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DATE: July 1, 2019
TO: Dan Cardwell and Jessica Gwilt, Pierce County
CC: Wayne Carlson and Brittany Port, AHBL
FROM: Bob Parker, Denise Chin, Sadie DiNatale, Ryan Ulsberger
SUBJECT: PIERCE COUNTY EMPLOYMENT DENSITY SURVEY TECHNICAL MEMORANDUM

1 Summary

An initial step in updating the methodology for Pierce County's buildable lands program is to review the methodology used to complete the 2014 Buildable Lands Report (BLR) and identify methodological changes based on amended state legislation, data availability, and best practices. Task 1.2 of the Buildable Lands Program Support work program includes an evaluation of the past employment density survey methodology, proposed refinements the approach, and conducting a new employment density survey for Pierce County. This memorandum summarizes ECONorthwest's initial research and analysis related to this task.

Several refinements to the 2014 methodology could improve the capacity and land need estimates. Given the amount of variability that exists in broad employment categories, and PSRCs regional plans, we recommend that any methodology employ the principles of simplicity and transparency. More complicated methods do not necessarily improve the results. We recommend the County consider adjustments for employment in residential areas and using the PSRC center framework.

Pierce County's challenge is developing an acceptable methodology that can be applied across many jurisdictions that range from urban centers to suburbs, to rural communities, to rural areas. After a thorough investigation of the methodological options, we make the offer the following recommendations:

- **Continue to use an EPA based method**. Given the countywide scope and the diversity of cities, EPAs are the most accurate and practical method for estimating employment capacity of vacant and under-utilitized land as well as land demand.

- **Consider refinements to the methods used in the 2014 BLR.** The County could make refinements to both the capacity and land demand estimates.

    o **Consider allocating some employment to non-employment lands**. Our review of the 2014 BLR suggests that all of the employment growth increment is allocated to employment lands. We suggest considering allocating some employment to non-employment lands.

    o **Consider disaggregating employment forecasts to three or more categories.** A review of the 2014 BLR only identified single value employment figures. The PSRC data ECO used for the employment density analysis in section 3 is available by city disaggregated by sectors or 2-digit NAICS codes. At the

simplest, the models could differentiate between retail, office, and warehouse employment densities.

- **Consider developing a land use typology based on PSRC's Regional Centers Strategy. Typology by PSRC regional centers.**[1] PSRC's VISION 2040 calls for the creation of central places with a mix of uses and activities connected by efficient transportation. PSRC designated 29 regional growth centers which are locations of the region's most significant business, governmental, and cultural facilities and are planning for growth. PSRC also identified nine regional manufacturing/industrial centers, which are locations for more intensive industrial activity. According to PSRC, both regional growth centers and regional manufacturing/industrial centers are focal points for planned growth, economic development and transportation infrastructure investments.

  Moreover, the framework identifies three primary geographies: Metropolitan Cities (16 centers), Core Cities (17), and Unincorporated Urban Areas (3). Five regional growth centers and two industrial/manufacturing centers are located in Pierce County.

  PSRC's 2013 Monitoring Report presents employment densities for each of the areas based on 2010 data. Exhibit X shows employment densities for Pierce County Centers. The observed densities are lower than the commercial assumptions in all instances, and considerably lower than the 2014 industrial assumptions for the industrial/manufacturing centers.

  Given that much of the county's employment is located outside these centers, any method will require assumptions for capacity of those lands. The County could use the 2014 assumptions, or use an approach based on city type.

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[1] https://www.psrc.org/sites/default/files/centers_monitoring.pdf

2 Background

An initial step in updating the methodology for Pierce County's buildable lands program is to review the methodology used to complete the 2014 Buildable Lands Report (BLR) and identify methodological changes based on amended state legislation, data availability, and best practices. Task 1.2 of the Buildable Lands Program Support work program includes an evaluation of the past employment density survey methodology, proposed refinements the approach, and conducting a new employment density survey for Pierce County. This memorandum summarizes ECONorthwest's initial research and analysis related to this task.

Pierce County last completed an employment density in 2007. The County is interested in whether the methods and assumptions used in the 2010 Survey are still reasonable, and if there are ways to improve them. AHBL subcontracted to ECONorthwest to provide this analysis. This document details the process of confirming employment density assumptions in Pierce County. The key questions considered in this task are:

- How accurate were the previous methods used?
- How does employment density vary by and within employment sectors?
- How does employment density vary by geography (e.g., cities)?

The 2010 analysis used Employment Security data that allowed matching of specific employers to tax lots. ESD no longer releases parcel-specific employment data. Thus, the updated employment density survey will require a different method to update the employment density assumptions. In addition, the County desires to understand how employment densities may have changed over time based on changing work configuration and technologies. ECONorthwest conducted the analysis presented in this memorandum using the following approaches:

(1) Spatial analysis in GIS using PSRC employment data by city and census tract

(2) A review of studies surrounding buildable land inventories, employment surveys, and other relevant research to observe new employment density methods or consider changing assumptions

(3) Informational interviews with real estate professionals to gain insight on recent trends in commercial and industrial employment in Pierce County

The 2014 BLR used a relatively simple method that applied standardized average employee per acre assumptions for commercial and industrial uses. The memo concludes with a discussion of the merits of the method used in the 2014 BLR as well as alternative methodological options for estimating demand for employment land.

The following sections provide legal context to buildable land inventories in Pierce County under Washington state's Growth Management Act; and a discussion of past methods and assumptions used in Pierce County's Employment Density Surveys.

2.1 Legal Context

The employment density survey provides data that support assumptions used to determine land needed for employment uses. The statutory guidance from the program is codified in RCW 3670A.215. Specifically, the following two subsections address density of employment:

- Based on the actual density of development, review commercial, industrial, and housing needs by type and density range to determine the amount of land needed for these uses for the remaining portion of the current 20-year planning period (RCW 36.70A.215(3)(e));

- Determine if there is sufficient employment capacity for the remainder of the planning period based upon planned and achieved densities (RCW 36.70A.215(3)(e));

Section 3 provides further guidance on how the data are used:

(a) Determine whether there is sufficient suitable land to accommodate the countywide population projection established for the county pursuant to RCW 43.62.035 and the subsequent population allocations within the county and between the county and its cities and the requirements of RCW 36.70A.110;

(b) Determine the actual density of housing that has been constructed and the actual amount of land developed for commercial and industrial uses within the urban growth area since the adoption of a comprehensive plan under this chapter or since the last periodic evaluation as required by subsection (1) of this section; and

(c) Based on the actual density of development as determined under (b) of this subsection, review commercial, industrial, and housing needs by type and density range to determine the amount of land needed for commercial, industrial, and housing for the remaining portion of the twenty-year planning period used in the most recently adopted comprehensive plan.

The 2018 *Buildable Lands Guidelines* document provide concise direction on the process and distill the requirements into two questions: How much land was actually developed for commercial and industrial uses within the UGA since the last comprehensive plan was adopted or the last evaluation completed? Based on this and other relevant information, how much land would be needed for commercial and industrial development during the remainder of the 20-year comprehensive planning period?

Thus, while the guidelines provide direction on how to address commercial and industrial development, they are not proscriptive and provide considerable local discretion with respect to methods. Because the focus of this research is on employment density, we do not address other aspects of the methods related to commercial and industrial land.

2.2 Methods and Assumptions Used in Previous Studies

In this section, we discuss past methods and assumptions from Pierce County's 2007 Employment Density Survey and 2014 Buildable Lands Report. As a general observation, the methods used for employment density surveys have not changed much throughout the years.

Definitions: Floor Area Ratios, Employees Per Square Foot, and Employees Per Acre

The Buildable Lands Guidelines and BLR reports use the terms Floor Area Ratio (FAR), Employees Per Square Foot (Emp/sf), and Employees Per Acre (EPA). We start by establishing definitions and the relationship between each of these metrics.

By definition, employment density is the ratio of labor to land. Several measures of employment density exist: FARs, EPAs, and sq. ft. per employee. To understand the relationship between Floor Area Ratios, square feet per employee, and employee per acre ratios, we start with definitions.

- Floor Area Ratio (FAR). The Floor Area Ratio is the total building square footage (building area) divided by the site size square footage (site area)

- Square Feet Per Employee (SFE). The total square feet required for employees. This includes shared spaces such as lobbies, hallways, elevators and stairwells, restrooms, and other built space.

- Employee per acre ratio (EPA). The total number of employees divided by the size of the site. Implicitly, this is a net density figure; it does not include land needed for streets and other public uses.

Given these definitions, there is a simple mathematical relationship between the three measures as expressed below.

FAR can be derived from EPA and SFE as follows:
(EPA*43560)/SF per Emp

SFE can be derived from EPA and FAR:
(FAR*43560)/EPA

EPA can be derived from SFE and FAR:
(FAR*43560)/SFE

A key issue in estimating EPA ratios is what values are used in the numerator and denominator. The numerator is typically straightforward—reported employment figures. Most analysis we have reviewed do not make distinctions about shifts, or whether employees are full or part time. This is consistent with the way employment data are typically presented.

The issue of the denominator is considerably trickier. The nature of commercial and industrial development is such that it often spans several tax lots. In these instances, calculating density on a tax lot basis can be misleading. Shopping centers, industrial parks, or any employment use

that includes multiple tax lots should be analyzed as combined sites. Parking can also be an issue—is parking part of an employment use or not? If it is in the same ownership and directly related to the use, it should be.

Mixing of employment further complicates matters. In a detailed analysis in Bend, Oregon, we found considerable mixing of employment that would be considered commercial or industrial. The data showed considerable employment in industrial zones that would typically be considered commercial, and the opposite. Zoning codes typically are not proscriptive by NAICS categories.

A final issue is employment that is on lands not zoned for employment. In Oregon cities, we have observed that between 10% and 25% of employment in a city can be on lands that are not zoned for employment. These include typical uses that sometimes locate in residential zones such as schools and churches, as well as home occupations, construction firms, and certain types of retail or service firms that are permitted by zoning.

One of the issues that complicates estimating land capacity is variability. As pointed out in previous Pierce County employment density surveys, employment density in commercial zones can range from more than 100 per acre for restaurants to a few per acre for certain retail uses. Employee per acre ratios implicitly assume…

Pierce County 2007 Employment Density Survey

Pierce County conducted employment density surveys in 2004 and 2007. In those surveys, the method was based on location-specific employment data from the Washington State Employment Security Department (ESD)[2] and parcel data from the Pierce County Assessor-Treasurer. Businesses included in the survey were randomly selected and categorized based on the sector.

The 2007 Employment Density Survey utilized building permit data, ESD covered employment data, and Pierce County Assessor-Treasurer (ATR) parcel records. Data for Downtown Tacoma was segregated and reported separately due to its unique development intensity—downtown Tacoma reported much higher employment density than elsewhere in the County.

To arrive at the average employee per acre numbers, the sum of the total number of employees and parcel acreage under each category was divided by the total employees by total acreage.

The 2007 Survey identified several data limitations such as unavailable ESD employment data for the entire five-year trending period at the initiation of the project; a large number of commercial/industrial permits in 1999 and 2000 could not be associated with ESD employment data points.

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[2] The ESD data includes firms that report covered employment. The data includes average employment, NAICS codes, and is geolocated. This makes calculating employment densities at the industry or zoning district level relatively straightforward: select a sample of employers, sum the average employment, and then divide it by the number of acres reported in the Assessor-Treasurer tax lot database.

Pierce County 2014 Buildable Lands Report

The 2014 BLR adopted the same methodology as the 2002 and 2007 analyses. The one exception in the 2014 BLR methodology is the consolidation of "underdeveloped" and "redevelopable" categories into one "underutilized" category, as well as the criteria used to identify parcels within this category. The authors note that this step was in effort to achieve inter-departmental consistency between the County's land use and transportation models.

Exhibit 1 provides a summary of resultant employment densities from past employment surveys and buildable lands reports in Pierce County. The report consistency applies the 8.25 EPA for commercial and the 19.37 EPA for industrial in all geographies but Tacoma.

Exhibit 1. Pierce County Employment Density Comparisons (employees per acre)

Employment sector	1999 Survey	2004 Survey Average	2004 Survey Median	2007 Survey	2014 BLR
Industrial	11.15	13.8	21.32	11.15	8.25
Commercial	34.3	21.92	19.37	19.37	19.37
Government	22.7	7.74	n/a	n/a	n/a
Downtown Tacoma	318	356.77	235.59	235.59	**

Source: ECONorthwest, with data from Pierce County 2007 Employment Density Survey and Pierce County 2014 Buildable Lands Report

** Table 11a of the 2014 Buildable Lands Report (page 225) shows that higher assumptions were used for Tacoma in many zones. The report does not provide an explanation of the source of the assumptions.

2018 Buildable Lands Guidebook

Chapter 3 of the 2018 *Buildable Lands Guidebook* provides guidance on approach and methodologies related to commercial and industrial land capacity. The guidebook indicates that data from the Institute of Transportation Engineers (ITE) presents employees per square footage of buildable area data their trip generation manuals to determine potential trip generation for development and redevelopment sites. Obtaining a copy of the ITE manual was cost prohibitive for this project.

The guidebook suggests that an alternative method that may be used is an employment density calculation based on a ratio of employees per net acre, if employee estimates are available. It suggests that Washington State Employment Sector data can supply jobs per acre estimates. ECO was unable to locate any analysis of employment density based on sector data. The next section presents an analysis of Census tract level. sector data compiled by PSRC.

The Guidebook also suggests that employment densities can be calculated using FAR for buildings constructed during the evaluation period. This approach can be refined by building type or type of employment if data are available. FAR data can then be combined with SF/Emp data from ITE or other sources to arrive at an estimate of employees and employment density in

EPA. This approach would allow for an estimate of achieved employment densities per land use category.

3 Pierce County 2019 Employment Density Analysis

The following sections detail analyses carried out by ECONorthwest to document achieved employment densities and inform methodological options.

3.1 Spatial Analysis of Employment Patterns and Densities

ECO explored alternative methods for estimating employment densities. This analysis intended to assess a methodology for estimating the density of employment throughout Pierce County, Washington using PSRC data at the census tract level combined with parcel data.

Our assessment of this approaches is that available data is not consistent enough to accurately predict employment densities with granularity to enable decision making. However, with directed effort, data maintained by Pierce County and other regional planning agencies could potentially be used for employment density analysis. We are unable to estimate the amount of effort it would take to make the data reasonably reliable for BLR purposes. Two factors are particularly problematic: (1) variability in employment densities within generalized categories; and (2) the quality of the underlying land use/parcel data.

Methodology

Assessors data is some of the most routinely maintained data by counties and represents the smallest geography available from tracking land use. Different properties have different appraisal types; for example, commercial properties are assessed differently than residential properties. Recognizing this advantage, the parcel database was used to identify the different types of land use occurring on properties throughout Pierce County.

As mentioned before, different types of appraisals occur for different types of land uses. Possible appraisal types are summarized in Exhibit 2.

Exhibit 2. Pierce County Appraisal Types

Land Use Categorization	Appraised Property Types
Residential Landuses	
	Residential
	Residential Leasehold
	Condominium
	Reference
Economic and Other Landuses	
	Commercial
	Commercial Condo
	Commercial Leasehold
	Commercial Multi Unit
	Industrial
	Trended Investment

Source: Pierce County Assessor

Appraisal types do not always correspond to the actual use of a parcel. Housing land uses can incorporate some economic uses which were not captured in this analysis. There is not an accurate way to predict where self-employed or work-from-home employees are based geographically from any available datasets. Furthermore, commercial and industrial appraisal types can also have residential land uses or community and cultural land uses which do not provide any employment. As a result, the Pierce County Assessor also identifies land use descriptions which attempts to clarify what the parcel's current use is. For non-housing appraisal types in Pierce County, there were 179 distinct land use descriptions. This analysis attempted to match land use descriptions to major sectors as designated by the North American Industry Classification System (NAICS). The land use NACIS describes the major sectors of employment as the following:

- Construction and Resources
- Finance, Insurance and Real Estate (FIRE)
- Manufacturing
- Retail
- Services
- Wholesale Trade, Transportation, and Utilities (WTU)
- Government
- Education

The minimum geographical unit available with employment coverage covering all of Pierce County is by census tract. Thus, each parcel was associated with the corresponding census tract.

Employment data was acquired from the Puget Sound Regional Council (PSRC) who has worked with the Washington State Employment Security Department (ESD) to conduct the

Quarterly Census of Employment and Wages (QCEW) and complied into the Covered Employment Estimate Dataset. This data collects the employment information for all employees covered by the Washington Unemployment Insurance Act and aggregates this data across census tracts. However, out of privacy concerns for employers, any employer who has more than 80% of the employment share for a given census tract has the value withheld.

Finally, the total land area for a given NACIS Major Sector was calculated by parcel area for each census tract. The PSRC employment data was joined to the parcel data using the census tract id, which revealed a total employee count per NACIS Major Sector land area where available. In areas where employment data was obscured, these parcels were removed from the analysis as

The result is an employment density covering the entirety of Pierce County.

Results

The results of the analysis, summarized in Exhibit 3, ranges of employment density range from 49 employees per acre for Finance, Insurance, and Real Estate uses to 2 employees per acre for both Construction and Resource, and Wholesale, Transportation, and Utility land uses in Pierce County. Unsurprisingly, land uses which are concentrated in office environments, or retail and service uses centered in Urban Centers have much higher employment densities that land uses which typically require larger footprints such as warehousing and industrial and manufacturing uses.

Exhibit 3.: Summary of Employment Density for NAICS Major Sectors

Economic Use Category	Total Census Tracts	Total Parcels	Total Acres	Total Employment	Employment Land Use Ratio (Employment/Acre)
CONSTRUCTION/RESOURCE	47	271	4,974	10,097	2
CONSTRUCTION/RESOURCE - EMPLOYMENT DATA REMOVED	3	32	569		
EDUCATION	132	746	5,206	20,494	4
FINANCE/INSURANCE/REAL ESTATE	76	350	241	11,716	49
FINANCE/INSURANCE/REAL ESTATE - EMPLOYMENT DATA REMOVED	11	14	12		
GOVERNMENT	96	369	2,318	19,013	8
MANUFACTURING	47	919	4,069	11,619	3
MANUFACTURING - EMPLOYMENT DATA REMOVED	28	89	1,034		
RETAIL	109	2,988	3,051	31,124	10
RETAIL - EMPLOYMENT DATA REMOVED	31	238	246		
SERVICES	147	7,566	15,151	113,820	8
SERVICES - EMPLOYMENT DATA REMOVED	2	9	22		
WHOLESALE/TRANSPORTATION/UTILITIES	86	2,054	7,868	16,389	2
WHOLESALE/TRANSPORTATION/UTILITIES - EMPLOYMENT DATA REMOVED	58	285	1,355		
UNCLASSIFIED	151	4,653	12,620		

Source: Pierce County, PSRC, Census, ECONorthwest

However, estimates of employment are likely to be lower than the actual employment because of the withheld employment estimates for those employers which had more than 80% of employment within a census tract. For example, employment in the Frederickson Manufacturing and Industrial Center is anchored by the Boeing Manufacturing Facility. The employment this facility was withheld because Boeing met the 80% threshold to obtain

anonymity in the PSRC employment dataset. Boeing is the 4th largest employer within Pierce County with an estimate employment of 1,550 employees as of 2018[3] and would represent an employment ratio of 2.7 employees per acre if all employees were working on the Fredrickson property.[4]

Review and Assessment

After reviewing the results from the employment density analysis for Pierce County, the results were not as conclusive as desired. In short, we do not conclude that this is a viable method that could be incorporated into the BLR.

In particular, two obstacles appeared while using the data available from the Pierce County Assessors Data and the PSRC Employment Dataset.

1. Assessors land use and appraisal types are not consistent across different land uses. Furthermore, land uses descriptions can describe a variety of potential uses that do not relate to economic activities cleanly; if they are classified at all.

2. Employment data is sensitive information and is often obscured to maintain the anonymity of an employer.

If these obstacles were mitigated, the feasibility of using the Pierce County Assessors Data and the PSRC Covered Employment Estimates could become a viable method. In particular, verifying the appraisal types and the land use descriptions of given parcels in Pierce County Assessors database would increase the resolution of the analysis. Furthermore, a partnership with the Washington State Employment Security Department to retrieve the employment data over the 80% employment threshold for a given census tract would allow for more refined results that could better estimate employment density in the county.

3.2 Literature review

EOC conducted an extensive literature review that included academic articles, planning reports conducted in cities and counties within and outside of Washington state, relevant findings from a similar ECONorthwest review conducted in 2015 that was focused on industrial employment densities. We also explored employment density themes throughout the region and the US. One observation we made is that there is little academic research on employment density—a fact we found surprising. Exhibit 4 displays a summary of studies reviewed from Washington state. A more detailed matrix can be found in Appendix 1.

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3 Economic Development Board, https://www.edbtacomapierce.org/area-profile/2018-major-employers/, Accessed May, 2019

4 Manufacturing and industrial land uses exists on an estimated 571 acres for Census tract 731.08.

Exhibit 4. Summary of Methods, Assumptions, and Findings from Washington State Studies

Location	Methodology	Employment Density Assumptions (Emp./acre or SFE)		Findings
		Commercial	Industrial	
Counties				
Clark	• Building permits primary source of data from 2006-2016.	9.3	10.9	County has sufficient capacity to accommodate projected employment growth.
Island	• Suppressed data substituted with older available data. • For jobs missing in QCEW data, methodology from PSRC used to estimate total employment from covered employment. • City of Freeland excluded from calculation of employment density average due to lack of amenities (sewer). • Due to County's low industrial employment, rounded average from neighboring counties (Skagit, Clark, Pierce) used for industrial assumptions.	17.0	8.0	Sufficient capacity to accommodate anticipated employment growth.
King (BLR)	• Half of jurisdictions brought forward 2007 BLR density and capacity calculations; remainder cities required new capacity analysis • Location-specific densities reported in final analysis.	250 - 850 SFE*	250 - 851 SFE*	Sufficient capacity to accommodate residential, employment growth.
King (Emp. Capacity Analysis)	• Employment density assumptions from 2007 BLR. • Does not consider future fiscal impacts of redevelopment within Duwamish Industrial Manufacturing Center.	550 SFE	800 SFE	• Total assessed land value for the South Park LID area is $2,458,285,700. • Total assessed value for the MIC site is $193,751,000.
Kitsap	• Methods for Land Capacity Analysis adjusted following Remand Order: 1) Using trend-based density factors for each residential zone 2) Increase public facility deduction to 20% 3) Remove discount for environmental purposes in Urban Restricted Zone 4) Platted lots adjustment	969 SFE	500 SFE	Sufficient capacity to meet industrial and commercial development to 2025, 2016-2036.

Location	Methodology	Employment Density Assumptions (Emp./acre or SFE)		Findings
		Commercial	Industrial	
Snohomish	• Existing structures (as of April 2011) counted as population or employment base; proposed, built, or occupied structures after April 2011 counted as future capacity.	200 - 700 SFE	300 - 20,000 SFE	Adequate land capacity reported in the County for the 2025 adopted UGA population and employment growth targets.
Thurston		3.3	1.5	Sufficient land supply to support projected growth to 2035.
Whatcom	• Based on 2009 Land Capacity Analysis methodology	626 - 900 SFE	775 - 3,500 SFE	Surplus capacity to meet future employment needs
Region				
Puget Sound Regional Council	• Relevant mixed-use zones and land classification included into analysis if related to industrial land. E.g. "Business Park"; "Employment Center" • Parcels considered industrial land if significant industrial development present or permitted to occur. • Four categories of industrial lands: Core industrial; Industrial commercial; Military industrial; Aviation operations areas • Special consideration given to tribal land; natural resource lands; limited areas of more intense rural development; planned developments		0.25 - 14.7*	Employable land capacity variable to area: • Strong demand / limited capacity: Interbay-Ship Canal, Duwamish-North Tukwila, Kent-Renton, and SeaTac-Des Moines subareas • Strong demand/adequate capacity: Frederickson- Lakewood, Southwest Everett and Tacoma-Puyallup subareas • Adequate capacity: I-405 Corridor, Arlington-Marysville, and North-Central Everett subareas • Surplus capacity: DuPont-Gray Field, Puget Sound Industrial Center (PSIC)-Bremerton-Sinclair Inlet, and Auburn-Sumner subareas
City				
Lakewood	• Developed a consolidated employment capacity model • Error in Pierce Co. BLR--one residential zone moved to commercial	12 - 25	15 - 25	Sufficient capacity to meet 2030, 2035 employment targets

Notes: *Location specific numbers reported; ranges provided here. SFE = Square foot per employee.

3.3 Interview findings

ECONorthwest conducted phone interviews with real estate professionals familiar with recent commercial and industrial development in Pierce County (Task 1.2, subtask 4 - Real Estate Professional Interviews). The purpose of the interviews was to better understand local development conditions and emerging employment trends in Pierce County. To the extent possible, ECONorthwest vetted reasonableness of employment density assumptions from the 2014 Buildable Lands study.

ECONorthwest interviewed the following real estate professionals:

1. Rob Allen, Senior Economic Development Specialist with Pierce County, Economic Development Department

2. Kevin Clegg, Special Assistant to the Executive for Business Services with Pierce County, Economic Development Department

3. Patrick Gemma, SVP Investment Officer with Prologis

3.3.1 Interview Key Themes

The interviews consisted of a series of questions (see Appendix B). The following sections describe the key themes from the interviews.

Revisit the 2014 Employment Density Assumptions

Pierce County's 2014 Buildable Lands study used the following employment density assumptions: 19.37 employees per acre for commercial and services (1 employee per 500 sq. ft.) and 8.25 employees per acre for industrial warehousing and manufacturing (1 employee per 900 sq. ft).

Interviewees suggested that while the commercial employment density assumption seemed reasonable, they are more practical in areas with generally higher densities, such as downtown Tacoma (we note that the BLR indicates much higher EPA assumptions were used in downtown Tacoma). The assumption seemed less practical (too high) for the more suburban areas of the county.

Interviews indicated they thought the industrial employment density assumption seemed inflated (too high). Four to five employees per acre seemed more reasonable, if not a little high. Further, employment capacity needs in industrial / manufacturing facilities will fluctuate depending on the amount of office space that exists in the facility (e.g., a large office component in an industrial / manufacturing facility will accommodate more employees per acre). When taking that factor into consideration, the industrial employment density assumption seemed more reasonable. The following assumption was provided to illustrate typical employment capacity needs: four employees per 1,000 sq. ft. for the office component with one employee per 1,000 sq. ft. for the industrial / manufacturing component.

Vary Average Employment Density Assumptions

Interviewees suggested that varying average employment density assumptions by geographic area and industry sector seemed reasonable.

By geographic area: It is reasonable to assume that downtown or high-density areas will have a higher average employment density assumption. However, lower average employment density assumptions should be assumed in more suburban cities and towns. Accordingly, average density could vary for each incorporated area or between incorporated area versus unincorporated area. An appropriate threshold to help inform varied density assumptions by geographic location was unknown.

By industry sector: Breaking out employment assumptions by sector also seemed reasonable. Large differences in employment densities exist between sector types, such as warehousing versus manufacturing. While an average density works in a general sense, a fair number of anomalies result in observable differences between sites of different sector types. Managing these anomalies may make the study more precise. For example, the manufacturing sector will accommodate more jobs per acre than wholesale trade and transportation; wholesale trade and transportation will accommodate more jobs per acre than warehousing (and big-box warehousing will accommodate fewer jobs per acre than other warehousing types).

Different industrial /manufacturing facilities (with office components) will typically demand different employment capacity needs as well. For example, a distribution center will typically have an office component accounting for 3% - 5% of total building sq. ft. A manufacturing facility will typically have an office component accounting for 10% of total building sq. ft.[5]

Technology and Automation Will Affect Employment Capacity Needs

Looking forward, interviewees suggested that technology and automation will have the biggest impact on employment capacity needs. Other commercial / industrial trends are not expected to drastically affect change. For example, automation of the manufacturing process is a much more significant portion of economic activity than any movement *toward* creative offices or makerspaces or *away* from shopping malls and big box stores. An interviewee compared other trends to an "artsy" community in a downtown area – the trend may be cool (innovation-wise) but does not scale very well and affects only a specific area.

A range of opinions exist about how technology and automation are currently changing employment capacity needs:

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[5] By using the previous example, four employees per 1,000 sq. ft. for an office component in an industrial / manufacturing facility: If both the distribution center and manufacturing facility were 100,000 sq. ft., the manufacturing facility would have about 40 office employees using 10% of the building while the distribution center would have about 12-20 office employees using 3-5% of the building.

- E-Commerce distribution centers (like Amazon) demand more employees per acre than traditional distribution centers because more people are needed to move goods in and around the center (and goods stay in the center for longer).

- Some distribution centers (like IKEA), are experiencing an interesting trend. Technology and automation reduce employment capacity needs, only for employment to increase soon after (although not to the same level). The hypothesis is that companies are "bouncing back" and can hire new employees to serve different roles than before.

Other Considerations

One interviewee provided a suggestion that may help inform employment density assumptions:

- Review the Institute of Transportation Engineers (ITE 10th addition) manual. ITE takes a deep dive into different land uses to determine traffic generation. It is possible that they determine traffic generation by using employment density assumptions. If this is true, the manual could offer a factual basis for Pierce County's assumptions. A caveat that small sample sizes may present limitations.

   We note that this approach is discussed in the 2018 *Buildable Lands Guidebook*.

4 Conclusions and Methodological Options

In general, most employment assumptions have remained the same since each county's previous employment density and/or buildable land study. This is likely because the relevant underlying data has not evolved much. Notable exceptions include Clark County, where lower employment densities were reported compared to its 2007 study. The City of Lakewood's study reported higher densities than what was found in Pierce County's 2014 study—the authors revised a zoning error that adjusted employment densities and showed that Lakewood has substantially more employment capacity than reported. An annotated literature review can be found in Appendix 2.

The following are methodological takeaways to note:

- **Employees per acre (EPA) vs. square feet per employee (SFE)**—some studies used employees per acre as a unit of measurement for employment densities, while others used square feet per employee. Because ESF requires an additional step to get to land estimates, we recommend using EPA as the measurement unit for employment density in Pierce County.

- **Densities seem to cluster around central figures**—while the results vary, employment densities (whether EPA or ESF) seem to cluster around some central figures (5-10 EPA for industrial uses; 15-25 EPA for commercial uses). These figures are not much different than those used in Pierce County's 2014 Buildable Lands Inventory and 2007 Employment Density Survey.

- **Location specific figures**—several studies developed location-specific employment densities (Chamberlain 2015; King County 2014; Gehrke and Srivastava 2012; Watson & Associates Economists Ltd. 2008). This could be an appropriate methodological approach for Pierce County to consider, which will be based on a taxonomy of development or place types. Considering the Cervero/Ewing method of defining place types could also be a useful methodological approach in determining location-specific figures.

- **Most studies relied on methods from their previous years**, with updates to employment data where possible. Lakewood, however, utilized a **hybrid method in calculating employment densities**, which combined a floor-to-area ratio method with acreage-based calculations using updated employment density factors identified by City staff. This method is worth consideration, given the time and resources available at Pierce County.

Notable Employment Trends in Washington State

- The Great Recession affected employment in the Puget Sound Region. Most studies noted, however, that the economy is bouncing back and recovering in their respective counties. Job growth in Washington is expected to rise over the next decade—several studies (e.g. Kitsap, Thurston) reported a projected increase in jobs, a majority of which will be in the commercial sector.

- There is an increasing number of remote workers/home businesses in the region. In Thurston County, for example, 20 percent of future jobs is projected to be in residential zones, which could be taken to mean remote, mobile employment and home-based businesses. The City of Lakewood reduced its total employment allocation by 12 percent to account for remote employees in its Employment Density Survey, consistent with a similar assumption in Pierce County's 2014 Buildable Lands Report.

Observations from Studies Outside of Washington State

- Accommodating future employment growth scenarios—the City of Reno, Nevada, made note of an impending Tesla factory that would increase employment in the city. The expansion of the University of Nevada in Reno was also a factor in future growth. The City utilized two growth scenarios, Baseline and Recent Trends to project future economic opportunities, where the latter doubled growth rate for manufacturing, wholesale trade, and transportation and warehousing to match Tesla's projected employment.

- Several studies (i.e. Reno, Minnesota, Placer County) used methods and assumptions informed by studies from other cities, such as Minneapolis, Washington state, Portland, Southern California, and Rhode Island.

4.1 Methodological Options

The primary objective of this research was to inform BLR methodologies around estimating land needed for employment. Several approaches exist for translating population/employment forecasts into land need. Exhibit 5 summarizes the approaches.

The first method is the easiest: jurisdictions should have current year population estimates as well as population forecasts. Estimates of the amount of developed commercial and industrial land should be developed during the supply analysis. The second method is similar to the first, but uses local employment estimates and forecasts.

The third method requires employee per acre assumptions. Employee-per-acre assumptions allow conversion of employment into acres. Employment density, however, varies considerably by industry—and even within industries. Thus, a small jurisdiction might use an assumption of 8 employees per acre, while a larger one might assume 15-20. Of importance here are whether the assumption is for *net* acres (i.e., land that is available for sale in parcels or lots after roads (right-of-way) has already been deducted, or gross acres (total land before those deductions): one should assume more employees on a net acre than on a gross acre, other things being equal.

Exhibit 5. Basic methods for estimating employment land demand

Method	Description
Population/developed land ratio	Uses the number of developed commercial and industrial acres per 1000 persons and extrapolates it to the planning horizon using the local population forecast.
Employment/developed land ratio	Uses the number of developed commercial and industrial acres per 1000 employees and extrapolates it to the planning horizon using the local population forecast. Requires both a current employment estimate and an employment forecast.
Employee per acre (EPA) ratio	Assumes a specific employment density, expressed in employees per acre. At the simplest level, the method uses an aggregate EPA ratio for all new employment. Requires both a current employment estimate and an employment forecast.
Floor area ratio (FAR) / Employees per sq. ft. (ESF)	Uses zoning to determine floor area ratios and allowable lot coverage. Lot coverage * FAR provides an estimate of built space in square feet. Built space * ESF provides an estimate of land capacity for employment.
Expert consultation	Relies on the expertise of local developers, business leaders and others to estimate land needs.

A variation of the third method is to build up to estimates of employees by using assumptions about floor-to-area ratios (FAR) and about square feet of built space per employee. For example, assumptions of 500 square feet of total (not usable or leasable) office space per employee and of a FAR of 0.3 (built space equals 30% of the buildable area) would yield about 26 employees per net acre, and about 21 employees per gross acre. This method tends to yield greater densities

than those typically assumed for employees per acre, perhaps because the FAR assumes for a single lot are hard to sustain over a larger area.

Each of these methods has limitations.

- **Population and Developed Land Ratio.** This method has two key limitations: (1) use of population forecasts to derive estimates of employment land; and (2) the quality of parcel data. The method is simple: divide developed acres by population to get a ratio of persons per acre (usually expressed as acres per 1,000 persons). A key issue is population is not a good proxy for employment and does not recognize variability of the amount of employment lands in a region. For example, a city that is an industrial center might have half its land in industrial uses; another may be a bedroom community with no industrial land. A second limitation is that assessor's parcel data typically requires considerable effort to identify lands in employment uses that are developed. As a result, this method provides very coarse estimates. We do not recommend considering this approach for the BLR.

- **Employment and Developed Land Ratio**. This is the same as the previous method, with the difference that it uses employment instead of population. ECO used the employment per developed land methodology to estimate EPAs (the analysis is summarized in Section 3 of this memo). The limitations of this method are the same for assessment data. A second limitation is the issue of how to address residential and other lands that might have employment but are not zoned for employment. Due to these limitations we do not recommend using this method for the BLR.

- **Employee Per Acre (EPA) Methods**. The advantage of EPA methods is that they distill the estimate into a very simple formula: net acres * EPA = capacity. EPA assumptions can be developed for broad employment types—the 2014 BLR used commercial (19.37 EPA) and industrial (8.25 EPA). These assumptions are in line with what we see in other studies (for example, Oregon advocates EPAs of 7-12 for heavy industrial uses; 10-15 for light industrial uses; and 12-20 for commercial uses). The limitations of this method are generally related to the source of the EPA assumptions as well as how the assumptions are applied. The EPAs used in the 2014 BLR were derived from a survey of properties using Employment Security data. In our view, this is the best method for developing assumptions using the best data sources.

  The biggest limitation of this approach is related to variability in employment densities. As we have discussed, considerable variation exists within zoning districts and within individual industries.

- **FAR/SFE Methods**. Like other methods, this method is limited by the quality of data. One of the biggest problems with this method is that it is difficult to generalize FARs across broad employment types. By definition, FARs are zoning specific. Moreover, variability exists in the amount of built space required by different industries. The amount of effort required to develop accurate estimates for the entire county is

significant given the countywide scope of the BLR. We do not recommend using this approach for future BLRs.

4.2 Recommendations

Pierce County's challenge is developing an acceptable methodology that can be applied across many jurisdictions that range from urban centers to suburbs, to rural communities, to rural areas. After a thorough investigation of the methodological options, we make the offer the following recommendations:

- **Continue to use an EPA based method**. Given the countywide scope and the diversity of cities, EPAs are the most accurate and practical method for estimating employment capacity of vacant and under-utilized land as well as land demand.

- **Consider refinements to the methods used in the 2014 BLR.** The County could make refinements to both the capacity and land demand estimates.

  o **Consider allocating some employment to non-employment lands**. Our review of the 2014 BLR suggests that all of the employment growth increment is allocated to employment lands. Analysis of employment patterns in every Oregon city ECO has worked in shows significant employment exists outside employment zones. Ideally, the amount of employment allocated to non-employment lands would be based on empirical analysis. We suggest exploring if an economist at the Washington Employment Security Department could conduct such an analysis based on zoning data provided by Pierce County.

    As an alternative, deductions could be made using ACS commute data. The 2013-17 ACS shows that 4.5% of worked at home. The assumption could be based on a countywide average, or on data for Census places. This refinement is a land demand refinement.

  o **Consider disaggregating employment forecasts to three or more categories.** A review of the 2014 BLR only identified single value employment figures. The PSRC data ECO used for the employment density analysis in section 3 is available by city disaggregated by sectors or 2-digit NAICS codes. At the simplest, the models could differentiate between retail, office, and warehouse employment densities. Typically, these would be grouped by NAICS codes. This method is only possible if the employment forecasts/allocations are disaggregated.

  o **Consider developing a land use typology based on geography and zoning.** One critique we heard of the 2014 method was that it does not adequately recognize geographic differences. Both ECO's previous work, as well as the literature we reviewed, suggest that geographic variations in employment density exist. In our view, the variations are both due to geography (e.g., one would expect higher

densities in urban cores than in rural areas—a fact that Tacoma's analysis for the 2014 BLR documents) and zoning. In short, a methodology that recognizes regional differences in land uses could be more robust. The question then is, what options are available?

Following are a few variations for consideration:

- **Typology by city size.** This would be a simple methodology that would develop a typology of city sizes and then associated those with EPA assumptions. The general idea would be that smaller cities and rural areas would be assigned lower EPA assumptions.

- **Typology by PSRC regional centers.**[6] PSRC's VISION 2040 calls for the creation of central places with a mix of uses and activities connected by efficient transportation. PSRC designated 29 regional growth centers which are locations of the region's most significant business, governmental, and cultural facilities and are planning for growth. PSRC also identified nine regional manufacturing/industrial centers, which are locations for more intensive industrial activity. According to PSRC, both regional growth centers and regional manufacturing/industrial centers are focal points for planned growth, economic development and transportation infrastructure investments.

  Moreover, the framework identifies three primary geographies: Metropolitan Cities (16 centers), Core Cities (17), and Unincorporated Urban Areas (3). Five regional growth centers and two industrial/manufacturing centers are located in Pierce County.

  PSRC's 2013 Monitoring Report presents employment densities for each of the areas based on 2010 data. Exhibit X shows employment densities for Pierce County Centers. The observed densities are lower than the commercial assumptions in all instances, and considerably lower than the 2014 industrial assumptions for the industrial/manufacturing centers.

  Given that much of the county's employment is located outside these centers, any method will require assumptions for capacity of those lands. The County could use the 2014 assumptions, or use an approach based on city type as described above.

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[6] https://www.psrc.org/sites/default/files/centers_monitoring.pdf

Exhibit 6. Employment Densities in Pierce County Centers, 2010

Type/Center Name	Core Geography	EPA
Regional Growth Centers		
Lakewood	Core City	11.2
Puyallup Downtown	Core City	10.3
Puyallup South Hill	Core City	6.8
Tacoma Downtown	Metropolitan City	22.1
Tacoma Mall	Metropolitan City	14.8
Regional Manufacturing/Industrial Centers		
Fredrickson	Unincorporated UGA	1.2
Port of Tacoma MIC	Metropolitan City	1.8

Source: https://www.psrc.org/sites/default/files/centers_monitoring.pdf, pg 87-88

- **Typology by Zoning.** This is a variation on the previous approach and would be based on local zoning. Effectively, it would require developing a crosswalk between zoning districts and EPAs. This approach has some problems: (1) the number of zoning districts in the county, and (2) data limitations would make it difficult to assign EPAs to zoning districts with any certainty.

In summary, several refinements to the 2014 methodology could improve the capacity and land need estimates. Given the amount of variability that exists in broad employment categories, and PSRCs regional plans, we recommend that any methodology employ the principles of simplicity and transparency. More complicated methods do not necessarily improve the results. We recommend the County consider adjustments for employment in residential areas and using the PSRC center framework.

Appendix 1: Literature Review Matrix

Studies from Washington State

Location	Document Reviewed	Methodology	Employment Density Assumptions (Emp./acre)		Notable Trends	Findings
			Commercial	Industrial		
Counties						
Clark	BLI, 2015	• Building permits primary source of data from 2006-2014 • GIS to link parcels to building permits	9.3	10.9	County has experienced employment gains, however, observed net densities lower than 2007 planning assumptions--could be due to businesses adding employees without requiring new buildings.	County has sufficient capacity to accommodate projected employment growth.
Island	Comp. Plan, 2016	• Suppressed data substituted with older available data • For jobs missing in QCEW data, methodology from PSRC used to estimate total employment from covered employment • City of Freeland excluded from calculation of employment density average due to lack of amenities (sewer) • Due to County's low industrial employment--rounded average from neighboring counties (Skagit, Clark, Pierce) used for industrial assumptions.	17	8	• UGAs resized to accommodate growth in 20 years. • Reduction in size of Freeland and Langley to result in more concentrated growth.	Sufficient capacity to accommodate anticipated employment growth

Location	Document Reviewed	Methodology	Employment Density Assumptions (Emp./acre)		Notable Trends	Findings
			Commercial	Industrial		
King	BLI, 2014	• Half of jurisdictions brought forward 2007 BLR density and capacity calculations; remainder cities required new capacity analysis • Location-specific densities reported in final analysis	250 - 850 SFE*	250 - 851 SFE*	Majority of capacity in Metro and Core cities	Sufficient capacity to accommodate residential, employment growth
King	Emp. Capacity Analysis, 2010	• Employment density assumptions from 2007 BLR • Does not consider future fiscal impacts of redevelopment within Duwamish Industrial Manufacturing Center	550 SFE	800 SFE	South Park has significant portion of employment land capacity	• Total assessed land value for the South Park LID area is $2,458,285,700. • Total assessed value for the MIC site is $193,751,000
Kitsap	BLI, 2014	• Methods for Land Capacity Analysis adjusted following Remand Order: 1) Using trend-based density factors for each residential zone 2) Increase public facility deduction to 20% 3) Remove discount for environmental purposes in Urban Restricted Zone 4) Platted lots adjustment	969 SFE	500 SFE	Majority commercial jobs expected to increase (over 70%) Industrial jobs expected to increase by 6%	Sufficient capacity to meet industrial and commercial development to 2025, 2016-2036
Snohomish	BLI, 2012	• Existing structures (as of April 2011) counted as population or employment base; proposed, built, or occupied structures after April 2011 counted as future capacity.	200 - 700 SFE	300 - 20,000 SFE		Adequate land capacity reported in the County for the 2025 adopted UGA population and employment growth targets.

Location	Document Reviewed	Methodology	Employment Density Assumptions (Emp./acre)		Notable Trends	Findings
			Commercial	Industrial		
Thurston	BLI, 2014		3.3	1.5	• Majority employment expected in commercial zones (over 70%) • Industrial jobs expected to increase by 8% • Employment in residential zones (remote jobs / home-based businesses) expected to increase by 20% • Federal endangered species listings anticipated to affect commercial, industrial land supply	Sufficient land supply to support projected growth to 2035.
Whatcom	BLI, 2016	Based on 2009 Land Capacity Analysis methodology	626 - 900 SFE	775 - 3,500 SFE	County-wide surplus employment capacity of almost 13%	Surplus capacity to meet future employment needs
Region						

Location	Document Reviewed	Methodology	Employment Density Assumptions (Emp./acre)		Notable Trends	Findings
			Commercial	Industrial		
PSRC	Industrial Land Analysis, 2015	• Relevant mixed-use zones and land classification included into analysis if related to industrial land. E.g. "Business Park", "Employment Center" • Parcels considered industrial land if significant industrial development present, permitted to occur. • Four categories of industrial lands: 1. Core industrial 2. Industrial commercial 3. Military industrial 4. Aviation operations areas • Special consideration given to: 1. Tribal lands 2. Natural resource lands 3. Limited Areas of more intense Rural Development 4. Planned Developments		0.25 - 14.7*	• Revival of manufacturing industry, comparable to the Gulf region, South Carolina, Colorado. • Industrial jobs occuring in non-industrial zoned land. • Non-industrial jobs on industrial lands projected to grow to 45% by 2040.	• Employable land capacity variable to area: Strong demand / limited capacity: Interbay-Ship Canal, Duwamish-North Tukwila, Kent-Renton, and SeaTac-Des Moines subareas. • Strong demand/adequate capacity: Frederickson- Lakewood, Southwest Everett and Tacoma-Puyallup subareas. • Adequate capacity: I-405 Corridor, Arlington-Marysville, and North-Central Everett subareas • Surplus capacity: DuPont-Gray Field, Puget Sound Industrial Center (PSIC)-Bremerton-Sinclair Inlet, and Auburn-Sumner subareas.
City						
Lakewood	Emp. Density Survey, 2017	• Developed a consolidated employment capacity model. • Error in Pierce Co. BLR--one residential zone moved to commercial	12 - 25	15 - 25	City has substantially greater employment capacity than reported in Pierce Co. BLR.	Sufficient capacity to meet 2030, 2035 employment targets

Notes: *Location specific numbers reported; ranges provided here. SFE = Square foot per employee.

Other Studies from Around the US

Location	Document Reviewed	Methodology	Employment Density Assumptions (Emp./acre)		Notable Trends	Findings
			Commercial	Industrial		
Counties						
Placer, CA	Dev. Estimates, 1994	Two development scenarios used to project growth--2010 and 2040. Assumes County caotures over 18% regional employment growth for both scenarios.	333 - 550 SFE	700 SFE	• Strong long-term growth rates expected in Sacramento region. • Placer Co. expected to be one of the fastest growing counties due to population and employment increasing from 1990-2010.	Sufficient capacity to meet employment growth needs.
Maricopa, AZ	Emp. Analysis, 2012	• Identified 32 significant regional employment clusters in relation to transit • Employment clusters are assigned sector mix values		5.6 - 14.2	Lowest employment densities in regions characterized by production, distribution, repair	Employment clusters within quarter mile of transit in central and south region have highest densities and employment concentrations--mostly not industrial
Scott, MN	Commercial / Industrial Analysis, 2012	Informed by previous employment density research in other cities		344 - 753 SFE	Buildings with more on-site amenities have higher densities	• Commercial and industrial land expected to expand, but at slower pace than 2006 study. • Sufficient capacity to meet demand but may require land designation changes to meet this change.
Cities						

Location	Document Reviewed	Methodology	Employment Density Assumptions (Emp./acre)		Notable Trends	Findings
			Commercial	Industrial		
Anchorage, AK	BLI, 2009	• Employment density assumptions based on previous studies and trends from other cities. • Employment projections do not account for major construction projects, i.e. Natural Gas Pipeline, the Knik Arm Bridge, the Pebble Mine, Kensington Mine. • Employment density assumptions based on current trend of low density and FARs.		500 - 2000 SFE**	• Major construction projections anticipated to affect industrial sector. • Natural gas pipeline expected to require infrastructure improvements. • Changes in federal spending, expansions in mining or tourism, major infrastructure projects, oil price fluctuations known to have significant impact on local and regional economy. • City is on the lower end of spectrum in regard to industrial employment density.	Sufficient capacity to meet employment growth needs.
Eugene, OR	Emp. Density Analysis, 2006	Employment densities broken down by plan designation and study area	36.3 - 53.9*	8.3 - 20.7*		Provides employment densities by land use designation and study area.
Eugene, OR	Emp. Land Assumptions, 2011	• Government employment growth excluded because typically occurs on public, semi-public lands. • Used "safe harbor" methodology--utilized growth rate for Lane County as calculated by the State.	20 - 90.3	5 - 20	• New employment on non-employment lands: Covered employment occuring in residential and other non-employment land designations. • Increasing number of employment in existing space, making it difficult to predict vacancy rate. Number used in study reflects recession.	Community Advisory Committee agreed that densities would be similar to past.

Location	Document Reviewed	Methodology	Employment Density Assumptions (Emp./acre)		Notable Trends	Findings
			Commercial	Industrial		
Guelph, Canada	Emp. Land Assumptions, 2008	Location-specific densities reported	5 - 106*	2 - 48*	• Competitive industrial land prices. • Employment in Industrial sector expected to increase, followed by commercial and institutional development. • Land-extensive employment trends in warehousing sector.	• Limited supply of employment land, especially for larger sites. • City has adequate land for employment needs to 2031.
Minneapolis, MN	Emp. Pol. Plan, 2006	Introduces Industrial Scorecard to indicate each industry's projected growth, employment demand, and land demand.	7 - 64	14 - 42	Industrial sector significant economic contributor to City.	• Industrial land supply depleting. • City should adopt Employment Districts. • Rezoning for residential use should be reconsidered. • Rezonings should consider job impacts, tax base impacts, viability, transition costs, and adjacency to viable industrial areas.
Reno, NV	Emp. Capacity Analysis, 2016	• Two growth scenarios, Baseline and Recent trends to forecast anticipated employment • Industrial / Commercial buildings categorized by high density and medium/low density	0.15 - 1.25	0.15 - 0.5	Forecasting upcoming employment centers, i.e. Tesla Gigafactory, U of Nevada-Reno	City has capacity to meet employment demands. Growth rate for manufacturing doubled in forecast model to accommodate anticipated employment
San Diego, CA	Industrial Element, n.d.			15.7	Limited industrial land to meet anticipated employment needs.	Rezonings recommended to encourage industrial development.
Region						

Location	Document Reviewed	Methodology	Employment Density Assumptions (Emp./acre)		Notable Trends	Findings
			Commercial	Industrial		
SCAG	Emp. Density Survey, 2001	Over 100 categories consolidated into 10 categories. Employment densities calculated using two methods, median, and weighted averages for employment per acre and FARs.	11.04 - 22.9**	10.63 - 17.05**	Density in Government Offices land use category unusually high--possibly due to small sample size.	Employment density factors derived to be used at region- and county-level.
State						
Oregon	Emp. Density Survey, n.d.	• Employment outside of Central Business District but within city limits referred as Peripheral Employment. • Effects of Great Recession and rise in e-commerce could be reflected in data but difficult to prove at this stage.			• Decreasing jobs in Wholesale, Retail, Transportation, and IT jobs. • Retail trade survived Great Recession.	• Employment densities of downtown central commercial areas have decreased. • Employment densities in city peripheries are more varied.

Notes: *Location specific numbers reported; ranges provided here. **Report also provides weighted averages and/or averages by industry for employee per square foot. SFE = Square foot per employee.

Appendix 2: Annotated Literature Review

Studies from Washington state

Carter, Stephen, and Susan Davis. 2010. South Park Bridge Tiger Grant II Employment Capacity Analysis. ECONorthwest.

This memo includes the technical analysis to be used as background to contribute to the economic competitiveness analysis portion of the Tiger II grant application.

Location: King County, Washington

Relevant Information (2):

- ECONorthwest identified 2007 employment densities from the King County Buildable Lands Report:
    - Commercial: 550 square feet/employee
    - Industrial/warehouse: 800 square feet/employee

Chamberlain, Elizabeth. 2015. Industrial Lands Analysis for the Central Puget Sound Region. Puget Sound Regional Council.

This report assesses economic activity on industrial land in the central Puget Sound region. It is intended to "serve a broad range of land use and economic development planning needs and interests" (E-1).

Location: Puget Sound Region, Washington

Relevant Information (3-8):

- Employment densities for individual Manufacturing/Industrial Centers:
    - Ballard-Interbay (core industrial and industrial commercial): 14.66 EPA
    - Duwamish (core industrial and industrial commercial): 11.61 EPA
    - Frederickson (core industrial and industrial commercial): 1.17 EPA
    - Kent MIC (core industrial): 7.64 EPA
    - North Tukwila (core industrial): 14.05 EPA
    - Paine field/Boeing Everett (core industrial): 10.00 EPA
    - Port of Tacoma (core industrial): 1.79 EPA
    - Puget Sound Industrial Center-Bremerton: 0.25 EPA

Clark County. 2015. Clark County Buildable Lands Plan Monitoring Report.

This report provides updates to the County's enactment of the Growth Management Act, specifically sprawl reduction and urban growth concentration.

Location: Clark County, WA

Relevant information (4, 20)

- 2007 planning assumptions:
    - Commercial: 20 employees/acre
    - Industrial: 9 employees/acre
- Observed densities are lower than the 2007 planning assumptions:
    - Commercial: 9.3 employees/acre
    - Industrial: 10.9 employees/acre
- "Clark County has seen employment gains from 2006 to 2014. It is likely that some businesses have added employees, which would not require new building permits and may account for the low employment density reported." (20)

Gifford, Kevin. 2017. City of Lakewood Employment Capacity Analysis. BERK Consulting.

This report found that employment densities in Lakewood diverge from Pierce County's 2014 Buildable Lands Report. BERK's analysis concludes that the City of Lakewood has substantially greater employment capacity available than is represented in the 2014 Pierce County Buildable Lands Report.

Location: City of Lakewood, Washington

Relevant information:

- BERK developed a consolidated employment capacity model
    - "This blended approach combines the FAR-based method described for the Central Business District with acreage-based calculations using updated employment density factors, as identified by City staff."
    - "Model assumes a reduction in the market factor for underutilized properties from 50% (assumed by the Pierce County BLR) to 35%, comparable to other commercial hubs in northern Pierce County."
    - Model provides sufficient employment capacity to meet Lakewood's 2030 and 2035 employment targets.
- "Per 2014 Pierce County BLR report, total employment allocation is reduced by 12.1% to account for mobile workers and employees working from home."
- Found error in Pierce Co. BLR
    - ARC zone in residential moved to commercial. This study accounted for ARC zone in employment density
- Lakewood adjusted densities
    - Commercial density: 12-25 employees/acre
    - Industrial density: 15-25 employees/acre

Island County. 2016. "Appendix B: Population Growth Analysis & Accommodations." Island County 2036: 2016 GMA Periodic Review.

This document provides detailed account of Island County's population projections, including buildable lands analysis and employment projections. This document is an appendix to Island County's periodic review of the Growth Management Act.

Location: Island County, WA

Relevant information

- "Suppressed data was substituted for three sectors (Mining, Utilities and Management of Companies and enterprises) using older available data." (16)

- "To compensate for these missing jobs in the QCEW data, a methodology developed by PSRC was used to estimate total employment from covered employment."

- Commercial: 17 employees/acre

- Industrial: 8 employees/acre

- County comparisons

    o Skagit County

        ▪ Commercial: 20 employees/site acre

        ▪ Industrial: 6.5 employees/site acre

    o Clark County (see Clark Co. review—same as 2007 assumptions)

    o Pierce Co. (Unincorporated Pierce County 2014 buildable lands report)

        ▪ Manufacturing/Warehousing: 8.2 employees per acre

        ▪ Commercial/Services: 19.37 employees per site acre

King County. 2014. King County Buildable Lands Report.

This report is an update to the 2007 BLR, in fulfillment of the GMA. The report spans the time period from January 2006 to January 2012, encompassing all 39 cities in King County. The BLR concludes that King County has sufficient capacity to accommodate residential and employment growth.

Location: King County, Washington

Relevant information:

- Employment growth still in transition out of Great Recession (2)

- Minor shortfall in job capacity in unincorporated areas, but majority of King County's capacity to accommodate growth is located in Metro and Core cities. (3)

- Used similar assumptions to 2007 BLR, updated housing and jobs data to 2012

    o "Achieved densities and – for some cities – land capacity data are brought forward from the 2007 BLR into this 2014 BLR. Half of King County's

jurisdictions reported sufficient housing and job capacity in 2007 to absorb even the higher numbers in the new 2006-31 targets. Those cities, including most of the Small Cities, carried forward their 2007 BLR density and capacity calculations into this 2014 BLR… The remaining cities required new analysis of land capacity to overcome a shortfall of capacity with respect to the new targets as part of their process of developing new comprehensive plans." (2)

  o Employment capacity in Table 5.5, 2007 BLR pg V-9

Kitsap County Department of Community Development. 2014. Kitsap County 2014 Buildable Lands Report.

This document provides information on Kitsap County's update to its growth projections and land capacity for housing and employment. The report found that the County had sufficient land supply to meet the demand for commercial and industrial development to 2025, and the 2016-2036 planning period.

Location: Kitsap County

Relevant information:

- "Kitsap County adopts employment targets to be consistent with the Puget Sound Regional Council's (PSRC) Regional Growth Strategy." (53)

- Over 45,000 additional jobs anticipated, majority commercial

  o Industrial jobs expected to increase by 6.4%

- From Appendix:

  o Commercial: 969 sq ft/employee

  o Industrial: 500 sq ft/employee

Snohomish County Council. 2012. Snohomish County Buildable Lands Report.

This report is in accordance with the Growth Management Act. The report evaluates land needs and capacity for residential, commercial, and industrial use anticipated in 20-year planning period, spanning to 2025.

Location: Snohomish County, Washington

Relevant information (3,23):

- Adequate land capacity reported in the County for the 2025 adopted UGA population and employment growth targets.

- No capacity shortfall anticipated in UGAs or cities within the UGAs

- Food Services = 200 sq ft/employee

- Other Services = 400 sq ft/employee

- Finance, Insurance and Real Estate (FIRE) - mini-storage warehouses only = 20,000 sq ft/employee

- Finance, Insurance and Real Estate (FIRE) - other = 350 sq ft/employee

- Retail = 700 sq ft/employee

- Manufacturing = 500 sq ft/employee

- Wholesale, Transportation and Utilities (WTU) = 1,000 sq ft/employee

- Government/Education = 300 sq ft/employee

Thurston Regional Planning Council. 2014. Buildable Lands Inventory for Thurston County.

Thurston County's BLR reports sufficient land supply to support projected growth to 2035. Varying by jurisdiction, Thurston County can sufficiently meet the demand for employment land needs.

Location: Thurston County, Washington

Relevant information:

- Majority of new employment expected to be in commercial zones (72%)

- 8% new jobs expected in industrial zones

- 20% jobs expected in residential zones, i.e. remote workers, home-based businesses

- Employment densities:

  o Commercial: 3.3 employees/1,000 sq ft.

  o Industrial: 1.5 employees/1,000 sq ft.

- "Questions remain as to how much of the commercial and industrial land supply will be available for development due to the pending federal endangered species listings." (65)

Whatcom County Planning and Development Services. 2016. Land Capacity Analysis Report.

This report provides a summary of the land capacity analysis for Whatcom County and its Urban Growth Areas as part of the County's Comprehensive Plan.

Location: Whatcom County, Washington

Relevant information:

- Employment density (found in Appendix C)

  o Commercial: 626-900 sq ft./employee

  o Industrial: 775-3500 sq ft./employee

- "Each UGA has a population growth capacity surplus or deficit within 6% of the allocation, with the exception of the Blaine UGA, which has considerable surplus capacity within its city limits. Figure 2 shows a countywide employment capacity surplus of 12.6%." (1)

Studies outside of Washington state

City of Minneapolis. 2006. Industrial Land Use Study and Employment Policy Plan.

The purpose of this study was to provide information and policy direction for industrial land use and employment in Minneapolis.

Location: Minneapolis, Minnesota

Relevant Information (52-53):

- Minneapolis Assessor/InfoUSA employment per acre:

  - Utilities: 42 EPA

  - Construction: 30 EPA

  - Manufacturing: 27 EPA

  - Wholesale Trade: 20 EPA

  - Transportation & Warehousing: 14 EPA

  - Information: 64 EPA

  - Real Estate, Rental, Leasing: 7 EPA

  - Professional and Technology Services: 64 EPA

  - Other Services: 50 EPA

  - All Industries: 34 EPA

Economic and Planning Systems, Inc. 2009. Anchorage Industrial Land Assessment Final Report. Prepared for the Anchorage Economic Development Corporation.

Chapter 4 of this report, "Industrial Land Demand," estimates the demand for future industrial land in Anchorage by analyzing the relationship between employment and industrial space.

Location: Municipality of Anchorage, Alaska

Relevant Information (29-38):

- Assumptions for employment density in Anchorage by land use category, based on "EPS experience and professional judgment and have been supplemented by significant research of employment density trends specific to the MOA" (31).
  - Industrial Services, Assembly, and Manufacturing: 1000 sq. ft./employee
  - Miscellaneous Industrial (Open storage, processing, heavy manufacturing, utilities, trades, and transportation): 1,800 sq. ft./employee
  - Warehouse/Distribution: 2,800 sq. ft./employee
  - Industrial Flex Space: 500 sq. ft./employee
- EPS conducted a national review of employment density studies with the following results:
  - Pierce County, WA (2006): 13.8 EPA for manufacturing/warehousing
  - Hillsboro, OR (n.d.): 9.0 EPA for industrial

- o Silverton, OR (2006): 8.9 EPA for industrial
- o Caledon, Ontario, Canada (2007): 17.0 EPA for manufacturing, 9.0 EPA for warehouse/distribution
- o Peel Region, Ontario, Canada (2007): 15.8 EPA for industrial
- o Grand Traverse County, MI (n.d.): 30.0 EPA for intensive industry, 14.0 EPA for intermediate intensive, 8.0 EPA for extensive
- o Portland-Vancouver MSA (2001): 10.0 EPA for warehouse/distribution, 24.5 EPA for general industrial, 24.3 EPA for tech/flex
- o Wilsonville, OR (2008): 16.3 EPA for efficient land need, 14.2 EPA for medium land need, 12.3 EPA for high land need
- o Minneapolis, MN (2006): 27.0 EPA for manufacturing, 14.0 EPA for transportation and warehousing

Economic & Planning Systems, Inc. 2016. City of Reno: Employment Demand Forecast and Needs Analysis.

This report is a technical analysis to inform the policies and strategies of the City of Reno's Master Plan. It contains a summary of technical analysis, stakeholder feedback, and policy recommendations for the economic components of the Master Plan.

Location: Reno, NV

Relevant information (6-10)

- Used different building types to estimate employment density and land demand. Sub-categories within building types to reflect development density levels and square feet of building space.
- Assumptions based on existing conditions within the Region and national industry standards.
- Building types:
  - o Office
    - Type A (Suburban or Campus Office): 300 sq ft./employee, 0.25 FAR
    - Type B (Mid-Rise / High-Rise Office): 250 sq ft./employee, 1.0 FAR
  - o Industrial
    - Type A (Large Scale or Heavy Industrial): 1,500 sq ft./employee, 0.15 FAR
    - Type B (Small Scale or Light Industrial): 500 sq ft./employee, 0.50 FAR
  - o Retail
    - Type A (Large Format Retail): 400 sq ft./employee, 0.15 FAR
    - Type B (Small Format Retail): 400 sq ft./employee, 0.60 FAR
  - o Accommodation and Food Service
    - Type A (Accommodation): 750 sq ft./employee, 1.25 FAR

- - Type B (Food Service): 500 sq ft./employee, 0.30 FAR

  o Education

    - Type A (General Education): 1,000 sq ft./employee, 0.50 FAR

- Upcoming presence of Tesla's Gigafactory is noted to potentially have impact on employment trends.

- University of Nevada-Reno and its expansion is noted as another economic driver with impact on increased employment.

- Two growth scenarios used to project future economic opportunities, Baseline and Recent Trends. In Recent Trends scenario, growth rate is doubled for manufacturing, wholesale trade, and transportation and warehousing to match trends and include upcoming employment from Tesla.

ECONorthwest. 2006. "Eugene Employment Density Analysis."

This document provides a table of employment density by plan designation and study area in Eugene, Oregon.

Location: Eugene, Oregon.

Relevant information:

- Employment densities were broken down to be more location specific to study area

- Industrial:

  o Campus Industrial: 20.7 EPA

  o Heavy Industrial: 8.3

  o Light Medium Industrial: 15.8

  o Special Heavy Industrial: Not disclosable

- Commercial: 36.3 EPA

  o Commercial Mixed-use: 39.7

  o Major Retail Center: 53.9

Envision Eugene Technical Resource Group. 2011. City of Eugene Employment Land Assumptions Summary.

This document summarizes several assumptions that relate to Eugene's employment land needs. Employment density estimates were based on a 2006 employment density study of 22 areas of Eugene. The Community Advisory Committee agreed that densities would be similar to what they were in the past.

Location: Eugene, Oregon

Relevant Information (4-5)

- Industrial employment density: Ranged from 5 EPA (heavy industrial) to 20 EPA (light or campus industrial); Average industrial EPA: 13

- Commercial employment density: Ranged from 30 EPA (mixed retail and office) to 93 EPA (downtown); Average commercial EPA: 68

- Retail employment density: Ranged from 20 EPA to 37 EPA; Average retail EPA: 23

"Evaluating Employment Density and Land Needs: Floor Area Ratios, Employees Per Square Foot, and Employees Per Acre." N.d.

This document provides context to the units used when calculating employment densities.

Relevant information:

- Floor-to-Area ratio (FAR), Employees per acre (EPA), square feet per employee (SFA) are three different ways to express employment density

- The document provides the mathematical relationship between FAR, EPA, and SFA

    o "FAR can be derived from EPA and SF/Emp as follows: (EPA*43560)/SF per Emp

    o SF/Emp can be derived from EPA and FAR: (FAR*43560)/EPA

    o EPA can be derived from SF and FAR: (FAR*43560)/SF per Emp"

- The document also shows the relationship when other variables are held constant:

    o "FAR increasing: When sq. ft. per employee is held constant and FAR increases, EPA also increases (e.g., there is a linear relationship between EPA and FAR)

    o FAR constant/ sf per emp decreasing: When sq. ft. per employee decreases and FAR is held constant, EPA increases at an increasing rate (e.g., a compounding relationship)

    o FAR + SF/Emp Increasing. Under this scenario EPA remains constant.

    o FAR Increasing and SF/Emp decreasing. When both FAR and sf/emp are increased, EPA increases at an increasing rate (e.g., a compounding relationship)"

    o This information is provided in graph form as well

Gehrke, Amanda and Sujata Srivastava. 2012. Final Employment Analysis Memorandum for Maricopa Association of Governments Sustainable Land Use and Transportation Strategy. Strategic Economics.

This updated memo provides information and insight into the relationship between transit (both planned and existing) and employment patterns in Maricopa County. Strategic Economics identified 32 significant regional employment clusters. The Maricopa Association of Governments serves the Phoenix metro area.

Location: Maricopa County, Arizona

Relevant Information (7-15):

- Employment clusters within one-quarter mile of transit in the central and south MAG region have the highest densities and employment concentrations, mainly not industrial

- Regions characterized by PDR (Production, Distribution, and Repair) have lowest employment densities in the region

- Employment clusters are assigned sector mix values. Listed below are employment clusters with over 40% PDR classification, and each cluster's corresponding employment density (jobs per acre)

    o Falcon Field, 58% PDR, 5.6 EPA

    o I-10 West Corridor, 63% PDR, 2.8 EPA

    o West Chandler, 45% PDR, 10.3 EPA

    o West Temple Industrial, 40% PDR, 14.2 EPA

Karr, Peter. N.d. Employment and Density in Oregon 2004–2012. University of Oregon.

This study reports employment trends and density changes in Oregon's current downtown and city peripheries from 2004 to 2012. The author focuses on Wholesale and Retail Trade, Transportation, and Information Service Sectors (NAICS Codes 42, 44-45, 48-49, and 51-56), and how much employment from these sectors are in Residential and Mixed-use zones outside of downtown. The study reports findings from Albany, Bend, Corvallis, Eugene, Grants Pass, McMinnville, Medford, Salem, and Springfield.

Location: Oregon (Albany, Bend, Corvallis, Eugene, Grants Pass, McMinnville, Medford, Salem, and Springfield)

Relevant information (10, 23):

- Metrics for evaluation of density included:
    o Count of Businesses per 2-digit NAICS Designation
    o Average Minimum Number of Employees
    o Average Maximum Number of Employees
    o Average Total Number of Employees
    o Standard Deviation
    o Sum of Total Employees working in that Industry
    o Sum of Acreage Totals for Tax Lots Containing Businesses
- Employment in Wholesale and Retail Trade, Transportation, and Information Services has decreased.
- Retail Trade (NAICS Codes 44 and 45) showed increases.
- Employment densities of downtown central commercial areas have decreased, except Salem and Bend showing greater than 5% increase
- Employment densities in city peripheries are more varied

Mullins, Matt, and Amanda Janzen. 2012. "Commercial/Industrial Market Analysis for Scott County, Minnesota." Maxfield Research Inc. Prepared for the Scott County Community Development Agency.

This study analyzed commercial and industrial land supply for Scott County. It is estimated that commercial and industrial land would expand in the county from 2012-2020. To estimate employment density, Maxfield Research, Inc. used previous employment density research in Minneapolis, Washington (state), Portland, Southern California, and Rhode Island.

Location: Scott County, Minnesota

Relevant Information (97-99):

- Estimated EPA using previous studies: Utilities (40), Construction (30), Manufacturing (30), Wholesale Trade (20), Transportation and Warehousing (15), Information (60), Real Estate, Rental, Leasing (20), Professional and Technical Services (60), Other Services (50).

- Square feet per employee has increased in industrial sectors from 2001 to 2010:

    - Light Industrial: 365 sq ft/employee in 2001 to 387 sq ft/employee in 2010

    - General Industrial: 344 sq ft/employee in 2001 to 505 sq ft/employee in 2010

    - General Warehouse: 538 sq feet/employee in 2001 to 753 sq ft/employee in 2010

    - Large Scale/High Bay: 861 sq ft/employee in 2001 and 2010

- Industrial, warehouse, and distribution have experienced increases in EPA since 2001

- Buildings that have more on-site amenities have higher EPAs

Placer County. 1994. Assumptions and Development Estimates. Placer County Countywide General Plan Final EIR.

This chapter is a discussion of assumptions and development estimates in Placer County's Countywide General Plan Final EIR. The document reports estimates for the development scenarios for years 2010 and 2040, which provide the basis for the rest of the impact assessment.

Location: Placer County, CA

Relevant information (2-8)

- Employment density assumptions:

    - Commercial: 550 sq ft/worker

    - Office: 333 sq ft/worker

    - Industrial: 700 sq ft/worker

    - Assumptions based on 1991 County Assessor's database and projections of use over time

San Diego Industrial Element. N.d.

This portion of the general plan examines industrial parcels in Southeastern San Diego.

Location: San Diego County, California

Relevant Information (97):

- SANDAG identified 180 acres of industrial zoned land in Southeastern San Diego, with an employment density of 15.7 jobs per acre.

The Natelson Company. 2001. Employment Density Study Summary Report. Southern California Association of Governments.

This document produces employment density figures based on land use categories from six counties. The consultants consolidated over 100 categories into 10 categories and calculated employment densities using two methods, median and weighted averages for employment per acre and floor-to-area ratios.

Location: Six-county SCAG region (Imperial County, Los Angeles County, Orange County, Riverside County, San Bernardino County, and Ventura County)

Relevant information:

- Land use categories from six counties were aggregated to 10 primary land use categories:
  - Regional Retail
  - Other Retail/Svc.
  - Low-Rise Office
  - High-Rise Office
  - Hotel/Motel
  - R & D/Flex Space
  - Light Manufacturing
  - Heavy Manufacturing
  - Warehouse
  - Government Offices
- Employment density reported in two formats
  - Median employees per acre density and median FAR. Employees per acre:
    - Regional Retail: 14.99
    - Other Retail/Svc.: 13.49
    - Low-Rise Office: 22.91
    - High-Rise Office: 116.32
    - Hotel/Motel: 11.04
    - R & D/Flex Space: 18.13

- Light Manufacturing: 11.63
- Heavy Manufacturing: 17.05
- Warehouse: 10.63
- Government Offices: 16.23

- Weighted average of employees per acre density and weighted average FAR. Employees per acre:
  - Regional Retail: 19.71
  - Other Retail/Svc.: 21.98
  - Low-Rise Office: 43.95
  - High-Rise Office: 175.49
  - Hotel/Motel: 33.07
  - R & D/Flex Space: 20.53
  - Light Manufacturing: 17.83
  - Heavy Manufacturing: 31.14
  - Warehouse: 11.40
  - Government Offices: 51.67

Watson & Associates Economists Ltd. 2008. City of Guelph Employment Lands Strategy Phase 1.

This Employment Lands Strategy created a vision and plan for future employment lands in the City of Guelph, while maintaining competitiveness in business retention and attraction. The first of two phases, Phase 1: Needs and Opportunities Analysis, identified future employment lands by forecasting demand and evaluating existing vacant and developable land supply.

Location: Guelph, Ontario, Canada

Relevant Information (4-14 – 4-18):

- 2006 Employees per net acre in Hanlon Business Park (287 net acres)
  - Manufacturing: 16 EPA
  - Warehousing & Distribution (including transportation, storage, and wholesale trade): 11 EPA
  - Utilities & Construction: 2 EPA
  - Office: 6 EPA
  - Retail: 5 EPA
  - Other: 24 EPA
- 2006 Employees per net acre in the York-Watson Industrial Area (110 net acres)
  - Manufacturing: 29 EPA
  - Warehousing & Distribution (including transportation, storage, and wholesale trade): 11 EPA

- o Utilities & Construction: 30 EPA
- o Office: 14 EPA
- o Retail: 24 EPA
- o Other: 1 EPA
- James Snow Parkway Area, Milton, Industrial EPA: 18
- Harry Walker Parkway Industrial Park, Newmarket, Light Industrial EPA: 23
- Beaver Creek/Commerce Valley Dr. Area, Richmond Hill, Business Commercial/Office EPA: 86; Prestige Industrial EPA: 48
- Brantford, General Industrial EPA: 8
- Mississuga, Limited Outside Storage Industrial EPA: 20, Outside Storage Industrial EPA: 9, Restricted Commercial EPA: 106