3.2 Air Quality

This section summarizes the *Air Quality Assessment* prepared by Geomatrix Consultants, Inc. (March 4, 2008). The primary purpose of this analysis was to assess whether the proposed project would be likely to result in significant adverse air quality impacts. None were identified.

Air quality is generally assessed in terms of whether concentrations of air pollutants are higher or lower than ambient air quality standards set to protect human health and welfare. Three agencies have jurisdiction over ambient air quality within the proposed project area: the U.S. Environmental Protection Agency (EPA), the Washington Department of Ecology (Ecology), and the Olympic Region Clean Air Agency (ORCAA). These agencies establish regulations that govern both the concentration of pollutants in the outdoor air, and contaminant emissions from air pollution sources. ORCAA applies the National Ambient Air Quality Standards (NAAQS).

Ecology and ORCAA maintain a network of air quality monitoring stations throughout the Olympic region to measure existing air quality. These stations are sited based on the intended use of the data they collect. Most monitoring stations focus on a single source or group of sources, and are usually in or near urban areas or close to specific large air pollution sources. Monitoring stations in more remote areas provide an indication of regional air pollution levels. Based on monitoring data collected over a period of years, regions are designated as "attainment" or "nonattainment" areas for particular air pollutants. Attainment status is therefore a measure of whether air quality in an area complies with the various NAAQS.

3.2.1 Criteria Air Pollutants

“Criteria air pollutants” are those that are long-established “pollutants” for which there are health-based ambient air quality standards, and for which there has been monitoring. For the purpose of the Thurston Highlands *Air Quality Assessment*, these include ozone, particulate matter, and carbon monoxide.

AFFECTED ENVIRONMENT

Ozone. Ozone is a highly reactive form of oxygen created by sunlight-activated chemical transformations of nitrogen oxides and volatile organic compounds (hydrocarbons) in the atmosphere. Ozone problems tend to be regional in nature because the atmospheric chemical reactions that produce ozone occur over a period of time, and because during the delay between emission and ozone formation, ozone precursors can be transported far from their sources. Transportation sources like automobiles and trucks are some of the sources that produce ozone precursors.

Thurston County is one of the fastest-growing counties in Washington, and such growth has produced the potential for a variety of sources that could generate elevated levels of ground-level ozone. A study to examine ozone in the region was established in 1997. Prior to this study, there were no ozone data for Thurston County. The counties north and east of Thurston County were at one time designated as ozone nonattainment areas because ozone levels exceeded the NAAQS on numerous occasions. Since 1997, ORCAA has monitored ozone in Thurston County at a monitor in Yelm. The Yelm ozone monitor was inactive between October 2005 and May 2006 while it was moved to another location within the City. Monitoring data collected to date indicate that the area is in attainment with the 1-hour and 8-hour ozone standards (EPA 2007).

Particulate Matter. Many industrial activities and operations, fuel combustion sources like residential wood burning, motor vehicle engines and tires, and other sources emit large and small particles into the air. Such particulate matter may be comprised of inert materials or may be chemically active and potentially harmful to human health. Such small particles can be transported far from their source(s) of emission, and can carry on their surfaces other pollutants. Federal, state, and local regulations set limits for particulate matter in the air based on the size of the particles and the related potential threat to health. When first regulated, particle pollution limits were based on "total suspended particulates," which included all sizes of particles. As sampling technology has improved and the importance of particle size and chemical composition have become more clear, ambient standards for particle pollution have been revised to focus on the smaller size fractions thought to be more dangerous to people.

There are now air quality standards for PM10, or particles less than or equal to about 10 micrometers (microns) in diameter, as well as for PM2.5, or particulate matter less than or equal to 2.5 microns in diameter. The latter size fraction is now thought to represent the most dangerous size fraction of airborne particulate matter because such small particles (e.g., a typical human hair is about 100 microns in diameter) can be breathed deeply into the lungs. In addition, such particles are often associated with toxic substances that are deleterious in their own right that can adsorb to the particles and be carried into the respiratory system. Based on the most recent health studies, in September 2006, EPA set new, more stringent standards for particulate matter based on fine (PM2.5) and coarse (PM10) particulate matter (EPA 2006).

While the Thurston Highlands project area is within a PM10 attainment area, following the enactment of the 1990 Clean Air Act Amendments, the portion of Thurston County that includes Olympia, Lacey, and Tumwater was designated nonattainment for PM10. After implementation of control measures and years of monitoring data indicating reduced levels of PM10, the Thurston County PM10 nonattainment area was reclassified as attainment for PM10, so the area is now a PM10 maintenance area (EPA 2000). Yelm and the proposed Thurston Highlands development area are outside (i.e., were never included in) the former PM10 nonattainment area.

The PM10 and PM2.5 monitoring stations located at the Mountain View Elementary School in Lacey are closest to the project study area. The Mountain View site is positioned to provide geographical and population coverage for the particulate matter network in Thurston County. Particulate matter levels measured at this location primarily represent wood smoke in and from a residential area of Lacey. Based on current PM2.5 data from this site and PM10 saturation studies (i.e., typically short-term, specialized sampling programs using multiple monitors in several locations) conducted during the winters of 1994-1996, this site probably represents the highest community-oriented exposures at the neighborhood scale in Thurston County. The Mountain View monitors have not recorded a violation of the PM10 or PM2.5 standard in recent years. Except possibly near large numbers of residential wood-burning devices, particulate matter levels in the project area probably comply with both PM10 and PM2.5 standards most of the time.

Carbon Monoxide. Carbon monoxide is the product of incomplete combustion. It is generated by the engines in transportation sources and other fuel-burning activities like residential space heating, and especially heating with solid fuels like coal or wood. Carbon monoxide is usually the air pollutant of greatest concern related to roadway transportation sources because it is the pollutant emitted in the greatest quantity for which there are short-term health standards. CO is a pollutant for which the impact is usually localized, and CO concentrations typically diminish within a short distance of roads. The highest ambient

concentrations of CO usually occur near congested roadways and intersections during wintertime periods of air stagnation.

The project study area is located in an unclassifiable/attainment area for CO since no monitors in Thurston County have ever violated the CO NAAQS. A CO monitor was established in Olympia in May of 1992, and relocated in 1995 to Sleater-Kinney Road in Lacey. In April of 2002 the Lacey monitor was discontinued in accord with an EPA request that all CO monitoring in Thurston County be terminated because no CO problems had been found in the area (ORCAA 2004).

POTENTIAL IMPACTS DURING CONSTRUCTION

Full Build-Out Conceptual Land Use Alternatives

Potential air quality impacts during construction of the Master Planned Community would be similar for any of the conceptual land use alternatives. Temporary, localized emissions of fugitive dust and vehicle emissions (particulate, carbon monoxide, carbon dioxide, volatile organic compounds, and nitrogen oxides) would occur; however, these emissions are not anticipated to result in any significant impact on the overall ambient air quality in Yelm (Geomatrix Consultants, March 4, 2008).

The engines of heavy trucks and smaller equipment such as generators and compressors would emit air pollutants that would slightly degrade local air quality. These emissions and the resulting concentrations, however, would be far outweighed by emissions from existing traffic within the transportation study area. Nonetheless, emissions from such sources, and especially from diesel-fueled engines, are coming under increasing scrutiny because of their suspected risk to human health. So, although there is little or no danger of such emissions resulting in pollutant concentrations that would exceed an applicable ambient air quality standard, pollution control agencies are now urging that emissions from diesel equipment be minimized to the extent practicable in order to reduce potential health risks.

Some phases of construction would cause odors detectable to some people in the area. This may be particularly noticeable during paving operations using asphalt. Odors associated with paving operations would be short-term.

Phase 1 Development Concept

Potential air quality impacts during construction within the Phase 1 development area would be similar in nature to those described above for full build-out, though generated from a smaller area − approximately 351 acres (28 percent) of the site.

No Action Alternative

If the site were to remain temporarily undeveloped, there would be no construction emissions to the air.

POTENTIAL DEVELOPED-CONDITION IMPACTS

Of the various criteria pollutants for which there are health-based National Ambient Air Quality Standards (NAAQS), only a few would likely be emitted from sources related to the proposed Thurston Highlands Master Planned Community. The applicant proposes to use

covenants, codes and restrictions to prohibit residential wood-burning appliances, such as wood stoves or fireplaces from which emissions include both fine particulate matter and CO. Instead, homes within the development equipped with fireplaces would use natural gas or propane appliances that would not result in significant emissions of either CO or fine particulate matter. Therefore, the developed condition of the project would not be expected to result in more than minor emissions of any pollutants.

The Thurston Highlands Master Planned Community would increase traffic volumes and affect traffic conditions on local roadways. The air pollutant of major concern with the transportation component of the project would be CO. Of the various vehicular emissions that are regulated, CO is the pollutant emitted in the largest quantity. As a result, CO was the primary focus of the Thurston Highlands *Air Quality Assessment* as an indicator of potential worst-case impacts related to the project.

The air quality analysis that considered project traffic consisted of a microscale CO hot-spot analysis using computer models recommended or required by EPA guidelines and/or air quality rules. Existing and predicted future traffic conditions with and without the Thurston Highlands Preferred Alternative were used to estimate worst-case CO concentrations near project-affected intersections in the existing (2006), Phase 1 (2012), and Phase 2 (2015) years. The specific models and analysis methods are described in more detail in the Thurston Highlands *Air Quality Assessment* (Geomatrix Consultants, March 4, 2008).

Mobile6.2 – Emission Factor Modeling. Traffic-related air quality modeling analysis requires vehicle emission factors for the years of interest. For this purpose, Geomatrix used the latest EPA vehicle emissions factor model, Mobile6.2, to calculate average in-use fleet emission factors for hydrocarbons, oxides of nitrogen, and carbon monoxide.

CAL3QHC Dispersion Modeling. Geomatrix used the CAL3QHC dispersion model (version 2) to calculate peak-hour CO concentrations near the three intersections forecast to be most affected by the Thurston Highlands development (described below). CAL3QHC is designed to calculate pollutant concentrations caused by transportation sources. It considers "free-flow" and "queue" emissions (based on Mobile emission factors) together with intersection geometry, wind direction, and other meteorological factors.

CAL3QHC Evaluated Intersections. The intent of an air quality analysis related to surface transportation sources is to examine the potential for impacts near the signalized intersections most likely to be adversely affected by project-related traffic. EPA suggests modeling the worst intersections that would be directly affected by a project to the degree that the level of service (LOS) would be degraded to a LOS "D" or worse due to a project.[1] Consistent with EPA guidance, signalized intersections that would be affected by the proposed project were screened for possible dispersion modeling by reviewing the intersection LOS analyses of evening (PM) peak traffic conditions for the first two phases of the project (2012 and 2015).

Full Build-Out Conceptual Land Use Alternatives

Potential air quality impacts in the full build-out condition of any of the conceptual land use alternatives would be similar. Because the *Air Quality Assessment* is based on the *Transportation Impact Analysis* for the project, and the *Transportation Impact Analysis* found that the Preferred Alternative would generate the largest number of trips during the PM peak

[1] LOS is defined in the Transportation section of this Draft EIS (Sectin 3.17).

hour, quantitative information reported in this analysis relates to the Preferred Alternative conceptual land use plan.

The *Transportation Impact Analysis* (Transportation Engineering Northwest 2008) examined local and regional intersections. Air quality modeling results for the worst-case CO concentrations at the three most project-affected intersections are far below the levels allowed by the applicable 35-ppm 1-hour or the 9-ppm 8-hour ambient air quality standards (see Table 3.2-1). Modeling indicates that there would be no air quality problems with existing conditions, 2012, or 2015 No Action or the Preferred Alternative for the Thurston Highlands Master Planned Community. Although traffic delays would more than double at some intersections between 2006 to 2015, maximum predicted CO concentrations are forecast to decrease in 2012 and 2015 due to federal vehicle emission reduction requirements.

Table 3.2-1. Calculated maximum peak 1-hour and 8-hour CO concentrations (in ppm).

Intersection	Period	2006	2012 Phase 1		2015 Phase 2	
			No Action	Preferred Alternative	No Action	Preferred Alternative
SR-510 at Martin Way SE	1-hour	8.2	7.2	7.1	6.4	6.8
	8-hour	5.7	5.0	5.0	4.5	4.8
SR-510 at 1st St	1-hour	5.7	5.0	5.4	4.6	5.1
	8-hour	4.0	3.5	3.8	3.2	3.6
SR-510 at 1st St	1-hour	5.9	5.2	5.9	4.8	4.9
	8-hour	4.1	3.6	4.1	3.4	3.4

Notes:

Model-predicted 1-hour CO concentrations include an assumed background concentration of 3.0 ppm to account for other emission sources in the area. This is likely a conservative assumption.
In accordance with EPA guidelines, 8-hr concentrations are calculated from 1-hour concentrations using a 0.7 "persistence factor" to account for changes in concentrations that would occur due to fluctuations in traffic and meteorological conditions over an 8-hour period.

Source: Geomatrix Consultants, Inc. (March 4, 2008).

Future conditions in 2025 with full build-out of the proposed project were qualitatively considered. Because conditions this far in the future related to the proposed project and many other factors are highly speculative, the following discussion is necessarily very general.

Trip generation can be compared among the three conceptual land use alternatives to generally consider the implications of full build-out. Review of the air quality implications of the Traditional Development Alternative and Urban Village Alternative in 2025 considered the trip generation expected to occur with and without the Thurston Highlands Master Planned Community. Either of these alternatives would use the same points of access as the Preferred Alternative. Table 3.2-2 shows the estimated net trips that would be generated by each conceptual land use alternative in 2025, and compares the Traditional Development Alternative and the Urban Village Alternative to the Preferred Alternative. Based on these data, while the Urban Village Alternative would produce the greatest number of daily trips, the peak hour with the highest net trips would be associated with the PM peak hour of the Preferred Alternative.

Table 3.2-2. Thurston Highlands 2025 full build-out trip generation (TENW 2008).

Period	2025 Thurston Highlands Alternative				
	Preferred	Traditional Development		Urban Village	
	Net Trips Generated	Net Trips Generated	Increase over Preferred	Net Trips Generated	Increase over Preferred
AM Peak	3,420	3,530	110	3,295	-125
PM Peak	5,345	4,675	-670	5,335	-10
Daily	64,000	52,450	-11,550	68,200	4,200
Source: Transportation Engineering Northwest (2008).					

Given the ongoing trend for reduction in vehicle CO emissions, it is highly likely that future project-related traffic with full build-out would be unlikely to cause significant air quality issues related to CO. This general finding should, however, be confirmed based on specific project-related and future transportation system data as this information becomes available (Geomatrix Consultants, March 4, 2008).

The air quality impact analysis conducted for this project considered the primary emission sources directly related to the project. Other than minor, incidental off-site development that maybe stimulated by the new mixed-use center that would be created by the Thurston Highlands Master Planned Community, there are no known or anticipated indirect actions, plans, or projects that would be likely to generate substantial levels of indirect emissions that would affect local or regional air quality.

The *Transportation Impact Analysis* on which the *Air Quality Assessment* was based considered both projected growth as well as planned transportation improvements and development projects in the project vicinity. Planned transportation improvements identified in the analysis were assumed to be completed by the 2012 or 2015 horizon years used for Thurston Highlands Phase 1 and Phase 2 build-out and occupancy. Consequently, the results of the air quality modeling presented above represent the additive effect of transportation-related air quality impacts during the early phases of Thurston Highlands development for which quantitative impact analyses were performed.

Phase 1 Development Concept

The CO hot-spot analysis conducted for Phase 1 (2012) and Phase 2 (2015) of the proposed development indicated future decreases in worst-case CO concentrations despite expected increases in traffic volumes and delays. These projected decreases in CO concentrations would be due to existing vehicle emission reduction requirements that will continue in future years, including into and beyond 2025 (i.e., the projected full build-out horizon year of the Thurston Highlands Master Planned Community).

No Action Alternative

There would be no change in air quality emissions from the site and no traffic-related emissions on access routes to the site if the No Action Alternative were selected. If the property remains temporarily undeveloped, there would be no construction-related on-site emissions. Maintaining the existing forest cover would result in no criteria pollutant emissions, and could

serve to remove some contaminants from the air. Eventual development of the site as allowed by current City zoning and Comprehensive Plan designations, could lead to emissions similar to those described for the Thurston Highlands Master Planned Community.

MITIGATION MEASURES FOR CRITERIA AIR POLLUTANTS

Incorporated Plan Features. The applicant proposes to implement the following list of mitigation measures during construction to minimize potential impacts from vehicle exhaust and fugitive dust. Several of these mitigation measures would be included in the project construction plan because they will also be required by the NPDES Construction Stormwater Permit.

- Use only equipment and trucks that are maintained in good operational condition.
- Encourage car pooling or other trip reduction strategies for construction workers.
- Stage construction to minimize overall transportation system congestion and delays to reduce regional emissions of pollutants during construction.
- Restrict idling of construction equipment and vehicles (e.g., limit idling to a maximum of 15 minutes) when turning off such equipment would not damage the equipment or excessively delay related activities.
- Locate construction equipment away from sensitive receptors such as fresh air intakes to buildings, air conditioners, and sensitive populations, to the maximum extent practicable.
- Locate construction staging zones as far away as practicable from people and especially from any sensitive populations such as the elderly and the young.
- Develop a dust control plan during project planning to identify sources and activities that would be likely to generate fugitive dust and the means to control such emissions.
- Spray exposed soil with water or other suppressant to reduce particulate emissions and deposition; include dust controls on paved and unpaved roads and in site preparation, grading and loading areas.
- Cover or use moisteners or soil stabilizers to minimize emissions from storage piles; minimize drop heights involved in creating storage piles or haul-vehicle loading.
- Cover all trucks transporting friable materials, or wet such materials in trucks, and/or provide adequate freeboard (space from the top of the material to the top of the truck bed), to reduce particulate emissions during transport.
- Pave or use gravel on staging areas and roads that would be exposed for long periods, and reduce speeds on unpaved roads or work areas.
- Use quarry spalls or other approved construction entrances, vehicle scrapes, or wheel washers to remove particulate matter that would otherwise be carried off site by vehicles to decrease deposition of particulate matter on area roadways.
- Remove particulate matter deposited on paved, public roads, sidewalks, and bicycle and pedestrian paths to reduce mud and dust; sweep and wash streets continuously to reduce emissions.
- Cover dirt, gravel, and debris piles as needed to reduce dust and windblown debris, and avoid dust-generating activities during windy periods.
- Route and schedule construction trucks to reduce delays to traffic during peak travel times to reduce air quality impacts caused by a reduction in traffic speeds.

It is notable that both an on-site gravel supply and the grading proposal for the project would significantly minimize the number of truck trips to/from the site during construction. A large on-site gravel resource (approximately 800,000 cubic yards of in-place material) will be used for road construction, utility trench backfill, and building pad construction. This will keep approximately 35,000 trips internal to the site (KPFF Consulting Engineers 2008). Further, the

grading proposal will balance cut and fill material on the property to the maximum extent practicable, thereby minimizing the number of export trips.

Based on the results of the *Air Quality Assessment*, no significant air quality impacts would be expected from the developed condition of any of the conceptual land use alternatives; therefore, no operational mitigation measures are warranted or proposed.

Applicable Regulations. Construction contractors would be required to comply with Olympic Region Clean Air Agency (ORCAA) Rule 8.3 requiring reasonably available control technology to minimize fugitive dust emissions.

Construction contractors would also be required to comply with ORCAA rules when emitting odor-bearing air contaminants. Rule 8.5 requires use of "reasonably available control technology to mitigate odor-bearing gases emitted into the atmosphere…"

Other Possible Mitigation Measures. Given that there is heavy traffic within the study area during some periods of the day, consideration should be given to scheduling haul traffic during off-peak times (e.g., between 9 AM and 4 PM) to have the least affect on other traffic, and to minimize indirect increases in traffic-related emissions.

SIGNIFICANT UNAVOIDABLE ADVERSE IMPACTS

No significant adverse air quality impacts attributable to criteria air pollutants (i.e., ozone, particulate matter, or carbon monoxide) have been identified, and none would be expected as a result of the Thurston Highlands Master Planned Community, for the reasons described above (Geomatrix Consultants, March 4, 2008).

3.2.2 Greenhouse Gas Emissions

The phenomenon of natural and human-caused effects on the atmosphere and related planetary systems due to global warming and other changes is generally referred to as "climate change." Due to the importance of the "greenhouse effect" and related atmospheric warming to climate change, the gases that affect such warming are called greenhouse gases or GHGs. The GHGs of primary importance are carbon dioxide (CO_2), methane, ozone, and nitrous oxide. Because CO_2 is the most abundant of these gases (but not necessarily the most damaging to the atmosphere on a volume basis because of varying residence time after emission), GHGs are now often quantified in terms of CO_2 equivalents, or CO_2 e.

Compared to the Criteria Air Pollutants discussed above, GHGs are only recently being recognized as an issue for consideration in the environmental review of land use proposals. Carbon dioxide (CO_2) is not considered a "pollutant" based on direct health-related impacts, so it cannot be subject to ambient standards that control concentrations in the air. Instead, approaches to managing CO_2e are based on emission controls aimed at first slowing down, then reducing overall atmospheric concentrations over time.

AFFECTED ENVIRONMENT

Emissions of certain gases from natural and anthropogenic (human-made) sources accumulate in the atmosphere and over time, can affect and change operational mechanisms within the atmosphere. For example, some gases that were once used extensively in refrigeration systems were found to accumulate in the atmosphere and to destroy high-elevation

ozone that shields the earth from harmful radiation. Based on this finding, uses of such gases are now strictly controlled.

Over the past 30 years, there has been a growing body of scientific evidence that human-caused emissions of some gases have been leading to changes in atmospheric systems. There is now ample evidence indicating these changes are affecting the climate of the planet on a large scale. Most scientists now believe that if steps are not taken to begin to reduce such emissions now and in the future, serious climatic changes that have already begun will continue to occur to the extent that they will affect the lives of most people, animals, and plants on earth. For more additional information regarding climate change, refer to information at the following link: http://www.pscleanair.org/programs/climate/whatis.aspx.

In response to the issue of climate change, several states and many local jurisdictions are now taking steps to begin reducing GHG emissions. For example, the states of California, Massachusetts, and Washington have adopted GHG emission reduction goals similar to those included in the Kyoto Protocol, the widely-adopted international guideline intended to address this issue. In addition, numerous cities have adopted similar goals and have begun implementing programs to begin quantifying GHG emissions in order to eventually begin reducing them. Although recent legislation in Washington State established GHG emission reduction targets in future years and set specific emission targets for some sources, there are as yet no specific emission reduction requirements or targets that apply to development projects.

POTENTIAL IMPACTS DURING CONSTRUCTION

Greenhouse gas emissions would be generated during construction to the extent that nonrenewable resources are used in development (e.g., wood products harvested from natural forests, exotic lumber, virgin metals, or more than essential quantities of concrete), and vehicle miles are traveled associated with the delivery of materials and construction worker trips. This condition would be the case for implementation of any of the conceptual land use alternatives or the Phase 1 development concept.

No Action Alternative

If the No Action Alternative were selected, and no development were to occur on the site in the short-term, there would be no construction period during which GHGs would be generated from the property.

POTENTIAL DEVELOPED-CONDITION IMPACTS

The Thurston Highlands project GHG emissions assessment was performed using tools that are still in the process of being developed and refined. Consequently, the GHG tabulation included below is a preliminary indication of expected project-related GHG emissions.

The tabulation of GHGs presented below is based on 2012 Phase 1 of the proposed development, so it includes only the initial residential portion of the Master Planned Community. Later stages of the proposed project are likely to be subject to additional review of potential emissions that could affect climate change. At that time it is expected that more detailed review tools will be available for considering this issue. Tools with the capability to consider additional specific information regarding advances in building techniques and materials, household energy conservation measures, and factors affecting alternative (i.e., non-automobile) means of

transportation would greatly benefit any such review. Furthermore, by the time of such future review it is likely there will be some established gage for assessing potential environmental impacts related to such emissions.

Phase 1 Development Concept

The Phase 1 development concept was formulated to assist service providers and decision makers with developing a quantitative understanding of the prospective requirements and impacts of the early stages of the Master Planned Community. This phase was used for a representative quantitative impact analysis of possible greenhouse gas emissions associated with construction and the developed condition of the project.

The tabulation of GHGs was based on a calculational procedure issued by King County, Washington in October 2007. Geomatrix modified this tool to reflect project-specific data where possible. In accordance with findings regarding the primary sources of GHG emissions, this tabulation focused on three areas/sources of emissions as described below.

- Building materials and processes (Embodied emissions). This portion of the calculation considered both the "upstream" (i.e., mining, harvest, manufacturing, and transport) and the "downstream" (i.e., subsequent, "in place" use and maintenance) of building materials. The default values were modified to reflect averages based on materials expected to be used in the Phase 1 project development (instead of applying averages based on all materials combined).

- Post-development energy usage (Energy). This element considered energy consumption in terms of British thermal units (btus) consumed by use of electricity and natural gas for providing space heating and power for household uses. The default values were modified to reflect better estimates of Pacific Northwest energy usage (instead of national averages).

- Transportation (Transport). This component considered GHG emissions related to vehicle use by people living in Phase 1 of the development. Here again, one critical default value was modified to reflect estimated project-related annual vehicle miles traveled (VMT).

Many of the details of the calculations performed to estimate overall GHG emissions are included in Appendix A of the *Air Quality Assessment* (Geomatrix Consultants, March 4, 2008). A summary tabulation is presented in Table 3.2-3.

Table 3.2-3. Lifecycle GHG emissions associated with Thurston Highlands Phase 1.

Type of Residential Building	# of Units	Emission Factors By Unit ($MTCO_2e$)			Total using the number of units estimate ($MTCO_2e$)
		Embodied	Energy	Transport	
Single-Family Home	597	30	489	608	672,634
Multi-Family Unit in Large Building	281	10	260	441	199,604
Multi-Family Unit in Small Building	130	16	495	644	150,202
Totals	1,008				1,022,439

MT = metric tons = 1.1023 short tons; a short ton = 2,000 pounds
Source: Geomatrix Consultants, Inc., adapted from King County calculation procedure; see Appendix A of the *Thurston Highlands Master Planned Community Air Quality Assessment*.

The estimated CO_2 equivalent emissions shown in Table 3.2-3 represent the lifecycle emissions of Phase 1 of the proposed project; that is, the cumulative emissions over the useful life of the homes to be built in the project. The useful life of single-family homes is assumed to be about 58 years, and the life of multi-family homes about 80 years.

There are as yet no particular means to gage whether such emissions constitute an "impact" in terms of their potential effects on climate. Current guidance in this area simply indicates the need to estimate CO_2e emissions with the intent to compile data for use in later discussions of this issue. And although it would be useful to put these emissions into perspective based on comparisons with similar sorts of projects, no truly comparative data yet exist.

To put the project-related CO_2e emissions estimate in perspective, readers are encouraged to consider that a new, natural gas-fired power plant (about 600 MW) generates about 2 million tons of CO_2e annually during *each year* it operates, or about 100 million tons over 50 years. This compares with about 1.1 million tons of CO_2e over the *entire life* of the Thurston Highlands Phase 1 development scenario (i.e., 50 years for single-family homes and 80 years for multi-family homes), or about 1.1% of a clean power plant (over 50 years). Older power plants and any plant burning coal emit much more CO_2e. With this perspective, the proposed project would be a relatively minor contributor to overall emissions of CO_2e.

The CO_2e compilation for the proposed project did not attempt to factor in measures that would tend to reduce such emissions by conserving household energy use and reducing VMT due to project sources. With effective implementation of such measures, CO_2e emissions from the project would be lower than indicated above.

Full Build-Out Conceptual Land Use Alternatives

In the absence of project-specific information that will not be developed in detail until at least the completion of Phase 1 of the development, it is not possible to thoroughly consider the GHG/climate change implications of later project phases. So even though there is likely to be increased awareness of this issue in the future along with more stringent review requirements that include quantification and consideration of possible GHG emission offsets, evaluating this issue is beyond the scale of current analytical methods and review requirements. It is worth noting, however, that the proposed development project includes "built green" and sustainable development measures and operations. These are described in more detail under Mitigation Measures in Draft EIS Section 3.6. Such measures would tend to result in lower GHG emissions compared with more conventional suburban development. The Mitigation Measures section below describes sustainable development elements of the proposed Master Planned Community.

Procedures for calculating, analyzing, and interpreting the implications of greenhouse gas emission generation from site-specific development proposals are in the earliest stages at the time of this writing. There is no uniform guidance at the State level (i.e., from the Washington Department of Ecology), nor from local jurisdictions other than King County. It is expected that future phases of Thurston Highlands will undergo supplemental environmental review to quantitatively evaluate specific phased development proposals in the context of the affected environment at that time, with advanced methods of analysis.

No Action Alternative

Through the process of photosynthesis, the chlorophyll in green plants, in the presence of sunlight, coverts carbon dioxide to oxygen. If the Thurston Highlands site were to temporarily remain undeveloped, the reprod forest cover on the property would continue to serve a beneficial effect from a greenhouse gas perspective – emitting no GHGs, and absorbing GHGs generated by other sources in the surrounding environment. Eventual development of the site as allowed under current plans could lead to GHG emissions similar to those expected due to the project. In the long term, a less well planned development on the site could lead to increased GHG emissions compared to the proposed project (e.g., if construction were to occur using less sustainable techniques and materials), and also could lead to increased traffic-related GHG emissions if more traditional forms of development were to occur.

MITIGATION MEASURES FOR GREENHOUSE GAS EMISSIONS

Specific measures that would minimize GHG emissions include any steps that would alter those aspects of the project that contribute to emissions due to construction of the development, energy use by the people who live there, or the need to drive.

Incorporated Plan Features. The applicant proposes to advocate to builders within the Thurston Highlands Master Planned Community to minimize the use of concrete and maximize the use of wood and wood composites. Because renewable and recycled materials use less resources and require a fraction of the energy necessary to produce virgin materials, associated GHG emissions are substantially lower. This would reduce GHG emissions associated with construction of the Master Planned Community compared with more conventional development practices.

Transportation sources are usually the single largest contributor to GHGs related to development, so any steps that reduce vehicle miles travelled (VMT) would reduce emissions of climate-affecting gases. The mixed-use Master Planned Community proposal would provide opportunities for people to live near their work and near essential services and desirable amenities, thereby tending to reduce VMT compared with conventional suburban development. The concentrated residential and commercial densities also would provide an attractive center for rapid transit systems that can provide alternative modes of transportation and reduce VMT in single-occupancy vehicles.

Applicable Regulations. Although there are no specific requirements to do so, some of the elements of the Thurston Highlands Master Planned Community would serve to reduce CO_2e emissions over the life of the project by implementing the *Sustainability Guidelines* adopted by the City of Yelm (September 19, 2006). These measures would reduce CO_2e emissions in a variety of ways by minimizing vehicle miles traveled (e.g., "create pedestrian-friendly neighborhoods" and "provide a variety of transportation choices"), and reducing emissions by increasing energy efficiencies (e.g., "compact building design" and "reduce operating costs . . . through energy and resource conservation").

Other Possible Mitigation Measures. End-use energy consumption in residences is a primary contributor to overall GHG emissions. Such energy use is a function a multiple factors, many of which can be positively affected during development of the facility. Site layout/design that maximizes exposure to the sun in the winter and takes advantage of natural ventilation can reduce winter heating needs and the need for summertime forced-air ventilation. Using construction techniques and materials that exceed building code requirements can reduce long-term energy use. Employing innovative heating technologies such as heat pumps, hot-water radiant floors, and ultra high-efficiency furnaces also would reduce energy consumption compared with conventional space-heating systems. Similarly, technologies to provide or supplement water-heating (e.g., on-demand and/or solar-assisted heating instead of continuously heated, large tank reservoirs) also would reduce the overall energy footprint of the development. Any steps that reduce energy use would minimize related GHG emissions. Implementing a high LEED®, "built green," or other low-impact/high-efficiency building standard, would conserve resources and minimize GHG emissions compared with conventional development techniques. The applicant proposes to advocate these choices to builders within the Thurston Highlands Master Planned Community. The City will also encourage builders to comply with adopted *Sustainability Guidelines*, and emerging technologies over the course of the development.

SIGNIFICANT UNAVOIDABLE ADVERSE IMPACTS

No significant adverse air quality impacts attributable to greenhouse gas emissions have been identified, and none would be expected as a result of the Thurston Highlands Master Planned Community, for the reasons described above (Geomatrix Consultants, March 4, 2008).