

Appendix M

NERTS Fuel Use Assessment

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Northeast Recycling and Transfer Station Project

Fuel Use Assessment

February 2025

King County Department of Natural Resources and Parks,
Solid Waste Division

Northeast Recycling and Transfer Station Project E00633E19

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Acronyms and Abbreviations

BSFC	Brake Specific Fuel Consumption
CNG	compressed natural gas
County	King County, Washington
Ecology	Washington State Department of Ecology
EIS	Environmental Impact Statement
Gal	Gallon
GHG	greenhouse gases
LEED	Leadership in Energy and Environmental Design
Mcf	Thousand cubic feet
MMBtu	million British thermal units
MOVES4	Motor Vehicle Emission Simulator Version 4
mph	miles per hour
MRW	moderate risk waste
NERTS	Northeast Recycling and Transfer Station
PSE	Puget Sound Energy
RTS	Recycling and Transfer Station
SEPA	Washington State Environmental Policy Act
SCAP	Strategic Climate Action Plan
SWD	Solid Waste Division
TBD	to be determined
VMt	vehicle miles traveled
WAC	Washington Administrative Code

EXECUTIVE SUMMARY

PURPOSE AND NEED

The King County Department of Natural Resources and Parks, Solid Waste Division (SWD), operates a system of eight transfer stations, two drop box facilities, one facility and one Wastemobile that accept moderate risk waste (MRW)¹ from residents and small businesses, and one regional landfill in King County, Washington. The County 2019 Comprehensive Solid Waste Management Plan (2019 Solid Waste Comp Plan) (King County 2019), which was adopted by cities per the adoption process described in the interlocal agreements between King County and incorporated cities in King County (see Section 1.2.1 in the FEIS) and approved by Ecology, identified the need for a new transfer station to replace the aging Houghton Recycling and Transfer Station in the northeast Lake Washington area of King County. The nearly 60-year-old Houghton Recycling and Transfer Station is one of the busiest in terms of tonnage and transactions, yet it has outlived its useful life and lacks capacity for the type of recycling and collection services that are increasingly in demand. The new recycling and transfer station (RTS), which will be called the Northeast Recycling and Transfer Station (NERTS), is proposed to be located in the northeastern part of King County, an area illustrated in Figure 5-4 of the 2019 Solid Waste Comp Plan. This document analyzes the fuel use of a new NERTS for the alternatives under consideration.

ALTERNATIVES

The County is considering two action alternatives (Alternatives 1 and 2) in addition to the No Action Alternative for the NERTS, as follows:

- No Action Alternative – A new recycling and transfer station would not be sited in northeastern King County. The existing Houghton Transfer Station at 11724 NE 60th Street in Kirkland would continue to be operated.
- Alternative 1: The existing Houghton RTS and adjacent area at 11724 NE 60th Street in Kirkland. Two options:
 - 1A – A facility constructed after the existing transfer station building is closed and deconstructed or demolished
 - 1B – A facility constructed while the existing transfer station building is open and operating, and then the existing transfer station building would be closed and repurposed, or deconstructed or demolished and replaced after the new station is open
- Alternative 2: A site composed of six tax parcels in the 15000 block of Woodinville-Redmond Road NE in Woodinville

SUMMARY OF FINDINGS

The No Action Alternative would not affect the current or future fuel use from the facility but would result in higher operational impacts than the proposed Alternatives 1 and 2. The fuel use impacts from the construction and operation of the proposed actions would not have significant cumulative impacts on fuel supplies.

As the tonnage of disposed waste increases along with population, anticipated fuel use will increase for the No Action Alternative compared to existing conditions. Alternatives 1A, 1B, and 2 include the use of a compactor, whereas the No Action Alternative does not. The addition of a compactor would reduce the total number of transfer hauling trips for the same amount of waste. The reduction in hauling trips would result in lower fuel use for King County transfer trailers over the long term compared with the No Action Alternative. The trip distance from the proposed transfer station to Cedar Hill Landfill for Alternative 2 is

¹ Moderate Risk Waste: relatively small quantities of hazardous waste generated by households and small businesses. Moderate risk waste includes household hazardous waste.

longer than for Alternatives 1A and 1B, and as a result, the fuel use for King County transfer trailers has a greater reduction for Alternative 1 than for Alternative 2. Overall fuel use follow the same pattern, with all action alternatives using less fuel in 2029 and 2040 compared with the No Action Alternative in each year, with Alternative 2 using slightly more than Alternative 1 in each year.

1. Introduction and Project Description

King County Department of Natural Resources and Parks, Solid Waste Division (SWD), is proposing to site, design, and build a modern transfer station in northeast King County (the County) to meet the region's growing demand for environmentally responsible waste management services. The new station would replace the existing aging Houghton RTS in Kirkland, which has been in service since the mid-1960s and does not have the capacity to offer the recycling and collection services customers increasingly need and want. The Fuel Use Assessment, prepared in support of an environmental impact statement (EIS) being prepared by the County as required by the Washington State Environmental Policy Act (SEPA), addresses impacts on energy and natural resources associated with the No Action Alternative and the proposed action alternatives.

Energy resources are affected by the use of fuels for human activities including facility construction and operation. This assessment describes the fuel consumption of the proposed alternatives for the new Northeast Recycling and Transfer Station (NERTS) and evaluates potential impacts that may result from the No Action Alternative and from the construction and operation of two potential action alternatives for a new transfer station (Alternative 1 in Kirkland and Alternative 2 in Woodinville, Washington) (Figure 1-1). This assessment has been assembled to aid in EIS decision-making, with detailed information regarding energy use.

1.1. Project Description

The new NERTS facility will include an enclosed solid waste transfer and processing area, enclosed solid waste compactor units, a recycling collection and sorting area, employee facility, scale house and weigh station, space for on-site customer queuing, a possible fueling station, and possible moderate risk waste disposal for products from homes and small qualifying businesses (Alternative 2 only).

The new facility would be designed and constructed to meet today's building and environmental standards and standards for service, operational efficiency, and customer and employee safety. The facility would provide improved recycling services to meet the County's environmental goals, and waste would be cost-effectively compacted for efficient transport. The facility would also have space for waste storage in the event of a major regional disaster and sufficient off-street queuing space for private and commercial vehicles.

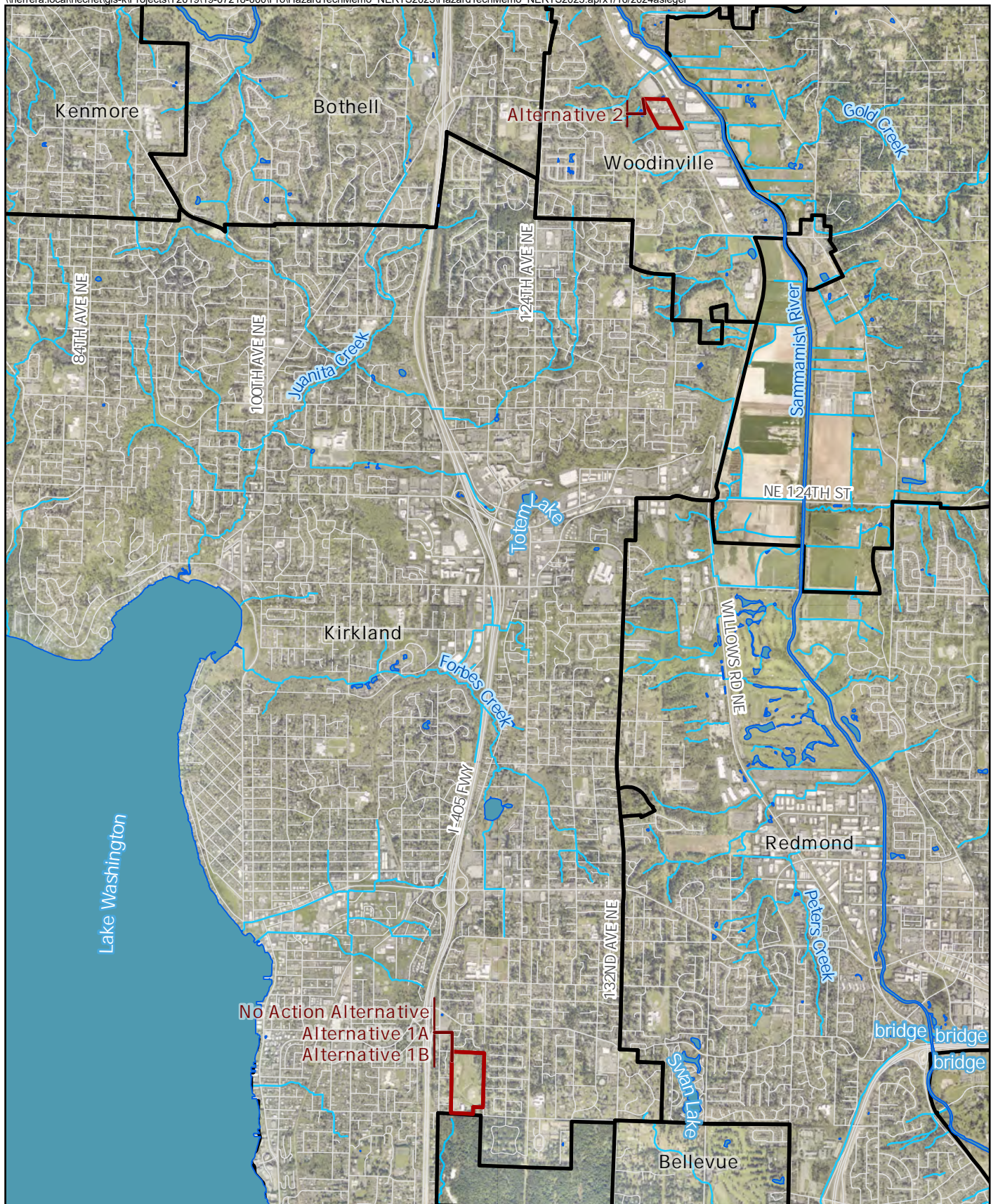
1.2. Project Alternatives

1.2.1. No Action Alternative

The existing Houghton Transfer Station is located at 11724 NE 60th Street in Kirkland on parcel 1759701890. The site is bordered to the east and west by single-family homes. Directly south of the site is NE 60th Street and directly south of NE 60th Street is Bridle Trails State Park. Under the No Action Alternative, no new NERTS facility would be developed at any location, and the existing Houghton RTS would continue to operate at its current location. If a new transfer station were not built, the existing transfer station would continue to offer limited recycling services for as long as it operates, and services would not be modernized or expanded to accommodate a growing population and solid waste industry changes. The facility would not be enclosed to control noise and odors. Waste would continue to not be compacted, which affects the number of transfer trucks and trailers that use the Houghton RTS, and there would not be space for waste storage in the event of a major regional disaster. The existing site is 8.4 acres. Access to the site is from NE 60th Street.

The existing facility is not enclosed, so it does not control noise nor odors. In 2022, the Houghton Transfer Station received two odor complaints on SWD's customer service line.

The Houghton RTS was built to codes before King County established sustainability goals for building development. The existing station does not include green building and sustainable design features that are part of the two action alternatives.



- Legend**
- Road
 - Streams
 - ▭ Alternative Locations
 - Waterbody
 - ▭ City Limit



Figure 1-1. Vicinity Map of King County Solid Waste Division Northeast Recycling and Transfer Station Alternatives.



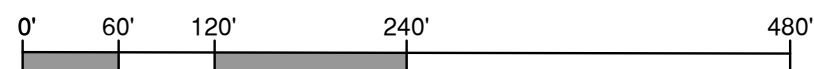
SCALE: 1" = 4,000'-0"
 0 2,000 4,000
 Feet



King County



SCALE: 1"=120'-0"



LEGEND

- SITE BOUNDARY
- AREA BOUNDARY

Figure 1-2 No Action Alternative

King County Solid Waste Division
Northeast Recycling and Transfer Station



King County

1.2.2.Elements Common to the Action Alternatives

The new facility would be built to modern transfer station and green building standards. The addition of compactors to reduce the volume of garbage before it is hauled to the landfill or other disposal facility could reduce the total number of transfer hauling trips to and from the new station by nearly a third, reducing the cost of operations and traffic impacts (King County 2019). In addition, modern transfer stations are built as fully enclosed buildings, resulting in reduced external dust, noise, odor, and litter. New transfer stations offer sufficient queuing space for customers and storage space for waste, including expanded dedicated areas for recycling services. All action alternatives would include the following physical elements (except where noted):

- Scale house and scales
- Enclosed transfer building for waste handling, sorting, and processing, with separate areas for commercial and self-haul drop-off
- Waste compactors
- Recycling and material staging areas
- Administration and staff area, and possible public education/meeting area
- Station perimeter fence
- MRW collection building (Alternative 2 only)
- A fueling station (to be determined)
- A “To Be Determined” building to house additional private recycling or reuse operators or other service providers
- Roadways for customers and SWD vehicles
- Covered and uncovered parking for waste transfer trailers
- Staff and visitor parking
- Stormwater management
- Wastewater management
- Landscaping.

1.2.2.1. Building Features

The approximate footprint of the building area would be between 80,000 square feet and 125,000 square feet. This would provide space for solid waste, recycling, administration, MRW collection (Alternative 2 only), and disaster event waste storage. Buffers between the active area of the station and neighboring uses would be appropriately sized and designed to reduce or eliminate impacts.

The height of the new station would depend on site conditions, city zoning codes, and the duly adopted building code. The distance from the main tipping floor – where refuse is dumped by customers – down to the compactor(s) would be approximately 20 feet and may be partially below grade. The height from the main tipping floor to the highest point of the roof would be approximately 50 feet – which is the distance required for commercial garbage trucks to tip without hitting the overhead misting (or equivalent technology), fire sprinkler, ventilation, and other systems. The overall height of the new station would be approximately 70 feet above the lowest level (50 to 70 feet above ground level). Development of buildings, parking areas, and roadways at the new transfer station would result in up to seven to nine acres of impervious surfaces.

The new transfer station will target the highest green building standards possible at each site, under King County’s Green Building and Sustainable Development ordinance and King County Code Title 18 Environmental Sustainability Programs.

1.2.2.2. Elements of Operation

The following activities and services would be provided at the new station:

- Disposal and transfer of garbage from self-haul and commercial customers
- Acceptance of source-separated waste from self-haul customers
 - Co-mingled recyclables (curbside mix of paper, cardboard, tin, aluminum, plastic containers, glass bottles and jars)
 - Cardboard
 - Mixed yard and food waste
 - Clean wood
 - Plastic film
 - Expanded polystyrene (Styrofoam)
 - Scrap metal
 - Mercury lighting (fluorescent tubes and compact fluorescent bulbs)
 - Large appliances (refrigerant and non-refrigerant)
 - Small appliances (anything with a cord)
 - Additional recyclables, which may include bicycles and bicycle parts, CD/DVD/VCR players, rigid plastics, textiles, mattresses, carpet, gypsum wallboard, aggregates (bricks, pavers, porcelain sinks and toilets), asphalt shingles and other construction and demolition waste; and other materials targeted for diversion from disposal
- Potential removal of recyclables from mixed loads and/or construction and demolition waste loads
- Potential mixed waste sorting and processing
- Potential transfer of commercial yard waste and curbside recyclables
- Potential on-site organics sorting and processing
- Potential MRW service.

While providing recycling services remains an important element of the 2019 Solid Waste Comp Plan, specific policies and goals change over time. To this end, transfer stations, which are meant to last for approximately 50 years, must be designed to be flexible, with sufficient space to reconfigure operations as program requirements change over time.

The following measures are anticipated during operations for the health and safety of customers, employees, and neighbors:

- The transfer building will be fully enclosed except for the entry/exit points, reducing off-site dust, noise, odor, and litter.
- A mechanical exhaust ventilation system with filtration media will be incorporated into the transfer station building for odor and dust control within the building.
- A misting system or equivalent technology will be installed in the transfer building for odor and dust control within the building.
- The tipping floor will be cleared at the end of each day, with waste stored in the sealed compactor, if necessary.
- Fully loaded transfer trailers will be removed from the station in the order they are filled.
- Transfer trailers will be fully enclosed, and doors and door-seals will be maintained to reduce the potential for odor, spills and litter leaving the building.
- Efficient on-site traffic flows will minimize vehicle queuing, reducing emissions.
- The station will be cleaned weekly at a minimum.

1.2.2.3. Alternative 1

The site for Alternative 1 is located at 11724 NE 60th Street in Kirkland. Alternative 1 has two options:

- 1A – a facility constructed after the existing transfer station building is closed and deconstructed or demolished (Figure 1-3)
- 1B – a facility constructed while the existing transfer station building is open and operating, and then the existing transfer station building would be closed and repurposed, or deconstructed or demolished and replaced after the new station is open (Figure 1-4).

Alternative 1A includes removal of the existing transfer station building prior to construction of the new station and inclusion of a “TBD” (to-be-determined) facility to house future private recycling or reuse operations or service providers; Alternative 1A does not provide for a MRW collection facility. The proposed potential site development area for Alternative 1A is about 10 acres. Full recycling services would be provided with Alternative 1A. Taylor Fields (the closed Houghton landfill property) is currently used as baseball fields and for active and passive recreation, with a network of trails traversing the property. The entire parcel is owned by King County SWD. Improvements to Taylor Fields are also planned.

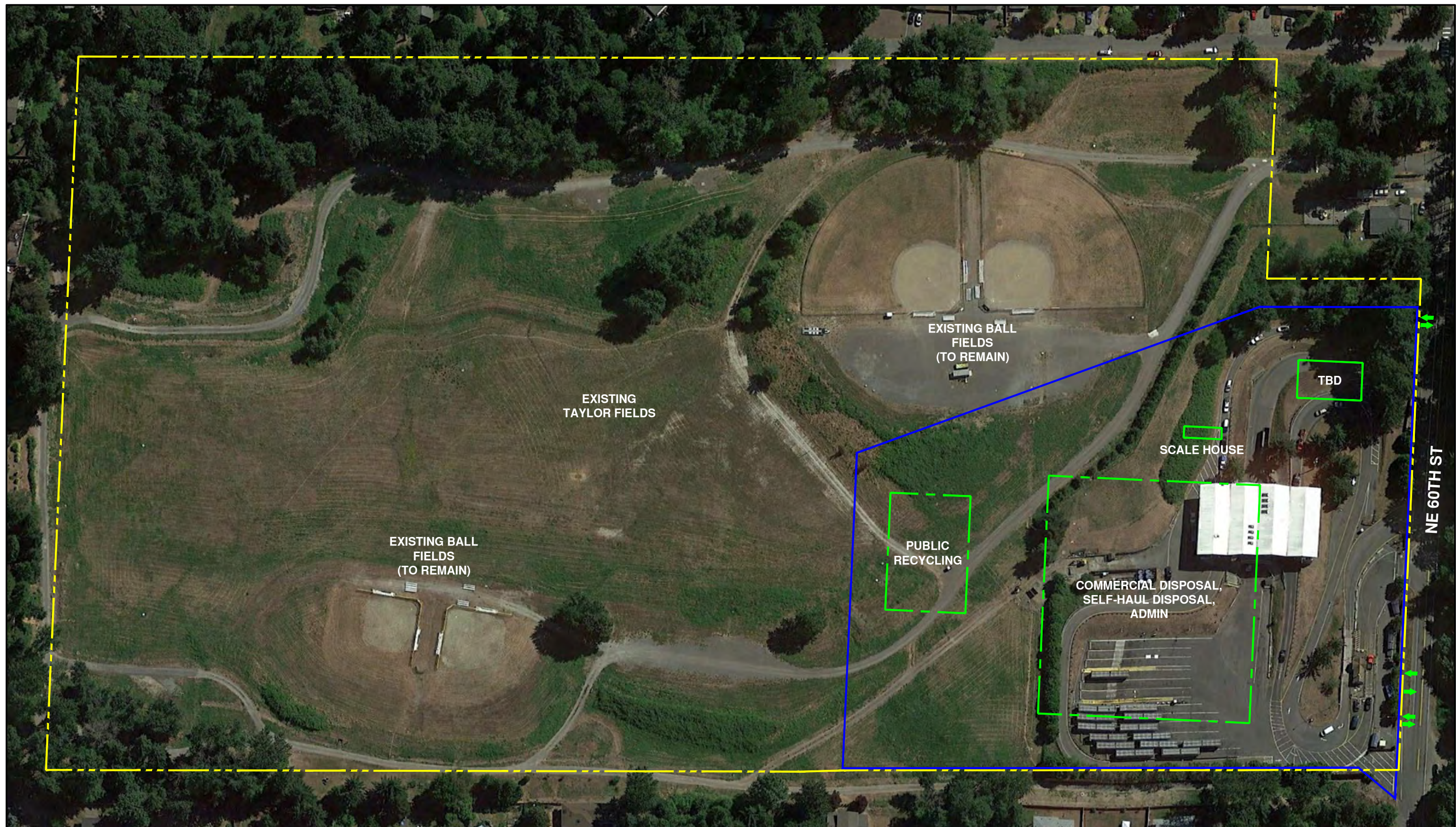
Alternative 1B retains the existing transfer station building during construction of the new station, and then closes and repurposes it, or deconstructs or demolishes and replaces it after the new station is open. While a future use has not been determined, the repurposed or replaced facility could house future private recycling or reuse operations or service providers. Alternative 1B does not provide for a MRW collection facility. The proposed potential site development area for Alternative 1B is about 12.75 acres. Full recycling services would be provided with Alternative 1B. Improvements to Taylor Fields are also planned.

The site is bordered to the east and west by single-family homes. Directly south of the site is NE 60th Street and directly south of NE 60th Street is Bridle Trails State Park. The area immediately north of the existing transfer station, where much of the development would take place, is also zoned P – Park/Open Space. Both Alternative 1A and Alternative 1B may include removal of some existing waste in the development footprint to accommodate construction of new facilities.

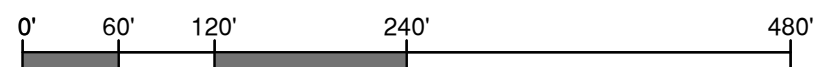
1.2.2.4. Alternative 2

The site for Alternative 2 is located on six tax parcels in the 15000 block of Woodinville-Redmond Road NE in Woodinville on parcels 1526059086, 5711600010, 5711600020, 5711600030, 1526059094, and 1526059095. The proposed site is 12.9 acres, with an area available for development of at least seven acres with additional area potentially available dependent on compliance with federal, state, and local environmental regulations. (Figure 1-5). The site is bordered to the north and south by commercial and light industrial uses. To the east is Woodinville-Redmond Road NE and further east are commercial and light industrial uses. To the west is a sloped greenspace, an abandoned Burlington Northern-Santa Fe Railroad rail line, and residential properties. Access to the Woodinville site is from Woodinville-Redmond Road Northeast. The site is currently used for commercial uses including construction, portable toilet rental, manufacturing, and automotive businesses, which would be relocated. A portion of the site is vacant and undeveloped and contains a wetland. Full recycling services would be provided with Alternative 2.

Alternative 2 offers service for collection of MRW, which would be stored in specialized containers on site. MRW includes hazardous waste generated by households and small businesses. Where the SWD currently provides MRW service, the following materials are accepted: pesticides, glues and adhesives, antifreeze, aerosols, automotive products, fuels, rechargeable batteries, button batteries, pool and spa chemicals, oil-based paints, hobby chemicals, mercury devices, thinners and solvents, fluorescent bulbs, toxic cleaning products, fuel cylinders (under five gallons), lithium batteries, and alkaline batteries. Individual loads are limited to 50 gallons and containers greater than five gallons are generally not accepted.



SCALE: 1"=120'-0"



LEGEND

- ALTERNATIVE LOCATION
- POTENTIAL SITE DEVELOPMENT AREA
- FUTURE DEVELOPMENT AREAS
- EXAMPLE ENTRANCE / EXIT

Figure 1-3
Action Alternative 1A

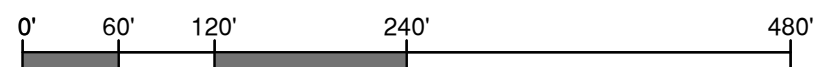
King County Solid Waste Division
Northeast Recycling and Transfer Station



King County



SCALE: 1"=120'-0"



LEGEND

- ALTERNATIVE LOCATION
- POTENTIAL SITE DEVELOPMENT AREA
- FUTURE DEVELOPMENT AREAS
- EXISTING BUILDINGS TO REMAIN DURING CONSTRUCTION
- ➡ EXAMPLE ENTRANCE / EXIT

Figure 1-4
Action Alternative 1B

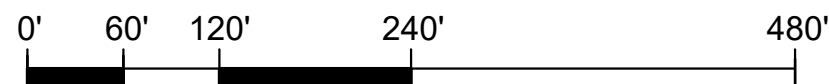
King County Solid Waste Division
Northeast Recycling and Transfer Station



King County



SCALE: 1"=120'-0"



LEGEND

	ALTERNATIVE BOUNDARY		EXISTING WETLAND AREA
	POTENTIAL SITE DEVELOPMENT AREA		EXAMPLE ENTRANCE / EXIT
	FUTURE DEVELOPMENT AREAS		
	79.8' WETLAND BUFFER		
	10'-0" BUILDING SETBACK		

Figure 1-5
Alternative 2

King County Solid Waste Division
Northeast Recycling and Transfer Station



King County

1.3. Construction Methods for the Action Alternatives

Design of the new NERTS facility has not been initiated at this time. However, it is anticipated that the action alternatives would require general earthwork and other activities to prepare the site for construction of facility buildings and associated functions. These activities may include, but not be limited to, soil excavation, soil filling, site grading, pile driving, utility trenching, waste excavation, modification or installation of environmental controls, installation of underground utilities, installation of drainage systems, material deliveries, building construction, and installation of equipment. Each of these activities would utilize appropriate construction equipment for the desired function. King County will require the design to minimize soil disturbance to the extent feasible.

2. Regulatory Context

Under the action alternatives, development and the associated fuel usage that has potential to impact energy and natural resources would require compliance with federal, state, and local regulations. Federal, state, and local agencies and applicable regulations related to energy and natural resources are described in the following sections.

2.1. Federal and State Laws, Plans, and Policies

2.1.1. Energy Policy Act

The Energy Policy Act addresses energy production in the United States, including energy efficiency; renewable energy; oil and gas; coal; Tribal energy; nuclear matters and security; vehicles and motor fuels, including ethanol; hydrogen; electricity; energy tax incentives; hydropower and geothermal energy; and climate change technology.

2.2. State Regulations

2.2.1. State Environmental Policy Act

SEPA is intended to ensure that environmental values are considered during decision-making by state and local agencies. SEPA procedures require agencies to identify and evaluate whether the proposed project or action will have probable significant adverse environmental impacts, and where appropriate, to develop mitigation measures that will reduce adverse environmental impacts. Proposals with impacts are subject to the County's SEPA substantive authority to approve, deny, or approve with conditions to mitigate the impacts.

2.2.2. Washington Utilities and Transportation Commission

The WUTC regulates private, investor-owned electric and natural gas utilities in Washington. It is the commission's responsibility to ensure regulated companies provide safe and reliable service to customers at reasonable rates, while allowing them the opportunity to earn a fair profit.

WAC 480 – Utilities and Transportation Commission regulates utilities in Washington, including but not limited to electrical, gas, irrigation, telecommunication, and water companies. State law (WAC 480 120) regulates the rates and charges, services, facilities, and practices of utilities. Any change in customer charges or service provision policy requires WUTC approval.

2.2.3. Clean Building Act

Washington's Clean Building Act (HB 1257) was signed into law in May 2019. The Clean Building Act required the Washington State Department of Commerce to develop a Clean Buildings Standard (WAC 194-50). The Clean Buildings Act requires all covered commercial buildings to comply with energy management provisions to reduce energy consumption and improve energy efficiency to reduce greenhouse gas emissions from the building sector.

2.3. Local Laws, Plans, and Policies

2.3.1. King County

King County has adopted several plans and regulations related to energy and natural resources. The 2023 King County Comprehensive Plan contains policies and strategies for conservation of lands with long-term commercial significance for farming, forestry, and mineral extraction, and for encouraging their productive and sustainable management. The strategy consists of policies to guide planning, incentives, education, regulation, and purchase or transfer of development rights. KCC Title 21A establishes land use regulations to implement the King County Comprehensive Plan's policies and objectives.

King County also helps enforce the GMA, which provides tools for local jurisdictions to effectively manage growth and provides a vision for the preparation of comprehensive plans.

King County promotes the conservation of energy and natural resources through both voluntary and regulatory means. King County's Green Building and Sustainable Development Ordinance, updated in 2022 through King County Ordinance 19402, ensures the planning, design, construction, remodeling, renovation, maintenance, and operations of any King County owned or financed capital project is consistent with the latest green building and sustainable development practices. The ordinance was implemented as recommended in the SCAP to ensure King County facilities are consistent with the highest green building and sustainable development practices. The SCAP provides strategies to achieve green building goals such as establishing a water use baseline to increase water efficiency and requiring County capital programs to strive for carbon neutral development (SCAP 2020). Ordinance 19402 establishes minimum performance requirements for energy, emissions, stormwater management, and construction and demolition materials diversion, and requires all eligible new construction projects to strive for Leadership in Energy and Environmental Design (LEED) Platinum certification in accordance with King County Title 18 Environmental Sustainability Program and the updated ordinance. The LEED rating system provides credits for sustainable sites, water efficiency, energy and atmosphere, materials and resources, indoor environmental quality, innovation and design process, and regional priority. The Ordinance also encourages innovation and supports flexibility by adding alternative green building rating systems, including Built Green, Evergreen Sustainable Development Standard, Salmon Safe, and Living Building Challenge, among others. The SCAP states that King County's Wastewater Treatment Division and Solid Waste Division shall each independently achieve carbon-neutral operations by 2025. The SCAP also provides strategies to electrify King County's vehicle fleet and build out charging infrastructure (GHG 2.12.1); and expand the use of alternative fuels when electric vehicles are not feasible (GHG 2.12.2). The SCAP supports implementation of Ordinance 19052, which targets conversion of 50% of heavy-duty county-operations vehicles to electric vehicles by 2038 and 100% by 2043.

DNRP, including SWD, participates in PSE's Green Direct Program, where up to 100 percent of their energy is from dedicated, local, renewable energy resources. Small amounts of electricity from newer electricity accounts in PSE's service territory are not procuring 100 percent carbon-free electricity (SCAP 2023).

2.3.2. City of Kirkland

The City of Kirkland promotes energy efficiency in their buildings through voluntary programs. The Kirkland Sustainability Master Plan (2021) set key energy goals such as securing carbon-free electricity, reducing vehicle miles traveled, and reducing the use of natural gas in buildings by converting systems to clean electric. Kirkland's High Performing Green Building Program encourages the public to construct energy-efficient buildings by offering expedited permit review for certified high-performing new buildings.

The Kirkland Comprehensive Plan (2022) also focuses on energy and natural resource policies that support their sustainability initiatives in Chapter V – Environment. The Comprehensive Plan outlines goals for stewardship of natural resources, development of energy efficient buildings, and use of renewable energy. The Comprehensive Plan discusses the adoption of the Natural Resource Management Plan in 2003 which has been used to address environmental issues. The City has used the Natural Resource Management Plan to develop new environmental programs, initiatives, and regulations.

2.3.3. City of Woodinville

Woodinville's Climate Action Plan promotes energy efficiency and includes the following goals:

- Advancing building decarbonization
- Reducing energy use in new and existing buildings
- Increasing energy resilience to climate impacts

Woodinville aims to implement these goals by:

- Following Washington State Building and Energy Code
- Expanding their heat pump program

- Providing contractor incentives
- Promoting green power
- Implementing other programs that improve energy efficiency

The Woodinville Comprehensive Plan (2015) encourages energy-responsible decisions, energy conservation, renewable energy use, and protection of natural resources and critical areas. The Comprehensive Plan outlines key goals for utilities such as “encourage reduced energy consumption, conservation, the use of renewable technologies, and energy responsible land use decisions” and “explore providing incentives to residents and businesses that improve building energy performance and/or incorporate on-site renewable energy.”

3. Methodology

3.1. Construction

Fuel consumption from off-road construction equipment during construction of NERTS was estimated using Brake Specific Fuel Consumption (BSFC) from the U.S. Environmental Protection Agency (EPA) Motor Vehicle Emission Simulator Version 4 (MOVES4) program. Fuel consumption from on-road vehicles was estimated using the energy consumption rates for vehicles from MOVES4. Calculations were carried out as follows:

For off-road equipment, fuel consumption was calculated using the BSFC from MOVES4 and the projected construction durations, hours of equipment operation, and estimated numbers and types of equipment for each year. Information of anticipated project specific equipment were used, supplemented with default settings and parameters from MOVES4.

For on-road vehicles, including haul trucks, onsite trucks, and worker commuter vehicles, fuel consumption was calculated using the energy consumption rates from MOVES4 and the anticipated number of trips and trip distances to the construction sites. All haul trucks were assumed to be heavy-duty diesel vehicles (combination unit short-haul vehicles), onsite pickups were assumed to be gasoline light commercial trucks, and worker commuter vehicles were assumed to be gasoline-powered passenger cars and trucks.

3.2. Operation

Energy consumption by vehicles during operations was estimated using the energy consumption rate from MOVES4 and estimated project vehicle miles traveled (VMT) in the project area. Vehicle types and assigned corresponding MOVES4 source type categories are shown in Table 3-1. Fuel types for each type of vehicle included in the analysis were determined based on MOVES4 defaults for King County, which accounts for an increased number of electric or alternative fuel vehicles in future years. Employee vehicles included passenger cars and passenger trucks. The higher energy consumption rates of these two types of vehicles were used in the analysis. MOVES4 defaults were used where project-specific or agency-provided data were not available. Vehicle fuel types of each source category in Table 1 were based on MOVES4 default fuel distribution in the county for each analysis year. Vehicle trips and VMT associated with the project were estimated based on potential routes that the vehicles would take between each centroid location of relevant zip codes using actual King County transaction data. Analysis was done to cross-reference potential routes to access each project site from these given zip codes and ultimately developed into an assignment percentage. VMT is shown in Table 3-2. Mileage for weekend transfer trailers is based on “worst case” scenario under the current five-day hauling operation.

Table 3-1. Vehicle Categories for Operation

Operation Vehicle Types	MOVES4 Source Category
King County transfer trailers	Combination short-haul truck
Commercial hauling trucks	Refuse truck
Self-haul vehicles (cars)	Passenger car
Self-haul vehicles (trucks)	Single-unit short-haul truck
Employees	Passenger car and passenger truck
Moderate Risk Waste self-haul	Single-unit short-haul truck
Moderate Risk Waste transfer trucks	Single-unit short-haul truck

Table 3-2. Vehicle Miles Traveled Data

	Kirkland NERTS Site						Woodinville NERTS Site	
	Existing		Alternative 1A and Alternative 1B			Alternative 2		
	2023	2023	2029 & 2040	2029 & 2040	2029 & 2040	2029 & 2040	2029 & 2040	2029 & 2040
	Weekday	Weekend	No Action Weekday	No Action Weekend	Action Weekday	Action Weekend	Action Weekday	Action Weekend
Self Haul								
Daily Volume	186.0	324.0	404.0	531.0	404.0	531.0	404.0	531.0
Daily VMT: Freeway	1425.0	2482.3	3,224.8	4,238.6	3,224.8	4,238.6	949.0	1,247.3
Average Speed (mph): Freeway	45.5	45.5	48.3	48.3	48.3	48.3	48.1	48.1
Daily VMT: Local	1,594.5	2,777.5	3,333.6	4,381.6	3,333.6	4,381.6	4,287.7	5,635.6
Average Speed (mph): Local	16.4	16.0	15.6	15.3	15.6	15.3	22.6	21.7
Commercial								
Daily Volume	71.0	0.0	111.0	0.0	111.0	0.0	111.0	0.0
Daily VMT: Freeway	400.8	0.0	626.6	0.0	626.6	0.0	713.5	0.0
Average Speed (mph): Freeway	48.0	0.0	48.0	0.0	48.0	0.0	47.3	0.0
Daily VMT: Local	546.6	0.0	854.5	0.0	854.5	0.0	992.1	0.0
Average Speed (mph): Local	14.9	0.0	14.9	0.0	14.9	0.0	21.5	0.0
Employees								
Daily Volume	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Daily VMT: Freeway	60.4	60.4	60.4	60.4	60.4	60.4	93.6	93.6
Average Speed (mph): Freeway	48.3	48.3	48.3	48.3	48.3	48.3	51.8	51.8
Daily VMT: Local	74.0	74.0	74.0	74.0	74.0	74.0	135.0	135.0
Average Speed (mph): Local	17.0	15.6	17.0	15.6	17.0	15.6	22.0	20.5

	Kirkland NERTS Site						Woodinville NERTS Site	
	Existing		Alternative 1A and Alternative 1B			Alternative 2		
	2023	2023	2029 & 2040	2029 & 2040	2029 & 2040	2029 & 2040	2029 & 2040	2029 & 2040
	Weekday	Weekend	No Action Weekday	No Action Weekend	Action Weekday	Action Weekend	Action Weekday	Action Weekend
Transfer Trailers								
Daily Volume	25.0	25.0	33.0	33.0	25.0	25.0	25.0	25.0
Daily VMT: Freeway	670.0	670.0	884.4	884.4	670.0	670.0	935.0	935.0
Average Speed (mph): Freeway	40.2	40.2	40.2	40.2	40.2	40.2	43.2	43.2
Daily VMT: Local	585.0	585.0	772.2	772.2	585.0	585.0	705.0	705.0
Average Speed (mph): Local	33.7	28.1	33.7	28.1	33.7	28.1	34.1	29.2
MRW Self-Haul								
Daily Volume	0.0	0.0	0.0	0.0	0.0	0.0	73.3	0.0
Daily VMT: Freeway	0.0	0.0	0.0	0.0	0.0	0.0	172.1	0.0
Average Speed (mph): Freeway	0.0	0.0	0.0	0.0	0.0	0.0	48.1	0.0
Daily VMT: Local	0.0	0.0	0.0	0.0	0.0	0.0	777.7	0.0
Average Speed (mph): Local	0.0	0.0	0.0	0.0	0.0	0.0	22.6	0.0
MRW Transfer Trucks								
Daily Volume	0	0	0	0	0	0	0.4	0
Daily VMT: Freeway	0	0	0.0	0	0	0	18.4	0
Average Speed (mph): Freeway	0	0.0	0.0	0.0	0	0.0	48.1	0.0
Daily VMT: Local	0	0	0.0	0	0	0	1.6	0
Average Speed (mph): Local	0	0.0	0.0	0.0	0	0.0	22.6	0.0
TOTAL								

	Kirkland NERTS Site						Woodinville NERTS Site	
	Existing		Alternative 1A and Alternative 1B			Alternative 2		
	2023	2023	2029 & 2040	2029 & 2040	2029 & 2040	2029 & 2040	2029 & 2040	2029 & 2040
	Weekday	Weekend	No Action Weekday	No Action Weekend	Action Weekday	Action Weekend	Action Weekday	Action Weekend
Daily Volume								
Daily VMT: Freeway	2,556.2	3,212.7	4,796.3	5,183.4	4,581.9	4,969.0	2,881.7	2,275.9
Average Speed (mph): Freeway								
Daily VMT: Local	2,800.1	3,436.5	5,034.4	5,227.8	4,847.2	5,040.6	6,899.1	6,475.6
Average Speed (mph): Local								
Total	5356.3	6,649.2	9,830.6	10,411.2	9,429.0	10,009.6	9,780.8	8,751.5

4. Results

4.1. Overview

The impacts on fuel use from the No Action Alternative, Alternative 1A, Alternative 1B, and Alternatives 2 are presented in this section. Impacts were categorized into impacts during construction and operation. Details of energy consumption modeled by MOVES4 are in Appendix A.

4.2. Construction

Summaries of construction energy consumption from the MOVES4 modeling for each of the action alternatives are shown in Tables 4-1 to 4-3. Note the gasoline consumption is the same for all action alternatives due to similar construction equipment activities utilizing that fuel.

Table 4-1. Project Construction Energy Consumption – Alternative 1A

Construction Year	Diesel	Gasoline	Total Energy
	gallons/year	gallons/year	MMBtu/year
2027	595,806	16,991	79,774
2028	292,954	22,663	40,907
2029	145,252	7,255	19,814
Total	1,034,012	46,909	140,495

Table 4-2. Project Construction Energy Consumption – Alternative 1B

Construction Year	Diesel	Gasoline	Total Energy
	gallons/year	gallons/year	MMBtu/year
2027	619,907	16,991	82,920
2028	479,305	22,663	65,233
2029	145,252	7,255	19,814
Total	1,244,464	46,909	167,967

Table 4-3. Project Construction Energy Consumption – Alternative 2

Construction Year	Diesel	Gasoline	Total Energy
	gallons/year	gallons/year	MMBtu/year
2027	569,777	16,991	76,376
2028	454,921	22,663	62,050
2029	145,252	7,255	19,814
Total	1,169,950	46,909	158,240

4.3. Operations

A summary of the operation energy consumption results from MOVES4 modeling for diesel, gasoline, ethanol E85, compressed natural gas (CNG), and electricity are shown in Table 4-4. For comparison purposes, Table 4-5 presents the operation gasoline and diesel transportation fuel consumption in gallons per year by vehicle classification for existing, no action, and both action alternatives. Table 4-6 shows the estimated total operations fuel use for all fuel types including diesel, gasoline, ethanol E85, CNG and electricity.

Table 4-4. Operation Energy Consumption by Fuel Types

Operation Years		Gasoline	Diesel	CNG	Ethanol	Electricity	Total Energy Consumption
		MMBtu/year	MMBtu/year	MMBtu/year	MMBtu/year	MMBtu/year	MMBtu/year
2023	Existing Condition	5,046	18,629	406	2,286	71.4	24,152
2029	No Action	7,225	25,106	669	2,718	844	33,846
2029	Alternative 1A Alternative 1B	7,225	22,169	659	2,718	831	30,885
2029	Alternative 2	6,183	24,705	703	2,362	734	32,326
2040	No Action	4,106	19,508	567	1,261	2,208	26,390
2040	Alternative 1A Alternative 1B	4,106	16,968	559	1,261	2,147	23,781
2040	Alternative 2	3,520	19,118	599	1,089	2,011	25,249

Table 4-5. Operational Gasoline and Diesel Transportation Fuel Consumption by Vehicle Types

Vehicle Classification 1,4	VMT Description	2023 Existing	2029 No Action	2029 Alternative 1A and 1B	2029 Alternative 2	2040 No Action	2040 Alternative 1A and 1B	2040 Alternative 2
		Gal/year	Gal/year	Gal/year	Gal/year	Gal/year	Gal/year	Gal/year
KC Transfer Trailers	To / From CHRLF and back to parking	72,421	88,190	66,810	85,887	76,265	57,776	74,375
Commercial Hauling Trucks	To / From zip code mid-point and back to parking	34,896	47,647	47,647	50,664	32,452	32,452	34,772
Self-Haul Vehicles (Cars) 2	To / From zip code mid-point and back to parking	25,912	35,422	35,422	27,502	16,999	16,999	13,192
Self-Haul Vehicles (Trucks) 2	To / From zip code mid-point	41,955	69,867	69,867	54,588	49,508	49,508	38,154
Employees 3	To / From zip code mid-point	2,387	1,714	1,714	2,692	929	929	1,461
MRW Self-Haul	To / From zip code mid-point	0	0	0	9,696	0	0	6,323
MRW Transfer Trucks	To / From Vendor facility	0	0	0	227	0	0	163
Total		177,571	242,840	221,461	231,255	176,153	157,664	168,440

Table 4-6. Operations Fuel Use in 2029 and 2040

Fuel Use	Unit	2029	2029	2029	2040	2040	2040
		No Action	Alternative 1	Alternative 2	No Action	Alternative 1	Alternative 2
Gasoline Energy	Gal/year	60,094	60,094	51,430	34,155	34,155	29,279
Diesel Energy	Gal/year	182,746	161,367	179,825	141,998	123,510	139,161
CNG Energy	Mcf/year	646	636	678	547	540	579
Ethanol Energy	Gal/year	36	36	31	17	17	14
Electricity Energy	MMBtu/year	844	831	734	2,208	2,147	2,011
Total Energy	MMBtu/year	33,846	30,885	32,326	26,390	23,781	25,249

Note: 1 J = 0.0009478 Btu

Gal = Gallon

Mcf = Thousand cubic feet

MMBtu = million British thermal units

4.4. Comparison of Alternatives

4.4.1. Construction Energy Consumption

As shown in Tables 4-1 to 4-3, Alternative 1B and 2 would have slightly higher fuel consumption than Alternative 1A. Alternative 1B and 2 would have higher amount of soil excavation, export, and import than Alternative 1A during construction. Therefore, Alternatives 1B and 2 require additional construction equipment use and haul truck trips during the excavation phase, resulting in higher fuel consumption than alternative 1A. The majority of the energy consumption during the project construction phase are from diesel fuel usage by onsite construction equipment and the offsite hauling vehicles. Approximately 96% of the fuel consumption during construction is from diesel.

4.4.2. Operation Energy Consumption

As shown in Tables 4-4 to 4-6, the No Action Alternative would result in higher vehicle operational energy consumption than Alternatives 1A, Alternative 1B, and Alternative 2 in 2029 and 2040. When compared to existing conditions, anticipated fuel use will increase for the No Action Alternative because the tonnage of disposed waste increase along with the population.

In general, Alternatives 1A, 1B, and 2 would have lower fuel consumption during facility operation in 2029 and 2040 than the No Action Alternative. This is because the action alternatives include the use of a compactor, whereas the No Action Alternative does not. The addition of a compactor would reduce the total number of transfer hauling trips for the same amount of waste. The reduction in hauling trips would result in lower fuel use for King County transfer trailers over the long term compared with the No Action Alternative. The trip distance from the proposed transfer station to Cedar Hill Landfill for Alternative 2 is longer than for Alternatives 1A and 1B, and as a result, the fuel use for King County transfer trailers has a greater reduction for Alternative 1 than for Alternative 2. Overall fuel use follows the same pattern, with all action alternatives using less fuel in 2029 and 2040 compared with the No Action Alternative in each year, with Alternative 2 using slightly more energy than Alternative 1 in 2029 and 2040.

The top contributor to the project operation energy consumption is diesel which accounts for approximately 77 percent of the energy consumption under the existing condition, 72 to 77 percent under the in 2029, and 71 to 75 percent in 2024, depending on the alternatives. The second top contributor to energy consumption is gasoline fuel, contributing approximately 14 to 21 percent of the energy consumption depending on the analysis year and alternatives. Overall, the combined diesel and gasoline usage are 95 to 96 percent of the energy consumption in 2029 and 89 to 90 percent of the energy consumption in 2040. The rest of the energy consumption is from CNG, electricity, and ethanol. The decreasing trend of diesel and gasoline consumption in future years is consistent with vehicles shifting from fossil fuels to cleaner energy such as CNG, ethanol, and electricity.

5. References

King County. 2019. King County. Comprehensive Solid Waste Management Plan. Department of Natural Resources and Parks Solid Waste Division. November.

SCAP. 2020. King County 2020 Strategic Climate Action Plan. Department of Natural Resources and Parks & King County Climate Action Team. May 2021.

SCAP. 2023. 2023 Biennial Update, King County 2020 Strategic Climate Action Plan. Department of Natural Resources and Parks & King County Climate Action Team. 2023.

Appendix A

Energy Calculations

Energy Consumption Summary

Total Fuel Usage during Construction - Alternative 1a

	Diesel	Gasoline	Total Energy
Construction Year	gallons/year	gallons/year	MMBtu/year
2027	595,806	16,991	79,774
2028	292,954	22,663	40,907
2029	145,252	7,255	19,814
Total	1,034,012	46,909	140,495

Total Fuel Usage during Construction - Alternative 1b

	Diesel	Gasoline	Total Energy
Construction Year	gallons/year	gallons/year	MMBtu/year
2027	619,907	16,991	82,920
2028	479,305	22,663	65,233
2029	145,252	7,255	19,814
Total	1,244,464	46,909	167,967

Total Fuel Usage during Construction - Alternative 2

	Diesel	Gasoline	Total Energy
Construction Year	gallons/year	gallons/year	MMBtu/year
2027	569,777	16,991	76,376
2028	454,921	22,663	62,050
2029	145,252	7,255	19,814
Total	1,169,950	46,909	158,240

Operation Fuel Consumption Summary - in MMBtu/Year

Operation Years		Gasoline MMBtu/year	Diesel MMBtu/year	CNG MMBtu/year	Ethanol MMBtu/year	Electricity MMBtu/year	Total Energy Consumption MMBtu/year
2023	Existing Condition	5,046	18,629	406	2,286	71.4	24,152
2029	No Action	7,225	25,106	669	2,718	844	33,846
2029	Alternative 1a, Alternative 1b	7,225	22,169	659	2,718	831	30,885
2029	Alternative 2	6,183	24,705	703	2,362	734	32,326
2040	No Action	4,106	19,508	567	1,261	2,208	26,390
2040	Alternative 1a, Alternative 1b	4,106	16,968	559	1,261	2,147	23,781
2040	Alternative 2	3,520	19,118	599	1,089	2,011	25,249

Operational Gasoline and Diesel Transportation Fuel Consumption – by Vehicle Types in Gallons/Year

		Existing 2023	No Action 2029	Alternative 1a and 1b 2029	Alternative 2 2029	No Action 2040	Alternative 1a and 1b 2040	Alternative 2 2040
Vehicle Classification	VMT Description	Gal/year	Gal/year	Gal/year	Gal/year	Gal/year	Gal/year	Gal/year
KC Transfer Trailers	To / From CHRLF and back to parking	72,421	88,190	66,810	85,887	76,265	57,776	74,375
Commercial Hauling Trucks	To / From zip code mid-point and back to parking	34,896	47,647	47,647	50,664	32,452	32,452	34,772
Self-Haul Vehicles (Cars)	To / From zip code mid-point and back to parking	25,912	35,422	35,422	27,502	16,999	16,999	13,192
Self-Haul Vehicles (Trucks)	To / From zip code mid-point	41,955	69,867	69,867	54,588	49,508	49,508	38,154
Employees 3	To / From zip code mid-point	2,387	1,714	1,714	2,692	929	929	1,461
MRW Self-Haul	To / From zip code mid-point	0	0	0	9,696	0	0	6,323
MRW Transfer Trucks	To / From Vendor facility	0	0	0	227	0	0	163
Total		177,571	242,840	221,461	231,255	176,153	157,664	168,440

Operations Fuel Use in 2029 and 2040 -All Fuel Types by Volume (Except Electricity)

		2029	2029	2029	2040	2040	2040
Fuel Use	Unit	No Action	Alternative 1a and 1b	Alternative 2	No Action	Alternative 1a and 1b	Alternative 2
Gasoline Energy	Gal/year	60,094	60,094	51,430	34,155	34,155	29,279
Diesel Energy	Gal/year	182,746	161,367	179,825	141,998	123,510	139,161
CNG Energy	Mcf/year	646	636	678	547	540	579
Ethanol Energy	Gal/year	36	36	31	17	17	14
Electricity Energy	MMBtu/year	844	831	734	2,208	2,147	2,011
Total Energy	MMBtu/year	33,846	30,885	32,326	26,390	23,781	25,249

Phasing Information (start and end month for each) - Alternative 1a

Phase Description	Start	End	Number of Working Days
Activity/Phase #1 -NTP	1/1/2027	1/31/2027	26
Activity/Phase #2 - Mob	2/1/2027	2/28/2027	23
Activity/Phase #3 - Clearing	3/1/2027	4/30/2027	51
Activity/Phase #4 - Excavation (2027)	5/1/2027	12/31/2027	209
Activity/Phase #4 - Excavation (2028)	1/1/2028	4/30/2028	103
Activity/Phase #5 - Foundations/Walls/Roof (2028)	2/1/2028	12/31/2028	286
Activity/Phase #5 - Foundations/Walls/Roof (2029)	1/1/2029	1/31/2029	26
Activity/Phase #6 - Equipment	2/1/2029	4/30/2029	75
Activity/Phase #7 - Landscaping	5/1/2029	5/31/2029	26
Activity/Phase #8 - Commissioning	6/1/2029	6/30/2029	25

Phasing Information (start and end month for each) - Alternative 1b

Phase Description	Start	End	Number of Working Days
Activity/Phase #1 -NTP	1/1/2027	1/31/2027	26
Activity/Phase #2 - Mob	2/1/2027	2/28/2027	23
Activity/Phase #3 - Clearing	3/1/2027	4/30/2027	51
Activity/Phase #4 - Excavation (2027)	5/1/2027	12/31/2027	209
Activity/Phase #4 - Excavation (2028)	1/1/2028	4/30/2028	103
Activity/Phase #5 - Foundations/Walls/Roof (2028)	2/1/2028	12/31/2028	286
Activity/Phase #5 - Foundations/Walls/Roof (2029)	1/1/2029	1/31/2029	26
Activity/Phase #6 - Equipment	2/1/2029	4/30/2029	75
Activity/Phase #7 - Landscaping	5/1/2029	5/31/2029	26
Activity/Phase #8 - Commissioning	6/1/2029	6/30/2029	25

Phasing Information (start and end month for each) - Alternative 2

Phase Description	Start	End	Number of Working Days
Activity/Phase #1 -NTP	1/1/2027	1/31/2027	26
Activity/Phase #2 - Mob	2/1/2027	2/28/2027	23
Activity/Phase #3 - Clearing	3/1/2027	4/30/2027	51
Activity/Phase #4 - Excavation (2027)	5/1/2027	12/31/2027	209
Activity/Phase #4 - Excavation (2028)	1/1/2028	4/30/2028	103
Activity/Phase #5 - Foundations/Walls/Roof (2028)	2/1/2028	12/31/2028	286
Activity/Phase #5 - Foundations/Walls/Roof (2029)	1/1/2029	1/31/2029	26
Activity/Phase #6 - Equipment	2/1/2029	4/30/2029	75
Activity/Phase #7 - Landscaping	5/1/2029	5/31/2029	26
Activity/Phase #8 - Commissioning	6/1/2029	6/30/2029	25

NERTS Project Construction Diesel Consumption Summary - Alternative 1a

Construction Fuel Summary - Nonroad

	Diesel	Diesel	Diesel
	ton/year	gallons/year	MMBtu/year
Nonroad Construction Equipment 2027	1,904	544,942	71,135
Nonroad Construction Equipment 2028	726	207,689	27,111
Nonroad Construction Equipment 2029	401	114,834	14,990.1
Total nonroad Equipment	3,031	867,465	113,236

Construction Fuel Summary - Onroad

	Diesel	Gasoline	Diesel	Gasoline
	gallons/year	gallons/year	MMBtu/year	MMBtu/year
Onroad Vehicles 2027	50,864	16,991	6,640	1,999
Onroad Vehicles 2028	85,265	22,663	11,130	2,666
Onroad Vehicles 2029	30,418	7,255	3,971	853
Total Onroad Vehicles	166,546	46,909	21,740	5,518

Total Fuel Usage during Construction - Alternative 1a

	Diesel	Gasoline	Total Energy
	gallons/year	gallons/year	MMBtu/year
2027	595,806	16,991	79,774
2028	292,954	22,663	40,907
2029	145,252	7,255	19,814
Total	1,034,012	46,909	140,495

Calculation Factors:

Heat value:	KJ/g	MMBtu/g
Diesel	43.488	4.122E-05
gasoline	43.717	4.143E-05

1 KJ = 9.478E-7 MMBtu

	diesel	gasoline
	g/gallon	g/gallon
density	3167	2839.00

Alternative 1a: Construction Emissions Calculations - Offroad Construction Equipment

Offroad Construction Equipment Emissions - Roadway Construction

Construction Equipment Name	Number of Equipment	Hours per Day	Number of Days	Total Hours	Year	Energy Factors	Emissions	MOVES Equipment Types
						BSFC	BSFC	
						lb/hour	ton/year	
Phase 1								
Water truck	1	10	26	260	2027	171.389	22.281	Off-highway Trucks
Phase 2								
Low boys	2	4	8	61	2027	171.389	5.256	Off-highway Trucks
Excavators	4	4	8	123	2027	37.831	2.320	Excavators
Graders	1	10	23	230	2027	44.808	5.153	graders
Dozers	2	4	8	61	2027	57.193	1.754	Crawler Tractor/Dozers
Off Road Dump Truck	4	4	8	123	2027	171.389	10.512	Off-highway Trucks
10 wheeler dump truck and trailer	4	4	8	123	2027	171.389	10.512	Off-highway Trucks
fork lifts	2	1	4	8	2027	22.487	0.086	Rough Terrain Forklifts
Cranes	2	1	4	8	2027	36.605	0.140	cranes
Water truck	1	10	23	230	2027	171.389	19.710	Off-highway Trucks
Phase 3								
Excavators	4	10	51	2040	2027	37.831	38.588	Excavators
Dozers	2	5	51	510	2027	57.193	14.584	Crawler Tractor/Dozers
Off Road Dump Truck	2	10	51	1020	2027	171.389	87.409	Off-highway Trucks
Water truck	1	8	51	408	2027	171.389	34.963	Off-highway Trucks
Phase 4 (2027)								
Excavators	4	10	209	8360	2027	37.831	158.135	Excavators
Dozers	2	10	209	4180	2027	57.193	119.534	Crawler Tractor/Dozers
Off Road Dump Truck	4	10	209	8360	2027	171.389	716.408	Off-highway Trucks
10 wheeler dump truck and trailer	4	10	139	5573	2027	171.389	477.605	Off-highway Trucks
Water truck	1	10	209	2090	2027	171.389	179.102	Off-highway Trucks
Phase 4 (2028)								
Excavators	4	2.5	103	1030	2028	37.831	19.483	Excavators
Dozers	2	2.5	103	515	2028	57.193	14.727	Crawler Tractor/Dozers
Off Road Dump Truck	4	2.5	103	1030	2028	171.390	88.266	Off-highway Trucks
10 wheeler dump truck and trailer	4	2.5	69	687	2028	171.390	58.844	Off-highway Trucks
Water truck	1	2.5	103	258	2028	171.390	22.066	Off-highway Trucks
Phase 5 (2028)								
Excavators	2	10	286	5720	2028	37.831	108.197	Excavators
Construction Cranes	2	10	286	5720	2028	36.605	104.690	Cranes
Fork Lifts	2	10	286	5720	2028	22.487	64.312	Rough Terrain Forklifts
Water truck	1	10	286	2860	2028	171.390	245.087	Off-highway Trucks
Phase 5 (2029)								
Excavators	2	10	26	520	2029	37.831	9.836	Excavators
Construction Cranes	2	10	26	520	2029	36.605	9.517	Cranes
Fork Lifts	2	10	26	520	2029	22.487	5.847	Rough Terrain Forklifts
Water truck	1	10	26	260	2029	171.390	22.281	Off-highway Trucks
Phase 6								
Low Boys	4	8	50	1600	2029	171.390	137.112	Off-highway Trucks
Construction Cranes	2	10	75	1500	2029	36.605	27.454	Cranes
Fork Lifts	2	10	75	1500	2029	22.487	16.865	Rough Terrain Forklifts
Water truck	1	10	75	750	2029	171.390	64.271	Off-highway Trucks
Phase 7								
Dozers	2	10	26	520	2029	57.193	14.870	Crawler Tractor/Dozers
10 wheeler dump truck and trailer	2	10	26	520	2029	171.390	44.561	Off-highway Trucks
Excavators	2	5	26	260	2029	37.831	4.918	Excavators
Water truck	1	10	26	260	2029	171.390	22.281	Off-highway Trucks
Phase 8								
Water truck	1	10	25	250	2029	171.390	21.424	Off-highway Trucks
Total 2027							1904.052	
Total 2028							725.673	
Total 2029							401.236	

Note:

1. Emission factors were obtained from a MOVES4 Nonroad Module run for King County, weekdays, 12-month average, based on MOVES4 defaults.
2. All equipment assumed to be diesel-fueled.

Alternative 1a: Construction Emissions Calculations - Onroad Vehicles

Onroad Vehicles Emissions - Roadway Construction

Vehicles	Type	Number of Vehicles	Number of RTs/day per Vehicle	Miles/RT	Number of Days	Total Vehicle Miles	Year	Fuel factors	Emissions
								Fuel	Fuel Usage
								MMBtu/mile	MMBtu/year
Phase 1									
Worker commute	Passenger	4	1	30	26	3120	2027	0.004	13.543
Haul trucks	Haul	0	0	0	26	0	2027	0.020	0.000
Concrete trucks	Haul	0	0	0	26	0	2027	0.020	0.000
Onsite pickups	Pickup	4	1	100	26	10400	2027	0.005	48.042
Phase 2									0.000
Worker commute	Passenger	20	1	30	23	13800	2027	0.004	59.903
Haul trucks	Haul	0	0	0	23	0	2027	0.020	0.000
Concrete trucks	Haul	0	0	0	23	0	2027	0.020	0.000
Onsite pickups	Pickup	4	1	100	23	9200	2027	0.005	42.498
Phase 3									
Worker commute	Passenger	40	1	30	51	61200	2027	0.004	265.655
Haul trucks	Haul	1	40	30	51	61200	2027	0.020	1228.327
Concrete trucks	Haul	0	0	0	51	0	2027	0.020	0.000
Onsite pickups	Pickup	4	1	100	51	20400	2027	0.005	94.236
Phase 4 (2027)									
Worker commute	Passenger	40	1	30	209	250800	2027	0.004	1088.665
Haul trucks	Haul	1	43	30	209	269610	2027	0.020	5411.261
Concrete trucks	Haul	0	0	0	209	0	2027	0.020	0.000
Onsite pickups	Pickup	4	1	100	209	83600	2027	0.005	386.182
Phase 4 (2028)									
Worker commute	Passenger	40	1	30	103	123600	2028	0.004	520.371
Haul trucks	Haul	1	43	30	103	132870	2028	0.020	2632.062
Concrete trucks	Haul	0	0	0	103	0	2028	0.020	0.000
Onsite pickups	Pickup	4	1	100	103	41200	2028	0.005	185.510
Phase 5 (2028)									
Worker commute	Passenger	40	1	30	286	343200	2028	0.004	1444.913
Haul trucks	Haul	0	0	0	286	0	2028	0.020	0.000
Concrete trucks	Haul	1	50	30	286	429000	2028	0.020	8498.190
Onsite pickups	Pickup	4	1	100	286	114400	2028	0.005	515.104
Phase 5 (2029)									
Worker commute	Passenger	40	1	30	26	31200	2029	0.004	127.142
Haul trucks	Haul	0	0	0	26	0	2029	0.020	0.000
Concrete trucks	Haul	1	50	30	26	39000	2029	0.020	762.739
Onsite pickups	Pickup	4	1	100	26	10400	2029	0.004	45.406
Phase 6									
Worker commute	Passenger	40	1	30	75	90000	2029	0.004	366.756
Haul trucks	Haul	1	25	30	62.5	46875	2029	0.020	916.753
Concrete trucks	Haul	1	50	30	62.5	93750	2029	0.020	1833.506
Onsite pickups	Pickup	4	1	100	75	30000	2029	0.004	130.979
Phase 7									
Worker commute	Passenger	20	1	30	26	15600	2029	0.004	63.571
Haul trucks	Haul	1	30	30	26	23400	2029	0.020	457.643
Concrete trucks	Haul	0	0	0	26	0	2029	0.020	0.000
Onsite pickups	Pickup	4	1	100	26	10400	2029	0.004	45.406
Phase 8									
Worker commute	Passenger	10	1	30	25	7500	2029	0.004	30.563
Haul trucks	Haul	0	0	0	25	0	2029	0.020	0.000
Concrete trucks	Haul	0	0	0	25	0	2029	0.020	0.000
Onsite pickups	Pickup	4	1	100	25	10000	2029	0.004	43.660
Total 2027 Diesel									6639.588
Total 2028 Diesel									11130.251
Total 2029 Diesel									3970.641
Total 2027 Gasoline									1998.724
Total 2028 Gasoline									2665.898
Total 2029 Gasoline									853.483

Notes:

1. Emission factors were obtained from MOVES4 Onroad Module runs at the Project Scale for King County at the annual level for weekdays. Emission factors
2. Passenger vehicles included gasoline cars and gasoline trucks. Emission factors represent the higher emission rate of the two types of vehicles.
3. PM emission factors includes tire wear and brake wear.
4. Emission factors are at an average vehicle speed of 40 mph.

NERTS Project Construction Diesel Consumption Summary - Alternative 1b

Construction Fuel Summary - Nonroad

	Diesel	Diesel	Diesel
	ton/year	gallons/year	MMBtu/year
Nonroad Construction Equipment 2027	1,904	544,942	71,135
Nonroad Construction Equipment 2028	1,336	382,317	49,907
Nonroad Construction Equipment 2029	401	114,834	14,990.1
Total nonroad Equipment	3,641	1,042,094	136,032

Construction Fuel Summary - Onroad

	Diesel	Gasoline	Diesel	Gasoline
	gallons/year	gallons/year	MMBtu/year	MMBtu/year
Onroad Vehicles 2027	74,965	16,991	9,786	1,999
Onroad Vehicles 2028	96,988	22,663	12,661	2,666
Onroad Vehicles 2029	30,418	7,255	3,971	853
Total Onroad Vehicles	202,370	46,909	26,417	5,518

Total Fuel Usage during Construction - Alternative 1b

	Diesel	Gasoline	Total Energy
	gallons/year	gallons/year	MMBtu/year
2027	619,907	16,991	82,920
2028	479,305	22,663	65,233
2029	145,252	7,255	19,814
Total	1,244,464	46,909	167,967

Calculation Factors:

Heat value:	KJ/g	MMBtu/g
Diesel	43.488	4.122E-05
gasoline	43.717	4.143E-05

1 KJ = 9.478E-7 MMBtu

	diesel	gasoline
	g/gallon	g/gallon
density	3167	2839.00

Alternative 1b: Construction Emissions Calculations - Offroad Construction Equipment

Offroad Construction Equipment Emissions - Roadway Construction

Construction Equipment Name	Number of Equipment	Hours per Day	Number of Days	Total Hours	Year	Energy Factors	Emissions	MOVES Equipment Types
						BSFC	BSFC	
						lb/hour	ton/year	
Phase 1								
Water truck	1	10	26	260	2027	171.389	22.281	Off-highway Trucks
Phase 2								
Low boys	2	4	8	61	2027	171.389	5.256	Off-highway Trucks
Excavators	4	4	8	123	2027	37.831	2.320	Excavators
Graders	1	10	23	230	2027	44.808	5.153	graders
Dozers	2	4	8	61	2027	57.193	1.754	Crawler Tractor/Dozers
Off Road Dump Truck	4	4	8	123	2027	171.389	10.512	Off-highway Trucks
10 wheeler dump truck and trailer	4	4	8	123	2027	171.389	10.512	Off-highway Trucks
fork lifts	2	1	4	8	2027	22.487	0.086	Rough Terrain Forklifts
Cranes	2	1	4	8	2027	36.605	0.140	cranes
Water truck	1	10	23	230	2027	171.389	19.710	Off-highway Trucks
Phase 3								
Excavators	4	10	51	2040	2027	37.831	38.588	Excavators
Dozers	2	5	51	510	2027	57.193	14.584	Crawler Tractor/Dozers
Off Road Dump Truck	2	10	51	1020	2027	171.389	87.409	Off-highway Trucks
Water truck	1	8	51	408	2027	171.389	34.963	Off-highway Trucks
Phase 4 (2027)								
Excavators	4	10	209	8360	2027	37.831	158.135	Excavators
Dozers	2	10	209	4180	2027	57.193	119.534	Crawler Tractor/Dozers
Off Road Dump Truck	4	10	209	8360	2027	171.389	716.408	Off-highway Trucks
10 wheeler dump truck and trailer	4	10	139	5573	2027	171.389	477.605	Off-highway Trucks
Water truck	1	10	209	2090	2027	171.389	179.102	Off-highway Trucks
Phase 4 (2028)								
Excavators	4	10	103	4120	2028	37.831	77.932	Excavators
Dozers	2	10	103	2060	2028	57.193	58.909	Crawler Tractor/Dozers
Off Road Dump Truck	4	10	103	4120	2028	171.390	353.062	Off-highway Trucks
10 wheeler dump truck and trailer	4	10	69	2747	2028	171.390	235.375	Off-highway Trucks
Water truck	1	10	103	1030	2028	171.390	88.266	Off-highway Trucks
Phase 5 (2028)								
Excavators	2	10	286	5720	2028	37.831	108.197	Excavators
Construction Cranes	2	10	286	5720	2028	36.605	104.690	Cranes
Fork Lifts	2	10	286	5720	2028	22.487	64.312	Rough Terrain Forklifts
Water truck	1	10	286	2860	2028	171.390	245.087	Off-highway Trucks
Phase 5 (2029)								
Excavators	2	10	26	520	2029	37.831	9.836	Excavators
Construction Cranes	2	10	26	520	2029	36.605	9.517	Cranes
Fork Lifts	2	10	26	520	2029	22.487	5.847	Rough Terrain Forklifts
Water truck	1	10	26	260	2029	171.390	22.281	Off-highway Trucks
Phase 6								
Low Boys	4	8	50	1600	2029	171.390	137.112	Off-highway Trucks
Construction Cranes	2	10	75	1500	2029	36.605	27.454	Cranes
Fork Lifts	2	10	75	1500	2029	22.487	16.865	Rough Terrain Forklifts
Water truck	1	10	75	750	2029	171.390	64.271	Off-highway Trucks
Phase 7								
Dozers	2	10	26	520	2029	57.193	14.870	Crawler Tractor/Dozers
10 wheeler dump truck and trailer	2	10	26	520	2029	171.390	44.561	Off-highway Trucks
Excavators	2	5	26	260	2029	37.831	4.918	Excavators
Water truck	1	10	26	260	2029	171.390	22.281	Off-highway Trucks
Phase 8								
Water truck	1	10	25	250	2029	171.390	21.424	Off-highway Trucks
Total 2027							1904.052	
Total 2028							1335.831	
Total 2029							401.236	

Note:

1. Emission factors were obtained from a MOVES4 Nonroad Module run for King County, weekdays, 12-month average, based on MOVES4 defaults.
2. All equipment assumed to be diesel-fueled.

Alternative 1b: Construction Emissions Calculations - Onroad Vehicles

Onroad Vehicles Emissions - Roadway Construction

Vehicles	Type	Number of Vehicles	Number of RTs/day per Vehicle	Miles/RT	Number of Days	Total Vehicle Miles	Year	Fuel factors	Emissions
								Fuel	Fuel Usage
								MMBtu/mile	MMBtu/year
Phase 1									
Worker commute	Passenger	4	1	30	26	3120	2027	0.004	13.543
Haul trucks	Haul	0	0	0	26	0	2027	0.020	0.000
Concrete trucks	Haul	0	0	0	26	0	2027	0.020	0.000
Onsite pickups	Pickup	4	1	100	26	10400	2027	0.005	48.042
Phase 2									0.000
Worker commute	Passenger	20	1	30	23	13800	2027	0.004	59.903
Haul trucks	Haul	0	0	0	23	0	2027	0.020	0.000
Concrete trucks	Haul	0	0	0	23	0	2027	0.020	0.000
Onsite pickups	Pickup	4	1	100	23	9200	2027	0.005	42.498
Phase 3									
Worker commute	Passenger	40	1	30	51	61200	2027	0.004	265.655
Haul trucks	Haul	1	40	30	51	61200	2027	0.020	1228.327
Concrete trucks	Haul	0	0	0	51	0	2027	0.020	0.000
Onsite pickups	Pickup	4	1	100	51	20400	2027	0.005	94.236
Phase 4 (2027)									
Worker commute	Passenger	40	1	30	209	250800	2027	0.004	1088.665
Haul trucks	Haul	1	68	30	209	426360	2027	0.020	8557.344
Concrete trucks	Haul	0	0	0	209	0	2027	0.020	0.000
Onsite pickups	Pickup	4	1	100	209	83600	2027	0.005	386.182
Phase 4 (2028)									
Worker commute	Passenger	40	1	30	103	123600	2028	0.004	520.371
Haul trucks	Haul	1	68	30	103	210120	2028	0.020	4162.330
Concrete trucks	Haul	0	0	0	103	0	2028	0.020	0.000
Onsite pickups	Pickup	4	1	100	103	41200	2028	0.005	185.510
Phase 5 (2028)									
Worker commute	Passenger	40	1	30	286	343200	2028	0.004	1444.913
Haul trucks	Haul	0	0	0	286	0	2028	0.020	0.000
Concrete trucks	Haul	1	50	30	286	429000	2028	0.020	8498.190
Onsite pickups	Pickup	4	1	100	286	114400	2028	0.005	515.104
Phase 5 (2029)									
Worker commute	Passenger	40	1	30	26	31200	2029	0.004	127.142
Haul trucks	Haul	0	0	0	26	0	2029	0.020	0.000
Concrete trucks	Haul	1	50	30	26	39000	2029	0.020	762.739
Onsite pickups	Pickup	4	1	100	26	10400	2029	0.004	45.406
Phase 6									
Worker commute	Passenger	40	1	30	75	90000	2029	0.004	366.756
Haul trucks	Haul	1	25	30	62.5	46875	2029	0.020	916.753
Concrete trucks	Haul	1	50	30	62.5	93750	2029	0.020	1833.506
Onsite pickups	Pickup	4	1	100	75	30000	2029	0.004	130.979
Phase 7									
Worker commute	Passenger	20	1	30	26	15600	2029	0.004	63.571
Haul trucks	Haul	1	30	30	26	23400	2029	0.020	457.643
Concrete trucks	Haul	0	0	0	26	0	2029	0.020	0.000
Onsite pickups	Pickup	4	1	100	26	10400	2029	0.004	45.406
Phase 8									
Worker commute	Passenger	10	1	30	25	7500	2029	0.004	30.563
Haul trucks	Haul	0	0	0	25	0	2029	0.020	0.000
Concrete trucks	Haul	0	0	0	25	0	2029	0.020	0.000
Onsite pickups	Pickup	4	1	100	25	10000	2029	0.004	43.660
Total 2027 Diesel									9785.670
Total 2028 Diesel									12660.520
Total 2029 Diesel									3970.641
Total 2027 Gasoline									1998.724
Total 2028 Gasoline									2665.898
Total 2029 Gasoline									853.483

Notes:

1. Emission factors were obtained from MOVES4 Onroad Module runs at the Project Scale for King County at the annual level for weekdays. Emission factors
2. Passenger vehicles included gasoline cars and gasoline trucks. Emission factors represent the higher emission rate of the two types of vehicles.
3. PM emission factors includes tire wear and brake wear.
4. Emission factors are at an average vehicle speed of 40 mph.

NERTS Project Construction Fuel Consumption Summary - Alternative 2

Construction Fuel Summary - Nonroad

	Diesel	Diesel	Diesel
	ton/year	gallons/year	MMBtu/year
Nonroad Construction Equipment 2027	1,904	544,942	71,135
Nonroad Construction Equipment 2028	1,336	382,317	49,907
Nonroad Construction Equipment 2029	401	114,834	14,990.1
Total nonroad Equipment	3,641	1,042,094	136,032

Construction Fuel Summary - Onroad

	Diesel	Gasoline	Diesel	Gasoline
	gallons/year	gallons/year	MMBtu/year	MMBtu/year
Onroad Vehicles 2027	24,834	16,991	3,242	1,999
Onroad Vehicles 2028	72,604	22,663	9,478	2,666
Onroad Vehicles 2029	30,418	7,255	3,971	853
Total Onroad Vehicles	127,856	46,909	16,690	5,518

Total Fuel Usage during Construction - Alternative 2

	Diesel	Gasoline	Total Energy
	gallons/year	gallons/year	MMBtu/year
2027	569,777	16,991	76,376
2028	454,921	22,663	62,050
2029	145,252	7,255	19,814
Total	1,169,950	46,909	158,240

Calculation Factors:

Heat value:	kJ/g	MMBtu/g	MMBtu/gallon
Diesel	43.488	4.122E-05	1.305E-01
Gasoline	43.717	4.143E-05	1.176E-01

1kJ = 0.9478 Btu

	Diesel	gasoline
	g/gallon	g/gallon
Density	3167	2839

Alternative 2: Construction Emissions Calculations - Offroad Construction Equipment

Offroad Construction Equipment Emissions - Roadway Construction

Construction Equipment Name	Number of Equipment	Hours per Day	Number of Days	Total Hours	Year	BSFC (Diesel)	Diesel	MOVES Equipment Types
						lb/hour	ton/year	
Phase 1								
Water truck	1	10	26	260	2027	171.389	22.281	Off-highway Trucks
Phase 2								
Low boys	2	4	8	61	2027	171.389	5.256	Off-highway Trucks
Excavators	4	4	8	123	2027	37.831	2.320	Excavators
Graders	1	10	23	230	2027	44.808	5.153	graders
Dozers	2	4	8	61	2027	57.193	1.754	Crawler Tractor/Dozers
Off Road Dump Truck	4	4	8	123	2027	171.389	10.512	Off-highway Trucks
10 wheeler dump truck and trailer	4	4	8	123	2027	171.389	10.512	Off-highway Trucks
fork lifts	2	1	4	8	2027	22.487	0.086	Rough Terrain Forklifts
Cranes	2	1	4	8	2027	36.605	0.140	cranes
Water truck	1	10	23	230	2027	171.389	19.710	Off-highway Trucks
Phase 3								
Excavators	4	10	51	2040	2027	37.831	38.588	Excavators
Dozers	2	5	51	510	2027	57.193	14.584	Crawler Tractor/Dozers
Off Road Dump Truck	2	10	51	1020	2027	171.389	87.409	Off-highway Trucks
Water truck	1	8	51	408	2027	171.389	34.963	Off-highway Trucks
Phase 4 (2027)								
Excavators	4	10	209	8360	2027	37.831	158.135	Excavators
Dozers	2	10	209	4180	2027	57.193	119.534	Crawler Tractor/Dozers
Off Road Dump Truck	4	10	209	8360	2027	171.389	716.408	Off-highway Trucks
10 wheeler dump truck and trailer	4	10	139	5573	2027	171.389	477.605	Off-highway Trucks
Water truck	1	10	209	2090	2027	171.389	179.102	Off-highway Trucks
Phase 4 (2028)								
Excavators	4	10	103	4120	2028	37.831	77.932	Excavators
Dozers	2	10	103	2060	2028	57.193	58.909	Crawler Tractor/Dozers
Off Road Dump Truck	4	10	103	4120	2028	171.390	353.062	Off-highway Trucks
10 wheeler dump truck and trailer	4	10	69	2747	2028	171.390	235.375	Off-highway Trucks
Water truck	1	10	103	1030	2028	171.390	88.266	Off-highway Trucks
Phase 5 (2028)								
Excavators	2	10	286	5720	2028	37.831	108.197	Excavators
Construction Cranes	2	10	286	5720	2028	36.605	104.690	Cranes
Fork Lifts	2	10	286	5720	2028	22.487	64.312	Rough Terrain Forklifts
Water truck	1	10	286	2860	2028	171.390	245.087	Off-highway Trucks
Phase 5 (2029)								
Excavators	2	10	26	520	2029	37.831	9.836	Excavators
Construction Cranes	2	10	26	520	2029	36.605	9.517	Cranes
Fork Lifts	2	10	26	520	2029	22.487	5.847	Rough Terrain Forklifts
Water truck	1	10	26	260	2029	171.390	22.281	Off-highway Trucks
Phase 6								
Low Boys	4	8	50	1600	2029	171.390	137.112	Off-highway Trucks
Construction Cranes	2	10	75	1500	2029	36.605	27.454	Cranes
Fork Lifts	2	10	75	1500	2029	22.487	16.865	Rough Terrain Forklifts
Water truck	1	10	75	750	2029	171.390	64.271	Off-highway Trucks
Phase 7								
Dozers	2	10	26	520	2029	57.193	14.870	Crawler Tractor/Dozers
10 wheeler dump truck and trailer	2	10	26	520	2029	171.390	44.561	Off-highway Trucks
Excavators	2	5	26	260	2029	37.831	4.918	Excavators
Water truck	1	10	26	260	2029	171.390	22.281	Off-highway Trucks
Phase 8								
Water truck	1	10	25	250	2029	171.390	21.424	Off-highway Trucks
Total 2027							1904.052	
Total 2028							1335.831	
Total 2029							401.236	

Note:

1. Emission factors were obtained from a MOVES4 Nonroad Module run for King County, weekdays, 12-month average, based on MOVES4 defaults.
2. All equipment assumed to be diesel-fueled.

Alternative 2: Construction Emissions Calculations - Onroad Vehicles

Onroad Vehicles Emissions - Roadway Construction

Vehicles	Type	Number of Vehicles	Number of RTs/day per Vehicle	Miles/RT	Number of Days	Total Vehicle Miles	Year	Fuel factors	Emissions
								Fuel	Fuel Usage
								MMBtu/mile	MMBtu/year
Phase 1									
Worker commute	Passenger	4	1	30	26	3120	2027	0.004	13.543
Haul trucks	Haul	0	0	0	26	0	2027	0.020	0.000
Concrete trucks	Haul	0	0	0	26	0	2027	0.020	0.000
Onsite pickups	Pickup	4	1	100	26	10400	2027	0.005	48.042
Phase 2									
Worker commute	Passenger	20	1	30	23	13800	2027	0.004	59.903
Haul trucks	Haul	0	0	0	23	0	2027	0.020	0.000
Concrete trucks	Haul	0	0	0	23	0	2027	0.020	0.000
Onsite pickups	Pickup	4	1	100	23	9200	2027	0.005	42.498
Phase 3									
Worker commute	Passenger	40	1	30	51	61200	2027	0.004	265.655
Haul trucks	Haul	1	40	30	51	61200	2027	0.020	1228.327
Concrete trucks	Haul	0	0	0	51	0	2027	0.020	0.000
Onsite pickups	Pickup	4	1	100	51	20400	2027	0.005	94.236
Phase 4 (2027)									
Worker commute	Passenger	40	1	30	209	250800	2027	0.004	1088.665
Haul trucks	Haul	1	16	30	209	100320	2027	0.020	2013.493
Concrete trucks	Haul	0	0	0	209	0	2027	0.020	0.000
Onsite pickups	Pickup	4	1	100	209	83600	2027	0.005	386.182
Phase 4 (2028)									
Worker commute	Passenger	40	1	30	103	123600	2028	0.004	520.371
Haul trucks	Haul	1	16	30	103	49440	2028	0.020	979.372
Concrete trucks	Haul	0	0	0	103	0	2028	0.020	0.000
Onsite pickups	Pickup	4	1	100	103	41200	2028	0.005	185.510
Phase 5 (2028)									
Worker commute	Passenger	40	1	30	286	343200	2028	0.004	1444.913
Haul trucks	Haul	0	0	0	286	0	2028	0.020	0.000
Concrete trucks	Haul	1	50	30	286	429000	2028	0.020	8498.190
Onsite pickups	Pickup	4	1	100	286	114400	2028	0.005	515.104
Phase 5 (2029)									
Worker commute	Passenger	40	1	30	26	31200	2029	0.004	127.142
Haul trucks	Haul	0	0	0	26	0	2029	0.020	0.000
Concrete trucks	Haul	1	50	30	26	39000	2029	0.020	762.739
Onsite pickups	Pickup	4	1	100	26	10400	2029	0.004	45.406
Phase 6									
Worker commute	Passenger	40	1	30	75	90000	2029	0.004	366.756
Haul trucks	Haul	1	25	30	62.5	46875	2029	0.020	916.753
Concrete trucks	Haul	1	50	30	62.5	93750	2029	0.020	1833.506
Onsite pickups	Pickup	4	1	100	75	30000	2029	0.004	130.979
Phase 7									
Worker commute	Passenger	20	1	30	26	15600	2029	0.004	63.571
Haul trucks	Haul	1	30	30	26	23400	2029	0.020	457.643
Concrete trucks	Haul	0	0	0	26	0	2029	0.020	0.000
Onsite pickups	Pickup	4	1	100	26	10400	2029	0.004	45.406
Phase 8									
Worker commute	Passenger	10	1	30	25	7500	2029	0.004	30.563
Haul trucks	Haul	0	0	0	25	0	2029	0.020	0.000
Concrete trucks	Haul	0	0	0	25	0	2029	0.020	0.000
Onsite pickups	Pickup	4	1	100	25	10000	2029	0.004	43.660
Total 2027 Diesel									3241.819
Total 2028 Diesel									9477.561
Total 2029 Diesel									3970.641
Total 2027 Gasoline									1998.724
Total 2028 Gasoline									2665.898
Total 2029 Gasoline									853.483

Notes:

1. Emission factors were obtained from MOVES2 Onroad module runs at the Project Scale for King County at the annual level for weekdays. Emission factors represent the maximum emission rate between winter and summer afternoons.

2. Passenger vehicles included gasoline cars and gasoline trucks. Emission factors represent the higher emission rate of the two types of vehicles.

3. PM emission factors includes tire wear and brake wear.

4. Emission factors are at an average vehicle speed of 40 mph.

NERTS Project Operation Emissions Summary

Operation Fuel Consumption Summary - All Scenarios

Scenario		Gasoline	Diesel	CNG	Ethanol	Electricity	Total Energy
		MMBtu/year	MMBtu/year	MMBtu/year	MMBtu/year	MMBtu/year	MMBtu/year
2023	Existing Condition	5,046	18,629	406	2.3	71	24,152
2029	No Action	7,225	25,106	669	2.7	844	33,846
2029	Alternative 1a and 1b	7,225	22,169	659	2.7	831	30,885
2029	Alternative 2	6,183	24,705	703	2.4	734	32,326
2040	No Action	4,106	19,508	567	1.3	2,208	26,390
2040	Alternative 1a and 1b	4,106	16,968	559	1.3	2,147	23,781
2040	Alternative 2	3,520	19,118	599	1.1	2,011	25,249

Note: 1 J = 0.0009478 Btu

Difference in Operation Fuel Consumption as Compared to No Action

Scenario		Gasoline	Diesel	CNG	Ethanol	Electricity	Total Energy
		MMBtu/year	MMBtu/year	MMBtu/year	MMBtu/year	MMBtu/year	MMBtu/year
2029	Alternative 1a and 1b	0	-2,937	-10	0.0	-13	-2,961
2029	Alternative 2	-1,042	-401	34	-0.4	-110	-1,520
2040	Alternative 1a and 1b	0	-2,540	-7	0.0	-61	-2,608
2040	Alternative 2	-586	-390	33	-0.2	-197	-1,140

Operation Fuel Consumption Summary - Existing Condition 2023

Vehicle Classification	VMT Description	Gasoline	Diesel	CNG	Ethanol	Electricity	Total Energy
		MMBtu/year	MMBtu/year	MMBtu/year	MMBtu/year	MMBtu/year	MMBtu/year
KC Transfer Trailers	To and From CHRLF and back to parking	3	9,946	40	0.0	1	9,990
Commercial Hauling Trucks	To and From zip code mid-point and back to parking	62	4,723	346	0.0	2	5,133
Self-Haul Vehicles (Cars)	To and From zip code mid-point and back to parking	3,101	16	0	1.8	63	3,182
Self-Haul Vehicles (Trucks)	To and From zip code mid-point	1,600	3,935	20	0.0	1	5,556
Employees	To and From zip code mid-point	280	8	0	0.5	5	290
MRW Self-Haul	To and From zip code mid-point	0	0	0	0.0	0	0
MRW Transfer Trucks	To and From Vendor facility	0	0	0	0.0	0	0
Total		5,046	18,629	406	2.3	71	24,152

Fuel Consumptions (gallons for diesel, gasoline, and ethanol, MCF for CNG)

Conversion Factors

diesel (MMBtu/gallon)	gasoline (MMBtu/gallon)	CNG (MMBtu/MMCFM)	Ethanol E85 (MMBtu/gallon)
0.1202	0.1374	1036	0.0760

Operation Fuel Consumption Summary - Existing Condition 2023

Gasoline	Diesel	CNG	Ethanol	Electricity	Total Energy	Total gasoline and Diesel
gallons/year	gallons/year	MCF/year	gallons/year	MMBtu/year	MMBtu/year	gallons/year
22	72,399	39	0.0	1	9990	72,421
515	34,381	334	0.0	2	5133	34,896
25,797	115	0	23.3	63	3182	25,912
13,311	28,644	19	0.0	1	5556	41,955
2,328	59	0	6.8	5	290	2,387
0	0	0	0.0	0	0	0
0	0	0	0.0	0	0	0
41,973	135,598	392	30	71	24,152	177,571

Operation Fuel Consumption Summary - No Action 2029

Vehicle Classification	VMT Description	Gasoline	Diesel	CNG	Ethanol	Electricity	Total Energy
		MMBtu/year	MMBtu/year	MMBtu/year	MMBtu/year	MMBtu/year	MMBtu/year
KC Transfer Trailers	To and From CHRLF and back to parking	0	12,116	42	0.0	54	12,212
Commercial Hauling Trucks	To and From zip code mid-point and back to parking	41	6,499	591	0.0	100	7,231
Self-Haul Vehicles (Cars)	To and From zip code mid-point and back to parking	4,245	15	0	2.4	504	4,767
Self-Haul Vehicles (Trucks)	To and From zip code mid-point	2,738	6,470	35	0.0	167	9,410
Employees	To and From zip code mid-point	201	5	0	0.3	19	226
MRW Self-Haul	To and From zip code mid-point	0	0	0	0.0	0	0
MRW Transfer Trucks	To and From Vendor facility	0	0	0	0.0	0	0
Total		7,225	25,106	669	2.7	844	33,846

Operation Fuel Consumption Summary - No Action 2029

Gasoline	Diesel	CNG	Ethanol	Electricity	Total Energy	Total gasoline and Diesel
gallons/year	gallons/year	MCF/year	gallons/year	MMBtu/year	MMBtu/year	gallons/year
1	88,189	41	0.0	54	12212	88,190
338	47,309	571	0.0	100	7231	47,647
35,310	111	0	31.6	504	4767	35,422
22,771	47,096	34	0.0	167	9410	69,867
1,674	40	0	4.2	19	226	1,714
0	0	0	0.0	0	0	0
0	0	0	0.0	0	0	0
60,094	182,746	646	36	844	33,846	242,840

NERTS Project Operation Emissions Summary

Operation Fuel Consumption Summary - No Action 2040

Vehicle Classification	VMT Description	Gasoline	Diesel	CNG	Ethanol	Electricity	Total Energy
		MMBtu/year	MMBtu/year	MMBtu/year	MMBtu/year	MMBtu/year	MMBtu/year
KC Transfer Trailers	To and From CHRLF and back to parking	0	10,477	30	0.0	251	10,759
Commercial Hauling Trucks	To and From zip code mid-point and back to parking	4	4,454	508	0.0	482	5,448
Self-Haul Vehicles (Cars)	To and From zip code mid-point and back to parking	2,041	3	0	1.1	825	2,870
Self-Haul Vehicles (Trucks)	To and From zip code mid-point	1,952	4,571	28	0.0	615	7,166
Employees	To and From zip code mid-point	109	3	0	0.1	34	146
MRW Self-Haul	To and From zip code mid-point	0	0	0	0.0	0	0
MRW Transfer Trucks	To and From Vendor facility	0	0	0	0.0	0	0
Total		4,106	19,508	567	1.3	2,208	26,390

Operation Fuel Consumption Summary - No Action 2040

Gasoline	Diesel	CNG	Ethanol	Electricity	Total Energy	Total gasoline and Diesel
gallons/year	gallons/year	MCF/year	gallons/year	MMBtu/year	MMBtu/year	gallons/year
0	76,265	29	0.0	251	10759	76,265
31	32,421	490	0.0	482	5448	32,452
16,980	19	0	14.8	825	2870	16,999
16,234	33,274	27	0.0	615	7166	49,508
909	19	0	1.8	34	146	929
0	0	0	0.0	0	0	0
0	0	0	0.0	0	0	0
34,155	141,998	547	17	2,208	26,390	176,153

Operation Fuel Consumption Summary - Alternative 1a and 1b (Kirkland/Houghton) 2029

Vehicle Classification	VMT Description	Gasoline	Diesel	CNG	Ethanol	Electricity	Total Energy
		MMBtu/year	MMBtu/year	MMBtu/year	MMBtu/year	MMBtu/year	MMBtu/year
KC Transfer Trailers	To and From CHRLF and back to parking	0	9,178	32	0.0	41	9,252
Commercial Hauling Trucks	To and From zip code mid-point and back to parking	41	6,499	591	0.0	100	7,231
Self-Haul Vehicles (Cars)	To and From zip code mid-point and back to parking	4,245	15	0	2.4	504	4,767
Self-Haul Vehicles (Trucks)	To and From zip code mid-point	2,738	6,470	35	0.0	167	9,410
Employees	To and From zip code mid-point	201	5	0	0.3	19	226
MRW Self-Haul	To and From zip code mid-point	0	0	0	0.0	0	0
MRW Transfer Trucks	To and From Vendor facility	0	0	0	0.0	0	0
Total		7,225	22,169	659	2.7	831	30,885

Operation Fuel Consumption Summary - Alternative 1a and 1b (Kirkland/Houghton) 2029

Gasoline	Diesel	CNG	Ethanol	Electricity	Total Energy	Total gasoline and Diesel
gallons/year	gallons/year	MCF/year	gallons/year	MMBtu/year	MMBtu/year	gallons/year
0	66,810	31	0.0	41	9252	66,810
338	47,309	571	0.0	100	7231	47,647
35,310	111	0	31.6	504	4767	35,422
22,771	47,096	34	0.0	167	9410	69,867
1,674	40	0	4.2	19	226	1,714
0	0	0	0.0	0	0	0
0	0	0	0.0	0	0	0
60,094	161,367	636	36	831	30,885	221,461

Operation Fuel Consumption Summary - Alternative 1a and 1b (Kirkland/Houghton) 2040

Vehicle Classification	VMT Description	Gasoline	Diesel	CNG	Ethanol	Electricity	Total Energy
		MMBtu/year	MMBtu/year	MMBtu/year	MMBtu/year	MMBtu/year	MMBtu/year
KC Transfer Trailers	To and From CHRLF and back to parking	0	7,937	23	0.0	190	8,151
Commercial Hauling Trucks	To and From zip code mid-point and back to parking	4	4,454	508	0.0	482	5,448
Self-Haul Vehicles (Cars)	To and From zip code mid-point and back to parking	2,041	3	0	1.1	825	2,870
Self-Haul Vehicles (Trucks)	To and From zip code mid-point	1,952	4,571	28	0.0	615	7,166
Employees	To and From zip code mid-point	109	3	0	0.1	34	146
MRW Self-Haul	To and From zip code mid-point	0	0	0	0.0	0	0
MRW Transfer Trucks	To and From Vendor facility	0	0	0	0.0	0	0
Total		4,106	16,968	559	1.3	2,147	23,781

Consumption Summary -

Gasoline	Diesel	CNG	Ethanol	Electricity	Total Energy	Total gasoline and Diesel
gallons/year	gallons/year	MCF/year	gallons/year	MMBtu/year	MMBtu/year	gallons/year
0	57,776	22	0.0	190	8151	57,776
31	32,421	490	0.0	482	5448	32,452
16,980	19	0	14.8	825	2870	16,999
16,234	33,274	27	0.0	615	7166	49,508
909	19	0	1.8	34	146	929
0	0	0	0.0	0	0	0
0	0	0	0.0	0	0	0
34,155	123,510	540	17	2,147	23,781	157,664

NERTS Project Operation Emissions Summary

Operation Fuel Consumption Summary - Alternative 2 (Woodinville) 2029

Vehicle Classification	VMT Description	Gasoline	Diesel	CNG	Ethanol	Electricity	Total Energy
		MMBtu/year	MMBtu/year	MMBtu/year	MMBtu/year	MMBtu/year	MMBtu/year
KC Transfer Trailers	To and From CHRLF and back to parking	0	11,799	41	0.0	53	11,893
Commercial Hauling Trucks	To and From zip code mid-point and back to parking	43	6,911	629	0.0	106	7,689
Self-Haul Vehicles (Cars)	To and From zip code mid-point and back to parking	3,296	12	0	1.9	391	3,701
Self-Haul Vehicles (Trucks)	To and From zip code mid-point	2,139	5,055	28	0.0	131	7,352
Employees	To and From zip code mid-point	316	9	0	0.5	30	354
MRW Self-Haul	To and From zip code mid-point	380	898	5	0.0	23	1,306
MRW Transfer Trucks	To and From Vendor facility	9	21	0	0.0	1	31
Total		6,183	24,705	703	2.4	734	32,326

Operation Fuel Consumption Summary - Alternative 2 (Woodinville) 2029

Gasoline	Diesel	CNG	Ethanol	Electricity	Total Energy	Total gasoline and Diesel
gallons/year	gallons/year	MCF/year	gallons/year	MMBtu/year	MMBtu/year	gallons/year
1	85,886	40	0.0	53	11893	85,887
360	50,304	607	0.0	106	7689	50,664
27,415	87	0	24.5	391	3701	27,502
17,791	36,796	27	0.0	131	7352	54,588
2,629	63	0	6.6	30	354	2,692
3,160	6,536	5	0.0	23	1306	9,696
74	153	0	0.0	1	31	227
51,430	179,825	678	31	734	32,326	231,255

Operation Fuel Consumption Summary - Alternative 2 (Woodinville) 2040

Vehicle Classification	VMT Description	Gasoline	Diesel	CNG	Ethanol	Electricity	Total Energy
		MMBtu/year	MMBtu/year	MMBtu/year	MMBtu/year	MMBtu/year	MMBtu/year
KC Transfer Trailers	To and From CHRLF and back to parking	0	10,218	30	0.0	245	10,492
Commercial Hauling Trucks	To and From zip code mid-point and back to parking	4	4,772	544	0.0	517	5,838
Self-Haul Vehicles (Cars)	To and From zip code mid-point and back to parking	1,584	2	0	0.9	640	2,227
Self-Haul Vehicles (Trucks)	To and From zip code mid-point	1,504	3,523	22	0.0	474	5,523
Employees	To and From zip code mid-point	172	4	0	0.2	54	230
MRW Self-Haul	To and From zip code mid-point	249	584	4	0.0	79	915
MRW Transfer Trucks	To and From Vendor facility	6	15	0	0.0	2	24
Total		3,520	19,118	599	1.1	2,011	25,249

Operation Fuel Consumption Summary - Alternative 2 (Woodinville) 2040

Gasoline	Diesel	CNG	Ethanol	Electricity	Total Energy	Total gasoline and Diesel
gallons/year	gallons/year	MCF/year	gallons/year	MMBtu/year	MMBtu/year	gallons/year
0	74,375	29	0.0	245	10492	74,375
33	34,739	525	0.0	517	5838	34,772
13,178	14	0	11.5	640	2227	13,192
12,511	25,643	21	0.0	474	5523	38,154
1,431	30	0	2.9	54	230	1,461
2,073	4,250	3	0.0	79	915	6,323
54	110	0	0.0	2	24	163
29,279	139,161	579	14	2,011	25,249	168,440

Vehicle Classification	Vehicle Type in MOVES Modeling
KC Transfer Trailers	Combination Short-haul Truck
Commercial Hauling Trucks	Refuse Truck
Self-Haul Vehicles (Cars)	Passenger Car
Self-Haul Vehicles (Trucks)	Single Unit Short-haul Truck
Employees	Passenger Car and Trucks
MRW Self-Haul	Single Unit Short-haul Truck
MRW Transfer Trucks	Single Unit Short-haul Truck

NERTS Project Operation Emissions Summary

Operation Emissions Summary - All Scenarios

Scenario		Total Energy Consumption	Gasoline Energy Consumption	Diesel Energy Consumption	CNG Energy Consumption	Ethanol Energy Consumption	Electricity Energy Consumption
		J/year	J/year	J/year	J/year	J/year	J/year
2023	Existing Condition	25,481,689,625,604	5,323,996,482,210	19,654,613,584,268	428,270,756,306	2,411,915,263	75,285,284,174
2029	No Action	35,710,101,874,453	7,622,495,586,680	26,488,604,382,414	705,901,084,894	2,867,336,039	890,655,140,969
2029	Alternative 1a and 1b	32,586,498,849,243	7,622,479,180,225	23,389,740,021,773	695,070,520,440	2,867,336,039	876,763,447,309
2029	Alternative 2	34,106,644,773,571	6,523,467,291,271	26,065,210,349,239	741,382,937,287	2,492,006,164	774,608,265,084
2040	No Action	27,843,129,741,062	4,332,246,847,692	20,582,293,058,401	597,811,621,950	1,330,648,729	2,329,447,564,289
2040	Alternative 1a and 1b	25,091,243,990,590	4,332,246,847,692	17,902,429,569,054	590,035,282,534	1,330,648,729	2,265,201,642,580
2040	Alternative 2	26,639,824,230,948	3,713,878,659,785	20,171,008,425,984	632,404,999,132	1,148,594,933	2,121,383,551,114

Difference in Operation Emissions as Compared to No Action

Scenario		Total Energy Consumption	Gasoline Energy Consumption	Diesel Energy Consumption	CNG Energy Consumption	Ethanol Energy Consumption	Electricity Energy Consumption
		J/year	J/year	J/year	J/year	J/year	J/year
2029	Alternative 1a and 1b	-3,123,603,025,210	-16,406,454	-3,098,864,360,641	-10,830,564,455	0	-13,891,693,660
2029	Alternative 2	-1,603,457,100,882	-1,099,028,295,409	-423,394,033,175	35,481,852,393	-375,329,876	-116,046,875,885
2040	Alternative 1a and 1b	-2,751,885,750,472	0	-2,679,863,489,347	-7,776,339,416	0	-64,245,921,709
2040	Alternative 2	-1,203,305,510,114	-618,368,187,907	-411,284,632,417	34,593,377,182	-182,053,797	-208,064,013,175

Operation Emissions Summary - Existing Condition 2023

Vehicle Classification	VMT Description	Total Energy Consumption	Gasoline Energy Consumption	Diesel Energy Consumption	CNG Energy Consumption	Ethanol Energy Consumption	Electricity Energy Consumption
		J/year	J/year	J/year	J/year	J/year	J/year
KC Transfer Trailers	To and From CHRLF and back to parking	10,540,291,180,210	2,771,995,754	10,494,097,904,934	42,135,986,540	0	1,285,292,981
Commercial Hauling Trucks	To and From zip code mid-point and back to parking	5,415,803,250,214	65,336,036,608	4,983,419,738,158	364,960,371,694	0	2,087,103,754
Self-Haul Vehicles (Cars)	To and From zip code mid-point and back to parking	3,357,088,618,874	3,272,185,613,496	16,681,854,407	0	1,868,964,221	66,352,186,749
Self-Haul Vehicles (Trucks)	To and From zip code mid-point	5,862,183,106,870	1,688,419,391,848	4,151,892,805,838	21,174,398,072	0	696,511,112
Employees	To and From zip code mid-point	306,323,469,436	295,283,444,503	8,521,280,930	0	542,951,042	4,864,189,577
MRW Self-Haul	To and From zip code mid-point	0	0	0	0	0	0
MRW Transfer Trucks	To and From Vendor facility	0	0	0	0	0	0
Total		25,481,689,625,604	5,323,996,482,210	19,654,613,584,268	428,270,756,306	2,411,915,263	75,285,284,174

Operation Emissions Summary - No Action 2029

Vehicle Classification	VMT Description	Total Energy Consumption	Gasoline Energy Consumption	Diesel Energy Consumption	CNG Energy Consumption	Ethanol Energy Consumption	Electricity Energy Consumption
		J/year	J/year	J/year	J/year	J/year	J/year
KC Transfer Trailers	To and From CHRLF and back to parking	12,884,862,478,990	67,676,623	12,782,815,487,643	44,676,078,375	0	57,303,236,348
Commercial Hauling Trucks	To and From zip code mid-point and back to parking	7,629,297,862,498	42,895,672,432	6,857,358,848,236	623,983,771,423	0	105,059,570,406
Self-Haul Vehicles (Cars)	To and From zip code mid-point and back to parking	5,029,452,826,405	4,478,845,222,048	16,151,378,620	0	2,532,703,106	531,923,522,631
Self-Haul Vehicles (Trucks)	To and From zip code mid-point	9,928,482,969,169	2,888,348,776,570	6,826,508,528,523	37,241,235,096	0	176,384,428,979
Employees	To and From zip code mid-point	238,005,737,391	212,338,239,006	5,770,139,391	0	334,632,934	19,984,382,604
MRW Self-Haul	To and From zip code mid-point	0	0	0	0	0	0
MRW Transfer Trucks	To and From Vendor facility	0	0	0	0	0	0
Total		35,710,101,874,453	7,622,495,586,680	26,488,604,382,414	705,901,084,894	2,867,336,039	890,655,140,969

Operation Emissions Summary - No Action 2040

Vehicle Classification	VMT Description	Total Energy Consumption	Gasoline Energy Consumption	Diesel Energy Consumption	CNG Energy Consumption	Ethanol Energy Consumption	Electricity Energy Consumption
		J/year	J/year	J/year	J/year	J/year	J/year
KC Transfer Trailers	To and From CHRLF and back to parking	11,351,528,720,697	0	11,054,436,893,556	32,077,400,091	0	265,014,427,050
Commercial Hauling Trucks	To and From zip code mid-point and back to parking	5,748,126,970,436	3,905,225,121	4,699,368,179,731	535,971,835,061	0	508,881,730,522
Self-Haul Vehicles (Cars)	To and From zip code mid-point and back to parking	3,027,774,821,290	2,153,824,513,960	2,705,781,807	0	1,185,286,189	870,059,239,332
Self-Haul Vehicles (Trucks)	To and From zip code mid-point	7,561,153,216,910	2,059,187,225,853	4,822,978,243,968	29,762,386,798	0	649,225,360,292
Employees	To and From zip code mid-point	154,546,011,730	115,329,882,758	2,803,959,339	0	145,362,540	36,266,807,092
MRW Self-Haul	To and From zip code mid-point	0	0	0	0	0	0
MRW Transfer Trucks	To and From Vendor facility	0	0	0	0	0	0
Total		27,843,129,741,062	4,332,246,847,692	20,582,293,058,401	597,811,621,950	1,330,648,729	2,329,447,564,289

NERTS Project Operation Emissions Summary

Operation Emissions Summary - Alternative 1a and 1b (Kirkland/Houghton) 2029

Vehicle Classification	VMT Description	Total Energy Consumption	Gasoline Energy Consumption	Diesel Energy Consumption	CNG Energy Consumption	Ethanol Energy Consumption	Electricity Energy Consumption
		J/year	J/year	J/year	J/year	J/year	J/year
KC Transfer Trailers	To and From CHRLF and back to parking	9,761,259,453,780	51,270,169	9,683,951,127,003	33,845,513,921	0	43,411,542,688
Commercial Hauling Trucks	To and From zip code mid-point and back to parking	7,629,297,862,498	42,895,672,432	6,857,358,848,236	623,983,771,423	0	105,059,570,406
Self-Haul Vehicles (Cars)	To and From zip code mid-point and back to parking	5,029,452,826,405	4,478,845,222,048	16,151,378,620	0	2,532,703,106	531,923,522,631
Self-Haul Vehicles (Trucks)	To and From zip code mid-point	9,928,482,969,169	2,888,348,776,570	6,826,508,528,523	37,241,235,096	0	176,384,428,979
Employees	To and From zip code mid-point	238,005,737,391	212,338,239,006	5,770,139,391	0	334,632,934	19,984,382,604
MRW Self-Haul	To and From zip code mid-point	0	0	0	0	0	0
MRW Transfer Trucks	To and From Vendor facility	0	0	0	0	0	0
Total		32,586,498,849,243	7,622,479,180,225	23,389,740,021,773	695,070,520,440	2,867,336,039	876,763,447,309

Operation Emissions Summary - Alternative 1a and 1b (Kirkland/Houghton) 2040

Vehicle Classification	VMT Description	Total Energy Consumption	Gasoline Energy Consumption	Diesel Energy Consumption	CNG Energy Consumption	Ethanol Energy Consumption	Electricity Energy Consumption
		J/year	J/year	J/year	J/year	J/year	J/year
KC Transfer Trailers	To and From CHRLF and back to parking	8,599,642,970,225	0	8,374,573,404,209	24,301,060,675	0	200,768,505,341
Commercial Hauling Trucks	To and From zip code mid-point and back to parking	5,748,126,970,436	3,905,225,121	4,699,368,179,731	535,971,835,061	0	508,881,730,522
Self-Haul Vehicles (Cars)	To and From zip code mid-point and back to parking	3,027,774,821,290	2,153,824,513,960	2,705,781,807	0	1,185,286,189	870,059,239,332
Self-Haul Vehicles (Trucks)	To and From zip code mid-point	7,561,153,216,910	2,059,187,225,853	4,822,978,243,968	29,762,386,798	0	649,225,360,292
Employees	To and From zip code mid-point	154,546,011,730	115,329,882,758	2,803,959,339	0	145,362,540	36,266,807,092
MRW Self-Haul	To and From zip code mid-point	0	0	0	0	0	0
MRW Transfer Trucks	To and From Vendor facility	0	0	0	0	0	0
Total		25,091,243,990,590	4,332,246,847,692	17,902,429,569,054	590,035,282,534	1,330,648,729	2,265,201,642,580

Operation Emissions Summary - Alternative 2 (Woodinville) 2029

Vehicle Classification	VMT Description	Total Energy Consumption	Gasoline Energy Consumption	Diesel Energy Consumption	CNG Energy Consumption	Ethanol Energy Consumption	Electricity Energy Consumption
		J/year	J/year	J/year	J/year	J/year	J/year
KC Transfer Trailers	To and From CHRLF and back to parking	12,548,425,610,964	65,909,518	12,449,043,170,382	43,509,540,517	0	55,806,990,548
Commercial Hauling Trucks	To and From zip code mid-point and back to parking	8,112,302,978,287	45,611,365,227	7,291,493,084,990	663,487,715,193	0	111,710,812,878
Self-Haul Vehicles (Cars)	To and From zip code mid-point and back to parking	3,904,887,930,816	3,477,393,914,453	12,539,997,017	0	1,966,401,144	412,987,618,203
Self-Haul Vehicles (Trucks)	To and From zip code mid-point	7,757,143,006,331	2,256,672,502,898	5,333,564,357,630	29,096,649,233	0	137,809,496,570
Employees	To and From zip code mid-point	373,833,528,653	333,517,813,586	9,063,107,440	0	525,605,020	31,243,078,081
MRW Self-Haul	To and From zip code mid-point	1,377,860,031,015	400,840,727,352	947,372,653,208	5,168,282,960	0	24,478,367,495
MRW Transfer Trucks	To and From Vendor facility	32,191,687,503	9,365,058,237	22,133,978,572	120,749,384	0	571,901,310
Total		34,106,644,773,571	6,523,467,291,271	26,065,210,349,239	741,382,937,287	2,492,006,164	774,608,265,084

Operation Emissions Summary - Alternative 2 (Woodinville) 2040

Vehicle Classification	VMT Description	Total Energy Consumption	Gasoline Energy Consumption	Diesel Energy Consumption	CNG Energy Consumption	Ethanol Energy Consumption	Electricity Energy Consumption
		J/year	J/year	J/year	J/year	J/year	J/year
KC Transfer Trailers	To and From CHRLF and back to parking	11,070,173,408,488	0	10,780,445,203,097	31,282,340,048	0	258,445,865,344
Commercial Hauling Trucks	To and From zip code mid-point and back to parking	6,159,042,491,361	4,184,397,384	5,035,311,232,750	574,286,776,074	0	545,260,085,152
Self-Haul Vehicles (Cars)	To and From zip code mid-point and back to parking	2,349,747,828,409	1,671,506,229,217	2,099,860,558	0	919,858,250	675,221,880,383
Self-Haul Vehicles (Trucks)	To and From zip code mid-point	5,827,091,472,906	1,586,936,804,567	3,716,884,791,672	22,936,732,711	0	500,333,143,956
Employees	To and From zip code mid-point	243,187,426,569	181,478,493,561	4,412,198,337	0	228,736,682	57,067,997,989
MRW Self-Haul	To and From zip code mid-point	965,660,370,253	262,985,743,298	615,958,812,523	3,801,054,764	0	82,914,759,669
MRW Transfer Trucks	To and From Vendor facility	24,921,232,961	6,786,991,758	15,896,327,047	98,095,536	0	2,139,818,621
Total		26,639,824,230,948	3,713,878,659,785	20,171,008,425,984	632,404,999,132	1,148,594,933	2,121,383,551,114

Emission Factors Sum

Emission Factors Summary

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Operations Emission Factors Summary

Emission Factors Summary

										Energy Consumption Rate (l/mile)										Energy Consumptions (l/year)						
No.	Scenario	Year	Day Type	Link ID	Link Description	NERTS Vehicle Classification	Source Type	Road Type	VMT per Day	Fuel Type 1 Fraction		Fuel Type 2 Fraction		Fuel Type 3 Fraction		Fuel Type 4 Fraction		Fuel Type 5 Fraction		Total Energy Consumption	Total Energy Consumption	Gasoline Energy Consumption	Diesel Energy Consumption	CNG Energy Consumption	Ethanol Energy Consumption	Electricity Energy Consumption
										Fuel Type 1 Fraction	Fuel Type 2 Fraction	Fuel Type 3 Fraction	Fuel Type 4 Fraction	Fuel Type 5 Fraction												
215	Alternative 2	2040	Weekend	7	freeway link 7	MRW Self-Haul	Single Unit Short-haul Truck	Freeway	0	Gasoline: 0.272	Diesel Fuel: 0.638	Compressed Natural Gas (CNG): 0.004	Ethanol (E-85): 0.000	Electricity: 0.086	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
216	Alternative 2	2040	Weekend	8	freeway link 8	MRW Transfer Trucks	Single Unit Short-haul Truck	Freeway	0	Gasoline: 0.272	Diesel Fuel: 0.638	Compressed Natural Gas (CNG): 0.004	Ethanol (E-85): 0.000	Electricity: 0.086	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
217	Alternative 2	2040	Weekend	9	local link 1	Self-Haul Vehicles (Cars)	Passenger Car	Local	2818	Gasoline: 0.711	Diesel Fuel: 0.001	Compressed Natural Gas (CNG): 0.000	Ethanol (E-85): 0.000	Electricity: 0.287	2.40E+06	7.04E+11	5.93E+11	6.30E+08	0.00E+00	2.70E+08	2.02E+11					
218	Alternative 2	2040	Weekend	10	local link 2	Self-Haul Vehicles (Trucks)	Single Unit Short-haul Truck	Local	2818	Gasoline: 0.272	Diesel Fuel: 0.638	Compressed Natural Gas (CNG): 0.004	Ethanol (E-85): 0.000	Electricity: 0.086	5.90E+06	1.73E+12	4.71E+11	1.0E+12	6.80E+09	0.00E+00	1.48E+11					
219	Alternative 2	2040	Weekend	11	local link 3	Commercial Hauling Trucks	Refuse Truck	Local	0	Gasoline: 0.001	Diesel Fuel: 0.818	Compressed Natural Gas (CNG): 0.093	Ethanol (E-85): 0.000	Electricity: 0.089	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
220	Alternative 2	2040	Weekend	12	local link 4	Employees (Cars)	Passenger Car	Local	135	Gasoline: 0.711	Diesel Fuel: 0.001	Compressed Natural Gas (CNG): 0.000	Ethanol (E-85): 0.000	Electricity: 0.287	2.48E+06	3.48E+10	3.11E+07	0.00E+00	1.36E+07	1.00E+10						
221	Alternative 2	2040	Weekend	13	local link 5	Employees (Trucks)	Passenger Truck	Local	135	Gasoline: 0.746	Diesel Fuel: 0.018	Compressed Natural Gas (CNG): 0.000	Ethanol (E-85): 0.001	Electricity: 0.235	3.35E+06	4.71E+10	3.51E+10	8.54E+08	0.00E+00	4.43E+07	1.10E+10					
222	Alternative 2	2040	Weekend	14	local link 6	KC Transfer Trailers	Combination Short-haul Truck	Local	705	Gasoline: 0.000	Diesel Fuel: 0.974	Compressed Natural Gas (CNG): 0.003	Ethanol (E-85): 0.000	Electricity: 0.023	2.09E+07	1.54E+12	0.00E+00	1.50E+12	4.34E+09	0.00E+00	3.58E+10					
223	Alternative 2	2040	Weekend	15	local link 7	MRW Self-Haul	Single Unit Short-haul Truck	Local	0	Gasoline: 0.272	Diesel Fuel: 0.638	Compressed Natural Gas (CNG): 0.004	Ethanol (E-85): 0.000	Electricity: 0.086	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
224	Alternative 2	2040	Weekend	16	local link 8	MRW Transfer Trucks	Single Unit Short-haul Truck	Local	0	Gasoline: 0.272	Diesel Fuel: 0.638	Compressed Natural Gas (CNG): 0.004	Ethanol (E-85): 0.000	Electricity: 0.086	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		

Notes:

N/A = not applicable

1. Emission factors were obtained from MOVES4 Onroad module runs at the Project Scale for King County at the annual level for both weekdays and weekends. Emission factors represent the maximum emission rate between winter and summer afternoons.

2. PM emission factors include tire wear and brake wear.

Project-Specific Vehicle Data

	Kirkland NERTS Site		Alternative 1a and 1b. Kirkland NERTS Site				Alternative 2. Woodinville NERTS Site	
	2023	2023	2029 & 2040	2029 & 2040	2029 & 2040	2029 & 2040	2029 & 2040	2029 & 2040
	Existing Weekday	Existing Weekend	No Action Weekday	No Action Weekend	Action Weekday	Action Weekend	Action Weekday	Action Weekend
Self Haul								
Daily Volume	186.0	324.0	404.0	531.0	404.0	531.0	404.0	531.0
Daily VMT: Freeway	1425.0	2482.3	3,224.8	4,238.6	3,224.8	4,238.6	949.0	1,247.3
Average Speed (mph): Freeway	45.5	45.5	48.3	48.3	48.3	48.3	48.1	48.1
Daily VMT: Local	1,594.5	2,777.5	3,333.6	4,381.6	3,333.6	4,381.6	4,287.7	5,635.6
Average Speed (mph): Local	16.4	16.0	15.6	15.3	15.6	15.3	22.6	21.7
Commercial								
Daily Volume	71.0	0.0	111.0	0.0	111.0	0.0	111.0	0.0
Daily VMT: Freeway	400.8	0.0	626.6	0.0	626.6	0.0	713.5	0.0
Average Speed (mph): Freeway	48.0	0.0	48.0	0.0	48.0	0.0	47.3	0.0
Daily VMT: Local	546.6	0.0	854.5	0.0	854.5	0.0	992.1	0.0
Average Speed (mph): Local	14.9	0.0	14.9	0.0	14.9	0.0	21.5	0.0
Employees								
Daily Volume	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Daily VMT: Freeway	60.4	60.4	60.4	60.4	60.4	60.4	93.6	93.6
Average Speed (mph): Freeway	48.3	48.3	48.3	48.3	48.3	48.3	51.8	51.8
Daily VMT: Local	74.0	74.0	74.0	74.0	74.0	74.0	135.0	135.0
Average Speed (mph): Local	17.0	15.6	17.0	15.6	17.0	15.6	22.0	20.5
Transfer Trailers								
Daily Volume	25.0	25.0	33.0	33.0	25.0	25.0	25.0	25.0
Daily VMT: Freeway	670.0	670.0	884.4	884.4	670.0	670.0	935.0	935.0
Average Speed (mph): Freeway	40.2	40.2	40.2	40.2	40.2	40.2	43.2	43.2
Daily VMT: Local	585.0	585.0	772.2	772.2	585.0	585.0	705.0	705.0
Average Speed (mph): Local	33.7	28.1	33.7	28.1	33.7	28.1	34.1	29.2
MRW Self-Haul								
Daily Volume	0.0	0.0	0.0	0.0	0.0	0.0	73.3	0.0
Daily VMT: Freeway	0.0	0.0	0.0	0.0	0.0	0.0	172.1	0.0
Average Speed (mph): Freeway	0.0	0.0	0.0	0.0	0.0	0.0	48.1	0.0
Daily VMT: Local	0.0	0.0	0.0	0.0	0.0	0.0	777.7	0.0
Average Speed (mph): Local	0.0	0.0	0.0	0.0	0.0	0.0	22.6	0.0
MRW Transfer Trucks								
Daily Volume	0	0	0	0	0	0	0.4	0
Daily VMT: Freeway	0	0	0.0	0	0	0	18.4	0
Average Speed (mph): Freeway	0	0.0	0.0	0.0	0	0.0	48.1	0.0
Daily VMT: Local	0	0	0.0	0	0	0	1.6	0
Average Speed (mph): Local	0	0.0	0.0	0.0	0	0.0	22.6	0.0
Visitors								
Assumed negligible, do not model								