Multi-Purpose Machine Gun (MPMG) Range at the Known Distance (KD) Range

Greenhouse Gas Analysis

January 30, 2020

Greenhouse Gas Analysis
Table of Contents

List of Figures

List of Tables

List of Appendices

1 BACKGROUND INFORMATION

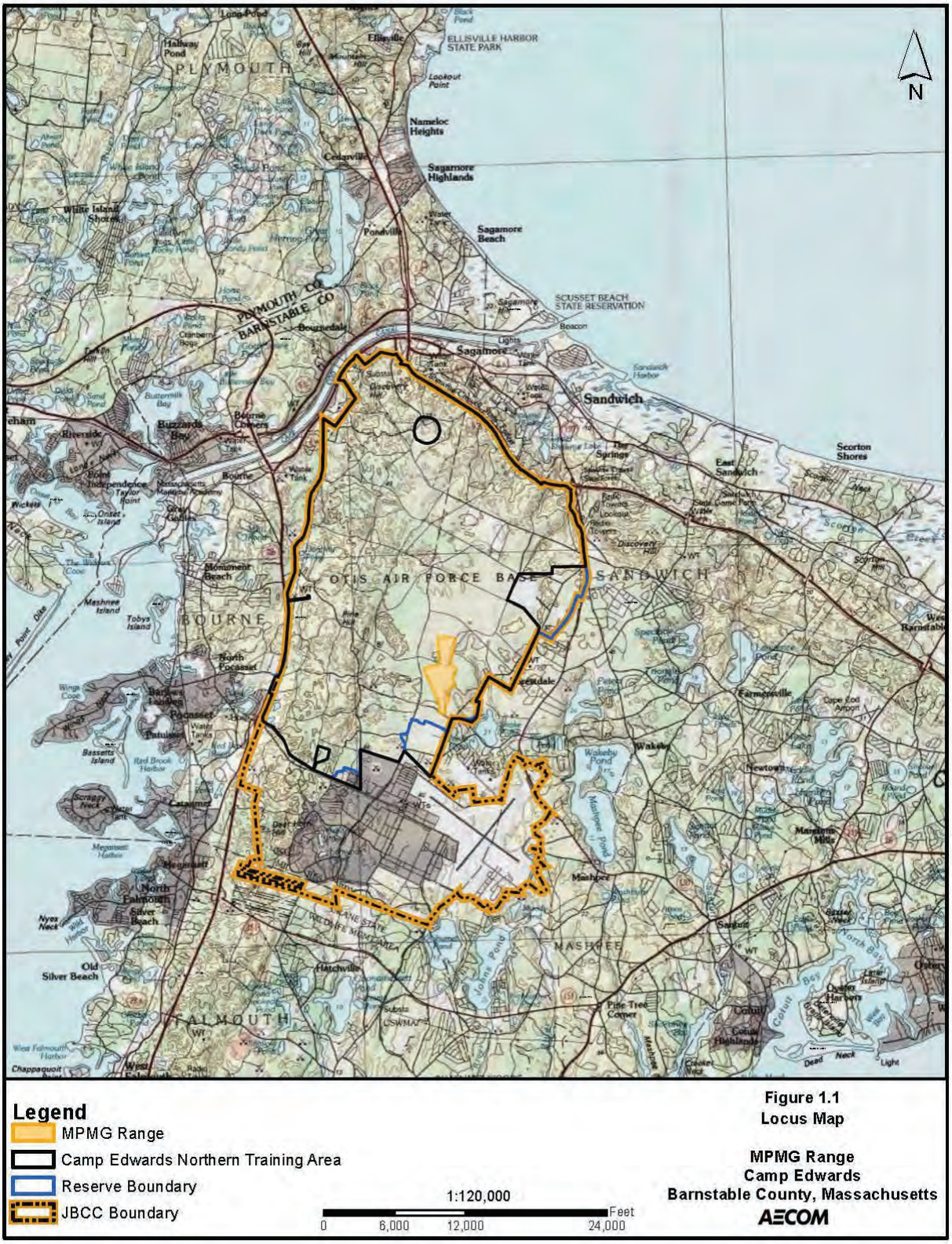
1.1 MEPA Greenhouse Gas Policy and Protocol

The Executive Office of Energy and Environmental Affairs ("EOEEA") has established a Greenhouse Gas ("GHG") Emissions Policy and Protocol last revised May 5, 2010 ("Policy") in accordance with the Massachusetts Environment Policy Act ("MEPA"). The purpose of the Policy is to inform the MEPA office of the quantity of GHG associated with proposed projects, by assessing the project baseline, considering available alternatives, and evaluating the feasibility and impact of performing the alternatives.

GHGs are emitted from stationary and mobile sources, resulting in trace amounts in the atmosphere. GHGs include water vapor, carbon dioxide ("CO_2"), nitrous oxide, methane, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. Water vapor occurs naturally and is the most abundant GHG, with CO_2 being the second most abundant. Because CO_2 constitutes an abundant amount of human-caused GHG emissions, CO_2 is used as the basis for calculating the equivalent amounts of CO_2 (i.e., CO_2e) other GHGs would emit. The carbon dioxide equivalent ("CO_2e") is therefore used as a measurement of GHGs as a common unit and allows GHGs to be expressed as a single number (USEPA 2016h). CO_2e is an accounting measure of GHGs which takes into account Global Warming Potentials ("GWP") for various GHG chemicals. For example, one ton of CO_2 is equivalent to one ton of CO_2e, one ton of methane ("CH_4") is equivalent to 25 tons of CO_2e, and one ton of nitrous oxide ("N_2O") is equivalent to 298 tons of CO_2e. The combined GHG total, represented as CO_2e, is the amount of CO_2 that has the equivalent global warming impact as the combination of different GHG species.

1.2 Description and Scope of Project

The Massachusetts Army National Guard ("MAARNG") is proposing to construct and operate a Multi-Purpose Machine Gun ("MPMG") Range (the Project) at the existing 600-yard Known Distance ("KD") Range at Camp Edwards (see **Figure 1.1**). The purpose of the Project is to provide the MAARNG with a mission required, Army-standard MPMG Range to allow the MAARNG to efficiently attain required training and weapons qualifications requirements within Massachusetts. A priority for the MAARNG at Camp Edwards is the continued use and development of live-fire ranges to meet the requirement that all Soldiers qualify with their primary weapon systems annually. Currently, the three closest MPMG ranges used for training include Camp Ethan Allen in Jericho, Vermont located over 270 miles away, Fort Dix in Ocean County, New Jersey located over 300 miles away, and Fort Drum located in Jefferson County, New York located over 370 miles away (see **Figure 1.2**). Implementation of the Project would allow the MAARNG to fulfill their mission by meeting their weapons qualifications standards and training requirements using in-State facilities, and to maintain their readiness posture. Construction of the MPMG Range at Camp Edwards within Massachusetts will eliminate the out-of-state travel to the other training facilities with MPMG Ranges.


N
PLYMOUTH
ELLISVILLE HARBOR STATE PARK
Nameloc Heights
Sagamore Highlands
Sagamore Beach
SCUSSET BEACH STATE RESERVATION
PLYMOUTH CO
BARNSTABLE CO
Bournedale
Sagamore
Sandwich
Buzzards Bay
Bourne
Scorton Shores
East Sandwich
OTIS AIR FORCE BASE
SANDWICH
BOURNE
Monument Beach
Pocasset
Farmersville
Wakeby
Mashpee
MASHPEE
FALMOUTH
Hatchville
Old Silver Beach
North Falmouth
Coonamessett
Cataumet
Waquoit
Chappaquoit
Legend
MPMG Range
Camp Edwards Northern Training Area
Reserve Boundary
JBCC Boundary
1:120,000
0
6,000
12,000
24,000
Feet
Figure 1.1
Locus Map
MPMG Range
Camp Edwards
Barnstable County, Massachusetts
AECOM

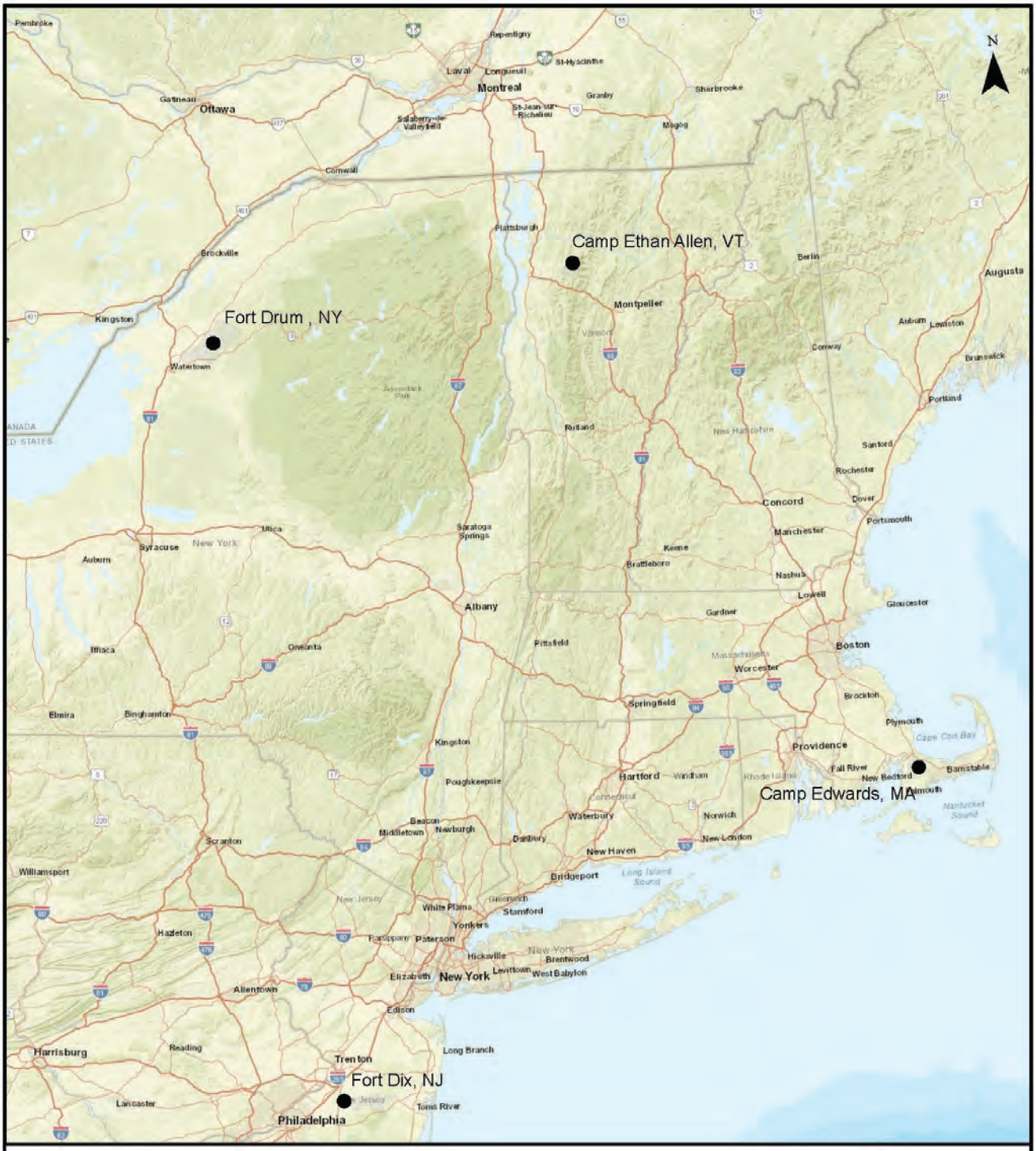


Figure 1.2
Camps of the Northeast

MPMG Range
Camp Edwards
Barnstable County, Massachusetts

AECOM

The Project involves the construction of an eight lane MPMG Range with six lanes 800 meters long with a width of 25 meters at the firing line and a width of 100 meters at a distance of 800 meters. The two middle lanes (Lanes 5 and 6) will extend an additional 700 meters to a distance of 1,500 meters long to accommodate .50 caliber rifles. The proposed MPMG Range is depicted on **Figure 1.3**.

The footprint of the Project would be 209.0 acres which includes improving the existing 600-yard KD Range comprised of approximately 38.5 acres (36.0 acres managed grasslands, 2.5 acres existing range control area) and approximately 170.5 acres of vegetation clearing. The range consists of: (1) the physical range footprint, consisting of the firing positions and targetry, (2) Range Operations Control Area ("ROCA") support structures; which includes a Range Control Tower, Ammunition Storage Building, and Covered Bleachers, and (3) approximately 10.0 acres of clearing for firebreaks. The 170.5 acres of vegetation clearing proposed includes the firebreaks.

Any new projects requiring filing of an Environmental Notification Form ("ENF") or Notices of Project Change ("NPC") initiates MEPA applicability review. Based on certain triggers, MEPA requires GHG analysis for projects with land alteration or clearing and forest conversion greater than 50 acres of land. The proposed MPMG Range Project will exceed the 50 acre threshold for land clearing and, therefore, is subject to MEPA requirements. The requirements include calculation of the Project baseline, estimation of emissions associated with the Preferred Alternative as well as outlining and committing to a series of mitigation measures that will help to reduce GHG emissions from the proposed Project.

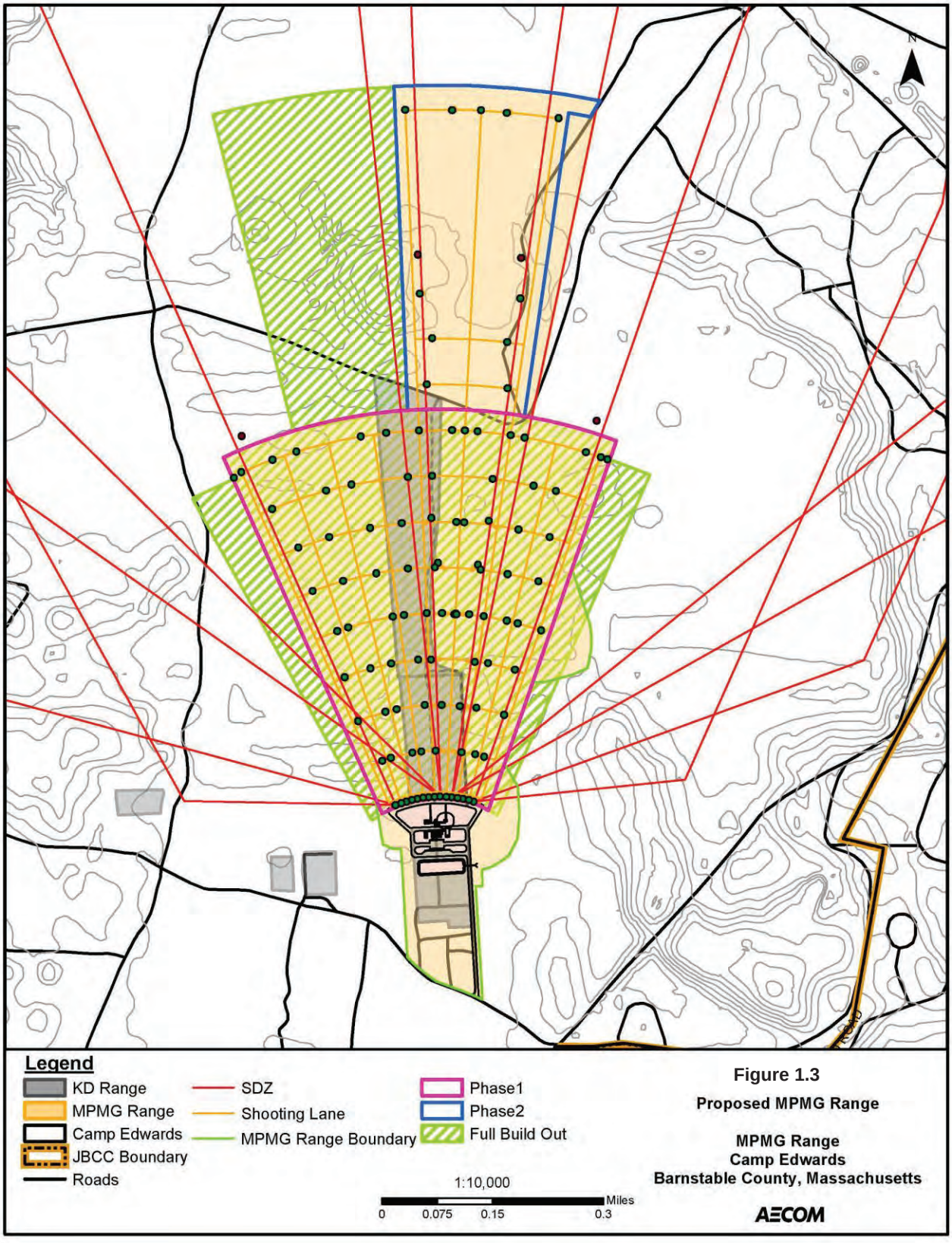
It should be noted that MEPA requires the GHG emissions to be calculated on a short ton (2,000 pounds) (hereinafter US Tons) basis which is in direct contrast with United States Environmental Protection Agency ("USEPA") which requires GHG emissions to be calculated on a metric ton (2,200 pounds) basis (hereinafter Metric Tons). Therefore, the emissions in this report will be expressed in both Short tons and Metric tons.

1.3 Baseline

Under existing baseline conditions (No-Build Alternative), the existing KD Range would continue to be used for training operations such as unmanned aircraft systems (UAS) on the 38.5 acres (36.0 acres managed grasslands, 2.5 acres ROCA) with little or no GHG emissions. The forested areas within the proposed MPMG Range footprint will continue to be vegetated with forests or grasslands providing carbon sequestration as described in **Section 1.8**. Sources of GHG emissions under baseline conditions are primarily due to transportation to out-of-state training activities by MAARNG units as described in **Section 2.1.1**.

1.4 Alternatives

This GHG assessment includes analysis of the three proposed alternatives including the Preferred Alternative, a Reduced-Scale Alternative, and a Full Build Alternative. The No-Build Alternative is represented as a baseline (or existing) condition. The Preferred Alternative will be constructed in two phases. Phase 1 will be the Reduced-Scale Alternative, that is, the eight lanes constructed at 800 meters in length. Phase 2 will add the extension of two lanes to a length of 1,500 meters..


N
Legend
KD Range
MPMG Range
Camp Edwards
JBCC Boundary
Roads
SDZ
Shooting Lane
MPMG Range Boundary
Phase1
Phase2
Full Build Out
1:10,000
Miles
0
0.075
0.15
0.3
Figure 1.3
Proposed MPMG Range
MPMG Range
Camp Edwards
Barnstable County, Massachusetts
AECOM

Both phases combined make up the Preferred Alternative. Acreages of the alternatives are provided in **Table 1**

Table 1: MPMG Range Alternatives

Alternative	800 meter lanes	1500 meter lanes	MPMG Range (acres)	Firebreak (acres)	Total Footprint (acres)	Tree clearing (acres)
Full Standard Build	10	4	294	12	306	267.5
Preferred Alternative	8	2	199	10	209	170.5
Reduced-Scale Alternative	8	0	128	10	138	99.5

1.5 Impacts

The following table summarizes the CO_2 impacts from the Proposed Project (Preferred Alternative) compared to the baseline conditions and the Reduced-Build and Full Build Alternatives. Each activity is described in other sections of this analysis along with a discussion of how the CO_2 emissions in US Tons were calculated.

Table 2: CO_2 Emissions Summary by Alternative (US Tons)

Activity	Baseline	Preferred Alternative	Reduced Build	Full Build
Transportation	**724**	**60**	**60**	**60**
Out-of-State Training	724	0	0	0
Travel of Work Crews	0	1	1	1
Within Camp Edwards after Range Construction	0	59	59	59
Construction	**0**	**897**	**549**	**1,157**
Land Clearing	0	734	430	935
Range Construction	0	129	85	189
ROCA Demolition and Construction	0	34	34	34
Land Clearing (Biomass Removal)	**0**	**39,649**	**23,295**	**61,992**
Range Operations	**0.3**	**1.3**	**1.3**	**1.3**
Firing of Weapons	0.3	0.3	0.3	0.3
ROCA Structures	0	1	1	1
CO_2 Emission Totals	**724.3**	**40,607.3**	**23,904.3**	**63,210.3**

1.6 Mitigation

Mitigation for the Proposed Project includes phasing of the construction and preservation of forested acreage within Camp Edwards. The Project will be constructed in two phases as described in Section 1.4 with the first phase being the Reduced-Build Alternative. Following the construction of the first phase, the two extended lanes will be constructed with the total impacts represented by the Preferred Alternative.

Substantial mitigation efforts are being proposed relative to impacts to rare species in consultation with the Massachusetts Natural Heritage and Endangered Species Program (NHESP) which includes the preservation of approximately 310 acres of land within Camp Edwards that is presently forested. Other management strategies includes the management of approximately 832 acres of forests through mechanical forestry.

In addition to the annual sequestration, mature forests sequester carbon throughout its life. One acre of forest provides 230 US Tons of sequestration. The estimated amount of sequestered carbon in the 13,500 acres of forest at Camp Edwards is estimated to be approximately 3,455,114 US Tons. One acre of mature grassland provides 10 US Tons of sequestration. The estimated amount of sequestered carbon in the 175 acres of grassland at Camp Edwards is estimated to be approximately 1,750 US Tons of sequestration. The annual GHG sequestration and lifetime sequestration from the mitigation acreage is summarized in **Table 3**.

Table 3: Sequestration and Mitigation

Management Action	Acreage	Annual Sequestration		Lifetime Sequestration	
		Rate*	US Tons	Rate	US Tons
Land Preservation	310	0.85 US Tons/ acre/year	263.5	230 US Tons/acre	71,300
Forestry Management	832	0.85 US Tons/ acre/year	707.2	230 US Tons/acre	162,012
Total Mitigation	**1,142**		**967.3**		**233,312**

* see **Section 1.8**

1.7 Sources of Greenhouse Gas Emissions

Sources of GHG emissions from the Project are primarily from following activities:

- Transportation (travel for out-of-state training, travel of work crews, travel to MPMG Range once constructed);
- Land Clearing (biomass removal)
- Construction (land clearing, range construction, ROCA demolition and construction);
- Range Operation (firing of weapons, ROCA structures)

The primary source of GHG emissions from transportation activities include personnel driving tactical and private vehicles to different training centers which are located out-of-state. GHG emissions will be emitted from diesel and gasoline fired tactical vehicles and on-road vehicles driven for travel to other out-of-state training facilities for range training purposes. GHG emissions

associated with transportation activities are CO_2, CH_4, and N_2O from internal combustion engines. The vehicle trips for training and associated GHG emissions occur annually under the existing (No-Build) conditions and will be used as the baseline for analysis of transportation generated GHG. See **Section 2.1.1** for baseline transportation conditions.

Sources of GHG emissions from transportation activities include travel for work crews during the construction period and travel within Camp Edwards during the MPMG Range operations period. Range operation emissions will be from tactical and private vehicles driven to the MPMG Range at Camp Edwards once it is constructed for training purposes. This travel is limited to within Camp Edwards as the Soldiers and units will already be at Camp Edwards for other training. See Section 2.2.1 for Preferred Alternative transportation conditions.

Sources of GHG emissions from land clearing includes CO_2 emissions through the removal of existing trees and shrubs (biomass). See **Section 2.2.2** for Preferred Alternative land clearing conditions.

Sources of GHG emissions from construction activities include diesel and gasoline fired non-road construction equipment and on-road construction vehicles during the construction period of the MPMG Range. GHG emissions associated with construction activities are CO_2, CH_4, and N_2O from internal combustion engines. The GHG emissions during construction will occur during land clearing, range construction, as well as demolition of existing structures and construction of ROCA support structures. See **Section 2.2.3** for Preferred Alternative construction conditions.

Sources of GHG emissions from range operations once the MPMG Range is constructed would include the firing of weapons which have limited CO_2 emissions. Emissions for ranges are calculated depending on the weapon being fired, rounds being fired, and number of soldiers training. It is not expected that the ROCA structures once constructed will emit any significant CO_2 as they are to be constructed without heating and cooling equipment. These buildings are used on a temporary basis while units are training which occurs primarily during the warmer months. See **Section 2.2.3** for Preferred Alternative range operations conditions.

1.8 Greenhouse Sequestration in Vegetation

Camp Edwards is comprised of 15,000 acres of land with approximately 13,500 acres of mature forest land and 175 acres of mature grasslands. The biomass within these forested lands provides carbon sequestration (capturing and storing) on an annual basis. According to USEPA, Inventory of US Greenhouse Gas Emissions and Sinks: 1990–2017, EPA 430-R-19-001, April 2019, between 2007 and 2017, the average annual sequestration of carbon in US forests was 0.23 US Tons (0.21 Metric Tons) per acre per year. This is equivalent of -0.85 US Tons (-0.77 Metric Tons) of CO_2 sequestration per acre of average US forest per year. Sequestration is shown in negative numbers because carbon is being captured or held within the biomass, acting as a sink for carbon. This is based on combustion of 1 molecule of carbon (molecular weight = 12) producing 1 molecule of CO_2 (molecular weight = 44) assuming complete combustion. The amount of carbon sequestered is multiplied by 3.67 (44/12, ratio of CO_2 to carbon) to calculate amount of CO_2 released or sequestered based on complete oxidation (combustion) of carbon. **Table 4** provides this information in table form.

Table 4: Total Sequestration of Forests - Baseline

Carbon Sequestration per acre per year	Carbon		CO2*		Acres at Camp Edwards	CO_2 Sequestration per acre per year	
	US Tons	Metric Tons	US Tons	Metric Tons		US Tons	Metric Tons
Forests	-0.23	-0.21	-0.85	-0.77	13,500	-11,475	-10,395

* 1 molecule of C (molecular weight of 44) = 1 molecule of $C0_2$ (molecular weight of 12)
Conversion factor C to $C0_2$ = 44/12 = 3.67 assuming complete combustion

Therefore, currently, at Camp Edwards, the 13,500 acres of forests provide a total of -11,475 US Tons (-10,395 Metric Tons) of CO_2 sequestered on an annual basis. A negative number indicates sequestration and a positive number indicates releases of CO_2. This represents the baseline sequestration for Camp Edwards. See **Section 2.12** for additional information. Table 4 provides sequestration amounts from proposed Mitigation

In addition to the annual sequestration, mature forests sequester carbon throughout its life. One acre of forest provides 230 US Tons of sequestration. The estimated amount of sequestered carbon in the 13,500 acres of forest at Camp Edwards is estimated to be approximately 3,455,114 US Tons. One acre of mature grassland provides 10 US Tons of sequestration. The estimated amount of sequestered carbon in the 175 acres of grassland at Camp Edwards is estimated to be approximately 1,750 US Tons of sequestration.

The emissions of net atmospheric CO_2 releases were estimated based on values obtained from the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4 - Agriculture, Forestry and Other Land Use.[1] Because exact Project-specific data is not available for forest composition, appropriate values were chosen from IPCC's options, using conservative estimates in order to derive a conservative estimate of net CO_2 released due to land clearing. The total net GHG release was calculated by subtracting the CO_2 to be sequestered in grasslands from the CO_2 currently sequestered in the vegetation types described above. These CO_2 sequestration amounts were estimated by multiplying Project-specific acreage data by the IPCC inputs summarized below.

1.9 Greenhouse Emissions from Removal of Vegetation

Emissions from the removal of vegetation during land clearing activities are estimated from the amount of biomass in the above ground and below ground parts of a tree (or other vegetation). The biomass (in Metric Tons of dry matter per hectare) numbers are then converted into Metric Tons of carbon and converted to CO_2 in US Tons.

Relevant values for the CO_2 sequestration amounts from forests were obtained from IPCC's Chapter 4 - Forest Land to derive a conservative estimate of the sequestration that will be released when vegetation is cleared. The following inputs were derived from IPCC and multiplied by the Project-specific acreage values:

- Carbon rates from above-ground biomass dry matter per hectare were obtained from Table 4.7. For all vegetation types, the calculations used for this analysis included the

[1] https://www.ipcc-nggip.iges.or.jp/public/2006gl/vol4.html

high (conservative) end of the range provided for temperate continental forests in North America.

- A ratio of below-ground biomass to above-ground biomass was obtained from the Table 4.4 and multiplied by the above-ground biomass dry matter values to derive an estimate of total dry matter per hectare. The calculations used the conservative end of the range provided for "other broadleaf above-ground biomass >150 tonnes[2] per [hectare]a" temperate forests, to derive a conservative estimate of below-ground biomass.
- Carbon rates per ton of dry matter were obtained from Table 4.3. For all vegetation types, the calculations used the conservative end of the range provided for temperate and boreal forests.

Relevant values for the CO_2 sequestered in mature grasslands were obtained from IPCC's Chapter 6 - Grassland. The following inputs were derived from IPCC:

- Tonnes of dry matter per hectare were obtained from Table 6.4. The calculations used the value provided for the "Warm Temperate – Wet" climate zone.
- Tonnes C per ton of dry matter of herbaceous biomass obtained from Section 6.3.1.4.

As described in **Section 2.2.2**, the Preferred Alternative would release 39,273 US Tons of CO_2 sequestered from the forested areas during land clearing activities and removal of forest cover type. The Preferred Alternative would release 376 US Tons of CO_2 sequestered from the land clearing of the grasslands.

2 Baseline and Alternative Analysis

Pursuant to the MEPA GHG Policy, this section presents a quantification and evaluation of the Projects' baseline, and alternatives to the baseline. The following alternatives will be assessed. Primarily, the differences will be based on acreage of vegetation to be cleared, area to be graded, and the length of the construction period.

2.1 Baseline Conditions

Under existing baseline conditions (No-Build Alternative), the existing KD Range would continue to be used for training operations such as UAS on the 38.5 acres (36.0 acres managed grasslands, 2.5 acres ROCA). This range is not presently used for live-fire training. The forested and grassland areas within the proposed MPMG Range footprint will continue to be vegetated and provide carbon sequestration annually.

Sources of GHG emissions under baseline conditions are primarily transportation to out-of-state training activities. Sources of GHG sequestration include the presence of vegetated areas including grasslands and forests.

[2] The unit of "tonnes" is also used in place of Metric Tons

2.1.1 Transportation

The baseline condition is primarily based on the direct transportation related emissions from the trips taken by convoy for training purposes to the out-of-state locations as there is no MPMG Range in Massachusetts. Currently, the three closest MPMG ranges used for training include Camp Ethan Allen in Jericho, Vermont located over 270 miles away, Fort Dix in Ocean County, New Jersey located over 300 miles away, and Fort Drum located in Jefferson County, New York located over 370 miles away. The vehicles in the convoy deployed for travel to these out-of-state training locations include High Mobility Multipurpose Wheeled Vehicles (HMMWV), Light Medium Tactical Vehicles (LMTV), Family of Medium Tactical Vehicles (FMTV), Medium Armored Tactical Vehicles (MATV), Armored Security Vehicles (ASV), and non-military passenger vehicles.

The calculated GHG emissions for the baseline conditions are summarized in **Table 5**. **Table 6** (following page) provides a breakdown of the mileage by vehicle type from 2019 Camp Edwards data and how the GHG emissions were calculated.

Table 5: Annual Transportation Emissions from Out-of-State Travel to Training Locations from Camp Edwards - Baseline

Vehicle Types by Fuel	CO_2 Emissions (US Tons)	CO_2 Emissions (Metric Tons)
Diesel Vehicles	691.3	628.1
Gasoline Vehicles	32.8	29.8
Total	**724.1**	**657.9**

Annually, the mileage driven by convoy for training purposes is approximately 282,240 miles for diesel and gasoline vehicles which is converted to CO_2 emissions as noted above. **Table 6** provides a summary of mileage driven by each type of vehicle in the convoy based on mileage to different locations where MPMG ranges exist. The backup data for the mileage by facility is provided in **Appendix A**.

The estimated annual fuel consumption (based on the miles per gallon or MPG rating) for diesel vehicles is 61,595 gallons and for gasoline vehicles is 3,348 gallons as shown on **Table 6**. It should be noted that as the emission factors for convoy vehicles are not readily available, CO_2 emissions from the vehicles were based on the estimated fuel consumption provided in the **Table 6**. The Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories, Volume 2 (2006 IPCC) estimates that 8,887 grams of CO_2 is emitted per gallon of gasoline assuming all the carbon in gasoline is converted to CO_2. Similarly, 2006 IPCC guidelines estimates that 10,182 grams of CO_2 is emitted per gallon of diesel consumed assuming all carbon in diesel is converted to CO_2.

Table 6: Annual Fuel Consumption and CO_2 Emissions by Vehicle Type, Camp Edwards - Baseline

Fuel Consumption						CO_2 Emissions		
Vehicle Type	**Vehicle Weight (Pounds)**	**Fuel Type**	**Fuel Capacity Per Vehicle (Gallons)**	**Total Annual Miles Driven**	**Fuel Consumption (Gallons)**	**CO_2 Emission Factor[1] (grams/gallon)**	**US Tons**	**Metric Tons**
HMMWV	12,100	Diesel	25	99,780	19,200	10,182	215.5	195.8
LMTV	22,904	Diesel	35	41,820	11,585	10,182	130.0	118.1
FMTV	28,889	Diesel	35	89,700	25,200	10,182	282.8	257.0
MATV	34,830	Diesel	30	3,000	750	10,182	8.4	7.6
ASV	29,000	Diesel	30	21,660	4,860	10,182	54.5	49.6
Non-military	8,000	Gasoline	18	26,280	3,348	8,887	32.8	29.8
		Annual Total (Diesel)		**255,960**	**61,595**	10,182	691.3	628.1
		Annual Total (Gasoline)		**26,280**	**3,348**	8887	32.8	29.8
		Total Annual Miles Driven		**282,240**	**64,943**	**Annual Total CO_2 Emissions**	**724.1**	**657.9**

[1]Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories, Volume 2 (2006 IPCC)

Source of Data: Camp Edwards Range Control, 2019

HMMWV High Mobility Multipurpose Wheeled Vehicle
LMTV Light Medium Tactical Vehicle
FMTV Family of Medium Tactical Vehicles
MATV Medium Armored Tactical Vehicle
ASV Armored Security Vehicle

2.1.2 Land Clearing (Biomass Removal)

Under the baseline condition (No-Build Alternative), no land clearing will occur. The vegetation at the site is presently comprised of four different cover types; three with woody vegetation:

- **Pine Oak Forest Woodland (PPOF)** - PPOF forest ranges from a low canopy with a dense shrub layer to a taller canopy with a sparser shrub layer. The pitch pine-oak forest woodland of Camp Edwards has a low canopy of pitch pine and tree oaks (black oak, scarlet oak, and white oak and a moderately continuous shrub layer of blueberry, black huckleberry, sheep laurel, and scrub oak.
- **Pitch Pine-Scrub Oak Community (PPSO)** - PPSO overstory community is almost entirely pitch pine with an understory of sometimes very dense scrub oak which creates the pitch pine-scrub oak. The prevalent shrub species of this community are black huckleberry and blueberry which are commonly interspersed among the more dominant scrub oak. White oak is present in understory where fire has been excluded and threatens to convert the community.
- **Scrub Oak Shrubland (SOS) -** This plant community represents one of the earliest states of vegetative succession on Camp Edwards and consists primarily of scrub oak with essentially no pitch pine. Other common plants in the scrub oak barrens include black huckleberry, blueberry, cat brier, and wintergreen. The majority of SOS at Camp Edwards is at significant risk of loss due to forest (pitch pine) encroachment due to lack of fire from artillery and historic sources.
- **Grassland -** Cultural or Managed Grasslands (MG) are human created and maintained open communities dominated by grasses. Mowing is the typical maintenance, however on Camp Edwards; fire has played and is playing a more important role. The grasslands are one of the least diverse plant communities on Camp Edwards, with only 37 identified species during a floristic inventory. The community is dominated by grass species including little bluestem, big bluestem, switchgrass, etc.

Under the baseline condition (No-Build Alternative), the forested land will continue to sequester carbon. As stated in **Section 1.6**, currently at Camp Edwards, an estimated 11,435 US tons of CO_2 will be sequestered on an annual basis and will result in a net reduction of CO_2 annually.

2.1.3 Construction

Under the baseline conditions (No-Build Alternative), there will be no construction at the proposed MPMG Range and no land will be cleared or graded. Therefore, no carbon emissions or sequestration are emitted under baseline conditions relative to construction.

2.1.4 Range Operations

Under the baseline condition (No-Build Alternative), the existing KD Range would continue to be used for training operations such as UAS. This range is not presently used for live-fire training. The ROCA buildings present are not heated or cooled and are not being utilized. Therefore, no CO_2 emissions are occurring as a result of existing range operations.

2.2 Preferred Alternative

The Preferred Alternative will involve the following activities that will generate CO_2 emissions:

- Transportation (travel of work crews, travel to MPMG Range once constructed),
- Land Clearing (biomass removal)
- Construction (land clearing, range construction, ROCA demolition and construction)
- Range Operations (firing of weapons, ROCA structures)

2.2.1 Transportation

Emissions resulting from transportation for the Preferred Alternative includes travel of work crews, during land clearing, range construction, and ROCA construction, and travel for training during range operations once the MPMG Range is constructed. Travel during the construction period for work crews is provided in **Table 7** for all three alternatives based on estimated commuting mileage and length of the construction period. Numbers are rounded to 1 US Ton for each alternative for purposes of the summary table.

Table 8 provides a similar analysis as was done for the baseline conditions for transportation for training purposes but estimates travel within Camp Edwards once the MPMG Range is constructed under the Preferred Alternative. Units and Soldiers would already be at Camp Edwards for training purposes, therefore the mileage estimate is based on round-trip mileage to the MPMG Range from a muster point within Camp Edwards. This estimated amount of 59.0 US Tons would be the same under the Reduced-Build and Full Build Alternatives.

Table 7: Total CO2 Emissions for Travel by Work Crews during Construction Period by Alternative

Alternative	Fuel Consumption		CO_2 Emissions		
	Miles Travelled	Fuel Consumption (Gallons)	CO_2 Emission Factor [1] (grams/ gallon)	US Tons	Metric Tons
Preferred Alternative	3,000	100	8,887	1.0	0.9
Reduced-Build	2,000	67	8,887	0.7 *	0.6
Full Build	4,000	133	8,887	1.3 *	1.2

* Rounded to 1 in summary Table 16
Assumes standard gas driven vehicle with fuel capacity averaging 30 MPG
[1] Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories, Volume 2 (2006 IPCC)

Table 8: Summary of Annual Vehicle Miles and Fuel Consumption by Vehicle Type - Preferred Alternative

Fuel Consumption						CO_2 Emmissions		
Vehicle Type	**Vehicle Weight (Pounds)**	**Fuel Type**	**Fuel Capacity Per Vehicle (Gallons)**	**Total Annual Miles Driven**	**Fuel Consumption (Gallons)**	**CO_2 Emission Factor[1] (grams/ gallon)**	**US Tons**	**Metric Tons**
HMMWV	12,100	Diesel	25	6,840	1,267	10,182	14.2	12.9
LMTV	22,904	Diesel	35	2,800	1,773	10,182	19.9	18.1
FMTV	28,889	Diesel	35	6,200	1,607	10,182	18.0	16.4
MATV	34,830	Diesel	30	200	50	10,182	0.6	0.5
ASV	29,000	Diesel	30	1,560	347	10,182	3.9	3.5
Non-military	8,000	Gasoline	18	1,800	240	8,887	2.4	2.1
		Annual Total (Diesel)		**17,600**	**5,044**			
		Annual Total (Gasoline)		**1,800**	**240**			
		Total Miles Driven		**19,400**	**5,284**	**Annual Total CO2 Emissions**	**59.0**	**53.6**

[1]Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories, Volume 2 (2006 IPCC)

HMMWV High Mobility Multipurpose Wheeled Vehicle
LMTV Light Medium Tactical Vehicle
FMTV Family of Medium Tactical Vehicles
MATV Armored Security Vehicle
ASV Medium Armored Tactical Vehicle

2.2.2 Land Clearing (Biomass Removal)

As shown on **Table 9**, the removal of the trees under the Preferred Alternative will result in the release of 39,273 US Tons of CO_2 and the alteration of grassland will result in the release of 376 US Tons of CO_2. Forests will be converted to managed grasslands as part of the range construction as the range floor will be planted with native grassland species. This will allow for the sequestration on an annual basis of 1,705 US Tons of CO_2 for 170.5 acres of grassland.

The vegetation is comprised of three different cover types with woody vegetation as described in **Section 2.1.2**, which will be cleared and graded for the range and then vegetated with native grasses to be managed as grasslands. The cleared trees and woody vegetation will be chipped on-site and removed off-site, likely to be sold to outside sources for use at biomass energy facilities as a fuel. The following table calculates the release of the CO_2 from land clearing.

Table 9: Estimated Emissions from Land Clearing Activity – Preferred Alternative

Vegetation Type	Acres	Above-Ground Biomass *	Below-Ground Biomass *	Total Biomass *	C per Metric Ton of Dry Matter	C (Metric Tons/ acre)	CO_2 (Metric Tons/ acre)	CO_2 (US Tons)	CO_2 (Metric Tons)
PPOF	50.0	200	88	288	0.49	57	209	11,517	10,470
PPSO	55.0	200	88	288	0.49	57	209	12,669	11,517
SOS	65.5	200	88	288	0.49	57	209	15,087	13,716
Total Forested	**170.5**							**39,273**	**35,703**
Total Grasslands	36.0			13.6	0.47	3	9	376	341
Total Emissions	**206.5**							**39,649**	**36,044**

* Metric Ton of dry matter per hectare
** ROCA acreage (2.5) not included here
Source: 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, Agriculture, Forestry and Other Land Use https://www.ipcc-nggip.iges.or.jp/public/2006gl/vol4.html

2.2.3 Construction

Emissions resulting from vehicles during the construction period of the Preferred Alternative include non-road equipment operation for land clearing, range construction, and ROCA demolition and construction.

2.2.3.1 Land Clearing

RSMeans Site Work Landscape Cost Data (2018) was utilized to estimate the equipment and crew needed for the land clearing and grubbing portion of the task. According to RSMeans Section 31 11 Clearing and Grubbing:

- To cut and chip medium trees up to 12” diameter, a crew of 6 members (1 foreman, 4 laborers and 1 equipment operator) can cut 0.7 acres per day. Equipment required will be one 12” brush chipper (130 hp), one crawler loader (3 CY) and two gas-fired 18” chain saws.

- To clear and grub dense brush including stumps, a crew of 3 members (1 equipment operator and 2 truck drivers) can grub and clear 1 acre per day. Equipment required will be 1 hydraulic excavator (1.5 CY) and 2-400 HP dump trucks (12 CY capacity).

Please see **Table 10** for the estimated hours of operation from the construction vehicles for land clearing. This table provides hours estimated for each of the three alternatives based on acreage to be cleared. Once the hours were determined, the next step was to identify the construction equipment to be used for the land clearing. **Table 11** provides the Project emissions of land clearing equipment by the three alternatives. Approximately 734 US Tons will be emitted during the Preferred Alternative construction period from land clearing equipment.

Table 10: Estimated Hours of Operation for Land Clearing by Alternative

Land Clearing Activity	Preferred Alternative	Reduced-Scale Alternative	Full Build Alternative
Cutting and chipping trees up to 12" diameter			
Acres per day (one 8-hour shift)	0.7	0.7	0.7
Acres to be cleared	170.5	99.5	267.5
Number of days to clear all acreage	244	143	383
Hours of Equipment Operation per day	8	8	8
Total hours for equipment operation	**1,952**	**1,144**	**3,064**
Crew Round Trip Hours for Commuting	1	1	1
Number of crews	6	6	6
Number of commuters by crew/day/pickup truck	6	6	6
Total hours of operation of pickup trucks	**1,464**	**858**	**2,298**
Clear and grub dense shrubs including stumps			
Acres per day (one 8-hour shift)	1.0	1.0	1
Acres to be cleared	170.5	99.5	267.5
Number of days to clear all acreage	171	100	268
Hours of equipment operation per day	8	8	8
Total hours for equipment operation	**1,368**	**800**	**2,144**
Crew round trip hours for commuting	1	1	1
Number of crews	3	3	3
Number of commuters by crew/day/pickup truck	3	3	3
Total hours of operation of pickup trucks	**513**	**300**	**804**

Table 11: Summary of Projected Emissions from Land Clearing Equipment by Alternative

Construction Equipment	Preferred Alternative		Reduced-Scale Alternative		Full Build Alternative	
	Equipment Usage (hr)	CO_2 Emissions (lb)	Equipment Usage (hr)	CO_2 Emissions (lb)	Equipment Usage (hr)	CO_2 Emissions (lb)
Chain saws	3,904	29,479	2,288	17,276	6,128	46,272
Dozer	1,952	276,173	1,144	161,855	3,064	141
Brush Chipper	1,952	133,750	1,144	78,386	3,064	209,944
Excavator, hydraulic, 1.5 cy	1,368	124,356	800	72,723	2,144	194,897
Dump Truck, 12 cy	2,736	347,666	1,600	203,314	4,288	544,880
Pickup Truck, 3/4 Ton	1,977	556,336	1,158	325,866	3,102	872,915
Total Emissions Pounds/year		**1,467,759**		**859,420**		**1,869,050**
Total Emissions US Tons/year (tpy)		**734**		**430**		**935**
Total Emissions Metric Tons/year		**666**		**390**		**850**

Source: Emission factors from USAFCEE Air Emissions Guide For Air Force Mobile Sources, July 2016, Section 4 and 5.
CO_2e = Carbon dioxide equivalent

2.2.3.2 Range Construction

To determine the amount of CO_2 produced during range construction, the number of days of construction were calculated based on acreage and amount of grading that could be completed in one day as shown in **Table 12.** The rate of CO_2 emissions from one dozer per hour would be 63.67 lbs/hr**.** If there are two crews working at the same time for range construction, there would be twice the emissions per hour but only half the hours would be needed, resulting in the same level of emissions. Approximately 129 US Tons of CO_2 will be emitted during the Preferred Alternative construction period from grading equipment.

Table 12: Total CO_2 Emissions from Range Construction

Alternative	Total Footprint (acres)	Total Footprint (s.y.)	Days based on 2,000 s.y. of grading*	Hours (based on an 8 hour day)	CO_2 for Dozer at 63.67 lbs/hr	CO_2 US Tons
Full Build	306	1,481,040	741	5,924	377,191	189
Preferred Alternative	209	1,011,560	506	4,046	257,624	129
Reduced-Scale Alternative	138	667,920	334	2,672	170,106	85

Source: Emission factors from USAFCEE Air Emissions Guide For Air Force Mobile Sources, July 2016, Section 4 and 5.
* Grading estimated at 2,000 s.y. per day for one crew with 2 crew members and one 30,000 lb grader)

2.2.3.3 ROCA Demolition and Construction

There are presently two wooden structures located at the KD Range, a tower and an ammunition building. The existing tower is approximately 400 s.f. in size. The Ammunition building is

approximately 600 s.f. in size. CO_2 will be produced from the equipment used for demolishing the existing buildings. Based on a conservative estimate of 2.5 weeks for the demolition, the CO2 emitted would be approximately 3 US Tons.

Based on conservative estimates of six months for the construction of the ROCA, the CO_2 emitted would be approximately 31 US Tons. The proposed MPMG Range will have approximately 3,968 s.f. of new construction in the following structures:

- Range Control Tower (657 s.f.)
- Range Operations and Storage Facility (800 s.f.)
- Ammunition Breakdown Building (185 s.f.)
- Bleacher Enclosure (726 s.f.)
- Range Classroom Building (800 s.f.)
- Covered Mess Shelter (800 s.f.)

The total amount of CO_2 produced by the ROCA demolition and construction is estimated to be 34 US Tons and will be the same for each of the three alternatives.

2.2.4 Range Operations

Sources of GHG emissions from range operations and from the ROCA structures once the MPMG Range is constructed would include the firing of weapons which have limited CO_2 emissions.

2.2.4.1 Firing of Weapons

The firing of weapons during training exercises at the MPMG Range will occur once constructed. Emissions for ranges are calculated depending on the weapon being fired, rounds being fired, and number of soldiers training. **Table 13** provides estimated annual usage of the MPMG Range based on the three-year (2017-2019) average of actual rounds used at Camp Edwards and the estimate increase of training as a result of the MPMG Range. The CO_2 generated from firing of weapons at the MPMG Ranges is estimated to be 0.3 US Tons/year. This amount would be the same for all three alternatives and the baseline condition although the CO_2 from the baseline condition would be emitted in other states.

Table 13: Estimated CO_2 Emissions from Firing of Weapons at MPMG Range

Ammunition Type	Total Rounds [1]	CO_2 lb
9 mm	139,671	28
5.66 mm	560,235	486
7.62 mm	3,002	3
40 mm	2,954	4
	Total lbs/year	**521**
	Total US Tons/year	**0.3**

[1] AP-42: Compilation of Air Emissions Factors, Environmental Protection Agency, Fifth Editions, Volume 1: Stationary Point and Areas Sources

2.2.4.2 ROCA Demolition and Construction

It is not expected that the ROCA structures once constructed will emit any significant CO_2 as they are to be constructed without heating and cooling equipment. These building are used on a temporary basis while units are training which occurs primarily during the warmer months. For the purposes of this analysis, we have assumed minimal CO_2 being produced from the ROCA Structures during operations. These structures are not heated and do not have air cooling systems and will be serviced by electric through overhead wires. For purposes of this analysis, we have assigned 1 US Ton/year for the ROCA structures.

2.3 Reduced-Scale Alternative

The Reduced-Scale Alternative will result in the following activities:

- Transportation
    - Travel of work crews would emit 1 US Ton (see **Table 7**)
    - Travel to MPMG Range once constructed would emit 59 US Tons (see **Table 8)**
- Land Clearing (biomass removal) would emit 23,295 US Tons (see **Table 14**)
- Construction
    - Land clearing would emit 430 US Tons (see **Table 11**)
    - Range construction would emit 85 US Tons (see **Table 12**)
    - ROCA demolition and construction would emit 34 US Tons (see **Section 2.2.4.1)**
- Range operations
    - Firing of weapons will emit 0.3 US Tons (see **Table 13**)
    - ROCA structures will emit 1 US Tons (see **Section 2.2.5**)

Table 14: Estimated Emission from Land Clearing Activity – Reduced-Scale Alternative

Vegetation Type	Acres	Above-Ground Biomass *	Below-Ground Biomass *	Total Biomass *	C per Metric Ton of Dry Matter	C (Metric Tons/ acre)	CO_2 (Metric Tons/ acre)	CO_2 (Metric Tons)	CO_2 (US Tons)
PPOF	40.0	200	88	288	0.49	57	209	8,376	9,214
PPSO	44.0	200	88	288	0.49	57	209	9,214	10,135
SOS	15.5	200	88	288	0.49	57	209	3,246	3,570
Total Forests	99.5							**20,835**	**22,919**
Total Grasslands	36.0			13.6	0.47	3	9	341	376
Total Emissions	135.5							**21,177**	**23,295**

* Metric Ton of dry matter per hectare
** ROCA acreage (2.5) not included here
Source: 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, Agriculture, Forestry and Other Land Use
https://www.ipcc-nggip.iges.or.jp/public/2006gl/vol4.html

2.4 Full Build Alternative

The Full Build Alternative will result in the following activities:

- Transportation
    - Travel of work crews would emit 1 US Ton (see **Table 7**)
    - Travel to MPMG Range once constructed would emit 59 US Tons (see **Table 8)**
- Land Clearing (biomass removal) would emit 61,992 US Tons (see **Table 15**)
- Construction
    - Land clearing would emit 935 US Tons (see **Table 11**)
    - Range construction would emit 189 US Tons (see **Table 12**)
    - ROCA demolition and construction would emit 34 US Tons (see **Section 2.2.4.1)**
- Range operations
    - Firing of weapons will emit 0.3 US Tons (see **Table 13**)
    - ROCA structures will emit 1 US Tons (see **Section 2.2.5**)

Table 15: Estimated Emissions from Land Clearing Activity - Full Build

Vegetation Type	Acres	Above-Ground Biomass *	Below-Ground Biomass *	Total Biomass *	C per Metric Ton of Dry Matter	C (Metric Tons/ acre)	CO_2 (Metric Tons/ acre)	CO_2 (Metric Tons)	CO_2 (US Tons)
PPOF	78.0	200	88	288	0.49	57	209	16,333	17,967
PPSO	85.0	200	88	288	0.49	57	209	17,799	19,579
SOS	104.5	200	88	288	0.49	57	209	21,882	24,071
Total Forests	267.5							**56,015**	**61,616**
Total Grasslands	36.0			13.6	0.47	3	9	341	376
Total Emissions	303.5							**56,356**	**61,992**

* Metric Ton of dry matter per hectare
** ROCA acreage (2.5) not included here
Source: 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, Agriculture, Forestry and Other Land Use https://www.ipcc-nggip.iges.or.jp/public/2006gl/vol4.html

2.5 Summary of Impacts

Table 16 (also included as **Table 2** but repeated here) provides a summary of all GHG emissions generated as a result of this Project compared to the baseline information and the three alternatives. Emission are calculated by transportation ,construction, land clearing, and range operations. Construction related emissions will be temporary and may produce short-term localized impacts limited to the construction period. Emissions from land clearing are also temporary but have the most impact on CO_2 emissions. Transportation related CO_2 emissions will be greatly reduced (by 82%) over existing baseline conditions. Long-term emissions would be generated from the training activities, specifically the firing of ammunition and the ROCA structures which are only estimated at 3 US Tons.

The majority of CO_2 emitted from the Project, all alternatives, is generated from the land clearing and the biomass removal. For each alternative, the biomass removal accounts for anywhere between 97.4% and 98.1% of the total CO_2 generated.

If you eliminate the land clearing (biomass removal) from the calculated totals and compare the emissions to the 726 US Tons under the baseline conditions, the Preferred Alternative result in an increase of emissions of 32%, the Full Build resulting in an increase of 68% over baseline emissions. Mitigation as discussed in the next section focuses primarily on the land clearing emissions.

Table 16: CO_2 Emissions Summary by Alternative (US Tons)

Activity	Baseline	Preferred Alternative	Reduced Build	Full Build
Transportation	**724**	**60**	**60**	**60**
Out-of-State Training	724	0	0	0
Travel of Work Crews	0	1	1	1
Within Camp Edwards after Range Construction	0	59	59	59
Construction	**0**	**897**	**549**	**1,157**
Land Clearing	0	734	430	935
Range Construction	0	129	85	189
ROCA Demolition and Construction	0	34	34	34
Land Clearing (Biomass Removal)	**0**	**39,649**	**23,295**	**61,992**
Range Operations	**0.3**	**1.3**	**1.3**	**1.3**
Firing of Weapons	0.3	0.3	0.3	0.3
ROCA Structures	0	1	1	1
CO_2 Emission Totals	**724.3**	**40,607.3**	**23,904.3**	**63,210.3**
CO_2 Emissions without Land Clearing	**726**	**960**	**611**	**1,220**

3 Mitigation

Mitigation for the Proposed Project includes phasing of the construction and preservation of forested acreage within Camp Edwards. The Project will be constructed in two phases as described in **Section 1.4** with the first phase being the Reduced-Build Alternative. Following the construction of the first phase, the two extended lanes will be constructed with the total impacts represented by the Preferred Alternative. Substantial mitigation efforts are being proposed relative to impacts to rare species in consultation with the Massachusetts Natural Heritage and Endangered Species Program (NHESP) which includes the preservation of approximately 310 acres of land within Camp Edwards that is presently forested. Other management strategies includes the management of approximately 832 acres of forests through mechanical forestry. The land preservation acreage alone provides mitigation for the impacts from the Proposed Project. Mitigation will continue each year with the annual sequestration occurring in the preserved forests. Grassland alteration during land clearing will also result in the release of CO_2 but will be mitigated by the replanting and restoration of the range floor with native grasses.

In addition to the annual sequestration, mature forests sequester carbon throughout its life. One acre of forest provides 230 US Tons of sequestration. The estimated amount of sequestered carbon in the 13,500 acres of forest at Camp Edwards is estimated to be approximately 3,105,000 US Tons. One acre of grassland provides 10 US Tons of sequestration. The estimated amount of sequestered carbon in the 175 acres of grassland at Camp Edwards is estimated to be approximately 1,750 US Tons of sequestration. The annual GHG sequestration and lifetime sequestration from the mitigation acreage is summarized in **Table 17** (also included as **Table 3)**.

Table 17: Sequestration and Mitigation

Management Action	Acreage	Annual Sequestration		Lifetime Sequestration	
		Rate*	US Tons	Rate	US Tons
Land Preservation	310	0.85 US Tons/ acre/year	263.5	230 US Tons/acre	71,300
Forestry Management	832	0.85 US Tons/ acre/year	707.2	230 US Tons/acre	162,012
Total Mitigation	**1,142**	0.85 US Tons/ acre/year	**967.3**	230 US Tons/acre	**233,312**
Forests at Camp Edwards	**13,500**	0.85 US Tons/ acre/year	**11,475**	230 US Tons/acre	**3,105,000**

* see **Section 1.8**

Camp Edwards continues to provide carbon sequestration on an annual basis through maintenance of forested land. Construction of the Proposed Project would only represent 1.3% of the carbon sequestered in the forests at Camp Edwards. The release of CO_2 from the Proposed Project will be mitigated in 3.5 years based on just the annual sequestration of GHG provided by the forested land at Camp Edwards. According to the latest GHG emissions inventory by Massachusetts, in CY 2016, the state sources emitted 74,200,000 million metric tons of CO_2e emissions. This is equivalent of 81,620,000 US tons of CO_2e emissions in CY2016 where complete dataset was available. The estimated CO_2e emissions for the Preferred Alternative (immediately after project completion) represents an insignificant amount (less than one hundredth fraction of 1%). Regardless, after the completion of Project, the continued annual sequestration by forested land at Camp Edwards will make up for the release during Project construction.

APPENDIX A: Annual Vehicle Miles Travelled to Out-of-State MPMG Ranges from Camp Edwards

Training Site and Location	Vehicle Type	Vehicle Weight (Pounds)	Fuel Type	Fuel Capacity Per Vehicle (Gallons)	No. of Vehicles	Roundtrip Distance (Annual Miles per Vehicle)	Total Annual Miles Driven	No. of Times Fuel Tank Filled	Total Fuel Used (Gallons)
Camp Ethan Allen, Jericho, VT	HMMWV	12,100	Diesel	25	117	540	63,180	4	11,700
	LMTV	22,904	Diesel	35	31	540	16,740	4	4,340
	FMTV	28,889	Diesel	35	55	540	29,700	4	7,700
	ASV	29,560	Diesel	30	36	540	19,440	4	4,320
	Non-military	8,000	Gas	18	19	540	10,260	4	1,368
Subtotal					**258**	**2700**	**139,320**		**29,428**
Fort Dix, Ocean City, NJ	HMMWV	12,100	Diesel	25	24	600	14,400	5	3,000
	LMTV	22,904	Diesel	35	27	600	16,200	5	4,725
	FMTV	28,889	Diesel	35	100	600	60,000	5	17,500
	MATV	34,830	Diesel	30	5	600	3,000	5	750
	Non-military	8,000	Gas	18	23	600	13,800	4	1,656
Subtotal					**179**	**3000**	**107,400**		**27,631**
Fort Drum, Jefferson County, NY	HMMWV	12,100	Diesel	25	30	740	22,200	6	4,500
	LMTV	22,904	Diesel	35	12	740	8,880	6	2,520
	ASV	29,000	Diesel	30	3	740	2,220	6	540
	Non-military	8,000	Gas	18	3	740	2,220	6	324
Subtotal					**48**	**2,960**	**35,520**		**7,884**
Total Annual Miles By Vehicle Type	HMMWV	12,100	Diesel	25	171	1880	99,780	15	19,200
	LMTV	22,904	Diesel	35	70	1880	41,820	15	11,585
	FMTV	28,889	Diesel	35	155	1140	89,700	9	25,200
	MATV	34,830	Diesel	30	5	600	3,000	5	750
	ASV	29,000	Diesel	30	39	1280	21,660	10	4,860
	Non-military	8,000	Gas	18	45	1880	26,280	14	3,348
Total					**485**	**8,660**	**282,240**	**68**	**64,943**

Source: Camp Edward Range Control, 2019

HMMWV	High Mobility Multipurpose Wheeled Vehicle
LMTV	Light Medium Tactical Vehicle
FMTV	Family of Medium Tactical Vehicles
MATV	Medium Armored Tactical Vehicle
ASV	Armored Security Vehicle