

KING COUNTY
ENVIRONMENTAL CHECKLIST

for

The Reserve at Washington National

May 16, 2016

Prepared For:
Lisa Inc.
400 Valley Ave NE
Puyallup, WA 98372

Prepared By:
Jennifer Caldwell
Dan Smith
15066

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PLAT 16-0001

KING COUNTY

ENVIRONMENTAL CHECKLIST

Action: _____

Receipt: _____

Received By: _____

Date: _____

I. INTRODUCTION INFORMATION

Name of Proposal (if applicable):

The Reserve at Washington National

Applicant: **Lisa Inc.**

Address: **400 Valley Avenue NE
Puyallup, WA 98372**

Phone: **(253) 383-3705**

Agent: **Craig Deaver, Principal with CES NW Inc.**

Address: **310-29th Street NE, Suite 101
Puyallup, WA 98371**

Phone: **(253) 848-4282**

Location of Project: **King County, Washington**

Address: **No address assigned
See Appendix for Vicinity Map.**

Section: **10, 14 & 15** Quarter: **SW** Township: **21** Range: **05**

Tax Parcel Numbers: **2025770630, 2025770640, 2025770650 and
2025770660**

Date Checklist Prepared: **May 16, 2016**

A. BACKGROUND

1. Proposed timing or schedule (including phasing, if applicable):

Gain preliminary plat approval in Summer/Fall 2016, construction permit issuance in Winter 2016, complete site construction and record final plat by Fall 2017 and begin home construction upon final plat recording.

2. Do you have any plans for future additions, expansion, or further activity related to or connected with this proposal? If yes, explain:

No, there are no further plans for expansion at this time.

3. List any environmental information you know about that has been prepared, or will be prepared, directly related to this proposal.

The project is a large lot subdivision located within rural zoning classification. No environmental information has been prepared and is not anticipated to be prepared.

4. Do you know whether applications are pending for governmental approvals of other proposals directly affecting the property covered by your proposal? If yes, explain:

Yes, a septic design from the Washington State Department of Health application has been submitted.

5. List any government approvals or permits that will be needed for your proposal, if known.

SEPA Determination, Hearing Examiner Approval, Administrative Design Review, Traffic Approval, Site Development Permit, Forest Practices Department of Ecology Dam Safety Permit, and building permits.

6. Give a brief, complete description of your proposal, including the proposed uses and the size of the project and site. There are several questions later in this checklist that ask you to describe certain aspects of your proposal. You do not need to repeat those answers on this page.

The site will be developed into 33 residential lots with an internal public road, utilities, large on-site septic system and open areas. An approximate 12-acre private lake is proposed with the project as part of the open areas.

7. Location of proposal. Give sufficient information for a person to understand the precise location of your proposed project, including a

street address, if any, and section, township, and range, if known. If a proposal would occur over a range of area, provide the range or boundaries of the site(s). Provide a legal description, site plan, vicinity map, and topographic map, if reasonably available. While you should submit any plans required by the agency, you are not required to duplicate maps or detailed plans submitted with any permit applications related to this checklist.

From WA-18 (heading east) – take the Auburn-Black Diamond Road exit and proceed northbound on Auburn-Black Diamond Road. Take a right onto 148th Way SE. Turn a right onto SE Husky Way. Take a right onto SE Diamond Drive. The road ends at the parcel boundary with a gate.

Section: **10, 14 and 15** Quarter: **SW** Township: **21** Range: **05**

B. ENVIRONMENTAL IMPACTS

1. EARTH

- a. General description of the site (circle one): flat, rolling, hilly, steep slopes, mountainous, other_____:

Rolling – 2 to 15 percent slopes

- b. What is the steepest slope on the site (approximate percent slope)?

The steepest slope on the site is approximately 50 percent towards the interior of the site and is located along its boundary

- c. What general types of soils are found on the site (for example, clay, sand, gravel, peat, muck)? If you know the classification of agricultural soils, specify them and note any agricultural land of long-term commercial significance and whether the proposal results in removing any of these soils.

The soils at the site have been identified as Alderwood and Kitsap soils, very steep (AkF), Everett gravelly sandy loam, 0 to 5 percent slopes (EvB) and Everett gravelly sandy loam, 15 to 30 percent slopes (EvD) as determined by the USDA Natural Resource Conservation Service (NRCS) maps of King County, Washington. There is a small portion of the site covered in water from the existing pond.

See Appendix for the Soils Map and Soils Description

- d. Are there surface indications or history of unstable soils in the immediate vicinity? If so, describe.

Yes. There is a landslide hazard area located approximately 50 feet north of the northern property line.

- e. Describe the purpose, type, total area, and approximate quantities and total affected area of any filling, excavation, and grading proposed. Indicate source of fill.

The site will be designed to balance cut and fill quantities to the greatest extent possible. Grading plans prepared by a licensed professional engineer will be submitted to King County for review and approval. It is estimated that approximately 160,000 cubic yards of total cut and 160,000 cubic yards of total fill will be required during construction of the proposed project.

- f. Could erosion occur because of clearing, construction, or use? If so, generally describe.

Yes, if vegetation is cleared during wet weather, there is a potential for erosion to occur.

- g. What percent of the site will be covered with impervious surfaces after project construction (for example, asphalt, or buildings)?

The project will construct new roadways with 4.03 acres of impervious coverage, while the private lake will have a surface area of 11.91 acres, and it is assumed that each lot will construct 10,000 square feet. of impervious surfaces for driveways and structures. This results in a total impervious surface area of 23.51 acres; therefore, approximately 14 percent of the site will be covered with impervious surfaces.

- h. Proposed measures to reduce or control erosion, or other impacts to the earth, if any:

As part of the grading plan, a temporary erosion and sedimentation control plan will be prepared for approval by King County. Erosion control features will be installed prior to construction and maintained until construction is complete and the threat of erosion ceases to exist.

2. AIR

- a. What types of emissions to the air would result from the proposal during construction, operation, and maintenance when the project

is completed? If any, generally describe and give approximate quantities if known.

The grading activities proposed at the site will cause dust particulate to be emitted to the air. Vehicles and equipment used during the construction can be a potential source of emissions. When the project is complete, the site may be the source of vehicle emissions from vehicles using the site. However, quantities are unknown.

- b. Are there any off-site sources of emissions or odor that may affect your proposal? If so, generally describe.

Vehicles using the surrounding street system to the east can be a source of emissions or odor. However, it is not anticipated that these off-site vehicle sources of emissions will impact this proposal. There are no other known sources of odor or emissions in the vicinity.

- c. Proposed measures to reduce or control emissions or other impacts to air, if any:

Unwanted dust particulate can be controlled, to a certain extent, by the application of water before and during construction activities. It is assumed the construction vehicles used will be equipped with factory-installed mufflers and spark arresters that would control excessive emissions.

After construction onsite vehicles are assumed to meet State and Federal emission regulations.

3. WATER

- a. Surface Water:

1. Is there any surface water body on or in the immediate vicinity of the site (including year-round and seasonal streams, saltwater, lakes, ponds, wetlands)? If yes, describe type and provide names. If appropriate, state what stream or river it flows into.

Yes, there is an existing man made pond on-site used by the Washington National Golf Course for irrigation purposes.

2. Will the project require any work over, in, or adjacent to (within 200 feet) the described waters? If yes, please describe and attach available plans for this work.

Yes, work is proposed within 200-feet of the existing pond.

3. Estimate the amount of fill and dredge material that would be placed in or removed from surface water or wetlands and indicate the area of the site that would be affected. Indicate the source of fill material.

No amount of fill or dredge will be placed or removed from surface waters on the site.

4. Will the proposal require surface water withdrawals or diversions? Give general description, purpose, and approximate quantities if known.

No, the project does not include any surface water withdrawals or diversions.

5. Does the proposal lie within a 100-year floodplain? If so, note location on the site plan.

No.

6. Does the proposal involve any discharges of waste materials to surface waters? If so, describe the type of waste and anticipated volume of discharge.

No, the proposal does not include discharges of waste materials to any existing surface water.

b. Ground Water:

1. Will ground water be withdrawn from a well for drinking water or other purposes? If so, give a general description of the well, proposed uses and approximate quantities withdrawn from the well. Will water be discharged to groundwater? Give general description, purpose, and approximate quantities if known.

There will be no groundwater withdrawals, but stormwater will be discharged to the ground water table. It is estimated that there will be about 8 acre-feet of stormwater will be infiltrated in 30 days as computed by WWHM.

2. Describe waste material that will be discharged into the ground from septic tanks or other sources, if any (for example: Domestic sewage; industrial, containing the following chemicals . . .; agricultural; etc.). Describe the general size of the system, the number of such systems, the number of houses to be served (if applicable), or the number of animals or humans the system(s) is/are expected to serve.

The project proposes a community Large Onsite Septic System (LOSS) for the 33 lots.

c. Water Runoff (including stormwater):

1. Describe the source of runoff (including stormwater) and method of collection and disposal, if any (include quantities, if known). Where will this water flow? Will this water flow into other waters? If so, describe.

The primary source of runoff will be from stormwater. Minimal water runoff is anticipated to occur due to landscape watering and other maintenance activities. The proposed stormwater conveyance system will be designed to collect and convey stormwater runoff from within the project, convey it to bioswales and infiltration trenches for water quality treatment and flow control respectively.

2. Could waste materials enter ground or surface waters? If so, generally describe.

Generally, a project of this type and size would provide areas of landscaping. If chemicals or fertilizers that are used to maintain these areas are not handled properly, it is possible they could enter ground or surface waters. To our knowledge, there are no other known sources of contaminants associated with this proposal.

3. Does the proposal alter or otherwise affect drainage patterns in the vicinity of the site? If so, describe.

The proposed plat stormwater design will maintain natural drainage patterns per King County design standards.

- d. Proposed measures to reduce or control surface, ground, and runoff water impacts, if any:

The project proposes to collect its runoff with the use

of roadside ditches and conveys it to bioswales for stormwater quality treatment. The bioswales are upstream of subsurface infiltration trenches located underneath the ditch line. These facilities are designed in accordance with the most current King County Surface Water Design Manual.

4. PLANTS

- a. Check the type(s) of vegetation found on the site:

☐ Deciduous tree:

☒ Evergreen tree: Cedar

☒ Shrubs

☒ Grass

☐ Pasture

☐ Crop or grain

☐ Orchards, vineyards or other permanent crops

☐ Wet soil plants:

☐ Water plants:

☐ Other types of vegetation:

- b. What kind and amount of vegetation will be removed or altered?

The site was cleared during previous permitted grading activities. Minor areas of grass and shrubs are present with some trees located along the project's perimeter.

- c. List threatened or endangered species known to be on or near the site.

To our knowledge, there are no threatened or endangered plant species on or near the site.

- d. Proposed landscaping, use of native plants, or other measures to preserve or enhance vegetation on the site, if any:

Landscaping will incorporate native plant species in accordance with King County Code.

- e. List all noxious weeds and invasive species known to be on or near the site.

No, noxious weeds or invasive species are known to be on or near the site.

5. **ANIMALS**

- a. List any birds and other animals, which have been observed on or near the site or are known to be on or near the site. Examples include:

Birds: **songbirds, crows**

Mammals: **deer, field mice, squirrels**

Fish: **None**

- b. List any threatened or endangered species known to be on or near the site.

There are no threatened or endangered species known to exist on or near the site to our knowledge.

- c. Is the site part of a migration route? If so, explain.

To our knowledge, the site is not part of a migration route.

- d. Proposed measures to preserve or enhance wildlife, if any:

The project is a large lot residential subdivision. No measures are proposed.

- e. List any invasive animal species known to be on or near the site.

None known.

6. **ENERGY AND NATURAL RESOURCES**

- a. What kinds of energy (electric, natural gas, oil, wood stove, solar) will be used to meet the completed project's energy needs? Describe whether it will be used for heating, manufacturing, etc.

The primary energy source required to meet the energy needs of the proposed project is electricity. Sufficient amounts of which would be used to maintain a comfortable lifestyle and environment. The electricity would be used to for heating and lighting purposes.

- b. Would your project affect the potential use of solar energy by adjacent properties? If so, generally describe.

No, the existing properties are large lots single-family parcels or golf course ranges with plenty of area for solar panels. The largest impact to placing solar panels is the existing foliage on the adjacent parcels.

- c. What kinds of energy conservation features are included in the plans of this proposal? List other proposed measures to reduce or control energy impacts, if any:

The homebuilder will build the proposed homes using the appropriate energy efficient materials, per King County, as defined in the International Energy Conservation Code. This will be based on the current industry standards for home building.

7. ENVIRONMENTAL HEALTH

- a. Are there any environmental health hazards, including exposure to toxic chemicals, risk of fire and explosion, spill, or hazardous waste that could occur because of this proposal? If so, describe.

Typically, a residential development is not a source of environmental health hazards. During construction of the proposed project, it is possible that a spill related to construction activity or equipment may occur. Once the plat has been constructed, the risk of fire is always present within a residential development.

- 1) Describe any known or possible contamination at the site from present or past uses.

No known possible contamination at the site from present or past uses.

- 2) Describe existing hazardous chemicals/conditions that might affect project development and design. This includes underground hazardous liquid and gas transmission pipelines located within the project area and in the vicinity.

There are no known hazardous chemicals/conditions that might affect the project development and design.

- 3) Describe any toxic or hazardous chemicals that might be stored, used, or produced during the project's development or construction, or at any time during the operating life of the project.

During construction, typical materials for construction oil, petroleum or grease may be used and stored on-site and properly disposed of in accordance with the required stormwater pollution prevention plan. No chemicals will be produced.

- 4) Describe special emergency services that might be required.

While not anticipated to occur, the services of the local emergency service providers may be required at some time.

- 5) Proposed measures to reduce or control environmental health hazards, if any:

None are proposed.

b. Noise

- 1) What types of noise exist in the area, which may affect your project (for example: traffic, construction or production equipment, other)?

Noise exists from the neighboring golf course. However, it is not anticipated that the noise will adversely impact the proposed project.

2. What types and levels of noise would be created by or associated with the project on a short-term or long-term basis (for example: traffic, construction or production equipment, other)? Indicate what hours noise would come from the site.

During the short-term, construction activity at the project site will vary considerably as the construction progresses. In addition, because the noise produced on the site depends on the equipment being used, the noise would vary from day to day. Maximum construction noise levels can be expected to range from 65 to 89 dBA with an average value of approximately 85 dBA. Minimum noise levels can be expected to have a wider range of 57 to 88 dBA with an average value of 78 dBA (based on a construction activity noise model, described in *Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances*). Noise associated with construction operations on the site will occur roughly between the hours of 7:00 a.m. to 6:00 p.m., Monday through Friday. Long-term noise impacts will result from vehicles using the site and noises typical to a single-family development and recreational use (including various types of motorized and non-motorized watercraft) of the proposed lake by residents. All long-term noise impacts will be in

compliance with allowed noise standards.

3. Proposed measure to reduce or control noise impacts, if any:

Noise impacts associated with the construction phases of the project will be limited in duration. To mitigate general noise impacts during the grading phase, measures such as using and regularly maintaining efficient mufflers and quieting devices on all construction equipment and vehicles can be anticipated. No measures to mitigate noise impacts during the building phase are proposed. Construction hours will be limited to the normal workday, 7:00 a.m. to 6:00 p.m.

8. LAND AND SHORELINE USE

- a. What is the current use of the site and adjacent properties? Will the proposal affect current land uses on nearby or adjacent properties? If so, describe.

Current use is Vacant Land.

South: Golf Course and Single-Family parcels

East, West and North: Single-Family parcels and large lots

- b. Has the site been used as working farmlands or working forestlands? If so, describe. How much agricultural or forestland of long-term commercial significance will be converted to other uses as a result of the proposal, if any? If resources lands have not been designated, how many acres in farmland or forestland tax status will be converted to nonfarm or non-forest use?

To our knowledge, the project site has not been used working farmlands or working forestlands.

- 1) Will the proposal affect or be affected by surrounding working farm or forest land normal business operations, such as oversize equipment access, the application of pesticides, tilling and harvesting? If so, how:

To our knowledge, the adjacent parcels are not used for agriculture or forestry.

- c. Describe any structures on the site.

None.

- d. Will any structures be demolished? If so, what?

None, no structures will be removed.

- e. What is the current zoning classification of the site?

King County – RA-5

Please see the zoning map in the appendix for clarification of zoning.

- f. What is the current comprehensive plan designation of the site?

Rural

- g. If applicable, what is the current shoreline master program designation of the site?

Project is not in an area designated as a shoreline, does not apply.

- h. Has any part of the site been classified as a critical area by the city or county? If so, specify.

The northern boundary of the parcel is a steep slope area and listed as an erosion hazard area. No construction is anticipated within or near these areas.

- i. Approximately how many people would reside or work in the completed project?

The proposed plat will provide 33 homes and housing for approximately 99 residents.

- j. Approximately how many people would the completed project displace?

None.

- k. Proposed measures to avoid or reduce displacement impacts, if any:

No one will be displaced.

- l. Proposed measures to ensure the proposal is compatible with existing and projected land uses and plans, if any:

The proposed residential plat is adjacent to other single-family residential uses and is within unincorporated King County. The site is currently zoned RA-5 (King County).

- m. Proposed measures to ensure the proposal is compatible with nearby agricultural and forestlands of long-term commercial significance, if any:

To our knowledge, the adjacent parcels are not used for agricultural or forest lands.

9. HOUSING

- a. Approximately how many units would be provided, if any? Indicate whether high, middle, or low-income housing.

The development anticipates creating 33 new housing units in the proposed residential plat. It is assumed the housing units will be in the high-income range.

- b. Approximately how many units, if any, would be eliminated? Indicate whether high, middle, or low-income housing.

None. No structures exist on-site.

- c. Proposed measures to reduce or control housing impacts, if any:

None.

10. AESTHETICS

- a. What is the tallest height of any proposed structure(s), not including antennas; what is the principal exterior building material(s) proposed?

Maximum building height is 40 feet.

- b. What views in the immediate vicinity would be altered or obstructed?

No views in the immediate vicinity would be altered or obstructed. The view of the site, of course, will be altered to that of a large lot rural single-family housing development.

- c. Proposed measures to reduce or control aesthetic impacts, if any:

The proposed plat will include architecturally compatible homes. After home construction, the parcels will have landscaping. The interior public road will be built to King County Road Standards.

11. LIGHT AND GLARE

- a. What type of light or glare will the proposal produce? What time of day would it mainly occur?

Light and glare will result from reflective surfaces, exterior building lights, and streetlights. Interior lighting may be noticeable. The occurrence of light impacts are anticipated from dusk to dawn.

- b. Could light or glare from the finished project be a safety hazard, interfere with views, or affect wildlife?

It is highly unlikely that glare or light from the project site will interfere with views or affect wildlife. Streetlights and other outdoor lighting are intended to promote safety rather than create a safety hazard.

- c. What existing off-site sources of light or glare may affect your proposal?

Off-site sources of light or glare that may be noticeable would be the result from reflective surfaces, exterior building lights, streetlights and interior lighting from the surrounding neighborhoods. The occurrence of light impacts are anticipated from dusk to dawn and are not anticipated to affect the project.

- d. Proposed measures to reduce or control light and glare impacts, if any:

The exterior building lights and streetlights will be of low intensity, typically used for safety and security purpose.

12. RECREATION

- a. What designated and informal recreational opportunities are in the immediate vicinity?

There are several designated and informal recreational opportunities that are in the immediate vicinity of the proposed site. Some of these opportunities include: Washington National Golf Course, tennis courts, Lake Holm surrounding the property and the open space acreage on-site

- b. Would the proposed project displace any existing recreational uses? If so, describe.

No, the project will not displace any recreational opportunities.

- c. Proposed measures to reduce or control impacts on recreation, including recreation opportunities to be provided by the project or application, if any:

Passive and active recreation space will be provided within the project site, which includes a private lake for active recreation and open space for passive recreation.

13. HISTORIC AND CULTURAL PRESERVATION

- a. Are there any buildings, structures, or sites, located on or near the site that area over 45 years old listed in or eligible for listing in national, state, or local preservation registers located on or near the site?

No, there are no buildings or structures on site.

- b. Are there any landmarks, features or other evidence of Indian or historic use or occupation? This may include human burials or old cemeteries. Are there any material evidence, artifacts, or areas of cultural importance on or near the site? Please list any professional studies conducted at the site to identify such resources.

To our knowledge, there are none.

- c. Describe the methods used to assess the potential impacts to cultural and historic resources on or near the project site. Examples include consultation with tribes and the department of archeology and historic preservation, archaeological surveys, historic maps, GIS data, etc.

No formal studies have been conducted to assess cultural or historic resources associated with the site. The site was graded previously under an approved King County permit.

- d. Proposed measures to avoid, minimize, or compensate for loss, changes to, and disturbance to resources. Please include plans for the above and any permits that may be required.

There are no measures proposed to reduce or control impacts. However, if objects are unearthed during site work that may be culturally significant, the Washington

State Office of Archaeology and Historic Preservation will be notified.

14. TRANSPORTATION

- a. Identify public streets and highways serving the site, and describe proposed access to the existing street system. Show on site plans, if any:

The project site is located along SE Diamond Drive, which connects to Highway 18 via SE Husky Way and SE Auburn-Black Diamond road.

See Appendix for Vicinity Map.

- b. Is the site or affected geographic area currently serviced by public transit? If so, generally describe. If not, what is the approximate distance to the nearest transit stop?

No. A review of the King Transit regional bus schedule indicates that transit service is not provided directly to the site. There are no bus routes in the area.

- c. How many parking spaces would the completed project or non-project proposal have? How many would the project eliminate?

The project will have 66 parking spaces and will not eliminate any.

- d. Will the proposal require any new improvements to existing roads, streets, pedestrian, bicycle or state transportation facilities, not including driveways? If so, generally describe (indicate whether public or private).

Yes, the project proposes approximately 5,500 linear feet of public roads; of which, 1,000 linear feet of that is located offsite along the southwestern property line.

- e. Will the project or proposal use (or occur in the immediate vicinity of) water, rail, or air transportation? If so, generally describe.

No.

- f. How many vehicular trips per day would be generated by the completed project or proposal? If known, indicate when peak volumes would occur and what percentage of the volume would be trucks (such as commercial and non-passenger vehicles). What data or transportation models were used to make these estimates?

Per the TIA prepared by Heath & Associates Inc., it is estimated the project will generate approximately 314 trips per day.

- g. Will the proposal interfere with, affect or be affected by the movement of agricultural and forest products on roads or streets in the area? If so generally describe.

No.

- h. Proposed measures to reduce or control transportation impacts, if any:

This project is expected to be a minor generator of new trips in the area. Although a formal sight distance study has not been conducted yet, due to the flat straight alignment, available sight distance in both directions should meet or exceed the 35 mph design speed minimum set by AASHTO. Applicable impact traffic fees will be paid to King County. No other mitigations are identified at this time.

15. PUBLIC SERVICES

- a. Would the project result in an increased need for public services (for example: fire protection, police protection, public transit, health care, schools, other)? If so, generally describe.

Yes. Whenever a residential development is constructed, the need for public services, such as police and fire protection, increases. Auburn School District, King County Sheriff, and King County Fire District serve the site.

- b. Proposed measures to reduce or control direct impacts on public services, if any:

Impacts will be controlled by the increase in tax base and tax assessments paid to the public services as well as impact fees.

16. UTILITIES

- a. Circle utilities currently available at the site: **Adjacent to the proposed plat are electricity, water, refuse service, telephone, cable.**
- b. Describe the utilities that are proposed for the project, the utility providing the service, and the general construction activities on the site or in the immediate vicinity, which might be needed.

The proposed project anticipates using the following utilities:

Electricity, water, refuse service, on-site septic system, telephone/cable/internet, gas, and stormwater.

SIGNATURES

The above answers are true and complete to the best of my knowledge. I understand that the lead agency is relying on them to make its decision.

Signature: _____

Name of Signee: Craig Deaver

Position and Agency/Organization: _____

Principal of CES NW INC.

Date Submitted: May 19, 2016

Section I: Buildings

Type (Residential) or Principal Activity (Commercial)	# Units	Square Feet (in thousands of square feet)	Emissions <i>Per Unit</i> or <i>Per Thousand Square Feet</i> (MTCO2e)			Lifespan Emissions (MTCO2e)
			Embodied	Energy	Transportation	
Single-Family Home.....	33		98	672	792	51541
Multi-Family Unit in Large Building	0		33	357	766	0
Multi-Family Unit in Small Building	0		54	681	766	0
Mobile Home.....	0		41	475	709	0
Education		0.0	39	646	361	0
Food Sales		0.0	39	1,541	282	0
Food Service		0.0	39	1,994	561	0
Health Care Inpatient		0.0	39	1,938	582	0
Health Care Outpatient		0.0	39	737	571	0
Lodging		0.0	39	777	117	0
Retail (Other Than Mall).....		0.0	39	577	247	0
Office		0.0	39	723	588	0
Public Assembly		0.0	39	733	150	0
Public Order and Safety		0.0	39	899	374	0
Religious Worship		0.0	39	339	129	0
Service		0.0	39	599	266	0
Warehouse and Storage		0.0	39	352	181	0
Other		0.0	39	1,278	257	0
Vacant		0.0	39	162	47	0

Section II: Pavement.....

Pavement.....		175.43				8771
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Total Project Emissions:

60312

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JUN 17 2016

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PLAT 16-0001

King County Department of Development and Environmental Services
SEPA GHG Emissions Worksheet
Version 1.7 12/26/07 (Introduction Revised March 2011)

Introduction

The Washington State Environmental Policy Act (SEPA) requires environmental review of development proposals that may have a significant adverse impact on the environment. If a proposed development is subject to SEPA, the project proponent is required to complete the SEPA Checklist. The Checklist includes questions relating to the development's air emissions. The emissions that have traditionally been considered cover smoke, dust, and industrial and automobile emissions. With our understanding of the climate change impacts of greenhouse gas (GHG) emissions, King County requires the applicant to also estimate these emissions.

Emissions created by Development

GHG emissions associated with development come from multiple sources:

- The extraction, processing, transportation, construction and disposal of materials and landscape disturbance (Embodied Emissions)
- Energy demands created by the development after it is completed (Energy Emissions)
- Transportation demands created by the development after it is completed (Transportation Emissions)

GHG Emissions Worksheet

King County has developed a GHG Emissions Worksheet that can assist applicants in answering the SEPA Checklist question relating to GHG emissions.

The SEPA GHG Emissions worksheet estimates all GHG emissions that will be created over the life span of a project. This includes emissions associated with obtaining construction materials, fuel used during construction, energy consumed during a buildings operation, and transportation by building occupants.

The SEPA GHG Emissions worksheet should not be used to estimate GHG emissions from large, complex projects, such as urban planned developments, major infrastructure projects, or projects that require an Environmental Impact Statement (EIS). For more sophisticated tools that may help with assessing the GHGs of these actions, see the Washington State Department of Ecology's (Ecology) SEPA and climate change website:

<http://www.ecy.wa.gov/climatechange/sepa.htm>

Using the Worksheet

1. Descriptions of the different residential and commercial building types can be found on the second tabbed worksheet ("Definition of Building Types"). If a development proposal consists of multiple projects, e.g. both single family and multi-family residential structures or a commercial development that consists of more than one type of commercial activity, the appropriate information should be estimated for each type of building or activity.
2. For paving, estimate the total amount of paving (in thousands of square feet) of the project.
3. The Worksheet will calculate the amount of GHG emissions associated with the project and display the amount in the "Total Emissions" column on the worksheet. The applicant should use this information when completing the SEPA checklist.

4. The last three worksheets in the Excel file provide the background information that is used to calculate the total GHG emissions.
5. The methodology of creating the estimates is transparent; if there is reason to believe that a better estimate can be obtained by changing specific values, this can and should be done. Changes to the values should be documented with an explanation of why and the sources relied upon.
6. Print out the "Total Emissions" worksheet and attach it to the SEPA checklist. If the applicant has made changes to the calculations or the values, the documentation supporting those changes should also be attached to the SEPA checklist.

Disclaimer – March 2011

This worksheet has not been updated 2007. Since then, new resources have become available that more accurately estimate the greenhouse gas emissions impacts of projects. This worksheet can still be used to provide a coarse estimate of a typical project's climate change impact, but should be used with caution. See Ecology's SEPA and climate change website for additional resources:

<http://www.ecy.wa.gov/climatechange/sepa.htm>

Definition of Building Types

Type (Residential) or Principal Activity (Commercial)	Description
Single-Family Home.....	Unless otherwise specified, this includes both attached and detached buildings
Multi-Family Unit in Large Building	Apartments in buildings with more than 5 units
Multi-Family Unit in Small Building	Apartments in building with 2-4 units
Mobile Home.....	
Education	Buildings used for academic or technical classroom instruction, such as elementary, middle, or high schools, and classroom buildings on college or university campuses. Buildings on education campuses for which the main use is not classroom are included in the category relating to their use. For example, administration buildings are part of "Office," dormitories are "Lodging," and libraries are "Public Assembly."
Food Sales	Buildings used for retail or wholesale of food.
Food Service	Buildings used for preparation and sale of food and beverages for consumption.
Health Care Inpatient	Buildings used as diagnostic and treatment facilities for inpatient care.
Health Care Outpatient	Buildings used as diagnostic and treatment facilities for outpatient care. Doctor's or dentist's office are included here if they use any type of diagnostic medical equipment (if they do not, they are categorized as an office building).
Lodging	Buildings used to offer multiple accommodations for short-term or long-term residents, including skilled nursing and other residential care buildings.
Retail (Other Than Mall).....	Buildings used for the sale and display of goods other than food.
Office	Buildings used for general office space, professional office, or administrative offices. Doctor's or dentist's office are included here if they do not use any type of diagnostic medical equipment (if they do, they are categorized as an outpatient health care building).
Public Assembly	Buildings in which people gather for social or recreational activities, whether in private or non-private meeting halls.
Public Order and Safety	Buildings used for the preservation of law and order or public safety.
Religious Worship	Buildings in which people gather for religious activities, (such as chapels, churches, mosques, synagogues, and temples).
Service	Buildings in which some type of service is provided, other than food service or retail sales of goods
Warehouse and Storage	Buildings used to store goods, manufactured products, merchandise, raw materials, or personal belongings (such as self-storage).
Other	Buildings that are industrial or agricultural with some retail space; buildings having several different commercial activities that, together, comprise 50 percent or more of the floorspace, but whose largest single activity is agricultural, industrial/ manufacturing, or residential; and all other miscellaneous buildings that do not fit into any other category.
Vacant	Buildings in which more floorspace was vacant than was used for any single commercial activity at the time of interview. Therefore, a vacant building may have some occupied floorspace.

Sources:

Residential 2001 Residential Energy Consumption Survey
Square footage measurements and comparisons
<http://www.eia.doe.gov/emeu/recs/sqft-measure.html>

Commercial Commercial Buildings Energy Consumption Survey (CBECS),
Description of CBECS Building Types
<http://www.eia.doe.gov/emeu/cbecs/pba99/bldgtypes.html>

Embodied Emissions Worksheet
Section I: Buildings

Type (Residential) or Principal Activity (Commercial)	# thousand sq feet/ unit or building	Life span related embodied GHG missions (MTCO2e/unit)	Life span related embodied GHG missions (MTCO2e/ thousand square feet) - See calculations in table below
Single-Family Home	2.53	98	39
Multi-Family Unit in Large Building	0.85	33	39
Multi-Family Unit in Small Building	1.39	54	39
Mobile Home	1.06	41	39
Education	25.9	951	39
Food Sales	3.0	217	39
Food Service	5.6	217	39
Health Care Inpatient	241.4	9,346	39
Health Care Outpatient	10.4	403	39
Lodging	35.8	1,386	39
Retail (Other Than Mall)	9.7	376	39
Office	14.8	573	39
Public Assembly	14.2	550	39
Public Order and Safety	15.5	600	39
Religious Worship	10.1	391	39
Service	6.5	252	39
Warehouse and Storage	16.9	654	39
Other	21.9	848	39
Vacant	14.1	546	39

Section II: Pavement	All Types of Pavement
	39

	Columns and Beams	Intermediate Floors	Exterior Walls	Windows	Interior Walls	Roofs
Average GWP (lbs CO2e/sq ft): Vancouver, Low Rise Building	5.3	7.8	19.1	51.2	5.7	21.3
Average Materials in a 2,272-square foot single family home	0.0	2,289.0	3,206.0	283.0	6,050.0	3,103.0
MTCO2e	0.0	8.0	27.8	6.6	15.6	30.0
						88.0
						38.7

Sources

All data in black text

Residential floorspace per unit

Floorspace per building

Average GWP (lbs CO2e/sq ft): Vancouver, Low Rise Building

Athena EcoCalculator
Athena Assembly Evaluation Tool v2.3- Vancouver Low Rise Building
Assembly Average GWP (kg) per square meter
<http://www.athenami.ca/tools/ecocalculator/index.html>
Lbs per kg 2.20
Square feet per square meter 10.76

Average Materials in a 2,272-square foot single family home

Buildings Energy Data Book: 7.3 Typical/Average Household
Materials Used in the Construction of a 2,272-Square-Foot Single-Family Home, 2000
http://buildingsdatabook.eren.doe.gov/?id=view_book_table&tableID=2036&f=xls
See also: NABE, 2004 Housing Facts, Figures and Trends, Feb. 2004, p. 7.

Average window size

Energy Information Administration/Housing Characteristics 1993
Appendix B, Quality of the Data, Pg. 5
<http://eia.doe.gov/pub/consumption/residential/nrs3.html>

King County, DNRP, Contact: Matt Kuharic, matt.kuharic@kingcounty.gov

2001 Residential Energy Consumption Survey (National Average, 2001)
Square footage measurements and comparisons
<http://www.eia.doe.gov/emeu/recs/recs-measure.html>

EIA, 2003 Commercial Buildings Energy Consumption Survey (National Average, 2003)
Table C3, Consumption and Gross Energy Intensity for Sum of Major Fuels for Non-Mall Buildings, 2003
http://www.eia.doe.gov/emeu/recs/cbrecs2003/detailed_tables_2003/2003ser9/2003ser/c3.xls

Embodied GHG Emissions.....Worksheet Background Information

Buildings

Embodied GHG emissions are emissions that are created through the extraction, processing, transportation, construction and disposal of building materials as well as emissions created through landscape disturbance (by both soil disturbance and changes in above ground biomass).

Estimating embodied GHG emissions is new field of analysis; the estimates are rapidly improving and becoming more inclusive of all elements of construction and development.

The estimate included in this worksheet is calculated using average values for the main construction materials that are used to create a typical family home. In 2004, the National Association of Home Builders calculated the average materials that are used in a typical 2,272 square foot single-family household. The quantity of materials used is then multiplied by the average GHG emissions associated with the life-cycle GHG emissions for each material.

This estimate is a rough and conservative estimate; the actual embodied emissions for a project are likely to be higher. For example, at this stage, due to a lack of comprehensive data, the estimate does not include important factors such as landscape disturbance or the emissions associated with the interior components of a building (such as furniture).

King County realizes that the calculations for embodied emissions in this worksheet are rough. For example, the emissions associated with building 1,000 square feet of a residential building will not be the same as 1,000 square feet of a commercial building. However, discussions with the construction community indicate that while there are significant differences between the different types of structures, this method of estimation is reasonable; it will be improved as more data become available.

Additionally, if more specific information about the project is known, King County recommends two online embodied emissions calculators that can be used to obtain a more tailored estimate for embodied emissions: www.bulldcarbonneutral.org and www.athenasmi.ca/tools/ecoCalculator/.

Pavement

Four recent life cycle assessments of the environmental impacts of roads form the basis for the per unit embodied emissions of pavement. Each study is constructed in slightly different ways; however, the aggregate results of the reports represent a reasonable estimate of the GHG emissions that are created from the manufacture of paving materials, construction related emissions, and maintenance of the pavement over its expected life cycle. For specifics, see the worksheet.

Special Section: Estimating the Embodied Emissions for Pavement

Four recent life cycle assessments of the environmental impacts of roads form the basis for the per unit embodied emissions of pavement. Each study is constructed in slightly different ways; however, the aggregate results of the reports represent a reasonable estimate of the GHG emissions that are created from the manufacture of paving materials, construction related emissions, and maintenance of the pavement over its expected life cycle.

The results of the studies are presented in different units and measures; considerable effort was undertaken to be able to compare the results of the studies in a reasonable way. For more details about the below methodology, contact matt.kuharic@kingcounty.gov.

The four studies, Meil (2001), Park (2003), Stripple (2001) and Treloar (2001) produced total GHG emissions of 4-34 MTCO₂e per thousand square feet of finished paving (for similar asphalt and concrete based pavements). This estimate does not including downstream maintenance and repair of the highway. The average (for all concrete and asphalt pavements in the studies, assuming each study gets one data point) is ~17 MTCO₂e/thousand square feet.

Three of the studies attempted to thoroughly account for the emissions associated with long term maintenance (40 years) of the roads. Stripple (2001), Park et al. (2003) and Treloar (2001) report 17, 81, and 68 MTCO₂e/thousand square feet, respectively, after accounting for maintenance of the roads.

Based on the above discussion, King County makes the conservative estimate that 50 MTCO₂e/thousand square feet of pavement (over the development's life cycle) will be used as the embodied emission factor for pavement until better estimates can be obtained. This is roughly equivalent to 3,500 MTCO₂e per lane mile of road (assuming the lane is 13 feet wide).

It is important to note that these studies estimate the embodied emissions for roads. Paving that does not need to stand up to the rigors of heavy use (such as parking lots or driveways) would likely use less materials and hence have lower embodied emissions.

Sources:

Meil, J. A. Life Cycle Perspective on Concrete and Asphalt Roadways: Embodied Primary Energy and Global Warming Potential. 2006. Available:
[http://www.cement.ca/cementinst/ees8ec7b0d630126852566c40052107b/6ec79dc8ae03a782852572b90061b914/\\$FILE/ATTK0WF3/athena%20report%20Feb.%202002%202007.pdf](http://www.cement.ca/cementinst/ees8ec7b0d630126852566c40052107b/6ec79dc8ae03a782852572b90061b914/$FILE/ATTK0WF3/athena%20report%20Feb.%202002%202007.pdf)

Park, K. Hwang, Y., Seo, S., M.ASCE, and Seo, H., "Quantitative Assessment of Environmental Impacts on Life Cycle of Highways," Journal of Construction Engineering and Management, Vol 129, January/February 2003, pp 25-31, (DOI: 10.1061/(ASCE)0733-9364(2003)129:1(25)).

Stripple, H. Life Cycle Assessment of Road. A Pilot Study for Inventory Analysis. Second Revised Edition. IVL Swedish Environmental Research Institute Ltd. 2001. Available:
<http://www.ivl.se/rapporter/pdf/B1210E.pdf>

Treloar, G., Love, P.E.D., and Crawford, R.H. Hybrid Life-Cycle Inventory for Road Construction and Use. Journal of Construction Engineering and Management. P. 43-49. January/February 2004.

Energy Emissions Worksheet

Type (Residential) or Principal Activity (Commercial)	Energy consumption per building per year (million Btu)	Carbon Coefficient for Buildings	MTCO ₂ e per building per year	Floorspace per Building (thousand square feet)	MTCE per thousand square foot per year	MTCO ₂ e per thousand square foot per year	Average Building Life Span	Lifespan Energy Related MTCO ₂ e emissions per thousand square foot	Lifespan Energy Related MTCO ₂ e emissions per thousand square foot
Single-Family Home	107.3	0.108	11.61	2.53	4.6	16.8	57.9	672	266
Multi-Family Unit in Large Building	41.0	0.108	4.44	0.85	5.2	19.2	80.5	357	422
Multi-Family Unit in Small Building	78.1	0.108	8.45	1.39	6.1	22.2	80.5	681	489
Mobile Home	75.9	0.108	8.21	1.06	7.7	28.4	57.9	475	448
Education	2,125.0	0.124	264.2	25.6	10.3	37.8	62.5	16,526	646
Food Sales	1,110.0	0.124	138.0	5.6	24.6	90.4	62.5	8,632	1,541
Food Service	1,436.0	0.124	178.5	5.6	31.9	116.9	62.5	11,168	1,994
Health Care Inpatient	60,152.0	0.124	7,479.1	241.4	31.0	113.6	62.5	467,794	1,938
Health Care Outpatient	985.0	0.124	122.5	10.4	11.8	43.2	62.5	7,660	737
Lodging	3,578.0	0.124	444.9	35.8	12.4	45.6	62.5	27,826	777
Retail (Other Than Mall)	720.0	0.124	89.5	9.7	9.2	33.8	62.5	5,599	577
Office	1,376.0	0.124	171.1	14.8	11.6	42.4	62.5	10,701	723
Public Assembly	1,338.0	0.124	166.4	14.2	11.7	43.0	62.5	10,405	733
Public Order and Safety	1,791.0	0.124	222.7	15.5	14.4	52.7	62.5	13,928	899
Religious Worship	440.0	0.124	54.7	10.1	5.4	19.9	62.5	3,422	339
Service	501.0	0.124	62.3	6.5	9.6	35.1	62.5	3,896	599
Warehouse and Storage	764.0	0.124	95.0	16.9	5.6	20.6	62.5	5,942	352
Other	3,600.0	0.124	447.6	21.9	20.4	74.9	62.5	27,997	1,278
Vacant	294.0	0.124	36.6	14.1	2.6	9.5	62.5	2,286	162

Sources

All data in black text

Energy consumption for residential buildings

King County, DNRP. Contact: Matt Kuharic, matt.kuharic@kingcounty.gov

2007 Buildings Energy Data Book: 6.1 Quad Definitions and Comparisons (National Average, 2001)

Table 6.1.4: Average Annual Carbon Dioxide Emissions for Various Functions

<http://buildingsdatabook.eren.doe.gov/>

Data also at: http://www.eia.doe.gov/emeu/recs/recs2001_ce/ce1-4c_housingunits2001.html

Energy consumption for commercial buildings and

EIA, 2003 Commercial Buildings Energy Consumption Survey (National Average, 2003)

Table C3. Consumption and Gross Energy Intensity for Sum of Major Fuels for Non-Mall Buildings, 2003

http://www.eia.doe.gov/emeu/cbecs/cbecs2003/detailed_tables_2003/2003set9/2003excel/c3.xls

Floorspace per building

Note: Data in plum color is found in both of the above sources (buildings energy data book and commercial buildings energy consumption survey).

Carbon Coefficient for Buildings

Buildings Energy Data Book (National average, 2005)

Table 3.1.7: 2005 Carbon Dioxide Emission Coefficients for Buildings (MMTCE per Quadrillion Btu)

http://buildingsdatabook.eere.energy.gov/?id=view_book_table&TableID=2057

Note: Carbon coefficient in the Energy Data book is in MTCE per Quadrillion Btu.

To convert to MTCO₂e per million Btu, this factor was divided by 1000 and multiplied by 44/12.

2001 Residential Energy Consumption Survey (National Average, 2001)

Square footage measurements and comparisons

<http://www.eia.doe.gov/emeu/recs/recs/sqft-measure.html>

Residential floorspace per unit

average life span of buildings,
estimated by replacement time method

	Single Family Homes	Multi-Family Units in Large and Small Buildings	All Residential Buildings
New Housing Construction, 2001	1,273,000	329,000	1,602,000
Existing Housing Stock, 2001	73,700,000	26,500,000	100,200,000
Replacement time:	57.9	80.5	62.5

(national
average, 2001)

Note: Single family homes calculation is used for mobile homes as a best estimate life span.
Note: At this time, KC staff could find no reliable data for the average life span of commercial buildings.
Therefore, the average life span of residential buildings is being used until a better approximation can be ascertained.

Sources:

New Housing
Construction,
2001 Quarterly Starts and Completions by Purpose and Design - US and Regions (Excel)
http://www.census.gov/construction/quarterly_starts_completions_cust.xls
See also: <http://www.census.gov/construction/newresconstindex.html>

Existing
Housing Stock,
2001 Residential Energy Consumption Survey (RECS) 2001
Tables HC1:Housing Unit Characteristics, Million U.S. Households 2001
Table HC1-4a. Housing Unit Characteristics by Type of Housing Unit, Million U.S. Households, 2001
Million U.S. Households, 2001
http://www.eia.doe.gov/emeu/recs/recs2001/hc_pdf/housingunits/hc1-4a_housingunits2001.pdf

Transportation Emissions Worksheet

Type (Residential) or Principal Activity (Commercial)	# people/ unit or building	# thousand sq feet/ unit or building	# people or employees/ thousand square feet	vehicle related GHG emissions (metric tonnes CO2e per person per year)	MTCO2e/ year/ thousand square feet	Average Building Life Span	Life span transportation related GHG emissions (MTCO2e/ per unit)	Life span transportation related GHG emissions (thousand sq feet)
Single-Family Home.....	2.8	2.53	1.1	4.9	13.7	57.9	792	313
Multi-Family Unit in Large Building	1.9	0.85	2.3	4.9	9.5	80.5	766	904
Multi-Family Unit in Small Building	1.9	1.39	1.4	4.9	9.5	80.5	766	550
Mobile Home.....	2.5	1.06	2.3	4.9	12.2	57.9	709	668
Education	30.0	25.6	1.2	4.9	147.8	62.5	9247	361
Food Sales	5.1	5.6	0.9	4.9	25.2	4.5	1579	282
Food Service.....	10.2	5.6	1.8	4.9	50.2	62.5	3141	561
Health Care Inpatient	455.5	241.4	1.9	4.9	2246.4	9.3	140506	582
Health Care Outpatient	19.3	10.4	1.9	4.9	95.0	62.5	5941	571
Lodging	13.6	35.8	0.4	4.9	67.1	62.5	4194	117
Retail (Other Than Mail).....	7.8	9.7	0.8	4.9	38.3	62.5	2394	247
Office	28.2	14.8	1.9	4.9	139.0	9.4	8696	588
Public Assembly	6.9	14.2	0.5	4.9	34.2	62.5	2137	150
Public Order and Safety	18.8	15.5	1.2	4.9	92.7	60	5796	374
Religious Worship	4.2	10.1	0.4	4.9	20.8	2.1	1298	129
Service	5.6	6.5	0.9	4.9	27.6	4.3	1729	266
Warehouse and Storage	9.9	16.9	0.6	4.9	49.0	2.9	3067	181
Other	18.3	21.9	0.8	4.9	90.0	4.1	5630	257
Vacant	2.1	14.1	0.2	4.9	10.5	62.5	657	47

Sources

All data in black text

King County, DNRP. Contact: Matt Kuharic, matt.kuharic@kingcounty.gov

people/ unit

Estimating Household Size for Use in Population Estimates (WA state, 2000 average)

Washington State Office of Financial Management

Kimpel, T. and Lowe, T. Research Brief No. 47. August 2007

<http://www.ofm.wa.gov/researchbriefs/brief047.pdf>

Note: This analysis combines Multi Unit Structures in both large and small units into one category; the average is used in this case although there is likely a difference

Residential floorspace per unit

2001 Residential Energy Consumption Survey (National Average, 2001)

Square footage measurements and comparisons

<http://www.eia.doe.gov/emeu/recs/recs/sqft-measure.html>

employees/thousand square feet

Commercial Buildings Energy Consumption Survey commercial energy uses and costs (National Median, 2003)

Table B2. Totals and Medians of Floorspace, Number of Workers, and Hours of Operation for Non-Mall Buildings, 2003

http://www.eia.doe.gov/emeu/cbecs/cbecs2003/detailed_tables_2003/2003set1/2003excel/b2.xls

Note: Data for # employees/thousand square feet is presented by CBECS as square feet/employee. In this analysis employees/thousand square feet is calculated by taking the inverse of the CBECS number and multiplying by 1000.

vehicle related GHG emissions

Estimate calculated as follows (Washington state, 2006)_

56,531,930,000 2006 Annual WA State Vehicle Miles Traveled
Data was daily VMT. Annual VMT was 365*daily VMT.
<http://www.wsdot.wa.gov/mapsdata/fdo/annualmileage.htm>

6,395,798 2006 WA state population

<http://quickfacts.census.gov/qfd/states/53000.html>

8839 vehicle miles per person per year

0.0506 gallon gasoline/mile

This is the weighted national average fuel efficiency for all cars and 2 axle, 4 wheel light trucks in 2005. This includes pickup trucks, vans and SUVs. The 0.051 gallons/mile used here is the inverse of the more commonly known term "miles/per gallon" (which is 19.75 for these cars and light trucks).

Transportation Energy Data Book. 26th Edition. 2006. Chapter 4: Light Vehicles and Characteristics. Calculations based on weighted average MPG efficiency of cars and light trucks.

http://cta.ornl.gov/data/fedb26/Edition26_Chapter04.pdf

Note: This report states that in 2005, 92.3% of all highway VMT were driven by the above described vehicles.

http://cta.ornl.gov/data/fedb26/Spreadsheets/Table3_04.xls

24.3 lbs CO2e/gallon gasoline

The CO2 emissions estimates for gasoline and diesel include the extraction, transport, and refinement of petroleum as well as their combustion.

Life-Cycle CO2 Emissions for Various New Vehicles, RENew Northfield.

Available: <http://renewnorthfield.org/wpcontent/uploads/2006/04/CO2%20emissions.pdf>

Note: This is a conservative estimate of emissions by fuel consumption because diesel fuel, with a emissions factor of 26.55 lbs CO2e/gallon was not estimated.

2205

4.93 lbs/metric tonne

vehicle related GHG emissions (metric tonnes CO2e per person per year)

average life span of buildings, estimated
by replacement time method

See Energy Emissions Worksheet for Calculations

Commercial floorspace per unit

EIA, 2003 Commercial Buildings Energy Consumption Survey (National Average, 2003)

Table C3. Consumption and Gross Energy Intensity for Sum of Major Fuels for Non-Mall Buildings, 2003

http://www.eia.doe.gov/emeu/cbecs/cbecs2003/detailed_tables_2003/2003set9/2003excel/c3.xls