. Salmon, Suite 900 ■ Portland, Oregon 97204-2919 ■ PHONE 503.225.9010 ■ FAX 503.225.9022

TECHNICAL MEMORANDUM

DATE: October 7, 2015

PROJECT: 14-1553.700

TO: Joe Dills, Angelo Planning Group

FROM: Mathew L. Hickey, P.E.
Murray, Smith & Associates, Inc.

REGISTERED PROFESSIONAL ENGINEER
19195
Matthew L Hickey
OREGON
JULY 15, 1997
MATTHEW L. HICKEY
RENEWS 6-30-17

RE: Frog Pond Area Plan – Concept Plan Infrastructure Analysis (Task 7)

Introduction

The Frog Pond Area Plan, led by the City of Wilsonville, will establish a vision for the 500-acre Frog Pond area, define expectations for the type of community it will be in the future, and recommend implementation steps. The adopted vision statement for the plan is: "The Frog Pond Area in 2035 is an integral part of the Wilsonville community, with attractive and connected neighborhoods. The community's hallmarks are the variety of quality homes; open spaces for gathering; nearby services, shops and restaurants; excellent schools; and vibrant parks and trails. The Frog Pond Area is a convenient bike, walk, drive, or bus trip to all parts of Wilsonville."

Executive Summary

The purpose of this memorandum is to evaluate major public utility infrastructure and framework improvements and their associated costs to serve future development in the Frog Pond Area. The major and framework infrastructure improvements are limited to domestic water, sanitary sewer and storm drainage.

- Major infrastructure improvements are generally defined as those necessary to support the Frog Pond Area in addition to areas outside the project area. This includes upgrades to existing infrastructure within the City and oversizing of new infrastructure to serve areas beyond the Frog Pond Area. Projects which contain oversized infrastructure are eligible for System Development Charge (SDC) credits from developers who construct them. For both water and sewer collection piping, oversizing is considered for pipe diameters greater than 8 inches in diameter. Stormwater improvements managing runoff from SDC eligible street surfaces are also eligible for stormwater SDC credits. Eligible street surfaces are defined as arterial or collector streets exceeding 48-feet in paved width, or for the portion of a street beyond a 24-foot half street bordered by existing development.

- Framework infrastructure improvements are generally defined as those needed solely to serve the Frog Pond Area and which will be placed within the framework streets shown on Figures 1 through 3. The framework infrastructure excludes minor utility elements to be located within minor neighborhood streets.

The overall estimated planning level costs for providing these services is summarized in Tables 1A and 1B below. Table 1A includes projects needed to serve the Frog Pond Area as reported by Capital Improvement Plans (CIP) contained within the City's Water and Sanitary Sewer Collection System Master Plans. Of the costs reported in Table 1A, Table 1B allocates the costs of each project applicable to the neighborhoods within the Frog Pond Area Plan. Table 1C includes costs for both Major and Framework infrastructure improvements shown on Figures 1 through 3.

Table 1A | CIP Major Infrastructure Project Cost Summary

Utility & CIP Project	Total Cost	Developer Cost	City Cost	Remarks
Water system upgrades: West Side Reservoir	$5.8m	Paid through SDCs[1]	$5.8m	25% of the storage need is attributable to the Frog Pond Area
Collection system upgrades: Boeckman Trunk Sewer	$8.0m		$8.0m	52% of total wastewater flow is attributable to the Frog Pond Area
Collection system upgrades: Memorial Park Pump Station expansion and relocation	$5.2m		$5.2m	48% of total wastewater flow is attributable to the Frog Pond Area
Total Cost	$19.0m		$19.0m	

[1] The full cost of these improvements will be funded by the City. The portion of the demand (and cost) attributable to the Frog Pond Area is included for purposes of managing SDC funds pertaining to growth in the Frog Pond Area, as analyzed in the Funding Analysis memorandum prepared by Leland Consulting Group.

Table 1B | CIP Major Infrastructure Project Cost By Neighborhood

Utility & CIP Project	Pro-rated Cost	Prorated Cost by Neighborhood			
		West	East	South	
				School	Non-School
Water system upgrades: West Side Reservoir	$1.45m	$484,000	$612,000	$22,000	$332,000
Collection system upgrades: Boeckman Trunk Sewer	$4.16m	$1,389,000	$1,757,000	$63,000	$953,000
Collection system upgrades: Memorial Park Pump Station expansion and relocation	$2.50m	$833,000	$1,054,000	$38,000	$572,000
Total Cost	$8.11m	$2,706,000	$3,423,000	$123,000	$1,857,000

Table 1C | Major and Framework Infrastructure Cost Summary

Neighborhood	Utility Service			Total Cost
	Stormwater	Sanitary Sewer	Domestic Water & Fire Protection	
West	$8,660,000	$3,300,000	$5,070,000	$17,030,000
East	$8,290,000	$7,800,000	$6,370,000	$22,460,000
South	$4,310,000	$1,950,000	$1,860,000	$8,120,000
Total Cost	$21,260,000	$13,050,000	$13,300,000	$47,610,000

Smaller residential streets and their associated utilities are not addressed within this analysis. The neighborhood collectors and framework streets are addressed due to a higher degree of confidence in their ultimate location, versus the uncertainty relative to the proposed location of smaller residential streets. The smaller residential streets are anticipated to be configured and paid for by property developers as more site specific plans are created.

Conceptual Plan Infrastructure Analysis

Background

This technical memorandum serves to supplement the overall concept planning effort underway for these development areas, which will address density and mix of uses and housing types, location of schools, parks and natural areas, water quality and ecosystem protection, multimodal transportation, public facilities location and service providers, and a funding plan. The analysis presented in this memorandum is based on information provided by Angelo Planning Group (APG), dated September 22, 2015.

APG, with input from market research conducted by Leland Consulting Group and feedback from City staff and residents, provided estimates of densities for future development. This information was then used to determine anticipated demands for water and design flows for sanitary sewer service, in addition to estimations of impervious area generating stormwater runoff. A summary of this information is provided in the Tables 2A thru 2C below.

Table 2A | Residential Net Acreage by Housing Type

Neighborhood	Large-lot Single Family	Medium-Lot Single Family	Small-lot Single Family	Single Family attached	Totals
West	29.7	47.0	24.5	0.0	101.2
East	22.7	17.6	15.5	25.6	81.4
South	5.2	22.4	26.3	0.0	54.0
Totals	57.6	87.1	66.3	25.6	236.5

Table 2B | Residential Dwelling Unit Density by Housing Type

	Large-lot Single Family		Medium-Lot Single Family		Small-lot Single Family		Single Family attached
Neighborhood	4.4 DU/AC	5.4 DU/AC	6.2 DU/AC	7.3 DU/AC	8.7 DU/AC	10.9 DU/AC	17.4 DU/AC
West	✓		✓		✓		n/a
East		✓		✓		✓	✓
South		✓		✓		✓	✓

Notes: DU = Dwelling Unit AC = Acres

Table 2C | School and Park Net Acreage[2]

Neighborhood	Acres	Students	Teachers
South	40	1,200	105

Utility Infrastructure Improvement Concepts

The anticipated utility infrastructure required to support the proposed land use is presented below. These elements consist of stormwater, sanitary sewer, domestic water and fire flow supply improvements.

[2] 10 acres of the 40 acre site south of Advance Road will be a 10-acre community park owned by the City of Wilsonville.

Stormwater Improvements

The *City of Wilsonville Stormwater Master Plan (March 2012),* prepared by URS, was used as the basis for developing drainage concepts for the project area. The Stormwater Master Plan (SWMP) notes that conveyance systems are sufficient within the proximity of the project area to avoid flooding, and no mention of capital improvements necessary for supporting the development within the project area was made. The SWMP places an emphasis on the benefits of Low Impact Development (LID) approaches to stormwater management, and these techniques were used in developing drainage concepts for the project area. Additional details for managing stormwater through LID methods is presented further in the City's 2014 Public Works Standards.

The City of Wilsonville Stormwater Master Plan provides percentages of impervious areas based on various land use types[3]. A set aside area for stormwater management facilities was then obtained by applying a factor of 7.5 percent for commercial and residential areas, and 10 percent for streets relative to these impervious areas. This factor represents an LID approach to stormwater management, and is a ratio calculated by dividing a facility's surface area by its tributary impervious area. These results are summarized in Table 3. Streets were allocated the maximum allowable ratio of 10 percent by City's Public Work Standards (PWS) of stormwater set aside due to their tributary area comprising essentially all impervious surfaces. The approximate size and location of these commercial, residential and street set aside areas are shown on Figures 1 through 3.

Table 3 | Stormwater Set Aside Acreage for LID Facilities

Neighborhood	Commercial / Institutional / Civic	Framework Streets	Residential	Totals
West	0.07	2.77	6.67	9.51
East	0.37	2.24	6.06	8.67
South	0.00	1.51	3.79	5.30
Totals	0.44	6.52	16.52	23.48

Note: LID facilities placed within right-of-way landscape area could reduce the set aside acreage for Framework Streets.

In the absence of detailed layouts for development within the project area, it is anticipated that individual developers will be responsible for the design, construction and financing of stormwater improvements to meet the City's design criteria. Developers of parcels on low lying elevations would need to provide sufficient conveyance capacity through their property to allow for upstream development to occur. Providing through conveyance capacity in this manner would be in conformance with Oregon drainage law, and would not entitle

[3] Technical Memorandum, March 2012, City of Wilsonville Stormwater Master Plan Update Hydraulic and Hydrologic Modeling, URS Corporation.

developers for compensation from upstream property owners. Utilizing this approach essentially fosters an environment for implementing LID principles by managing drainage close to the origin of runoff.

Due to the presence of riparian corridors, steep slopes and wetlands within the project area, most subbasins are not situated well for a regional stormwater facility; however the southern outfalls for West neighborhood along Boeckman Road (see Figure 1) and areas surrounding the BPA easement in the East neighborhood (see Figure 2) appear to be suitable for these types of facilities. Utilizing a regional facility would allow for more dense development upstream of the facility by reducing set aside areas for stormwater management.

The City has identified two public regional stormwater facilities that will manage runoff from Boeckman Road (see Figure 1) and Stafford Road (see Figure 2). Since these regional stormwater facilities are anticipated to accompany design and construction of the Boeckman Road and Stafford Road Urban Upgrade Projects, their costs are included in the transportation related documentation of the Frog Pond Area Plan. Their costs are excluded from this analysis and their illustration in Figures 1 and 2 is provided for general planning purposes.

Cost of Stormwater Facilities

Stormwater management is anticipated to consist largely of roadside bioswales and detention basins to manage drainage originating from development. Drainage originating from private developments is expected to be managed by collection, treatment and detention systems constructed by the private developer in accordance with the City's Public Works Standards (PWS) and Oregon Drainage Law. Costs for the major and framework stormwater improvements, consisting of stormwater set aside areas and bioswales identified in Figures 1 through 3, are presented in Table 4 below. Costs for stormwater set aside area include property value, in addition to construction. Since bioswales are anticipated to be constructed within Right-of-way, their costs only account for construction and exclude property value.

Table 4 | Major and Framework Stormwater Infrastructure Cost Summary

Neighborhood	Total Cost	Developer Cost	City Cost
West	$8,660,000	$8,520,000	$140,000
East	$8,290,000	$8,080,000	$210,000
South	$4,310,000	$4,310,000	$0
Total Cost	$21,260,000	$20,910,000	$350,000

Existing Stormwater Facilities

An existing regional detention pond[4] exists on the north side of Boeckman Road within the Boeckman Creek corridor. The flow control structure was constructed in 1997 and has been indicated by the City to receive drainage from areas up to Elligsen Road, including the Xerox and Mentor Graphics properties. In the absence of design calculations for sizing the pond, further analysis is recommended to understand if modifications can be made to the existing flow control structure. These alterations may allow the structure to manage stormwater originating from the West neighborhood, and presents an opportunity to increase development density within the project area by eliminating the need for additional flow control facilities.

Sanitary Sewer Improvements

Collection System Master Plan

Murray, Smith and Associates, Inc., (MSA) prepared a Collection System Master Plan (CSMP) for the City of Wilsonville under a separate contract in March 2015. Results from that effort indicate that the existing sewer systems serving the project area (namely the Boeckman trunk sewer and Memorial Park Pump Station) are deficient relative to serving future development within the UGB and URA.

The CSMP work concludes that improvements will be required to the Boeckman trunk sewer, and that relocation and upgrades to the Memorial Park Pump Station (MPPS) downstream of the Boeckman trunk sewer will be a future necessary improvement. This pump station is situated within the flood plains of the Willamette River and Boeckman Creek, making it a potential environmental hazard. Both these improvements are anticipated to be necessary in the next 6 to 10 years, if the urban reserves are added to the UGB. This timeframe is based on the percentage of development occurring within each neighborhood shown in Table 5.

Table 5 | Study Area Development

Timeframe	West Neighborhood	East and South Neighborhoods
0-5 years	40%	0%
6-10 years	95%	25%
11-20-years	100%	100%

The highest priority project for the City as it relates to these improvements is relocation and upgrades to the MPPS. The need for this project will be triggered by development of the Advance Road School and the West neighborhood of the Frog Pond Area. The existing

[4] City of Wilsonville Project No. 92-06-001, Boeckman Creek Flow Control Structure.

MPPS can support approximately 40% of the West neighborhood and both new Middle and Primary Schools before becoming deficient.

The CSMP identifies upgrades to the Boeckman Trunk Sewer as the next major infrastructure priority project to facilitate development of the Frog Pond Area. The existing trunk sewers can serve full build-out of the West neighborhood and Advance Road School. Once development begins to extend into the East or South neighborhoods, upgrades to this trunk sewer will be required.

Frog Pond Area Improvements

For the Frog Pond Area, the design for sanitary sewers is governed by inflow and infiltration, the natural topography and City standards for minimum pipe slopes and pipe sizes. Table 6 below summarizes the peak wastewater flows that are estimated to result from the proposed land use. The Average Peak Daily Flow (APDF) is used to size sewer pipes and is calculated by including Average Dry Weather Flows (ADWF) multiplied by a peaking factor of two, plus contributions from Rainfall Derived Inflow and Infiltration (RDII) at 1,800 gallons per acre per day. These two assumptions for ADF and PDF are consistent with the values being utilized by the current CSMP under development with the City.

Table 6 | Sanitary Sewer Flow Summary

Neighborhood	Average Peak Daily Flow (APDF), GPM
West	308
East	343
South	209
Totals	859

The sewer flow rates presented in Table 6 were used to size the sanitary sewer pipe diameters shown in Figures 1 through 3. A minimum pipe diameter of 8 inches was selected in accordance with PWS. Another key consideration in determining the pipe diameter was the need to achieve service to remote areas at or near minimum pipe slopes, while still maintaining the minimum flow velocities that typically prevent sediment deposition.

Sewer improvements assume the lowest elevation served will be range between approximately 217 and 220 feet while maintaining the required minimum 5 feet of pipe cover. This elevation appears to balance serving the majority of the area by gravity while avoiding pipe depths greater than approximately 18 feet. In the East Neighborhood, properties north of Newland Creek are anticipated to require pump stations for service, as will those properties with an elevation below 220’ and east of SW 60th Avenue. In the South Neighborhood, properties south of the school and east of SW 60th Avenue with elevations below 217’ are anticipated to require pump stations for service.

Cost of Sewer Collection Facilities

Costs presented in Table 7 below reflect sanitary sewer infrastructure necessary for the Frog Pond Area. These costs include all collections system piping, manholes, pump stations and force mains shown on Figures 1 through 3. The costs for sanitary sewer infrastructure include assumptions that: sewers do not exceed 18 feet depth; manholes are provided on average every 400 feet and at all street intersections; and rock is not encountered and trenches can be excavated using conventional methods. Sewer piping exceeding the minimum required 8-inch diameter are considered oversized, and their costs above the minimum standard included in the “City (SDC) Share” column.

Table 7 | Major and Framework Sanitary Sewer Infrastructure Cost Summary

Neighborhood	Total Cost	Developer Cost	City Cost
West	$3,300,000	$3,100,000	$200,000
East	$7,800,000	$7,670,000	$130,000
South	$1,950,000	$1,915,000	$35,000
Total Cost	$13,050,000	$12,685,000	$365,000

Domestic Water and Fire Service Improvements

The *City of Wilsonville Water System Master Plan* (September 2012) prepared by Keller Associates, Inc., provides the basis for domestic water and fire system planning within the proposed development areas. This master plan was developed with a study boundary that encapsulated the project area and provides recommendations for infrastructure improvements as follows:

- Distribution System – A looped system consisting of 12-inch distribution mains are proposed to surround the expansion area. The Water System Master Plan did not account for natural topography or areas unsuitable for development when determining the recommended piping alignments. Figures 1 through 3 at the end of this memorandum shows alignments that account for these factors. Key points of connection with the existing water system are shown to be made to piping in Boeckman Road and Canyon Creek Road. Additional connections to the existing system crossing Boeckman Creek and Meridian Creek are also indicated. These crossing are assumed to be below grade directionally drilled pipelines, however they may be installed on future pedestrian bridges under consideration by the City.

  The Water System Master Plan notes that once the water treatment plant begins to exceed production of 12.5 million-gallons-per-day (MGD), the transmission and distribution system is at risk for sudden pressure surges resulting from sudden stops in flow (i.e. power failures). Development of the project area, in addition to the increased demand from Sherwood would appear to create peak hour flows exceeding 12.5 MGD. The master plan notes that a 750-cubic foot capacity hydropneumatic tank is recommended to mitigate the potential damage from a sudden pressure surge on the transmission system. While no cost was provided for the tank, these systems may cost $0.5 million.

- Storage – The Water System Master Plan indicates that there is a city-wide storage need of 0.30 million gallons (MG) started in 2010, and will increase to 8.97 MG in 2030. This storage need is currently not a critical issue since any storage deficiencies are met through supplemental supply provided by the City's eight backup wells.

  Full build-out of the project area is anticipated to increase the 2010 storage need by an additional 1.5 MG. The proposed 3.0 MG West Side Tank and 24-inch Transmission Main Project (ID#125) identified in the master plan at the intersection of Tooze and Baker Road would provide sufficient storage to accommodate the build-out need of the project area based on the Water System Master Plan. The West Side Tank project was indicated to cost nearly $5.8 million and be needed by the year 2017. The City identified that 25% of this project cost is attributable to development within the Frog Pond Area.

The Frog Pond UGB area and URA reside within the City of Wilsonville Pressure Zone 'B'. This zone is characterized at having a hydraulic grade of 400 feet and service elevation range of 100 to 285 feet, Mean Sea Level (MSL). Since the topography of the project area ranges between 200 and 250 feet, domestic service could be anticipated to be supplied with pressures ranging from 80 to 105 pounds per square inch (psi). Installation of individual pressure reducing valves on services over 80 psi are recommended to reduce working pressures within the range of most household appliances.

Since the fire flow rates typically exceed the domestic demand by eight to ten times, water main diameters are minimally influenced by proposed land uses. Domestic water and fire service design is primarily influenced by the City's PWS requirements for fire flow. The City's PWS stipulate that minimum fire flow shall be 1,500 gallons per minute (gpm) with a residual pressure of 20 pounds per square inch (psi) for single family residential areas. All other areas shall be provided with fire flows of 3,000 gpm at 20 psi. These fire flow rates are significantly higher than the anticipated maximum daily domestic water demands for the area, as summarized in Table 8.

Table 8 | Domestic Water Demand

Neighborhood	Average Day Demand (ADD), gpm	Maximum Day Demand (MDD), gpm[5]
West	111	271
East	160	383
South	88	311
Totals	359	956

Notes: ADD = Average Day Demand MDD = Maximum Day Demand

Fire flow requirements are the main factor in the pipe sizing as shown in Figures 1 through 3. Additionally, analysis considered maintaining flow velocities below 10 feet per second during concurrent maximum day demand and fire demand. Although the peak water demands plus fire flows in certain portions of the Frog Pond Area could be served by piping less than 8-inch in diameter, the PWS requirement for an 8-inch minimum waterline size dictates their use.

It is recommended that the City conduct hydraulic modeling for confirmation of the sizing for the piping system. Modeling will determine if the pipe sizing of the looped system is adequate to serve future Urban Growth Reserve areas, such as the Elligsen reserve to the north of the Frog Pond Area's West Neighborhood. Updated modeling may also refine the timing for the West Side Tank project identified by the WSMP by reflecting actual development that has actually occurred throughout the City since the issuance of the document.

Cost of Water and Fire Protection Facilities

The costs for domestic water and fire infrastructure include an assumption that fire hydrants are provided on average every 400 feet and at all street intersections. Developers would be responsible for providing water mains of 8-inch minimum diameter for their projects, and would be eligible for SDC credits for installation of mains with greater diameters. Costs for water system improvements are summarized in Table 9 below.

Table 9 | Major and Framework Domestic Water and Fire Infrastructure Cost Summary

Neighborhood	Total Cost	Developer Cost	City Cost
West	$5,070,000	$4,610,000	$460,000
East	$6,370,000	$5,540,000	$830,000
South	$1,860,000	$1,530,000	$330,000
Total Cost	$13,300,000	$11,680,000	$1,620,000

[5] Maximum Day Demands are calculated using Table ES.1 – Water Demands by User Type, of the City of Wilsonville Water System Master Plan, September 12, 2012.

Cost Estimates for Infrastructure

The costs provided within this memorandum are considered a Feasibility Level or Class 4 estimate as defined by the American Association of Cost Engineering (AACE) and are considered accurate to +50 percent to –30 percent. Cost estimates are inclusive of direct construction costs in addition to a construction contingency, engineering, legal and anticipated City administrative expenses. Cost factors applied within this analysis are presented in Figure 4.

All costs assume new construction. Costs for erosion control, traffic control, and pavement surface restoration are omitted from this documentation, as they would be duplicated under the transportation costs associated with street construction. Rock excavation costs are also omitted from presented project costs. Based on City observation, rock is typically not encountered at the proposed infrastructure depths within the project area. Detailed cost estimate information is provided in *Appendix A*.

Note about Datums

All elevations reported in this report are on the 1988 North American Vertical Datum (NAVD88). Another relevant datum is the 1929 National Geodetic Vertical Datum (NGVD29), used by the City of Wilsonville GIS system. Subtract 3.56-feet from the elevations in this report to achieve equivalent elevations in the NGVD29 datum. The Water System Master Plan makes reference to MSL. The relationship of MSL to NAVD88 requires calibration from tide models which is outside the scope of this document; however MSL can be fairly closely approximated to NGVD29.

Summary

This memorandum evaluates the major infrastructure and framework utility needs for the Frog Pond Area. The water demands and sewer and storm drainage design flows were estimated and the facilities sized based on the proposed land use. The overall costs for providing these services is summarized in Tables 10A thru 10C, and illustrated in Figures 1 through 3.

Table 10A | CIP Major Infrastructure Project Costs

Utility & CIP Project	Total Cost	Developer Cost	City Cost	Remarks
Water system upgrades: West Side Reservoir	$5.8m	Paid through SDCs[6]	$5.8m	25% of the storage need is attributable to the Frog Pond Area
Collection system upgrades: Boeckman Trunk Sewer	$8.0m		$8.0m	52% of total wastewater flow is attributable to the Frog Pond Area
Collection system upgrades: Memorial Park Pump Station expansion and relocation	$5.2m		$5.2m	48% of total wastewater flow is attributable to the Frog Pond Area
Total Cost	$19.0m		$19.0m	

Table 10B | CIP Major Infrastructure Project Cost By Neighborhood

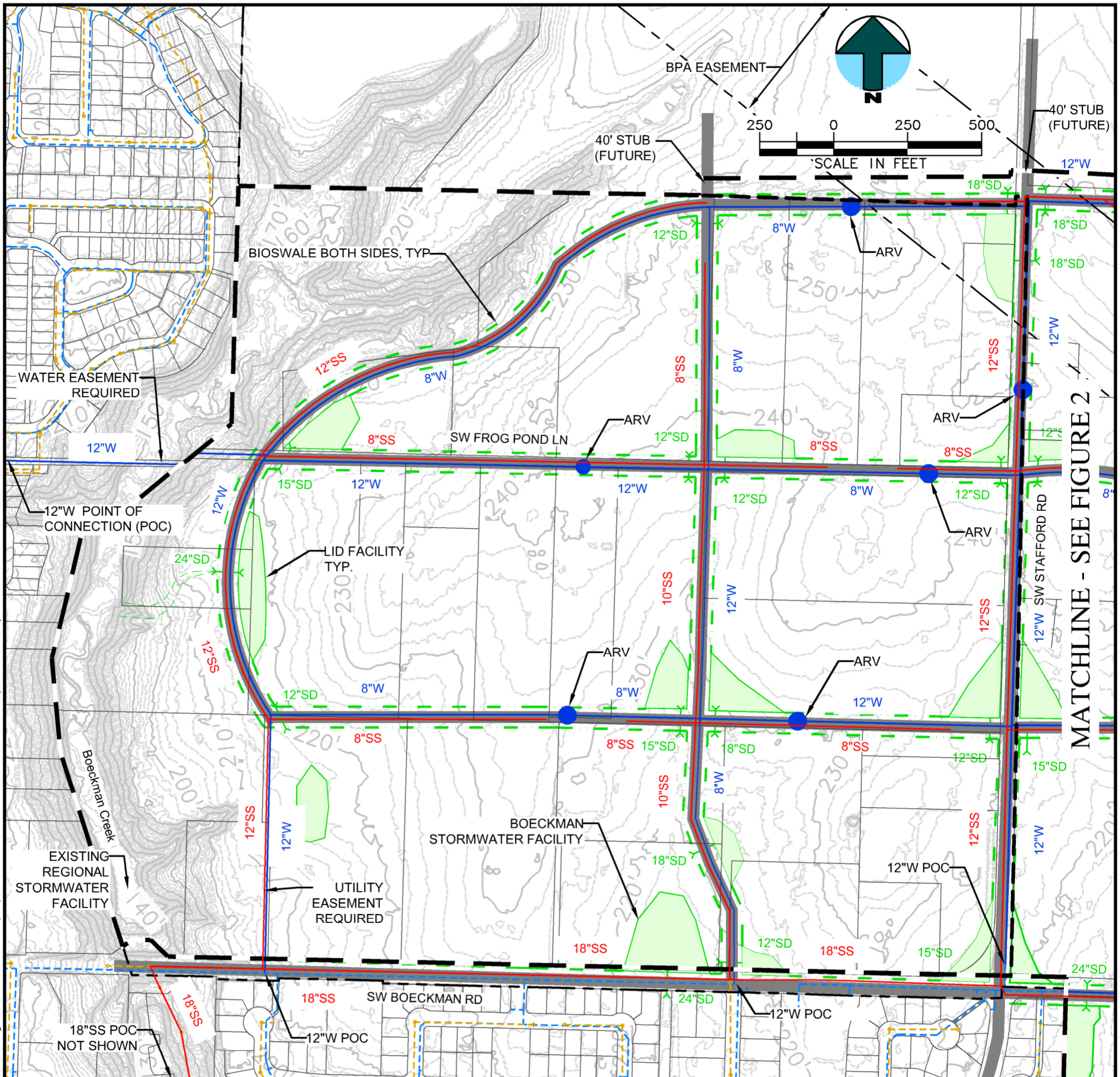
Utility & CIP Project	Pro-rated Cost	Prorated Cost by Neighborhood			
		West	East	South	
				School	Non-School
Water system upgrades: West Side Reservoir	$1.45m	$484,000	$612,000	$22,000	$332,000
Collection system upgrades: Boeckman Trunk Sewer	$4.16m	$1,389,000	$1,757,000	$63,000	$953,000
Collection system upgrades: Memorial Park Pump Station expansion and relocation	$2.50m	$833,000	$1,054,000	$38,000	$572,000
Total Cost	$8.11m	$2,706,000	$3,423,000	$123,000	$1,857,000

Table 10C | Major and Framework Infrastructure Cost Summary

Neighborhood	Utility Service			Totals
	Stormwater	Sanitary Sewer	Domestic Water & Fire Protection	
West	$8,660,000	$3,300,000	$5,070,000	$17,030,000
East	$8,290,000	$7,800,000	$6,370,000	$22,460,000
South	$4,310,000	$1,950,000	$1,860,000	$8,120,000
Totals	$21,260,000	$13,050,000	$13,300,000	$47,610,000

MLH:njm

[6] The full cost of this improvement will be funded through SDC revenue by the city. The portion of the demand (and cost) attributable to the Frog Pond Area is included for purposes of managing SDC funds pertaining to growth in the Frog Pond Area, as analyzed in the Funding Analysis memorandum prepared by Leland Consulting Group.



LEGEND

- FROG POND AREA BOUNDARY
- WASTEWATER PIPE - NEW
- WASTEWATER FORCE MAIN - NEW
- WASTEWATER PUMP STATION - NEW
- WASTEWATER PIPE - EXISTING
- STORM CULVERT - NEW
- STORM LID FACILITY - NEW
- STORM PIPE - EXISTING
- STORM BIOSWALE - NEW
- WATER PIPE - NEW
- WATER AIR RELIEF VALVE (ARV) - NEW
- WATER PIPE - EXISTING
- CITY LIMITS
- URBAN GROWTH BOUNDARY (UGB)
- NEW STREET

FIGURE 1

City of WILSONVILLE in OREGON

Frog Pond Area Plan
Composite Utility Plan

CONCEPT PLAN - INFRASTRUCTURE FRAMEWORK PLANS - WEST NEIGHBORHOOD

MSA
Murray, Smith & Associates, Inc.
Engineers/Planners
Portland, Oregon

October 2015
14-1553.700

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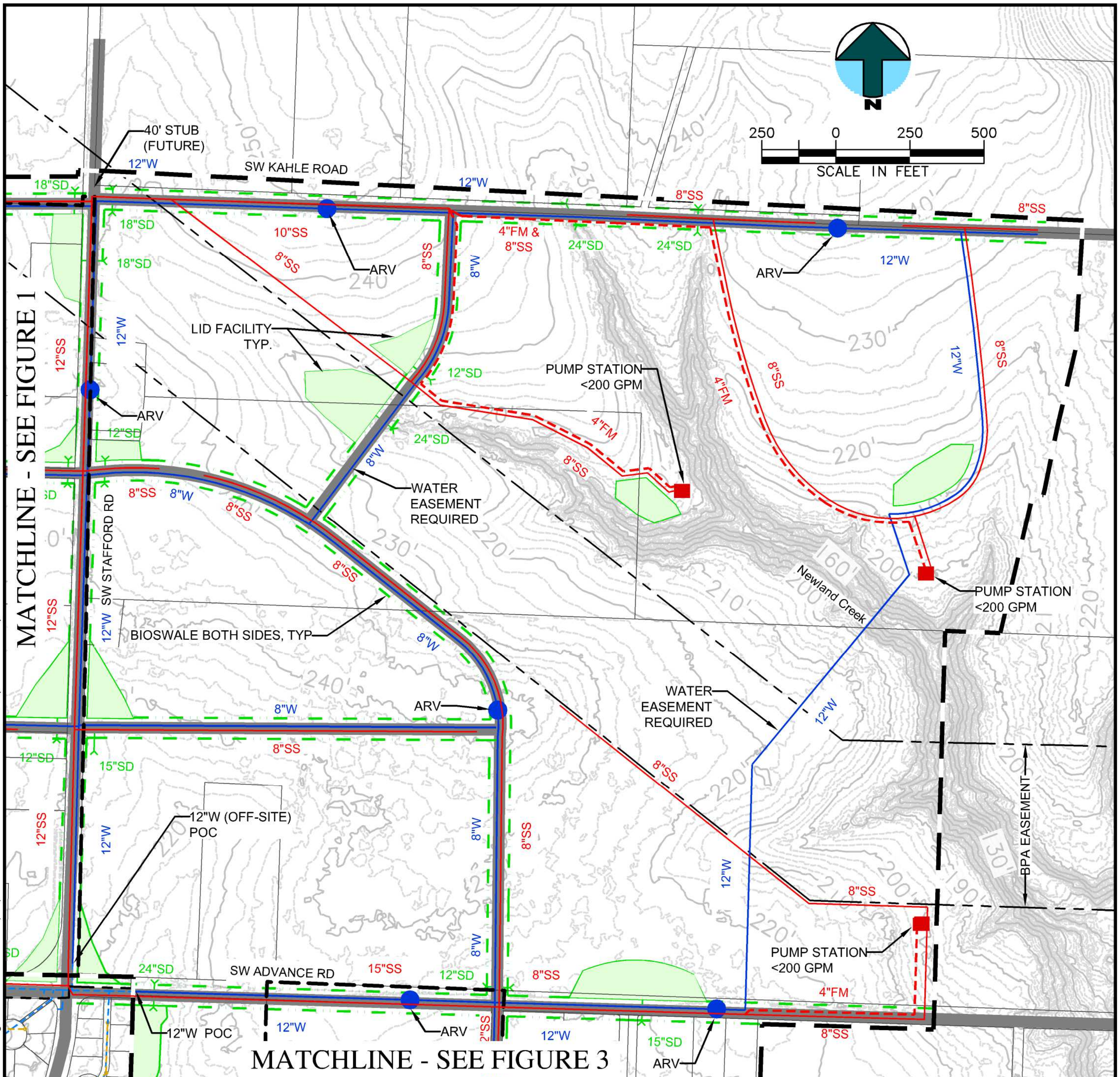


LEGEND

- FROG POND AREA BOUNDARY
- WASTEWATER PIPE - NEW
- WASTEWATER FORCE MAIN - NEW
- WASTEWATER PUMP STATION - NEW
- WASTEWATER PIPE - EXISTING
- STORM CULVERT - NEW
- STORM LID FACILITY - NEW
- STORM PIPE - EXISTING
- STORM BIOSWALE - NEW
- WATER PIPE - NEW
- WATER AIR RELIEF VALVE (ARV) - NEW
- WATER PIPE - EXISTING
- CITY LIMITS
- URBAN GROWTH BOUNDARY (UGB)
- NEW STREET

FIGURE 2

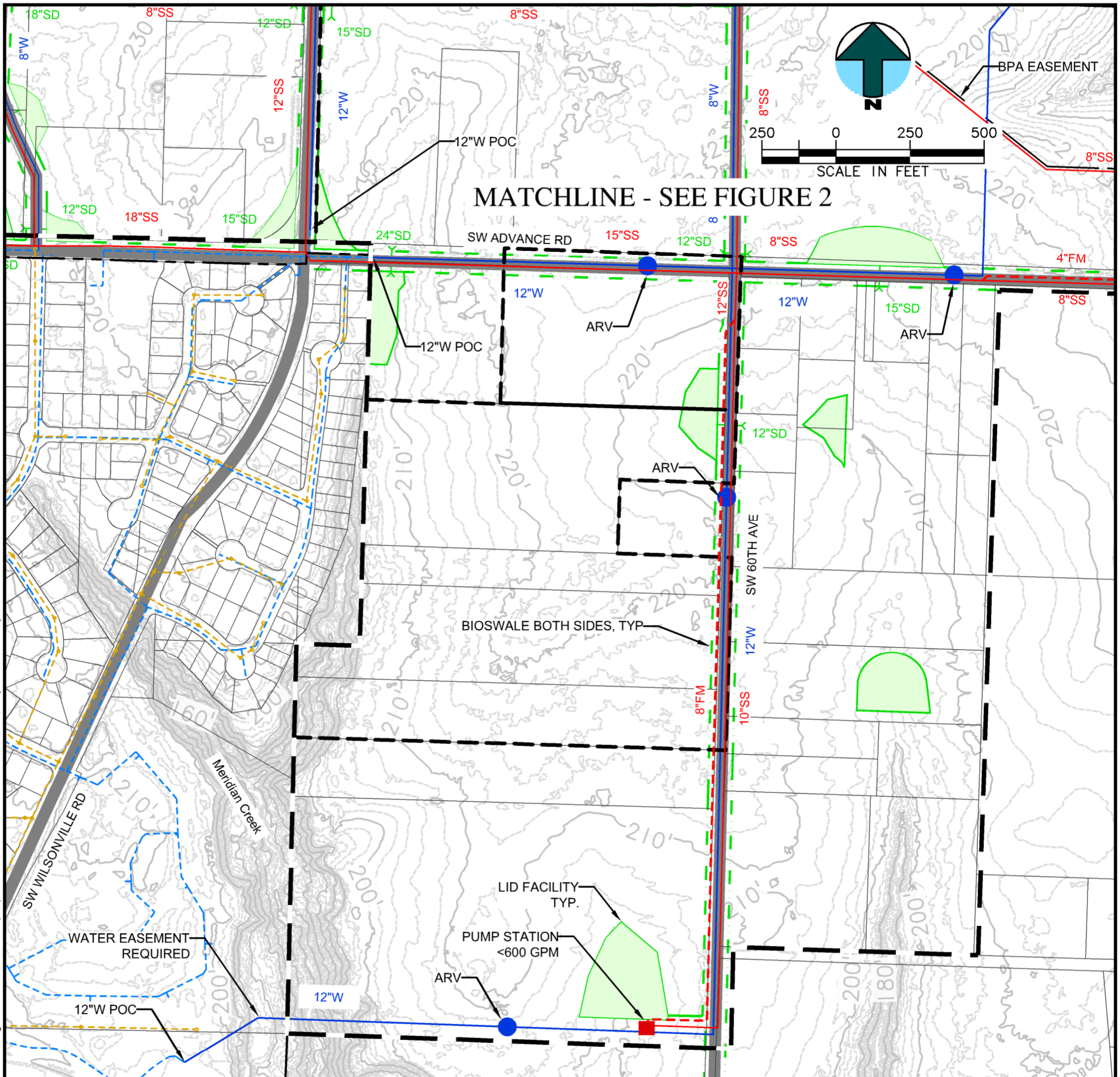
City of WILSONVILLE in OREGON

Frog Pond Area Plan
Composite Utility Plan

CONCEPT PLAN - INFRASTRUCTURE FRAMEWORK PLANS - EAST NEIGHBORHOOD

MSA
Murray, Smith & Associates, Inc.
Engineers/Planners
Portland, Oregon

October 2015
14-1553.700



LEGEND

- FROG POND AREA BOUNDARY
- WASTEWATER PIPE - NEW
- WASTEWATER FORCE MAIN - NEW
- WASTEWATER PUMP STATION - NEW
- WASTEWATER PIPE - EXISTING
- STORM CULVERT - NEW
- STORM LID FACILITY - NEW
- STORM PIPE - EXISTING
- STORM BIOSWALE - NEW
- WATER PIPE - NEW
- WATER AIR RELIEF VALVE (ARV) - NEW
- WATER PIPE - EXISTING
- CITY LIMITS
- URBAN GROWTH BOUNDARY (UGB)
- NEW STREET

FIGURE 3

City of WILSONVILLE in OREGON

Frog Pond Area Plan
Composite Utility Plan

CONCEPT PLAN -
INFRASTRUCTURE FRAMEWORK
PLANS - SOUTH NEIGHBORHOOD

MSA
Murray, Smith & Associates, Inc.
Engineers/Planners
Portland, Oregon

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14-1553.700

G:\PDX_Projects\14\1553\CAD\Figures\14-1553-OR-PREFER-PLAN.dwg FIGURE 3 10/6/2015 1:06 PM NJM 20.0s (LMS Tech)

APPENDIX A – COST ESTIMATES

Cost Summary

	Sewer			Water			Storm		
Neighborhood	Piping	MPPS Exansion	Boeckman Upgrades	Piping	Westside Reservoir	Hydropnuematic Tank	Improvemetns	Totals	
West	$ 3,220,000	SDC's	SDC's	$ 4,720,000	SDC's	SDC's	$ 8,660,000	$ 11,200,000	
East	$ 7,650,000	SDC's	SDC's	$ 5,890,000	SDC's	SDC's	$ 8,290,000	$ 17,250,000	
South	$ 1,930,000	SDC's	SDC's	$ 1,710,000	SDC's	SDC's	$ 4,310,000	$ 4,960,000	
Totals	$ 12,800,000	$ 5,130,000	$ 7,510,000	$ 12,320,000	$ 5,800,000	$ 500,000	$ 21,260,000	$ 52,350,000	
Developer Cost	$ 12,685,000	SDC's	SDC's	$ 11,680,000	SDC's	SDC's	$ 20,910,000	$ 45,275,000	+ SDC's
City (SDC) Share	$ 115,000	$ 5,130,000	$ 7,510,000	$ 640,000	$ 5,800,000	$ 500,000	$ 350,000	$ 22,005,000	

	Sewer - Framework			Water - Framework			Storm - Framework	
Neighborhood	Piping			Piping			Infrastructure	Totals
West	$ 3,220,000			$ 4,720,000			$ 8,660,000	$ 16,600,000
East	$ 7,650,000			$ 5,890,000			$ 8,290,000	$ 21,830,000
South	$ 1,930,000			$ 1,710,000			$ 4,310,000	$ 7,950,000
Totals	$ 12,800,000			$ 12,320,000			$ 21,260,000	$ 46,380,000

Unit Cost Assumptions

Sewer		
8" Dia. Main, LF	$	85
10" Dia. Main, LF	$	90
12" Dia. Main, LF	$	95
15" Dia. Main, LF	$	100
18" Dia. Main, LF	$	110
Manhole	$	8,000
4" Dia. ForceMain, LI	$	50
8" Dia. ForceMain, LI	$	55
Overhead Factor		1.0

Water		
8" Dia. Main, LF	$	150
12" Dia. Main, LF	$	180
Hydrant	$	3,500
Air Release Valve	$	3,500
POC	$	5,000
Overhead Factor		1.0

Storm			
Swale, LF	$	25	
Setaside, AC	$	376,360	
Property Cost, AC	$	261,360	($6 / s.f.)
Improvements, AC	$	115,000	
Culvert, LF	$	75	
Overhead Factor		1.0	

Sewer Collection System

West Neighborhood

Pipe Segment	Sewer Diameter (in)	Sewer Length (ft)	Sewer Main Cost	Manholes	Manhole Cost	Forcemain (ft)	Forcemain Cost	Pump Station Cost	Total Cost	Overhead Factor	Subtotal	Rounded Cost	Developer Cost	City Cost
40	12	1,226	$ 116,470	4	$ 32,000				$ 148,470	$ 148,470	$ 296,940	$ 300,000	$ 290,000	$ 10,000
41	12	2,737	$ 260,015	7	$ 56,000				$ 316,015	$ 316,015	$ 632,030	$ 640,000	$ 600,000	$ 40,000
42	18	2,492	$ 274,120	7	$ 56,000				$ 330,120	$ 330,120	$ 660,240	$ 670,000	$ 560,000	$ 110,000
43	10	1,762	$ 158,580	5	$ 40,000				$ 198,580	$ 198,580	$ 397,160	$ 400,000	$ 400,000	$ -
44	8	1,096	$ 93,160	3	$ 24,000				$ 117,160	$ 117,160	$ 234,320	$ 240,000	$ 250,000	$ (10,000)
45	8	1,100	$ 93,500	3	$ 24,000				$ 117,500	$ 117,500	$ 235,000	$ 240,000	$ 250,000	$ (10,000)
46	8	401	$ 34,085	2	$ 16,000				$ 50,085	$ 50,085	$ 100,170	$ 110,000	$ 110,000	$ -
47	8	389	$ 33,065	1	$ 8,000				$ 41,065	$ 41,065	$ 82,130	$ 90,000	$ 90,000	$ -
48	8	1,492	$ 126,820	4	$ 32,000				$ 158,820	$ 158,820	$ 317,640	$ 320,000	$ 330,000	$ (10,000)
49	8	938	$ 79,730	3	$ 24,000				$ 103,730	$ 103,730	$ 207,460	$ 210,000	$ 220,000	$ (10,000)
	Totals	13,633	$ 1,269,545	39	$ 312,000				$ 1,581,545	$ -	$ -	$ 3,220,000	$ 3,100,000	$ 120,000

Sewer Collection System - Continued

East Neighborhood

Pipe Segment	Sewer Diameter (in)	Sewer Length (ft)	Sewer Main Cost	Manholes	Manhole Cost	Forcemain (ft)	Forcemain Cost	Pump Station Cost	Total Cost	Overhead Factor	Subtotal	Rounded Cost	Developer Cost	City Cost
51	12	2,664	$ 253,080	7	$ 56,000				$ 309,080	$ 309,080	$ 618,160	$ 620,000	$ 590,000	$ 30,000
52	8	1,423	$ 120,955	4	$ 32,000				$ 152,955	$ 152,955	$ 305,910	$ 310,000	$ 320,000	$ (10,000)
53	8	2,600	$ 221,000	7	$ 56,000				$ 277,000	$ 277,000	$ 554,000	$ 560,000	$ 580,000	$ (20,000)
54	10	1,500	$ 135,000	4	$ 32,000				$ 167,000	$ 167,000	$ 334,000	$ 340,000	$ 330,000	$ 10,000
55	15	1,450	$ 145,000	4	$ 32,000				$ 177,000	$ 177,000	$ 354,000	$ 360,000	$ 330,000	$ 30,000
56	10	1,200	$ 108,000	3	$ 24,000				$ 132,000	$ 132,000	$ 264,000	$ 270,000	$ 260,000	$ 10,000
62	8	3,554	$ 302,090	9	$ 72,000				$ 374,090	$ 374,090	$ 748,180	$ 750,000	$ 780,000	$ (30,000)
63	8	2,635	$ 223,975	7	$ 56,000				$ 279,975	$ 279,975	$ 559,950	$ 560,000	$ 580,000	$ (20,000)
64	8	1,814	$ 154,190	5	$ 40,000				$ 194,190	$ 194,190	$ 388,380	$ 390,000	$ 410,000	$ (20,000)
65	4		$ -	0	$ -	900	$ 45,000	$500,000	$ 545,000	$ 545,000	$ 1,090,000	$ 1,090,000	$ 1,090,000	$ -
66	4		$ -	0	$ -	2,400	$ 120,000	$500,000	$ 620,000	$ 620,000	$ 1,240,000	$ 1,240,000	$ 1,240,000	$ -
67	4		$ -	0	$ -	1,600	$ 80,000	$500,000	$ 580,000	$ 580,000	$ 1,160,000	$ 1,160,000	$ 1,160,000	$ -
	Totals	18,840	$ 1,663,290	50	$ 400,000				$ 3,808,290	$ 3,808,290	$ 7,616,580	$ 7,650,000	$ 7,670,000	$ (20,000)

South Neighborhood

Pipe Segment	Sewer Diameter (in)	Sewer Length (ft)	Sewer Main Cost	Manholes	Manhole Cost	Forcemain (ft)	Forcemain Cost	Pump Station Cost	Total Cost	Overhead Factor	Subtotal	Rounded Cost	Developer Cost	City Cost
60	12	160	$ 15,200	1	$ 8,000				$ 23,200	$ 23,200	$ 46,400	$ 50,000	$ 45,000	$ 5,000
61	10	2650	$ 238,500	7	$ 56,000				$ 294,500	$ 294,500	$ 589,000	$ 590,000	$ 580,000	$ 10,000
70	8		$ -	0	$ -	2600	$ 143,000	$ 500,000	$ 643,000	$ 643,000	$ 1,286,000	$ 1,290,000	$ 1,290,000	$ -
	Totals	2,810	$ 253,700	8	$ 64,000				$ 960,700	$ 960,700	$ 1,921,400	$ 1,930,000	$ 1,915,000	$ 15,000

Water

West Neighborhood

Pipe Segment	Water Main Dia (in)	Water Main Length (ft)	Water Main Cost	Hydrants	Hydrant Cost	ARV's	ARV Cost	POC Cost	Total Cost	Overhead Factor	Subtotal	Rounded Cost	Developer Cost	City Cost
1	12	2733	$ 491,940	7	$ 24,500	0	$ -	$ 10,000	$ 526,440	$ 526,440	$ 1,052,880	$ 1,060,000	$ 950,000	$ 110,000
2	12	2344	$ 421,920	6	$ 21,000	1	$ 3,500		$ 446,420	$ 446,420	$ 892,840	$ 900,000	$ 800,000	$ 100,000
3	12	1051	$ 189,180	3	$ 10,500	1	$ 3,500		$ 203,180	$ 203,180	$ 406,360	$ 410,000	$ 370,000	$ 40,000
4	8	923	$ 138,450	3	$ 10,500	0	$ -	$ 5,000	$ 153,950	$ 153,950	$ 307,900	$ 310,000	$ 330,000	$ (20,000)
5	8	1449	$ 217,350	4	$ 14,000	1	$ 3,500		$ 234,850	$ 234,850	$ 469,700	$ 470,000	$ 500,000	$ (30,000)
6	8	1051	$ 157,650	3	$ 10,500	1	$ 3,500		$ 171,650	$ 171,650	$ 343,300	$ 350,000	$ 370,000	$ (20,000)
7	8	884	$ 132,600	3	$ 10,500	0	$ -		$ 143,100	$ 143,100	$ 286,200	$ 290,000	$ 310,000	$ (20,000)
8	8	2865	$ 429,750	8	$ 28,000	1	$ 3,500		$ 461,250	$ 461,250	$ 922,500	$ 930,000	$ 980,000	$ (50,000)
	Totals	13,300	$ 2,178,840	37	$ 185,000	5	$ 25,000	$ 10,000	$ 2,388,840	$ 2,340,840	$ 4,681,680	$ 4,720,000	$ 4,610,000	$ 110,000

East Neighborhood

Pipe Segment	Water Main Dia (in)	Water Main Length (ft)	Water Main Cost	Hydrants	Hydrant Cost	ARV's	ARV Cost	POC Cost	Total Cost	Overhead Factor	Subtotal	Rounded Cost	Developer Cost	City Cost
10	12	2575	$ 463,500	7	$ 24,500	1	$ 3,500		$ 491,500	$ 491,500	$ 983,000	$ 990,000	$ 880,000	$ 110,000
11	12	2919	$ 525,420	8	$ 28,000	2	$ 7,000		$ 560,420	$ 560,420	$ 1,120,840	$ 1,130,000	$ 1,010,000	$ 120,000
12	12	3234	$ 582,120	9	$ 31,500	0	$ -		$ 613,620	$ 613,620	$ 1,227,240	$ 1,230,000	$ 1,100,000	$ 130,000
13	12	2069	$ 372,420	6	$ 21,000	2	$ 7,000	$ 5,000	$ 405,420	$ 405,420	$ 810,840	$ 820,000	$ 730,000	$ 90,000
14	8	926	$ 138,900	3	$ 10,500	0	$ -		$ 149,400	$ 149,400	$ 298,800	$ 300,000	$ 320,000	$ (20,000)
15	8	1408	$ 211,200	4	$ 14,000	0	$ -		$ 225,200	$ 225,200	$ 450,400	$ 460,000	$ 480,000	$ (20,000)
16	8	1753	$ 262,950	5	$ 17,500	1	$ 3,500		$ 283,950	$ 283,950	$ 567,900	$ 570,000	$ 610,000	$ (40,000)
17	8	1200	$ 180,000	3	$ 10,500	0	$ -		$ 190,500	$ 190,500	$ 381,000	$ 390,000	$ 410,000	$ (20,000)
	Totals	16,084	$ 2,736,510	45	$ 157,500	6	$ 21,000	$ 5,000	$ 2,920,010	$ 2,920,010	$ 5,840,020	$ 5,890,000	$ 5,540,000	$ 350,000

South Nbrhd.

Pipe Segment	Water Main Dia (in)	Water Main Length (ft)	Water Main Cost	Hydrants	Hydrant Cost	ARV's	ARV Cost	POC Cost	Total Cost	Overhead Factor	Subtotal	Rounded Cost	Developer Cost	City Cost
30	12	2583	$ 464,940	7	$ 24,500	1	$ 3,500		$ 492,940	$ 492,940	$ 985,880	$ 990,000	$ 890,000	$ 100,000
31	12	1831	$ 329,580	5	$ 17,500	1	$ 3,500	$ 5,000	$ 355,580	$ 355,580	$ 711,160	$ 720,000	$ 640,000	$ 80,000
	Totals	4,414	$ 794,520	12	$ 42,000	2	$ 7,000	$ 5,000	$ 848,520	$ 848,520	$ 1,697,040	$ 1,710,000	$ 1,530,000	$ 180,000

Storm

West Neighborhood

Pipe Segment	Road Length (ft)	Swale Length (ft)	Swale Cost	Culvert (ft)	Culvert Cost	Set Aside Area (AC)	Set Aside Cost	Total Cost	Overhead Factor	Subtotal	Rounded Cost	Developer Cost	City Cost
1	2,970	2,970	$ 74,250	50	$ 3,750	1.84	$ 691,237	$ 769,237	$ 769,237	$ 1,538,475	$ 1,540,000	$ 1,400,000	$ 140,000
2	2,967	5934	$ 148,350	100	$ 7,500	0.30	$ 112,390	$ 268,240	$ 268,240	$ 536,479	$ 540,000	$ 540,000	$ -
3	2,494	4988	$ 124,700	200	$ 15,000	1.98	$ 746,560	$ 886,260	$ 886,260	$ 1,772,519	$ 1,780,000	$ 1,780,000	$ -
4	2,546	5092	$ 127,300	200	$ 15,000	0.50	$ 187,705	$ 330,005	$ 330,005	$ 660,010	$ 670,000	$ 670,000	$ -
5	3,794	7588	$ 189,700	100	$ 7,500	1.38	$ 518,273	$ 715,473	$ 715,473	$ 1,430,945	$ 1,440,000	$ 1,440,000	$ -
Addtl Pvt SW Setasides		0	$ -		$ -	3.57	$ 1,343,605	$ 1,343,605	$ 1,343,605	$ 2,687,210	$ 2,690,000	$ 2,690,000	$ -
	Totals	26,572	$ 664,300	650	$ 48,750	9.56	$ 3,599,769	$ 4,312,819	$ 4,312,819	$ 8,625,639	$ 8,660,000	$ 8,520,000	$ 140,000

East Neighborhood

Pipe Segment	Road Length (ft)	Swale Length (ft)	Swale Cost	Culvert (ft)	Culvert Cost	Set Aside Area (AC)	Set Aside Cost	Total Cost	Overhead Factor	Subtotal	Rounded Cost	Developer Cost	City Cost
10	3,252	6,504	$ 162,600	100	$ 7,500	0.57	$ 214,990	$ 385,090	$ 385,090	$ 770,180	$ 780,000	$ 780,000	$ -
11	1,416	2832	$ 70,800	50	$ 3,750	0.00	$ -	$ 74,550	$ 74,550	$ 149,100	$ 150,000	$ 150,000	$ -
12	2,708	5416	$ 135,400	100	$ 7,500	0.00	$ -	$ 142,900	$ 142,900	$ 285,800	$ 290,000	$ 290,000	$ -
13	1,216	2432	$ 60,800	100	$ 7,500	1.21	$ 454,336	$ 522,636	$ 522,636	$ 1,045,273	$ 1,050,000	$ 1,050,000	$ -
14	3,477	6954	$ 173,850	150	$ 11,250	1.20	$ 450,094	$ 635,194	$ 635,194	$ 1,270,388	$ 1,280,000	$ 1,280,000	$ -
15	4,082	8164	$ 204,100	100	$ 7,500	2.89	$ 1,086,787	$ 1,298,387	$ 1,298,387	$ 2,596,774	$ 2,600,000	$ 2,390,000	$ 210,000
Addtl Pvt SW Setasides		0	$ -		$ -	2.83	$ 1,065,099	$ 1,065,099	$ 1,065,099	$ 2,130,198	$ 2,140,000	$ 2,140,000	$ -
	Totals	32,302	$ 807,550	600	$ 45,000	8.69	$ 3,271,306	$ 4,123,856	$ 4,123,856	$ 8,247,713	$ 8,290,000	$ 8,080,000	$ 210,000

South Nghborhd.

Pipe Segment	Road Length (ft)	Swale Length (ft)	Swale Cost	Culvert (ft)	Culvert Cost	Set Aside Area (AC)	Set Aside Cost	Total Cost	Overhead Factor	Subtotal	Rounded Cost	Developer Cost	City Cost
16	2,900	5,800	$ 145,000	100	$ 7,500	3.66	$ 1,378,103	$ 1,530,603	$ 1,530,603	$ 3,061,206	$ 3,070,000	$ 3,070,000	$ -
Adtl SW Setasides		0	$ -		$ -	1.64	$ 617,230	$ 617,230	$ 617,230	$ 1,234,461	$ 1,240,000	$ 1,240,000	$ -
	Totals	5,800	$ 145,000	100	$ 7,500	5.30	$ 1,995,334	$ 2,147,834	$ 2,147,834	$ 4,295,667	$ 4,310,000	$ 4,310,000	$ -

CIP Major Infrastructure Project Cost By Neighborhood

Sewer

	Average Peak Daily Flow, gpm	Ratio
West	308	36%
East	343	40%
South	209	24%
Non-School	198	23%
School	12	1%
Totals	860	100%

Water

	Average Day Demand, gpm	Ratio
West	111	31%
East	160	45%
South	88	25%
Non-School	82	23%
School	6	2%
Totals	359	100%

	Weighted Ratio
West	33.4%
East	42.2%
South	24.4%
Non-School	22.9%
School	1.5%

Project Ratio

	MPPS	Boeckman	Reservoir	Total
Project Cost	$ 5,200,000	$ 8,000,000	$ 5,800,000	$ 19,000,000
Frog Pond %	**48%**	**52%**	**25%**	
West	16.0%	17.4%	8.3%	
East	20.3%	22.0%	10.6%	
South	11.7%	12.7%	6.1%	
Non-School	11.0%	11.9%	5.7%	
School	0.7%	0.8%	0.4%	

Cost Ratio

	MPPS	Boeckman	Reservoir	
Frog Pond %	**48%**	**52%**	**25%**	**Totals**
West	$ 832,830	$ 1,388,050	$ 483,816	$ 2,704,696
East	$ 1,053,961	$ 1,756,601	$ 612,277	$ 3,422,838
South	$ 609,209	$ 1,015,349	$ 353,908	$ 1,978,466
Non-School	$ 571,663	$ 952,772	$ 332,096	$ 1,856,531
School	$ 37,546	$ 62,577	$ 21,812	$ 121,935
Totals	$ 2,496,000	$ 4,160,000	$ 1,450,000	$ 8,106,000

Appendix F. Land Use/Transportation Alternatives Analysis

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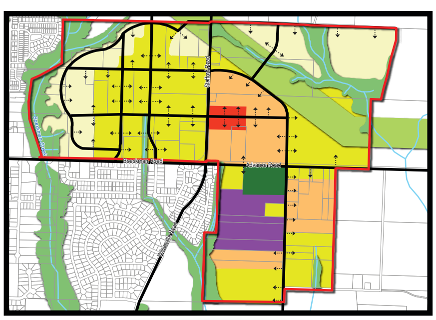
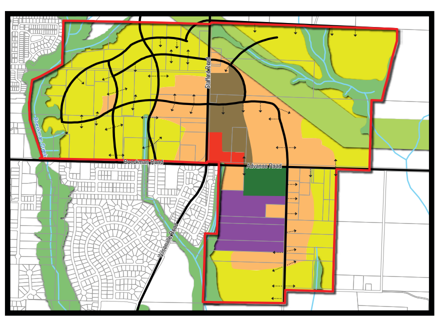
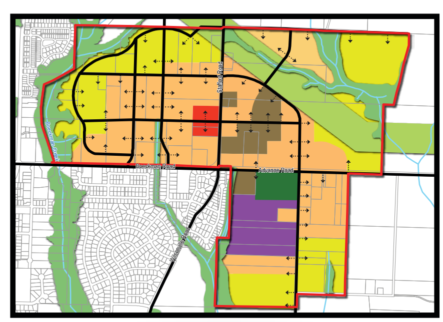
FROG POND AREA PLAN
Creating a great community

Land Use and Transportation Alternatives Summary and Evaluation







City of Wilsonville

September 24, 2014

Prepared by Angelo Planning Group, DKS Associates, Leland Consulting Group, Murray, Smith & Associates, Pacific Habitat Services, and Walker Macy.

Table of Contents

Executive Summary

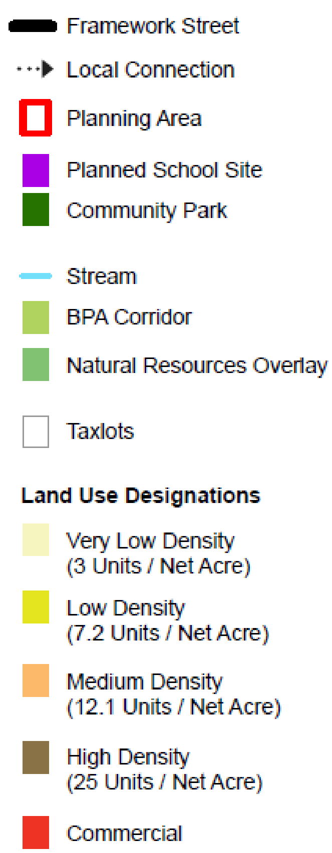
Introduction

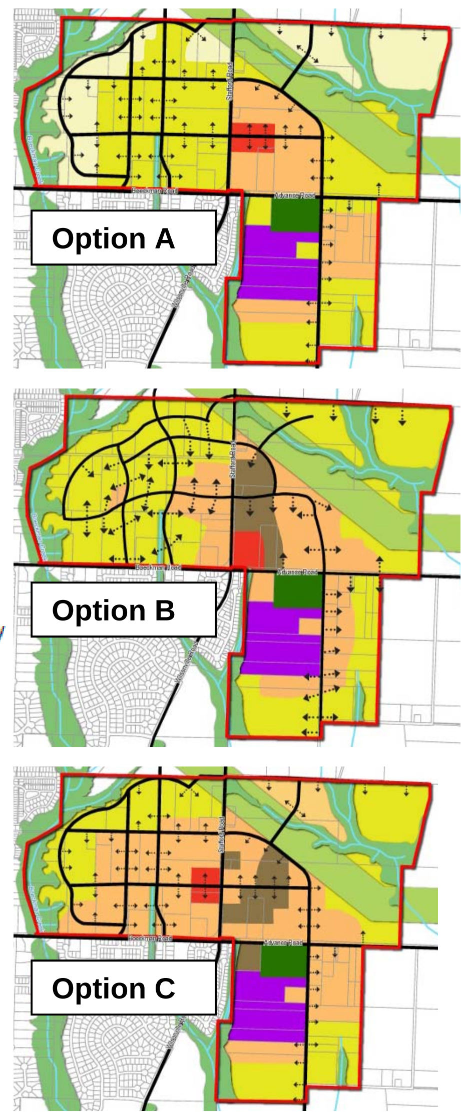
The Frog Pond Area Plan, led by the City of Wilsonville, will establish a vision for the 500-acre Frog Pond area, define expectations for the type of community it will be in the future, and recommend implementation steps. The project team has developed a set of three land use and transportation alternatives for consideration by the Frog Pond Planning Task Force, the public, stakeholders, and city policy-makers. All three of the alternatives are intended to implement the Frog Plan Area Plan's vision and guiding principles. The variations between the alternatives illustrate how there are different ways to achieve the vision. Based on this evaluation and the community dialogue that will occur, a "preferred" concept plan will be prepared. It is likely that a hybrid plan will be created that will combine the best elements of each of the alternatives.

Alternatives Overview & Land Use

Land use in all three alternatives is predominately residential, with a neighborhood-scale retail area to serve new and existing residents.

Option A has a "grid" street network and the lowest overall residential capacity of the three alternatives; the retail area is located at the east side of the intersection of Stafford Road and a new local street south of Frog Pond Lane. This option prioritizes single family detached housing in the early years of development, located in the neighborhood west of Stafford Road. Medium density is included in the Urban Reserve, to achieve a mix of housing types, consistent with the guiding principles and market analysis recommendations.





Option B is laid out around a more curvilinear or "organic" street network. In Option B, the variety of housing ranges increases, resulting in a greater mix than Option A and an overall residential capacity and density that falls in between the other alternatives. The retail area is located adjacent to the intersection of Stafford Road and Advance Road. The housing program in this option is in the middle of the range recommended in the market analysis, providing the full range of housing from detached single family to cottages to townhomes to apartments.

Option C organizes residential uses around the “grid” street layout and provides more medium density housing (cottages and townhomes) than Option B, resulting in the highest total number of residential units of the three alternatives. It represents the high end of the housing programs recommended in the market analysis. The retail area is located on the west side of the intersection of Stafford Road and a new local street south of Frog Pond Lane.

The estimated total residential capacity of the Frog Pond area for each land use alternative is summarized in the table below.

Land Use Alternative	Total Housing Capacity (Units)	Average Net Density (Units / Net Acre)
Option A - Grid Low	1,759	7.2
Option B - Organic Medium	2,343	9.6
Option C - Grid High	2,653	11.0

Roads & Trails

Existing roads in the Frog Pond area will be upgraded to the City of Wilsonville’s standards, including sidewalks and bike lanes. Stafford Road will have adequate capacity at three lanes (one travel lane each direction and a center turn lane as needed) to accommodate the build-out of the Frog Pond area, but will likely need to be widened to five lanes due to growth of background traffic and the future development of the Elligsen Urban Reserve (4G). Boeckman Road will have adequate capacity with three lanes. Advance Road can likely remain a collector road, providing access and on-street parking to serve adjacent land uses.

New collector roads are planned to run through the Frog Pond Area providing connections within the neighborhoods to the perimeter streets – from Boeckman Road at Willow Creek Drive to the northern edge of the Frog Pond Area, with potential for extension into the Elligsen Urban Reserve; along or adjacent to Frog Pond Lane to Stafford Road and continuing east to the BPA power lines; and from 60th Avenue north to the BPA power lines. These new collector roads will have sidewalks and bike lanes. In addition, a network of local roads will provide connectivity within the neighborhoods. All new local roads will include sidewalks.

The planned Boeckman Creek Regional Trail is shown extending north of Boeckman Road along the top of the bank of Boeckman Creek. Another trail is proposed within the BPA easement east of Stafford Road. Additional trails are proposed to provide links to the future school sites south of Advance Road. All trails are planned to connect across the major streets at local street intersections.

Safe and convenient bicycle and pedestrian crossings of the major roads are an essential part of making the Frog Pond area a great neighborhood. In particular, Stafford Road at Kahle Road will become a new entrance to the city. This location marks the transition "from country to city" and also ties into the history of the Grange. This area merits a "gateway" treatment.

Natural Resources, Open Space, and Parks

Several stream corridors and one wetland within the planning area have been identified as likely meeting locally significant resource criteria. These will be subject to Significant Resource Overlay Zone (SROZ) protections upon annexation to the City of Wilsonville. Other wetlands that were identified as part of the inventory for the Frog Pond Area that do not meet the criteria for local significance are assumed to be addressed by property owners / developers in accordance with state and federal regulations, which allow impacts subject to mitigation requirements when the property owner can show that the proposed project has the least impact to wetlands or waterways of all practicable alternatives that meet the project purpose and need. Further coordination with the Department of State Lands is needed to refine implementation strategies.

One of the project's Guiding Principles is to provide access to nature. One of the ways this can be implemented is through visual and physical access to protected resource areas, such as with parks or streets located adjacent to the edge of the protected area. The "framework" streets have been located to support visual and physical access to Boeckman Creek and the BPA Power line easements. All three alternatives provide for these areas to be amenities enjoyed by the neighborhoods, and not resources that are "walled off" by development.

The City's planned 10-acre community park is planned south of Advance Road as a key focal point. Two neighborhood parks will be needed in the neighborhood west of Stafford Road, and one in the neighborhood east of Stafford Road and north of Advance Road. Neighborhood parks are generally designed to be about 2.5 acres in size. Locations for future neighborhood parks are not identified specifically; they will be worked out either through development review or through land acquisition by the City of Wilsonville.

Sustainable stormwater management is another key component of the Frog Pond plan. The stormwater management approaches are anticipated to consist largely of roadside bioswales, with green street features wherever possible, and detention basins to manage drainage originating from development.

Key Questions and Considerations

The following summarizes key questions and considerations to be discussed by project participants during the evaluation of the alternatives and creation of the preferred alternative.

What is the appropriate mix and location of housing to achieve the vision and ensure feasible implementation? The alternatives explore a key "creative tension" for the plan: the more an alternative provides a mix of housing types as recommended in the market study - i.e. including attached single family and multi-family - the less that alternative provides single family detached housing. Option B is the closest to providing a middle ground of housing mix that generally matches market demand while also emphasizing single family homes. Option B provides 50%

Low Density Residential, 36% Medium Density Residential (which includes small-lot single family), and 14% High Density Residential. Based on the market study, roughly half of the Medium Density Residential shown on the plan options would be comprised of small-lot single family detached homes. Variations in housing mix and density between the three options have little impact on transportation or utility infrastructure improvement needs or costs; however, more housing generates more System Development Charge revenue to pay for off-site improvements.

Is a wider range of housing types needed in the West Neighborhood? Potential refinements could include providing a limited amount of Very Low Density Residential and/or a small amount of High Density Residential along with a mix of Low and Medium Density in the West Neighborhood in order to increase diversity of housing options.

Can Medium Density Residential be designed to provide a sensitive and compatible edge to adjacent Rural Reserve, or should urban-rural edges be developed only with Low or Very Low Density Residential? There may be little difference in impacts between having townhomes and small-lot single family versus standard lot single family adjacent to the rural edge, but more density increases the number of households in close proximity to working farmland, and means that tools like setbacks and landscaping would need to be provided through common open space or a trail corridor. Where possible, each plan option provides a “transect” from higher to lower densities, including lower density adjacent to rural lands.

Should housing transition down adjacent to Boeckman Creek or should the natural area be treated as an amenity for higher density housing? With clustered development, site planning can provide visual and physical access to a greater degree than would be possible with single family homes. The southern area along Boeckman Creek also has good access to employment areas to the east and the Town Center to the south, though it has less proximity to any of the retail sites within the Frog Pond Area.

Which retail location is most desirable? The locations identified in Options A and C would not have access from an intersection with a signal, which is a significant drawback. Since retail generally follows “rooftops” rather than preceding them, this is an advantage to a location in the East neighborhood, as in Options A and B. The location identified in Option B provides the greatest visibility for pass-by traffic and could have a synergistic relationship with the city’s future community park, located just across Advance Road. A fourth potential retail site adjacent to the Grange has several advantages, including highlighting the historic Grange building as a community focal point, and the potential to site some parking and stormwater management for the development in the BPA easement.

Which street network is preferable? The grid network in Options A and C offers advantages including providing internal connections that support circulation and access, a local street network that is easy to understand and navigate, a better location for a future traffic signal that improves traffic flow, better potential for future transit coverage, better alignment with property lines, and better flexibility for incremental implementation without a master developer. The "organic" street network is somewhat more responsive to topography and as a result requires fewer utility easements.

Issues for Further Study

Several implementation considerations for the Frog Pond Area Plan have begun to emerge from the evaluation of alternatives. As the concept plan and implementation strategies are prepared, the plan should address:

- Site design techniques for the Frog Pond retail area to ensure it is compatible with adjacent neighborhoods, easily accessible by all modes, and supports a high-quality pedestrian environment on adjacent streets;
- Where and to what degree to allow or encourage the use of alleys for residential development;
- Mechanisms to ensure provision of neighborhood parks if the Frog Pond Area is developed incrementally;
- Stormwater management strategies – on-site treatment and detention versus consolidated facilities serving multiple developments;
- Appropriate levels of protection for existing mature trees and tree groves;
- Wetland mitigation strategies;
- Appropriate bicycle and pedestrian crossing treatments for major road intersections to ensure safe routes to school and easy connections within the Frog Pond Area; and
- How certain road and utility infrastructure improvements will be built and paid for, such as urban upgrades to Stafford Road.

These issues will be explored further throughout the course of the project.

Introduction

The Frog Pond Area Plan, led by the City of Wilsonville, will establish a vision for the 500-acre Frog Pond area, and define expectations for the type of community it will be in the future. The project team has developed a set of three land use and transportation alternatives for consideration by the Frog Pond Planning Task Force, the public, stakeholders, and city policy-makers. This report describes the three alternatives currently under consideration as well as certain design concepts that are equally relevant for all alternatives. This report also summarizes information detailed in separate technical memoranda on the performance of the three alternatives to enable the Task Force, public, and policy-makers to make informed recommendations and decisions about a preferred alternative.

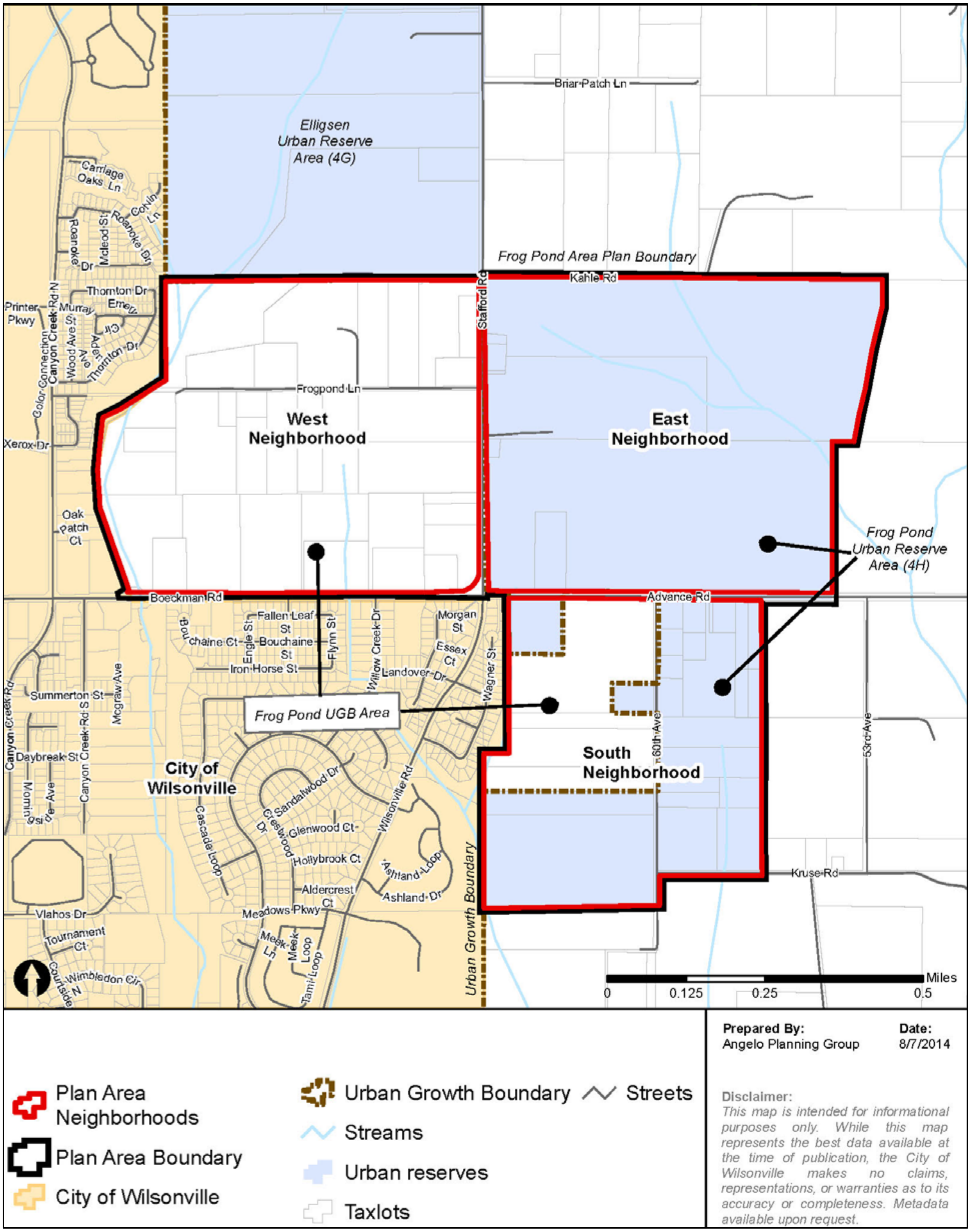
Description of Land Use and Transportation Alternatives

Overview

All three of the alternatives are intended to implement the Frog Plan Area Plan's vision and guiding principles. The alternatives, while different, share certain common elements in the area of land uses, schools and institutions, and street network. The variations between the alternatives illustrate how different ways exist to achieve the vision. Based on the alternatives evaluation presented in this summary and the community dialogue that will occur, a "preferred" concept plan will be prepared. Likely the evaluation and dialogue will create a hybrid plan combining the best elements of each of the alternatives together with the common elements.

The descriptions of the three alternatives make reference to three neighborhoods within the Frog Pond Area, identified on Figure 1. Exhibits 1A, 1B, and 1C show the land use and street frameworks for each of the three alternatives.

Figure 1: Frog Pond Neighborhoods



Land Uses

Land use in all three alternatives is predominately residential, with a retail area to serve new and existing residents.

The land use choices were shaped by the Frog Pond Area Plan Market Analysis prepared by Leland Consulting Group (included as Appendix A to this report); local policy direction about desired housing mix and balance of attached versus detached housing; requirements to provide land for needed housing; the urban design principle of “transects” that arrange land uses based on intensity, transitioning from the highest intensity to the lowest intensity; and focusing density near amenities such as retail areas, parks, and transit.

The retail area is approximately the same size in each alternative – approximately 5.3 acres, which would accommodate approximately 69,000 square feet of space in multiple buildings. The size is based on the Market Analysis done previously in the project based on projected demand from new residential growth, pass by traffic, and existing homes in the area. The Market Analysis also examined the locations of existing retail and services

The East and South neighborhoods have generally higher densities than the West neighborhood, because the residential areas are outside the Urban Growth Boundary (UGB), are designated Urban Reserve, and are more likely to be brought into the UGB by Metro if they demonstrate efficient accommodation of needed housing. Residential densities in each alternative are generally highest adjacent to the location identified for the retail area and adjacent to existing and potential transit service. The intention of this combination of land use is to support a walkable retail center with excellent transportation facilities.

Residential densities are described as “Very Low”, “Low”, “Medium”, and “High” on the alternatives. Example images of these categories are provided in Exhibit 2. They are described in general terms below.

- **Very Low Density Residential** is assumed to be all single-family detached housing on relatively large lots, averaging roughly three housing units per net acre[1] of land.
- **Low Density Residential** is assumed to be nearly all single-family detached housing on standard-sized lots (e.g. 5,000 to 8,000 square feet), averaging 7.2 housing units per net acre of land.
- **Medium Density Residential** is assumed to include small-lot single-family homes as well as townhomes, cottage homes, and similar housing types, averaging 12.1 units per net acre of land. In the market study, approximately half of the medium density residential homes are small-lot single family.
- **High Density Residential** is assumed to include multi-family housing, such as two- to three-story apartments and similar housing types, averaging 25 units per net acre of land.

Table 1 presents the key elements of the three alternatives.

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1 A net acre is the buildable land remaining after environmental and other constraints, street right-of-way, and stormwater management areas are accounted for and deducted.

Table 1: Land Use Alternatives

Alternative & Summary	Land Use by Neighborhood		
	West Neighborhood	East Neighborhood	South Neighborhood
Option A: "Grid" street network with lowest residential density	Exclusively Low and Very Low Density Residential use. The lowest densities are located closer to Boeckman Creek and the BPA power lines.	The retail area is located at the east side of the intersection of Stafford Road and the southern framework street. Medium density residential surrounds and supports the retail area, which are a key ingredients necessary for successful retail, enclosed by a framework street. Areas further east and north transition to Low Density Residential, with Very Low Density Residential in the "lobes" of buildable land between the creeks south of Kahle Road.	Two blocks of Medium Density Residential are shown: one east of 60th Avenue and one just south of the school property. The remainder is shown as Low Density Residential.
Option B: Curvilinear or "organic" street network with a residential density that falls between the other alternatives	Includes a mix of Low and Medium Density Residential use. The Medium Density is generally focused closer to Stafford Road and along the southern east-west framework street, although one block of Medium Density is shown further west, in a location central to the neighborhood. This arrangement is intended to focus medium density near the neighborhood center, and also provide low density residential along the north side of Boeckman Road across from similar single family homes.	The retail area is located adjacent to the intersection of Stafford Road and Advance Road. It is surrounded and supported by High Density Residential use, which then transitions to Medium Density Residential. The farthest east and north portions of this neighborhood are planned for Low Density Residential, including the areas south of Kahle Road.	Medium Density Residential is focused close to the school and park site, with Low Density residential along the east and south edges.
Option C: "Grid" street network with highest residential density	Includes the neighborhood retail area, located on the west side of the intersection of the southern framework street. Much of the neighborhood is planned for Medium Density Residential, with a transition to Low Density Residential at the northern and eastern edges.	Includes a mix of residential densities, with High Density Residential generally close to the southern framework street for ease of access to the retail area to the west. It is broken into one area that spans the southern framework street, reaching diagonally from Stafford Road to the BPA easement, and one smaller area adjacent to Stafford Road a little further north. The eastern portion of this neighborhood is planned for Low Density Residential, providing a transition to rural areas to the east. Of the two "lobes" south of Kahle Road, one is planned for Medium Density Residential, while the other (further east) is planned for Low Density residential.	There is a block of High Density Residential located between the school/park property and Advance Road, buffered from the existing neighborhoods to the west by Meridian Creek. The southern portion of this neighborhood is planned for Low Density Residential, while the remainder is planned for Medium Density Residential.

Institutions and Schools

All three alternatives identify the future school and community park site in the South neighborhood as a fixed location. The land is already owned by the School District, which, pending the outcome of a November bond measure, could initiate land use actions to begin development of a middle school on the site.

Because the future plans of existing institutions, such as the Grange and the Community of Hope church, are not known at this time, and because the school district has indicated that the land it holds in the West Neighborhood may not ultimately be used for a future school, land use designations have been identified for all land within the Frog Pond Area, including these institutions, except for the future school and park site in the South neighborhood.

Parks

A future 10-acre city owned community park is planned south of Advance Road. The land is currently part of the school district's 40-acre property. This park will serve the Frog Pond Area as well as existing neighborhoods. Its primary recreational focus will be to provide athletic fields to meet the growing needs of the community. Facilities are expected to include multi-use play fields and appropriate parking, a playground, restroom building, concession area, and picnic shelter.

Neighborhood parks will be needed in the West and East neighborhoods: two in the West neighborhood and one in the East neighborhood. The two neighborhood parks in the West Neighborhood implement the parks adopted in the Wilsonville Parks and Recreation Master Plan (2007). Locations for future neighborhood parks are not identified specifically; rather, a parks framework diagram is included in Exhibit 3 that illustrates general areas within which a future neighborhood park should be located. Neighborhood parks are typically designed to be about 2.5 acres in size and include a wide range of features balancing passive and active recreation. Exhibit 4 includes examples of different styles of neighborhood-scale parks. One option is to provide a linear neighborhood park along a portion of the Boeckman Creek Corridor that would include a proposed trail alignment (discussed on page 13).

Street Network

The alternatives all envision a connected local street network, framed around identified "Framework Streets", connecting to the existing major roadways. While there are three land use alternatives, there are only two street frameworks: the "grid" option or the curvilinear "organic" option.

All alternatives include two connections to Boeckman Road at existing local street intersections and three connections to Stafford Road north of Boeckman Road. The number of connections to Advance Road is expected to be roughly the same in all alternatives, with the existing connection to 60th Avenue and two or more additional local street connections. Access points to existing streets are driven by minimum street spacing and intersection alignment requirements. A future north-south roadway through the West Neighborhood is envisioned to ultimately extend into the Elligsen Urban Reserve (4G).

All alternatives provide the option for alleys in some or all blocks. Alleys may be especially appropriate for development adjacent to major roads where direct vehicle access to the property is restricted by access spacing standards, but are simply one option for consideration at this stage of the project.

The grid street network responds to existing property lines and right-of-way, and provides a regular, largely rectilinear local street pattern, while acknowledging natural areas and constraints. The organic street network assumes one or a few master developers within each neighborhood, allowing for street alignments that do not follow property lines, but take their inspiration from the area's topography and natural resources. Additional local streets are assumed to provide a connected set of blocks. However, these blocks are not necessarily regularly shaped, and do not always intersect at right angles. Few of the streets follow property lines.

Street Classification

Exhibits 5A and 5B show the proposed street functional classifications for each street framework. A detailed explanation of these classifications and the associated standards and designs is included in the Future Transportation Analysis memorandum by DKS Associates, which is included as Appendix B to this report. Generally speaking, arterial roads, especially major arterials (such as Stafford Road), are intended to prioritize flow of traffic through an area over access to individual developments or homes within an area. Collector roads are intended to provide access into neighborhoods or commercial/industrial areas and connections to arterial roads and key destinations. Local roads are intended to provide primarily access to individual properties, with little through-traffic. In the Frog Pond Area, pedestrian safety and comfort is a priority along all streets, regardless of classification and functional role for vehicles.

Street Design Concepts and Crossings

Exhibits 6A and 6B, respectively, show design concepts for Stafford Road, and the north-south collector in the West Neighborhood, at key intersections. These illustrations are intended to highlight the importance of pedestrian and bicycle treatments and crossings, and the character of the roadways, consistent with their functional classification and the street cross-sections identified in the Transportation System Plan (TSP). Exhibit 7 includes examples of intersection crossing treatments. In addition, roundabouts may be considered at key intersections within the neighborhoods to facilitate traffic movement and moderate vehicle speeds in the neighborhood.

In addition, Exhibit 8 shows a Stafford Road gateway concept. Development in the West Neighborhood, and eventually in the East Neighborhood as well, will establish a new entrance to the city. Placement of the gateway is at the intersection of Kahle Road and Stafford Road and will extend south toward Frog Pond Lane. This location marks the transition “from country to city” calming traffic and also ties into the history of the Grange. A high level concept is shown, along with a selection of design elements to consider for the gateway.

Bicycle and Pedestrian Frameworks

The overall intent and organization of the bicycle and pedestrian frameworks is similar for both the grid and organic street frameworks, shown in Exhibits 9A and 9B. Exhibit 10 shows an additional diagram illustrating the relationship between the Frog Pond Area trails and other bicycle and pedestrian routes and destinations within and adjacent to the City of Wilsonville.

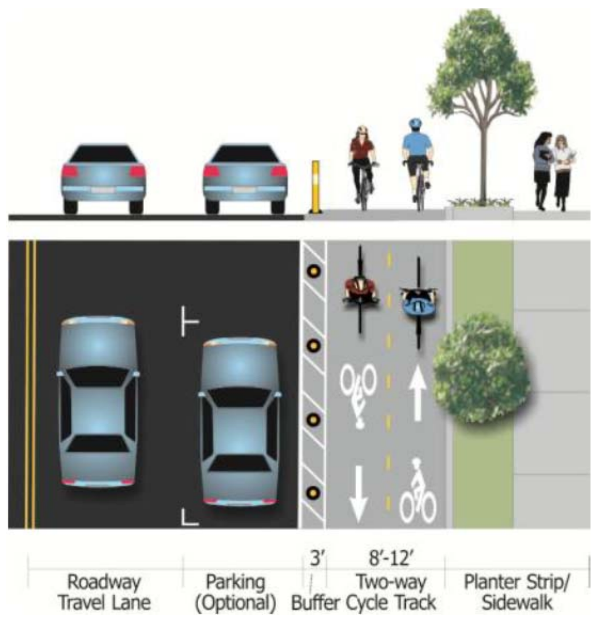
Providing safe routes to existing and planned schools is a key goal of the bicycle and pedestrian frameworks. Grade-separated bicycle and pedestrian crossings may be appropriate for key intersections on the major roadways in order to provide safe routes to school and better linkages between the neighborhoods.

On-Street Facilities

Collector and Arterial streets are planned for future bike lanes where they do not currently exist, either through urban upgrades or through construction of new roadways within the neighborhoods. All new local roads will include sidewalks.

A cycle track treatment that places bikes going both directions on the same side of the street, with a buffer or barrier to provide protection from vehicle traffic, as shown in Figure 2, may be appropriate on 60th Ave from Advance Road to the southern edge of the planning area on west side, adjacent to the school.

Figure 2: Two-Way Cycle Track



West Neighborhood: Boeckman Creek Trail

Plans show the planned Boeckman Creek Regional Trail extending north of Boeckman Road into the West neighborhood. South of Boeckman Road, the Wilsonville TSP shows the trail running within the creek canyon along the sewer line easement. After passing under the Boeckman Road bridge, the trail would likely climb to the top of bank along an existing access/maintenance road and run roughly along the edge of the vegetated corridor / Significant Resource Overlay Zone through the West neighborhood. Where outside the SROZ The trail alignment provides the opportunity for a linear park along the natural feature that could have nodes of activity framed by the forest edge. The location of this trail as a visible and accessible part of the neighborhood's west side is an intended outcome. This location will ensure the trail is a neighborhood amenity, and increase its use and safety. This trail would leave Boeckman Creek and traverse the northern edge of the West neighborhood to link to the BPA corridor, intersecting Stafford Road at Kahle Road. As a regional trail, this should be paved, but stormwater runoff from the trail will need to be managed so as not to impact Boeckman Creek.

Connections to the trail from the adjacent streets and in the form of accessways between homes in residential developments should be provided as frequently as is practical in order to maximize bicycle and pedestrian connectivity and convenience.

East Neighborhood: BPA Easement Trail

In the East neighborhood, where the BPA easement cuts through on a diagonal, plans propose a trail to run from Kahle Road to roughly the point where the easement turns to run east, at which point the trail would leave the easement, turning south to intersect with Advance Road at a local street intersection. Connections from the adjacent streets should be provided as frequently as is practical in order to maximize bicycle and pedestrian connectivity and convenience. Trails in all three neighborhoods will provide important Safe Routes to Schools opportunities.

South Neighborhood: School Connection Trails

The trail from the BPA easement would link to a proposed trail along the eastern edge of the South Neighborhood that would provide an edge to the future urban area, and, through landscaping and appropriate fencing, help buffer and protect the farmland in the adjacent rural reserve area. The trail would connect to the southern edge of the school property, providing as direct a route to the planned location of the school buildings as possible.

An additional trail would link from the existing Wilsonville High School and Boeckman Creek Elementary School across Meridian Creek to the future school sites, co-located with infrastructure easements and associated creek crossings. The two trails should meet along the southern edge of the school property in order to provide through-access for the public as well as access for students and school employees.

60th Avenue Trail

The possibility of using the existing unimproved 60th Avenue right-of-way as a trail south of the Frog Pond Area, connecting to the Willamette River at Oregon State Parks Willamette Meridian Landing, is identified for further exploration. Such a connection could provide a highly desirable link to the river and the open space and recreational opportunities at Willamette Meridian Landing.

Natural Resources

Significant Resources

Exhibit 11 shows stream corridors and wetlands identified as likely meeting locally significant resource criteria. These will be subject to Significant Resource Overlay Zone (SROZ) protections upon annexation to the City of Wilsonville.

Other wetlands identified as part of the inventory for the Frog Pond Area that do not meet the criteria for local significance are assumed to be addressed by property owners / developers in accordance with state and federal regulations, which allow impacts subject to mitigation requirements when the property owner can show that the proposed project has the least impact to wetlands or waterways of all practicable alternatives that meet the project purpose and need. For the purposes of calculating capacities, it was assumed that 80% of the non-significant wetlands would be developed and mitigated off-site. This is a significant implementation issue that will need further definition.

Tree Groves

Existing tree groves were also inventoried as part of the planning work for this project. Identified groves are shown on Exhibit 11. The tree groves within the planning area provide a key visual asset, and are a link to the historic character of the area. To the extent that existing, mature trees can be retained and protected as annexation and development occurs, it will contribute to the character and desirability of new neighborhoods, as shown in several of the example images in Exhibits 2, 4, and 12. The city has existing annexation policies that incentivize (but do not mandate) tree retention.

Open Space Edges

One of the project's Guiding Principles is to provide access to nature. One of the ways this can be implemented is through visual and physical access to protected resource areas. Exhibit 12 provides example images of relationships between open spaces and the adjacent land use that provide for visual and physical access. Trails and park improvements are generally assumed to be located outside the SROZ boundary, with the possible exception of creative play, natural trails and crossing points.

Stormwater Management

Sustainable stormwater management is another key component of the Frog Pond Plan. The stormwater management approaches are anticipated to consist largely of a toolbox of approaches to treat, detain, and infiltrate runoff on-site. The City expects drainage originating from private development required to be managed by the private developer in accordance with the City’s Public Works Standards and Oregon Drainage Law. The plans also assume new streets and on-site development will include low impact development (LID) techniques to the extent possible. The city’s Stormwater Master Plan and Public Works Standards include a variety of LID options for stormwater management. Examples of low impact development as well as other types of green infrastructure are shown on Exhibit 13.

Alternatives Evaluation

Overview

The transportation impacts and infrastructure needs associated with the three alternatives have been evaluated in technical memoranda produced by DKS Associates and Murray Smith Associates, respectively. These technical memoranda are included as appendices to this report, and a brief summary of key findings from each evaluation are presented in this section. In addition, Leland Consulting Group is preparing an infrastructure Funding Analysis that evaluates infrastructure costs and expected city revenues from System Development Charges (SDCs). While this analysis is not yet complete, a few of the key early findings are summarized in this section.

This section also includes an evaluation of the land use considerations of each alternative. Finally, a matrix is provided on page 20 that summarizes the project team's evaluation of the three alternatives relative to the project's Guiding Principles.

Land Use Considerations

Capacity and Density

The total residential capacity of the Frog Pond Area is estimated to range from roughly 1,760 units in Option A to roughly 2,650 units in Option C, as shown in Table 2. The overall net residential density for the full Frog Pond Area ranges from 7.2 units per net acre in Option A to 11 units per net acre in Option C. A more detailed table showing net acres, percent of total units, and an estimate of the percent detached housing by neighborhood and for total for the planning area is included in Exhibit 14.

Table 2: Residential Capacity and Density Estimate Summary

	West Neighborhood		East Neighborhood		South Neighborhood		Frog Pond Area (Totals)	
Land Use	**Units**	**Net Density**	**Units**	**Net Density**	**Units**	**Net Density**	**Units**	**Net Density**
Option A - Grid Low								
Very Low Density	99	3	104	3	-	3	203	3
Low Density	492	7.2	169	7.2	219	7.2	880	7.2
Medium Density	-	12.1	384	12.1	292	12.1	677	12.1
High Density	-	25	-	25	-	25	-	25
Total	**591**	**5.8**	**657**	**7.3**	**511**	**9.4**	**1,759**	**7.2**
Option B - Organic Medium								
Very Low Density	-	3	-	3	-	3	-	3
Low Density	609	7.2	320	7.2	230	7.2	1,159	7.2
Medium Density	201	12.1	381	12.1	274	12.1	856	12.1
High Density	-	25.0	328	25.0	-	25	328	25
Total	**810**	**8.0**	**1,029**	**11.6**	**504**	**9.2**	**2,343**	**9.6**
Option C - Grid High								
Very Low Density	-	3	-	3	-	3	-	3
Low Density	276	7.2	229	7.2	174	7.2	680	7.2
Medium Density	706	12.1	574	12.1	330	12.1	1,610	12.1
High Density	-	25.0	363	25.0	-	25	363	25
Total	**982**	**10.2**	**1,166**	**12.4**	**505**	**9.8**	**2,653**	**11.0**

Housing Mix and Variety

Each of the three land use alternatives provides at least two different housing designations within each neighborhood. The East neighborhood has three density designations in each of the alternatives. In addition, each residential designation is intended to capture a range of lot sizes and, in some cases, housing types, as described on page 9 and illustrated in Exhibit 2. To ensure that any one neighborhood does not become too dominated by a single housing type or style, policies and regulations could be developed that would allow, encourage, or even require development of a variety of housing styles and types within each development or each neighborhood.

The mix of single family detached homes relative to attached and multi-family housing is not entirely fixed by the land use alternatives, because some of the residential density categories, especially the Medium Density Residential designation, may include both detached homes and attached or multi-family housing. However, for the purposes of estimating the share of attached and detached housing, we assume that the Very Low Density is entirely single family detached homes, the Low Density residential is 95% detached, the Medium Density Residential is roughly half detached housing and half attached housing, and the High Density Residential is entirely attached housing. Given those assumptions, Option A provides the highest percentage of detached housing in the West Neighborhood (96%) and overall (78%), while Option C provides the lowest percentage with 63% in the West Neighborhood and 55% overall (see details in Exhibit 14).

There is a trade-off for each of the alternatives in that the better the alternative is aligned with the housing program recommended in the market study, the less well it meets the city's goals of reaching a balance between attached and detached housing (although they all have the potential to move the city closer to that balance, if the mix matches that assumed above). Option B may be the closest to providing a middle ground of density that generally matches market demand while also emphasizing single family homes.

Potential refinements as a preferred land use alternative is developed could include providing a broader range of densities in the West Neighborhood, such as a limited amount of Very Low Density Residential and/or a small amount of High Density Residential along with a mix of Low and Medium Density in order to increase diversity of housing options in this neighborhood.

Residential Land Use Patterns

Each of the land use alternatives has its own strengths and weaknesses. In addition to decisions about the overall level of residential density and housing mix discussed above, some of key distinctions and decision points related to the arrangement of different residential densities include:

- ***What housing type is appropriate in the Kahle Road area?*** Lower density may provide a more compatible transition to adjacent rural uses, but because both "lobes" require their own small sewer pump stations, the development costs may necessitate more units to spread the costs across.
- ***What housing type is appropriate for the parcel bounded by the future school and park site, Advance Road, and Meridian Creek?*** This location has excellent amenities, including proximity to the community park and school and the Meridian Creek natural area. If the retail is located at the location shown in Option B, this area would also have

excellent proximity to the retail area. It is also buffered from existing single family neighborhoods by the creek. This is an important and fairly visible location, so design will be important, regardless of housing type.

- ***Can Medium Density Residential be designed to provide a sensitive and compatible edge to adjacent Rural Reserve, or should urban-rural edges be developed only with Low or Very Low Density Residential?*** There may be little difference in impacts between having townhomes and small-lot single family versus standard lot single family adjacent to the rural edge, but it does increase the number of households in close proximity to working farmland. Setbacks and landscaping could be important site design tools regardless of density, but the smaller the lots, the less room there is for such features, unless they are provided through common open space or a trail corridor.
- ***Should density transition down adjacent to Boeckman Creek (as shown in Options A and C) or should the natural area be treated as an amenity for higher density housing?*** With clustered development, site planning can provide visual and physical access to a greater degree than would be possible with single family homes. The southern area along Boeckman Creek also has good access to employment areas to the east and the Town Center to the south, though it has less proximity to any of the retail sites within the Frog Pond Area.

Retail Location and Character

The three land use alternatives identity three different retail locations. Exhibits 15A, 15B, and 15C are site studies of how each of these locations could work – locations of buildings, parking, access points, etc. In addition, Exhibit 15D is a site study for a fourth location adjacent to and including the Grange; this site is not shown on any of the three land use alternatives.

The retail areas in Options A and C are envisioned as a two-sided “Main Street” environment, with excellent accessibility by all modes and pedestrian-friendly, street-oriented storefronts. Wilsonville has experience with trying to create walkable storefronts but a number of marketplace realities have made this outcome difficult to achieve in practice. While on-street parking would be available on the local streets, parking areas would face residential development on the back sides of the blocks. Developers and retailers generally only want one entrance, and generally prefer it to be oriented towards the bulk of the parking, making it difficult to get operational front doors to the sidewalk with parking behind.

The locations identified in Options A and C share another challenge: for transportation reasons (as discussed on subsequent pages), a traffic signal is more appropriate at the second new intersection north of Boeckman Road along Stafford Road, but this means the retail area would not have a signal at its access point. The success of the retail area will depend on ease of access for Frog Pond Area residents as well as residents of existing neighborhoods and those passing by. Access from an intersection with a traffic signal is much preferred for the retail area.

The retail locations in Options A and B, being in the East neighborhood, allow more time for residential development to be built in the West neighborhood before the retail could be built. Since retail generally follows “rooftops” rather than preceding them, this is an advantage to a location in the East neighborhood.

The location identified in Option B provides the greatest visibility for pass-by traffic and could have a synergistic relationship with the city's future community park, located just across Advance Road. Those visiting the park for athletic events and activities as well as for general recreation would have easy walking access to shops and services. However, this location also has a number of drawbacks. Little or no access would be provided from Stafford Road due to access spacing standards; however, access would be available from Advance Road. This access location would require nearly all those driving to the retail area to pass through the Wilsonville / Boeckman / Stafford / Advance Road intersection – one of the busiest in the area – and then make a left turn into the retail area. The issue of wanting stores to provide a pedestrian-oriented face to the street while the parking is located to the back is a challenge for the location in Option B, as it is in Options A and C. In Option B, with on-street parking not expected on Stafford Road, it is even less likely that stores would want to provide entrances facing that street.

The fourth potential retail site (called Option D), shown in Exhibit 15D but not in any of the land use options, has several advantages, including highlighting the historic Grange building as a community focal point, the potential to site some parking and stormwater management for the development in the BPA easement, and a location in the East neighborhood. Other than Kahle Road, the property next to the Grange may be one of the last areas to develop – a favorable consideration for small scale commercial.

Of these choices, the most promising seem to be Option B and Option D, though both need additional refinement and evaluation for access and site design considerations.

Key Transportation Findings

The evaluation of the future transportation system based on the land use and transportation alternatives presented in this report found the following:

- The variation in residential land uses (location and amount) between the three alternatives makes little difference in traffic and intersection delays; the additional transportation projects needed to support growth in Frog Pond are essentially the same for all alternatives.
- The location of a new traffic signal on Stafford Road makes more difference in delays – the location further north in Options A and C provides better traffic flow.
- Having the new east-west collector road through the East and West Neighborhoods and the associated traffic signal located further north in Options A and C also provides better future transit coverage in the northern part of the Frog Pond Area if a bus can be routed along the collector in the future.
- Stafford Road can function acceptably with three lanes (two travel lanes and a center turn lane) through the 20-year planning horizon for this project, but will likely need to be expanded to five lanes shortly thereafter.
- Advance Road is currently designated as a Collector. Retaining this designation (rather than reclassifying it as a Minor Arterial) when the East and South Neighborhoods urbanize offers benefits including allowing more frequent street and driveway access points and opportunities for on-street parking. More access points and connections

could facilitate multi-modal connections to the community park and schools in the South neighborhood, as well as providing greater opportunities for access to a retail or multi-family development at the northeast corner of Stafford and Advance Road. On-street parking could support both the community park and retail or higher intensity land uses near that corner.

- Urban upgrades (including adding sidewalks, bike lanes, center turn lanes) are needed for Boeckman Road, Stafford Road, and Advance Road in conjunction with development to fill in the pedestrian and bicycle network and connect to adjacent parts of Wilsonville.
- The layout of the grid network does a particularly good job of providing internal connections that support circulation and access.

Key Utility Infrastructure Findings

The evaluation of the water, sanitary sewer, and stormwater systems needed to serve growth in the Frog Pond Area found the following:

- The overall costs for providing utility infrastructure are similar for the three alternatives. Although the demands for each utility service varied between alternatives, the minimum requirements for infrastructure sizing typically governed their design. These minimum requirements often generate utilities with capacities that exceed their service demands.
- Water and sewer lines can generally be aligned with the framework streets; however, some easements will be necessary. The street layout of Option B requires slightly less use of easements.
- A number of the "framework" water and sewer lines that will serve Frog Pond will need to be "oversized" relative to minimum standards in order to serve growth in other parts of the Frog Pond Area or to provide capacity for future growth in the Elligsen Urban Reserve. Where on-site infrastructure must be over-sized to serve development beyond the abutting property, developers are anticipated to install these improvements at time of development; however, they are given System Development Charge (SDC) credits for the incremental cost increase due to oversizing.
- Both the water and sewer systems have major off-site improvements needed that are partially related to growth in Frog Pond, but are also needed to serve other parts of the city or to correct existing issues.
- Several parts of the East Neighborhood require pump stations for sanitary sewer, including both "lobes" off Kahle Road and the far southeastern corner of the East Neighborhood. An additional pump station is needed to serve the southern end of the South Neighborhood. The cost of these pump stations is assumed to be borne by the developer.
- The higher development density in Option C will have more impervious areas than in the other alternatives. These larger impervious areas will generate the need for larger stormwater management facilities, increasing stormwater management costs above the other alternatives.

Key Infrastructure Funding Findings

The preliminary work on the Frog Pond Funding Analysis has identified the following key findings:

- The amount of net SDC revenue generated by development in Frog Pond varies based on the amount of residential development: Option A generates the least SDC revenue for the city, while Option C generates the most. The difference in total SDC revenues (across all SDCs) between Option A and Option C is close to $20 million.
- The infrastructure costs estimated for building out Frog Pond are very consistent across the three alternatives, as noted above.
- While the City is expected to pay for and build a number of key pieces of infrastructure, Frog Pond developers are expected to pay for the majority (about three-quarters) of infrastructure costs. Clackamas County, Metro, and the West Linn Wilsonville School District are also expected to pay for some improvements.
- For all three alternatives, there is sufficient SDC revenue to exceed the amount of expected SDC credits and pay for some or all of the other city-funded projects that are related to growth in Frog Pond.

Guiding Principles Evaluation Summary

The following matrix summarizes the evaluation of the three land use and transportation alternatives against the project's Guiding Principles and other relevant evaluation measures. This is a relative comparison – "good", "better", and "best" notations refer to good, better, or best fulfillment of the stated Guiding Principle. Ties are possible.

Table 3: Evaluation Summary Matrix

Guiding Principle	Evaluation Measures	Option A Rating	Option B Rating	Option C Rating	Rationale
Create great neighborhoods *Frog Pond's homes, streets, open spaces, neighborhood-scale retail, and other uses fit together into walkable, cohesive, and connected neighborhoods. Frog Pond is a fun place to live.*	% of housing units within ¼ mile of neighborhood-scale retail	Good (45%)	Good (45%)	Better (50%)	Research shows that people are more likely to walk to service if they are located within about a quarter mile, or about a five-minute walk. Option C clusters more of the housing adjacent to the neighborhood retail area relative to the other two alternatives.
	"Legibility" & distinctiveness of neighborhoods – sense of place	Better	Good	Better	Grid streets make way-finding easy and are also somewhat distinctive since they are not common in Wilsonville today. The grid scheme also follows some of the original parcel and settlement patterns, providing a tie to the history of the area. The organic street network creates a distinctive feel to the neighborhood but may make way-finding more difficult.
Create a complete streets and trails network	Compliance with 300' spacing guideline identified in TSP	Good	Good	Good	While only a few local streets have been identified, both street frameworks lend themselves to 300' blocks.

Guiding Principle	Evaluation Measures	Option A Rating	Option B Rating	Option C Rating	Rationale
Streets are designed for safe and enjoyable travel by bike, on foot, or by car. A great network of trails is provided. Safe crossings and connections are provided throughout the street and trail network.	Provision for safe routes to planned schools	Good	Good	Good	All three alternatives have nearly identical off-street trails that provide connections to the future school site, and all provide nearly identical connections to the existing elementary and high school located to the south on Wilsonville Road (via either Wilsonville Road or local streets). Depending on how local streets are actually connected, the grid pattern has slightly more potential for shorter, more direct, and more convenient routes to and from the schools. The main distinction between the alternatives is the location of the presumed traffic signal. The more northerly location in Options A and C will provide a convenient bicycle and pedestrian crossing point only for those coming from the northern portion of the West Neighborhood; those starting further south will likely use the Boeckman Road crossing instead, which is a busier intersection. The more southerly location in Option B will provide a more convenient crossing point for cyclists and pedestrians crossing Stafford Road to reach the future school site. However, with the retail located at the first intersection north of Boeckman Road in both Options A and C, the location of the signal may need to be reconsidered for these alternatives.
	Alignment of trails & primary bicycle/pedestrian routes with safe & easy crossing locations	Good	Good	Good	All three alternatives align proposed trail crossings of major roads with proposed local street intersections; however, all of the proposed crossing points are at what are presumed to be stop-controlled, rather than signalized, intersections.
	Miles of trails proposed	Good	Good	Good	All three alternatives have essentially the same trail network proposed.

Guiding Principle	Evaluation Measures	Option A Rating	Option B Rating	Option C Rating	Rationale
	Streets and trail network provide connections to allow for a variety of route options	Good	Good	Good	All three alternatives provide nearly identical trail networks with similar opportunities to connect to the street network. The grid network framework street alignment near Boeckman Creek could mean that the trail parallels that street for a portion of its length at the north. In either case, stubbed streets or bicycle & pedestrian accessways can be provided that link to the trail network from all adjacent streets.
Provide access to nature *The creeks and natural areas provide opportunities to see and interact with nature close to home.*	Length of street frontage abutting to natural areas	Better	Good	Better	The grid network framework street alignment along the north end of Boeckman Creek provides more opportunity for a street adjacent to the open space without development in between. The organic street framework could easily be adjusted to do the same.
	Street layout integration with natural resource areas	Good	Better	Good	Both street frameworks respond to the natural resource areas on site. Neither includes framework streets that cross a natural resource area except to provide a connection to the development in the northeast corner of the East neighborhood across the BPA easement and the drainage/wetland area that runs through it. The crossing location identified in the organic street network (Option B) may have slightly less impact on the resource area due to its location further upstream, but more detailed study is needed to determine this with any certainty.
	Length of trails adjacent to or within natural areas	Good	Good	Good	The three alternatives provide essentially identical trail networks, all of which are focused along the edge of Boeckman Creek and within the BPA easement.
Create community gathering spaces *Beautiful parks, quality schools, and*	Retail node centrally located as focal point for Frog Pond neighborhoods	Good	Good	Good	All three retail locations are fairly centrally located within the Frog Pond area and all provide good focal points for adjacent development.

Guiding Principle	Evaluation Measures	Option A Rating	Option B Rating	Option C Rating	Rationale
other public spaces serve as community centers and gathering places. The land uses, transportation, and open space around the Advance Road school and park sites support a compatible neighborhood plan in that area. The Frog Pond Grange, and adjacent uses, fit together as a focal point of the community.	Compatibility of land uses in South neighborhood with future park and schools	Good	Good	Better	Option C includes high density residential in the corner between Advance Road and the park / school site. This location provides the higher density development with excellent access to the future community park and schools while also buffering it from nearby lower density housing. The medium density housing surrounding much of the park and school site in all three alternatives provides many households in housing types that may be more family-oriented with excellent proximity to the future park and schools.
Provide for Wilsonville's housing needs *A variety of attractive homes are provided to fulfill the City's housing needs and align with the market. Single-family homes are an important part of the mix, and*	Degree of match between housing mix and recommended mix from market analysis	Good	Better	Best	The market analysis included two housing mix options. The higher density mix included in the market analysis, which best reflected market trends, is most similar to Option C. The lower density mix from the market analysis, which is similar to Option B, was noted as offering limited diversity in the product mix, with less small lot single family homes and multifamily housing than demographic trends would suggest demand for. Option A provides a substantially different mix of housing products than recommended in the market study, with a greater emphasis on larger lot single-family homes and less attached housing types.

Guiding Principle	Evaluation Measures	Option A Rating	Option B Rating	Option C Rating	Rationale
neighborhoods are designed to be multi-generational and offer a diversity of attractive housing options at a variety of prices.	Degree of match between housing mix and Wilsonville's housing policy objectives	Best	Better	Good	Wilsonville has expressed a policy objective of moving towards an overall balance between single family detached housing and attached housing that is closer to a 50/50 split. Some policy-makers have also expressed a desire for more large-lot single-family housing. Option A best meets those policy objectives, with an overall 62% to 38% split for the whole Frog Pond area between the residential categories that are all or nearly all single family detached homes, and those that are more likely to be attached products (Medium Density, as noted previously, may include a mix of attached townhomes and detached small-lot homes). Option C has just 26% of the housing for the Frog Pond area overall in the density ranges that are expected to be detached homes, and 74% in Medium and High Density, which are more likely to be attached housing products.
	Each neighborhood provides for a variety of housing options	Good	Good	Better	While the range of densities provided in each neighborhood varies somewhat between the alternatives, all three provide for two densities of housing in the West neighborhood and three densities of housing in the East neighborhood. Option C provides three densities of housing in the South neighborhood, while the other alternatives provide two.
Create a feasible implementation strategy *A realistic funding plan for infrastructure, smart and flexible*	Cost and ease of available mechanisms to fund transportation system improvements	Good	Better	Best	The difference in transportation costs between the three options is negligible; however the greater levels of residential development in Option C and, to a lesser extent, Option B generate more SDC revenue to pay for transportation improvements.

Guiding Principle	Evaluation Measures	Option A Rating	Option B Rating	Option C Rating	Rationale
regulations, and other strategies promote successful implementation of the plan.	Cost and ease of available mechanisms to fund water system improvements	Good	Better	Best	Water system improvements for Option B are slightly less costly - about 4% ($1 million) less than Options A and C overall due to differences in the layouts. There is a greater difference in SDC revenue generated by each alternative, with Option C and, to a lesser extent, Option B generating more SDC revenue to pay for off-site water system improvements.
	Cost and ease of available mechanisms to fund sanitary sewer system improvements	Good	Better	Best	Sewer system improvements for Options A and C are slightly less costly – about 2% ($0.8 million) less than Option B due to differences in the layouts. There is a greater difference in SDC revenue generated by each alternative, with Option C and, to a lesser extent, Option B generating more SDC revenue to pay for off-site sewer system improvements.
	Compatibility of water, sewer and stormwater alignments with road layout	Good	Better	Good	Option B requires slightly less easements for water and sewer lines than Options A and C due to differences in the street networks.
	Operations & maintenance considerations, including accessibility of lines, for water, sewer and stormwater	Good	Good	Good	No significant operations and maintenance concerns have been identified for any of the alternatives.
	Reliance on gravity sewer vs. pumping	Good	Good	Good	All three alternatives require three small pump stations in the East neighborhood and one in the South neighborhood, but can otherwise be served by gravity sewer.

Guiding Principle	Evaluation Measures	Option A Rating	Option B Rating	Option C Rating	Rationale
	Ability of plan to develop over time with multiple developers	Best	Low	Better	The grid street network in Options A and C is more feasible to build incrementally without a master developer. The organic street network in Option B would be difficult to build without significant lot consolidation in the West Neighborhood. In Options A and B, the retail is nearly all located on a single parcel, which would make it easier to implement than in Option C, in which it is split across multiple properties that are not in common ownership. In Option B, the shaping of the residential land uses does not respond to property lines, and as a result is more dependent on a master developer for implementation. In Option C, the shaping of residential land uses in the West neighborhood largely works with the property lines, but the locations identified for High Density Residential are fragmented across properties that are not in common ownership. In Option A, the shaping of residential land uses works well with the property lines.
Frog Pond is an extension of Wilsonville *Frog Pond is truly connected – it is an easy and safe walk, bike trip, or bus ride to other parts of Wilsonville, and Frog Pond feels like a well-planned extension of the city.*	Alignment of main access points and internal circulation roads (i.e. Neighborhood Collector streets) with adjacent neighborhood connections	Good	Good	Good	All three alternatives align the connection points to Boeckman Road with the existing local street intersections that connect to neighborhoods to the south.
	% of residents/jobs within 1/4 mile of existing transit routes	Good (36%)	Better (38%)	Best (40%)	Over a third of housing units would be located within a quarter mile of existing transit routes in all three alternatives. Option C focuses the greatest percentage of new housing adjacent to existing transit routes. (Percentages are shown at left.)

Guiding Principle	Evaluation Measures	Option A Rating	Option B Rating	Option C Rating	Rationale
	Accessibility of commercial area to existing neighborhoods	Good	Best	Better	All three alternatives provide access to the future retail area from existing Wilsonville neighborhoods via Wilsonville / Stafford Road. The retail location in Option B provides more direct access for existing neighborhoods to the south and west.
Retain trees *Mature native trees are integrated into the community to enhance the area's character and value.*	Alignment of roads to avoid stands of mature native trees	Good	Good	Good	The framework streets in all alternatives generally avoid existing tree groves.
	Potential impacts to tree groves from infrastructure alignments	Good	Good	Good	All three alternatives require a water line easement through a wooded area around Newland Creek in the East neighborhood. No other framework infrastructure alignments are anticipated to impact tree groves.
	Potential for parks to align with high-quality tree groves	Good	Good	Good	All alternatives have roughly the same potential for future parks to be aligned with high-quality tree groves. Future park locations will be determined through land acquisition efforts by the city, through subsequent concept plan refinements or the development review process.
Honor Frog Pond's history *A sense of history is retained, recognized, and celebrated.*	Prominence of Grange relative to street network and other land uses	Good	Best	Better	The northern framework street in Option B crosses closer to the Grange itself, providing an opportunity to create a plaza between the Grange and the street that would complement and highlight the Grange building. The location of the retail in the West neighborhood in Option C provides the possibility of a second, smaller node in the East neighborhood near the Grange.
	Retention of Frog Pond Lane	Better	Low	Better	The organic street framework in Option B assumes that Frog Pond Lane is abandoned. The grid street framework in Options A and C retains Frog Pond Lane as part of the future street network. Frog Pond Lane may have historic and sentimental value to those whose families have lived or owned property in the area for many decades.

Guiding Principle	Evaluation Measures	Option A Rating	Option B Rating	Option C Rating	Rationale
Provide compatible transitions to surrounding areas *New urban land uses are good neighbors to adjacent rural land uses, future developable areas, and existing neighborhoods. The plan provides for future growth of the City into adjacent urban reserves.*	Number of new homes within 1,000 feet of a Rural Reserve	Best (about 470)	Better (about 550)	Good (about 570)	Option A has the fewest new homes located within 1,000 feet of a Rural Reserve (numbers shown at left).
	Use of transects to transition density adjacent to rural edges	Better	Better	Good	Option A has very low density housing in the northeast corner of the East neighborhood where it abuts Rural Reserve and low density housing on the southern end of the South neighborhood where it abuts Rural Reserve, but some medium density housing on the east side of the South neighborhood. Option B locates low density housing along all of the outer edges of the Frog Pond plan area. Option C has medium density in part of the northeast corner of the East neighborhood and on part of the eastern edge of the South neighborhood.
	Use of open spaces or other features to provide buffers to adjacent rural areas	Good	Good	Good	All three alternatives show a potential future trail alignment down the eastern edge of the South neighborhood that could help provide an edge and a buffer to the adjacent Rural Reserve if appropriately designed and landscaped.
	Land use and transportation patterns can logically be extended into Elligsen Urban Reserve in the future	Good	Good	Good	All three alternatives plan for the eventual extension of the north-south neighborhood collector through the West neighborhood into the Elligsen Urban Reserve.

Guiding Principle	Evaluation Measures	Option A Rating	Option B Rating	Option C Rating	Rationale
Promote healthy, active lifestyles *Extensive walkways, community gardens, recreational facilities, and other elements support active and healthy lifestyles.*	Connectivity of trails to parks, schools, open spaces, and neighborhood-scale retail	Good	Good	Good	All three alternatives have essentially the same trail network, which connects well to the future schools and to the BPA powerline easement and the Boeckman Creek corridor, but does not connect directly to the retail area or the future community park.
Integrate sustainability *The plan integrates solutions which address economic, environmental and social needs. Frog Pond is a sustainable community over the long term.*	Environmental impacts to wetlands, tree groves and SROZ areas in the placement of transportation, water, sewer, and stormwater facilities	Good	Good	Good	Alignment of framework streets and infrastructure facilities (with the possible exception of local streets) generally avoid tree groves and significant natural resource areas. Wetland impacts from roads and infrastructure are about the same in all three alternatives.
	Total impervious area	Better	Better	Good	Option C has higher density residential development, which tends to have higher impervious surface coverage.
	Proximity of new infrastructure to seismic & landslide hazard areas, and steep slopes	Good	Better	Good	Alignment of West Neighborhood roadway for Concept 2 being offset from Boeckman Creek ravine reduces proximity of new infrastructure to the Boeckman Creek ravine, which has steep slopes.
	Compatibility of stormwater management facilities with existing topography	Good	Good	Good	All alternatives offer similar opportunities to design stormwater management facilities that are compatible with existing topography.

Guiding Principle	Evaluation Measures	Option A Rating	Option B Rating	Option C Rating	Rationale
Coordinate with Wilsonville's transportation network *The plan is consistent with the Wilsonville Transportation System Plan for all modes of travel: trails, bikeways, SMART, and vehicles. Traffic impacts are managed for key streets and intersections, including the I-5 interchanges.*	Level of Service (LOS) at Study Intersections	Best	Good	Better	Two study intersections would fail to meet LOS standards in Option B. Option A and C each have only one intersection that fails to meet standards, but one study intersection performs slightly better in Option A than Option C and delays are slightly shorter for Option A. This difference is primarily due to the difference in the signal location; the location further north in Options A and C performs better.
	Integration of the various travel modes (pedestrian, bicycle, transit, and motor vehicle) that facilitates transportation choices	Better	Good	Better	The layout of the grid network does a particularly good job of providing internal connections that support circulation and access. The collector street route being located further north also provides better transit coverage in the northern part of the planning area.
	Number and magnitude of deviations to projects and standards identified in TSP	Good	Good	Good	No major deviations from TSP standards are needed for any of the alternatives. The additional transportation projects needed to support growth in Frog Pond are essentially the same for all alternatives.

Issues for Further Study

Several implementation considerations for the Frog Pond Area Plan have begun to emerge from the evaluation of alternatives, including:

- Site design techniques for the Frog Pond retail area to ensure it is compatible with adjacent neighborhoods, easily accessible by all modes, and supports a high-quality pedestrian environment on adjacent streets;
- Where and to what degree to allow or encourage the use of alleys for residential development;
- Mechanisms to ensure provision of neighborhood parks if the Frog Pond Area is developed incrementally;
- Stormwater management strategies – on-site treatment and detention versus consolidated facilities serving multiple developments;
- Appropriate levels of protection for existing mature trees and tree groves;
- Wetland mitigation strategies;
- Appropriate bicycle and pedestrian crossing treatments for major road intersections to ensure safe routes to school and easy connections within the Frog Pond Area; and
- How certain road and utility infrastructure improvements will be built and paid for, such as urban upgrades to Stafford Road.

These issues will be explored further throughout the course of the project as it moves towards a final plan and set of implementation measures.

Exhibits & Appendices

List of Exhibits

List of Appendices

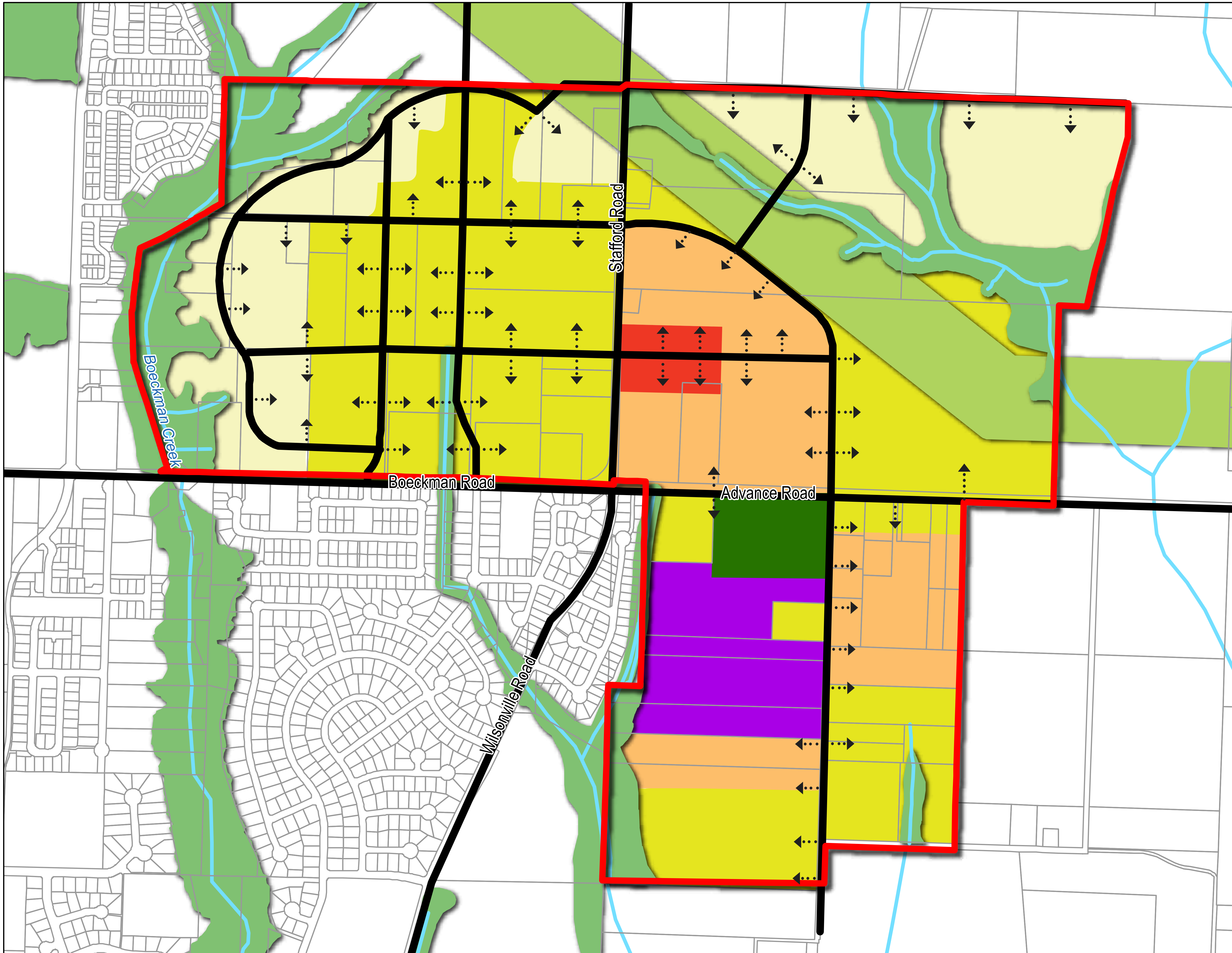


Exhibit 1A

FROG POND AREA PLAN
Creating a great community

Option A

- Framework Street
- Local Connection
- Planning Area
- Planned School Site
- Community Park
- Stream
- BPA Corridor
- Natural Resources Overlay
- Taxlots

Land Use Designations

- Very Low Density (3 Units / Net Acre)
- Low Density (7.2 Units / Net Acre)
- Medium Density (12.1 Units / Net Acre)
- High Density (25 Units / Net Acre)
- Commercial

0 250 500 1,000 Feet

Prepared By: Angelo Planning Group

Date: 8/19/2014

Coordinate System: NAD 1983 HARN State Plane Oregon North FIPS 3601

Disclaimer: *This map is intended for informational purposes only. While this map represents the best data available at the time of publication, the City of Wilsonville makes no claims, representations, or warranties as to its accuracy or completeness. Metadata available upon request.*

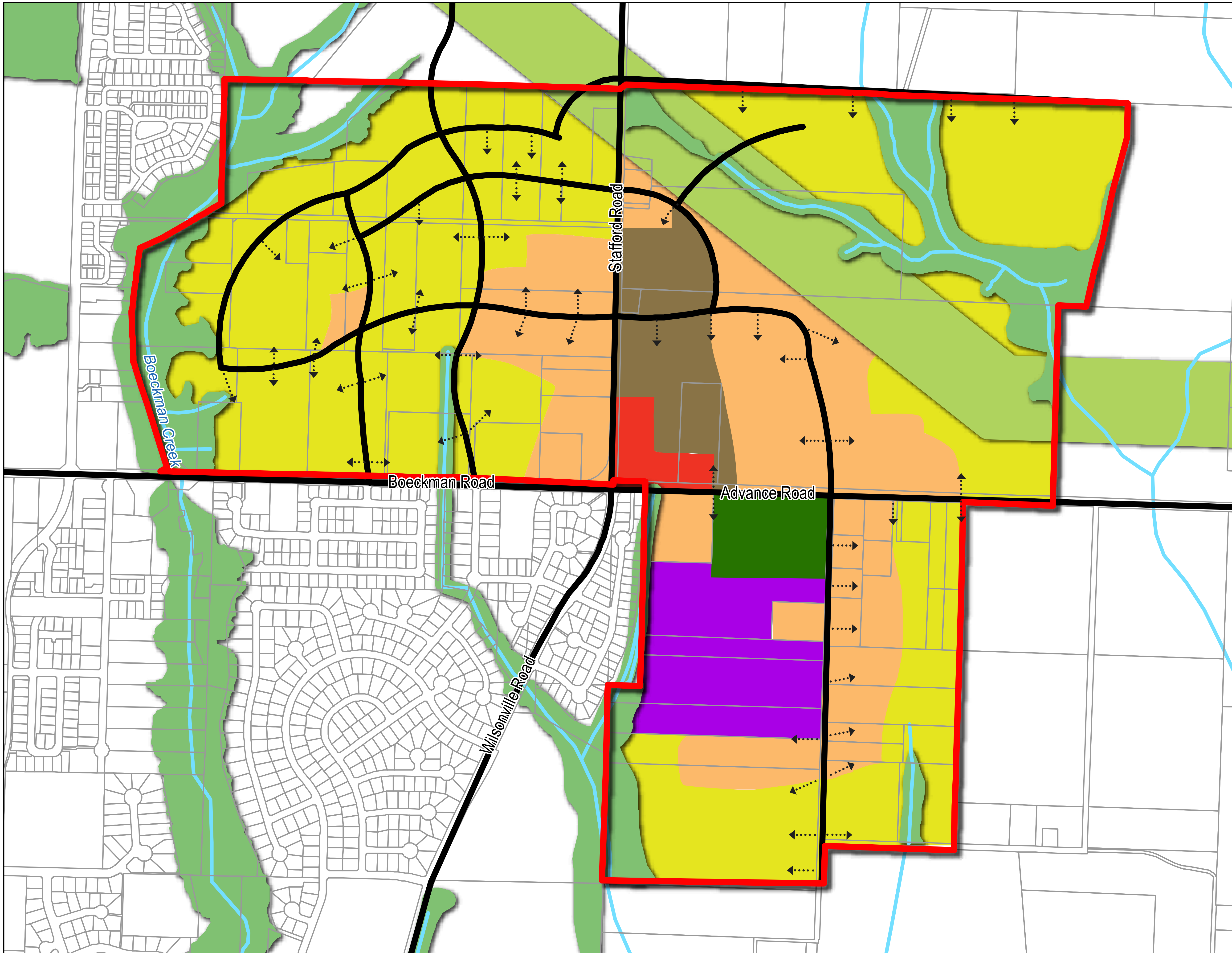


Exhibit 1B

FROG POND AREA PLAN
Creating a great community

Option B

- Framework Street
- Local Connection
- Planning Area
- Planned School Site
- Community Park
- Stream
- BPA Corridor
- Natural Resources Overlay
- Taxlots

Land Use Designations

- Very Low Density (3 Units / Net Acre)
- Low Density (7.2 Units / Net Acre)
- Medium Density (12.1 Units / Net Acre)
- High Density (25 Units / Net Acre)
- Commercial

0 250 500 1,000 Feet

Prepared By: Angelo Planning Group

Date: 9/10/2014

Coordinate System:
NAD 1983 HARN State Plane Oregon North FIPS 3601

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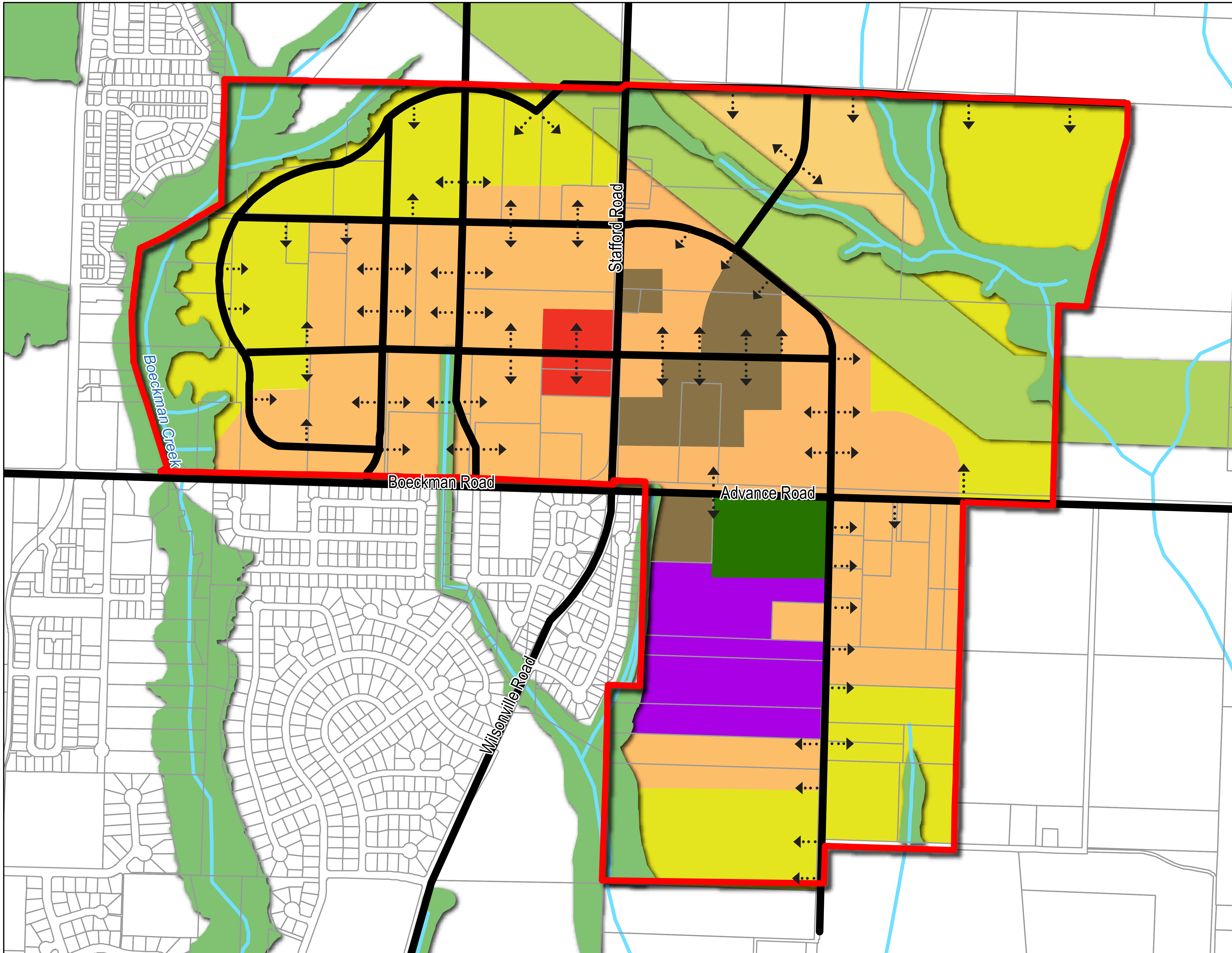

Exhibit 1C

FROG POND AREA PLAN
Creating a great community

Option C

Framework Street
Local Connection
Planning Area
Planned School Site
Community Park
Stream
BPA Corridor
Natural Resources Overlay
Taxlots

Land Use Designations

Very Low Density (3 Units / Net Acre)
Low Density (7.2 Units / Net Acre)
Medium Density (12.1 Units / Net Acre)
High Density (25 Units / Net Acre)
Commercial

Feet
0 250 500 1,000

Prepared By:
Angelo Planning Group

Date:
8/19/2014

Coordinate System:
NAD 1983 HARN State Plane Oregon North FIPS 3601

Disclaimer:
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Exhibit 2

Very Low Density
(with Accessory Dwelling Unit over garage)

Very Low Density Residential

Very Low Density Residential

Low Density Residential

Low Density Residential

Low Density Residential

Low-Density Residential
(Duplex within single-family home neighborhood)

Low Density Residential
(With mature tree protected in front yard)

Land Use & Housing Types

Creating a great community

Exhibit 2

Medium Density Residential
(Townhomes)

Medium Density Residential
(Townhomes)

Medium Density Residential
(Townhomes)

Medium Density Residential
(Cottages)

Medium Density Residential
(Cottages)

High-Density Residential
(Garden Apartments)

High-Density Residential
(Small Condominium)

High-Density Residential
(Garden Apartments)

Land Use & Housing Types

FROG POND
Creating a great community

Exhibit 2

Neighborhood-scale commercial building


Corner left unbuilt to provide access into parking lot from Main Street


Stormwater treatment integrated into Main Street


Parking is located behind buildings and well-landscaped. On-street parking contributes to supply.

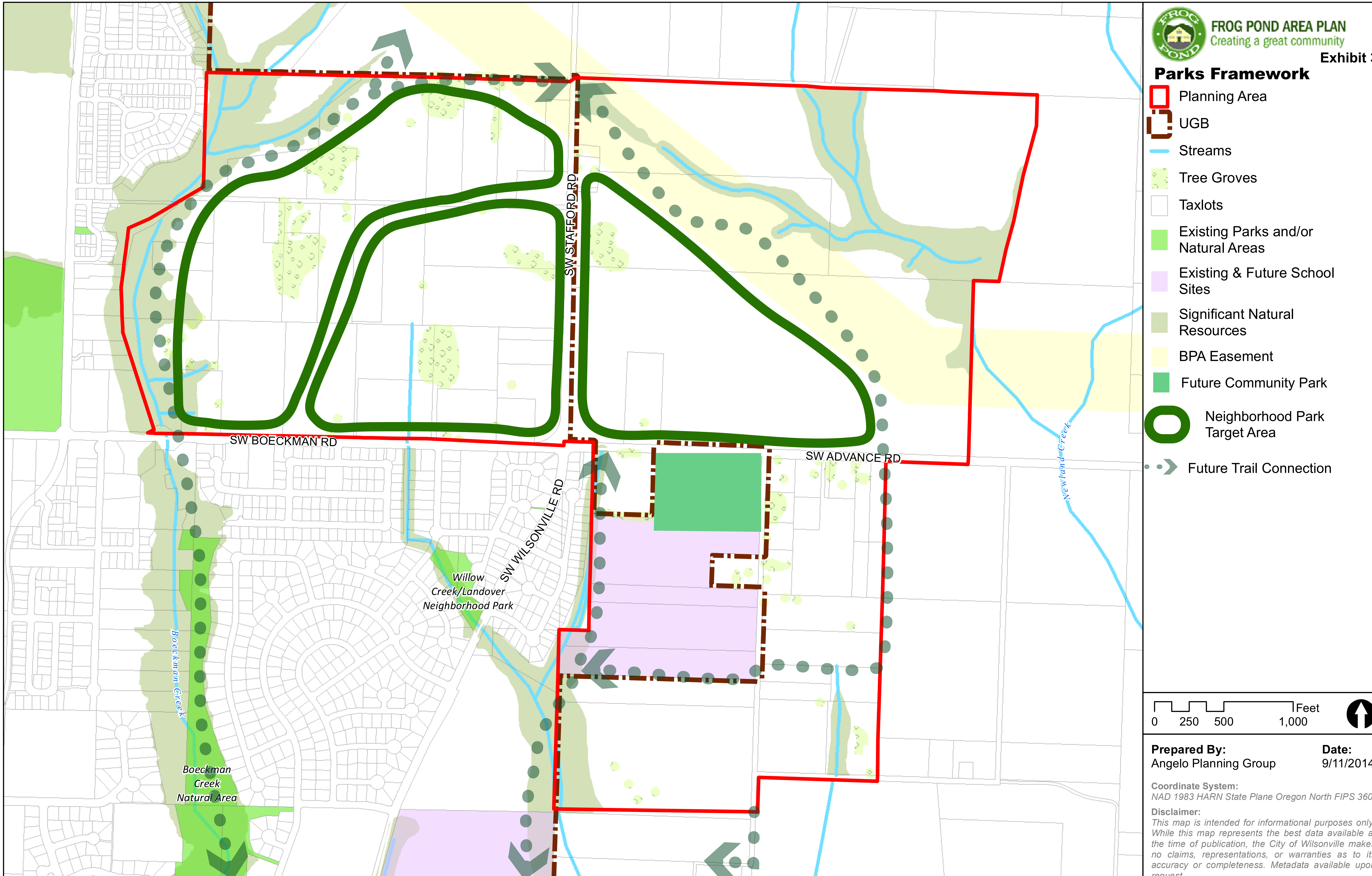

Mature trees protected within parking lot

Commercial
(Small-scale retail)


Commercial
(Mixed Use, 3 stories housing over 1 retail)


Commercial
(Mixed Use, 2 stories housing over 1 retail)

Neighborhood Commercial


FROG POND AREA PLAN
Creating a great community
Exhibit 3
Parks Framework
Planning Area
UGB
Streams
Tree Groves
Taxlots
Existing Parks and/or Natural Areas
Existing & Future School Sites
Significant Natural Resources
BPA Easement
Future Community Park
Neighborhood Park Target Area
Future Trail Connection
Feet
0 250 500 1,000
Prepared By:
Angelo Planning Group
Date:
9/11/2014
Coordinate System:
NAD 1983 HARN State Plane Oregon North FIPS 3601
Disclaimer:
This map is intended for informational purposes only. While this map represents the best data available at the time of publication, the City of Wilsonville makes no claims, representations, or warranties as to its accuracy or completeness. Metadata available upon request.
SW STAFFORD RD
SW BOECKMAN RD
SW ADVANCE RD
SW WILSONVILLE RD
Willow Creek/Landover Neighborhood Park
Boeckman Creek Natural Area
Boeckman Creek
Newland Creek

FROG POND
Creating a great community

Exhibit 4


Kids' fountain in park plaza


Park events


Civic space and mature trees in neighbor-hood park


Neighborhood Center Plaza


Neighborhood Park


Trails


Park integrated with powerline easement

Park Design Concepts

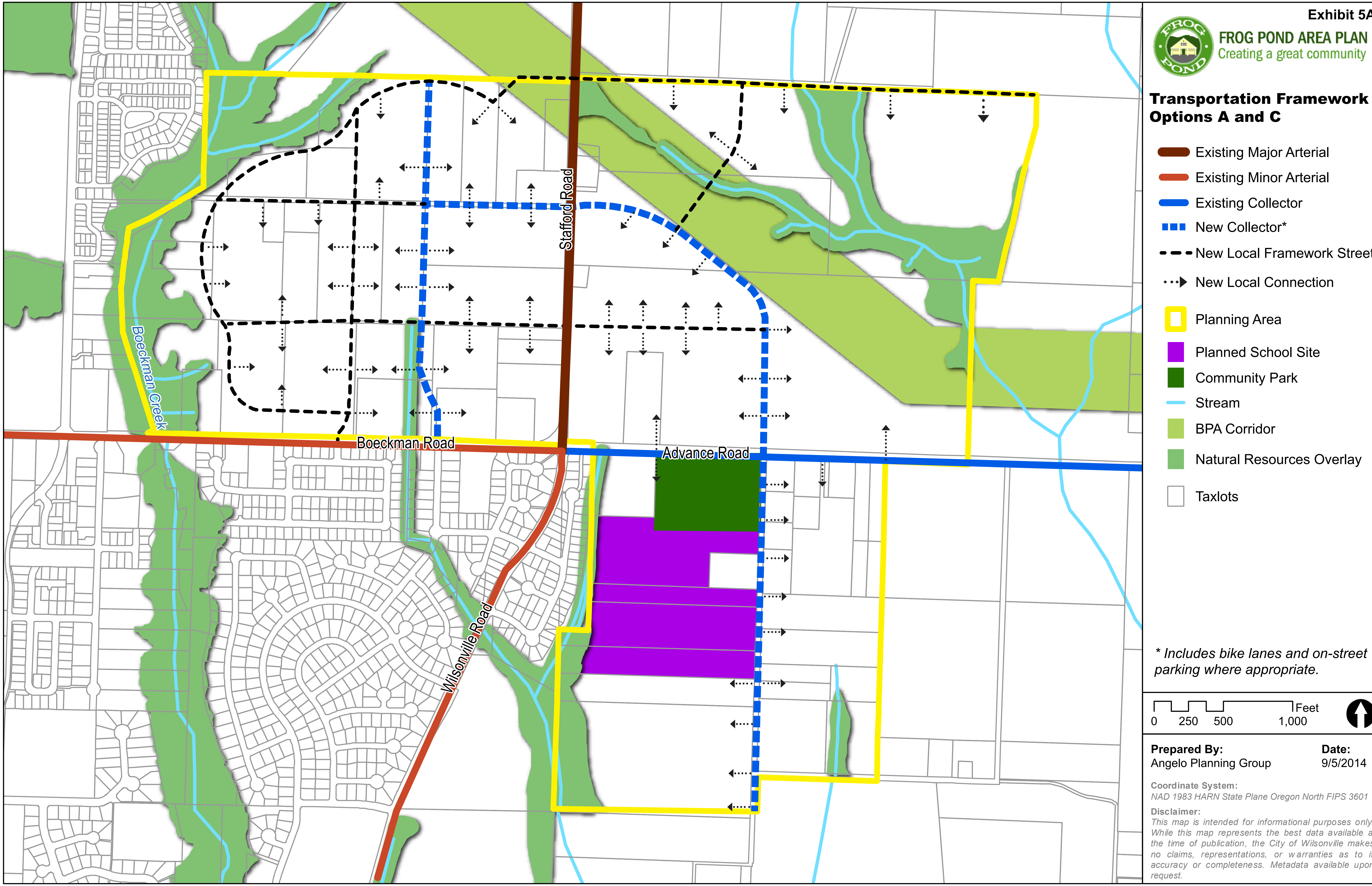


Exhibit 5A
FROG POND AREA PLAN
Creating a great community
Transportation Framework Options A and C
Existing Major Arterial
Existing Minor Arterial
Existing Collector
New Collector*
New Local Framework Street
New Local Connection
Planning Area
Planned School Site
Community Park
Stream
BPA Corridor
Natural Resources Overlay
Taxlots
* Includes bike lanes and on-street parking where appropriate.
Feet
0 250 500 1,000
Prepared By:
Angelo Planning Group
Date:
9/5/2014
Coordinate System:
NAD 1983 HARN State Plane Oregon North FIPS 3601
Disclaimer:
This map is intended for informational purposes only. While this map represents the best data available at the time of publication, the City of Wilsonville makes no claims, representations, or warranties as to its accuracy or completeness. Metadata available upon request.
Stafford Road
Boeckman Creek
Boeckman Road
Advance Road
Wilsonville Road

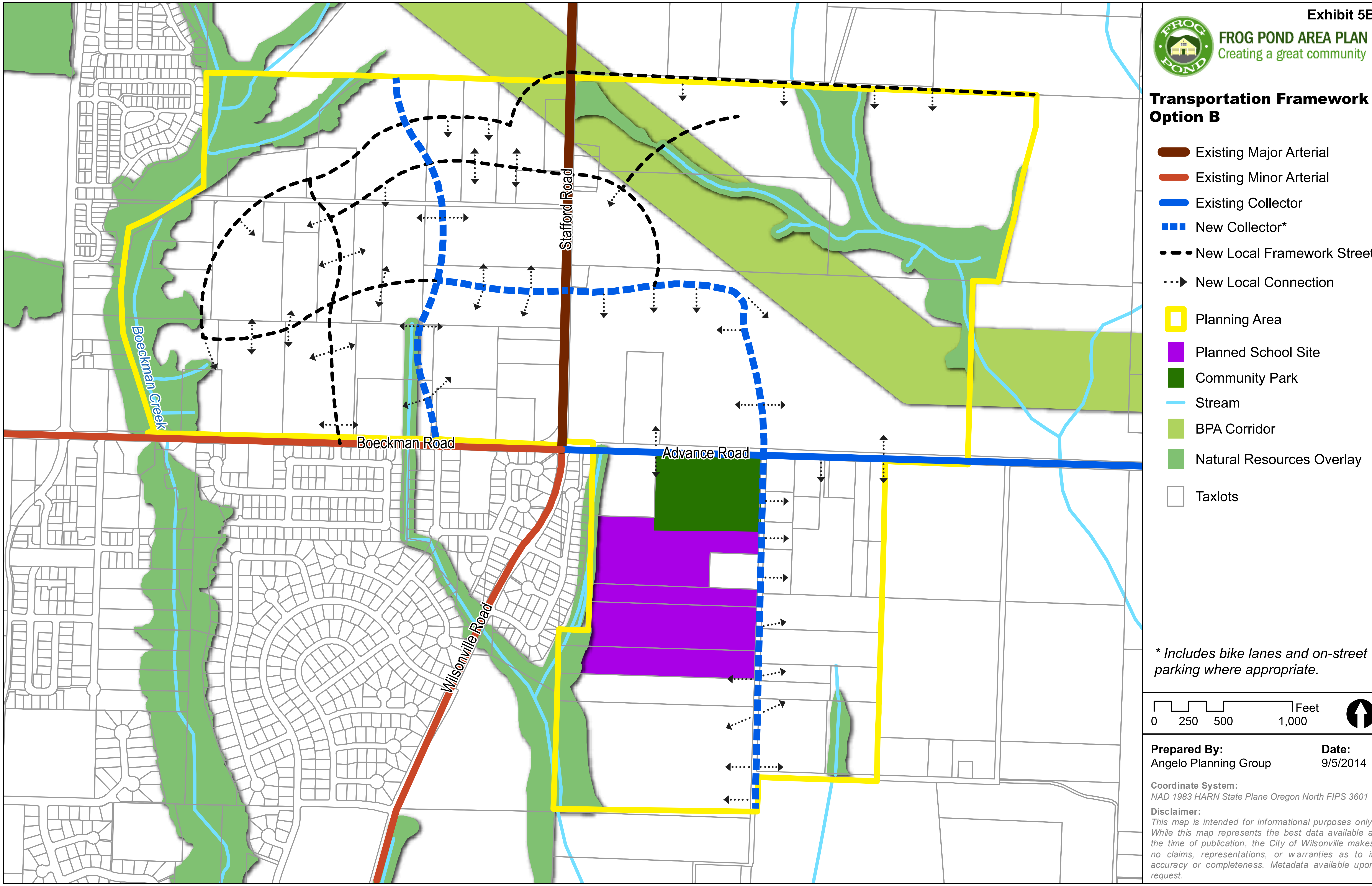


Exhibit 5B
FROG POND AREA PLAN
Creating a great community
Transportation Framework Option B
Existing Major Arterial
Existing Minor Arterial
Existing Collector
New Collector*
New Local Framework Street
New Local Connection
Planning Area
Planned School Site
Community Park
Stream
BPA Corridor
Natural Resources Overlay
Taxlots
* Includes bike lanes and on-street parking where appropriate.
0 250 500 1,000 Feet
Prepared By:
Angelo Planning Group
Date:
9/5/2014
Coordinate System:
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Disclaimer:
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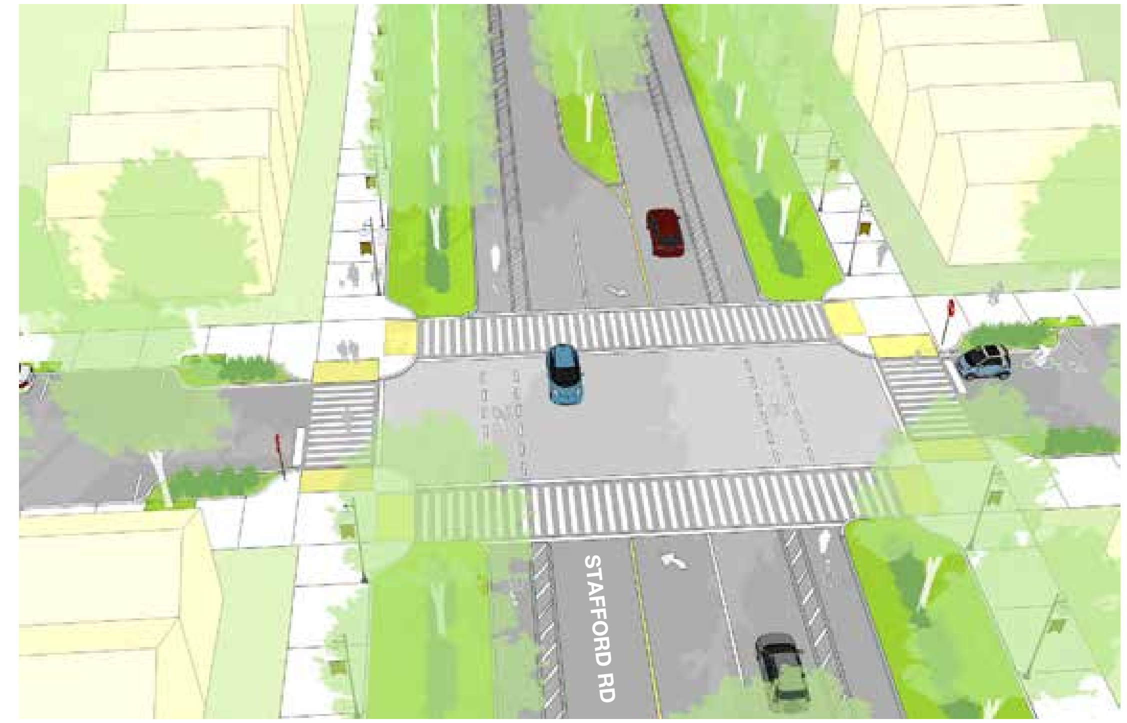
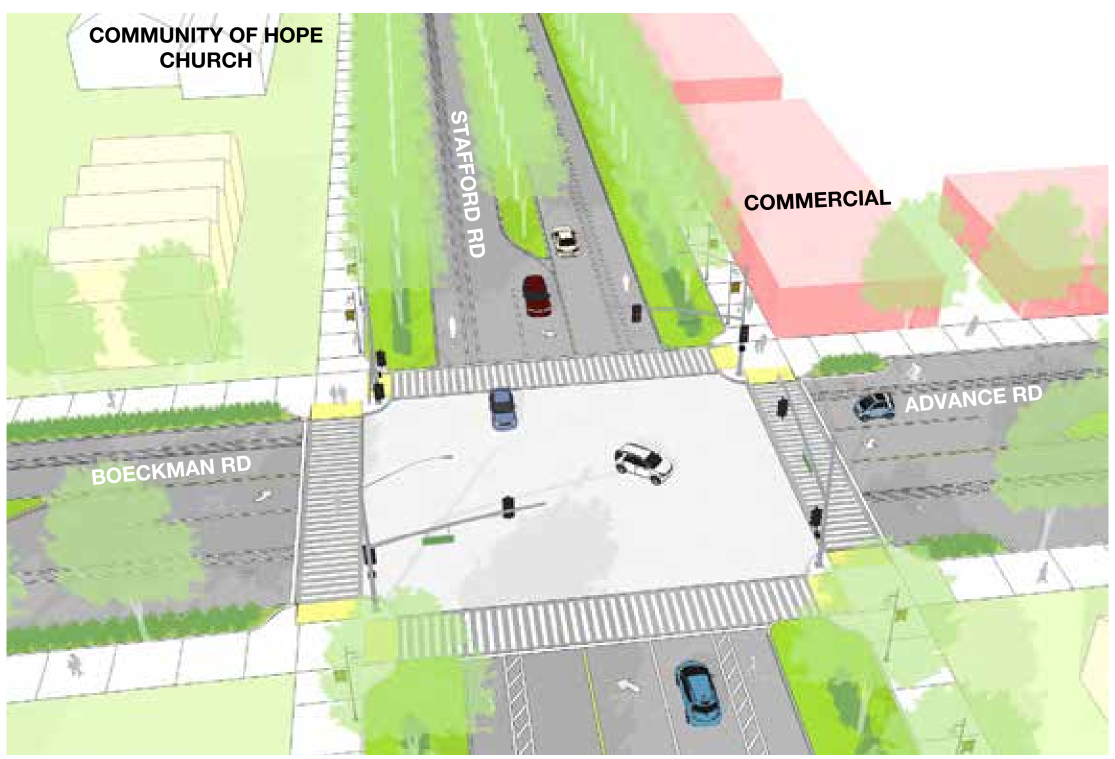
Stafford Road
Boeckman Creek
Boeckman Road
Advance Road
Wilsonville Road

Exhibit 6A

1 **New Neighborhood Collector Intersection**

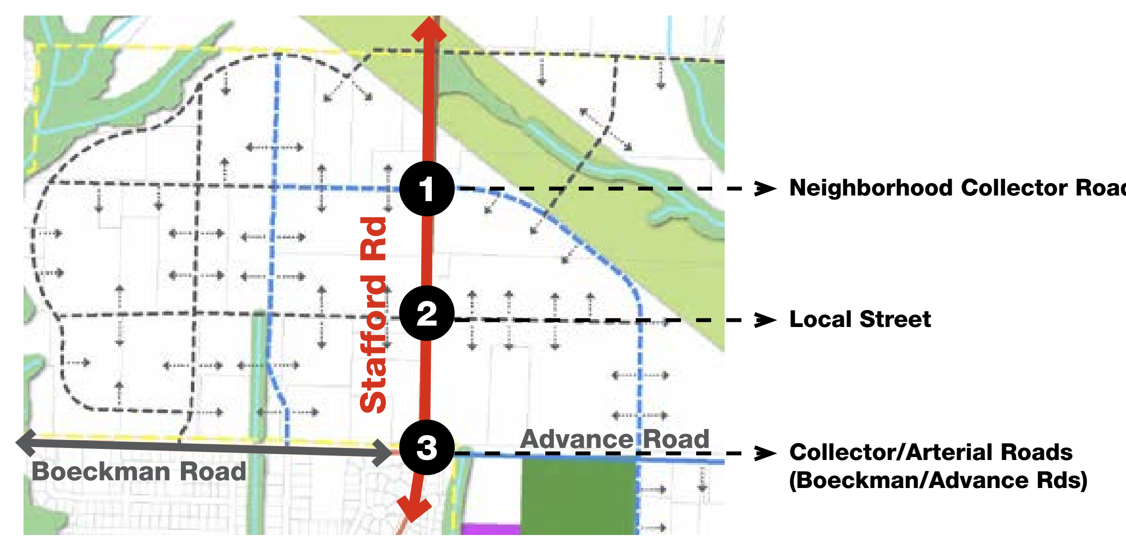


2 **New Local Street Intersection**



3 **Boeckman Road/Advance Road Intersection**

Sidewalk extents represent sufficient ROW for potential expansion of Stafford Rd. to 5 lanes



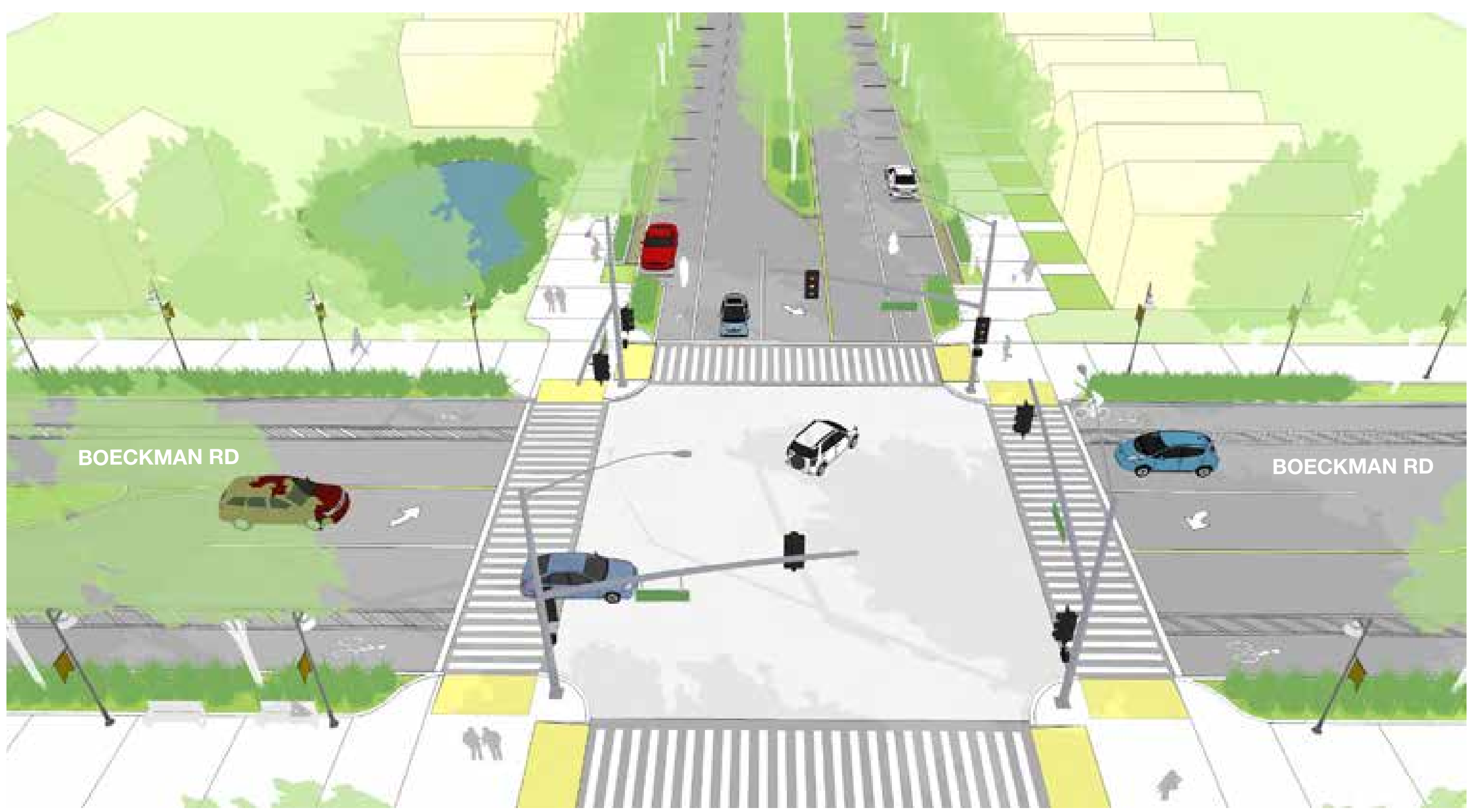
Key Map

Stafford Road Intersection Types

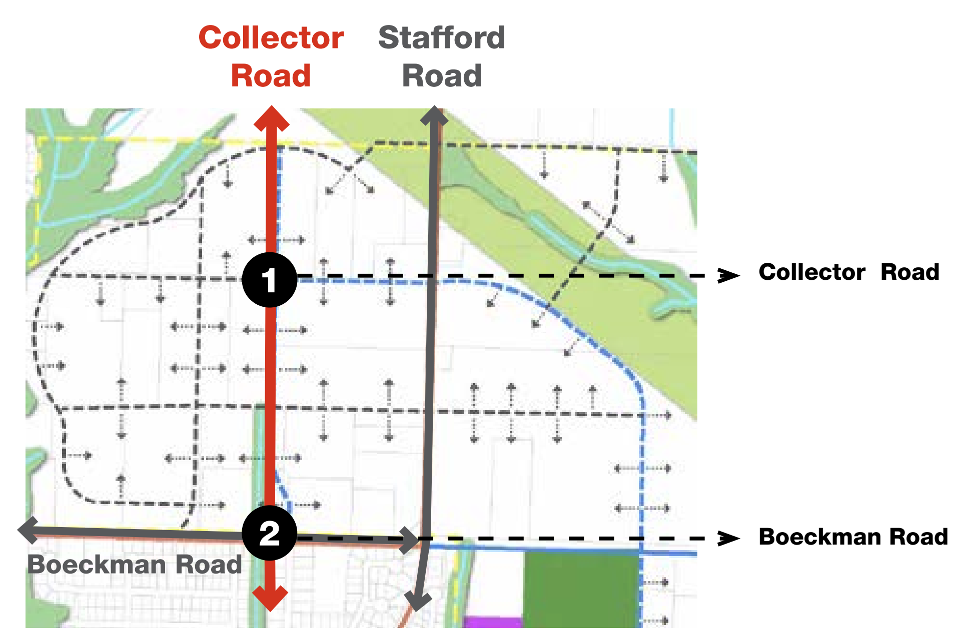
Exhibit 6B

1 Collector Road Roundabout

Wilsonville Roundabout Example



2 Boeckman Road Intersection



Key Map

Collector Road Characteristics

Exhibit 7

Pedestrian Refuge at Roundabout

Bicycle Priority at Intersection

Curbless Street and Intersection

Pedestrian Undercrossings

Pedestrian Undercrossings

Zebra Crossing
(Provides wide, visible and safe crossing)

Concrete Crosswalk

Curb Bump-Out

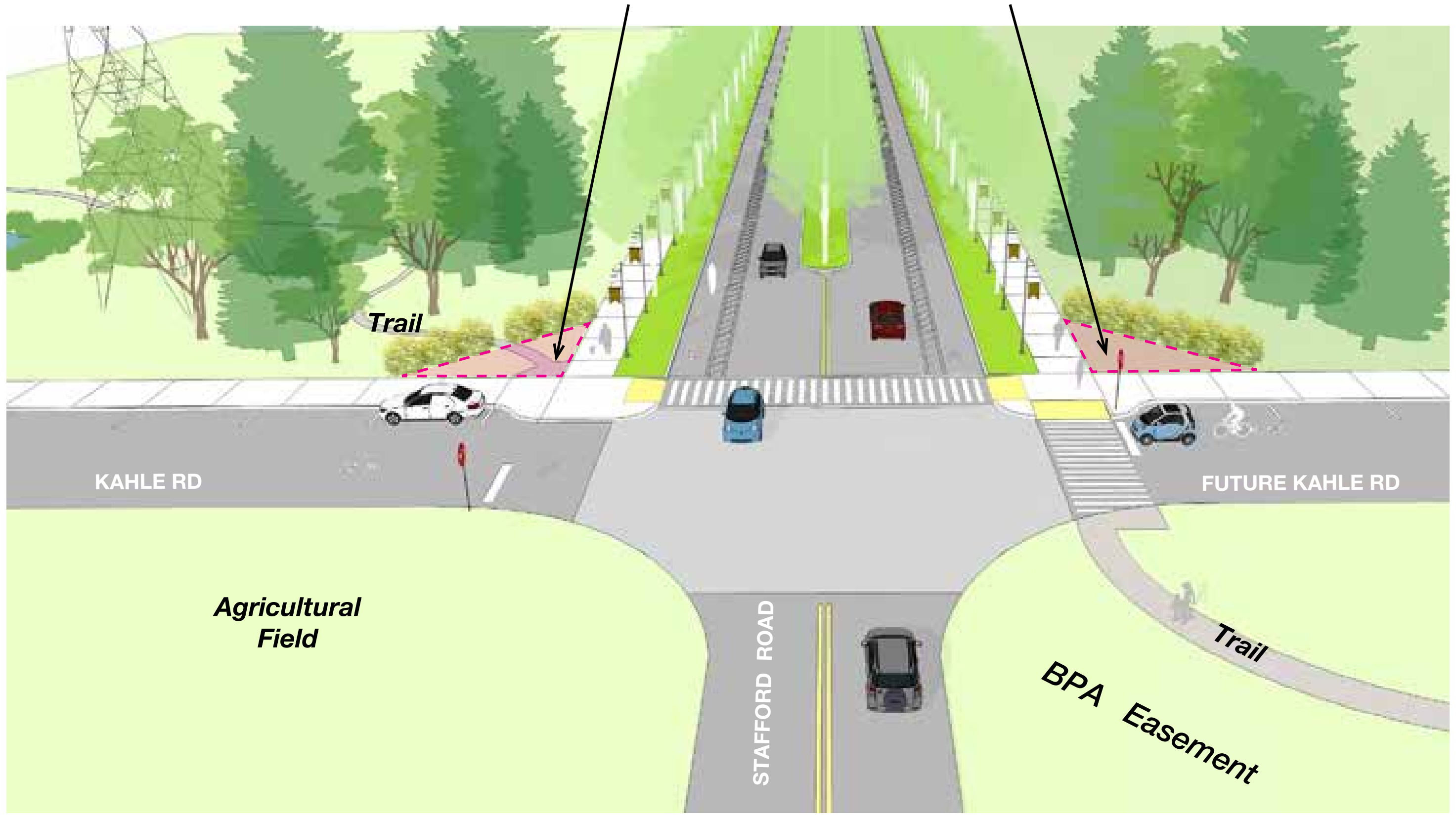
Intersection Treatments

Exhibit 8

Seasonal color provides visual interest

Opportunity to highlight trail connection

Potential area for gateway element



Conceptual Gateway Intersection
SW Stafford & SW Kahle, looking south

- Facilitates transition from rural to urban setting
- Landscape and signage design should reflect the character of the planning area

Vertical elements, landscape and signage mark transitions and gateways

Stafford Road "Gateway" Intersection

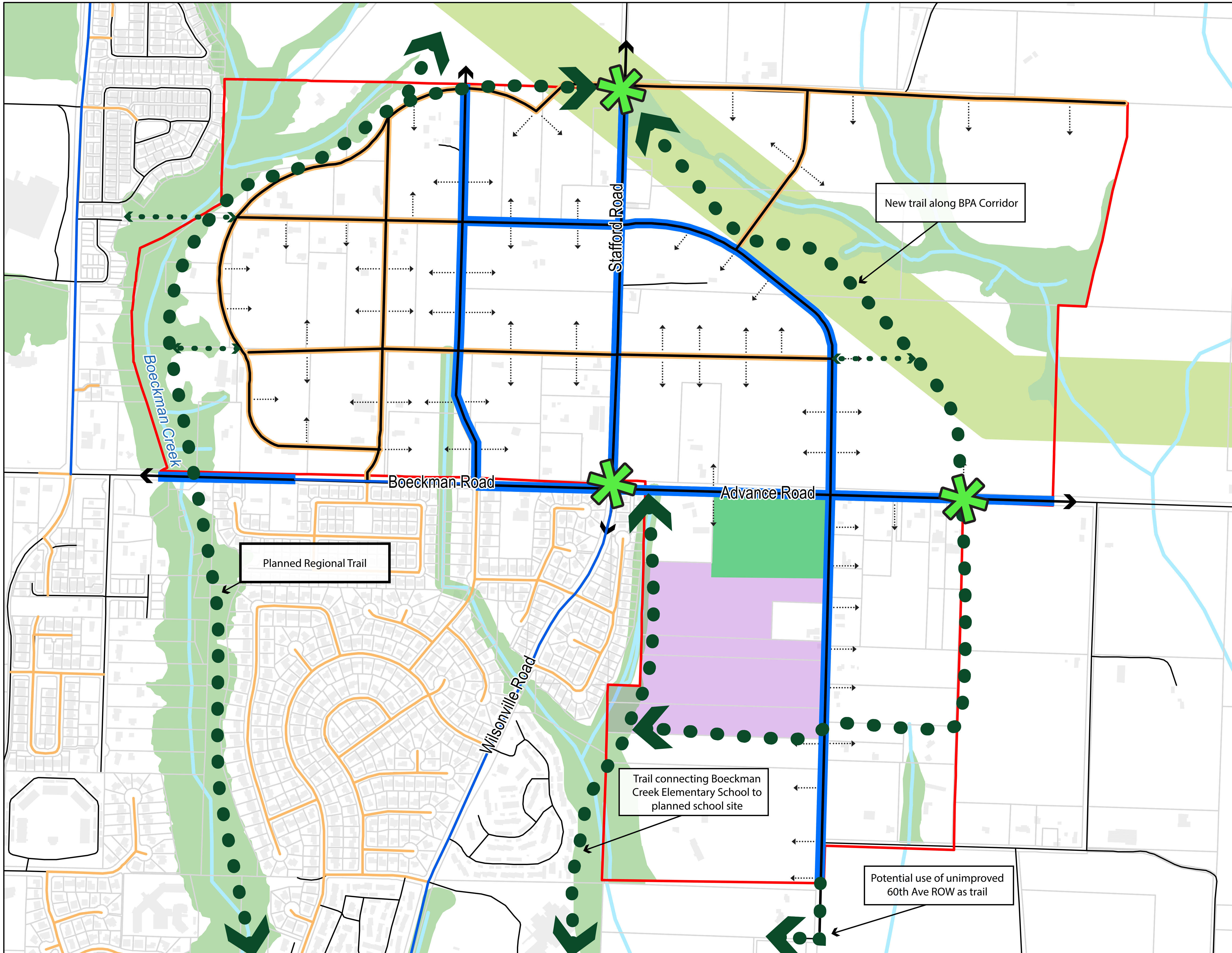


Exhibit 9A

FROG POND AREA PLAN
Creating a great community

Bicycle / Pedestrian Circulation

Option A and C

- Framework Street
- Local Connection
- Planning Area
- Planned School Site
- Community Park
- Stream
- BPA Corridor
- Natural Resources Overlay
- Taxlots
- Existing Sidewalks
- Framework Street with Proposed Sidewalks (All local connections will have sidewalks)
- Existing Bicycle Lane and Sidewalks
- Proposed Bicycle Lane and Sidewalks
- Future Trail Connection
- Potential Grade-Separated Crossing

0 250 500 1,000 Feet

Prepared By: Angelo Planning Group

Date: 9/3/2014

Coordinate System: NAD 1983 HARN State Plane Oregon North FIPS 3601

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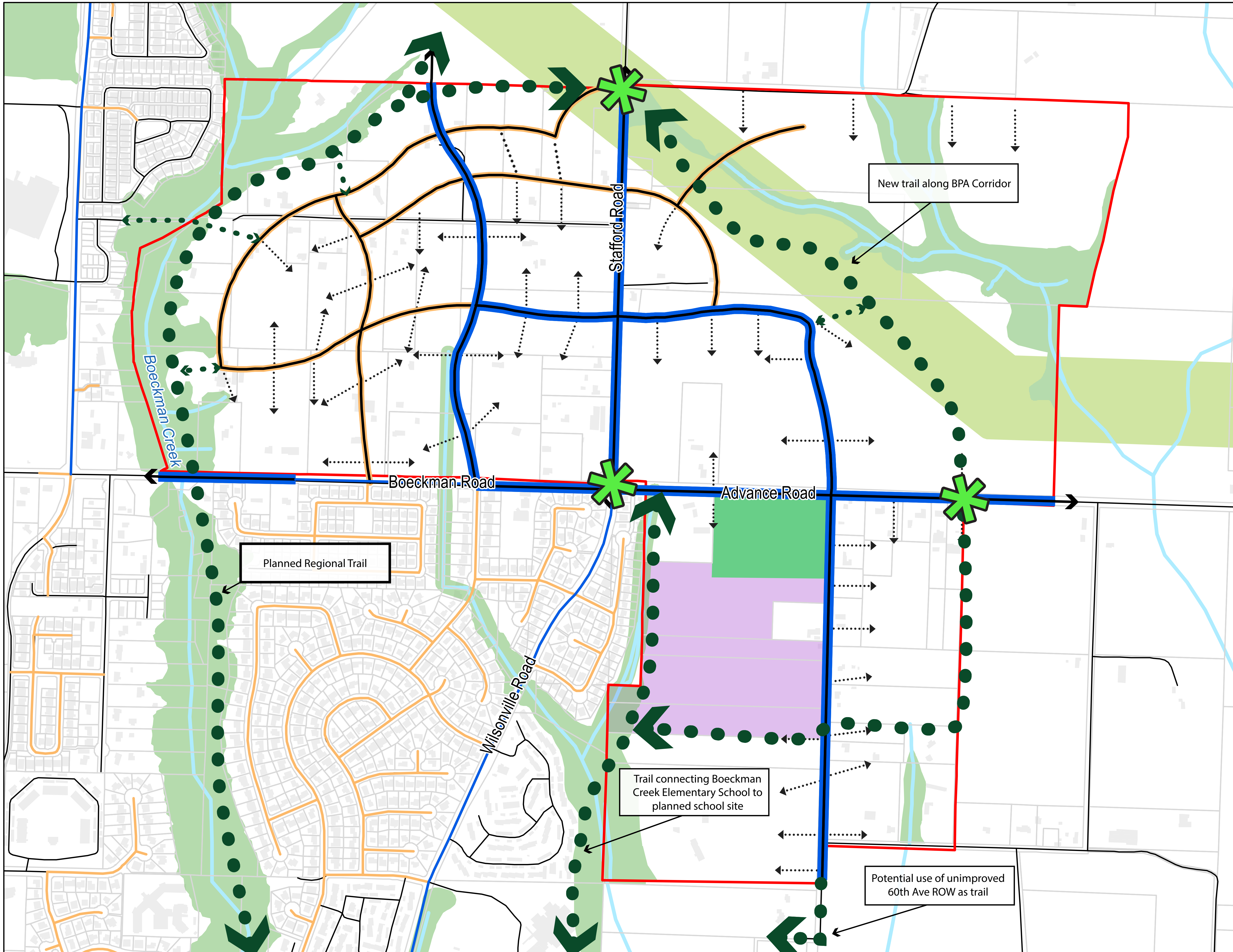

Exhibit 9B

FROG POND AREA PLAN
Creating a great community

Bicycle / Pedestrian Circulation
Option B

- Framework Street
- Local Connection
- Planning Area
- Planned School Site
- Community Park
- Stream
- BPA Corridor
- Natural Resources Overlay
- Taxlots
- Existing Sidewalks
- Framework Street with Proposed Sidewalks (All local connections will have sidewalks)
- Existing Bicycle Lane and Sidewalks
- Proposed Bicycle Lane and Sidewalks
- Future Trail Connection
- Potential Grade-Separated Crossing

0 250 500 1,000 Feet

Prepared By: Angelo Planning Group

Date: 9/3/2014

Coordinate System: NAD 1983 HARN State Plane Oregon North FIPS 3601

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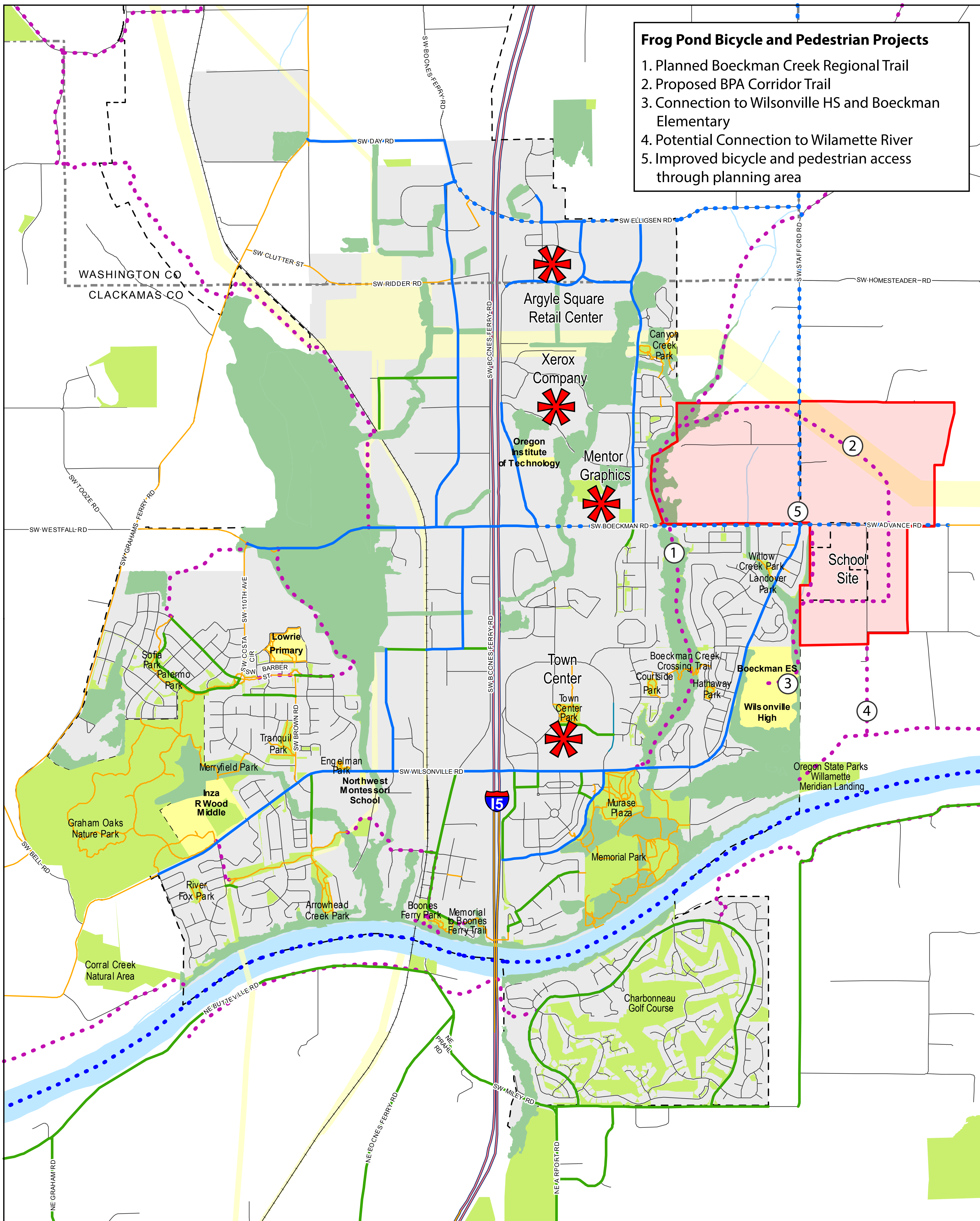
Exhibit 10

FROG POND AREA PLAN
Creating a great community



Existing Bike Lane

Proposed Bikeway

Low-Moderate Traffic Through Street

Existing Trail

Proposed Regional Trail

Proposed Water Trail

Major Destination

Urban Growth Boundary

Park

School

Natural Area

City of Wilsonville

Frog Pond Planning Area

0 1,000 2,000 4,000 Feet

Coordinate System:
NAD 1983 HARN State Plane Oregon North FIPS 3601

Prepared By:
Angelo Planning Group

Date:
9/10/2014

Disclaimer:
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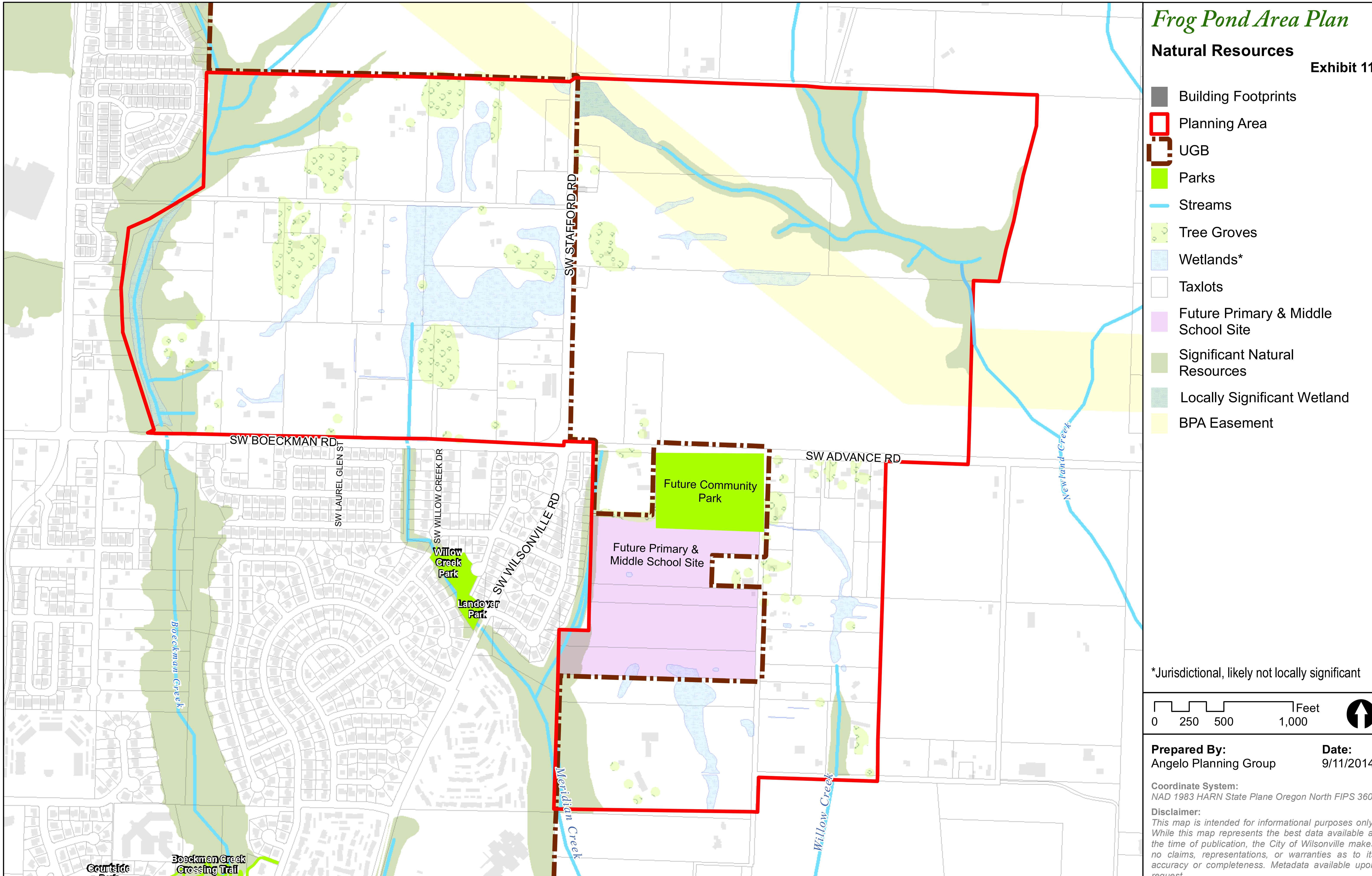

Frog Pond Area Plan
Natural Resources
Exhibit 11
Building Footprints
Planning Area
UGB
Parks
Streams
Tree Groves
Wetlands*
Taxlots
Future Primary & Middle School Site
Significant Natural Resources
Locally Significant Wetland
BPA Easement
*Jurisdictional, likely not locally significant
0 250 500 1,000 Feet
Prepared By:
Angelo Planning Group
Date:
9/11/2014
Coordinate System:
NAD 1983 HARN State Plane Oregon North FIPS 3601
Disclaimer:
This map is intended for informational purposes only. While this map represents the best data available at the time of publication, the City of Wilsonville makes no claims, representations, or warranties as to its accuracy or completeness. Metadata available upon request.
SW STAFFORD RD
SW BOECKMAN RD
SW ADVANCE RD
SW LAUREL GLEN ST
SW WILLOW CREEK DR
SW WILSONVILLE RD
Future Community Park
Future Primary & Middle School Site
Willow Creek Park
Landover Park
Boeckman Creek
Meridian Creek
Willow Creek
Newland Creek
Boeckman Creek Crossing Trail
Courtside Park

Creating a great community

Exhibit 12

Homes overlooking community garden

Low density home overlooking open space

Homes facing pocket park

Homes facing park and natural area

Homes overlooking nature park

Homes facing Powerline easement

Open Space Edge Conditions

Creating a great community

Exhibit 13

Green Roof
(Reduces roof runoff and improves building insulation)

Pervious Paving
(Allows rainwater to percolate into soil)

Parking Lot Rain Garden
(Natural detention and filtration of parking lot rainwater)

Retention Pond
(Holds rainwater in wetland environment)

Stormwater Bioswale
(Natural detention and filtration of on-street rainwater)

Street Trees
(Provide canopy over street for shade, pedestrian comfort, and rainwater absorption)

Green Infrastructure

Exhibit 14

Frog Pond Area Plan Land Use Options: Capacity and Density Estimates

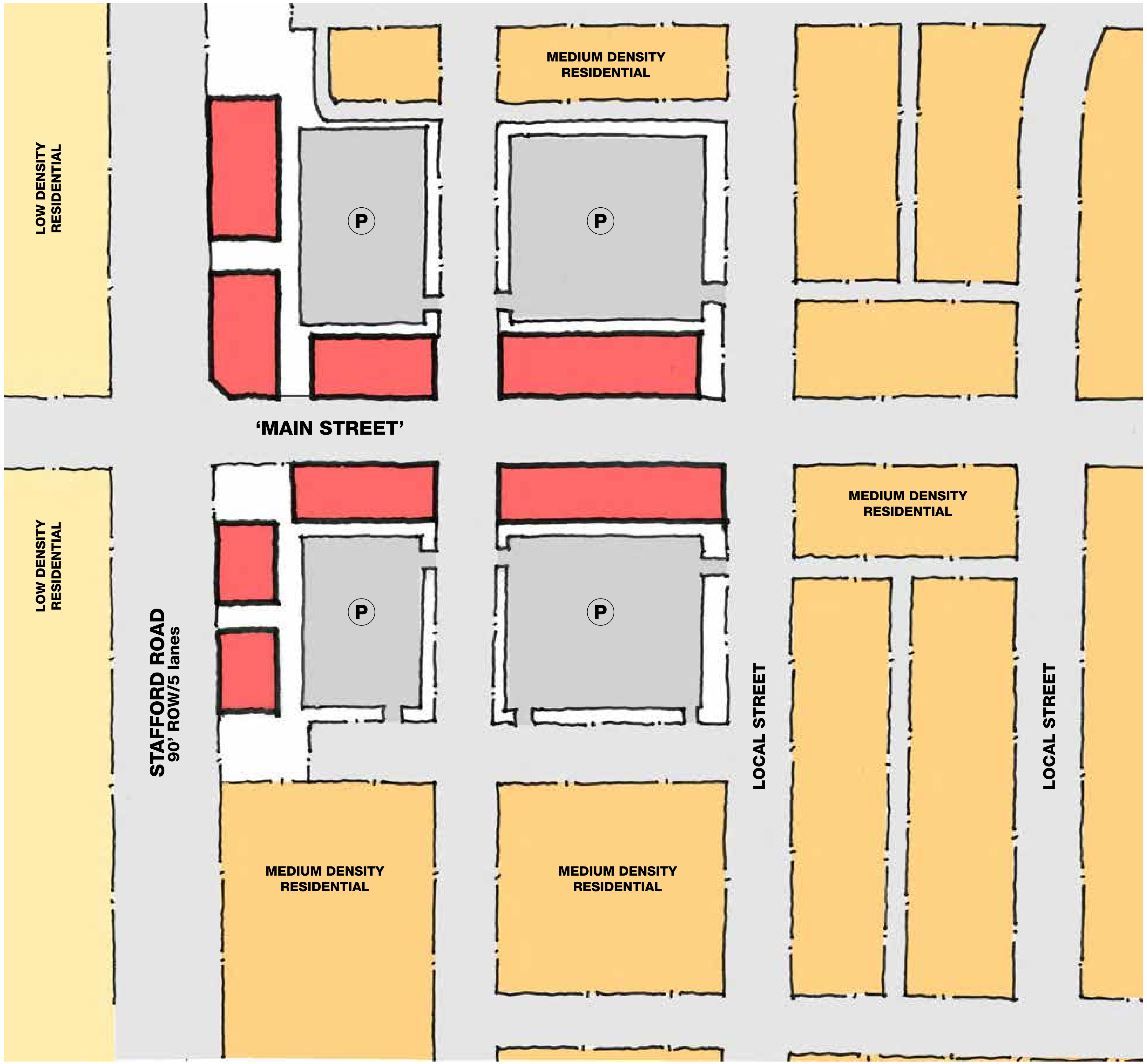
Option A - Grid Low		West Neighborhood					East Neighborhood					South Neighborhood					Frog Pond Area (Totals)				
Land Use	Map Key	Net Residential Acres	Units	% of units	% detached (est)	Net Density	Net Residential Acres	Units	% of units	% detached (est)	Net Density	Net Residential Acres	Units	% of units	% detached (est)	Net Density	Net Residential Acres	Units	% of units	% detached (est)	Net Density
Very Low Density		33.0	99	17%	17%	3	34.6	104	16%	16%	3	-	-	0%	0%	3	67.6	203	12%	12%	3
Low Density		68.3	492	83%	79%	7.2	23.5	169	26%	24%	7.2	30.4	219	43%	41%	7.2	122.2	880	50%	48%	7.2
Medium Density		-	-	0%	0%	12.1	31.7	384	58%	29%	12.1	24.2	292	57%	29%	12.1	55.9	677	38%	19%	12.1
High Density		-	-	0%	0%	25	-	-	0%	0%	25	-	-	0%	0%	25	-	-	0%	0%	25
Total		101.3	591		96%	5.8	89.8	657		69%	7.3	54.6	511		69%	9.4	245.7	1,759	100%	78%	7.2

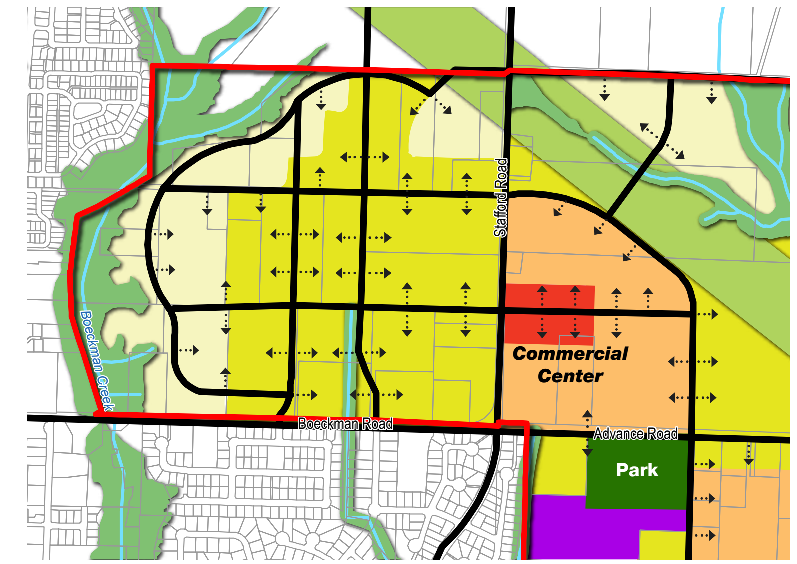
Option B - Organic Medium		West Neighborhood					East Neighborhood					South Neighborhood					Frog Pond Area (Totals)				
Land Use	Map Key	Net Residential Acres	Units	% of units	% detached (est)	Net Density	Net Residential Acres	Units	% of units	% detached (est)	Net Density	Net Residential Acres	Units	% of units	% detached (est)	Net Density	Net Residential Acres	Units	% of units	% detached (est)	Net Density
Very Low Density		-	-	0%	0%	0	-	-	0%	0%	0	-	-	0%	0%	3	-	-	0%	0%	3
Low Density		84.579612	609	75%	71%	7.2	44.4	320	31%	30%	7.2	31.9	230	46%	43%	7.2	160.9	1,159	49%	47%	7.2
Medium Density		16.6	201	25%	12%	12.1	31.5	381	37%	19%	12.1	22.7	274	54%	27%	12.1	70.7	856	37%	18%	12.1
High Density		-	-	0%	0%	25.0	13.1	328	32%	0%	25.0	-	-	0%	0%	25	13.1	328	14%	0%	25
Total		101.2	810		84%	8.0	89	1,029		48%	11.6	54.6	504		71%	9.2	244.8	2,343	100%	65%	9.6

Option C - Grid High		West Neighborhood					East Neighborhood					South Neighborhood					Frog Pond Area (Totals)				
Land Use	Map Key	Net Residential Acres	Units	% of units	% detached (est)	Net Density	Net Residential Acres	Units	% of units	% detached (est)	Net Density	Net Residential Acres	Units	% of units	% detached (est)	Net Density	Net Residential Acres	Units	% of units	% detached (est)	Net Density
Very Low Density		-	-	0%	0%	0	-	-	0%	0%	0	-	-	0%	0%	3	-	-	0%	0%	3
Low Density		38.4	276	28%	27%	7.2	31.9	229	20%	19%	7.2	24.2	174	35%	33%	7.2	94.5	680	26%	24%	7.2
Medium Density		58.3	706	72%	36%	12.1	47.4	574	49%	25%	12.1	27.3	330	65%	33%	12.1	133.0	1,610	61%	30%	12.1
High Density		-	-	0%	0%	25.0	14.5	363	31%	0%	25.0	-	-	0%	0%	25	14.5	363	14%	0%	25
Total		96.7	982		63%	10.2	93.8	1,166		43%	12.4	51.5	505		66%	9.8	242.0	2,653	100%	55%	11.0

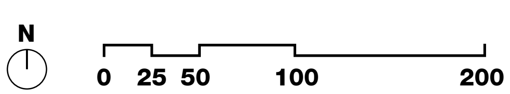
Creating a great community

Exhibit 15A





Key Map



COMMERCIAL FOOTPRINTS

** Option shows 69,000sf of commercial space, with +/-240 surface parking spaces*

** See Neighborhood Commercial Images for more information*

Neighborhood Commercial Center Program and Access Study

Option A

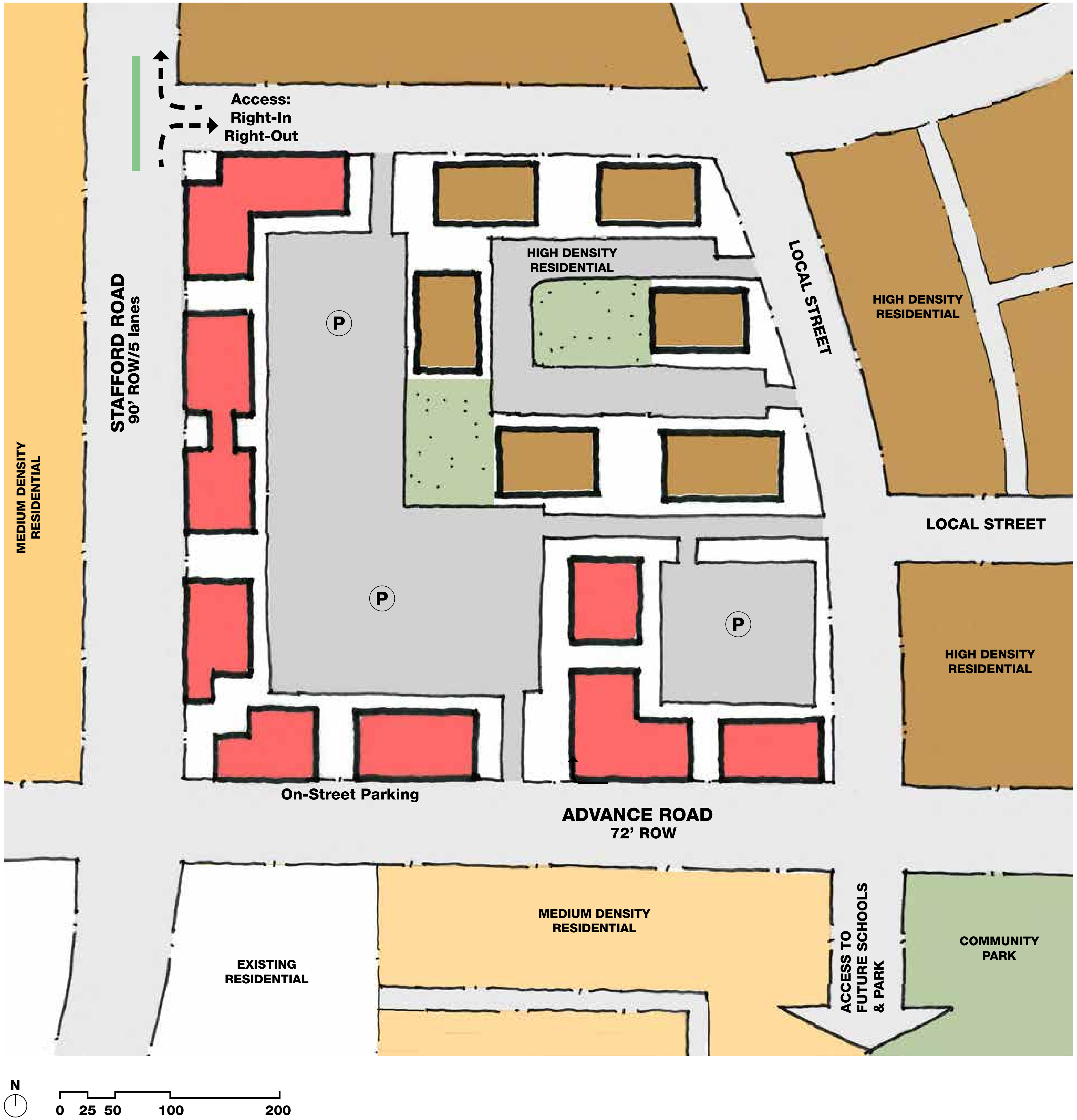
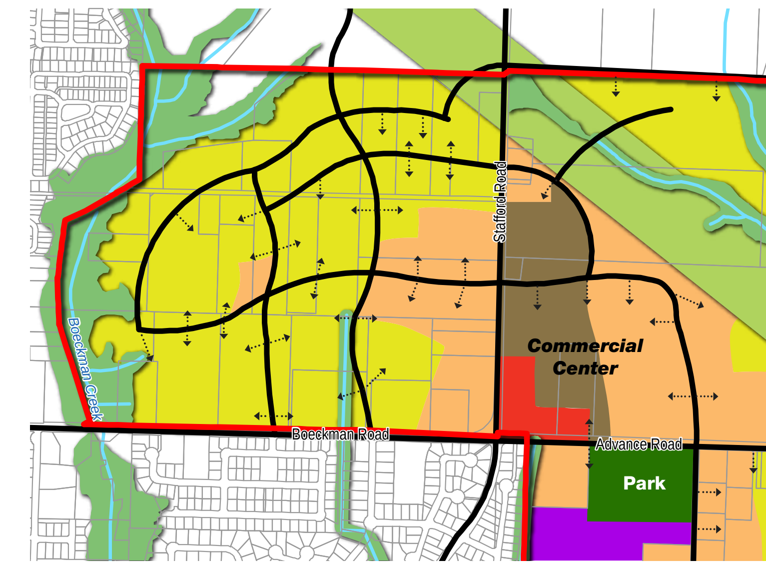


Exhibit 15B



Key Map

COMMERCIAL FOOTPRINTS

** Option shows 69,000sf of commercial space, with +/-240 surface parking spaces*

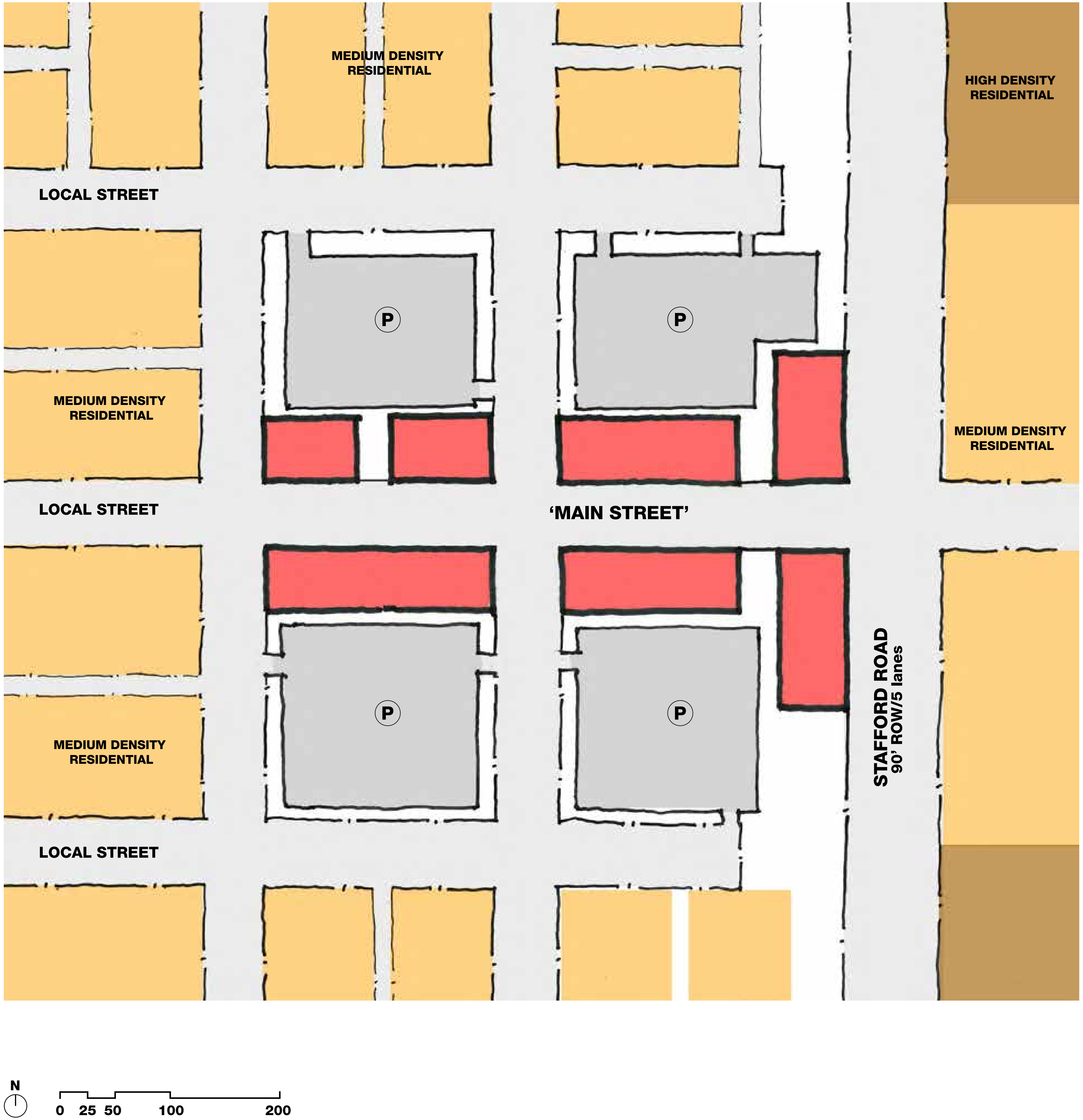
** See Neighborhood Commercial Images for more information*

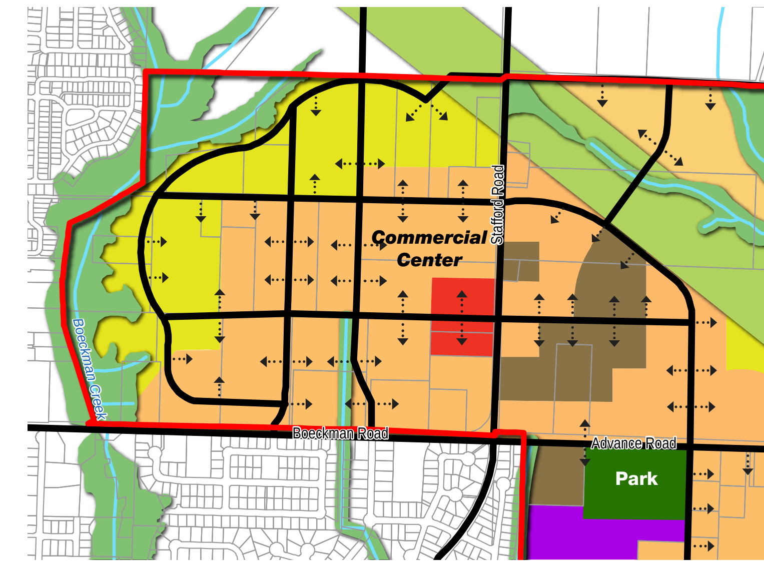
Neighborhood Commercial Center Program and Access Study

Option B

Creating a great community

Exhibit 15C





Key Map

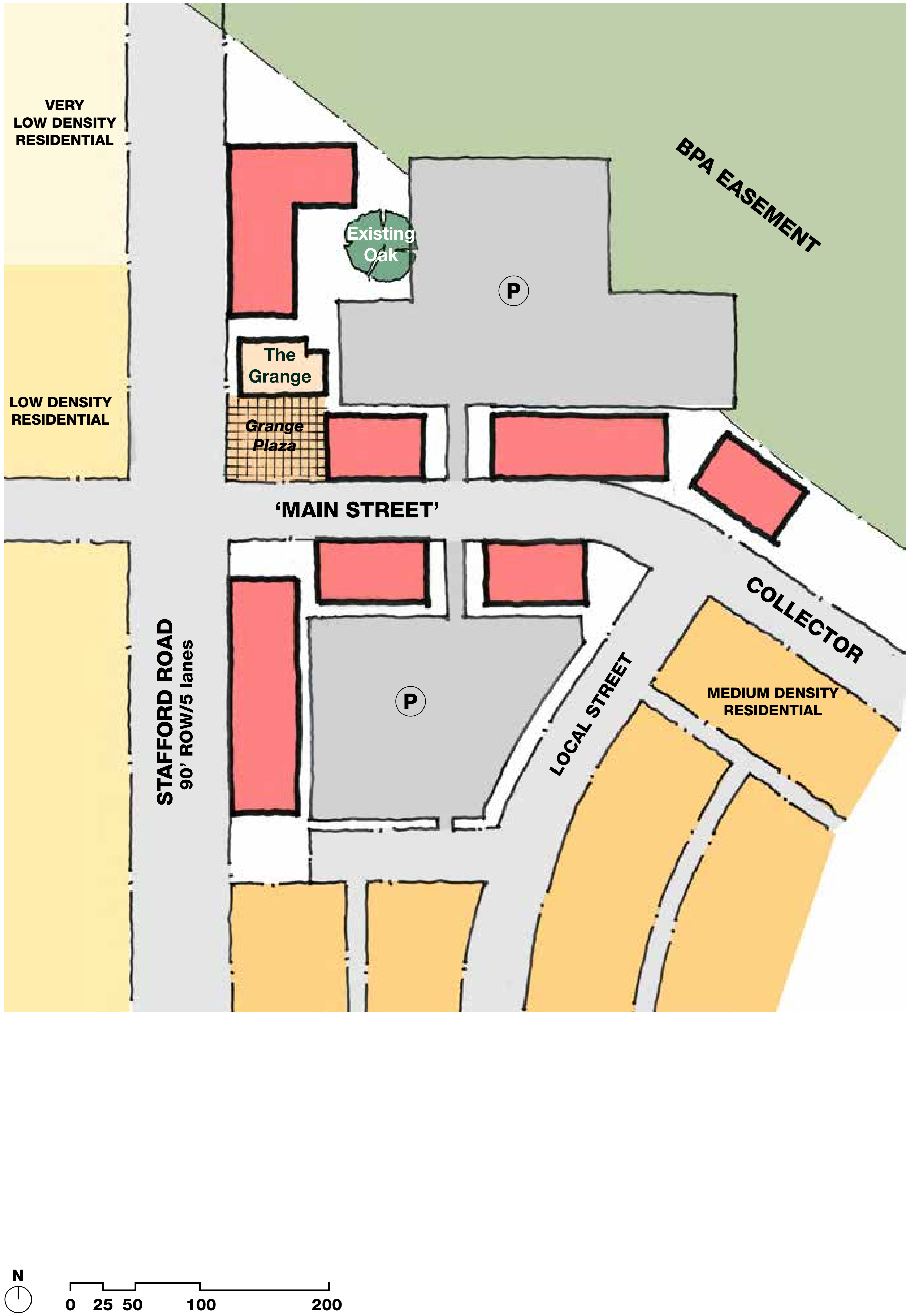
COMMERCIAL FOOTPRINTS

** Option shows 69,000sf of commercial space, with +/-240 surface parking spaces*

** See Neighborhood Commercial Images for more information*

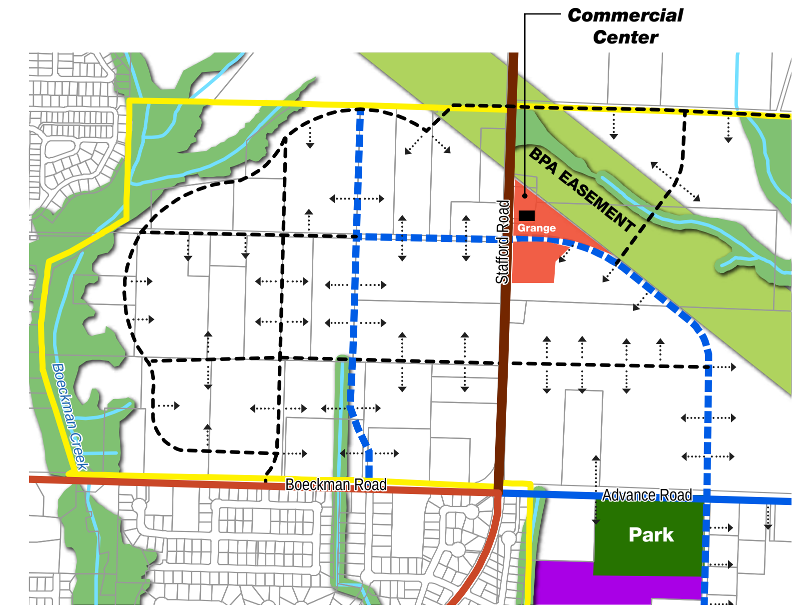
Neighborhood Commercial Center Program and Access Study

Option C



FROG POND
Creating a great community

Exhibit 15D



Key Map

COMMERCIAL FOOTPRINTS

* *Option shows 69,000sf of commercial space, with +/-240 surface parking spaces*

* *See Neighborhood Commercial Images for more information*

Neighborhood Commercial Center Program and Access Study

Option D

FROG POND AREA PLAN
Creating a great community

Appendix A: Frog Pond Area Plan Market Analysis

City of Wilsonville

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FROG POND AREA PLAN

MARKET ANALYSIS

PREPARED FOR

City of WILSONVILLE OREGON

PREPARED BY

LELAND CONSULTING GROUP

People Places Prosperity August 2014

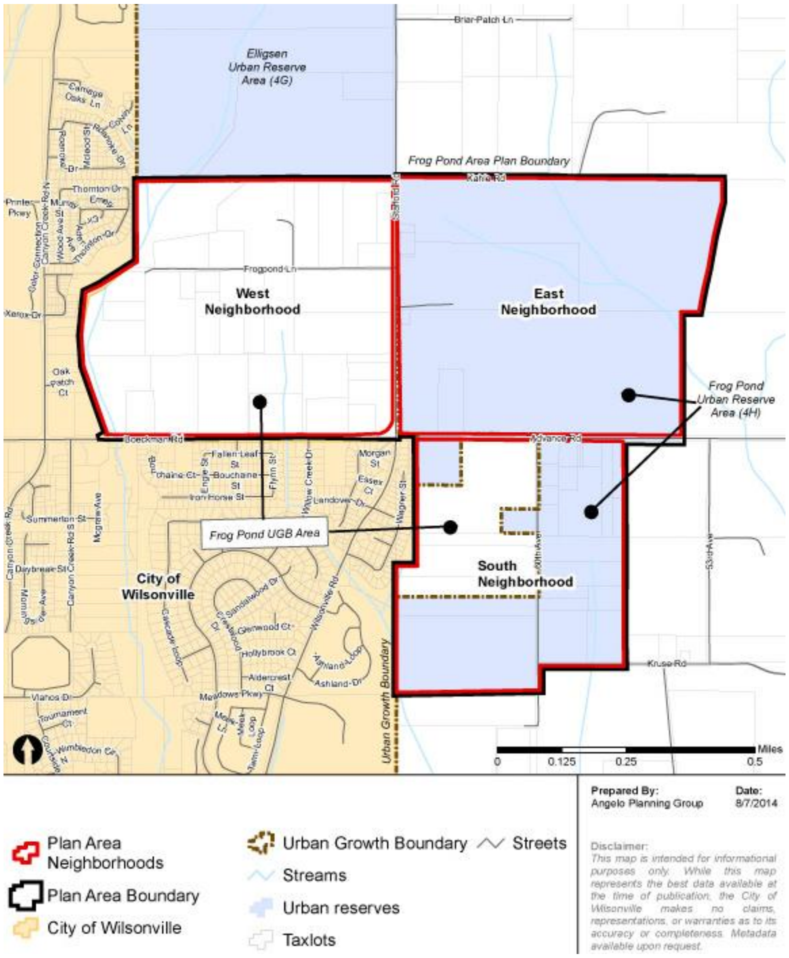
Contents

Introduction and Executive Summary

This market analysis is one component of the Frog Pond Area Plan, which the City of Wilsonville has initiated in order to establish a vision for the area, and to define expectations for the type of community that the 495-acre Frog Pond Area will become in the future. Leland Consulting Group (LCG), the authors of this report, is part of a consultant team led by Angelo Planning Group, which has been engaged by the City of Wilsonville to manage parts of the Frog Pond Area Plan. Through a process that will involve Wilsonville's citizens and elected officials, the Frog Pond Area Plan will ultimately identify the types of development (housing, neighborhood retail, parks, etc.), supporting infrastructure, regulatory framework, and a series of implementation steps needed to realize the plan. This executive summary provides key findings of the market analysis, while details are contained in the body of the report beginning on page 7.

The purpose of this market analysis is to provide the City and Frog Pond Area Plan participants with information about the types of residential and commercial real estate that are likely to be in demand and market feasible in the Frog Pond study area. The market analysis takes into account the project's goals to (1) create a concept plan for the entire 495-acre Frog Pond Area shown in Figure 1 below; and (2) create more specific master plan recommendations for the 179-acre "West Neighborhood" portion that is within the Urban Growth Boundary (UGB). Development within the West Neighborhood will occur first, and development within the East and South Neighborhoods will occur later if they are brought into the UGB by Metro. The real estate market is of critical importance to the future of the entire Frog Pond Area, since this new community will be shaped by both the private sector (e.g., land owners, developers, new residents, retail tenants) and the public sector (through planning, regulation, provision of infrastructure, annexation, and other actions).

Figure 1. The Frog Pond Area



Source: City of Wilsonville, Angelo Planning Group.

Demographic context. Wilsonville is one of the Portland region's fastest growing cities. Metro has projected that the city's households will grow at 1.8 percent annually through 2035, faster than the region and other nearby cities such as Tualatin and Sherwood. The city may also grow faster than this rate: between 2000 and 2012, Wilsonville's households grew at a rate of 2.8 percent per year, despite the recession. Therefore, there will almost certainly be demand for housing, and potentially commercial development, in Wilsonville and Frog Pond during the next two decades.

Wilsonville's residents are more likely to have a bachelor's or advanced degree than residents of the region, they earn slightly more than households regionwide, and they are more likely to work in white collar jobs. Wilsonville has large shares of both young adults and senior residents, while the city has a smaller share of households headed by middle-aged adults compared to the region.

Analysis by Metro, the State of Oregon, and the US Census Bureau indicate that America's demographics are changing, and growth in the Frog Pond market area is likely to include a wide variety of household types. The most dramatic growth will come in the 65+ senior population, whose numbers will increase by 93 percent between 2015 and 2035. By comparison, no other age group is expected to grow by more than 29 percent during that time period. In addition, "non-traditional" household types such as families with children, couples, single-parent households, and single-person households will be important components of growth and therefore will shape real estate demand in

Frog Pond. Sixty-eight percent of Wilsonville's current households are one or two people; such smaller households have been growing as a share of the country's population since the 1970s, a trend that is expected to continue. Wilsonville's recently adopted Residential Land Study (RLS) documents many of these projections and sets the stage for this market analysis.

The Frog Pond Area. Past policies adopted by the City of Wilsonville and Metro call for the Frog Pond Area to be developed primarily as a residential community, though ancillary commercial development may take place in Frog Pond. These policy decisions directly influence this market analysis. As shown in Figure 1, the Frog Pond Area contains two main sub-areas. The first is the West Neighborhood, which is located west of Stafford Road and is 179 gross acres in size. The second is the East and South Neighborhoods combined, located east of Stafford Road. With the exception of the planned school property, the East and South Neighborhoods are outside the UGB, will therefore develop later, and are 316 gross acres in size. Together the two areas comprise 495 gross acres.

Frog Pond has a number of positive features including easy access to natural areas, existing and planned schools and parks, jobs, retail services, and major transportation infrastructure. Developers interviewed as part of this study consistently view Wilsonville in general and Frog Pond in particular as a desirable location for future residential and commercial development, though they did not consistently point out any specific advantages that Frog Pond has compared to other Wilsonville locations.

Housing market analysis. Based on the RLS, demographic projections, past housing built in Wilsonville, and other factors, Leland Consulting Group recommends that Frog Pond be developed as a community that contains a relatively broad mix of housing types including a variety of detached single-family, attached single-family, and multifamily homes. In total, LCG projects that Frog Pond is likely to be built out with between 2,200 and 2,700 homes. This report proposes a series of housing development principles on page 23, followed by two housing development scenarios for the West Neighborhood, and two for the East and South Neighborhoods, in order to provide alternative development options. The primary housing type should be single-family detached homes within a variety of lot sizes, since such homes continue to be the choice of most American households. Because one and two-person households make up the majority of market area households, and because of the dramatic growth of the senior population, LCG recommends that the program contain a significant share of small lot single-family homes (lots between 2,500 and 4,000 square feet), as well as multifamily and attached housing. Developers generally support a diversity of housing within a large community such as Frog Pond, since such a broad mix of housing will accommodate a wider segment of the population, and therefore speed sales and absorption.

Recent surveys and research by the National Association of Realtors (NAR), Urban Land Institute (ULI), and others show that the amenities associated with complete and walkable neighborhoods are important in addition to the home itself. These popular amenities include shops within an easy walk, places to walk for exercise, public transportation, and sidewalks. Such features should be taken into account in the design of the community.

There is no single "correct" development program for the purposes of this study. Rather, the development scenarios described above provide a range of reasonable expectations. The actual housing program should be influenced by the community's goals and vision, public policy set by the City, and this Frog Pond Area Plan process. In addition to market considerations, development alternatives with more housing will generate more public revenues, particularly through systems development charges, which fund community infrastructure such as roads, sewer, and water lines, and reduce the funding required from elsewhere in the city.

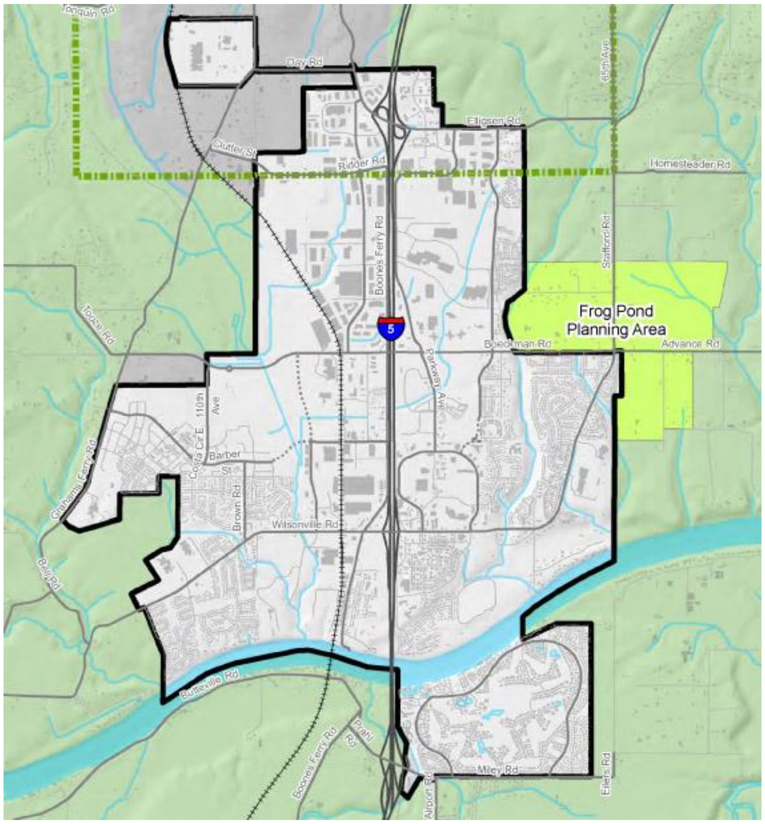
Retail market analysis. The Frog Pond Area community will build out along the edge of an existing urbanized city and region. As mentioned above, nearby goods and services are an amenity that residents will want; however, “retail follows rooftops”—in other words, significant retail development only takes place when there is a significant population of likely shoppers in the area. As a potential retail location, Frog Pond benefits from being situated along two arterial roads, Boeckman/Advance Roads and Stafford/Wilsonville Roads, which will provide some drive-by traffic. Retail in Frog Pond can also serve some adjacent existing communities to the west and southwest.

Based on an evaluation of current and projected future retail spending, LCG projects that Frog Pond could *potentially* support a small to medium-size grocery-anchored retail center (60,000 square feet or more) at full project build out in approximately 2035. If such a grocery-anchored center cannot be attracted, Frog Pond could support a smaller center of between 10,000 and 30,000 square feet. A variety of factors will affect retail feasibility, particularly whether or not other retail is built near Frog Pond during the next 20 years, the number of homes in the area, and retail development formats in the future. Regardless of the size and scale of retail, the focus should be on establishing a retail/commercial hub development that provides some goods and services for local residents, while also creating a gateway, center, sense of place, and social hub for the area.

Demographic Context

Figure 2 below shows the Frog Pond Planning Area and the City of Wilsonville. Frog Pond is well located: It is proximate to both urban amenities such as employment centers, retail areas, major transportation routes, and parks. It is also adjacent to attractive rural lands to the north, east, and south. The area's specific attributes including natural areas are evaluated in more detail on page 21.

Figure 2. City of Wilsonville and Frog Pond Area



Source: City of Wilsonville.

Information Sources

The population and demographic projections on the following pages make use of a number of information sources, including demographic forecasts prepared by Metro, Portland's regional government; ESRI Business Analyst, a private third-party data provider; the State of Oregon's Office of Economic Analysis, which produces the official long-term population forecasts for all of the State's counties; the US Census; and the City of Wilsonville Residential Lands Study (2014) and permitting database. In addition to these data sources, LCG consulted recent research on housing preferences completed by the National Association of Realtors, the Urban Land Institute (ULI), and others. The purpose of the Residential Land Study (RLS), completed in compliance with Statewide Planning Goal 10, is to inventory Wilsonville's existing residential land, project future demand for housing and residential land, and to help Wilsonville's decision makers develop policies to guide housing development in the city over the next 20 years, from 2014 to 2034. While the Residential Land Study's findings and recommendations apply citywide, it also contains some high level guidance specifically for the Frog Pond Area, which is referenced in this report.

Population and Household Forecast

Demographics are fundamental to estimating market demand for residential and commercial real estate. The types of housing and commercial goods forecasted to be in demand in the future in Wilsonville and Frog Pond will depend on the types of people and households who live there in the future.

Table 1 shows the household growth projected by Metro (the Portland regional government) for the 2010 to 2035 time period for the Cities of Wilsonville, Tualatin, and Sherwood, the “Frog Pond market area,” and the three primary metro-area counties. The market area encompasses the three cities and the areas immediately around them. This area was defined based on interviews with developers, who stated that it is the area that future Frog Pond residents are most likely to be drawn from. A map of the market area is shown on the following page. Some key takeaways from this demographic projection are:

Wilsonville is projected to grow quickly. As shown in Table 1, Metro projects the number of households in Wilsonville to grow at a rate of 1.8 percent annually between 2010 and 2035. Metro projects Wilsonville will grow at faster rate than other nearby cities such as Tualatin, Sherwood, Tigard, West Linn, and Lake Oswego, and at a faster rate than the region as a whole. While Metro’s projections show rapid growth for Wilsonville, they may actually underestimate the pace of growth: The Residential Land Study documents that Wilsonville’s “average annual population growth between 1990 and 2012 was nearly 5% and 3.2% between 2000 and 2012.”

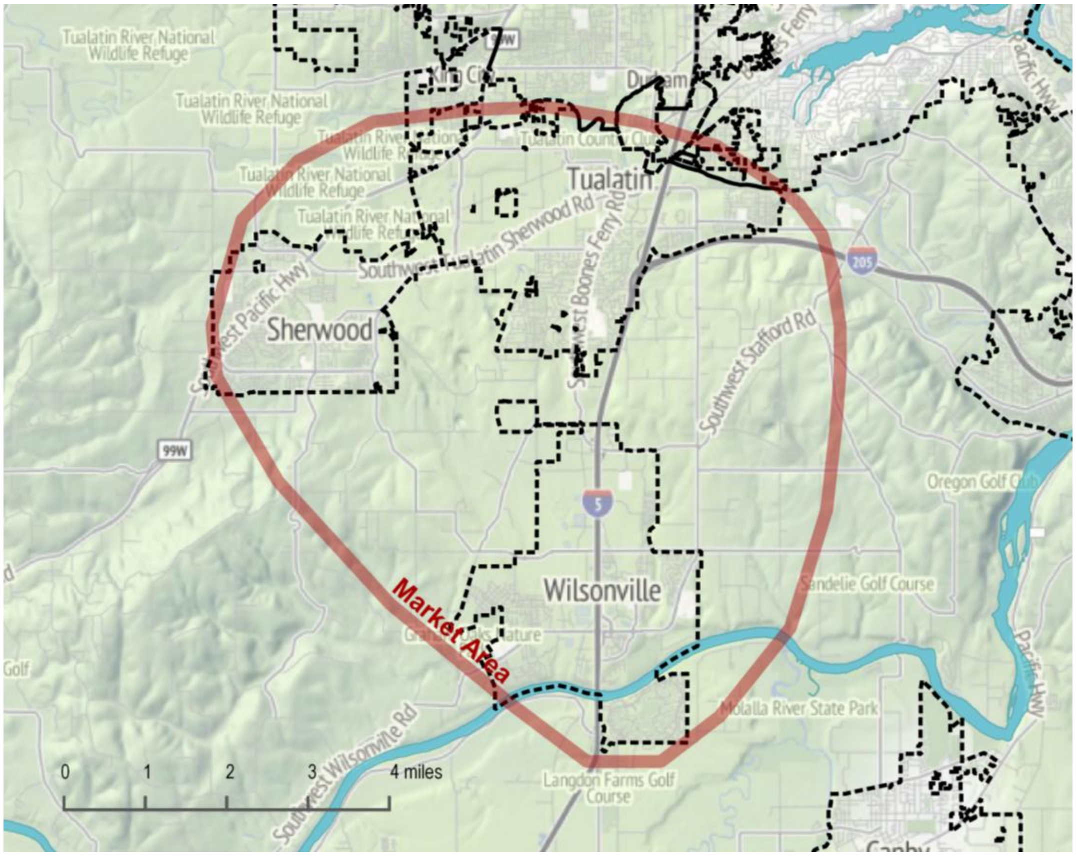
Regardless of the exact rate, household growth is the key driver of demand for new housing, as well as a key driver of commercial development. This means that there will be demand over the next 20 years for housing in the Frog Pond Area, and that it makes sense to conduct this Concept Plan process now in order to prepare for that demand.

Table 1. Demographic Forecasts for Wilsonville and the Metro Region

Jurisdiction	Households			
	2010	2035	Change	CAGR
City of Wilsonville	8,011	12,530	4,519	1.8%
City of Tualatin	10,000	11,170	1,170	0.4%
City of Sherwood	6,316	7,269	953	0.6%
Frog Pond Market Area	**27,825**	**38,704**	**10,879**	**1.3%**
Clackamas County	146,324	208,437	62,113	1.4%
Multnomah County	304,649	442,546	137,897	1.5%
Washington County	202,647	289,592	86,945	1.4%
Three County Total	**653,620**	**940,575**	**286,955**	**1.5%**

Source: Metroscope Gamma Forecasts, Published Feb 07, 2013, http://www.oregonmetro.gov/regional-2035-forecast-distribution. Note that Metro’s projections shown in Table 1 include the Frog Pond West Neighborhood, but not Frog Pond East or South, since those neighborhoods are currently outside the UGB.

Figure 3. Frog Pond Primary Market Area



Source: Leland Consulting Group.

Wilsonville's Current Demographic Characteristics

Table 2 and Table 3 on the following page summarize key demographic attributes of Wilsonville, the Frog Pond market area, and the Portland region (Metropolitan Statistical Area or MSA). The data is for 2014 except where noted. Some key takeaways from this demographic analysis are:

- Wilsonville has a higher percentage of young adult residents (aged 24 to 34) and older residents (aged 65+) than the market area or region. Conversely, a slightly smaller percentage of Wilsonville's population is middle-aged (aged 35 to 64) than the market area or region.
- Fifty-nine percent of Wilsonville's households are "family households"—those with two or more related family members living together—compared with 68 and 64 percent in the market area and region, respectively.
- Wilsonville has a larger share (68 percent) of one and two-person households than the market area or region.

Table 2. Demographic Summary

Key: Lower — Higher Compared to the other geographical areas shown below.

Demographic figures are for 2014 except where otherwise noted.

Demographic Attribute	City of Wilsonville	Frog Pond Market Area	Portland MSA
Comparison to Portland MSA:	More 25 - 34 and 65+ HHs Fewer family HHs Smaller HHs More 1 and 2 person HHs Slightly higher HH and Per Capita Incomes	More children, 35 - 54 HHs More family HHs Larger HHs More 1 and 2 person HHs Higher HH and Per Capita Incomes	NA
Population By Age			
0 to 24	31%	34%	32%
25 - 34	16%	13%	15%
35 - 44	14%	15%	14%
45 to 54	13%	14%	14%
55 to 64	11%	12%	13%
65 +	15%	11%	13%
Family Households (2010 Census)	59%	68%	64%
Median Age	37.0	36.6	37.5
Household Size (Average)	2.32	2.57	2.52
Household by Size (2010 Census)			
1 and 2 person households	68%	58%	61%
3 and 4 person households	25%	32%	29%
5 + person households	7%	10%	10%

Source: ESRI Business Analyst, Leland Consulting Group.

Table 3 shows that:

- Both Wilsonville and the market area have a high percentage of residents (70 and 69 percent respectively) that are employed in “white collar” jobs, compared with 63 percent regionwide. This reflects a high earning demographic of professional, technical, and management workers and bodes well for the city’s long-term economic health.
- Incomes—particularly household incomes—are very high in the market area. Wilsonville household incomes are lower than the market area but slightly higher than the region. The high incomes in the market area reflects the high number of professional, technical, and management employees who perform their work in the market area or commute to those jobs elsewhere.
- Educational attainment follows a similar pattern to incomes. Forty-one percent of residents of the market area have a bachelor’s degree or higher, which is slightly more than Wilsonville, and significantly more than the region.
- The median home value in Wilsonville is slightly higher than the market area, and significantly higher than the region.
- These demographic attributes, along with the long-term population growth forecast by Metro, also demonstrate that housing demand is likely to be strong in Frog Pond during the next two decades.

Table 3. Demographic Summary (Continued)

Demographic Attribute	City of Wilsonville	Frog Pond Market Area	Portland MSA
Occupation			
"White Collar"	70%	69%	63%
"Blue Collar"	14%	14%	20%
Median Household Income	$59,812	$70,256	$57,441
Per Capita Income	$31,995	$33,336	$30,135
Education and Employment			
Less than High School	8%	8%	9%
High School or Equivalent	20%	18%	22%
Associate's or Some College	32%	33%	34%
Bachelor's or Advanced Degree	39%	41%	34%
Median Home Value	$349,927	$337,289	$275,516
Housing Tenure			
Owner Occupied Housing Units	43%	55%	56%
Renter Occupied Housing Units	51%	40%	38%

Source: ESRI Business Analyst, Leland Consulting Group.

Tapestry Segments

"Tapestry segments" are a series of demographic categories developed by ESRI, a national third-party demographic information provider that describe groups of people based on their lifestyles, attitudes, purchasing patterns, and interests. The benefit of Tapestry segments is that they go beyond raw numbers and begin to describe groups of people in everyday language. Tapestry segments can also sometimes be overly simplistic, and because they are created at the national level, some aspects of different segments may not apply locally. ESRI uses information from the US Census, Bureau of Labor, and other private sector data sources to create Tapestry segments.

As shown in Table 4 below, the City of Wilsonville is dominated by three main Tapestry segments—Enterprising Professionals, Silver and Gold, and Up and Coming Families—which together comprise 95 percent of the city's total population. ESRI estimates that the Enterprising Professionals group alone accounts for 65 percent of the city's population, and is therefore 34 times more prevalent than in the nation at large. Attributes of the top three Tapestry segments are summarized below; additional information about them is included in the appendix.

Table 4. City of Wilsonville's Primary Tapestry Segments

Tapestry Segment	Percent of Households		
	City of Wilsonville	United States	Prevalence Compared to US
Enterprising Professionals	65%	2%	34
Silver and Gold	19%	1%	19
Up and Coming Families	12%	4%	3
Urban Chic	4%	1%	3
Exurbanites	1%	3%	0
All others	0%	89%	NA

Source: ESRI, Leland Consulting Group.

Enterprising Professionals (65%)

- Young, educated, single, married, working professionals, residents of Enterprising Professionals neighborhoods have a median age of 33.2 years.
- Forty-three percent of the households are singles who live alone or share housing with roommates, and 43 percent are married couple families.
- With an annual household growth of 1.95 percent per year since 2000, the households in this segment comprise approximately two percent of total U.S. households.
- Enterprising Professionals residents move frequently to find growth opportunities and better jobs, especially in cities such as Chicago, Atlanta, and Seattle.
- Forty-six percent of the households are located in the South, 29 percent are in the West, and 20 percent are in the Midwest.
- They prefer to own instead of rent in newer neighborhoods of townhouses or apartments. The median home value is $239,007.
- For those who rent, the average gross rent is 36 percent higher than the U.S. average.

Silver and Gold (19%)

- With a median age of 61.3 years, Silver and Gold residents are the second oldest of the Tapestry segments.
- More than 70 percent are aged 55 years or older.
- Most residents have retired from professional occupations. Half of the households are composed of married couples without children.
- Residents of these neighborhoods are not ethnically diverse; 93 percent of them are Caucasian.
- One-fourth of this Tapestry segment is located in the West, mainly in California and Arizona. Neighborhoods are exclusive with a home ownership rate of 81 percent.
- The median home value is $290,103. Silver and Gold ranks second of the Tapestry segments for the percentage of seasonal housing owners.
- Because these seniors have moved to newer single-family homes, they are not living in the homes where they raised their children.

Up and Coming Families (12%)

- With an annual household growth rate of 1.69 percent, Up and Coming Families represents Tapestry's second highest household growth market.
- A mix of Generation Xers and Baby Boomers with a median age of 32.8 years, this segment is the youngest of Tapestry's affluent family markets.
- Residents of these neighborhoods are young, affluent families with younger children.
- Eighty percent of the households are families. Most of the residents are Caucasian; however, diversity is increasing as the segment grows.
- Most residents live in new single-family housing in the suburban outskirts of midsized metropolitan areas with populations higher than 250,000, with a median home value of $193,161. More than half the housing units were built in the last 10 years.
- Homeownership is at 80 percent.

Long-Term Demographic Trends

Two long-term demographic trends that are expected to have a significant impact on real estate demand at Frog Pond are described below. These are the aging of the Baby Boom generation, and the trend towards household diversity and decreasing household size.

Many other demographic trends are also affecting our communities today. For example, one is "Generation Y"—young Americans now in their 20s and early 30s. This is a large generation and is a major driver of the recent apartment market boom. However, over the 20-plus year build out of Frog Pond, the two trends identified above are expected to have the most significant impact.

Aging Baby Boomers

The figures below show the demographic trend that is variously called the aging of the Baby Boomers or the "silver tsunami," which is expected to have a significant impact on housing demand. As Baby Boomers (those born between 1946 and 1964) retire and begin to consider selling their homes and relocating within or beyond the metropolitan region, they are expected to have a major impact on housing markets, as they always have had throughout their lifespan. Many will be selling medium and large-size single-family homes and looking for smaller homes with lower maintenance and upkeep, and the freedom to "lock and leave" home to visit family and friends, and vacation elsewhere.

Figure 4 highlights several points. The population of Washington and Clackamas Counties for all age categories is growing between 2015 and 2035—the period during which Frog Pond is expected to build out—creating demand for housing that meets the needs of all of these groups. The 65+ population will grow by the largest amount. The effect of this growth will be even more pronounced since these are relatively small households and thus more housing units are needed to serve the same population. The population of the 35 to 64 age category, and their children, under 19, will also grow significantly. This group is likely to re-occupy many of the single-family homes now in the market area, and new homes in Frog Pond. The size of the 20 to 34 age group is not expected to increase much. This is because Generation Y / Millennials, now in their 20s and early 30s, make up a large age cohort, and the cohort behind them is expected to be smaller.

Figure 4. Forecasted Net Population Change by Age Group, 2015 to 2035

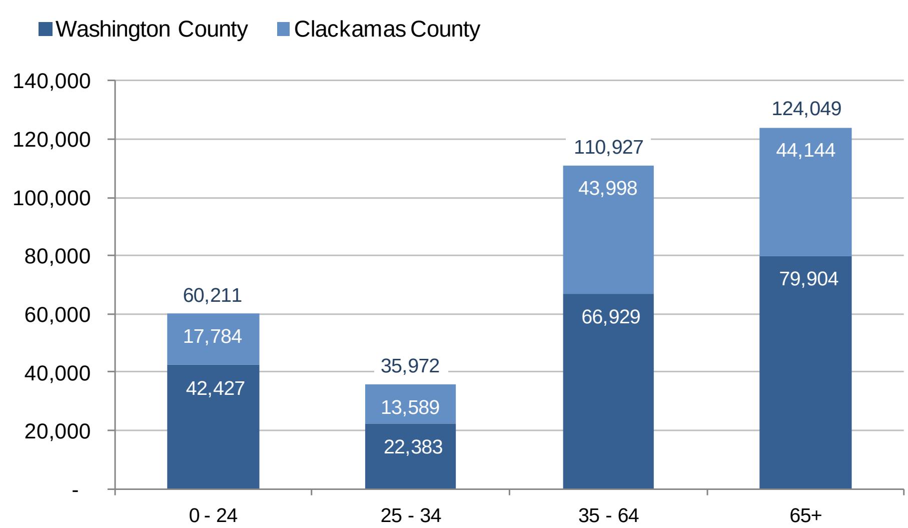
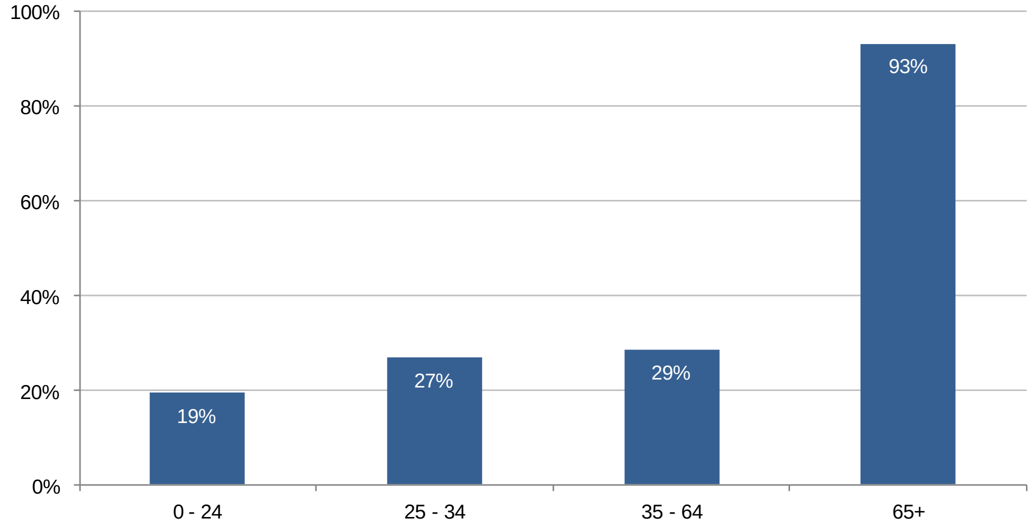


Figure 5 shows that, as a percentage of the current population, the growth in the 65+ age group will be far, far greater than growth in other age groups. While the numerical increase (shown in Figure 4) is only slightly greater than the increase in other population groups, the percent increase is far greater. Therefore, the impacts this age group will have on housing, healthcare, and other parts of society is likely to be greater. This local impact of the Baby Boom generation is consistent with the impact anticipated nationwide.

Figure 5. Forecasted Percent Population Increase by Age Group, 2015 to 2035

Washington and Clackamas Counties combined.



Source for both figures: Long-term Oregon State's County Population Forecast, 2010-2050, Office of Economic Analysis, State of Oregon, 2013; Leland Consulting Group.

Research on 65+ aged households tends to reach several broad conclusions. The following are some of the key findings from a Portland State University study on age-related housing demand shifts:[1]

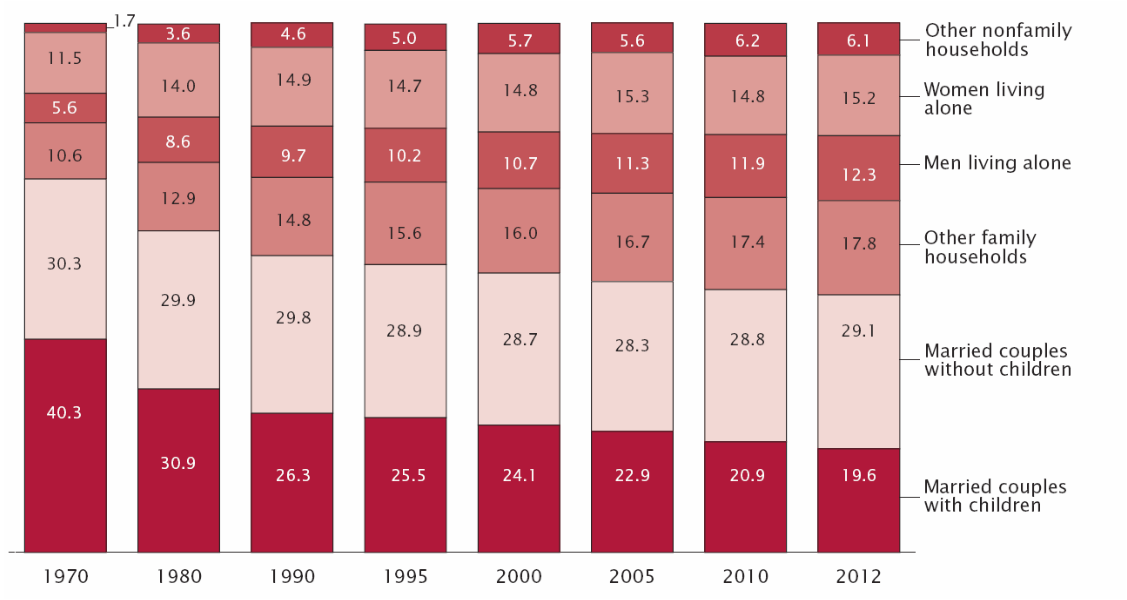
- "Middle-aged and older adults' clear preferences for suburban living must be acknowledged and plans developed to make suburban areas more pedestrian friendly and homes retrofitted or designed initially to better meet the needs of older adults."
- "With respect to features within the residence, there is a preference for a full bath and a bedroom on the main level as well as an entrance without steps."
- "When older householders do move, they are more likely to move into higher density housing than middle-age adults."
- "There are a number of indications… that baby boomers are more likely than younger adults to have a preference for more walkable locations, public transit, and higher density living."

[1] *Age-Related Shifts in Housing and Transportation Demand. A Multidisciplinary Study Conducted for Metro*, Portland State University, College of Urban and Public Affairs. 2006; excerpts from pages 1 and 44.

Increasing Household Diversity and Non-Traditional Households

When thinking about population growth, there can be a tendency to assume that this growth will be driven by “traditional” family households that consist of a married couple with children. However, as Figure 6 shows, this type of household has been becoming less prevalent over time, while most other “non-traditional” household types have increased as a share of the population over time. The other household types tend to be smaller than families with children, and tend to be open to a wider variety of housing types. One writer has identified four demographic “S groups” that have seen the highest rate of growth in recent decades and are expected to continue growing in the coming decades: seniors, singles, single-parent households, and starter households (e.g., the married couples without children shown below, and unmarried couples). This national trend is consistent with the Portland region: As shown in Table 2, the percentage of one-and two-person households is 68 percent in the City of Wilsonville, and 58 percent in the market area.

Figure 6. Households by Type as a Percent of All Households, United States, 1970 to 2012



Source: US Census Bureau.

Community Preferences

Real estate and home buying is all about "location, location, location"—in other words, the community, city, or neighborhood in which a given home is located. Since 2004, the National Association of Realtors (NAR) has conducted a nationwide poll to better understand what Americans are looking for in their future homes and communities. This is the most robust, widely-applicable survey instrument available to suggest how housing demand is evolving. One important focus of this poll is testing Americans' interest in the features of what are variously called "walkable communities," "complete communities," or "traditional neighborhood development." Such communities tend to be pedestrian friendly—parks, schools, shops and businesses are located within walking (and driving) distance of homes—and contain a range of different housing types where households of different ages and sizes can live—single-family homes, townhouses, and multifamily housing.

Figure 7 shows how people responded when asked, "Do you think there is too much, too little, or the right amount of each of the following in the area close to where you live?" Respondents most often felt that there are too few features such as safe routes for walking and biking, public transit, a diversity of housing, and shops and restaurants within an easy walk.

Figure 7. Which Neighborhood Amenities are in Demand?

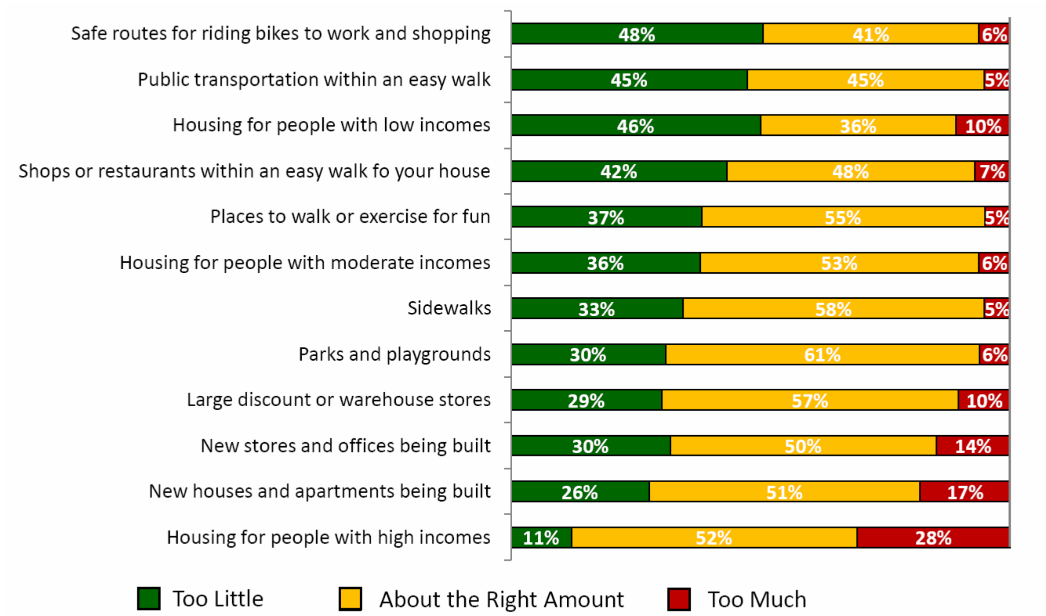
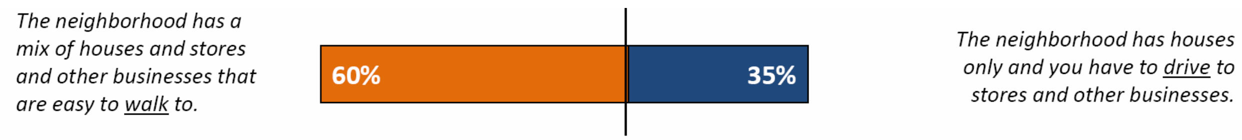


Figure 8 shows how people responded when asked to select the house where they would prefer to live when provided with two community options. By nearly a two-to-one margin, Americans prefer a neighborhood where they can walk to stores and businesses. The preference is significantly more pronounced among those who recently purchased a home or are currently in the market.

Figure 8. Community Preferences



Source, both figures: National Community Preference Survey, National Association of Realtors, October 2013.

The Urban Land Institute (ULI) is another organization that routinely evaluates home buyer and renter preferences. The ULI is a national professional association for developers, homebuilders, planners, and other land use professionals. Some key findings published by the ULI in the organization's *Residential Futures: Thought-Provoking Ideas on What's Next for Master-Planned Communities* (2012) are listed below. These are consistent with findings from Realtor's surveys and respond to the question, "What do buyers need in terms of housing and community?"

- Home buyers are, "looking for value (affordability), walkability, shopping, restaurants, services, good schools, and a sense of community."
- "Single-use zoning is out and mixed use is in, along with living close to services and jobs. The typical master planned community offering, including schools, parks, and pools, is still important, especially to first-time buyers. Couple that with a scarcity of resources, living near where you work and shop is in, long commutes are out."
- Home buyers "want safety, good schools, and proximity to employment, which usually entails less than a 30-minute commute. Financial security related to the home purchase means that the community is on stable ground and the builder is viable. Buyers want to feel that the housing value is permanent and appreciation is likely over time."

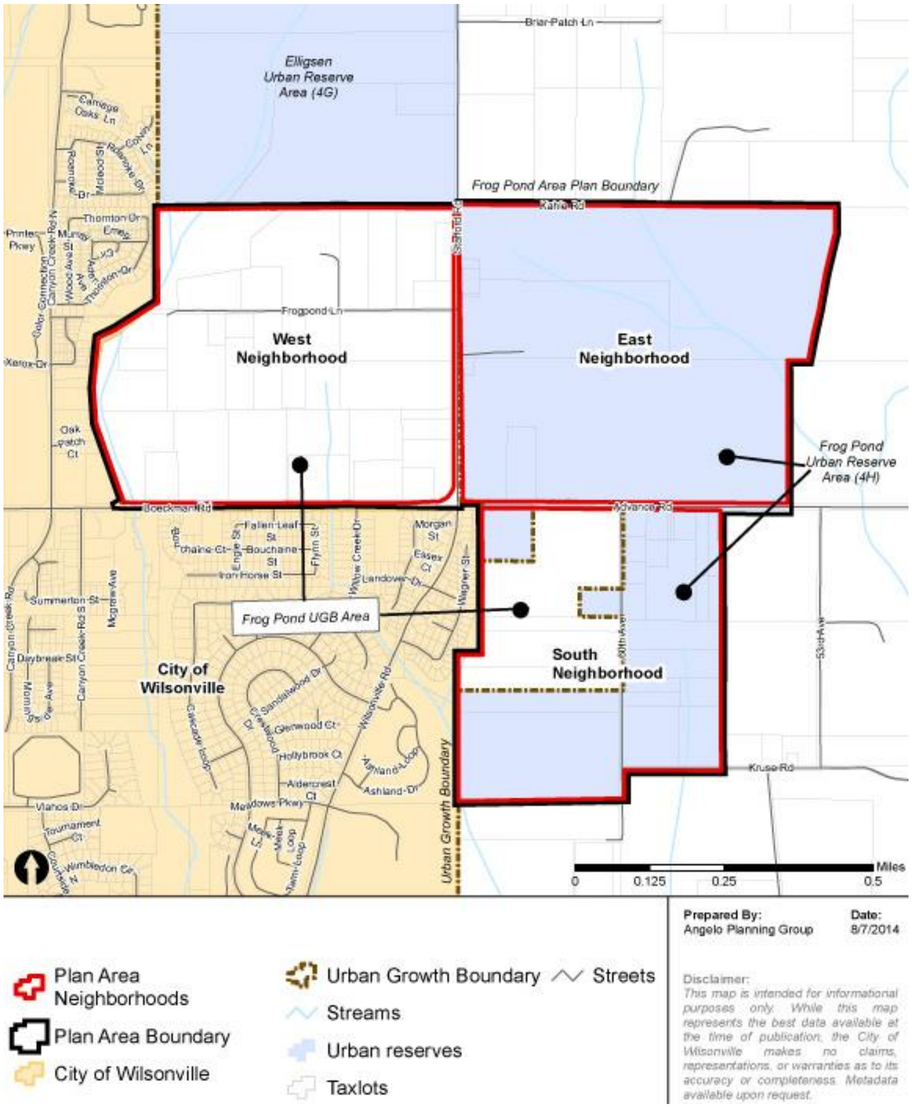
The Frog Pond Area

This market analysis addresses the Frog Pond Area (or "study area") as shown in Figure 9. In some sections of this report, the study area is divided into two parts: the West Neighborhood (or Frog Pond West), which is the land west of Stafford Road; and the East and South Neighborhoods, The entire Frog Pond Area is 495 gross acres. The City's 20-Year Look process has identified the entire Frog Pond Area as the top priority area for future residential development. Metro has supported this policy direction by designating the larger area as Urban Reserve 4H during its 2009 Urban Reserves designation process.

The West Neighborhood is 179.4 gross acres in size. It is currently located outside of the city's boundaries and inside the UGB. Because it is within the UGB, the West Neighborhood can be concept planned, annexed by the City, zoned, and then developed within the next few years. Developers and/or the City will also need to extend infrastructure to the area in advance of or concurrently with development. The intent of the City's current concept and master planning process is to set the stage for the near-term development of the West Neighborhood.

The Residential Land Study found that the development of the Frog Pond West Neighborhood is fundamental to the city's ability to accommodate future housing demand. In addition, based on discussions with Wilsonville's decision makers conducted during the Residential Land Study, and their desire to achieve a more balanced housing mix and the results of the housing needs analysis, the study recommends that Wilsonville plan for the Frog Pond West Neighborhood to be "developed predominantly with single-family detached housing." Specifically, the housing needs assessment modeling conducted for the Residential Land Study assumed that the housing would develop at densities between 5.0 and 8.5 dwelling units per gross acre in the West Neighborhood.

Figure 9. The Frog Pond Area



Source: City of Wilsonville, Angelo Planning Group.

The East and South Neighborhoods are larger—315.8 gross acres. With the exception of the future school property, both of these neighborhoods are currently outside both the city and UGB boundaries, but have been identified by the Metro regional government and the City as a residential Urban Reserve—an area that will be built out, primarily to accommodate housing growth, within the next 50 years. Because of the city's rapid and projected future population growth, Wilsonville may seek to bring the East and South Neighborhoods into the UGB sooner rather than later. For the purposes of this market analysis, LCG has assumed that development can begin in the East and South Neighborhoods in the year 2022; however, the actual date will depend on decisions made by the City of Wilsonville, Metro, and others.

The Residential Land Study concludes that Wilsonville may need residential land by 2032 or sooner, depending on the city's population growth rate in the coming decades. For this reason, the East and South Neighborhoods are being concept planned along with the West Neighborhood. Because of the Urban Reserve status, it is not a question of if the area will be built out with mainly housing, but when.

The Residential Land Study does not offer any specific density or land use recommendations for the East and South Neighborhoods.

Given the amount of time it takes to get a new area to be development-ready (i.e., brought into the UGB, planned, and services extended to the area), Wilsonville should begin discussions about bringing the East and South Neighborhoods into the UGB as part of the next cycle of UGB expansion discussions.

Key Features of the Frog Pond Area

The following are some of the key features of the study area that are most relevant to this market analysis and the future development of the area:

- **Natural areas,** including Boeckman Creek and various tree stands throughout. The area also benefits from views to ridgelines to the north and west. These natural features limit the amount of development that can take place, but can also be unique sources of identity, pride, and land value for the new community if they are properly integrated into the overall concept plan.

- **Schools.** The West Linn-Wilsonville School District currently owns properties in Frog Pond and is planning to build two schools there, a primary school and a middle school. The City will be building a 10-acre community park adjacent to these schools. These schools, along with the high quality of the School District, will increase the desirability of the future community, particularly for families. The concept plan should carefully consider how "safe routes to school" can be designed throughout the community. In addition to its South Neighborhood properties, the School District also owns several parcels in the West Neighborhood, but has not announced specific plans for these properties, which could be retained and developed by the School District, or sold.

- **The City of Wilsonville** has a good reputation in the marketplace for high-quality communities and development. Villebois' carefully integrated parks, homes, schools, and public realm distinguish it from almost all other suburban residential communities in the Portland region.

- **Proximity to jobs.** Wilsonville is known for the significant number of jobs within the city, as well as its accessibility to most Portland metro area employment centers and Salem. The planning area is also within a half-mile of the Mentor Graphics headquarters, Xerox, and other white collar offices, which will drive interest in Frog Pond.

- **Proximity to services and shopping.** The subject area is approximately two miles from the Wilsonville Town Center, and 2.5 miles from the Argyle Square regional shopping center at Elligsen Road. Both commercial centers offer a wide variety of goods and services.

- **Transportation access.** Advance Road/Boeckman Road bisects the area running east to west, and Stafford Road/Wilsonville Road bisects the area running north to south. Both roads currently carry about 5,000 cars per day and are significant transportation routes for travelers going to and from Wilsonville. Certain land uses, including retail, office/commercial, and apartments, benefit from higher exposure, and any such uses should be located near these main roads. The roads will carry more traffic in the future as development increases. SMART bus service connects the subject area to the Town Center and to the WES commuter train station.

- **Property ownership.** Assuming that one desired outcome of the concept plan is the establishment of a cohesive, integrated plan that knits the entire study area together and results in a whole greater than its parts, the fragmented property ownership is likely to present some challenges. Fragmented property ownership can prevent key gateway properties from being developed, empower hold-out owners to demand above-market land prices, and limit the potential for area-wide solutions to issues such as storm water management and transportation.

Buildable Land in the Frog Pond Area

The City of Wilsonville conducted a buildable lands inventory in order to better understand what parts of the study area are likely to remain in natural or undeveloped conditions, become infrastructure such as roads, or be buildable land where new residential and commercial development could take place. A summary of that inventory is shown in Table 5 below. The key figures used in this analysis are the gross buildable area (318 acres) and net buildable area (243 acres) shown at the bottom of the table. The new buildable area is the amount of land on which LCG expects that residential or commercial development can take place.

Table 5. Buildable Land Inventory

Land Category	Frog Pond Neighborhood (Acres)		
	West	East & South	Total
Total Area	**179**	**316**	**495**
Unbuildable			
Committed [a]	12	90	102
Unbuildable (stream corridor/ adjacent wetland / adjacent riparian buffer/ >25% slope)	24	37	61
Buildable but challenging			
Acreage of all non-significant wetlands	18	5	23
20% of the total acreage of non-significant wetlands [b]	4	1	5
Subtotal [c]	54	124	177
Gross Buildable (Total acreage less unbuildable)	**126**	**192**	**318**
Infrastructure and Amenities			
Internal Roads [d]	23	35	57
Stormwater Management	5	3	8
Parks [e]	5	5	10
Subtotal	33	42	75
Net Buildable			
Retail/Commercial	2	5	7
Residential	91	145	236
Net Buildable	**93**	**150**	**243**

Source: City of Wilsonville, Leland Consulting Group. Notes: a: Committed land includes the BPA easement, residential developments valued greater than $160,000, land held for planned schools and parks, the church property, and the Grange hall. b: This line lists the 20 percent of the land that is unbuildable due to constraints of wetland fill permitting. This is an assumption, to acknowledge the challenge of permitting and possible mitigation of potentially jurisdictional wetlands. c: Some areas of land are categorized in more than one "unbuildable" category. The Subtotal, therefore, is the amount of land classified as "unbuildable" for any reason. d: LCG estimate. e: Land that will be used for the Urban Growth Area community park is included in the "Committed" land above.

Housing Market Analysis

Residential Land Study Findings and Recommendations

Wilsonville's Residential Land Study was adopted in May 2014 and provides a framework for this market analysis, due to its extensive analysis of Wilsonville's household types, demographics, current and future housing, and other information. The Residential Land Study provides the following information that guides this market analysis:

- The types of housing that will be in demand, both citywide and in the study area; and
- Conceptual housing development targets that can be used as a starting point for planning in the study area.

Some of the Residential Land Study's key findings and recommendations that are relevant to the study area are summarized below.

Planning for balance. Wilsonville is planning for a complete, balanced community. The Wilsonville Comprehensive Plan includes a balanced portfolio of different housing types that are well-designed and will be developed across the community to serve different people at different points in their lives.

Future housing demand. The Residential Lands Study projects that the following housing will be needed in the Wilsonville planning area between 2014 and 2034 period. The projection is based on Metro's population growth forecasts as well as other assumptions. While the forecast for Wilsonville shows a need for all types of housing, the Study concludes that the supply of land available for multifamily development is sufficient. To balance the city's housing supply, the Study recommends planning for predominantly single-family housing in the Frog Pond Area.

Table 6. Forecast of Needed Housing Units by Mix and Density, Wilsonville, 2014 to 2034

Housing Type	Needed New Housing Units (2014 - 2034)	
	Number of new new dwellings	Percent of new dwellings
Single Family Detached	1,875	50%
Single Family Attached	375	10%
Multifamily	1,499	40%
Total	3,749	100%
Annual Average	187	

Source: Wilsonville Residential Lands Study, American Community Survey.

The complete Residential Land Study, background technical reports, and associated public records, can be found online at http://or-wilsonville.civicplus.com/335/2014-Residential-Land-Study.

Housing Types

In order to illustrate potential development scenarios within the Frog Pond Area, this market analysis uses five different housing types, as shown in Table 7 below. These are broad categories, and there can be significant variation in home design, layout, site size, and other factors within these types. These housing types are key parts of the "palette" with which stakeholders can paint the Frog Pond Area during later phases of the Concept Plan process. These housing types are based on housing recently built in Wilsonville, housing proposed for other comparable new development areas, and the definitions used in the Residential Land Study.

Table 7. Housing Types

Housing Type	Lot Size			Net
	Low	Average	High	Density
Large Lot Single Family	6,000	**7,500**	8,500	6.0
Medium Lot Single Family	4,000	**5,000**	6,000	7.5
Small Lot Single Family	2,500	**3,500**	4,000	11.0
Attached Single Family: Townhomes and Duplexes	1,000	**2,250**	2,500	16.0
Multifamily: Apts, Condos, and Senior Housing	NA	**NA**	NA	25.0

Large Lot Single-Family

Medium Lot Single-Family

Small Lot Single-Family

Single-Family Attached

Multifamily

The major change from the types defined by the Residential Land Study is that three different types of single-family detached housing are used here rather than one, in order to provide a more nuanced view of housing demand and on-the-ground development.

The housing densities shown in Table 7 and used elsewhere in this report are *net* densities: the number of units that are located on a given area of *net buildable land*. As shown in Table 5, net buildable land is the amount of land available after deductions have been made for natural areas, slopes, public and private roads, parks, and stormwater retention has been deducted from the *gross area*. Buildable land can also be defined as the parcel upon which residential dwellings are constructed, including any open space (e.g., yard) provided on that parcel. The definitions used here are consistent with the Oregon Administrative Rules and the Residential Land Study.

Residential Density in Wilsonville

Table 8 and Table 9 below show excerpts from the Residential Land Study that document the density of recent (2000 to 2012) residential development in Wilsonville. This analysis is useful because it provides Frog Pond Concept Plan stakeholders with a range of built examples of residential density that can be compared to the Frog Pond development scenarios presented later in this report. Table 8 shows the densities of different housing types, while Table 9 shows the densities within different plan (Comprehensive Plan and Zoning) designations.

The analysis shows a range of potential residential densities. Unsurprisingly, the lowest density housing type built in Wilsonville between 2000 and 2012 were single-family homes, with a density of 7.6 dwelling units per net acre; the net density of multifamily housing is 18.5. The weighted average (total) net density for these two housing types combined is 12.4. Table 9 shows that, across all housing types built within residential zones in the city between 2000 and 2012, the density is 10.8 dwelling units per net acre. In village-designated areas (Villebois), the density is 18.0 dwelling units per net acre.

Table 8. Residential Development Density by Housing Type, Wilsonville, 2000 to 2012

Housing Type	Net Density
Single Family	7.6
Multifamily	18.5
Total	12.4

Source: Wilsonville Residential Land Study, adapted from Table 3-5, May 2014.

Table 9. Residential Development Density by Plan Designation, Wilsonville, 2000 to 2012

Plan Designation	Net Density
Residential	10.8
Village (Villebois)	18.0

Source: Wilsonville Residential Land Study, adapted from Table 3-4, May 2014.

Recent Housing Permits in Wilsonville

In order to inform this market analysis and potential development programs for Frog Pond, LCG reviewed residential permits issued by the City of Wilsonville between 2000 and 2012, the same time period that was evaluated for the Residential Land Study. The summary results of this analysis are shown in the two tables below. Table 10 shows data for permits granted citywide between 2000 and 2012. Table 11 shows permits granted in Villebois during the same time period. Villebois is shown since it is a currently-developing "greenfield" community that is similar in size to Frog Pond, and therefore is likely to be comparable in some ways.

It is important to make several notes about this data in order to understand its applicability to Frog Pond. Past permitting may or may not be a good predictor of future housing demand. The data is likely to reflect some conditions that may or may not be in place at Frog Pond. For example, zoning and lot sizes citywide and in Villebois may or may not be similar to those imposed at Frog Pond. In addition, economic and demographic conditions such as the great recession and the rapid entry of Generation Y into the housing market may create distortions in this data which will not be replicated in the future. Nevertheless, this data can inform planning for Frog Pond.

Several trends emerge from this analysis. First, there have been more permits issued for multifamily housing than any of the other housing types; this is true both citywide and in Villebois. Second, a large share of permitting at Villebois has been within the small lot single-family housing type. This is likely due to a combination of factors, including market demand and the size of lots available to builders, defined by the Villebois Village Concept Plan and subsequent documents.

Table 10. City of Wilsonville Residential Permits, 2000 to 2012

Housing Type	Total Permits	
	Number	Percent
Large Lot Single Family	260	9%
Medium Lot Single Family	298	10%
Small Lot Single Family	356	12%
Attached Single Family	56	2%
Multifamily	1,892	66%
Total	**2,862**	**100%**

Source: City of Wilsonville permit database, Leland Consulting Group.

Table 11. Villebois Permits, 2000 to 2012

Housing Type	Total Permits	
	Number	Percent
Large Lot Single Family	74	8%
Medium Lot Single Family	75	8%
Small Lot Single Family	309	35%
Attached Single Family	56	6%
Multifamily	380	43%
Total	**894**	**100%**

Source: City of Wilsonville permit database, Leland Consulting Group.

Third, attached single-family homes made up a higher share of permitting in Villebois than the city as a whole. Finally, large and medium lot single-family housing both made up a similar and modest share of all permitting citywide and in Villebois.

Housing Demand Summary

Based on the review of local, regional, and national demographics trends, the Residential Land Study, emerging community preferences, and other factors, LCG has used the following principles in creating a series of development scenarios for Frog Pond:

- **General housing preferences.** Across all household types, there is a general preference for detached single-family homes and for walkable communities in which goods, services, amenities, and community meeting places are within easy walking, biking, or driving distance. People's ideal housing preferences are typically moderated by their home buying budget, location of work, school and relatives, and other factors.

- **Housing diversity.** Housing mix and diversity is important in a large area such as Frog Pond. LCG recommends that a range of housing types be included in the Frog Pond concept planning, since there is a correspondingly wide range of households—old and young, large and small. A large area should be appeal to a wide variety of households. This will speed sales and thus the financial viability of the area.

- **Flexibility.** Flexibility is important to developers. Future Comprehensive Plan and Zoning regulation should ideally allow flexibility in Frog Pond, since housing demand in 2035 is by nature difficult to predict, and developers will want some ability to adjust to changes in demand.

- **65+ households.** The greatest amount of household growth in Washington and Clackamas Counties, and other relevant geographical regions is expected to come from households aged 65 and older. This is a dramatic shift from past demographic patterns. Age 65 and older households who move will likely demand a mix of housing, but will tend towards homes that are lower maintenance, somewhat higher density, and have many amenities close by. Many in this age group will still desire detached single-family homes, though others will be interested in attached and multifamily housing.

- **Families with children.** There will also be significant household growth in the 35 to 65 age cohort. Within this broad cohort, married couples with children ("traditional households") are expected to tend to seek single-family detached housing, within a variety of lot sizes.

- **Non-traditional households**—including singles, single-parent, and married couple households without children—have grown consistently and dramatically since the 1970s and are expected to continue to grow. These tend to be one and two-person households, and LCG expects that they will exhibit a broad range of housing preferences, across detached and attached single-family and multifamily housing types. Because of their smaller size, they will tend to seek medium and smaller size homes.

- **Policy.** The Residential Land Study recommends that the Frog Pond West Neighborhood be "developed predominantly with single-family detached housing." However, it also recognizes that this Concept Plan process will ultimately determine the set of land uses at Frog Pond, and it does not set specific expectations for the East and South Neighborhoods.

- **Compatibility.** Housing in Frog Pond should be somewhat compatible with the densities and housing types that have been historically developed in Wilsonville's neighborhoods.

Based on these principles, Table 12 below summarizes LCG's high level forecast of likely housing demand in the Frog Pond Area during the next two decades.

The level of demand within each housing type is reflected by the length of the blue bars at right—the longer the bar, the greater the demand. This reflects a general, high level assessment of demand; the specific quantitative implications (i.e., the number of units likely to be built) are discussed in the following pages.

Table 12. Housing Demand Summary

Housing Type		Household Type			
	Lot Size Average	Boomers	Familes with Children	Couples, Single Parents, Non Family HHs	**Combined All Households**
Large Lot Single Family	7,500				
Medium Lot Single Family	5,000				
Small Lot Single Family	3,500				
Attached Single Family: Townhomes & Duplexes	2,250				
Multifamily: Apts, Condos, and Senior Housing	NA				

Source: Leland Consulting Group.

Housing Development Scenarios

Two housing development programs, or scenarios, for both the West Neighborhood, and the East and South Neighborhoods combined, are shown below, along with a brief summary of the rationale behind each. These housing scenarios will be used by the Frog Pond team—including the City, Angelo Planning Group, and the public—to inform Concept Plan (physical design) alternatives for the area. The scenarios may also be used to test the capacity of transportation, sewer, and water infrastructure, and for other elements of the Concept Plan process. LCG expects that they may be revised later in the planning process.

There is no single correct housing program for Frog Pond. Rather, there are multiple ways that housing at Frog Pond can meet the demand for housing that will be expressed by a variety of different household types that will consider moving to the area in the coming decades. Communities such as Villebois, Charbonneau, and Wilsonville's other neighborhoods each represent a somewhat different approach to appealing to potential residents.

West Neighborhood

The two tables below show Development Scenarios 1 and 2 for the Frog Pond West Neighborhood.

Scenario 1 is approximately the same density (7.7 dwelling units per net acre) as the average density of all single-family housing built in Wilsonville between 2000 and 2012 (see page 25). Ninety-four percent of the housing is single-family detached, which meets the Residential Land Study policy guidance. Nearly 60 percent of all housing is medium lot single-family, with lots between 4,000 and 6,000 square feet, which can be considered a "standard" residential lot. One drawback of this scenario is that the density may be too low to generate the revenues (through lot sales and systems development charges) necessary to build the highquality infrastructure expected in a complete, walkable community.

Scenario 2 has more housing diversity and is slightly denser. The overall density (10.6 dwelling units per net acre) is similar to all housing (including single and multifamily) built in residential-designated land in Wilsonville between 2000 and 2012 (see page 25). Sixty-nine percent of all housing is single-family detached, which should meet the intent of the Residential Land Study policy guidance. This scenario is more likely to achieve the principles of housing diversity and fostering a walkable community than Scenario 1. It is also more likely to meet the housing needs of 65+ and non-traditional households through the provision of more small lot single-family homes, as well as a greater share of attached and multifamily homes. This scenario would likely accommodate a single market rate or age-restricted multifamily project, which tend to start at about 150 units in size.

Table 13. West Neighborhood: Development Scenario 1

Housing Type	Lot Size	Net	Units		Net Acres	
	Average	Density	#	%	#	%
Large Lot Single Family	7,500	6.0	155	22%	25	28%
Medium Lot Single Family	5,000	7.5	410	59%	55	60%
Small Lot Single Family	3,500	11.0	90	13%	8	9%
Attached Single Family	2,250	16.0	45	6%	3	3%
Multifamily	NA	25.0	-	0%	-	0%
Total			700	100%	**91**	100%
Average		**7.7**				

Table 14. West Neighborhood: Development Scenario 2

Housing Type	Lot Size	Net	Units		Net Acres	
	Average	Density	#	%	#	%
Large Lot Single Family	7,500	6.0	65	7%	11	12%
Medium Lot Single Family	5,000	7.5	245	25%	33	36%
Small Lot Single Family	3,500	11.0	360	37%	33	36%
Attached Single Family	2,250	16.0	115	12%	7	8%
Multifamily	NA	25.0	180	19%	7	8%
Total			965	100%	**91**	100%
Average		**10.6**				

Source: Leland Consulting Group.

East and South Neighborhoods

The two tables below show Development Scenarios 1 and 2 for the Frog Pond East and South Neighborhoods.

Scenario 1 is approximately the same density (10.5 dwelling units per net acre) as all housing (including single and multifamily) built in residential-designated land in Wilsonville between 2000 and 2012 (see page 25). The majority (72 percent) of all housing is single-family detached, which is likely to be consistent and compatible with the Residential Land Study policy guidance for Frog Pond West. This scenario also provides some housing diversity and will meet the demands of some 65+ and non-traditional households through the provision of small lot single-family, single-family attached, and multifamily homes. By providing a significant share of these more compact housing types, this scenario should be able to foster a walkable community.

Scenario 2 is similar in terms of density (12.0 dwelling units per net acre) as all housing (including single and multifamily) built in Wilsonville between 2000 and 2012; this includes housing built in residential-designated land and in village-designated (Villebois) land. A majority (63 percent) of all housing is single-family detached, which is likely to be consistent and compatible with the Residential Land Study policy guidance for Frog Pond West. This scenario also provides more housing diversity than Scenario 1, which will meet the demands of some 65+ and non-traditional households through the provision of small lot single-family, single-family attached, and multifamily homes. This significant number of more compact housing types could be clustered in the center of the neighborhood around shops and open space in order to create a small retail and social hub for Frog Pond, putting more services within walking distance. This scenario would likely accommodate several market rate or age-restricted multifamily projects, which tend to start at about 150 units in size.

Table 15. East and South Neighborhoods: Development Scenario 1

Housing Type	Lot Size	Net	Units		Net Acres	
	Average	Density	#	%	#	%
Large Lot Single Family	7,500	6.0	45	3%	7	5%
Medium Lot Single Family	5,000	7.5	435	29%	58	40%
Small Lot Single Family	3,500	11.0	620	41%	57	39%
Attached Single Family	2,250	16.0	280	18%	17	12%
Multifamily	NA	25.0	145	10%	6	4%
Total			1,525	100%	**145**	100%
Average		**10.5**				

Table 16. East and South Neighborhoods: Development Scenario 2

Housing Type	Lot Size	Net	Units		Net Acres	
	Average	Density	#	%	#	%
Large Lot Single Family	7,500	6.0	35	2%	6	4%
Medium Lot Single Family	5,000	7.5	360	21%	48	33%
Small Lot Single Family	3,500	11.0	700	40%	64	44%
Attached Single Family	2,250	16.0	280	16%	17	12%
Multifamily	NA	25.0	365	21%	15	10%
Total			1,740	100%	**145**	103%
Average		**12.0**				

Source: Leland Consulting Group.

Frog Pond Area: All Neighborhoods Combined

Table 17 shows the results of combining the scenarios for both areas. The total number of housing units likely to be built in the area ranges from about 2,200 to 2,700.

Table 17. Development Scenarios for Entire Frog Pond Area

Housing Type	UGB Area		Urban Reserve		Entire Study Area	
	Low	High	Low	High	Low	High
	1	2	1	2		
Large Lot Single Family	155	65	45	35	200	100
Medium Lot Single Family	410	245	435	360	845	605
Small Lot Single Family	90	360	620	700	710	1,060
Attached Single Family	45	115	280	280	325	395
Multifamily	-	180	145	365	145	545
Total	**700**	**965**	**1,525**	**1,740**	**2,225**	**2,705**

Source: Leland Consulting Group.

A combination of these scenarios, or a variation on them, could be implemented. During this Concept Plan process, a preferred scenario should be selected based on this market analysis, the land planning process, input from the public and other stakeholders, transportation and infrastructure analysis, and other factors.

Absorption

Housing absorption—the rate of housing construction and sales—at Frog Pond will depend on a number of factors, including the actual rate of population and household growth in the metropolitan and market areas, economic conditions, when the areas are served with infrastructure and available for development, and the sales pace at Villebois, which will both complement and compete with Frog Pond.

Because of these variables, LCG created two different absorption forecasts, a “goal” or aggressive forecast, and a conservative forecast as shown in Table 18 below. The goal reflects developers’ and potentially the City’s desire for relatively quick absorption, and a build out of between nine and 13 years for the West Neighborhood, and 15 to 17 years for the East and South Neighborhoods. This goal forecast is only achievable if Wilsonville’s population and households continues to grow at the same pace as the city grew during the 2000 to 2012 period (2.8 percent per year). If the city grows at the slower rate projected by Metro (1.8 percent per year), the conservative absorption rate is more likely.

Table 18. Frog Pond Absorption Forecasts

Neighborhood	Dwelling Units		Goal		Conservative	
	Scenario 1	Scenario 2	Absorption	Years to Buildout	Absorption	Years to Buildout
West	700	965	75	9 to 13	60	12 to 16
East and South	1,525	1,740	100	15 to 17	60	25 to 29
Total	**2,225**	**2,705**	**175**		**120**	

At peak development levels, when the West, East, and South Neighborhoods are developing and selling at the same time, LCG projects that annual absorption will be between 120 and 175 units per year. For purposes of comparison, about 125 homes were sold at Villebois in 2013, and there should be well over 200 sold at Villebois in 2014. However, the sales rate during the recession was much slower, generally between 40 and 80 units per year.

Assuming that the East and South Neighborhoods are available for development in 2022, the peak development and sales period for Frog Pond would take place between 2022 and 2032. Assuming that development begins in the West Neighborhood in 2017, it will be fully developed by about 2032.

Absorption is important for several reasons. A faster build out increases developers' return on investment, land values, and the systems development charges and other public revenues that help to fund infrastructure.

Retail Market Analysis

Figure 10 shows the Frog Pond Area and the key retail/commercial nodes that are located nearby. The commercial cluster to the north at the Elligsen Road interchange is anchored by Target and Costco; the cluster to the south includes retail centers on both sides of I-5 around Wilsonville Road, and includes anchor retailers such as Fred Meyer and Albertsons. One benefit that both of these clusters have over Frog Pond is the very high traffic, visibility, and access that comes with their location near I-5, and along major high volume arterial roads.

Figure 10. Frog Pond Retail Context

Source: Leland Consulting Group.

Retail at Frog Pond will need to consider these other retail centers, and establish an effective role and niche in order to compete effectively.

Frog Pond's location at the "crossroads" of Wilsonville/Stafford and Boeckman/Advance Roads is positive for potential retail, since retailers depend on visibility and accessibility to customers. "Interior" retail locations such as the retails centers at Villebois and Charbonneau can struggle due to lower levels of drive-by traffic, visibility, and access. Average daily traffic (ADT) levels of about 5,000 on the two arterials are shown on Figure 10. These are too low today to attract retail development, however, they will increase in the future as housing development takes place and the region grows and they reflect significant pass through traffic already. The City's Transportation System Plan forecasts that ADT on these two roads will approximately double in the next 20 years.

Figure 10 also shows the primary retail market area, within the dashed white line. This includes the Frog Pond study area, as well as some built out residential areas to the northwest, west, and southwest. There are currently about 1,150 households living in these existing neighborhoods, and these households are the most likely potential shoppers in addition to those living in Frog Pond proper.

Taking into account this existing stock of about 1,150 households and the approximately 2,500 new households likely to ultimately reside at Frog Pond, there will be about 3,650 households in the primary market area at full project build out in 2035. Retail spending from these households could be supplemented by drive-by shoppers, and by employees who work to the west. However, these secondary markets (drive-by and employees) are already well served by retail to the north and south, and close to those centers.

Types of Retail Centers

Retail is typically built in a series of standard formats, and while these vary somewhat, they maintain general consistency in terms of anchor tenants, size (square footage), trade area, and other features. Several types of retail centers are summarized below. A corner store, convenience center, or neighborhood center are the most appropriate types of retail for Frog Pond. The 3,650 households projected in the primary market area at Frog Pond suggests that a convenience center would likely be feasible, and a grocery-anchored neighborhood center would be a stretch. While neighborhood centers often have a two-mile trade area, such a large trade area is unlikely in this case given the competitive retailers nearby to the north and south.

Table 19. Types of Retail Centers

Retail Center Type	Gross Retail Area	Dwellings Necessary To Support	Average Trade Area	Anchor Tenants
Corner Store	1,500 - 3,000	1,000	Neighborhood	Corner store
Convenience Center	10,000 - 30,000	2,000	1 mile radius	Specialty food or pharmacy
Neighborhood Center	60,000 - 90,000	6 - 8,000	2 mile radius	Supermarket and pharmacy
Community Center	100,000 - 400,000	20,000+	5 mile radius	Junior department store

Sources: Urban Land Institute, Leland Consulting Group.

Corner stores and convenience centers may not be as desirable as a full neighborhood center. They often do not create the same sense of place or have the same quality of design as a neighborhood center, and they do not fulfill the full range of daily needs, particularly in terms of food.
Larger regional and lifestyle center information is not shown, since those center types already exist at large freeway interchanges to the north and south and require very high volume transportation infrastructure, and are therefore not appropriate for Frog Pond.

Retail Demand

Retail demand was evaluated for two different future years and is shown in the two tables below. Table 20 shows retail demand in 2025, when the Frog Pond Area will be about halfway to full build out. In 2025, a typical grocery-anchored neighborhood center could not be supported. A typical grocery store is between 40,000 and 60,000 square feet, and this model shows support for only 27,200 square feet. A grocery is the anchor tenant for neighborhood centers, and developers will not build the rest of the center if the anchor is not feasible.

Table 20. Retail Demand and Supportable Retail Area: 2025

Retail Type	Future Demand (Retail Potential) $ million	Current Supply (Retail Sales) $ million	Spending Gap $ million	Sales PSF	Capture Rate	Net New Demand Square feet
Furniture & Home Furnishings Stores	$1.6	$0.2	$1.4	$275	10%	500
Electronics & Appliance Stores	$2.1	$1.2	$0.9	$325	10%	300
Bldg Materials, Garden Equip. & Supply Stores	$2.2	-	$2.2	$325	10%	700
Grocery Stores / Food and Beverage	$13.7	-	$13.7	$400	80%	27,200
Health & Personal Care Stores	$3.9	-	$3.9	$350	15%	1,650
Gasoline Stations	$6.7	-	$6.7	$1,200	10%	600
Clothing & Clothing Accessories Stores	$4.4	$0.2	$4.2	$300	10%	1,400
Sporting Goods, Hobby, Book & Music Stores	$2.0	$0.1	$1.9	$275	10%	700
General Merchandise Stores	$13.5	-	$13.5	$275	10%	4,900
Miscellaneous Store Retailers	$2.5	0.53	$1.9	$225	20%	1,800
Food Services & Drinking Places	$8.2	$1.2	$7.0	$325	20%	4,400
Total						**44,150**

Sources: ESRI Business Analyst, Leland Consulting Group.

Table 21 shows retail demand in 2035, when the Frog Pond Area is expected to be near completion.

Table 21. Retail Demand and Supportable Retail Area: 2035

Retail Type	Future Demand (Retail Potential) $ million	Current Supply (Retail Sales) $ million	Spending Gap $ million	Sales PSF	Capture Rate	Net New Demand Square feet
Furniture & Home Furnishings Stores	$2.5	$0.2	$2.3	$275	10%	800
Electronics & Appliance Stores	$3.2	$1.2	$2.0	$325	10%	600
Bldg Materials, Garden Equip. & Supply Stores	$3.4	-	$3.4	$325	10%	1,000
Grocery Stores / Food and Beverage	$21.0	-	$21.0	$400	80%	42,400
Health & Personal Care Stores	$6.1	-	$6.1	$350	15%	2,550
Gasoline Stations	$10.4	-	$10.4	$1,200	10%	900
Clothing & Clothing Accessories Stores	$6.8	$0.2	$6.6	$300	10%	2,200
Sporting Goods, Hobby, Book & Music Stores	$3.1	$0.1	$3.0	$275	10%	1,100
General Merchandise Stores	$20.8	-	$20.8	$275	10%	7,600
Miscellaneous Store Retailers	$3.8	0.53	$3.3	$225	20%	3,000
Food Services & Drinking Places	$12.6	$1.2	$11.4	$325	20%	7,000
Total						**69,150**

Sources: ESRI Business Analyst, Leland Consulting Group.

In 2035, a typical grocery-anchored neighborhood center is *potentially* feasibly. The anchor grocery store is closer to feasibility, and the total square footage in demand is within the typical range of neighborhood centers shown in Table 19. This level of demand is close to the point at which retail developers, in many years, would likely conduct a closer and more detailed feasibility analysis that takes into account the strength of the competitive retail centers, household demographics, traffic patterns, potential tenants, and other factors at that time. Retail is a dynamic type of development, and formats can change significantly over a decade. For example, large stores selling videos, compact discs, and books were commonplace in neighborhood retail centers a decade ago; now they have all but disappeared; photo developers and travel agencies are also rare today.

Retail feasibility will depend on what if any retail is developed in other locations. For example, a new retail center located to the west of the Frog Pond Area on Boeckman Road would absorb demand from Frog Pond and potentially preclude new development in the study area. This analysis assumes that no new retail is built within a one-mile radius of the Boeckman and Wilsonville Road intersection.

Retailer developers may decide to wait until after 2035 to build significant retail, when additional Urban Reserve Areas such as the Elligsen Urban Reserve Area to the north may enter the UGB. Finally, buildable land will be necessary to accommodate new retail development.

Retail development in edge locations such as Frog Pond is challenging and requires the right mix of pass-by traffic and visibility, a dearth of strong competition in the primary market area, and adequate population. This also underscores the adage that "retail follows rooftops" and gets developed only when there is sufficient housing to support it.

Retail as Place Making

While it is often difficult to attract retail to new communities on the edge of metropolitan regions, retail often helps to achieve the goal of building a "complete community" where residents can easily meet their daily needs on foot or by car. Such local-serving retail also provides a social hub and community-building function, and drives faster housing sales since this is seen as a top amenity by many prospective residents (see Community Preferences on page 17).

There are few good examples of successful, small-scale, local-serving retail in suburban locations. One example is at NorthWest Crossing, a master planned community on edge of the Bend metro area. Northwest Crossing contains about 35,000 square feet of retail, and though the space has for some periods had high vacancy rates, it provides a strong sense of place, and both a gateway and center for the community. The Northwest Crossing retail area is pictured below hosting a farmers market.

Appendices

Selected References

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- *Residential Futures: Thought-Provoking Ideas on What's Next for Master-Planned Communities*, Urban Land Institute, 2012, http://uli.org/wp-content/uploads/ULI-Documents/resident_futures_web_F.pdf.
- *Wilsonville Residential Land Study* and *Wilsonville Residential Land Study Technical Report,* City of Wilsonville and ECONorthwest, Adopted May 2014.
- *What Americans Really Want*, Arthur C. Nelson, Metropolitan Research Center, 2011.

Wilsonville Demographic Tapestry Segments

As shown in Table 22 below, the City of Wilsonville is dominated by three main tapestry segments—Enterprising Professionals, Silver and Gold, and Up and Coming Families—which together comprise 95 of the city's total population. ESRI estimates that the Enterprising Professionals group alone accounts for 65 percent of the city's population, and is therefore 34 times more prevalent than in the nation at large.

Table 22. City of Wilsonville's Primary Tapestry Segments

Tapestry Segment	Percent of Households		
	City of Wilsonville	United States	Prevalence Compared to US
Enterprising Professionals	65%	2%	34
Silver and Gold	19%	1%	19
Up and Coming Families	12%	4%	3
Urban Chic	4%	1%	3
Exurbanites	1%	3%	0
All others	0%	89%	NA

Source: ESRI, Leland Consulting Group.

Enterprising Professionals

65% of Wilsonville Population

Demographic

- Young, educated, single, married, working professionals, residents of Enterprising Professionals neighborhoods have a median age of 33.2 years.
- Forty-three percent of the households are singles who live alone or share housing with roommates, and 43 percent are married couple families.
- With an annual household growth of 1.95 percent per year since 2000, the households in this segment comprise approximately two percent of total U.S. households.
- The diversity of the population is similar to that of the U.S. Most of the residents are Caucasian; however, 12.4 percent are Asian.

Socioeconomic

- Median household income is $61,151.
- Ninety percent of the households earn income from wages and salaries; 39 percent receive income from investments.
- This is an educated group: approximately half of the population aged 25 years and older hold a bachelor's or graduate degree; more than three in four have attended college.
- These working professionals are employed in various jobs, especially in management, finance, computer, sales, and office/administrative support.

Residential

- Enterprising Professionals residents move frequently to find growth opportunities and better jobs, especially in cities such as Chicago, Atlanta, and Seattle.
- Forty-six percent of the households are located in the South, 29 percent are in the West, and 20 percent are in the Midwest.
- They prefer to own instead of rent in newer neighborhoods of townhouses or apartments. The median home value is $239,007.
- For those who rent, the average gross rent is 36 percent higher than the U.S. average.

Preferences

- They are young and mobile with growing consumer clout.
- Those who rent hold renter's insurance policies.
- They rely on cell phones and e-mail to stay in touch.
- They go online to download videos and music, track their investments, and shop for items, including personal computers and software.
- They own laptops, video game systems, and digital camcorders. They love to travel abroad and in the U.S. often.
- They play video games, visit theme parks, jog, and swim. They read computer, science, and technology magazines and listen to alternative, public-all-talk, and sports radio.
- They eat out at Cheesecake Factory and Chili's Grill and Bar. They shop for groceries at stores such as Publix and Albertson's.

Silver and Gold

19% of Wilsonville Population

Demographic

- With a median age of 61.3 years, Silver and Gold residents are the second oldest of the Tapestry segments.
- More than 70 percent are aged 55 years or older.
- Most residents have retired from professional occupations. Half of the households are composed of married couples without children.
- This segment is small, less than one percent of all U.S. households; however, annual household growth is 0.66 percent since 2000. Residents of these neighborhoods are not ethnically diverse; 93 percent of them are Caucasian.

Socioeconomic

- These are wealthy, educated seniors. Their median household income is $62,157.
- Fifty-six percent of the households still earn wages or salaries, half collect Social Security benefits, 63 percent receive investment income, and 35 percent collect retirement income.
- The percentage of those who work from home is higher than the U.S. worker percentage; nearly one-fourth of employed residents are self-employed, also higher than the U.S. level.

Residential

- Their affluence enables them to relocate to sunnier climates. More than 60 percent of these households are in the South, mainly in Florida.
- One-fourth of this Tapestry segment is located in the West, mainly in California and Arizona. Neighborhoods are exclusive with a home ownership rate of 81 percent.
- The median home value is $290,103. Silver and Gold ranks second of the Tapestry segments for the percentage of seasonal housing owners.
- Because these seniors have moved to newer single-family homes, they are not living in the homes where they raised their children.

Preferences

- Silver and Gold residents have the free time and resources to pursue their interests.
- They travel domestically and abroad including cruise vacations. They are also interested in home improvement and remodeling projects.
- Although they own the tools and are interested in home improvement and remodeling projects, they are more likely to contract for remodeling and housecleaning services.
- Active in their communities, they join civic clubs, participate in local civic issues, and write to newspaper or magazine editors. They prefer to shop by phone from catalogs such as L.L. Bean and Lands' End.
- Golf is more a way of life than just a leisure pursuit. They play golf, attend tournaments, and watch The Golf Channel. They also go to horse races, bird watching, saltwater fishing, and power boating. They eat out, attend classical music performances, and relax with a glass of wine.
- Favorite restaurants include Outback Steakhouse, Cracker Barrel, and Applebee's. Silver and Gold residents are avid readers of biography and mystery books and watch numerous news programs and news channels such as Fox News and CNN. Favorite non-news programs include detective dramas.

Up and Coming Families

12% of Wilsonville Population

Demographic

- With an annual household growth rate of 1.69 percent, Up and Coming Families represents Tapestry's second highest household growth market.
- A mix of Generation Xers and Baby Boomers with a median age of 32.8 years, this segment is the youngest of Tapestry's affluent family markets.
- Residents of these neighborhoods are young, affluent families with younger children.
- Eighty percent of the households are families. Most of the residents are white; however, diversity is increasing as the segment grows.

Socioeconomic

- Beginning their careers, residents of Up and Coming Families are earning above-average incomes. The median household income is $73,906, higher than the national median.
- Two-thirds of the residents aged 25 years and older have attended college; more than one in five holds a bachelor's degree.
- Ninety-one percent of households earn income from wages and salaries.
- Although half of the households have children, they also have working parents.

Residential

- In the suburban outskirts of midsized metropolitan areas with populations higher than 250,000, approximately half of Up and Coming Families neighborhoods are concentrated in the South, the other half in the West and Midwest.
- Most residents live in new single-family housing; with a median home value of $193,161. More than half the housing units were built in the last 10 years.
- Homeownership is at 80 percent.

Preferences

- Family and home dictate the products these residents buy.
- Many are beginning or expanding their families, so baby equipment, children's clothing, and toys are essential purchases.
- Because many are first-time homeowners, basic household furniture and lawn fertilizer, weed control, and insecticide products are important.
- Car loans and mortgage payments are major household budget items. They are most likely to own or lease an SUV or a minivan.
- They eat out at family restaurants, especially on the weekends, and buy fast food at the drive-through or for takeout.
- They play softball, take the kids to the zoo, and visit theme parks (generally Sea World or Disney World) where they make good use of their digital camera or camcorder.
- They rent comedy, family, and action/adventure DVDs. Cable station favorites include Country Music Channel, ESPN News, The Learning Channel, and the Disney Channel. They listen to country, soft rock, and contemporary hit radio.

FROG POND AREA PLAN

Creating a great community

Appendix B: Future Transportation Analysis memorandum

City of Wilsonville

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FROG POND AREA PLAN
Creating a great community

Appendix C: Frog Pond Area Plan Infrastructure Analysis memorandum

City of Wilsonville

MSA
Murray, Smith & Associates, Inc.
Engineers/Planners
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TECHNICAL MEMORANDUM

DATE: September 24, 2014

PROJECT: 14-1553.600

TO: Joe Dills, Angelo Planning Group

FROM: Mathew L. Hickey, P.E.
Murray, Smith & Associates, Inc.

RE: Frog Pond Area Plan – Concept Plan Infrastructure Analysis

REGISTERED PROFESSIONAL ENGINEER
19195
Matthew L Hickey
OREGON
JULY 15, 1997
MATTHEW L. HICKEY
RENEWS 6-30-15

Introduction

The Frog Pond Area Plan, led by the City of Wilsonville, will establish a vision for the 500-acre Frog Pond area, and define expectations for the type of community it will be in the future. The project team has developed a set of three land use and transportation alternatives for consideration by the Frog Pond Planning Task Force, the public, stakeholders, and city policy-makers. This memorandum is one of several that are intended to provide information on the performance of the three alternatives to enable the Task Force, public, and policy-makers to make informed recommendations and decisions about a preferred alternative.

Executive Summary

The purpose of this memorandum is to evaluate three alternative "on-site" public utility infrastructure improvements and their associated costs relative to various development scenarios for the Frog Pond Area. The term "off-site" is also used throughout this document to refer to those utilities that support larger tracts of developable land. These off-site improvements are oversized in relation to providing services for individual properties that developers will construct, and are eligible for System Development Charge (SDC) credits to the developer under the current City funding policies.

The infrastructure improvements evaluated in this memorandum are limited to domestic water, sanitary sewer and storm drainage. The land use and transportation alternatives consist of the following[1]:

- Concept 1 – Grid, Low

  This alternative consists of a "grid" street layout with roadway alignments that generally run east to west, and north to south. Residential zoning within this scenario has the lowest average density of the three alternatives.

- Concept 2 – Organic, Medium

  This alternative consists of an "organic" street layout and medium average residential densities for the Frog Pond Area.

- Concept 3 – Grid, High

  This alternative consists of a "grid" street layout as described under Concept 1. Residential zoning within this scenario has the highest average density of the three alternatives.

The overall costs for providing on-site utility infrastructure are similar for the three alternatives, as summarized in Table 1, and illustrated in Figures 1 through 6[2]. These costs represent the infrastructure necessary to support a development's actual demands and the minimum required improvements defined under the City's Public Works Standards (PWS). For developments required to construct infrastructure exceeding their actual demands due to planning considerations for adjacent properties, the City compensates the developer using SDC credits. These costs are summarized in Table 2.

Each concept's demands for water and the peak flows for wastewater and storm drainage were estimated and evaluated. Although the demands for each utility service varied between scenarios, the minimum requirements for infrastructure sizing typically governed their design. These minimum requirements often generate utilities with capacities that exceed their service demands, which is explained in greater detail within each service summary.

---

[1] The three land use and transportation alternatives are described and illustrated in more detail in the Frog Pond Alternatives Summary Report prepared by Angelo Planning Group.

[2] Smaller residential streets are not shown for this analysis. The neighborhood collectors are shown due to a higher degree of confidence in their ultimate location, versus the uncertainty relative to the proposed location of smaller residential streets. The smaller residential streets are anticipated to be configured by property developers as more site specific plans are created.

Table 1 | Total On-Site Infrastructure Cost Summary

Neighborhood	Concept 1 Grid, Low	Concept 2 Organic, Medium	Concept 3 Grid, High
West	$29.6m	$35.8m	$30.0m
East	$26.9m	$25.6m	$27.1m
South	$24.3m	$19.1m	$24.4m
Totals	$80.8m	$80.5m	$81.5m

The previous planning analysis for "off-site" infrastructure improvements associated with the Frog Pond Area described improvements to infrastructure components located outside the Frog Pond Area needed to serve growth within Frog Pond. It also identified the "framework" components of on-site infrastructure to serve growth broadly within Frog Pond as well as future possible growth areas, such as the Elligsen Urban Reserve (4G)[3].

Where on-site infrastructure must be over-sized to serve development beyond the abutting property, developers are required by City standards to install these improvements at time of development; however they are given SDC credits for the incremental cost increase due to the required oversizing. Table 2 presents the estimated oversizing costs to be paid by the City thru a reimbursement district, or through SDC credits for installed infrastructure exceeding the City's minimum requirements.

Infrastructure development options were evaluated relative to a number of criteria including cost, environmental impact and compatibility with development needs. Where utilities deviated from a roadway alignment, an easement was assumed to be necessary through private property and was evaluated as an unfavorable aspect of the alternative. An evaluation matrix (see Table 10) provided later in this memorandum outlines the criteria and results of this analysis. Based on this evaluation it appears that Concept 2 offers the most favorable outcome relative to the utility infrastructure, primarily due to lower overall cost and the compatibility of water, sewer and stormwater alignments with road layout.

[3] *Frog Pond Area Plan Off-Site Infrastructure Analysis*, Murray, Smith & Associates, Inc., July 18, 2014.

Table 2 | Total Off-Site Infrastructure Cost Summary

Utility	Total Cost	Developer Cost	City (SDC) share	Remarks
Off-site water distribution within Frog Pond Area	$1.5m	$1.2m	$0.3m	Minimum standard: 8-inch diameter water main
Off-site water storage	$5.8m	SDCs[4]	$5.8m	25% of the total cost is attributable to the Frog Pond Area
Off-site sanitary sewer lines within Frog Pond Area	$13.7m	$10.0m	$3.7m	Minimum standard: 8-inch minimum diameter sewer main
Existing Off-site sanitary sewer piping upgrades	$8.0m	SDCs[4]	$8.0m	52% of total wastewater flow is attributable to the Frog Pond Area
Memorial Park Pump Station expansion	$5.2m	SDCs[4]	$5.2m	48% of total wastewater flow is attributable to the Frog Pond Area
Totals	$34.2m	$11.2m	$23.0m	

Conceptual Plan Infrastructure Analysis

Purpose

The purpose of this memorandum is to evaluate three alternative "on-site" public utility infrastructure improvements and their associated costs relative to various development scenarios for the Frog Pond Area. The term "off-site" is also used throughout this document to refer to those utilities that support larger tracts of developable land. These off-site improvements are oversized in relation to providing services for individual properties for which developers will construct, and may be eligible for SDC credits to the developer or subject to a reimbursement district under the current City funding policies.

Background

The analysis presented in this memorandum is based on information provided in the draft Land Use Alternatives Capacity Analysis provided by Angelo Planning Group, dated July 31, 2014. The infrastructure improvements evaluated in this memorandum are limited to

[4] The full cost of this improvement will be funded through SDC revenue by the city. The proportion of the demand (and cost) attributable to the Frog Pond Area is included for purposes of comparing SDC revenues and expenditures linked to growth in Frog Pond, as analyzed in the Funding Analysis memorandum prepared by Leland Consulting Group.

domestic water, sanitary sewer and storm drainage. The land use and transportation alternatives consist of the following[5]:

- Concept 1 – Grid, Low

  This alternative consists of a "grid" street layout with roadway alignments that generally run east to west, and north to south. Residential zoning within this scenario has the lowest average density of the three alternatives.

- Concept 2 – Organic, Medium

  This alternative consists of an "organic" street layout and medium average residential densities for the Frog Pond Area.

- Concept 3 – Grid, High

  This alternative consists of a "grid" street layout as described under Concept 1. Residential zoning within this scenario has the highest average density of the three alternatives.

Figures 1 through 6 presented at the end of this memorandum illustrate the utility infrastructure needs for these development options. Figures 1 through 3 show utility infrastructure needed to support the grid street layouts associated with Land Use Concept 1 or 3, while Figures 4 through 6 indicate the utility needs for the organic street layout associated with Land Use Concept 2[6]. Regarding Land Use Concepts 1 and 3, the utility sizes are essentially the same between the development scenarios; as such, a single utility map is provided that will serve them both equally.

Utility Infrastructure Improvement Concepts

The anticipated on-site utility infrastructure required to support the land use alternatives are presented below. These elements consist of stormwater, sanitary sewer, domestic water and fire flow supply improvements. With the exception of stormwater, the infrastructure needs for the Frog Pond Area are very similar for the grid and organic street layouts and the alternative land use scenarios. As such, alternatives relative to planning these neighborhoods will likely be evaluated based on other factors besides the required utility infrastructure.

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[5] The three land use and transportation alternatives are described and illustrated in more detail in the Frog Pond Alternatives Summary Report prepared by Angelo Planning Group.
[6] Smaller residential streets are not shown for this analysis. The neighborhood collectors are shown due to a higher degree of confidence in their ultimate location, versus the uncertainty relative to the proposed location of smaller residential streets. The smaller residential streets are anticipated to be configured by property developers as more site specific plans are created.

An evaluation supporting this statement is provided under each of the following utility improvement summary sections below.

Stormwater Improvements

The planning for stormwater management facilities relies primarily upon their tributary impervious surface areas. These impervious areas can be estimated from the City of Wilsonville's Stormwater Master Plan, which provides percentages of impervious areas based on various land use types[7].

A set aside area for stormwater management facilities can then be obtained by applying an assumed ratio of 7.5 percent for commercial and residential areas, and 10 percent for streets relative to these impervious areas. This ratio represents a Low Impact Development (LID) approach to stormwater management, and the resulting set aside areas are summarized in Table 3. Streets were allocated the maximum allowable ratio by City's PWS of stormwater set aside due to their tributary area comprising essentially all impervious surfaces.

The approximate size and location of the stormwater management set aside areas are shown on Figures 1 through 6. The set aside areas have been placed at assumed locations based on general drainage routing resulting from various street configurations. These preliminary locations approximate the proportional set aside area necessary to manage stormwater originating from upstream impervious areas. They may be revised based on site-specific considerations at time of development.

Table 3 | Stormwater Set Aside Acreage for LID Facilities

				Residential Density				
	Neighborhood	**Commercial**	**Streets**	**Very Low**	**Low**	**Medium**	**High**	**Totals**
Concept 1 Grid, Low	West	0.0	2.8	0.8	2.4	0.0	0.0	6.0
	East	0.3	2.5	0.9	0.8	1.7	0.0	6.2
	South	0.0	1.5	0.0	1.1	1.3	0.0	3.9
	Totals	0.3	6.8	1.7	4.2	3.0	0.0	16.1
Concept 2 Organic	West	0.0	2.8	0.0	2.4	0.9	0.0	6.1
	East	0.3	2.5	0.0	0.8	1.7	1.1	6.4
	South	0.0	1.5	0.0	1.1	1.2	0.0	3.8
	Totals	0.3	6.8	0.0	4.2	3.8	1.1	16.3
Concept 3 Grid, High	West	0.3	2.7	0.0	2.4	3.2	0.0	8.5
	East	0.0	2.6	0.0	0.8	2.6	1.2	7.2
	South	0.0	1.5	0.0	1.1	1.5	0.3	4.3
	Totals	0.3	6.8	0.0	4.2	7.2	1.5	20.1

[7] Technical Memorandum, March 2012, City of Wilsonville Stormwater Master Plan Update Hydraulic and Hydrologic Modeling, URS Corporation.

The stormwater management approaches are anticipated to consist largely of roadside bioswales and detention basins to manage drainage originating from development. Drainage originating from private developments are expected to be managed by the private developer in accordance with the City's PWS and Oregon Drainage Law.

Since the total length of the neighborhood streets is nearly equivalent between the grid and organic schemes, the impervious areas associated with these facilities are also essentially equivalent. Therefore, the three alternatives are similar or equal in terms of needs and costs for stormwater infrastructure, which is reflected in the estimated costs for the improvements as summarized by Table 4.

Concept 3 will incur additional costs over the other options, since the higher development density is associated with greater impervious areas. These larger impervious areas would generate the need for larger stormwater management facilities, increasing their costs above the other alternatives.

Table 4 | On-Site Stormwater Infrastructure Cost Summary

Neighborhood	Concept 1 Grid, Low	Concept 2 Organic	Concept 3 Grid, High
West	$5.1m	$4.8m	$5.5m
East	$3.2m	$3.6m	$3.4m
South	$3.0m	$2.8m	$3.1m
Totals	$11.3m	$11.2m	$12.0m

Stormwater infrastructure must be constructed to convey drainage in accordance with the City's PWS and Oregon Drainage Law. Each successive conveyance within each basin will experience increased flows to account for the additional tributary areas upstream. As such, improvements are sized to convey the flows that are received, and are ineligible for reimbursement of system development charges.

Figures 1 through 6 anticipates that runoff for public roads will be comingled with private runoff, and conveyed to the downstream receiving conveyance by roadside bioswales and other strategically placed LID stormwater management facilities. The upsizing or additional improvements necessary to manage runoff from public roads is anticipated to be constructed by private developers as part of the overall development. The developers would be compensated for these improvements through a Stormwater Reimbursement District, while being responsible for the costs presented in Table 4.

Sanitary Sewer Improvements

The total length of the proposed streets within each of the grid and organic layout options are within approximately one percent. Since sanitary sewer collection piping is typically placed under the streets serving the adjacent developed areas, the total length of these utilities will be approximately equal for either street layout selected. In locations where the pipe deviates from a roadway alignment, piping is the same for all options.

For the Frog Pond Area, the alternative land uses do not appreciably impact the sizing of supporting sanitary sewers, since their design is more heavily influenced by inflow and infiltration, the natural topography and PWS for minimum pipe slopes and pipe sizes. Similarly, the pump stations necessary to serve areas with relatively low lying elevations are the same for all options.

Table 5 below summarizes the peak wastewater flows that are estimated to result from the alternative land uses. The Average Peak Daily Flow (APDF) is used to size sewer pipes and is calculated by including Average Dry Weather Flows (ADWF) multiplied by a peaking factor of two, plus contributions from Rainfall Derived Inflow and Infiltration (RDII) at 1,800 gallons per acre per day. These two assumptions for APDF and ADWF are consistent with the values being utilized by the current Wastewater Collection System Master Plan under development with the City.

The sewer flow rates presented in Table 5 were used to size the sanitary sewer pipe diameters shown in Figures 1 through 6. A minimum pipe diameter of 8 inches was selected based on the City's PWS. Another key consideration in determining the pipe diameter was the need to achieve service to remote areas at relatively flat pipe slopes, while still maintaining the minimum flow velocities that typically prevent sediment deposition.

Table 5 | Sanitary Sewer Flow Summary

	Average Peak Daily Flow (APDF), GPM		
Neighborhood	**Concept 1 Grid, Low**	**Concept 2 Organic**	**Concept 3 Grid, High**
West	302	352	397
East	308	393	417
South	215	213	231
Totals	825	958	1,045

In order to provide service to all areas within the Frog Pond Area, sewers in certain locations are anticipated to include segments of deep burial depths at minimum allowable slopes to overcome topographical constraints. This design approach may result in larger diameter pipes at greater free board depths in certain locations, and accommodate facility capacity that exceeds the demands generated in the development footprint of the three alternatives. Therefore, the three alternatives are similar or equal in terms of considerations for sanitary sewer infrastructure, which is reflected in the estimated costs for the improvements as summarized by Table 6.

Table 6 | On-Site Sanitary Sewer Infrastructure Cost Summary[8]

Neighborhood	Concept 1 Grid, Low	Concept 2 Organic	Concept 3 Grid, High
West	$13.5m	$20.8m	$13.5m
East	$17.2m	$14.6m	$17.2m
South	$15.1m	$11.2m	$15.1m
Totals	$45.8m	$46.6m	$45.8m

The previous planning analysis for “off-site” infrastructure improvements associated with the Frog Pond Area included three pump stations and associated force main[9]. The pump stations were categorized as off-site improvements based on the assumption that the basins served would include multiple developments. Categorizing the pump stations as off-site improvements would place the construction, operation and maintenance of the pump stations under the purview of the City. The City has since indicated that these pump stations should be considered “on-site” improvements and the responsibility of the private developer for construction. As such, the “on-site” costs in Table 6 account for the private pump stations indicated on Figures 1 through 6. The construction costs from the previous planning analysis for “Proposed Off-site Piping Connections” would therefore be revised from $15.9m to $13.7m.

The City’s minimum sanitary sewer is an 8 inches in diameter. Developers would be required to construct improvements meeting this minimum standard; however, the general development plan will require construction of interceptor sewers within major collector streets that will exceed this size based on anticipated loading from upstream properties. To account for this, these interceptors are considered off-site improvements and are presented in Table 7, along with the costs associated with meeting the City’s minimum sewer sizing requirements (these segments are identified as “OFF-SITE” on Figures 1 through 6). The column indicated as “Developer Cost” represents the sewer cost constructed at an 8-inch minimum diameter.

[8] The costs for sanitary sewer infrastructure include an assumption all sewers are 15 feet deep and that manholes are provided on average every 400 feet and at all street intersections.
[9] *Frog Pond Area Plan Off-Site Infrastructure Analysis*, Murray, Smith & Associates, Inc., July 18, 2014.

Table 7 | Proposed Connections to Off-Site Sanitary Sewers

Sewer Line	From	To	Length (lineal feet)	Diameter (inches)	Total Cost (million)	Developer Cost[10] (million)
SW Boeckman Road	Boeckman Creek	SW Stafford Road	2,800	18	$2.6	$1.9
SW Advance Road	SW Stafford Road	East boundary of URA North	2,600	10 and 15	$1.9	$1.7
SW Stafford Road	SW Boeckman Road	SW Briar Patch Lane	2,700	12	$1.6	$0.5
SW Briar Patch Lane	SW Stafford Road	Newland Creek tributary	1,200	10	$1.4	$0.8
Boeckman Sewer Extension	Boeckman Road	North boundary of Frog Pond UGB	3,350	12	$2.6	$2.2
Frog Pond Lane	Boeckman Road	Frog Pond Lane	1,800	10	$1.1	$0.9
SW 60th Ave.	School District south boundary	SW Advance Road	1,250	12	$1.1	$0.8
SW 60th Ave.	BPA easement	SW Advance Road	1,850	10	$1.4	$1.2
				Total =	$13.7	$10.0

Domestic Water and Fire Service Improvements

In a similar manner to the sanitary sewer, the length of the proposed streets within each of the grid and organic layouts resulted in nearly equivalent lengths of water main piping. The net densities between alternative land use scenarios do not appreciably impact the sizing of supporting utilities, since their design is primarily influenced by the City's PWS requirements for fire flow and the difference in domestic demands relative to the various development scenarios is relatively small.

The City's PWS stipulate that minimum fire flow shall be 1,500 gallons per minute (gpm) with a residual pressure of 20 pounds per square inch (psi) for single family residential areas. All other areas shall be provided with fire flows of 3,000 gpm at 20 psi. These fire flow rates are significantly higher than the anticipated maximum daily domestic water demands for the area, as summarized in Table 8.

[10] The "Developer Cost" accounts for the expense necessary to construct infrastructure meeting the City's minimum standards. The difference between the total cost and the developer cost would be credited back to the developer through adjustments to system development charges or a reimbursement district.

Table 8 | Domestic Water Demand

Neighborhood	Average Day Demand (ADD), gpm			Maximum Day Demand (MDD), gpm[11]		
	Concept 1 Grid, Low	Concept 2 Organic	Concept 3 Grid, High	Concept 1 Grid, Low	Concept 2 Organic	Concept 3 Grid, High
West	100	137	176	246	287	252
East	121	178	190	196	279	263
South	93	91	103	150	151	152
Totals	314	407	469	591	718	667

Fire flow requirements are the main factor in the pipe sizing as shown in Figures 1 through 6. Additionally, analysis considered maintaining flow velocities below 10 feet per second during concurrent maximum day demand and fire demand. Although the peak water demands plus fire flows in certain portions of the Frog Pond Area could be served by piping less than 8-inch in diameter, the PWS requirement for an 8-inch minimum waterline size dictates their use. Figures 1 through 3 illustrate the infrastructure needs for either Concept 1 or Concept 3, which are variations of residential density on the same grid street layout.

Since the fire flow rates typically exceed the domestic demand by eight to ten times, water main diameters are minimally influenced by the street configurations or the alternative land uses. Therefore, the three land use alternates are similar or equal in terms of considerations for domestic water and fire service infrastructure, which is reflected in the estimated costs for the improvements as summarized by Table 9.

Table 9 | On-Site Domestic Water and Fire Infrastructure Cost Summary[12]

Neighborhood	Concept 1 Grid, Low	Concept 2 Organic	Concept 3 Grid, High
West	\$11.0m	\$10.2m	\$11.0m
East	\$6.5m	\$7.4m	\$6.5m
South	\$6.2m	\$5.1m	\$6.2m
Totals	\$23.7m	\$22.7m	\$23.7m

It is recommended that the City conduct hydraulic modeling to confirm the sizing for "on-site" and "off-site" piping systems. Modeling will determine if the pipe sizing of the looped system is adequate to serve future Urban Reserve Areas, such as the Elligsen Urban Reserve (4G) to the north of the Frog Pond Area's West Neighborhood.

[11] Maximum Day Demands are calculated using Table ES.1 – Water Demands by User Type, of the City of Wilsonville Water System Master Plan, September 12, 2012.
[12] The costs for domestic water and fire infrastructure include an assumption that fire hydrants are provided on average every 400 feet and at all street intersections.

The previous planning analysis for "off-site" infrastructure improvements associated with the Frog Pond Area included $1.5m for "framework" components of the water distribution piping and $4.2m for off-site storage[13]. The framework water distribution piping accounted for 12 inch diameter mains, which exceed the City's minimum standard of 8 inches. The cost for 8 inch diameter distribution piping would be $1.2m. This portion of the cost would be considered developer responsibility, and has been included in Table 2. The remaining $0.3m would be funded through SDC credits to developers for oversizing.

Additionally, the storage demand from the Frog Pond Area was indicated by the City to represent 25% of the overall storage demand identified for the West Side Tank and 24-inch Transmission Main Project (Capital Improvement Project ID#125). The costs from the previous planning analysis for "Storage" would therefore be revised from $4.2m to $1.5m[14]. As such, the overall cost for this capital improvement project applicable to the Frog Pond Area is provided in Table 2.

Cost Estimates for Infrastructure

These costs presented in this memorandum are considered a Feasibility Level or Class 4 estimate as defined by the American Association of Cost Engineering (AACE). These values are considered accurate to +50 percent to –30 percent and are inclusive of direct construction costs in addition to a construction contingency, engineering, legal and anticipated City administrative expenses. All costs assume new construction. As such, no costs for pavement surface restoration are included for "on-site" piping. Costs for sanitary sewer are consistent with those being generated for the collection system Wastewater Master Plan under development.

Figures 1 through 6 illustrate infrastructure placed within roadway alignments for neighborhood collector streets. Although the smaller residential streets are not shown on Figures 1 through 6, the cost summaries provided include pricing for utilities placed within them. These costs assume that the utilities are sized for the minimum PWS standards, and are located consistently with the "Local Connection" indications on the area plan maps prepared by Angelo Planning Group[15].

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[13] *Frog Pond Area Plan Off-Site Infrastructure Analysis*, Murray, Smith & Associates, Inc., July 18, 2014.
[14] The full cost of this improvement will be funded through SDC revenue by the city. The proportion of the demand (and cost) attributable to the Frog Pond Area is included for purposes of comparing SDC revenues and expenditures linked to growth in Frog Pond, as analyzed in the Funding Analysis memorandum prepared by Leland Consulting Group.
[15] The three land use and transportation alternatives are described and illustrated in more detail in Frog Pond Alternatives Summary Report prepared by Angelo Planning Group.

Qualitative Evaluation of Development Alternatives

The Evaluation Matrix provided in Table 10 qualitatively evaluates the three land use alternatives relative to the guiding principles and other related evaluation criteria for the Frog Pond Area Plan. These guiding principles have been developed by the planning team to promote cohesive neighborhoods through a holistic approach to the planning process. This approach was developed to foster community connectivity, create neighborhood gathering places, meet the City's housing needs, integrate sustainability, and provide compatible transitions to surrounding areas.

The guiding principles within the matrix are evaluated qualitatively relative to each other within each category. The qualitative scoring is based on the following:

+	Denotes the alternative concept offers benefits relative to the others
-	Denotes the alternative concept exhibits additional issues relative to the others
=	Denotes the alternative concept is essentially equivalent to the others

Table 10 | Evaluation Matrix

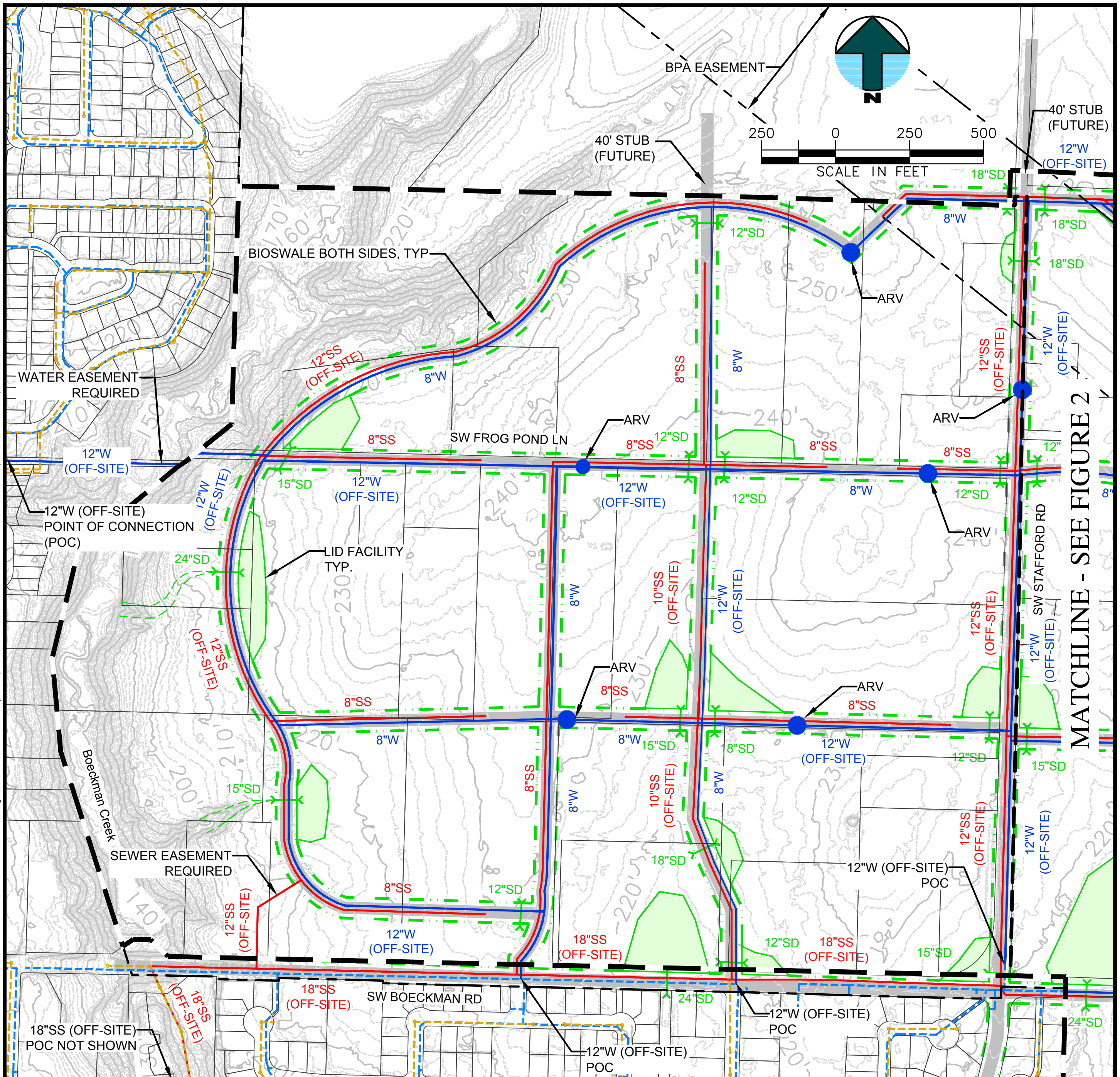
Guiding Principal	Evaluation Measures	Concept 1 Grid, Low	Concept 2 Organic, Med.	Concept 3 Grid, High	Remarks
Create a feasible implementation strategy - *A realistic funding plan for infrastructure, smart and flexible regulations, and other strategies promote successful implementation of the plan.*	Cost and ease of available mechanisms to fund water system improvements	=	+	=	Concept 2 is the least costly
	Cost and ease of available mechanisms to fund sanitary sewer system improvements	=	-	=	Concept 2 is the most costly
	Compatibility of water, sewer and stormwater alignments with road layout	=	+	=	Concept 2 requires minimum easements
	Operations & maintenance considerations, including accessibility to facilities, for water, sewer and stormwater	=	=	=	Alternatives are similar or equal
	Accommodating gravity sewer vs. relying on pumping	=	=	=	Alternatives are similar or equal
Retain trees - *Mature native trees are integrated into the community*.	Potential impacts to tree groves from infrastructure alignments	=	=	=	Alternatives are similar or equal
Integrate sustainability - *The plan integrates solutions which address economic, environmental and social needs. Frog Pond is a sustainable community over the long term.*	Environmental impacts to wetlands, tree groves and SROZ areas in the placement of transportation, water, sewer, and stormwater facilities	=	=	=	Alternatives are similar or equal
	Minimize total impervious area	=	=	-	Concept 3 realizes highest impervious areas
	Proximity of new infrastructure to seismic & potential landslide hazard areas, and steep slopes	=	+	=	West Neighborhood roadway for Concept 2 offset from Boeckman Creek ravine
	Compatibility of stormwater management facilities with existing topography	=	=	=	Alternatives are similar or equal

Summary

This memorandum evaluates the “on-site” utility infrastructure needs for the Frog Pond Area based on various development scenarios. The water demands and sewer and storm drainage design flows were estimated and the facilities sized based on the various development concepts. It was found that the infrastructure needs were very similar between the various street configuration and development densities and this was reflected in the facility sizing and estimated costs for each. The infrastructure needs were also quantitatively evaluated relative to the guiding principles and evaluation criteria developed by the planning team. It was found that utility infrastructure associated with the organic street layout of Concept 2 appeared to offer a slight advantage over the other alternatives relative to cost, compatibility with development configuration, and operations and maintenance considerations. This slight advantage was not of a magnitude to be considered critical in selecting the land use alternative.

MLH:njm

FIGURES



LEGEND

- FROG POND AREA BOUNDARY
- WASTEWATER PIPE - NEW
- WASTEWATER FORCE MAIN - NEW
- WASTEWATER PUMP STATION - NEW
- WASTEWATER PIPE - EXISTING
- STORM CULVERT - NEW
- STORM LID FACILITY - NEW
- STORM PIPE - EXISTING
- STORM BIOSWALE - NEW
- WATER PIPE - NEW
- WATER AIR RELIEF VALVE (ARV) - NEW
- WATER PIPE - EXISTING
- CITY LIMITS
- URBAN GROWTH BOUNDARY (UGB)
- NEW STREET

FIGURE 1

City of WILSONVILLE in OREGON

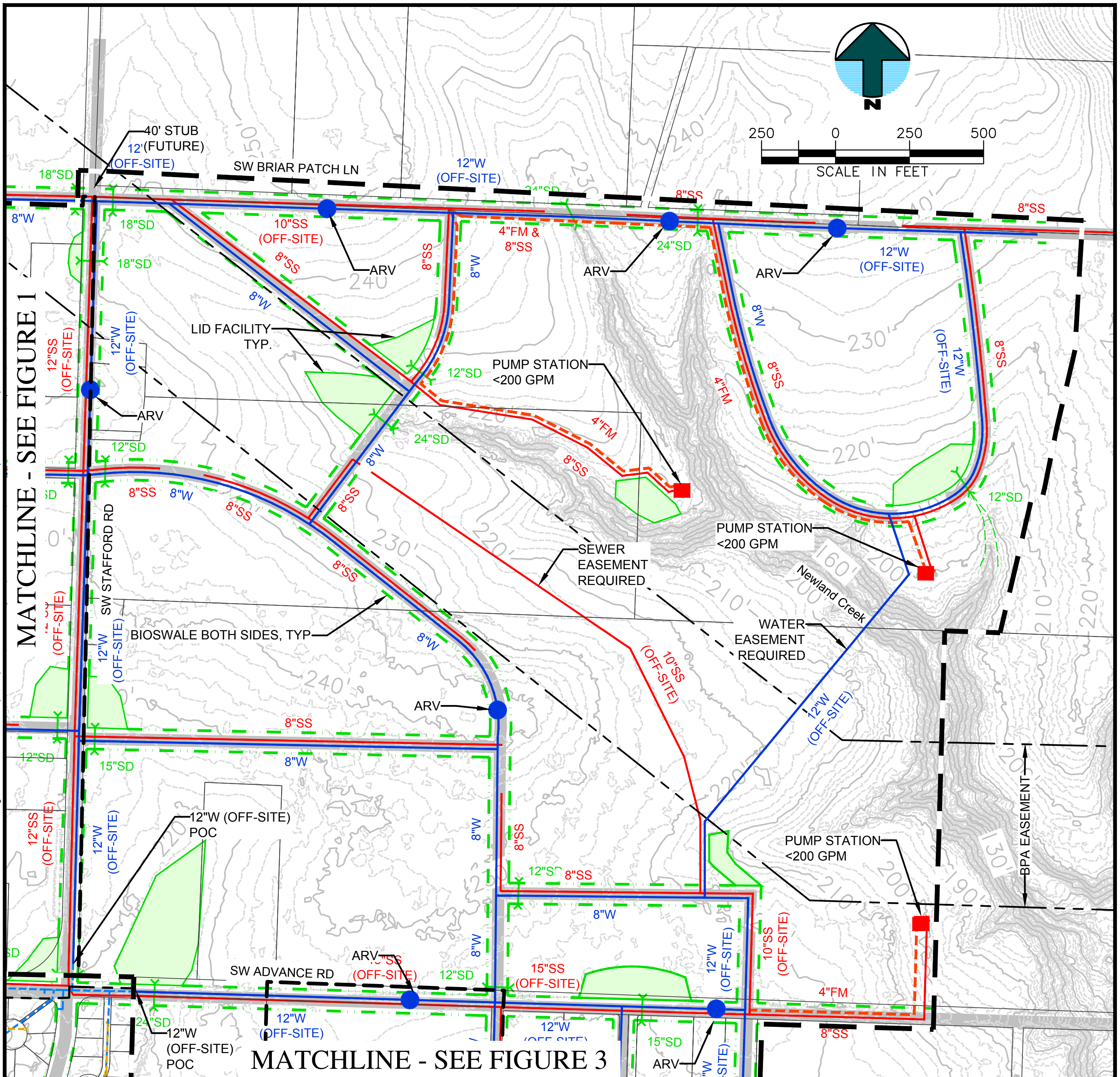
Frog Pond Area Plan
Composite Utility Plan

WEST NEIGHBORHOOD CONCEPTS 1 & 3 - GRID

MSA
Murray, Smith & Associates, Inc.
Engineers/Planners
Portland, Oregon

August 2014
14-1553.500

G:\PDX_Projects\14\1553\CAD\Figures\14-1553-OR-NEIGHBORHOOD COMPOSITE UTILITY PLANS.dwg FIGURE 1 8/28/2014 8:43 AM NJM 19.1s (LMS Tech)



LEGEND

- FROG POND AREA BOUNDARY
- WASTEWATER PIPE - NEW
- WASTEWATER FORCE MAIN - NEW
- WASTEWATER PUMP STATION - NEW
- WASTEWATER PIPE - EXISTING
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- STORM LID FACILITY - NEW
- STORM PIPE - EXISTING
- STORM BIOSWALE - NEW
- WATER PIPE - NEW
- WATER AIR RELIEF VALVE (ARV) - NEW
- WATER PIPE - EXISTING
- CITY LIMITS
- URBAN GROWTH BOUNDARY (UGB)
- NEW STREET

FIGURE 2

City of WILSONVILLE in OREGON

Frog Pond Area Plan
Composite Utility Plan

EAST NEIGHBORHOOD
CONCEPTS 1 & 3 - GRID

MSA
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Portland, Oregon

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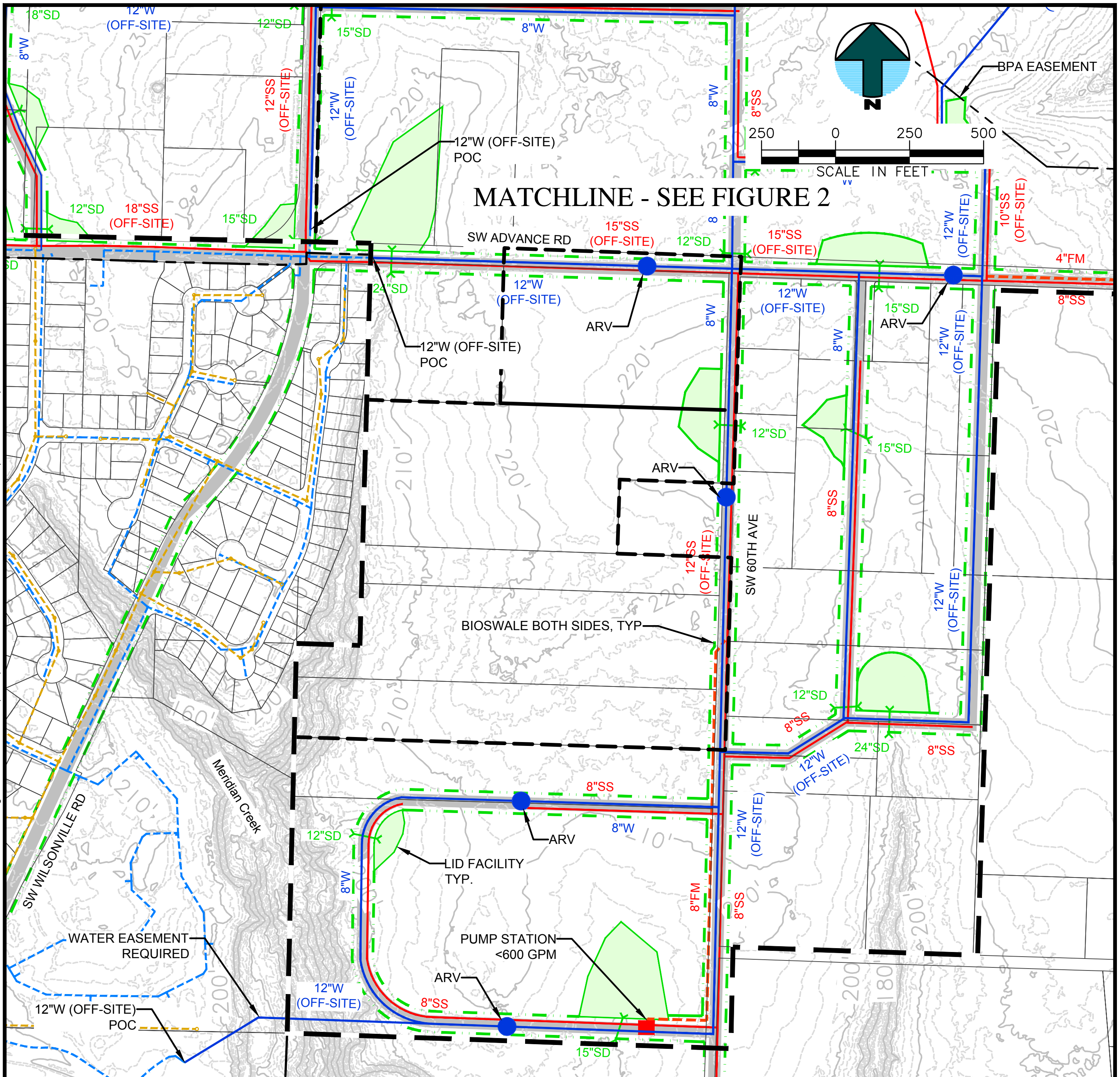
G:\PDX_Projects\14\1553\CAD\Figures\14-1553-OR-NEIGHBORHOOD COMPOSITE UTILITY PLANS.dwg FIGURE 2 8/28/2014 8:43 AM NJM 19.1s (LMS Tech)



G:\PDX_Projects\14\1553\CAD\Figures\14-1553-OR-NEIGHBORHOOD COMPOSITE UTILITY PLANS.dwg FIGURE 3 8/28/2014 8:43 AM NJM 19.1s (LMS Tech)

LEGEND

- FROG POND AREA BOUNDARY
- WASTEWATER PIPE - NEW
- WASTEWATER FORCE MAIN - NEW
- WASTEWATER PUMP STATION - NEW
- WASTEWATER PIPE - EXISTING
- STORM CULVERT - NEW
- STORM LID FACILITY - NEW
- STORM PIPE - EXISTING
- STORM BIOSWALE - NEW
- WATER PIPE - NEW
- WATER AIR RELIEF VALVE (ARV) - NEW
- WATER PIPE - EXISTING
- CITY LIMITS
- URBAN GROWTH BOUNDARY (UGB)
- NEW STREET

FIGURE 3

City of WILSONVILLE in OREGON

Frog Pond Area Plan
Composite Utility Plan

SOUTH NEIGHBORHOOD
CONCEPTS 1 & 3 - GRID

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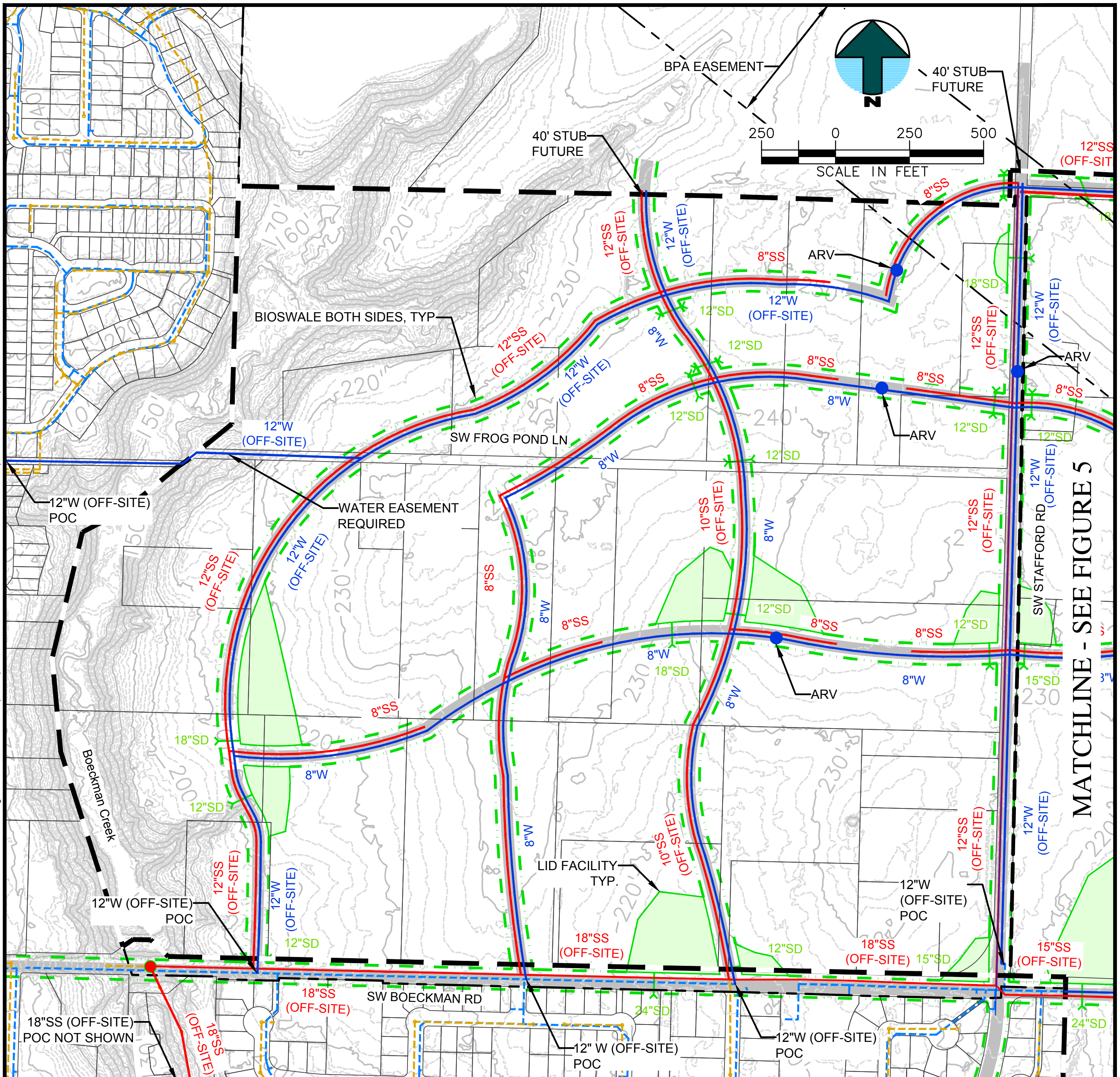

LEGEND

- FROG POND AREA BOUNDARY
- WASTEWATER PIPE - NEW
- WASTEWATER FORCE MAIN - NEW
- WASTEWATER PUMP STATION - NEW
- WASTEWATER PIPE - EXISTING
- STORM CULVERT - NEW
- STORM LID FACILITY - NEW
- STORM PIPE - EXISTING
- STORM BIOSWALE - NEW
- WATER PIPE - NEW
- WATER AIR RELIEF VALVE (ARV) - NEW
- WATER PIPE - EXISTING
- CITY LIMITS
- URBAN GROWTH BOUNDARY (UGB)
- NEW STREET

FIGURE 4

City of WILSONVILLE in OREGON

Frog Pond Area Plan
Composite Utility Plan

WEST NEIGHBORHOOD
CONCEPT 2 - ORGANIC

MSA
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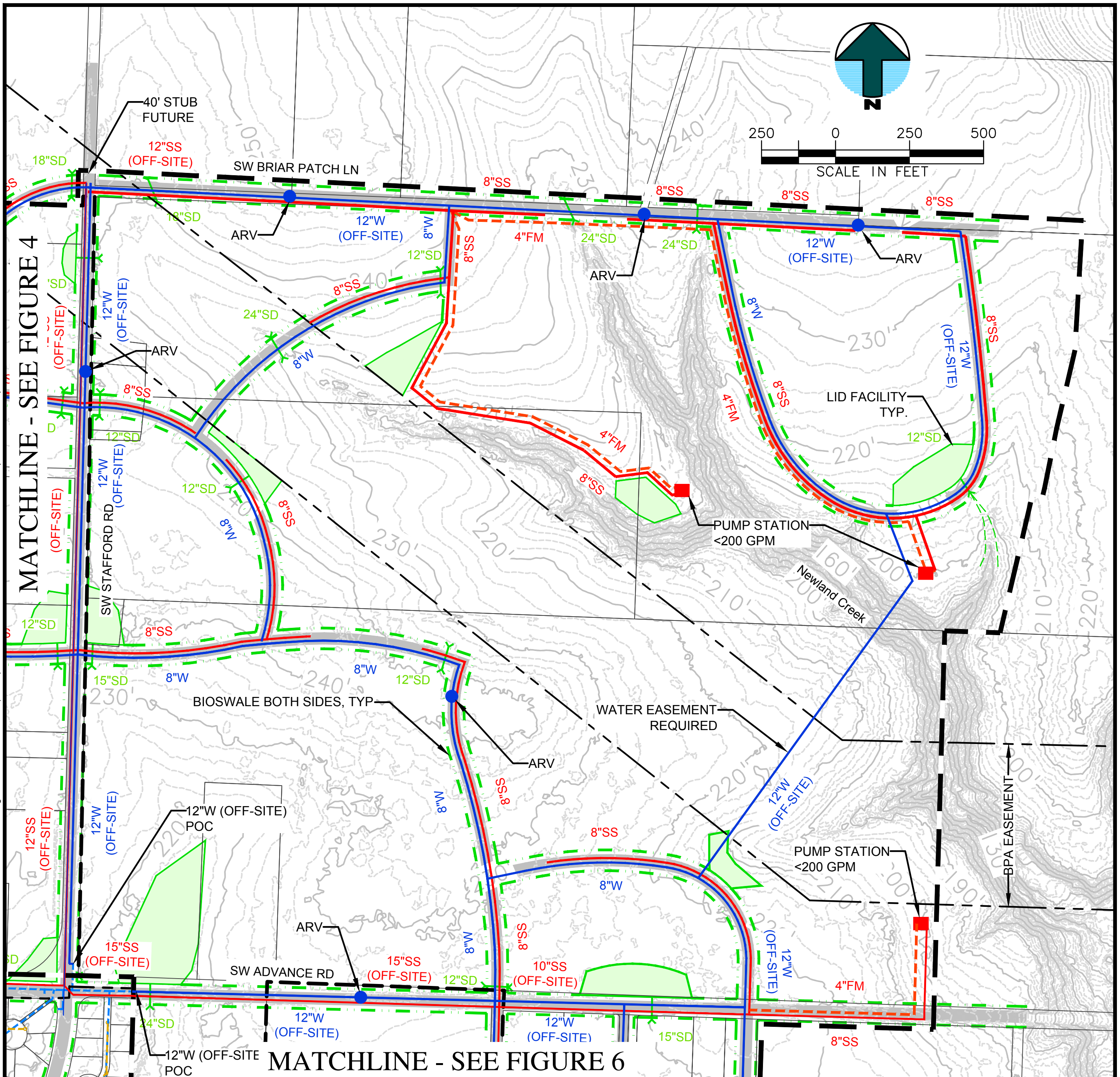
G:\PDX_Projects\14\1553\CAD\Figures\14-1553-OR-NEIGHBORHOOD COMPOSITE UTILITY PLANS.dwg FIGURE 4 8/28/2014 8:43 AM NJM 19.ls (LMS Tech)



LEGEND

- FROG POND AREA BOUNDARY
- WASTEWATER PIPE - NEW
- WASTEWATER FORCE MAIN - NEW
- WASTEWATER PUMP STATION - NEW
- WASTEWATER PIPE - EXISTING
- STORM CULVERT - NEW
- STORM LID FACILITY - NEW
- STORM PIPE - EXISTING
- STORM BIOSWALE - NEW
- WATER PIPE - NEW
- WATER AIR RELIEF VALVE (ARV) - NEW
- WATER PIPE - EXISTING
- CITY LIMITS
- URBAN GROWTH BOUNDARY (UGB)
- NEW STREET

FIGURE 5

City of WILSONVILLE in OREGON

Frog Pond Area Plan
Composite Utility Plan

EAST NEIGHBORHOOD
CONCEPT 2 - ORGANIC

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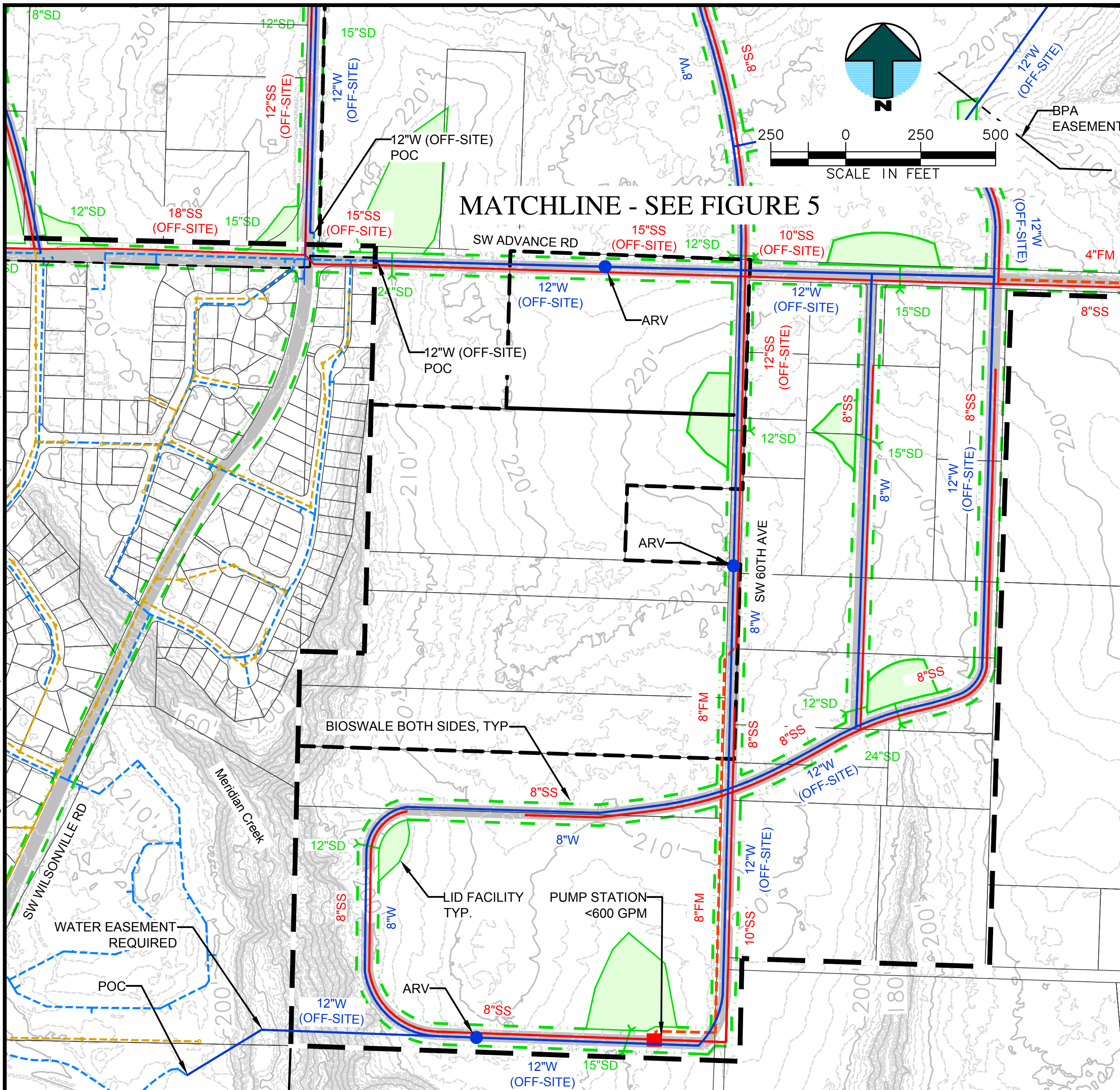
Portland, Oregon

August 2014
14-1553.500

G:\PDX_Projects\14\1553\CAD\Figures\14-1553-OR-NEIGHBORHOOD COMPOSITE UTILITY PLANS.dwg FIGURE 5 8/28/2014 8:43 AM NJM 19.1s (LMS Tech)



LEGEND

	FROG POND AREA BOUNDARY
	WASTEWATER PIPE - NEW
	WASTEWATER FORCE MAIN - NEW
	WASTEWATER PUMP STATION - NEW
	WASTEWATER PIPE - EXISTING
	STORM CULVERT - NEW
	STORM LID FACILITY - NEW
	STORM PIPE - EXISTING
	STORM BIOSWALE - NEW
	WATER PIPE - NEW
	WATER AIR RELIEF VALVE (ARV) - NEW
	WATER PIPE - EXISTING
	CITY LIMITS
	URBAN GROWTH BOUNDARY (UGB)
	NEW STREET

FIGURE 6

City of WILSONVILLE in OREGON

Frog Pond Area Plan
Composite Utility Plan

SOUTH NEIGHBORHOOD
CONCEPT 2 - ORGANIC

MSA
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Portland, Oregon

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G:\PDX_Projects\14\1553\CAD\Figures\14-1553-OR-NEIGHBORHOOD COMPOSITE UTILITY PLANS.dwg FIGURE 6 8/28/2014 8:43 AM NJM 19.1s (LMS Tech)

FROG POND AREA PLAN

Creating a great community

City of Wilsonville

Appendix G. Development Feasibility Analysis

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Memorandum

Date	3 June 2015
To	Chris Neamtzu, Planning Director, City of Wilsonville
From	Brian Vanneman and Wally Hobson, Leland Consulting Group
CC	Joe Dills, Angelo Planning Group
Subject	**Frog Pond Area Plan: Land Development Financial Analysis**
Project	5462

Introduction

As part of the Frog Pond Area Plan, Leland Consulting Group (LCG) was engaged by the City of Wilsonville to evaluate the economics of land development and single family home development in the study area. This memorandum summarizes LCG's findings, and was completed in order to address key questions relevant to the Frog Pond Area Plan, including:

- What types of single-family home development are likely to be feasible at Frog Pond (generate an adequate rate of return for developers), while also providing the funds necessary to pay for land and infrastructure?
- How do development inputs, particularly major off-site infrastructure costs, affect development feasibility at Frog Pond?

The first version of this memorandum was completed in January 2015. This version has been revised to take into account changes to the proposed land use concepts and revised infrastructure costs. A list of additional revisions to this memo is included on page 3.

Assumptions and Site Plans

Based on conversations with the City and Angelo Planning Group (APG), the following summarizes the assumptions used for this financial analysis:

- We assume that a potential land developer is considering the purchase of a generic 20-acre site within the Frog Pond West Neighborhood. At the point of development, the subject site is within the UGB, City comprehensive plan and zoning designations have been applied, and the developer can petition the City to annex the site. Other parts of the Frog Pond area are developing.
- Major components of the infrastructure system (major "framework" improvements to arterial roads and intersections, parks, major sanitary sewer and water lines and infrastructure, trails, etc.) are being constructed by the City and other land developers.
- In the event that the City or other developers elsewhere in Frog Pond are building and paying for major framework infrastructure, they will pass on a pro-rata share of the cost of those improvements via a reimbursement district or other mechanism (e.g., local improvement district or area specific System Development Charge (SDC); this is referred to here as a reimbursement district cost allocation per unit. See the Frog Pond Infrastructure Funding Strategy for a further discussion of infrastructure costs.

Four different site plans were initially modeled that represent different detached single family home lot sizes, as well as the likely size, scale, and price of the homes themselves. The first three site plans are similar to specific neighborhoods that already exist in Wilsonville. These site plans and approximate lot size are shown below and reflect the lot sizes planned for Frog Pond land use "Option D." The larger lot sizes proposed for land use Option E are discussed later.

- Small Lot: 4,000 square foot lots, similar to average lot sizes in the Legend at Villebois neighborhoods.
- Medium Lot: 6,000 square foot lots, similar to average lots sizes in the Landover neighborhood.
- Large Lot: 8,000 square foot lots, similar to average lot sizes in the Meadows neighborhood.
- Estate Lot: 15,000 square foot lots, representative of various "estate lot" homes located in Wilsonville and other communities in the metropolitan area.

Conceptual plans for the 20-acre subject site were prepared by Walker Macy landscape architects to show small, medium, and large lot development types. The estate lot development type was added later and therefore a concept plan was not drawn by Walker Macy. Information about the three comparable Wilsonville neighborhoods is included as attachments to this memorandum. The size and density of typical lots in Frog Pond were adjusted slightly in spring 2015, and therefore some figures used in this memo (such as the total number of units) no longer precisely match the drawings prepared by Walker Macy.

Data Sources

Between November 2014 and January 2015, Leland Consulting Group (LCG) reviewed home sale information in Wilsonville, Tualatin, and West Linn in order to inform our financial analyses for Frog Pond, and among other things to estimate reasonable sales prices of homes in Frog Pond (in 2015 dollars).

Our main data source was Metrostudy (www.metrostudy.com), which in our estimation is the best source of data regarding sales of new homes in the Portland region (Metrostudy was formerly New Home Trends). We also looked at data from Zillow and RMLS, and talked to developers and brokers. Metrostudy differs from most RMLS data in that it covers *new construction*. By contrast, RMLS reports information about the sales or new and older homes (*resales*). Prices for older homes (resales) are usually below new construction, and therefore less reliable. In addition, because Metrostudy covers only new construction, LCG believes that it is more indicative of recent (and near future) home building trends such as number of sales per year, size of homes, size of lots, etc. (We do acknowledge that people's choices may be constrained due to zoning, regulation, etc., and therefore issues such as demand for large lots may not be accurately reflected by past sales trends.) Metrostudy provided us with information on the sale of 1,786 homes (both attached and detached) in Wilsonville, Tualatin, and West Linn between January 1, 2005 and December 31, 2014, and this is the primary data used for this analysis.

In terms of larger lots, some recent testimony to City Council regarding Frog Pond has raised some valid questions. One of the problems with estimating "average" sales prices for expensive homes and larger lots is that there are not many of these sales. For example, of the 458 *new-build* homes that sold in Tualatin and Wilsonville between 2010 and 2014, only three were 10,000 or larger. Therefore, for estate lot homes, more judgment on our part was required, and we reviewed individual home sales near Frog Pond. LCG did see some homes that sold at or above $1 million, but these tended to be really exceptional lots and locations, in particular with views of and access to the Willamette River, a unique amenity that obviously does not exist at Frog Pond. This raises the related question of the size of the market for $800,000 or $1 million-plus homes is. Our demographic research indicates that 4 percent of households currently in Wilsonville earn more than $200,000, and therefore would be likely to be able to afford a home of $800,000 or more. In summary, a variety of sources suggests that housing that is accessible to households earning $75,000 to $150,000 per year should constitute the bulk of the offerings at Frog Pond. Data sources and relevant homebuyer demographics are discussed again on pages 4 (Inputs to the Financial Analysis) and 7 (Household Demographics for Wilsonville and Market Area).

Development Models

Two development models were used in order to test the viability of land and home development on the subject site. While the outputs of these models are different, they are both intended to test the development dynamics specifically on the subject site, and by extension, throughout the Frog Pond West Neighborhood. In each model, while most of the inputs used remain the same, selected inputs were changed in order to understand the impact of specific factors on development. These models are:

1. **Residual Land Value Model**. In this model, we solve for the estimated amount per square foot that a typical land developers would pay a current property owner for “raw” land (not served by infrastructure or subdivided), by beginning with the land developer’s revenues (the sale of finished lots to homebuilders), and deducting the land developer’s costs and required profit margin (25 percent). These costs are reimbursement district or off-site infrastructure costs; on-site infrastructure costs (the roads, sidewalks, sewer, water, and stormwater infrastructure internal to the project), and soft costs (design and engineering fees, legal, surveying, permitting, other). Revenues less costs and required profit equals residual land value. All inputs to this model are intended to reflect, as accurately as possible, current conditions in Frog Pond and Wilsonville.

   More information about each of these cost and revenue factors is described on the Inputs section which begins on page 4.

2. **Market Price vs. Required Price Model.** In this model, we compare the difference between the “required price” for the homes offered for sale on the subject site in Frog Pond, and the average market price for comparable homes in Wilsonville. The required price is defined as the price at which a developer (who builds both the home and develops the land) can feasibly pay for all of the costs of development described above, earn an acceptable profit, and pay a minimum of $4.00 per square foot for raw land (or $174,000 per acre). $4.00 per square foot was established, based on a review of current land values and in coordination with the City, as approximately the minimum land value at which land transactions for urban development would occur.

In summary, in the first model lot sale values are fixed to the current market while land values are allowed to vary in response. In the second model, land values are fixed to a reasonable minimum, and required home sales prices are allowed to vary in response. The purpose of both models is to help the project team, stakeholders, and decision makers understand the impact of housing types on residual land value and required home prices.

Memo Revisions

While the format of this analysis is consistent with the January 2015 memorandum, the following changes and revisions have been made, most of which were dictated by changes to the Frog Pond Area Plan. Some of these changes are explained in greater detail in the Inputs section that follows.

- Slightly different housing types (lot sizes) are assumed here, consistent with land use Options D and E, developed by APG in spring 2015.
- The off-site costs passed on to development on the 20-acre subject site via the reimbursement district cost allocation per unit, have been revised based on infrastructure funding refinements and are less than assumed in January. This reduction in off-site costs improves development feasibility, residual land values, and other measures of feasibility. The off-site cost allocation in the January analysis was approximately $25,000; here it is $14,000 and $17,000 for Options D and E respectively. The cost allocation is lower for Option D since there are more homes over which to divide the total reimbursement district cost allocation. The calculation for these off-site projects is included in the Frog Pond Infrastructure Funding Strategy.

- Home sales values have been increased by 9.4 percent to reflect the current hot housing market, and expectations that the market will continue to get hotter. Most housing value data originally collected for this analysis comes from 2013 and 2014, and Zillow reports a year-over-year, May 2014 to May 2015, home value increase of 9.4 percent for Wilsonville. In addition, homebuilders are typically looking to the future and in good markets, anticipating increasing sales prices. This escalation factor incorporates recent and anticipated future price escalation for 2015.

Inputs to the Financial Analysis

Costs. In addition to the off-site cost allocation mentioned above, land developers are expected to pay the following costs associated with development:

- Raw land purchase price. As described above, raw land purchase price is allowed to vary in the Residual Land Value model. In the Market Value model, a “target” minimum purchase price of $4.00 per square foot for raw land (or $174,000 per acre) was established.
- Reimbursement district or off-site cost allocation per unit. This is described above and is attributable to costs for major “framework” infrastructure with benefits to the entire West Neighborhood, particularly improvements to Boeckman and Stafford Roads (including the sewer and water infrastructure in those roads) and two Neighborhood Parks.
- On-site Street and Utility costs. On-site costs were provided by the City of Wilsonville’s Engineering staff based on recent development costs for projects in Villebois and other parts of the City, and in particular the Retherford Meadows subdivision which is now under construction and is believed to be a reasonable comparable project due to its size (88 homes) and timing. The on-site costs provided by the City include the costs of building internal streets, sanitary sewer, water, and stormwater facilities. On-site costs for Retherford Meadows are just under $27,000 per lot, and lots are similar in size to the small lot housing type evaluated here. Since there are 156 lots in the small lot concept (Concept D), total on-site costs are estimated at $4,160,000. This estimate was also checked by dividing the costs by the total linear footage of roadway in the project (approximately 4,480), which results in a cost of $928 per linear foot. Based on conversations with developers, this is reasonable, though infrastructure costs could be higher. For the purposes of this analysis, on-site costs are assumed to remain the same regardless of the site plan/lot size, since the configuration of the street network does not change.
- Other Soft Costs. These costs include land planning, architecture and engineering, survey, fees, title insurance, closing costs, legal, administrative, and other costs and are estimated at 10 percent of hard costs (on-site street and utility cost).
- Gross Profit Margin is targeted at 25 percent of gross revenue, an acceptable rate of return for land development, though many land developers have historically sought returns of 30 percent or higher.
- System Development Charges (SDCs). SDCs are not included as a cost in this analysis, since they will be paid by the homebuilders who purchase lots from our subject land developer, rather than by the land developer. SDCs are paid by homebuilders at the time of building permit application and issuance, and will are one of the City’s major funding sources for infrastructure.

Revenues. Since this is a land development financial model, revenue is generated from finished lot sales. A prototypical land developer buys the land, secures all entitlements and records the necessary subdivision documents, pays for off-site infrastructure, designs and pays for on-site infrastructure, landscaping, and amenities, and then sells lots to one or more homebuilders. In practice, the land developer and homebuilder are sometimes the same entity, but regardless, the process of land development alone must return an acceptable return on investment and profit to the land in order to induce the land developer’s participation.

To establish the fair market value for a finished lot, home sale information from New Home Trends/Metrostudy, Zillow, RMLS (Regional Multiple Listing Service), and online and field research were collected and analyzed. As stated above, these market value estimates have been updated to reflect the upswing in the housing market (nearly 10 percent over one year), and research conducted in spring 2015. Figure 1 shows some of the summary information about the market assumptions made in this analysis. Based on this data, market-average sales values for new homes in Option D of $394,000, $470,000, and $574,000 were established for the small, medium, and large lot homes respectively. (See "Home Price" row below.) Market-average sales values for the larger lot sizes and larger homes assumed in Option E and also shown. The Estate Lot size remains the same in both land use options, at 15,000 square feet.

Note that these figures are estimated *market averages for new construction homes*—actual home sales values will differ significantly depending a variety of attributes including location, home features, size, homebuilder, finishes and features, views, etc. In addition, market averages produced by RMLS depend heavily on *resales* of older homes which make up the majority of transactions, not new construction (just built) homes. Therefore, RMLS figures will tend to be lower.

Figure 1. Market Prices for Representative Wilsonville Single Family Homes

	Option D			Option E			Estate
	Small Lot	Med. Lot	Large Lot	Small Lot	Med. Lot	Large Lot	Lot
Lot Size	4,000	6,000	8,000	5,000	7,000	10,000	15,000
Home Size	2,150	2,575	3,000	2,365	2,790	3,500	4,000
Number of homes in 20 acre site	156	105	77	124	89	63	42
Home Market Price	$394,000	$470,000	$547,000	$432,000	$508,500	$635,000	$831,000
Home Price Per Square Foot	$183	$183	$182	$183	$182	$181	$208
Finished Lot Value	$98,500	$117,500	$136,750	$108,000	$127,125	$158,750	$207,750
Lot Value Per Square Foot	$25	$20	$17	$22	$18	$16	$14

Source: Metrostudy/New Home Trends, Zillow, RMLS, Leland Consulting Group.

The following information puts the data shown above for Option D into context; additional images and data about average homes in the market area is included in the appendices. The average sale price of a typical new construction small lot home (3,500 to 4,500 square foot lot) in Wilsonville in 2013 and 2014 was $360,000 according to Metrostudy data; this has been escalated to $394,000 based on the fact that the housing market has improved significantly and home prices are expected to continue to increase. The current asking prices (May 2015) for Legend Homes' Oxford and St. Tropez "small lot" homes at Villebois are $390,000 and $381,900, respectively.

The average sale price of a typical medium lot home in Wilsonville between in 2011 and 2014 was $426,818 according to Metrostudy data. As of September 2014, Zillow showed that the median sale price for a four bedroom home in Wilsonville was $442,000. The individual medium lot homes reviewed for this analysis contained four bedrooms. An average market value of $425,000 was selected for this analysis.

There are far fewer transactions in the large lot and estate lot categories. Therefore, reliable market averages are more difficult to establish and subject to greater judgment. The smaller number of large and estate lot homes likely reflects both Wilsonville's demographics and the availability of larger lot types.

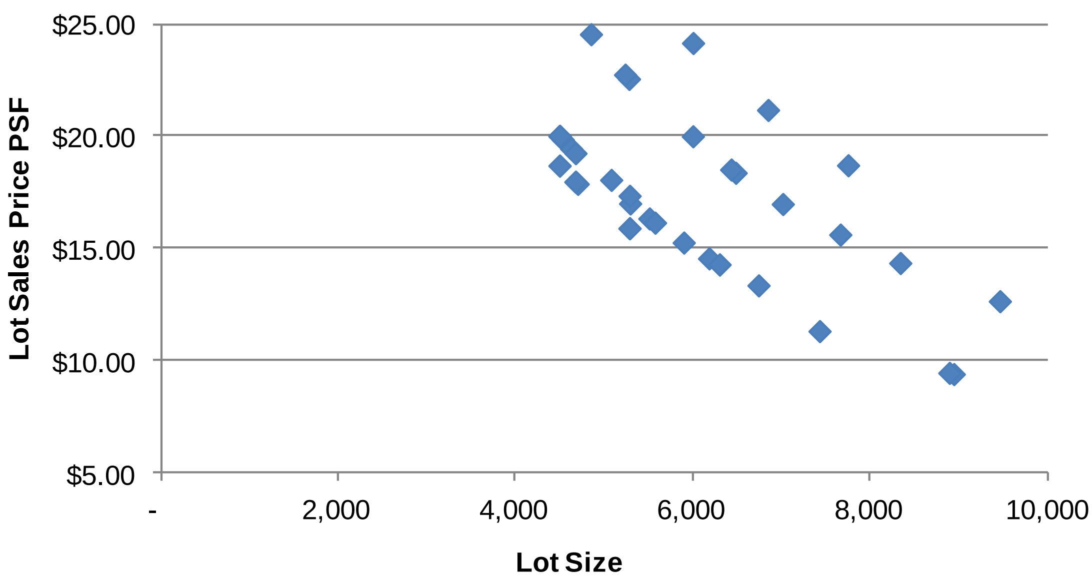
For example, of the 459 new-construction home sales recorded by New Home Trends between 2010 and 2014 in Wilsonville and Tualatin, 9 were for lots that were 8,500 square feet or larger (2 percent of all new-construction sales). Therefore, LCG reviewed individual home sales for these lot size categories as well as other data. Average large-lot home sales in Wilsonville range from approximately $500,000 to

$550,000. The average new construction home on an 8,000 to 9,000 square foot lot sold in either Tualatin or Wilsonville between 2010 and 2014 was $512,400. Based on this information and applying a year-over-year escalation factor, an average market value of $547,000 was selected for this analysis.

Again, there are very few estate lot sales upon which to base market averages. Most estate lots are positioned next to regionally-distinctive amenities, particularly views and direct access to the Willamette River. A market average of $831,000 for estate lots without such a regionally distinct amenity was estimated based on a review of comparable home sales. Information about a representative home sale of this size and price is included in the appendices.

Based on developer interviews and review of market data, and as reflected in Figure 1, lot values are estimated to be 25 percent of the finished home's sale price. Forty-five recent transactions were reviewed in which the average ratio between lot and home value was 25 percent. Developers interviewed for this project estimated this ratio at between 23 and 30 percent. Lot sales information from Metrostudy for a Wilsonville, Tualatin, and other cities was also reviewed and is consistent with this analysis. Figure 1 above shows that, as lot size increases, the per-square-foot value of lots typically decreases (even though the total home value increases). This trend is also shown in Figure 2, which shows from 45 lot sale transactions in recorded in Tualatin and Wilsonville since 2009, for which LCG has data for the finished home sale price, lot sale price, and lot size. (The majority of transactions shown took place in Tualatin. Unfortunately, neither Clackamas County nor Metrostudy is able to collect comprehensive data for all home and lot sales.) For these homes, lot sales averaged 25 percent of the sales value of the finished home. For example, the lot for a $400,000 home would cost the homebuilder $100,000.

Figure 2. Lot Sales Price Per Square Foot versus Lot Size



Source: Metrostudy / New Home Trends, Leland Consulting Group.

The primary housing market data collected and reviewed for this analysis was for homes built and sold in Wilsonville. Based on interviews with developers and brokers, data for Tualatin and Sherwood was also reviewed because these markets are comparable and competitive and sources reported that potential home-buyers are often considering homes in these other communities along with Wilsonville as they make a purchase decision. This is consistent with data collected by the RMLS, a REALTOR-owned real estate database, which includes Wilsonville in the "Tigard, Tualatin, Sherwood, Wilsonville" submarket.

Housing data for the City of West Linn was also reviewed. The RMLS October 2014 Market Action report lists the average year-to-date home sale value within the Tigard, Tualatin, Sherwood, Wilsonville submarket as $335,800; the comparable figure for the Lake Oswego, West Linn submarket is $531,400, about $195,600 (58 percent,) more than homes in the Wilsonville submarket. This is partially due to inventory–there are more high-value homes available in the Lake Oswego and West Linn submarket. It is also due in part to household incomes, regional location and access, amenities such as views, and historic and current perceptions in the marketplace.

Household Demographics for Wilsonville and Market Area

Key determinants of housing demand include household growth, employment, general economic conditions, and household incomes. Currently, the long-term population and employment growth outlook for the Portland metro region and Wilsonville are positive. For example, as documented in the Frog Pond Market Analysis (August 2014), Metro projects that household growth within Wilsonville will average 1.8 percent annually through 2035, and is therefore should continue to support housing demand in Frog Pond and elsewhere.

Figure 3 below shows the percent of Wilsonville households that are within a series of income categories. Each of these income categories implies a potential home price purchase, shown at right. These purchase prices generally represent the upper end of prices that households could qualify for, and assume that interest rates remain low (approximately 4.25 percent), and households have equity for a down payment.

Figure 3. Percent of Households by Income Range and Home Purchase Price, Wilsonville, 2014

Household Income Category		Percent of	Typical Monthly		Home Purchase	
Low	High	Households	Mortgage Payment		Price Range	
$0	$15,000	12%	$0	$310	$0	$60,000
$15,000	$25,000	9%	$310	$520	$60,000	$100,000
$25,000	$35,000	10%	$520	$730	$100,000	$140,000
$35,000	$50,000	12%	$730	$1,040	$140,000	$200,000
$50,000	$75,000	14%	$1,040	$1,560	$200,000	$300,000
$75,000	$100,000	14%	$1,560	$2,080	$300,000	$395,000
$100,000	$150,000	20%	$2,080	$3,130	$395,000	$600,000
$150,000	$200,000	5%	$3,130	$4,170	$600,000	$795,000
$200,000		4%	$4,170	$0	$795,000	+

Source: US Census, ESRI Business Analyst, Leland Consulting Group.

These income categories suggest current willingness to pay for single family homes for households currently located in Wilsonville, and show that the largest demographic groups and deepest sources of demand are likely to be from households in the $75,000 to $150,000 income range category, which makes up 34 percent of all households, and a greater share of homebuying households. The capacity to pay for homes that cost more than $600,000 is more limited, which is consistent with home sales data.

Community input received to date indicates that features such as back yards, parks, and access to schools are highly desirable features. LCG believes that these features, particularly yards, can be included as part of medium-lot home areas, and potentially other lot sizes.

Figure 3 below compares household income categories in Wilsonville to those in Tualatin and West Linn. While it is certainly possible that Wilsonville and Frog Pond could attract additional, higher-income households ($150,000-plus) from elsewhere, the $75,000 to $150,000 groups are also collectively larger in both Tualatin and West Linn. LCG recommends that the bulk of housing at Frog Pond be targeted to homebuyers in the $75,000 to $150,000 income range.

Figure 4. Percent of Households by Income Range
Wilsonville, Tualatin, and West Linn, 2014

Household Income Range			Wilsonville	Tualatin	West Linn
$0	-	$15,000	12%	8%	5%
$15,000	-	$25,000	9%	10%	4%
$25,000	-	$35,000	10%	10%	7%
$35,000	-	$50,000	12%	11%	9%
$50,000	-	$75,000	14%	16%	15%
$75,000	-	$100,000	14%	13%	11%
$100,000	-	$150,000	20%	17%	22%
$150,000	-	$200,000	5%	8%	13%
$200,000	+		4%	6%	14%

Source: US Census, ESRI Business Analyst, Leland Consulting Group.

Residual Land Value Model

The results of the residual land value model are summarized in Figures 2 (land use Option D) and 3 (Option E) below. Complete model inputs are shown in the Appendices, beginning on page 16.

Figure 5 shows that the projected residual values of raw land in Frog Pond for land use Option D are estimated at $6.33, $4.38, $3.17, and $2.08 per square foot for the small, medium, large, and estate lot projects respectively.

The primary reason that smaller lots perform better financially is that the land developer's total revenues (lot sales) are greater: there are more lots to sell at a higher price per square foot. Meanwhile, most major costs—on-site infrastructure, soft costs, and land—remain fixed. These dynamics favor small lot development despite the fact that other costs, particularly the off-site infrastructure allocation, increases as density increases.

The land values for the large and estate lots are below the minimum "target" land value of $4.00 per square foot, which will provide less incentive for property owners to sell to prospective land developers, and therefore less development "velocity" for Frog Pond.

Figure 5. Residual Land Value Model – Option D

	Small Lot	Medium Lot	Large Lot	Estate Lot
Lot Size (SF)	4,000	6,000	8,000	15,000
Net Density (LD Model)	10.9	7.3	5.4	2.9
Off-Site Allocation Cost per DU	$14,102	$14,102	$14,102	$14,102
Number of homes in 20 acre site	156	105	77	42
Lot Transfer Price	$98,500	$117,500	$136,750	$207,750
Required Home Price	$394,000	$470,000	$547,000	$831,000
Required Home Price per SF	$183	$183	$182	$163
Market Price	$394,000	$470,000	$547,000	$831,000
Market Price per SF	$183	$183	$182	$163
Raw Land Value per Square Foot	**$6.33**	**$4.38**	**$3.17**	**$2.08**

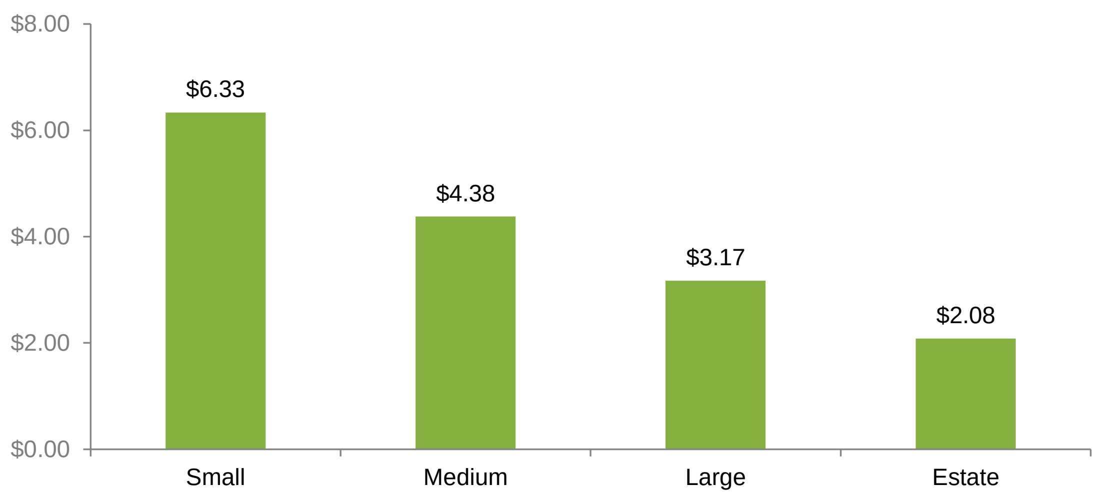


Figure 6 below shows that the projected residual values of raw land in Frog Pond for land use Option E are estimated at $4.62, $3.40, $2.70, and $2.08 per square foot for the small, medium, large, and estate lot projects respectively.

These changes are largely due to the fact that the lot sizes have been increased slightly for each of the housing types. As this happens, there are fewer lots that can be sold by the land developer within the subject site, less overall revenue, and less capacity to pay for raw land.

The land values for the medium, large, and estate lots are below the minimum “target” land value of $4.00 per square foot, which will provide less incentive for property owners to sell to prospective land developers, and therefore less development “velocity” for Frog Pond.

Figure 6. Residual Land Value Model – Option E

	Small Lot	Medium Lot	Large Lot	Estate Lot
Lot Size (SF)	5,000	7,000	10,000	15,000
Net Density (LD Model)	8.7	6.2	4.4	2.9
Off-Site Allocation Cost per DU	$17,012	$17,012	$17,012	$14,102
Number of homes in 20 acre site	124	89	63	42
Lot Transfer Price	$108,000	$127,125	$158,750	$207,750
Required Home Price	$432,000	$508,500	$635,000	$831,000
Required Home Price per SF	$201	$197	$212	$163
Market Price	$432,000	$508,500	$635,000	$831,000
Market Price per SF	$201	$197	$212	$163
Raw Land Value per Square Foot	**$4.62**	**$3.40**	**$2.70**	**$2.08**

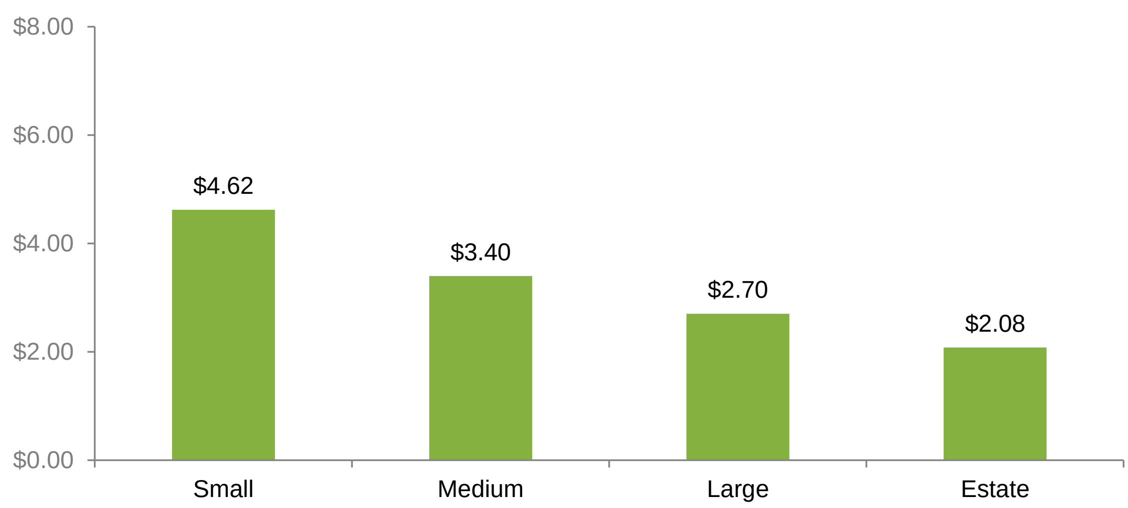


Figure 7 below shows the total lot sale revenues that would be realized by the land developer by selling home lots on the 20-acre subject site to homebuilders. This is calculated by multiplying the number of lots in the development by the lot sale (transfer) price (see Figures 5 and 6). More lots that are valued more per square foot result in greater total revenue. Total revenue is a key driver of residual land value. Since many costs associated with the site are fixed—particularly on-site infrastructure and soft costs—greater revenue results in greater capacity to pay for land.

Figure 7. Total Lot Sale Revenues for Subject Site

Market Price Model

The results of the Market Price vs. Required Price Model are shown in Figures 4 (land use Option D) and 5 (Option E).

Figure 8 below shows the summary data from Option D assuming a minimum target raw land value of $4.00 per square foot. For the small lot development type, the "required" home sales price (required in order to pay for all costs and profit while returning the target value to the land), is "below market" for the small lot project. This means that small lot homes could feasibly be built here, and that home sales prices or raw land purchase price could probably increase, thus bringing the home sales prices "to market." Medium lot development is 3 percent above market—very close.

However, the large and estate lot development types are above market by 16 percent ($86,500) and 32 percent ($267,800) respectively. Homes in the large and estate lot sizes would need to sell for about $86,500 and $267,800 more than comparable homes in the Wilsonville market. This means that developers would have to significantly decrease some costs—for raw land, on or off site infrastructure, soft costs—or profit in order to bring their homes in line with the market and compete effectively. The most likely approach is to decrease the purchase price for raw land. If costs cannot be reduced, large and estate lot housing would likely be infeasible.

Figure 8. Market Price Model – Land Use Option D

	Small Lot	Medium Lot	Large Lot	Estate Lot
Lot Size (SF)	4,000	6,000	8,000	15,000
Net Density	10.9	7.3	5.4	2.9
Dwelling Units on 20 Acres	156	105	77	42
Raw Land Cost per Square Foot	$4.00	$4.00	$4.00	$4.00
Off-Site Allocation Cost per DU	$14,102	$14,102	$14,102	$14,102
Lot Transfer Price	$87,698	$121,162	$158,383	$274,701
Required Home Price	$350,793	$484,647	$633,534	$1,098,804
Required Home Price per SF	$163	$188	$211	$215
Market Price	$394,000	$470,000	$547,000	$831,000
Market Price per SF	$183	$183	$182	$182
Percent Over Market	-11%	3%	16%	32%
Cost Over Market	$43,200	$14,600	$86,500	$267,800

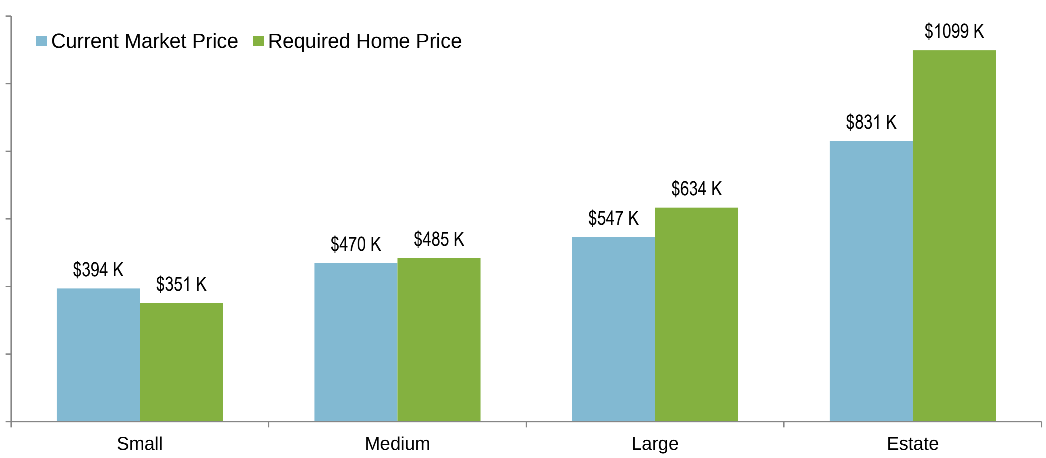
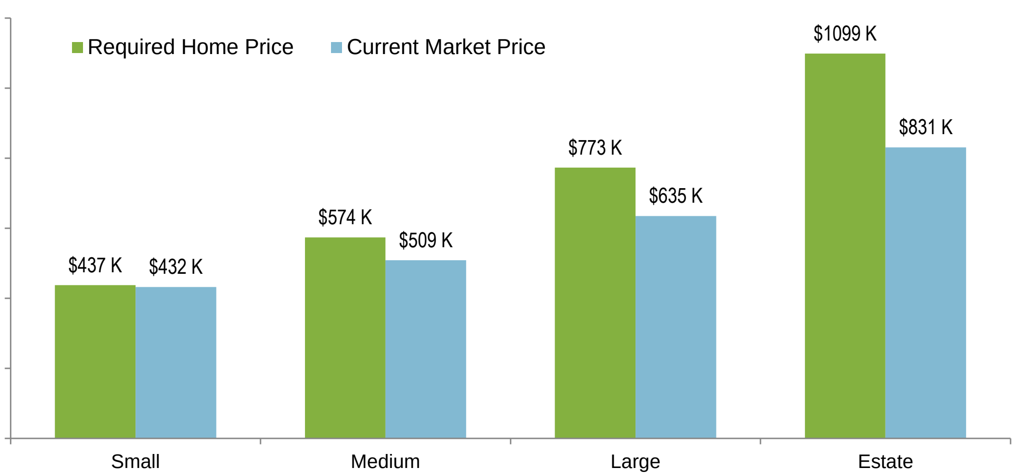


Figure 9 below shows the summary data from Option E assuming a minimum target raw land value of $4.00 per square foot. For the small lot development type, the "required" home sales price (required in order to pay for all costs and profit while returning the target value to the land), is 1 percent above market.

Medium, large, and estate lot development types are above market by 13, 22, and 32 percent respectively—homes in the medium, large, and estate lot sizes would need to sell for about $65,300, $138,100, and $267,800 more than comparable homes in the Wilsonville market. As stated above, this means that developers would have to significantly decrease some costs—for raw land, on or off site infrastructure, soft costs—or profit in order to bring their homes in line with the market and compete effectively. The most likely approach is to decrease the purchase price for raw land. If costs cannot be reduced, large and estate lot housing would likely be infeasible. The financial differences between this Option (E), and the previous Option (D), are due to the fact that the lot sizes have been increased for each of the housing types. As this happens, there are fewer lots that can be sold by the land developer within the subject site, less overall revenue, and less capacity to pay for raw land.

Figure 9. Market Price Model – Land Use Option E

	Small Lot	Medium Lot	Large Lot	Estate Lot
Lot Size (SF)	5,000	7,000	10,000	15,000
Net Density	8.7	6.2	4.4	2.9
Dwelling Units on 20 Acres	124	89	63	42
Raw Land Cost per Square Foot	$4.00	$4.00	$4.00	$4.00
Off-Site Allocation Cost per DU	$17,012	$17,012	$17,012	$14,102
Lot Transfer Price	$109,359	$143,444	$193,282	$274,701
Required Home Price	$437,434	$573,777	$773,129	$1,098,804
Required Home Price per SF	$203	$223	$258	$215
Current Market Price	$432,000	$508,500	$635,000	$831,000
Market Price per SF	$183	$183	$182	$182
Percent Over Market	1%	13%	22%	32%
Cost Over Market	$5,400	$65,300	$138,100	$267,800

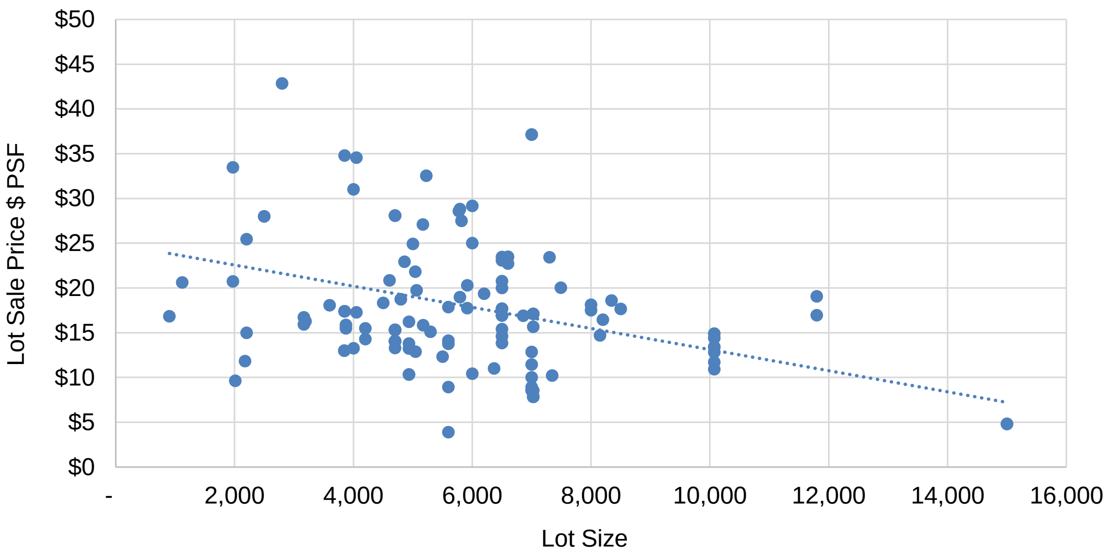


Limitations. Numerous inputs are required in order to fully evaluate a potential real estate development project. LCG considers this analysis to be preliminary, and additional analysis will need to be completed by developers considering investing in Frog Pond, including site-specific land plans, cost estimates, home designs, and target sales prices. Every reasonable effort has been made to ensure that the data contained in this report is accurate and reliable. This report is based upon estimates, assumptions and information developed by LCG from independent research, knowledge of the industry, and information and data received from other parties. No responsibility is assumed for inaccuracies in information received by LCG.

Appendix A: Additional Figures and Detailed Financial Analysis of Development Concepts

Figure 10. Lot Sales Price Per Square Foot compared to Lot Size

Washington County Lot Sales, 2012 – 2014; trend line shown.



Source: Metrostudy / New Home Trends, Leland Consulting Group.

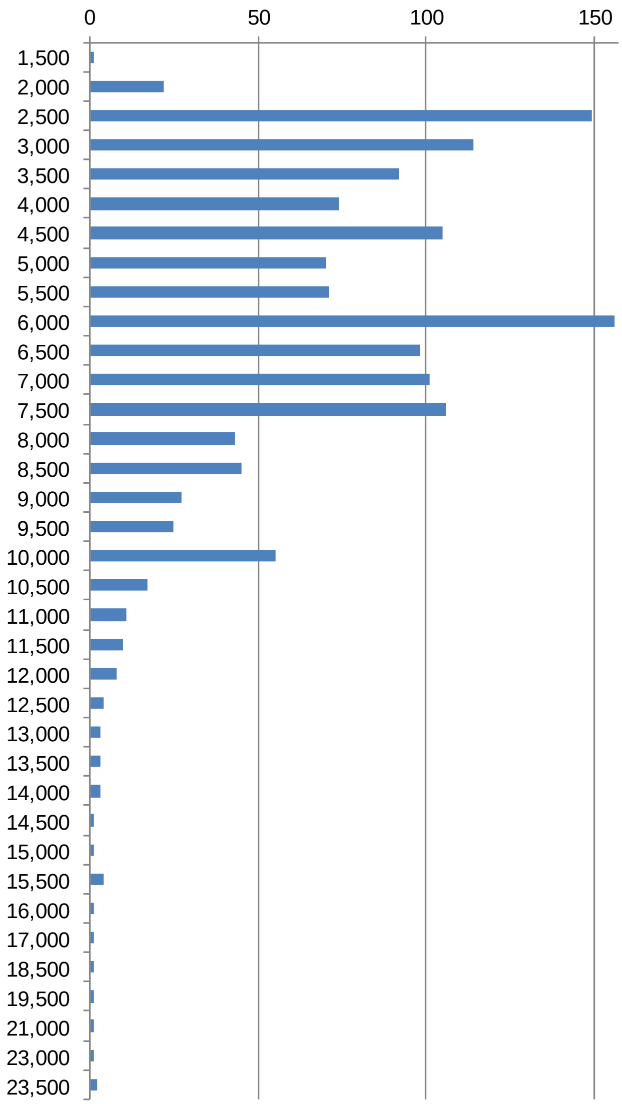
Figure 11. Average Detached Home Sales Price by City, New Construction, 2005 to 2014

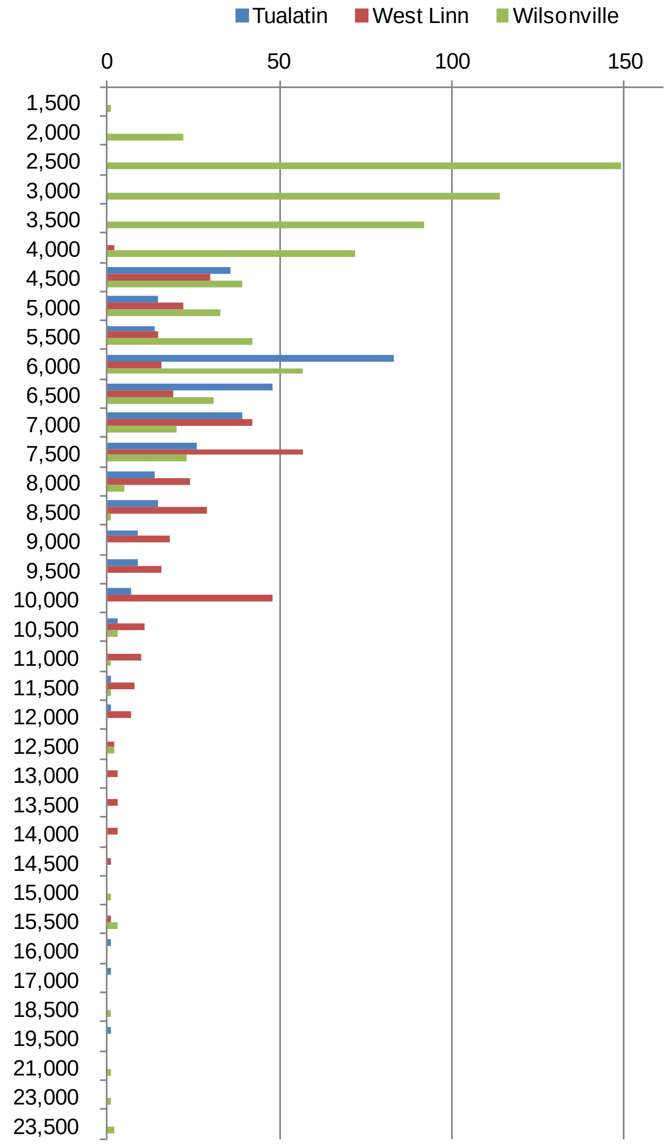
City	Average Sales Price	Percent Above Wilsonville
Wilsonville	$396,741	-
Tualatin	$507,981	28%
West Linn	$579,381	46%

Source: New Home Trends/Metrostudy, Leland Consulting Group.

Figure 12. Detached New Home Sales by Lot Size in Wilsonville, Tualatin, and West Linn, New Construction, 2005 to 2014

All sales (1,427) for all three cities.





Small Lot Development Concept (Option D)

Site Assumptions	Frog Pond Site	Legend At Villebois
Gross Site Size (acres)	20	31.2
Dwelling Units	156	188
Gross Density (du/acre)	7.8	6.0
Average Lot Size (square feet)	3,993	3,754
Right of Way (acres)	5.7	15.0
Net Buildable Area	14.3	16.2
Net Density (du/acre)	10.9	11.6

Note: ROW does not include alleyw ays.

Land Development Costs	Scenario 1				Market Model	RLV Model
	Percent	Cost per SF	Cost per Lot	Total Cost		
Raw Land	25.5%	$4.00	$22,338	$3,484,800	$22,338	$35,365
Off-site Cost Allocation	16.1%	$3.53	$14,102	$2,199,890	$14,102	$14,102
On-Site Street & Utility Cost	30.4%	$6.68	$26,667	$4,160,000	$26,667	$26,667
Other Soft Costs	3.0%	$0.67	$2,667	$416,000	$2,667	$2,667
Gross Profit Margin	25.0%	$5.49	$21,925	$3,420,230	$21,925	$19,700
Lot Sale Transfer Price	**100.0%**	**$21.96**	**$87,698**	**$13,680,920**	**$87,698**	**$98,500**

		$0
		25%
Off-Site Costs:	100%	0%
Home value market price increased by:		0%
Adjusted land price PSF:		**$6.33**

Finished Home Price	Home Price	Ave. Price per SF	Total	Market Price per SF	% Over Market
Market Value Model	$350,793	$163.16	$394,000	$183.26	-11%
	$350,793	$163.16	$394,000	$183.26	-11%
Residual Land Value Model	$394,000	$183.26	$394,000	$183.26	0%
Ratio of Lot Price to Total Price	25%				
Average Home Size (Square Feet)	2,150				

Medium Lot Development Concept (Option D)

Site Assumptions	Frog Pond Site	Canyon Creek Renaissance
Gross Site Size (acres)	20	10.4
Dwelling Units	105	45
Gross Density (du/acre)	5.3	4.3
Average Lot Size (square feet)	5,932	6,137
Right of Way (acres)	5.7	4.1
Net Buildable Area	14.3	6.3
Net Density (du/acre)	7.3	7.1

Note: ROW does not include alleyw ays.

Land Development Costs		Scenario 1			Market Model	RLV Model
	Percent	Cost per SF	Cost per Lot	Total Cost		
Raw Land	27.4%	$4.00	$33,189	$3,484,800	$33,189	$36,317
Off-site Cost Allocation	11.6%	$2.38	$14,102	$1,480,695	$14,102	$14,102
On-Site Street & Utility Cost	32.7%	$6.68	$39,619	$4,160,000	$39,619	$39,619
Other Soft Costs*	3.3%	$0.67	$3,961.90	$416,000	$3,962	$3,962
Gross Profit Margin	25.0%	$5.11	$30,290	$3,180,498	$30,290	$23,500
Lot Sale Transfer Price	**100.0%**	**$20.42**	**$121,162**	**$12,721,993**	**$121,162**	**$117,500**
						$0
						25%
Off-Site Costs:					100%	0%
Home value market price increased by:						0%
Adjusted land price PSF:						**$4.38**

Finished Home Price	Home Price	Ave. Price per SF	Market Price Total	Market Price per SF	% Over Market
Scenario 1	$484,647	$188.21	$470,000	$182.52	3.1%
Scenario 2	$484,647	$188.21	$470,000	$182.52	3.1%
Scenario 3	$470,000	$182.52	$470,000	$182.52	0.0%
Ratio of Lot Price to Total Price	25%				
Average Home Size (Square Feet)	2,575				

Large Lot Development Concept (Option D)

Site Assumptions	Frog Pond Site	Morey's Landing
Gross Site Size (acres)	20	56.0
Dwelling Units	77	138
Gross Density (du/acre)	3.9	2.5
Average Lot Size (square feet)	8,090	7,348
Right of Way (acres)	5.7	32.7
Net Buildable Area	14.3	23.3
Net Density (du/acre)	5.4	5.9

Note: ROW does not include alleyways.

Land Development Costs	Scenario 1				Market Model	RLV Model
	Percent	Cost per SF	Cost per Lot	Total Cost		
Raw Land	28.6%	$4.00	$45,257	$3,484,800	$45,257	$35,870
Off-site Cost Allocation	8.9%	$1.74	$14,102	$1,085,843	$14,102	$14,102
On-Site Street & Utility Cost	34.1%	$6.68	$54,026	$4,160,000	$54,026	$54,026
Other Soft Costs	3.4%	$0.67	$5,403	$416,000	$5,403	$5,403
Gross Profit Margin	25.0%	$4.89	$39,596	$3,048,881	$39,596	$27,350
Lot Sale Transfer Price	**100.0%**	**$19.58**	**$158,383**	**$12,195,524**	**$158,383**	**$136,750**

Check -		$0
		25%
Off-Site Costs:	100%	0%
Home value market price increased by:		0%
Adjusted land price PSF:		**$3.17**

Finished Home Price	Home Price	Ave. Price per SF	Total	Market Price per SF	% Over Market
Scenario 1	$633,534	$211.18	$547,000	$182.33	15.8%
Scenario 2	$633,534	$211.18	$547,000	$182.33	15.8%
Scenario 3	$547,000	$182.33	$547,000	$182.33	0.0%
Average Home Size (Square Feet)	3,000				
Ratio of Lot Price to Total Price	25%				

Estate Lot Development Concept

Site Assumptions	Frog Pond Site
Gross Site Size (acres)	20
Dwelling Units	42
Gross Density (du/acre)	2.1
Average Lot Size (square feet)	14,800
Right of Way (acres)	5.7
Net Buildable Area	14.3
Net Density (du/acre)	2.9

Note: ROW does not include alleyways.

Land Development Costs	Percent	Cost per SF	Cost per Lot	Total Cost	Market Model	RLV Model
Raw Land	30.2%	$4.00	$82,971	$3,484,800	$82,971	$43,146
Off-site Cost Allocation	5.1%	$0.95	$14,102	$592,278	$14,102	$14,102
On-Site Street & Utility Cost	36.1%	$6.69	$99,048	$4,160,000	$99,048	$99,048
Other Soft Costs	3.6%	$0.67	$9,905	$416,000	$9,905	$9,905
Gross Profit Margin	25.0%	$4.64	$68,675	$2,884,359	$68,675	$41,550
Lot Sale Transfer Price	**100.0%**	**$18.56**	**$274,701**	**$11,537,437**	**$274,701**	**$207,750**

		$0
		25%
Off-Site Costs:	100%	0%
Home value market price increased by:		0%
Adjusted land price PSF:		**$2.08**

Finished Home Price	Home Price	Ave. Price per SF	Market Price Total	Market Price per SF	% Over Market
Scenario 1	$1,098,804	$215.45	$831,000	$182.33	32.2%
Scenario 2	$1,098,804	$215.45	$831,000	$182.33	32.2%
Scenario 3	$831,000	$162.94	$831,000	$162.94	0.0%
Average Home Size (Square Feet)	5,100				
Ratio of Lot Price to Total Price	25%				

Appendix B

- Conceptual plans for the 20-acre subject site by Walker Macy landscape architects
- Comparable Wilsonville neighborhoods
- Representative Small, Medium, Large, and Estate Lot homes
- RMLS October 2014 Market Action Report

Appendix H. Infrastructure Funding Plan

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Memorandum

Date	3 June 2015
To	Chris Neamtzu, City of Wilsonville
From	Brian Vanneman, Leland Consulting Group
CC	Joe Dills, Angelo Planning Group
Subject	**Frog Pond Area Plan: Infrastructure Funding Strategy**
Project	5462 Frog Pond

INTRODUCTION AND EXECUTIVE SUMMARY

The Frog Pond Area Plan, led by the City of Wilsonville, will establish a vision for the 500-acre Frog Pond area and define expectations for the type of community it will be in the future. This memorandum is a part of the Frog Pond Area Plan and summarizes Leland Consulting Group's (LCG) infrastructure funding analysis and proposed strategy, which has been developed in collaboration with City of Wilsonville Community Development, Public Works, and Economic Development staff, and the Angelo Planning Group (APG) team. The types of infrastructure evaluated in this memorandum are transportation, sanitary sewer, water, stormwater, and parks.

Key findings and recommendations of this funding strategy include:

- **Funding strategies vary depending on the category and scale of infrastructure.** *"Local"* infrastructure will be paid for by developers, *"framework"* infrastructure such as Frog Pond arterial roads will be shared between developers and the City when oversizing is involved, and *"major off-site"* infrastructure will be built and paid for by the City through the Capital Improvement Projects (CIP) program. Descriptions of these three infrastructure categories and who pays for what infrastructure begins on page 4.
- **There are more than 40 different infrastructure projects proposed for the 500-acre Frog Pond Area.** The costs of these facilities have been estimated by DKS Associates (DKS), Murray, Smith & Associates, Inc. (MSA), and the City. Each of these facilities falls into one of the three categories listed above. A complete list of the infrastructure facilities and the recommended funding strategy for each begins on page 10.
- **This funding strategy defines two "reimbursement areas"—one for the West ("RA-W") and East and South ("RA-E") Neighborhoods—along with several infrastructure funding strategies that could be used in these areas.** In each reimbursement area, a number of framework infrastructure projects will benefit properties throughout the area. Therefore, the costs of these projects should be equitably distributed among multiple property owners, since there is currently no major, well-capitalized master developer capable of undertaking major infrastructure improvements within Frog Pond. For example, upgrades to Boeckman and Stafford Roads, and two new Neighborhood Parks, will benefit the entire West Neighborhood (and the City as a whole), and their cost cannot be carried by any single property owner.
- **The primary tools by which framework projects in the RA are likely to be funded are developer-initiated reimbursement districts, local improvement districts (LID), and city-initiated reimbursement districts.** These options can also be mixed and matched—both reimbursement districts and LIDs could be implemented to fund different projects in RA-W and –E. Both reimbursement districts and LIDs are tools whereby infrastructure is built upfront by a developer or the City, and the developer is then reimbursed for cost via fees or assessments from property

owners over time. A description of framework infrastructure and potential funding strategies begins on page 5.

- **The total cost of framework projects proposed to be paid for through reimbursement districts or LIDs is estimated to be $10.6 and $11.0 million respectively in the RA-W and RA–E, so these projects will therefore be a significant funding obligation for the developer or City.** However, these investments will be phased; while the RA-W improvements could be needed within the next few years, the RA-E may not be needed for some time.
- **Development in the Frog Pond area will generate significant SDC revenues, ranging from $46.8 to $55.4 million depending on which land use option is selected.** Several different variations of CIP-related revenues and costs are evaluated beginning on page 14. In this context, "revenues" are Systems Development Charges (SDCs, fees paid by developers when applying for building permits) and "costs" are infrastructure paid for by the CIP fund. (Costs associated with reimbursement districts or LIDs are not considered in this calculation since they will be financed and reimbursed separately.) If projected revenues from all three Frog Pond neighborhoods (West, East, and South) are taken into account, SDC revenues should exceed allocated CIP costs. If only the West Neighborhood is considered, then there is a funding gap for transportation, of $1 million for Option D and $1.95 million for Option E, due to CIP contributions to the Boeckman Road Bridge, and Boeckman and Stafford Road Urban Upgrade projects. There is a small sanitary sewer surplus (just under $160,000 for Option E). Water, Stormwater, and Parks SDCs show a surplus.
- **The proposed reimbursement areas will likely pass on most of the framework infrastructure costs to the developers and homebuilders who invest in Frog Pond via a cost allocation (fee or assessment) for each unit of housing.** Because different costs will be passed on to the West and East/South Neighborhoods, and there are different land use options (D and E), this per-unit cost allocation can vary. In the West Neighborhood, this reimbursement district fee is likely to be between $14,100 (Option D) and $17,000 (Option E), for the East and South Neighborhoods, it is likely to be between ($7,500 and $9,100), since more homes and commercial development are planned East of Stafford Road, but comparatively less infrastructure costs. This calculation is shown on page 18. It should be noted that there are different approaches (i.e., per acre) to calculating proportionate shares for reimbursement districts. For purposes of this memo, a per-door cost has been used.

TYPES OF INFRASTRUCTURE

This memorandum proposes a funding strategy for the following five types of infrastructure: transportation, sanitary sewer, water, stormwater, and parks. These are the types of infrastructure that are essential to new residential communities, and the City will play some role in the provision of this infrastructure. Collectively, this infrastructure includes arterial and collector roads, sanitary sewer pipes and pump stations, water pipes and reservoirs, stormwater detention ponds and detention basins, and trails and parks. Other types of infrastructure—particularly utilities such as power and cable—will be needed for Frog Pond, but are not paid for in whole or part by the City of Wilsonville and are therefore not considered here.

Infrastructure cost estimates for Frog Pond were completed by DKS Associates (transportation), Murray, Smith & Associates, Inc. (sanitary sewer, water, and stormwater), and the City of Wilsonville (parks). The City of Wilsonville's Engineering Division provided actual costs (engineering estimates or contractor bids) for more than 20 completed residential subdivision projects that were built in the city between 2005 and 2014. The primary sources for the cost estimates used here are listed below. Additional supplementary sources used can be found in the Appendices.

- *Frog Pond Area Plan – Future Transportation Analysis*, September 24, 2014, DKS Associates, and subsequent refinements to cost estimates (received May 27, 2015).
- *Frog Pond Area Plan – Concept Plan Infrastructure Analysis*, Murray, Smith & Associates, Inc., March 18, 2015.

Figures 1 and 2 below are representative images from the analysis prepared by DKS and MSA that show the location and types of infrastructure planned for Frog Pond. They are intended to be illustrative rather than a complete catalog of infrastructure. Figure 1 shows transportation infrastructure such as streets and trails. Figure 2 shows the sanitary sewer, water, and stormwater infrastructure proposed for the Frog Pond West Neighborhood (as red, blue, and green lines, respectively).

This memorandum does not contain detailed descriptions or specifications about the infrastructure to be funded. For example, DKS' recommendation is that the Advance Road Urban Upgrade project would upgrade "the existing road to a 3-lane cross section with sidewalks and bike lanes, which would be similar for either a Collector or Minor Arterial…" For such detailed descriptions of Frog Pond infrastructure, please consult the work prepared by DKS, MSA, and Angelo Planning Group (APG).

Figure 1. Auto, Bicycle and Pedestrian Transportation Infrastructure Diagram (DKS)

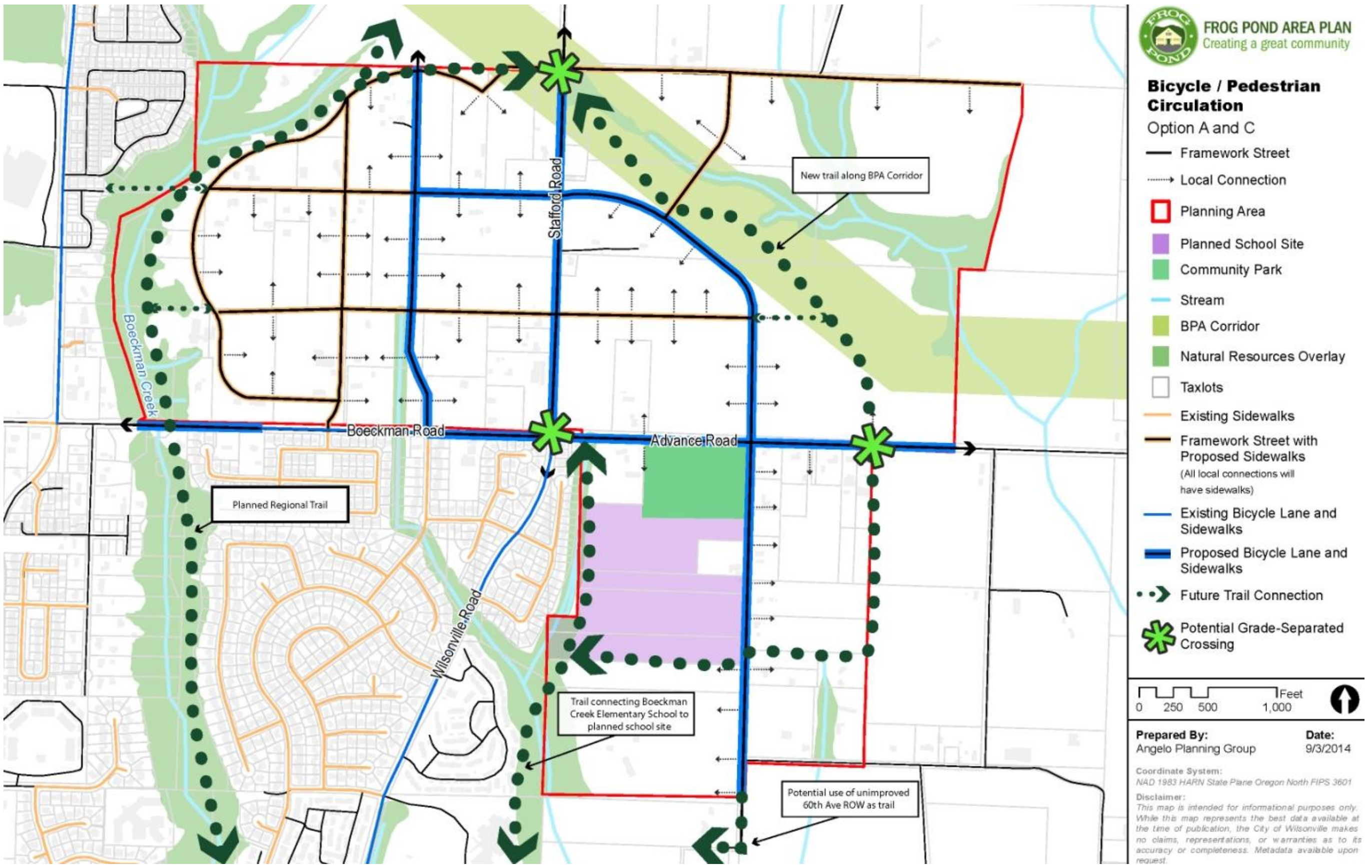
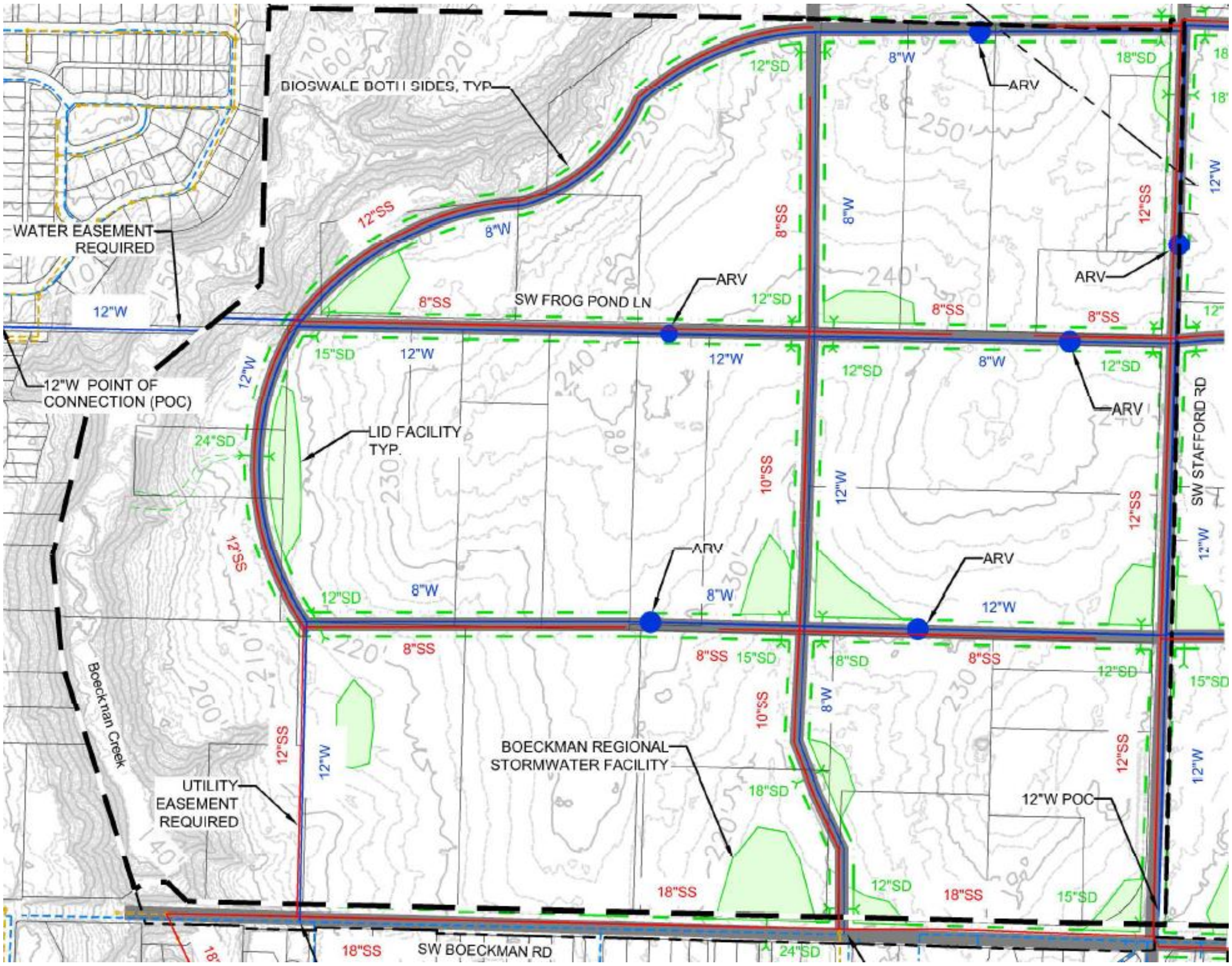


Figure 2. Frog Pond Composite Utility Plan – West Neighborhood (MSA)



INFRASTRUCTURE CATEGORIES AND FUNDING APPROACHES

There are three different categories or scales of infrastructure, which are listed below. It is important to distinguish between each of these infrastructure categories because different approaches to and sources of funding (e.g., City or developer) are typically used for each of the different categories. This funding strategy also recommends different approaches for each of these infrastructure categories.

- “Local” or “on-site” infrastructure;
- “Major off-site” infrastructure; and
- “Framework” or “major framework” infrastructure.

Local or On-Site Infrastructure

- “Local” or “on-site” infrastructure is located on or adjacent to a development property and largely serves the development (residential or commercial) that is on the site. This infrastructure may be of any type—transportation, sanitary sewer, water, stormwater, or parks.

- The City's policy is that this infrastructure is built and largely paid for by developers. The City may participate via SDC credits for oversized components (explained in the Framework Infrastructure section below).
- An example of local infrastructure is a local street 8-inch water line or sewer line that will serve a development site.
- The costs of the most local level of on-site infrastructure (with no oversized component) are not considered in this funding strategy since these are the responsibility of individual developers. These developer costs, are however, considered separately, in the Land Development Financial Analysis memorandum.
- This funding strategy recommends that developers continue to pay for local infrastructure up front, while receiving SDC credits for oversized components, in keeping with the City's policies.

Major Off-Site Infrastructure

- Major off-site infrastructure is infrastructure that is located outside of the 500-acre Frog Pond concept plan boundary.
- Examples include the West Side (water) Reservoir, Boeckman Trunk Sewer Line, Memorial Park Pump Station (MPPS), Boeckman Road Bridge, and Stafford Road—65th Ave Intersection Improvements.
- One reason this infrastructure is different from framework infrastructure is that a greater share of its capacity is needed to serve other parts of the City. Put another way, these are projects of citywide importance. For example, MSA has estimated that 25 percent of the capacity of the West Side Reservoir is needed for Frog Pond; the other 75 percent is needed to support growth in other parts of the City.
- For this reason, major off-site infrastructure is built and paid for by the City of Wilsonville through the CIP. SDCs are the primary source of funding for CIP facilities intended to provide capacity for growth; additional funding may come from utility rate funds, general fund reserves, transfers from other government agencies, and urban renewal funds (within urban renewal areas).
- Information on the City's capital projects program can be found at: http://www.ci.wilsonville.or.us/DocumentCenter/View/7317

Framework Infrastructure

- "Framework" or "major framework" infrastructure is larger than local infrastructure, serves many properties within Frog Pond, and is located within or adjacent to the Frog Pond boundary.
- Examples include upgrades to Boeckman and Stafford Roads, which will serve all of the homes planned for Frog Pond, as well as (to some degree) residents and businesses elsewhere in the City. Another example is the "oversized" water line in Stafford Road.
- In terms of scale and location, framework infrastructure is between local and major off-site infrastructure. However, there are likely to be more policy and logistical choices associated with framework than local or major off-site infrastructure.
- There is a developer and City share of most framework infrastructure, meaning that some part of the costs is paid for by both parties. This is in recognition that this larger infrastructure serves both the immediately surrounding development, as well as current and future residents and businesses. The developer share is the minimum size of the facility that is required by the City to serve the proposed development. For roads, the minimum required size is 24 feet from face of curb, or 48 feet if developers control both sides of the road. For sewer and water pipes, the minimum required pipe size

is 8 inches. The size of the facility beyond this minimum required size is the “oversize” amount, which is the City’s responsibility.

- These facilities may be built and paid for by developers, or by the City. If developers build the facility, they typically pay directly for the entire facility; the City contributes its (oversize) share via SDC credits, which developers can count against the SDC fees they owe at the time of building permit issuance. Several additional framework infrastructure funding strategies are described in the section below.
- This funding strategy recommends that the City consider taking an assertive and creative approach to coordinate the building of framework infrastructure and consider the tools described below, such as developer- and City-initiated reimbursement districts, and local improvement districts (LIDs). This is in part because there is at present no master developer at Frog Pond, and thus no known, well-capitalized party capable of financing major framework infrastructure.

FRAMEWORK INFRASTRUCTURE FUNDING STRATEGIES

While the appropriate funding strategy for local and major off-site improvements is relatively straightforward (developer and CIP funding, respectively), funding for framework infrastructure requires more careful consideration for several reasons:

- Framework infrastructure costs are significant—greater than local infrastructure—and must be paid for early in the development process, while the revenues that offset those costs (such as fees, lot or home sales) come later and may take place over many years, inferring that a financing mechanism or other approach is needed.
- The infrastructure will benefit multiple properties. The costs and benefits of infrastructure are not necessarily evenly divided among parties. For example, a 2.5-acre neighborhood park could theoretically be sited on a 5-acre property. While the land and construction cost for this park would typically fall to the developer, property owners and future residents throughout the West Neighborhood will benefit from the park. Thus, the cost would be concentrated and the benefit widespread. A mechanism that can distribute the costs among multiple parties is therefore needed.
- At this time, the City cannot rely on a “master developer” who would fund major projects as part of developing a significant part of Frog Pond West. As stated above, there is as yet no master developer or major land owners in the Frog Pond Area and thus no known, well-capitalized party capable of financing such major framework infrastructure. Currently, property is divided amongst many land owners. There are 26 property owners in the West Neighborhood, and the average property size is 5 acres. The largest ownership is 25 acres and the smallest is 0.9 acres.
- City action that helps to implement framework infrastructure will show momentum and public commitment to moving Frog Pond forward in a phased and logical manner. Cities often use their ability to invest in infrastructure to strategically advance the development of employment, residential, and mixed use areas.
- Without a larger funding strategy, small early developers in Frog Pond could struggle to make the infrastructure improvements necessary to develop their sites.

Reimbursement Areas

Given this context for framework infrastructure, an important component of this funding strategy is two “reimbursement areas”—one that encompasses infrastructure related to the West Neighborhood (RA-W), and one that encompasses infrastructure related to the East and South Neighborhoods (RA-E).

These reimbursement areas could incorporate some or all of the following specific funding tools, several of which are described in greater detail below:

- Reimbursement districts (RD), either developer or city initiated. Within each reimbursement *area* (West and East), numerous individual reimbursement *districts* could exist.
- LID, either developer or city initiated; or Advance Finance Districts (AFD), a variation on LID.
- Supplemental SDC.
- Expansion of the types of facilities that are considered SDC creditable by the City.
- Direct CIP investments.

The basic principles behind RD, LID, and supplemental SDCs are relatively similar: infrastructure is built and paid for in advance, and fees paid by property owners or developers over time serve to pay the principal, interest, and administrative costs associated with funding the original infrastructure.

There are approximately $10.6 million of major framework project costs within the RA-W, associated with the projects listed below. A detailed list of all projects, and the portion that RA-W would pay, is included in Tables 1 through 3, which begin on page 11.

- Two Neighborhood Parks in the West Neighborhood;
- Boeckman Road Urban Upgrade, including associated sewer and water lines in the right of way;
- Stafford Road Urban Upgrade, including associated sewer and water lines in the right of way; and
- Boeckman/Stafford Traffic Signal.

There are approximately $11.0 million of major framework project costs within the RA-E, as shown in Tables 1 through 3.

Improvements and funding mechanisms for the RA-W are likely to be needed before RA-E. Improvements and funding mechanisms for RA-W could be initiated following the adoption of the Frog Pond Area Plan and subsequent West Neighborhood Master Plan (Phase 2 of this project). The RA-E would only be initiated when the East and South Neighborhoods are brought into the Urban Growth Boundary and ready for development, which could be many years.

Reimbursement Districts

A reimbursement district is an area within which one party (a developer or the City) builds infrastructure that benefits multiple property owners. The other benefiting property owners pay a reimbursement fee—a pro rata share of the infrastructure costs (determined on a per-unit, lineal foot, or per-acre basis)—to the original developer or City, typically at the time when property owners seek public works permits for development. A single reimbursement district could cover all of the infrastructure in RA-W, or there could be numerous districts to cover different pieces of road, park, sewer, and water infrastructure. Reimbursement district fees are in addition to SDCs.

The City has used reimbursement districts in the past, for example, the City formed the Coffee Lake Drive Sewer Improvements Reimbursement District in 2012. The City's Reimbursement District policies are set forth in section 3.116 of the City Code.

LCG recommends that the following approaches and mechanisms be included in reimbursement districts, which should help to mitigate the costs and risk to the City:

- Developers should be encouraged to form and provide funding for reimbursement district improvements.
- RA-W improvements can be phased. For example, Boeckman Road might be improved before Stafford Road, which would enable developers or the City to stagger or phase its investments and take on smaller amounts of debt at any one time.

- Include an inflationary factor in the calculation of the reimbursement fee, which can help cover the developers or the City's interest carrying costs over time.
- Be prepared to extend the "sunset" time period for the reimbursement district, so that developers or the City can recapture all costs. The sunset time period is pre-set at ten years currently, and can be extended by the City Council for "good cause."

In a developer-initiated reimbursement district, a developer pays directly for the entire facility; the City contributes its (oversize) share via Systems Development Charge (SDC) credits, which developers can count against the SDC fees they owe at the time of building permit issuance.

In a city-initiated reimbursement district, the City would build and pay for the entire facility upfront. The developer (non-oversized) portion would then be charged back to developers via a reimbursement district.

In either case, the upfront capital that pays for reimbursement district improvements must be advanced by developers (from private sources) or the City (from the CIP fund, general fund, or other source), without a secure form of repayment. Therefore, there is financial risk to the party that initiates the district and developers may avoid initiating large-scale reimbursement districts. If development is slower than expected, the developer or City will have to carry the cost of debt service payments for a longer period of time. Fee revenue will also be lower if the amount of development is less than expected (for example, if a property owner is permitted to build 100 homes but only chooses to build 50). However, this particular issue could be addressed by different methodologies, including calculating costs on a per acre basis.

Local Improvement Districts

An LID is similar to a reimbursement district in that the cost of infrastructure that benefits multiple property owners is divided among those property owners in an equitable manner, and paid by an assessment. Like reimbursement districts, LIDs may be initiated by property owners or the City. One or more LIDs could be used in RA-W and RA–E, in conjunction with or in place of reimbursement districts.

LIDs differ from reimbursement districts in the following important ways:

- Typically, a majority (50% plus one) of property owners (weighted by the amount of area they own) must sign a petition in support of initiating the district. (The establishment of a reimbursement district is a discretionary decision made by the city council.) Naturally, this requires the support of property owners, and outreach and discussion among property owners may require considerable time.
- Assessments may be paid in a lump sum or financed over time at the property owner's discretion. Assessments are due upon allocation of costs. As noted above, fees are typically due later in a reimbursement district, when property owners seek public works permits.
- The LID creates a lien against each individual's property until all assessments are paid in full. This is seen as a negative by lenders, whose strong preference is that there be no other claims on the property on which they are making a loan, and often by property owners. This is a positive since the lien creates a secure income stream against which the City can issue bond debt. Whether an LID is initiated by property owners or the City, LID debt is always issued by a government agency, and thus takes advantage of low interest rates.

Thus, LIDs are a financing mechanism that can create capital for construction. By contrast, the capital for a reimbursement district must be advanced by the City (from the City's various infrastructure-related funds and may or may not include issuance of City debt) or developers (from private sources).

Additional details regarding LIDs can be found in Oregon Revised Statutes (ORS) Chapter 223: Local Improvements and Works.

Other Approaches to Framework Infrastructure

In addition to the reimbursement district and LID funding tools described above, the following tools help with the funding of framework infrastructure in the two reimbursement areas:

- *Supplemental SDC.* The City could establish an additional, supplemental SDC specific to Frog Pond. Functionally, this would be similar to a reimbursement district that covered all of the major framework costs associated with the entire RA-W or RA-E—a new fee would be put in place to help pay for these costs.
- *Expansion of the types of facilities that are considered SDC creditable by the City.* For example, certain park improvements could be considered SDC creditable, which would provide an extra incentive for developers to make those improvements. Such an approach was taken in Villebois, where certain park improvements were creditable. This could reduce SDC receipts which would be used to help fund CIP projects elsewhere.
- *Direct CIP investments.* As described elsewhere, the City could potentially fund additional projects or portions of projects, such as the Boeckman or Stafford Road upgrades, through the CIP. An analysis of each infrastructure component may be appropriate to determine if doing so would require deferring or reprioritizing other projects already on the list.

OTHER FUNDING SOURCES

In a small number of cases, there are additional funding sources that are expected to supplement those described above. These additional funding sources are:

- West Linn - Wilsonville School District. Two schools will be built within Frog Pond, and the school district is anticipated to pay for some infrastructure needed to serve these schools, such as improvements to Advance Road, Boeckman-Stafford traffic signal, South Neighborhood Collector roads, 12” water main extension, and a pump station and force main. It is important to note that what infrastructure the District will build is subject to the school project’s plans and phasing, and the City’s review of impacts—all of which are in the pre-application stages. All citations of costs and revenues related to the schools are preliminary and subject to change.

- Clackamas County. The County has identified the Stafford Road—65th Avenue Improvements in the agency’s transportation system plan. While this project is not likely to be built in the short or medium term (before 10 years), it is included in the list of relevant (off-site) projects in this strategy, and this strategy assumes that the County will take a major role in funding and building the project, with some participation from the City. The cost estimate used in this plan was developed by the County.

- Urban Renewal. No City of Wilsonville urban renewal funding for Frog Pond has been assumed as a part of this funding strategy. Conversations with City staff indicate that the City’s urban renewal task force has identified investments elsewhere in the City that are likely to be higher priorities.

- Grants and investments by other government agencies. Grants are a potential funding source. However, no specific grants have yet been identified that the planning team believes will provide significant infrastructure funding for Frog Pond. Metro’s Metropolitan Transportation Improvement Program (MTIP) is one such grant program, which guides how a range of federal and local transportation funds are invested in the region. MTIP funds could be used for major projects associated with Frog Pond, such as the Boeckman Road Bridge, but the collective judgment of City staff and the planning team is that it will be difficult to secure such funds since demand for MTIP funds typically outstrips availability. Nonetheless, it may be worthwhile for project stakeholders to continue to pursue grants and investments by other government agencies.

LIST OF FROG POND INFRASTRUCTURE PROJECTS

Tables 1 through 3 below contain a list of all the infrastructure projects associated with Frog Pond. Projects are grouped by type—transportation, sanitary sewer, water, stormwater, and parks—and then by category—local, framework, and major off-sites.

The “Funding Approach and Notes” column describes LCG’s recommended approach to funding each project, which has been developed in collaboration with the City’s Community Development and Public Works staff and APG team. Much of the information in this column is a recap of the Infrastructure Categories section above. An important premise is that the funding strategy for area within the UGB (the West Neighborhood, Schools, and community park) must stand on its own. The timing of development of the urban reserve areas is too uncertain to rely on for funding of projects that are needed for development of the area within the UGB.

The “Estimates” column shows who produced the cost estimate; in some cases, two cost estimates were completed. The costs columns show what entity or fund is expected to pay for the project.

Total estimated developer costs for RA-W and RA-E are highlighted in yellow at the bottom of Table 3.

Table 1. Frog Pond Infrastructure Cost Summary - Transportation

Project Category and Name		Who Builds?	Timing Facility Built with:	Funding Approach and Notes	Estimates by		Total Cost Est	City Costs		Developer Costs			Other Costs		City Cost Attributable to FP
					Est. 1	Est. 2		CIP or Other Fund	SDC Credits	Collectors Locals	RA West (RA-W)	RA East (RA-E)	Amount	Source	
Transportation															
Local	West Neighborhood Collectors	Developer	West	Developers build and receive SDC credits for oversize '(generally, roadway > 24' or 48', and bike lanes).	DKS	City	$9,510,000		$1,585,000	$7,925,000					$0
	East Neighborhood Collectors	Developer	East		DKS	City	$8,160,000		$1,360,000	$6,800,000					$0
	South Neighborhood Collectors	Developer	South	As above; school also pays for proportionate share.	DKS	City	$3,900,000		$450,000	$2,650,000			$800,000	School D.	$0
	Local roads	Developer	Varies	Developers build. No city costs, so costs are not included here.		City	-								-
Framework	Boeckman Road Urban Upgrade UU-02 (Part 1)	City	West	City builds. South side is city responsibility, north side is developers responsibility and is charged to RDW.	DKS		$3,700,000	$1,850,000			$1,850,000				$1,850,000
	Boeckman/Stafford Traffic Signal UU-02 (Part 2)	City	West	City builds, charges proportionate shares to RDW, RDE, and school district; city pays for remainder of project via CIP. This could be a gateway treatment than a roundabout.	DKS		$500,000				$70,000	$305,000	$125,000	School D.	$0
	Stafford Road Urban Upgrade UU-06 Phase 1	City	West	City builds with West Neighborhood; places reimbursement district on RDW, City (CIP) pays for 14' of 38'.	DKS		$3,000,000	$1,000,000			$2,000,000				$1,000,000
	Advance Road Urban Upgrade UU-P1 Phase 1A and 1B	City	School	Phase 1A and 1B is the facilities on the south side of Advance that are west of 60th. City builds, school district pays pro rata share.	DKS		$1,087,500	$543,750					$543,750	School D.	$0
	Stafford Road Urban Upgrade UU-06 Phase 2	City	East	City builds with East Neighborhood, places reimbursement district on RDE, developers pays for all additional roadway.	DKS	City	$2,000,000					$2,000,000			$0
	Potential Single-Lane Roundabout or Gateway Treatment on Stafford Road	City	East	Project is only built when E neighborhood develops. City builds, charges proportionate share to RDE. This could be more of a gateway treatment than a roundabout.	DKS		$600,000	$600,000							$0
	Advance Road Urban Upgrade UU-P1 Phase 2	City	East	Phase 2 is the facilities on the north side of Advance, and all facilities (north and south) east of 60th. City builds, pays for portion outside of FP (south side), charges developer costs to RDE.	DKS		$3,262,500	$543,750				$2,718,750			$0
Major Off Site	Boeckman Road Bridge I mprovements UU-01	City	TBD	City builds via CIP. This project is of citywide importance and addresses safety issues.	OBEC		$12,200,000	$12,200,000							$4,270,000
	Stafford Rd./65th Ave Improvements SI-03	County	TBD	Future project; not directly associated with FP. 10% attributable to FP.	County		$5,500,000	$1,000,000		$0			$4,500,000	County	$100,000
	Subtotal						**$53,420,000**	**$17,737,500**	**$3,395,000**	**$17,375,000**	**$3,920,000**	**$5,023,750**	**$5,968,750**		**$8,907,500**

Source for all subsequent tables and figures: Leland Consulting Group, based on cost estimates provided by DKS, MSA, and City of Wilsonville.

All figures and funding strategies are preliminary and subject to change.

Table 2. Frog Pond Infrastructure Cost Summary – Sanitary Sewer and Water

Project Category and Name		Who Builds?	Timing Facility Built with:	Funding Approach and Notes	Estimates by Est. 1	Est 2	Total Cost Est	City Costs CIP or Other Fund	SDC Credits	Developer Costs Collectors Locals	RA West (RA-W)	RA East (RA-E)	Other Costs Amount	Source	City Cost Attributable to FP
Sanitary Sewer															$0
Local	Major Sanitary Lines: West	Developer	West	Developers build, receive SDC credits for oversized components (>8")	MSA	City	$1,370,000		$80,000	$1,290,000					$0
	Major Sanitary Lines: East	Developer	East	"	MSA	City	$630,000		$40,000	$590,000					$0
	Major Sanitary Lines: South	Developer	South	"	MSA	City	$660,000		$35,000	$625,000					$0
	Local SS (8" and smaller)	Developer	Varies	Developers build. No city costs, so costs are not included here.	MSA	City	-								-
Framework	Boeckman Road SS	City	West	City builds as part of road rebuild, charges developer (non-oversize) portion to RDW.	MSA		$680,000	$120,000			$560,000				$120,000
	Stafford Road SS	City	West	City builds with Stafford Road Phase 1, charges developer (non-oversize) costs to RDW and RDE. Rough proportionality of 1/3 demand in West, and 2/3 in East assumed here.	MSA		$640,000	$50,000			$196,667	$393,333			$50,000
	Advance Road SS	City	School	City builds, charges developer (non-oversize) portion to RDE. This project only extends to 60th Ave; SS to the east is not oversized.	MSA		$780,000	$40,000				$740,000			$40,000
	Pump station and force main	School	School	School builds, serves school properties.	MSA		$1,290,000						$1,290,000	School D.	$0
Major Off Site	Boeckman Trunk Sewer	City	East	Major off site project, paid by City via CIP. 52% attributable to FP. Likely does not need to be built for the West Neighborhood, Schools, and Parks alone; can be built with East and South Neighborhoods.	MSA		$8,000,000	$8,000,000		$0					$4,160,000
	Memorial Park Pump Station	City	West	Major off site project, paid by City via CIP. 48% attributable to FP; however project is not growth related per se; it is in the flood plain and should be upgraded. Does not need to be in place until 40% of West Neighborhood and School is in place.	MSA		$5,200,000	$5,200,000		$0					$2,496,000
	Subtotal						**$19,250,000**	**$13,410,000**	**$155,000**	**$2,505,000**	**$756,667**	**$1,133,333**	**$1,290,000**		**$6,866,000**
Water															$0
Local	Major Water Lines: West	Developer	West	Developers build, receive SDC credits for oversized components (>8" pipe size).	MSA	City	$2,580,000		$460,000	$2,120,000					$0
	Major Water Lines: East	Developer	East		MSA	City	$2,580,000		$470,000	$2,110,000					$0
	Major Water Lines: South	Developer	South		MSA	City	$1,860,000		$330,000	$1,530,000					$0
	Local Water (8" and smaller)	Developer	Varies	Developers build. No city costs, so not included here.	MSA	City	$0								$0
Framework	Boeckman Road W	City	NA	NA. Water line in Boeckman already exists.	MSA		$0								$0
	Stafford Road W	City	West	Same as Stafford SS. 'City builds with Stafford Road Phase 1, charges developer (non-oversize) costs to RDW and RDE. Rough proportionality of 1/3 demand in West, and 2/3 in East assumed here.	MSA		$1,080,000	$200,000			$293,333	$586,667			$200,000
	Advance Road W	Shared	School	City builds, charges developer (non-oversize) portion to RDE.	MSA		$890,000	$160,000				$730,000			$160,000
Major Off Site	West Side Reservoir	City	West	Major off site project, paid by City via CIP. 25% attibutable to FP.	MSA		$5,800,000	$5,800,000							$1,450,000
	Subtotal						**$14,790,000**	**$6,160,000**	**$1,260,000**	**$5,760,000**	**$293,333**	**$1,316,667**	**$0**		**$1,810,000**

Source for all subsequent tables and figures: Leland Consulting Group, based on cost estimates provided by DKS, MSA, and City of Wilsonville. All figures and funding strategies are preliminary and subject to change.

Table 3. Frog Pond Infrastructure Cost Summary – Stormwater and Parks

Project Category and Name		Who Builds?	Timing Facility Built with:	Funding Approach and Notes	Estimates by Est. 1	Est. 2	Total Cost Est	City Costs CIP or Other Fund	SDC Credits	Developer Costs Collectors Locals	RA West (RA-W)	RA East (RA-E)	Other Costs Amount	Source	City Cost Attributable to FP
Stormwater															$0
Local	Local storm detention, on development sites.	Developer	Varies	Developers build. No city costs, so not included here.	MSA	City	$0			$0					$0
Major	Boeckman Road regional stormwater facility	NA	NA	Included in DKS' roadway cost estimates	MSA	DKS	$0								$0
Framework	Stafford Road regional stormwater facility	NA	NA	"	MSA	DKS	$0								$0
	Subtotal						**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**		**$0**
Parks															$0
Local	Frog Pond Neighborhood Park, P16, West	City	West	City acquires land, pays for construction, charges cost to RDW. Cost estimates include land and construction costs.	City		$3,375,900				$3,375,900				$0
	Frog Pond Neighborhood Park, P17, West	City	West	As above. Linear park with fewer built amenities, adjacent or connected to the Boeckman Creek Trail.	City		$2,286,900				$2,286,900				$0
	Frog Pond East Neighborhood Park	City	East	As above, city charges cost to RDE.	City		$3,375,900					$3,375,900			$0
	Boeckman Creek Trail, RT-01A	City	West	Developer builds, receives City share (2/3) from either SDC credits (assumed here) or CIP.	DKS		$850,000		$570,000	$280,000					$0
	South Neighborhood Trail	City	East		DKS		$700,000		$460,000	$240,000					$0
	BPA Easement Trail	City	East	City builds since trail is in BPA right of way, charges developer portion (1/3) to RDE.	DKS		$670,000	$450,000				$220,000			$450,000
	LT-P5 New School Site Trail	City	School	School builds and pays for this trail.	DKS		$700,000						$700,000	School D.	$0
Framework	Advance Rd. School Community Park, P18	City	West	Major project, paid via City CIP. 25% attributable to FP.	City		$5,410,000	$5,410,000							$1,352,500
	Subtotal						**$17,368,700**	**$5,860,000**	**$1,030,000**	**$520,000**	**$5,662,800**	**$3,595,900**	**$700,000**		**$1,802,500**
Total Costs							**$104,828,700**	**$43,167,500**	**$5,840,000**	**$26,160,000**	**$10,632,800**	**$11,069,650**	**$7,958,750**		**$19,386,000**

Source for all subsequent tables and figures: Leland Consulting Group, based on cost estimates provided by DKS, MSA, and City of Wilsonville.

All figures and funding strategies are preliminary and subject to change.

CIP COSTS AND REVENUES

This section compares estimates of the System Development Charge (SDC) revenues that would be generated by development in Frog Pond, with the Capital Improvement Projects (CIP) costs associated with Frog Pond, in order to estimate a funding surplus or gap for the City.

Since the primary revenue source for Capital Improvements Projects is SDCs—paid when building permits are obtained—these estimates depend in part on the land use density option selected. The estimates also depend on whether we consider the entire Frog Pond Area, or just the West Neighborhood. Note that in cases where current SDCs do not meet CIP needs, SDCs can be increased, or supplemental SDCs or reimbursement fees can be assigned to particular areas.

Table 4 below shows the two most recent land use options prepared by Angelo Planning Group, Options D and E. Option D is the working draft Concept Plan that was shared at the recent Open House. Option E is a lower density option that has been prepared for Planning Commission review. The primary difference in the two options, from an infrastructure funding point of view, is the amount of single family housing—Option D has approximately 21 percent more dwelling units, and therefore, significantly more SDC revenue.

Table 4. Land Use Options D and E

	D	E	
Frog Pond - All Neighborhoods			
Single Family (units)	**2,078**	**1,716**	**dus**
Multifamily (units)	-	-	dus
Commercial Area (sf)	69,150	69,150	SF
Elementary School (sf)	67,000	67,000	SF
Middle School (sf)	92,500	92,500	SF
Community Parks	10.0	10.0	acres
Neighborhood Parks	7.5	7.5	acres
West Neighborhood	754	625	dus
South and East Neighborhoods	1,324	1,091	dus

Source: Angelo Planning Group, Leland Consulting Group

Table 5 shows the current SDC fees paid by one single family home in Wilsonville, as well as the SDC revenues projected for Frog Pond under both land use options. Total SDC revenues are $56.0 and $47.3 million for Options D and E respectively.

Table 5. SDC Revenues - Options D and E

Plan and Area	Transp.	Sewer	Water	Storm	Parks	Total
Single Family Home	$7,381	$4,647	$5,300	$1,458	$5,150	$23,936
Option D						
West Neighborhood	$5,568,594	$3,503,838	$4,079,178	$1,129,280	$3,883,100	$18,163,990
East & South Neighborhoods	$13,766,649	$6,701,320	$7,542,193	$2,357,992	$6,910,522	$37,278,676
Total	**$19,335,243**	**$10,205,158**	**$11,621,371**	**$3,487,272**	**$10,793,622**	**$55,442,665**
Option E						
West Neighborhood	$4,616,445	$2,904,375	$3,395,478	$941,198	$3,218,750	$15,076,246
East & South Neighborhoods	$12,046,876	$5,618,569	$6,307,293	$2,018,278	$5,710,572	$31,701,588
Total	**$16,663,321**	**$8,522,944**	**$9,702,771**	**$2,959,476**	**$8,929,322**	**$46,777,833**

Source: City of Wilsonville, Leland Consulting Group

Note that not all SDC revenue comes from single family home development. About 10 percent of the total revenue comes from other types of development, including commercial and schools.

Tables 6 through 9 below compare SDC revenue (from Table 5) to the City's CIP costs (see "City Cost Attributable to FP" column at far right of infrastructure cost summary tables).

Note that not all City costs are considered to be attributable to Frog Pond. Rather, a percentage of the demand for *major off site* projects has been allocated to Frog Pond; notes are shown in the Funding Approach and Notes column of the infrastructure cost summary tables. For example, as mentioned above, only 25 percent of the West Side Reservoir is estimated to be attributable to new demand from Frog Pond, and thus, only 25 percent of the cost has been attributed to Frog Pond. Other examples include: 52 percent of the flow managed by the Boeckman Trunk Sewer, and 48 percent of the flow managed by the Memorial Park Pump Station, is attributable to Frog Pond, per MSA's analysis. The City has estimated that 35 percent of the PM peak hour traffic on the Boeckman Road Bridge is attributable to Frog Pond.

100 percent of the City's CIP costs associated with Framework and local infrastructure is considered to be attributable to Frog Pond, since this infrastructure likely would not be built if the area were not developed.

Tables 6 and 7 show that, when the entire Frog Pond area (all three neighborhoods) is taken into account, there is a funding surplus in each of the infrastructure types. Note that this funding surplus will be directed to the CIP, and thereby to other projects of citywide importance from which Frog Pond residents and businesses will benefit.

Table 6. Revenues and Costs – Option D, All Neighborhoods

	Transportation	Sewer	Water	Stormwater	Parks	**Total**
Sources						
SDCs Generated within FP Area	$19,335,243	$10,205,158	$11,621,371	$3,487,272	$10,793,622	$55,442,665
- SDCs credited to developers	$3,395,000	$155,000	$1,260,000	$0	$1,030,000	$5,840,000
Net Sources	$15,940,243	$10,050,158	$10,361,371	$3,487,272	$9,763,622	$49,602,665
Uses (CIP Costs Attributable to Frog Pond)	$8,907,500	$6,866,000	$1,810,000	$0	$1,802,500	$19,386,000
Funding Surplus or (Gap)	**$7,032,743**	**$3,184,158**	**$8,551,371**	**$3,487,272**	**$7,961,122**	**$30,216,665**

Source: City of Wilsonville, Leland Consulting Group

Table 7. Revenues and Costs – Option E, All Neighborhoods

	Transportation	Sewer	Water	Stormwater	Parks	**Total**
Sources						
SDCs Generated within FP Area	$16,663,321	$8,522,944	$9,702,771	$2,959,476	$8,929,322	$46,777,833
- SDCs credited to developers	$3,395,000	$155,000	$1,260,000	$0	$1,030,000	$5,840,000
Net Sources	$13,268,321	$8,367,944	$8,442,771	$2,959,476	$7,899,322	$40,937,833
Uses (CIP Costs Attributable to Frog Pond)	$8,907,500	$6,866,000	$1,810,000	$0	$1,802,500	$19,386,000
Funding Surplus or (Gap)	**$4,360,821**	**$1,501,944**	**$6,632,771**	**$2,959,476**	**$6,096,822**	**$21,551,833**

Source: City of Wilsonville, Leland Consulting Group

Tables 8 and 9 show that, when just the West Neighborhood is considered, there is a funding surplus in most of the infrastructure types. The exception is transportation, in which there is a $1 million gap for Option D, and a $1.95 million gap for Option E due to CIP contributions to the Boeckman Road Bridge, and Boeckman and Stafford Road Urban Upgrade projects ($4.95 million in Frog Pond West attributable costs). There are funding surpluses, sometimes slight, in the other infrastructure categories.

The sanitary sewer infrastructure surplus is very small—just under $160,000 for Option E. This is because the Memorial Park Pump Station and framework sewer lines in Boeckman and Stafford Roads ($2.66 million in Frog Pond West attributable costs) would need to be built along with the West Neighborhood.

Table 8. Revenues and Costs – Option D, West Neighborhood

	Transportation	Sewer	Water	Stormwater	Parks	**Total**
Sources						
SDCs Generated within FP Area	$5,568,594	$3,503,838	$4,079,178	$1,129,280	$3,883,100	$18,163,990
- SDCs credited to developers	$1,585,000	$80,000	$460,000	$0	$570,000	$2,695,000
Net Sources	$3,983,594	$3,423,838	$3,619,178	$1,129,280	$3,313,100	$15,468,990
Uses (CIP Costs Attributable to Frog Pond)	$4,985,000	$2,666,000	$1,650,000	$0	$1,352,500	$10,653,500
Funding Surplus or (Gap)	**($1,001,406)**	**$757,838**	**$1,969,178**	**$1,129,280**	**$1,960,600**	**$4,815,490**

Table 9. Revenues and Costs – Option E, West Neighborhood

	Transportation	Sewer	Water	Stormwater	Parks	**Total**
Sources						
SDCs Generated within FP Area	$4,616,445	$2,904,375	$3,395,478	$941,198	$3,218,750	$15,076,246
- SDCs credited to developers	$1,585,000	$80,000	$460,000	$0	$570,000	$2,695,000
Net Sources	$3,031,445	$2,824,375	$2,935,478	$941,198	$2,648,750	$12,381,246
Uses (CIP Costs Attributable to Frog Pond)	$4,985,000	$2,666,000	$1,650,000	$0	$1,352,500	$10,653,500
Funding Surplus or (Gap)	**($1,953,555)**	**$158,375**	**$1,285,478**	**$941,198**	**$1,296,250**	**$1,727,746**

REIMBURSEMENT DISTRICT COST ALLOCATION

An important issue for developers considering building in Frog Pond is the allocated cost of the reimbursement districts that they will need to pay in addition to SDCs and the other costs associated with land development. Developers must pay for infrastructure costs somehow, and developers' likely responses to higher-than-typical infrastructure costs will be to try to negotiate a lower cost for land, pass higher costs on through a higher home sale price (if possible), or look for other places where they can find buildable residential land. The impact of infrastructure costs on development feasibility is further explored in the Frog Pond Land Development Financial Analysis memorandum.

Table 10 shows the total cost of projects proposed to be paid for by RA-W and RA-E, and the "residential allocation." These figures come from the last row in Table 3. For RA-W, all costs paid for by the district are allocated to residential development. In RA-E, some costs (about 10 percent) are paid by commercial development, schools, and parks. The cost per unit is significantly higher in the West than East, since a smaller residential cost allocation is divided among many more units.

The reimbursement district cost per dwelling unit varies depending on the land use option. Because there are more housing units in Option D, the cost of all infrastructure projects is divided among more units, and the "cost allocation per unit" is lower. This allocation is the approximate reimbursement fee that a developer would have to pay for each housing unit.

Table 10. Reimbursement District Costs

	RA West	RA East
Cost of Projects Paid for by RD	$10,632,800	$11,069,650
- Commercial and School Allocation	$0	$1,138,789
= Residential Allocation	$10,632,800	$9,930,861
Option D		
Dwelling Units	754	1,324
RD Cost Allocation per Unit	$14,102	$7,501
Option E		
Dwelling Units	625	1,091
RD Cost Allocation per Unit	$17,012	$9,103

APPENDICES AND INFORMATION SOURCES

The following source documents were used in the preparation of this memorandum and are cited throughout when appropriate:

- Frog Pond Area Plan web site: http://www.ci.wilsonville.or.us/628/Frog-Pond-Area-Plan
- City of Wilsonville Capital Improvement Projects program, http://www.ci.wilsonville.or.us/150/Capital-Projects
- City of Wilsonville City Code, Section 3.116 Reimbursement for Extensions of Streets, Water, Storm Drainage and Sewer Lines or Other Utility Services. http://www.ci.wilsonville.or.us/DocumentCenter/View/34
- Adopted Budget, FY 2013-14, Capital Improvement Projects (CIP) section, pages 165 – 218.
- *Transportation Infrastructure – Street Credits/Reimbursements,* Steve R. Adams, P.E., Development Engineering Manager, City of Wilsonville, September 5, 2014.
- *Frog Pond Area Plan – Concept Plan Infrastructure Analysis*, Murray, Smith & Associates, Inc., March 18, 2015.
- *Wilsonville Transportation System Plan* (TSP), adopted June 17, 2013.
- *Wilsonville Parks & Recreation Master Plan*, adopted September 17, 2007.
- *Market Analysis*, Frog Pond Area Plan, Leland Consulting Group, August 2014.
- Land use plans, Angelo Planning Group.
- Discussions with City staff and Frog Pond consultant team members regarding required infrastructure and associated costs.

Appendix I. Undercrossing Review

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Memorandum

FROG POND AREA PLAN
Creating a great community

3/13/2015

To:	Frog Pond Area Plan Task Force
Cc:	Technical Advisory Committee
From:	Angelo Planning Group Team
Re:	Under-crossings Within the Frog Pond Concept Plan – What We Have Learned To Date

OVERVIEW

As part of the Frog Pond Concept Plan, interest has arisen for below grade street crossings near two main intersections in the planning area. The purpose of this memorandum is to summarize information gathered to date regarding below grade street crossings (aka under-crossings). For purposes of brevity, the information is summarized in bullet format.

CONCEPT

The vision and purpose of under-crossings is to:

- Facilitate safe street crossings for pedestrians and bicycles, particularly to the proposed schools and Community Park south of Advance Road.
- Support the vision for the Frog Pond area neighborhoods as one of Wilsonville's most walkable areas.

POTENTIAL LOCATIONS

- Please see the attached Bicycle and Pedestrian Framework Plan.
- The primary undercrossing would be located under Advance Road, approximately 660 feet east of the four corners intersection. This location is under the planned intersection that will serve as one of the access points to the schools and park, and, as access to the East Neighborhood and neighborhood commercial center to the north. The undercrossing would also be at the northern end of a planned trail.
- Another potential undercrossing is located at the gateway intersection of Stafford Road and Kahle Road.

CONSIDERATIONS FOR THE ADVANCE ROAD LOCATION

Site Study

- Walker Macy prepared the attached site study for the Advance Road location.
- To achieve the assumed grades shown, the access ramps would need to be configured either as:
    a. A straight access ramp extending approximately 200 feet north of Advance Road. A similar straight ramp design would run approximately 260 feet from the intersection on the south side of Advance Road.
    b. A switchback access ramp, which would require less distance north and south of the intersection but a wider footprint to accommodate the switchbacks.

Team Comments on the Site Study

- *Location* – Placing the trail and undercrossing next to the park creates a direct connection between those uses.
- *Switchbacks and ramps* – The advantage with switchbacks is they will slow bikes down. Question: would the switchback design be steeper with landings at the switchbacks? Perhaps a ramp on the south end and switchbacks on the north end would work well.
- *Light and openness* – To give it less of a dark trench look, either benching the retaining walls or battering them back should be considered. A battered wall with the switchback design would greatly improve the lighting.
- *Utilities* - MSA has prepared draft infrastructure plans for the Concept Plan. Utilties, particularly sewer routing, will need to be carefully reviewed to work with the undercrossing.
- *Coordination* – Clearly the design of the undercrossing needs to be highly coordinated with the School District and the City, reflecting considerations of infrastructure systems, safe routes to school, the trail-park relationship, attractiveness for all users, and impact to properties.

EXAMPLE PROJECTS

DKS summarizes two constructed undercrossing projects as follows (images are included in the attachments):

- "The first was a tunnel in Washougal Washington under SR-14. This tunnel had significant tunnel lighting for security purposes. As you can see from the photos, there is great visibility during the day due to the tunnel lighting. It also had two motion activated CCTV security cameras that record footage anytime someone walked through the tunnels. This tunnel had a planning level cost estimate of $3.1 million. The actual construction cost was $1.25 million. I'm not sure what the design and right of way fees were on this project."
- The second tunnel is in the Washington/Skamania portion of the Columbia River Gorge. This tunnel was for a Forest Service trail that crossed SR-14. Note that this tunnel did not have lighting so you can see how dark it appears. There were two similar grade separated tunnels constructed as part of this project so the attached bid is for two tunnels. The construction cost of these tunnels was $4.6 million or ($2.3 million per tunnel)."

RECOMMENDATION FOR THE CONCEPT PLAN

At this point, Angelo Planning Group recommends that the under-crossings be retained on the Bicycle and Pedestrian Framework Plan, and identified as a concept for continued study. That is, the Concept Plan would describe the vision and purpose for the under-crossings and include the information gathered during the Concept Plan process. The need for further detailed study, coordination, and design would be identified. The logical time for that work to be done is prior to engineering studies for the improvement of Advance Road as part of the park and school design.

ATTACHMENTS

- Bicycle and Pedestrian Framework Plan
- Walker Macy site study
- DKS images of example projects
- Images from the boards prepared for the Open House

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- Walker Macy site study
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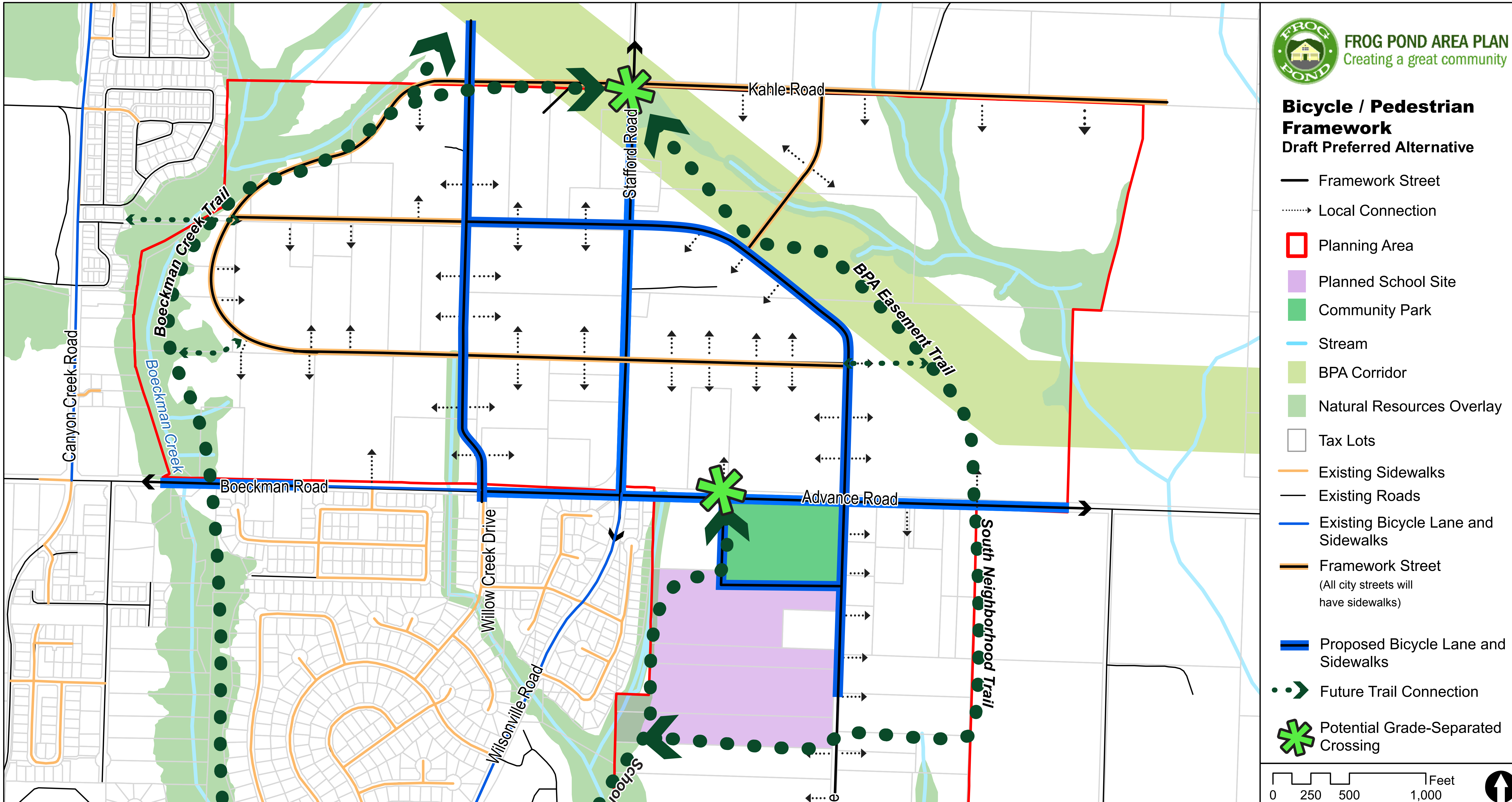
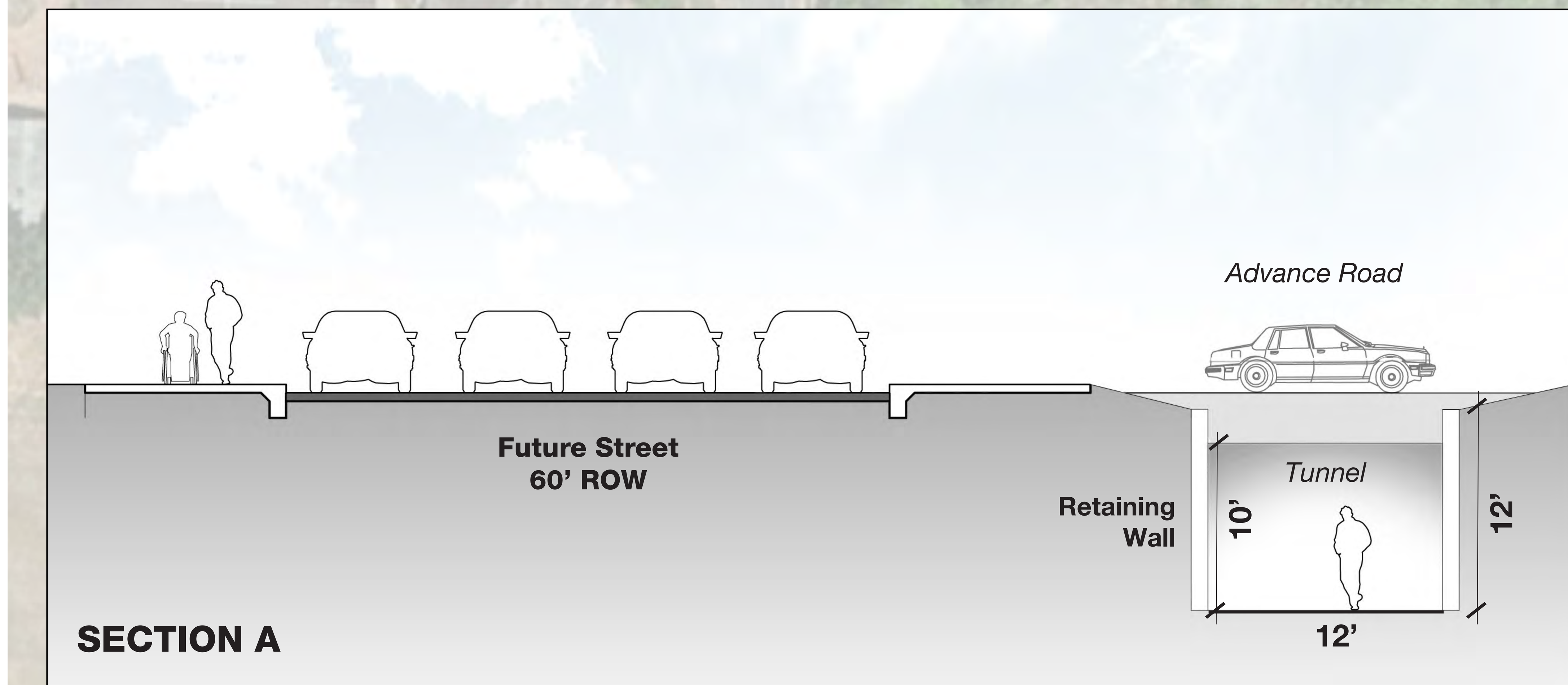


Prepared By:
Angelo Planning Group

Date:
11/21/2014

Coordinate System:
NAD 1983 HARN State Plane Oregon North FIPS 3601

Disclaimer:
This map is intended for informational purposes only. While this map represents the best data available at the time of publication, the City of Wilsonville makes no claims, representations, or warranties as to its accuracy or completeness. Metadata available upon request.



Undercrossing and Ramp Details

- A gradient less than 5% is not considered a ramp so does not need landings or railings.
- The opening for undercrossing tunnel should be 10 ft high by 12-14 ft wide.
- If trail width is over 12ft the opening width should match
- Gradient leading into the tunnel should not exceed 5% slope and should include a 5-8ft-long grade transition before entry and exit.
- Undercrossings shown will require significant retaining walls

If ramp is 5% or steeper there will be less ramp but the following apply:

- Maximum gradient= 1:12 or 8%
- Cross slope 2% max
- Maximum vertical rise of 30 inches before landing is required
- 2% slope on landings
- Landing length 60 inches min.
- Landing required at a change in direction (5'x5')
- Railings on both sides

Pedestrian and Bike Undercrossing Study

3.5.2015

UNDERCROSSING EXAMPLE 1: SR-14 Tunnel in Washougal, WA

Before: South side of SR 14

After: South end of SR 14 Pedestrian Tunnel, with stairs and ADA-accessible path connecting to fitness trail along the top of the Columbia River dike

UNDERCROSSING EXAMPLE 1: SR-14 Tunnel in Washougal, WA

Before: North side of SR 14

After: North end of SR 14 Pedestrian Tunnel, with pedestrian plaza

UNDERCROSSING EXAMPLE 1: SR-14 Tunnel in Washougal, WA

After: Pedestrian tunnel interior with basalt carvings of local Native American petroglyphs

UNDERCROSSING EXAMPLE 2: SR-14 Tunnel in Skamania County, WA

UNDERCROSSING EXAMPLE 2: SR-14 Tunnel in Skamania County, WA

Open House Images of Intersection Treatments

Pedestrian Refuge at Roundabout

HAWK Pedestrian Crossing

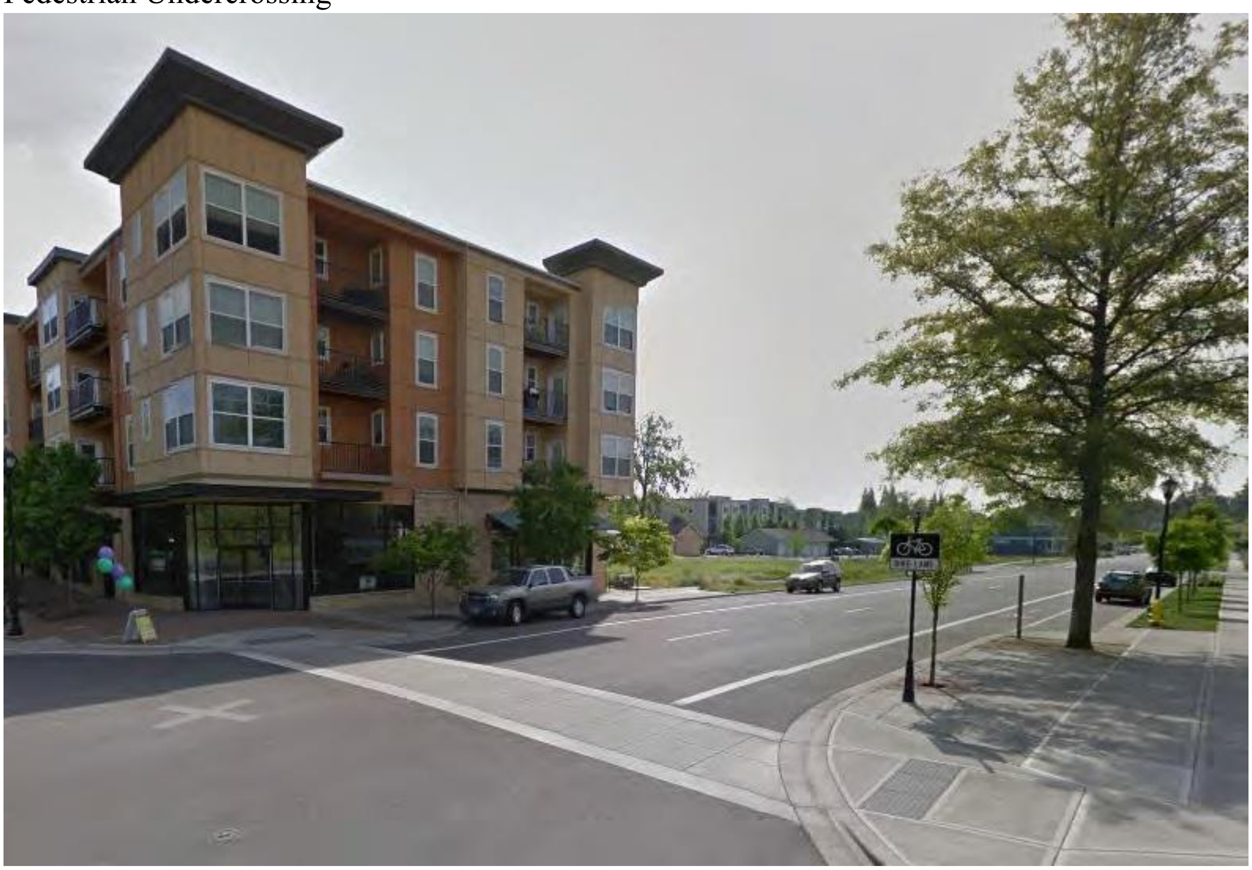
Open House Images of Intersection Treatments

Curbless Street and Intersection

Pedestrian Undercrossing

Open House Images of Intersection Treatments

Pedestrian Undercrossing



Concrete Crosswalk

Open House Images of Intersection Treatments

Curb Bump Out

Open House Images of Intersection Treatments

Zebra Crossing

Appendix J. Zoning Strategy

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Memorandum

Updated - 5/27/2015

To:	Frog Pond Area Plan Technical Advisory Committee and Task Force
Cc:	Project Team
From:	Joe Dills, Angelo Planning Group
Re:	Frog Pond Concept Plan Zoning Strategy

INTRODUCTION

The purpose of this memorandum is to discuss and recommend a zoning strategy for the Frog Pond Concept Plan and Master Plan. The term zoning strategy is used here as a short-hand term to mean the package of land use regulations needed for implementation, including amendments to the Wilsonville's Comprehensive Plan, Transportation System Plan, Zoning Code and related documents.

This strategy is a first "structural" review of the following questions:

- What documents will be amended or adopted to implement the plan?
- What should be the proposed Comprehensive Plan designation(s) for the area?
- What will be the nature of the implementing zoning: specifically, existing Planned Development Residential (PDR) regulations, Villebois-like village regulations, a hybrid of PDR and Villebois, or new regulations entirely?
- What standards and design guidelines should be anticipated?

This memo is a prelude to writing the actual regulations – an approach, not the language itself. It is beneficial to do now – as the Concept Plan is being prepared – so that the overall vision and plan direction is informed by knowledge of how it will be implemented.

References to the Concept Plan below refer to the concept plan for the entire 500-acre planning area. References to the Master Plan refer to the more detailed planning that will be done in Phase 2 of the project for the West Neighborhood, the area currently within the Urban Growth Boundary (UGB).

BACKGROUND REVIEW

Wilsonville Comprehensive Plan

Angelo Planning Group has reviewed the Wilsonville Comprehensive Plan to identify policies that are relevant to Frog Pond. Based on this review, the Comprehensive Plan provisions listed below are particularly relevant to crafting the zoning strategy.

1. **Concept Plan and Master Plan as supporting documents of the Comprehensive Plan.** As described in the Introduction section, concept plans, master plans and similar documents are adopted as supporting documents of the Comprehensive Plan. A distinction is made between those that are explicitly adopted as "part of the Comprehensive Plan" and those which are not. The former have regulatory authority, and apply when findings must be made "consistent with the Comprehensive Plan". Supporting documents which are not part of the Comprehensive Plan are more guiding and are not regulatory.

2. **Core Concepts.** Many of the core concepts in the Concept Plan are consistent with the goals and implementing measures of the Comprehensive Plan. Examples include:
   - Walkable neighborhoods.
   - Community design that blends the natural environment with urban development.
   - Local neighborhood commercial centers, with an emphasis on quality design and compatibility with adjacent residential areas.
   - Boeckman Creek as an open space with scenic views.
   - Protection of valuable natural resource lands.
   - Compatibility between urban development and adjacent rural and agricultural lands.
   - Recognition of, and priority for, good architectural design and overall community design.

3. **Minimum densities – the 80% rule.** The Comprehensive Plan includes an explicit Implementation Measure requiring a minimum density standard, as required by Metro. This standard is stated in the zoning code. Flexibility in its application is afforded through the City's Planned Development regulations.

4. **Comprehensive Plan Map designations.** The Frog Pond UGB area (the West Neighborhood) is designated as Area of Special Concern L. Most residential areas of the City carry a Residential plan map designation. The exception is Villebois which has a Village designation and package regulations that are specific to the Villebois master plan area.

Zoning Code

Based on a review of the code and discussions with staff, the following are important points to note regarding the zoning strategy.

1. PDR zoning provides flexibility to waive and modify standards. It is notable that minimum density is not currently eligible for waiver. Rather, some flexibility is provided through the different housing types and lot sizes allowed in the PDR zones.
2. Multi-family housing is "typically permitted" in PDR zones. This provision is counter to the intent for the West Neighborhood of Frog Pond.
3. The City has identified the need to address several problems with density ranges in the code: inconsistency with the density ranges in the Comprehensive Plan, and; gaps between the density ranges in PDR 4-5 and PDR 5-6.
4. The Village Zone regulations and review process of Villebois reflect the unique vision, master plan and details of Villebois. Several stakeholders have noted that development review in Villebois is very complicated and a more simplified system should be implemented in Frog Pond.
5. While the Village Zone and procedures may not be the best choice for Frog Pond (due to its uniqueness and complexity), staff have indicated that some of the standards may be useful to consider in Frog Pond.

Examples from Other Cities

Bend – Special Planned Districts (SPDs)

Bend uses Special Planned Districts to implement master plans in sub-areas of the City. There is a wide variety of SPDs: ranging from Northwest Crossing (a master planned community similar to Villebois) to the Medical District (a hospital-anchored medical district) to the Lave Ridge Refinement Plan (a residential neighborhood). Bend's SPDs focus on the code: each one is a chapter within the zoning ordinance. The chapters are generally very comprehensive, including uses, development standards, design requirements, and maps of street and other framework plans. Some SPDs are essentially mini-codes within the code, and others are a combination of base zoning and additional special area requirements.

For further information, please see: http://www.codepublishing.com/OR/bend/?BendDCNT.html

Portland – Plan Districts

Like Bend, Portland also implements sub-area plans through its zoning ordinance. Portland currently has 32 Plan Districts, covering many different neighborhoods, town centers and districts within the city. Portland's Plan Districts are crafted to include only those regulations that are different from the base zone or other sections of the code. Some are very complex – the Central City Plan District runs 47 pages - and others are comprised of relatively few requirements.

For further information, please see: http://www.portlandoregon.gov/bps/34563

Beaverton - South Cooper Mountain Community Plan

The City of Beaverton recently completed the South Cooper Mountain (SCM) Concept Plan, including the SCM Community Plan and code updates. The Concept Plan covers 2300 acres of land, including lands within the UGB and adjacent urban reserve lands. The Concept Plan was adopted by resolution as the guiding plan for the area. Land use implementation within the 544-acre UGB/city limits area occurs through a package of regulations: (1) Comprehensive Plan map designations; (2) the SCM Community Plan, a new Comprehensive Plan chapter containing goals and policies (along with explanatory text and graphics) that are part of most development reviews; (3) updates to the City's Transportation System Plan; and, (4) citations of the applicability of the Community Plan within the Development Code. Zoning (using the City's existing zones and standards) is applied concurrent with development review. Overall, the City will be using existing zones, standards and procedures, and supplementing them with a comprehensive set of Comprehensive Plan policies that specify requirements for development. The regulations described above were adopted in January, 2015 and will be effective on March 6, 2015.

For further information, please see: http://www.beavertonoregon.gov/index.aspx?NID=1210

AN APPROACH FOR FROG POND – DRAFT, FOR DISCUSSION

General goals and ideas

The zoning strategy for the Frog Pond area should:

a. Implement the Frog Pond vision and guiding principles.
b. Create a system that will implement the vision if there is incremental development in the Frog Pond UGB area. That is, the City should not rely on a large project/master developer approach like Villebois.
c. Design a zoning structure that will work in the short and long term: first in the West Neighborhood, then in the East and South Neighborhoods, and ultimately in other future urban reserve areas.
d. Only adopt new base zones if there is a compelling reason to. The more "new code" that is created, the more potential there is for problems.
e. Craft the fewest number of rules to get the job done, while meeting the City's expectations for quality development.

The Zoning Strategy

As a zoning strategy for the Frog Pond area, the City should consider creating a hybrid of its PDR regulations and the Villebois regulations. There are good elements to draw from each, and the local experience and familiarity with them will be valuable in future implementation.

The following zoning strategy elements and working ideas should be considered.

1. Adopt the Concept Plan (500-acre planning area) and Master Plan (UGB area) as supporting documents of the Comprehensive Plan as follows:

    a. The Concept Plan will establish, for the entire 500-acre area, the: overall vision and guiding principles; framework plans for land use, streets, pedestrian and bicycle networks, infrastructure and community design; infrastructure funding strategy; and zoning strategy. The Concept Plan would not be "part of the Comprehensive Plan" as defined by the City, that is, it would not have a regulatory role. Rather, it is a guiding plan for Comprehensive Plan amendments, more detailed master plans, code amendments, and on-going infrastructure planning.

    b. The Master Plan will establish, for the West Neighborhood and School-Park UGB areas, property specific Comprehensive Plan map designation(s) and the intended zones and future zoning boundaries. The Master Plan would also provide: zoomed-in versions of the frameworks plans, with supplementing details (as-needed) for streets, blocks, pedestrian and bicycle facilities, parks and open space, and infrastructure; design guidelines; and, an infrastructure funding plan.

    c. Master plans for the East and South Neighborhoods will be created after/if those areas are brought into the UGB.

2. Update/delete the "Area L" Comprehensive Plan designation and text to be consistent with the plan.

3. Create and apply a new Comprehensive Plan designation called "Neighborhood" as the "base" plan designation for the West Neighborhood. The Neighborhood designation's purpose will be to create complete and walkable new neighborhoods in Wilsonville. The City's Residential designation is an option, but a new designation would better reflect the City vision for new neighborhoods with the areas added to the UGB. The School-Park properties will be designated Public Lands.

4. Adopt "fixes" to the problems previously identified by the City regarding the Planned Development Residential zones and utilize these revised PDR zones in the Frog Pond area.[1] Add language to prohibit multi-family housing types in the PDR zones that are applied in the Frog Pond Master Plan (West Neighborhood). Table 1 lists a comparison between Comprehensive Plan densities, PDR zone densities and the working Frog Pond Concept Plan designations.

5. Supplement the PDR regulations with design requirements intended to create quality development, consistent with the Master Plan. How to codify these supplemental standards needs to be determined – one option is to create a new chapter "4.119 Standards Applying within the Neighborhood Comprehensive Plan designation." The Village Zone and Villebois regulations provide good source material for the supplemental design requirements. A working list is attached. However, the design standards to be applied in Frog Pond should be specifically tailored to Frog Pond.

6. Utilize a two-step approach for entitlements. Step 1 is the initial adoption of the Comprehensive Plan map designations and package of plan and code amendments. Step 2 is the application of property-specific zoning concurrent with PDR review. The following comparison table will need to be updated when the final land use designations for the Concept Plan are approved.

Table 1 Comparison Table

Comprehensive Plan Density	Zoning District	Closest Frog Pond Designation – as of May, 2015	Frog Pond Density – as of May, 2015
0-1 u/acre	PDR-1		
2-3 u/acre	PDR-2		
4-5 u/acre	**PDR-3**	Large Lot Single Family	5.4 u/acre
6-7 u/acre	**PDR-4**	Medium Lot Single Family	7.3 u/acre
10-12 u/acre	**PDR-5**	Small Lot Single Family	10.9 u/acre
16-20 u/acre	**PDR-6**	Attached Single Family	17.4 u/acre

[1] The City has identified the need to: (1) correct the density "gaps" between the PDR-4/PDR-5 and PDR 5/PDR 6 zones; and, (2) Make the densities cited in the Comprehensive Plan and Code more consistent.

Quality Design Requirements – Initial Ideas

The following is an initial list of the types of design requirements that would ensure high quality design. They are sourced primarily from the Villebois code and pattern books, as reviewed by City staff.

This list is intended solely as ideas and information. The Frog Pond design standards should be specifically tailored to implementing the Frog Pond vision.

1. A table of permitted building materials, similar to Villebois, to require quality materials with a shelf life and avoid materials such as vinyl siding.
2. A "rules of adjacency" approach that addresses architectural styles and colors intended to promote architectural compatibility and harmony between adjacent developments, and architectural variety within each PDR zone.
3. Fencing details, standards and placement.
4. Requirements for enhanced building elevations along public view sheds (streets, parks, trails, open space). This requires window trim, gridded windows, wrapped masonry at corners etc.
5. Street signs with the Frog Pond logo.
6. Dark sky street light requirements.
7. A unified approach to community elements such as street furniture, parks and playgrounds.
8. A master street tree plan based on planting strip widths and the functional classification of streets.
9. Encouragement of passive solar orientation.
10. Use of public works standards for Low Impact Development.
11. Lot diagrams with other design elements included regarding the home – 10" stoops, shutter size to cover window proportionally, courtyard designs on townhomes (semi-public space), no "snout" houses, rear setback in alleys, front setbacks for home/porch.
12. Alleys for attached single family and small lot single family development.

Appendix K. Neighborhood Center Review

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FROG POND AREA PLAN
Creating a great community

DRAFT

Neighborhood Retail Nodes

FOR
City of Wilsonville

PREPARED BY
LELAND CONSULTING GROUP

JULY 2015

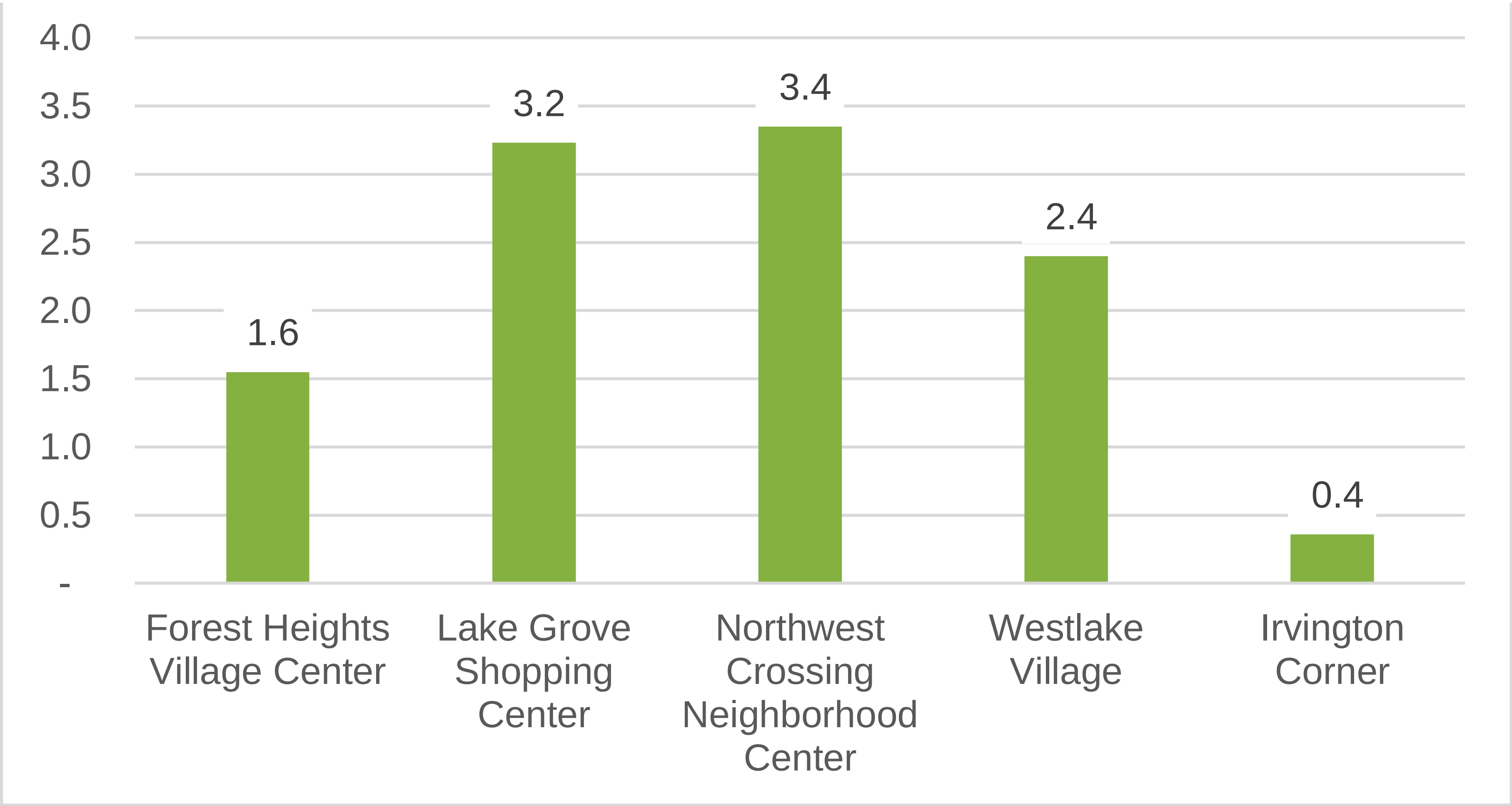
Retail Market: Typical Considerations

- Demand:
  - Current population: 1, 3, and 5 mile radius
  - Demographics
  - Future population
  - Drive by traffic (ADT)
  - Accessibility and visibility
  - Employment demographics
- Supply
  - Competition
  - What is already being offered

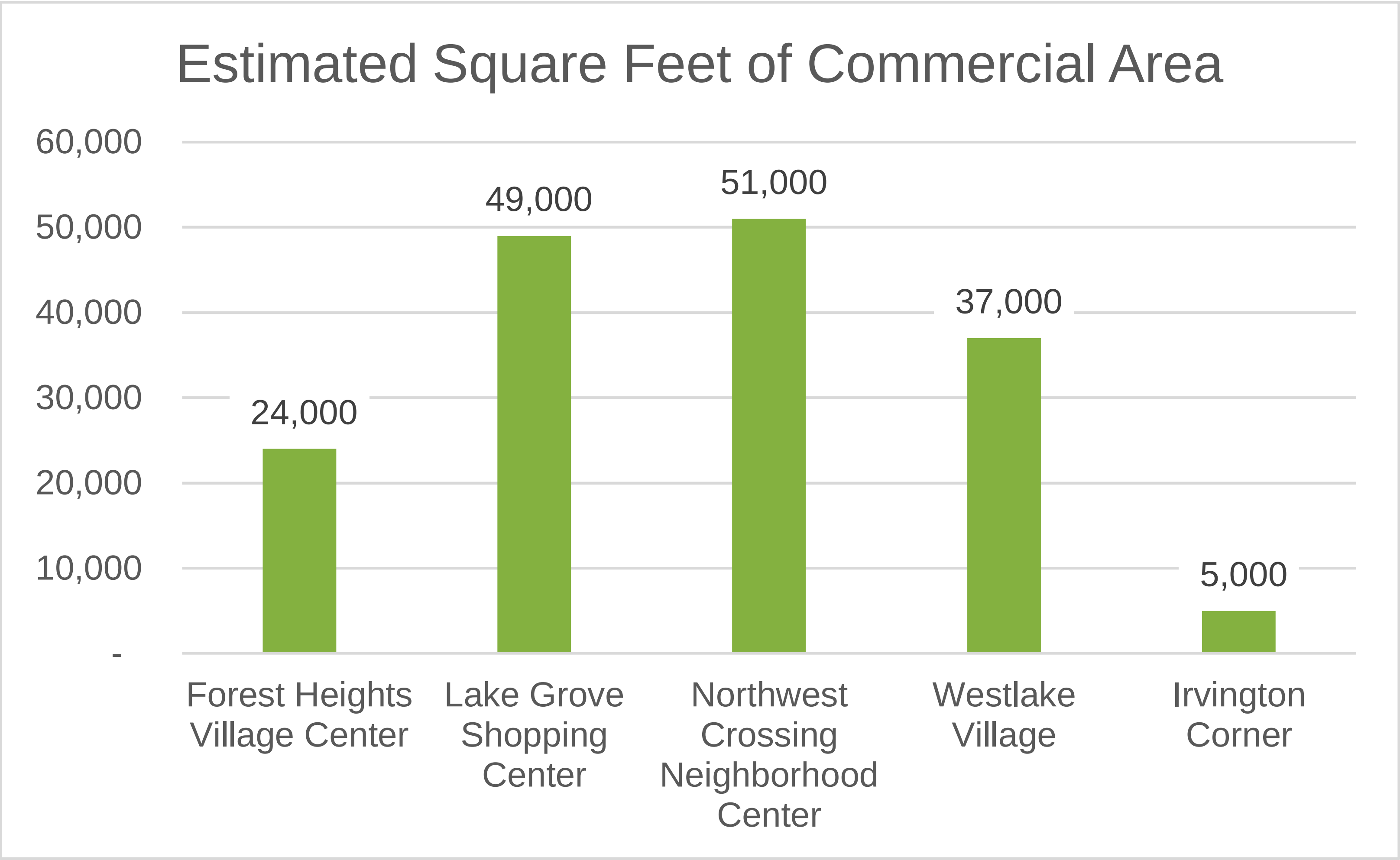
Neighborhood Retail: Benefits & Success Metrics

- Neighborhood benefits
  - Increased walkability and sociability
  - Increased desirability and home values
- Retail metrics
  - **Lease rates**
  - **Occupancy**
  - Sales per square foot (more difficult to get data)
  - Value – sale price PSF, assessed value

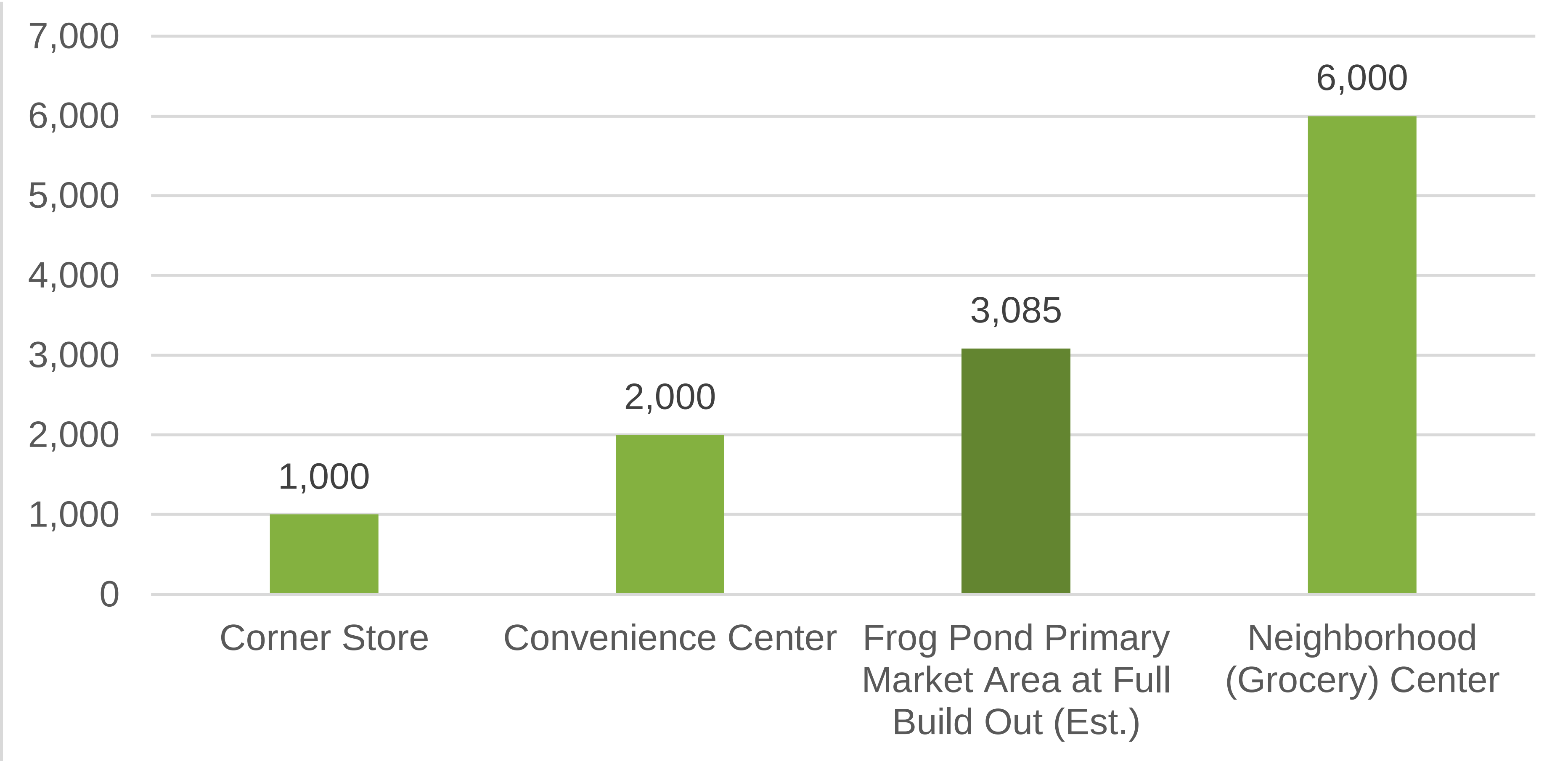
Neighborhood Retail Nodes: Size by Acres



Neighborhood Retail Nodes



Number of Households Required to Support



Typical Tenants

- Coffee shop
- Café / Restaurant
- Wine Shop
- Real Estate Office
- Eye care
- Salon
- Bank
- Grocery (sometimes)
- Specialty Food (e.g., Olive Oil)
- Gifts

Neighborhood Retail Nodes

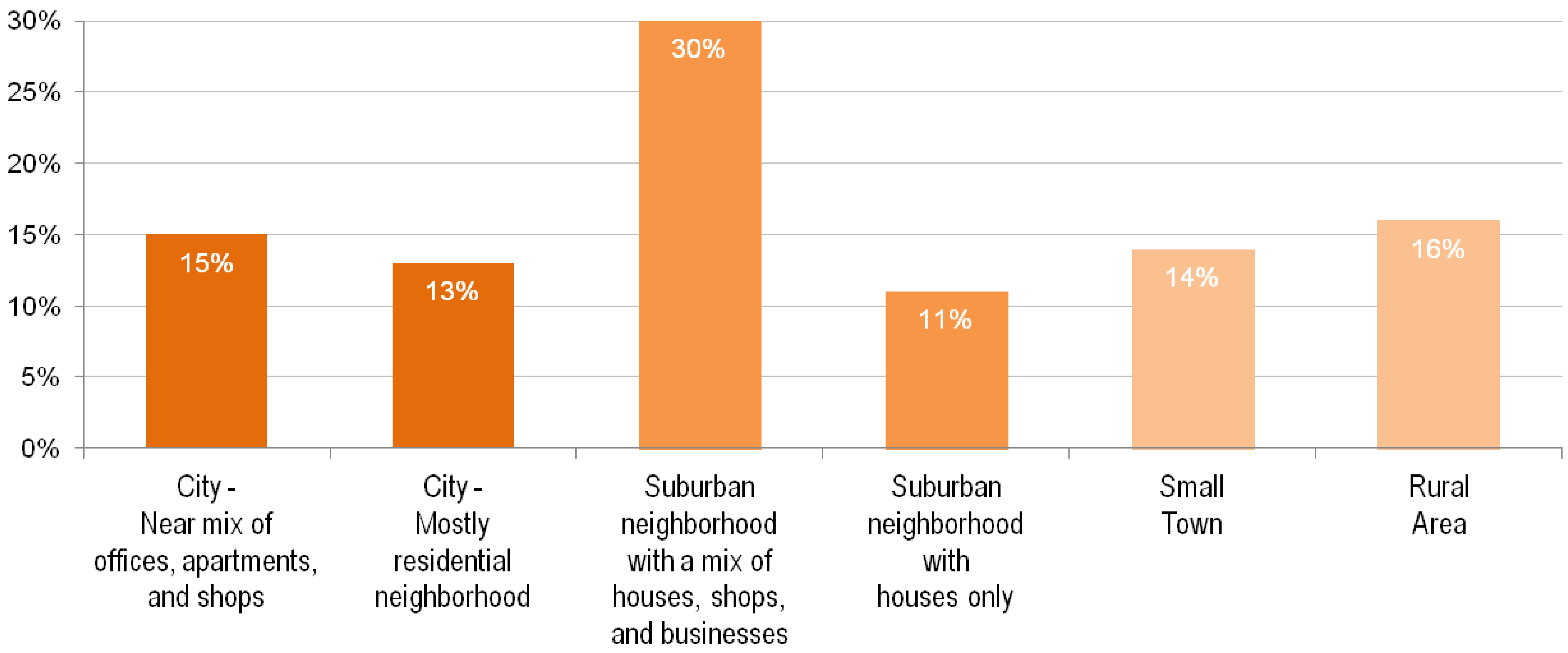
Name	Site Size Acres	Est. Retail Area (SF)	Address	
Forest Heights Village Center	1.6	24,000	2021 NW Miller Rd, Portland, OR 97229	Portland
Lake Grove Shopping Center	3.2	49,000	16380 Boones Ferry Rd, Lake Oswego, OR 97035	Lake Oswego
Northwest Crossing Neighborhood Center	3.4	51,000	2754 NW Crossing Dr, Bend, OR 97701	Bend
Westlake Village	2.4	37,000	14559 Westlake Dr, Lake Oswego, OR 97035	Lake Oswego
Irvington Corner	0.4	5,000	2518 NE 15th Ave, Portland, OR 97212	Portland
Frog Pond (Proposed)				

Neighborhood Retail Nodes - Other

- Orenco Station, Hillsboro
- Main Street, Fairview
- Old Town Square, Wilsonville
- Charbonneau Village Center, Wilsonville
- Villebois, Wilsonville
- Bethany Village, Portland
- Holiday Neighborhood Center, Boulder, CO
- Stapleton, Denver, CO

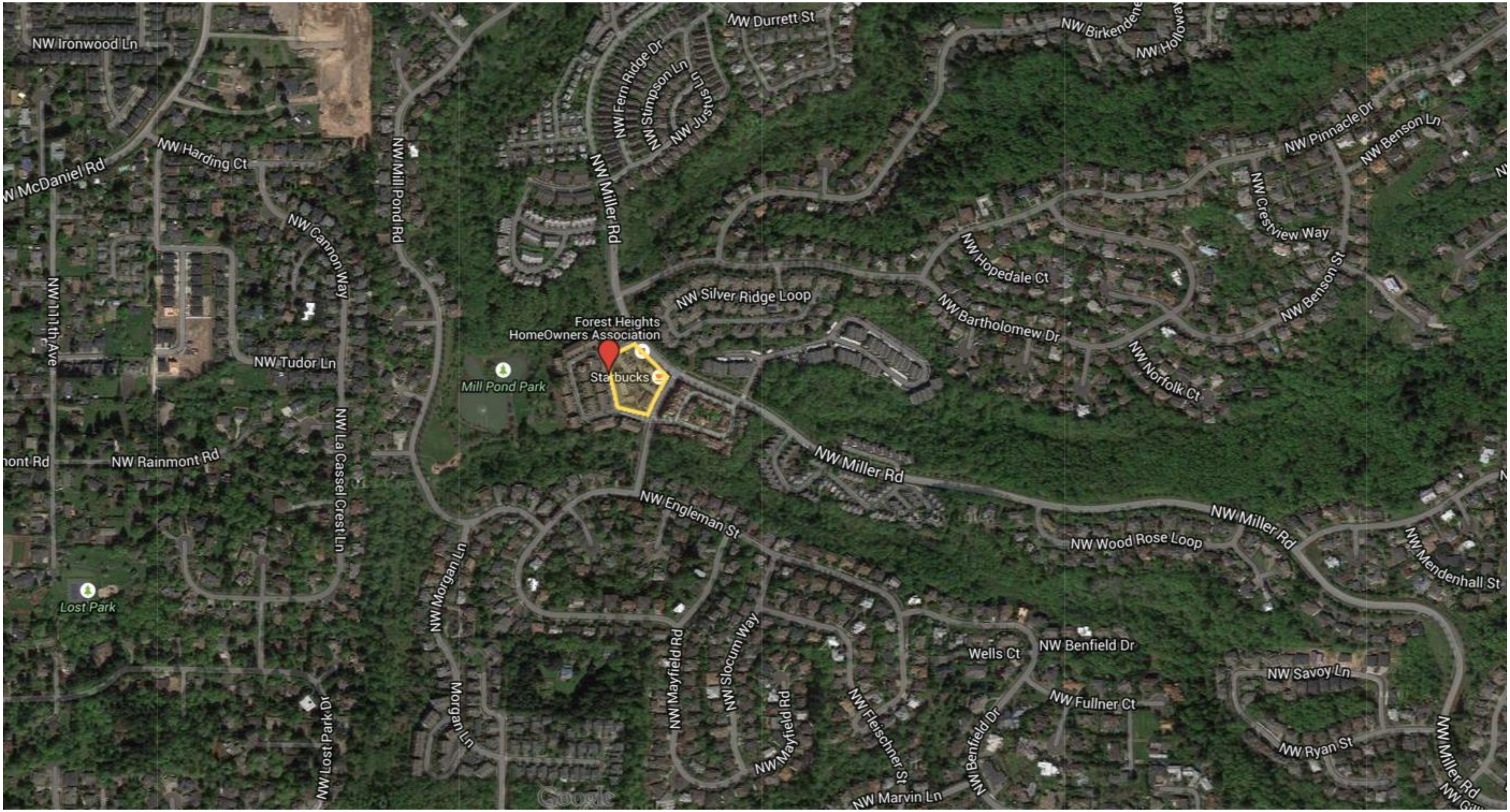
Community Preferences (Nationwide Realtors survey)

In which type of the following locations would you most like to live?



Source: National Community Preference Survey, National Association of Realtors, October 2013.

Forest Heights Village Center

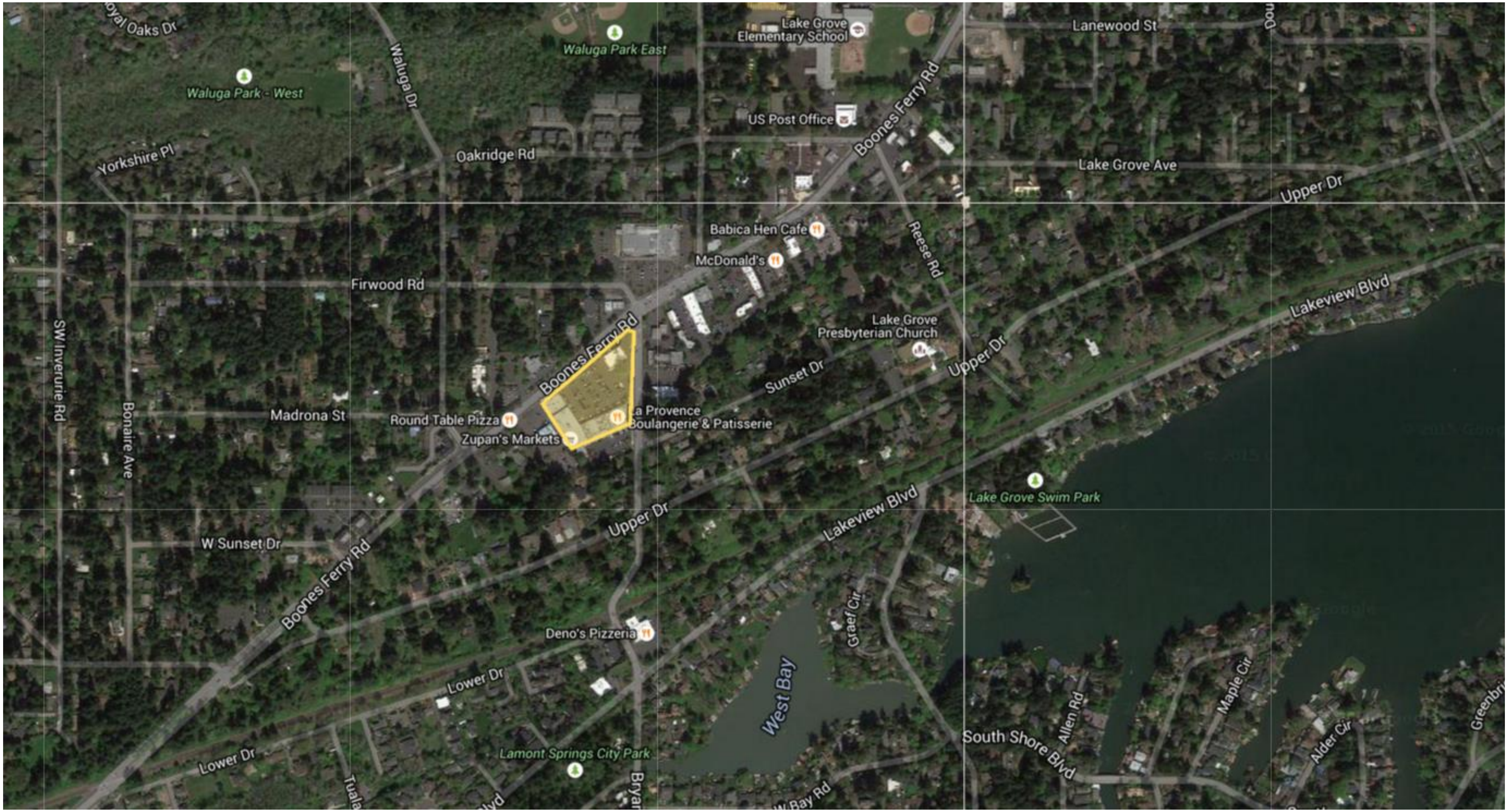

NW Ironwood Ln
NW Durrett St
NW Birkendene
NW Fern Ridge Dr
NW Stimpson Ln
NW Justus Ln
NW Harding Ct
NW McDaniel Rd
NW Mill Pond Rd
NW Miller Rd
NW Cannon Way
NW Pinnacle Dr
NW Benson Ln
NW Crestview Way
NW Hopedale Ct
NW Silver Ridge Loop
NW Bartholomew Dr
NW Benson St
NW 111th Ave
Forest Heights
HomeOwners Association
Starbucks
NW Tudor Ln
Mill Pond Park
NW Norfolk Ct
NW Rainmont Rd
NW La Cassel Crest Ln
NW Miller Rd
NW Engleman St
NW Miller Rd
NW Wood Rose Loop
NW Mendenhall St
Lost Park
NW Morgan Ln
NW Mayfield Rd
NW Slocum Way
Wells Ct
NW Benfield Dr
NW Savoy Ln
NW Fullner Ct
NW Lost Park Dr
Morgan Ln
NW Mayfield Rd
NW Fleischner St
NW Benfield Dr
NW Ryan St
NW Miller Rd
NW Marvin Ln
Google


Sweet Ambrosia
CAKES PASTRIES GELATO
REALTY TRUST
OPEN
2037
LUNCH
PASTRIES & DESSERT
SUNDAY BRUNCH
GELATO

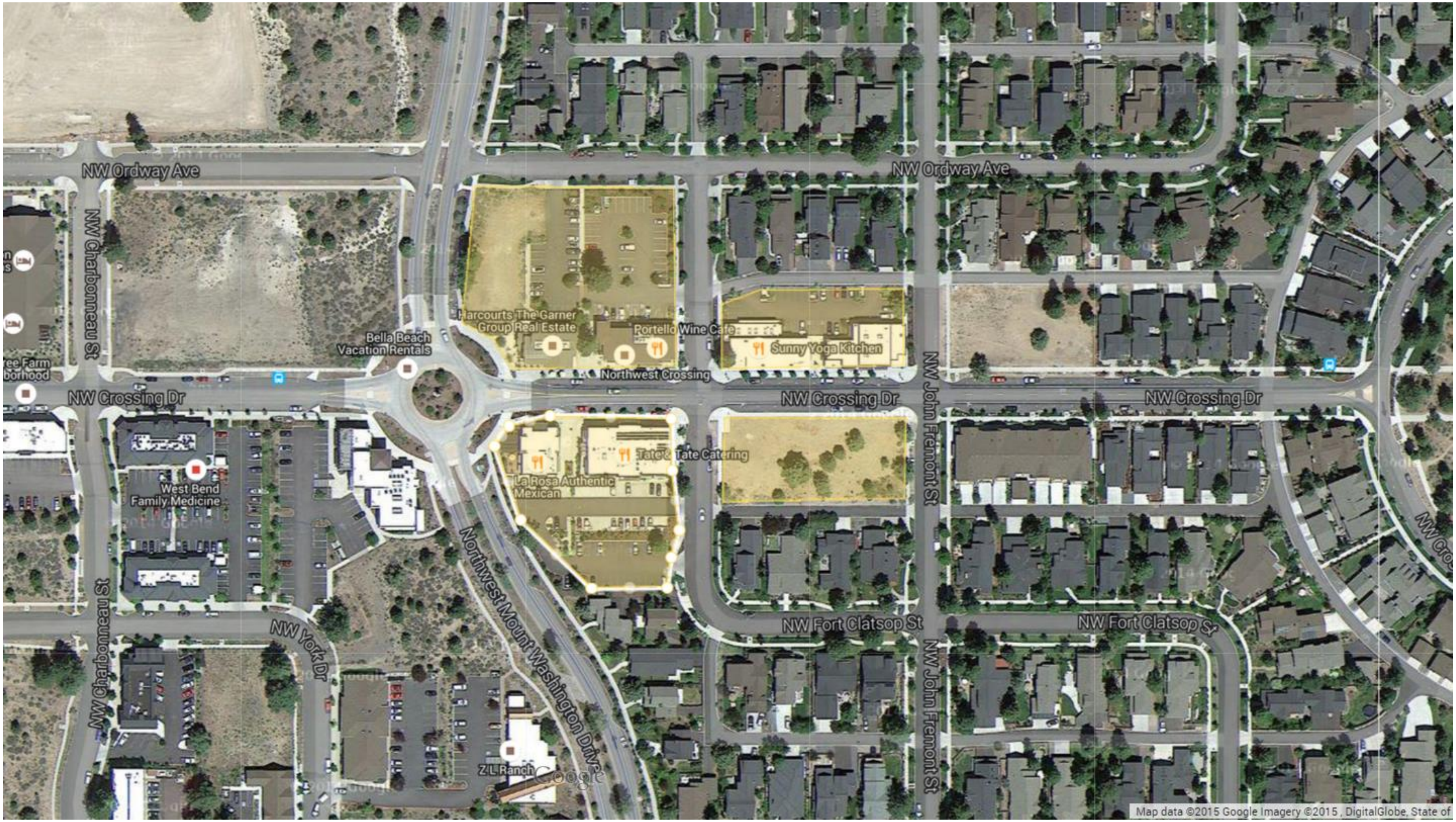

FOREST HEIGHTS
VILLAGE CENTER
SUPERCUTS
DentSpa
QUINN'S PRIME & VINE
Design Studio
In Stitches
STARBUCKS COFFEE
Cleaners
Sweet Ambrosia
FOREST HEIGHTS
HOMEOWNERS ASSOCIATION
REALTY TRUST
POSTALANNEX+

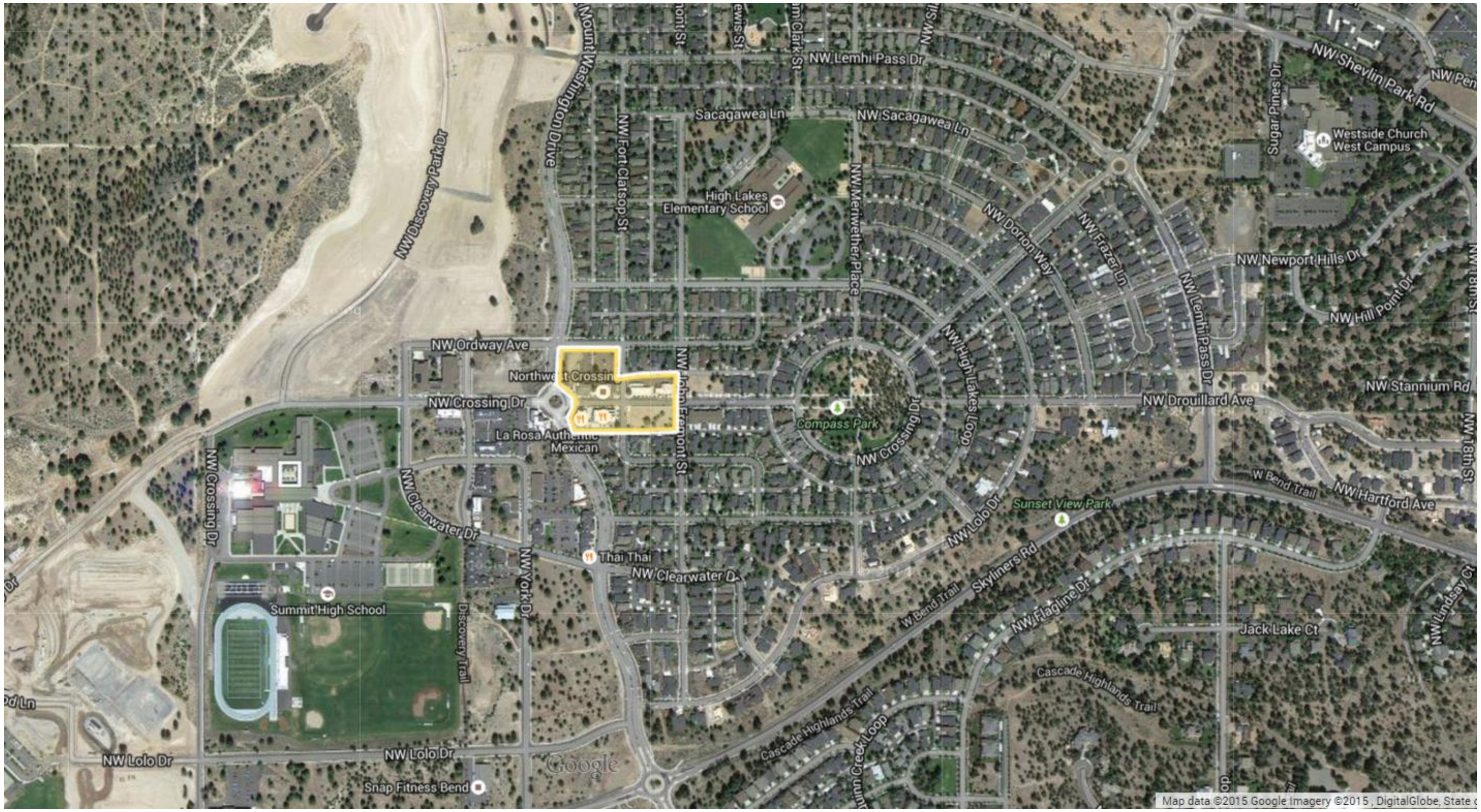

PIZZICATO
STARBUCKS COFFEE
2025

Lake Grove Shopping Center

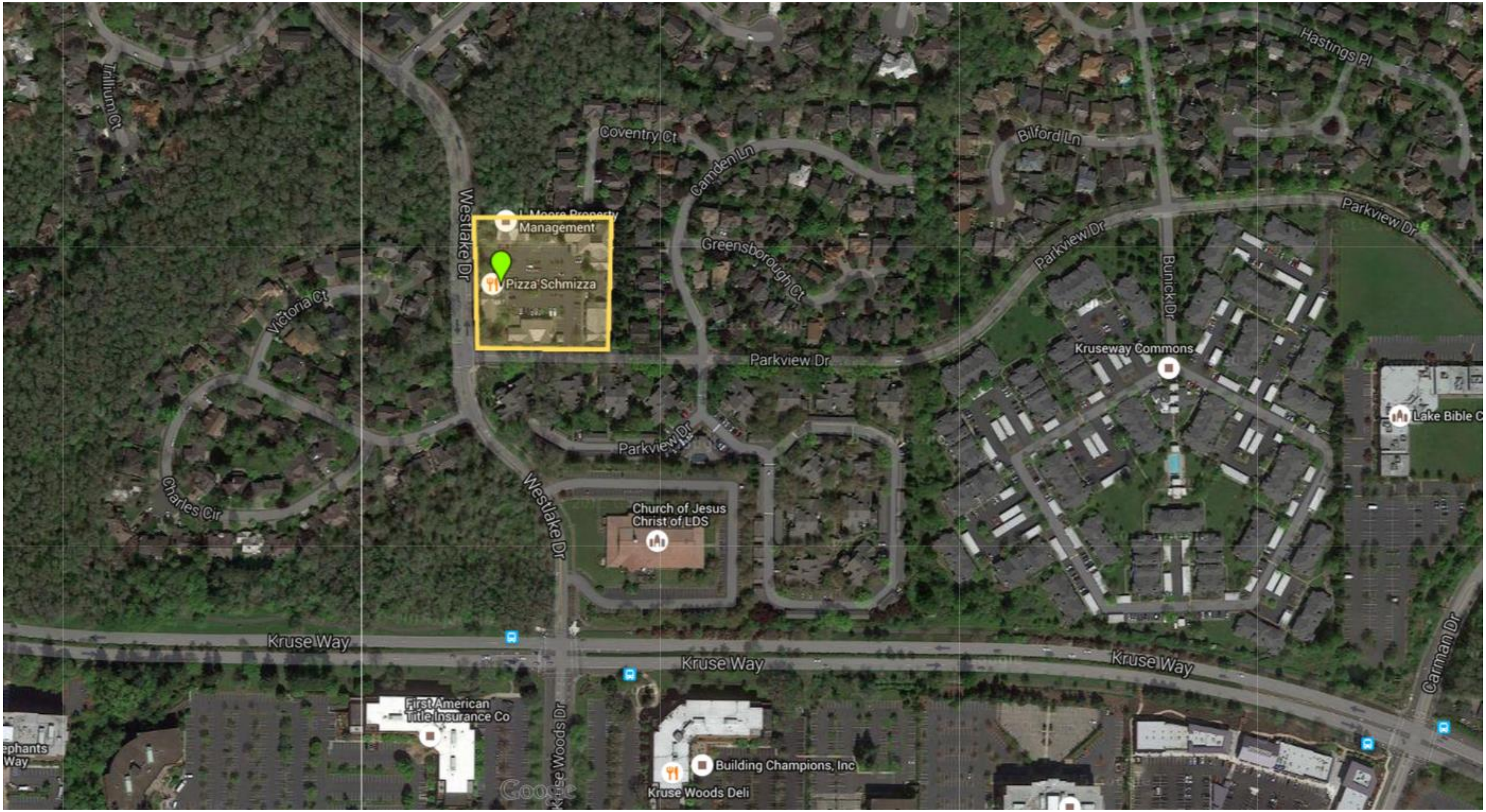

Lake Grove Elementary School
Waluga Park East
Waluga Park - West
Lanewood St
US Post Office
Boones Ferry Rd
Oakridge Rd
Yorkshire Pl
Lake Grove Ave
Upper Dr
Babica Hen Cafe
McDonald's
Reese Rd
Firwood Rd
Lakeview Blvd
Lake Grove Presbyterian Church
SW Inverurie Rd
Sunset Dr
Bonaire Ave
Madrona St
Round Table Pizza
La Provence Boulangerie & Patisserie
Zupan's Markets
Lake Grove Swim Park
W Sunset Dr
Deno's Pizzeria
Graef Cir
West Bay
Lower Dr
Maple Cir
Allen Rd
South Shore Blvd
Alder Cir
Lamont Springs City Park

Northwest Crossing Neighborhood Center

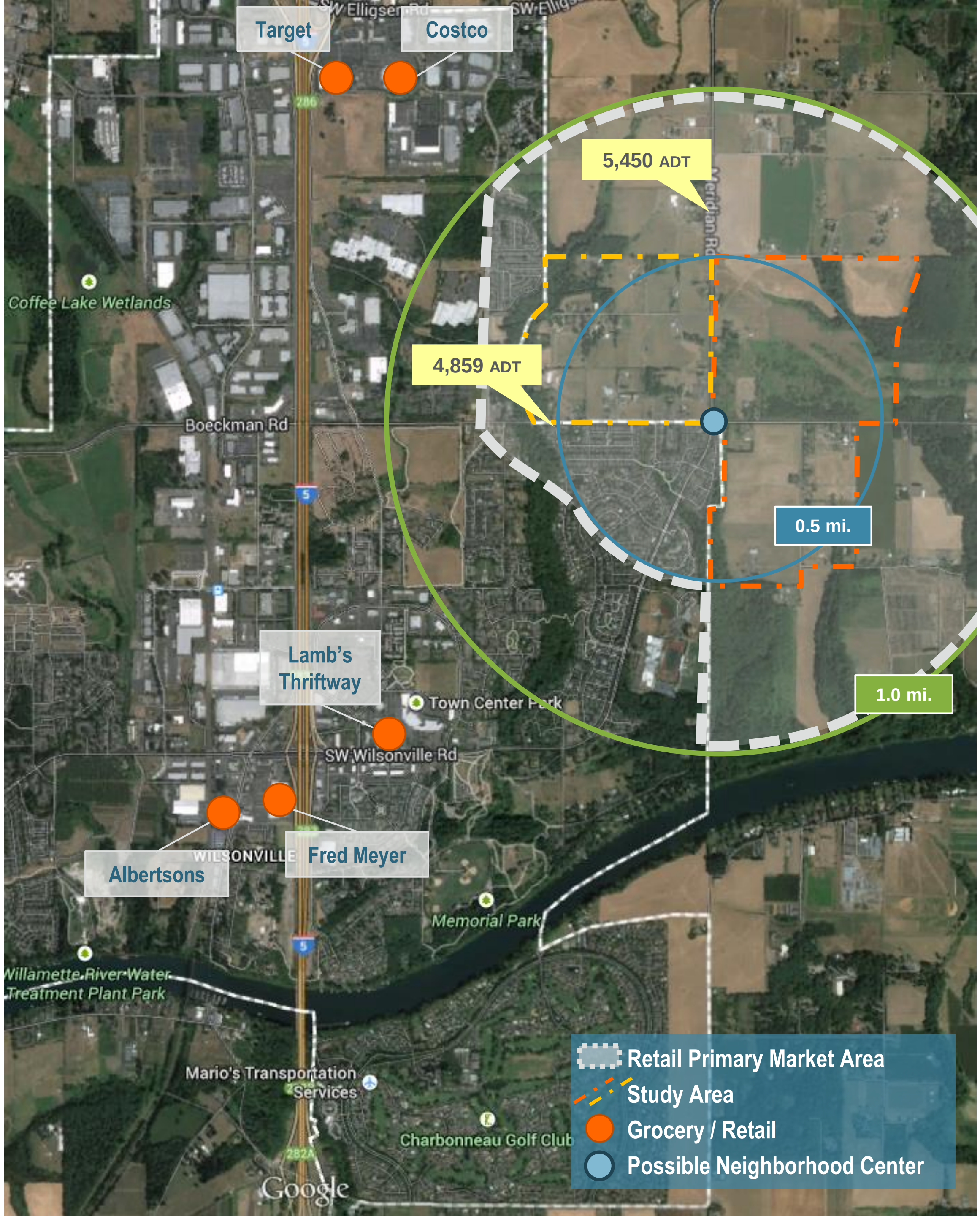



NW Lemhi Pass Dr
NW Shevlin Park Rd
Sacagawea Ln
NW Sacagawea Ln
Westside Church West Campus
High Lakes Elementary School
NW Discovery Park Dr
Mount Washington Drive
NW Fort Clatsop St
NW Merriwether Place
NW Dorion Way
NW Frazer Ln
NW Newport Hills Dr
NW Hill Point Dr
NW Lemhi Pass Dr
NW Ordway Ave
NW Crossing Dr
La Rosa Authentic Mexican
NW High Lakes Loop
NW Drouillard Ave
NW Stannium Rd
Compass Park
NW Crossing Dr
NW 18th St
NW Crossing Dr
NW Clearwater Dr
W Bend Trail
NW Hartford Ave
NW Lolo Dr
Sunset View Park
Thai Thai
NW Clearwater Dr
NW York Dr
Skyliners Rd
Summit High School
Discovery Trail
NW Flagline Dr
Jack Lake Ct
NW Lindsay Ct
Cascade Highlands Trail
NW Lolo Dr
Snap Fitness Bend
Google
Map data ©2015 Google Imagery ©2015, DigitalGlobe, State of

Westlake Village


Trillium Ct
Coventry Ct
Camden Ln
Bilford Ln
Hastings Pl
Parkview Dr
Westlake Dr
Management
Pizza Schmizza
Greensborough Ct
Bunick Dr
Victoria Ct
Parkview Dr
Kruseway Commons
Lake Bible C
Charles Cir
Church of Jesus Christ of LDS
Kruse Way
Carman Dr
First American Title Insurance Co
Building Champions, Inc
Kruse Woods Deli
Kruse Woods Dr

Retail / Commercial Analysis (2014)


Target
Costco
5,450 ADT
4,859 ADT
Meridian Rd
Coffee Lake Wetlands
Boeckman Rd
0.5 mi.
1.0 mi.
Lamb's Thriftway
Town Center Park
SW Wilsonville Rd
Albertsons
Fred Meyer
WILSONVILLE
Memorial Park
Willamette River Water Treatment Plant Park
Mario's Transportation Services
Charbonneau Golf Club
Retail Primary Market Area
Study Area
Grocery / Retail
Possible Neighborhood Center

At Half Build Out (2014 Analysis)

Industry Group	Future Demand (Retail Potential)	Current Supply (Retail Sales)	Spending Gap	Net New Demand (SF)
Furniture & Home Furnishings Stores	$1,655,673	$228,467	$1,427,206	250
Electronics & Appliance Stores	$2,084,632	$1,182,013	$902,619	150
Bldg Materials, Garden Equip. & Supply Stores	$2,182,480	$0	$2,182,480	700
Grocery Stores / Food and Beverage	$13,697,992	$0	$13,697,992	25,500
Health & Personal Care Stores	$3,946,138	$0	$3,946,138	1,650
Gasoline Stations	$6,768,188	$0	$6,768,188	600
Clothing & Clothing Accessories Stores	$4,448,471	$238,874	$4,209,597	700
Sporting Goods, Hobby, Book & Music Stores	$2,014,630	$75,760	$1,938,870	700
General Merchandise Stores	$13,567,391	$0	$13,567,391	4,900
Miscellaneous Store Retailers	$2,485,931	$530,133	$1,955,798	1,800
Food Services & Drinking Places	$8,228,230	$1,209,589	$7,018,641	4,400
Total				**41,350**

At Full Build Out (2014 Analysis)

Industry Group	Future Demand (Retail Potential)	Current Supply (Retail Sales)	Spending Gap	Net New Demand (SF)
Furniture & Home Furnishings Stores	$2,483,510	$228,467	$2,255,043	400
Electronics & Appliance Stores	$3,126,949	$1,182,013	$1,944,936	300
Bldg Materials, Garden Equip. & Supply Stores	$3,273,719	$0	$3,273,719	1,000
Grocery Stores / Food and Beverage	$20,546,987	$0	$20,546,987	38,250
Health & Personal Care Stores	$5,919,207	$0	$5,919,207	2,550
Gasoline Stations	$10,152,283	$0	$10,152,283	800
Clothing & Clothing Accessories Stores	$6,672,707	$238,874	$6,433,833	1,050
Sporting Goods, Hobby, Book & Music Stores	$3,021,946	$75,760	$2,946,186	1,100
General Merchandise Stores	$20,351,086	$0	$20,351,086	7,400
Miscellaneous Store Retailers	$3,728,896	$530,133	$3,198,763	2,800
Food Services & Drinking Places	$12,342,346	$1,209,589	$11,132,757	6,800
Total				**62,450**

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Strategic Advisors to Public and Private Development

Appendix L. Public Involvement Summary

FROG POND AREA PLAN
Creating a great community