Appendix D

Air Quality Analysis

APPENDIX D - Air Quality

This attachment provides the data, assumptions, methodology, and results of an air quality assessment that was performed to evaluate the Service Station Plaza (the Proposed Project) at Baltimore/Washington International Thurgood Marshall Airport (BWI Marshall Airport). For the assessment, a construction emissions inventory was prepared and an intersection analysis performed.

Regulatory Information

Federal Aviation Administration (FAA) Order 5050.4B[1] provides the basis for delineating the scope of the FAA's assessment of air quality impacts under the National Environmental Policy Act (NEPA) and the Clean Air Act (CAA), and contains guiding criteria for determining the extent of an air quality analysis. Additionally, FAA Order 1050.1F[2] directs agency personnel to ensure that an air quality assessment prepared under NEPA includes an analysis and summary conclusions of the Proposed Project's impacts on air quality and, when a NEPA analysis is needed, an assessment of the Proposed Project is required to evaluate the impact on the National Ambient Air Quality Standards (NAAQS).

The CAA requires the United States Environmental Protection Agency (EPA) to establish, and periodically review, NAAQS to protect public health, welfare and the environment. NAAQS have been established for the following six air pollutants (known as criteria pollutants): ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter (PM) and lead (Pb). Emissions of PM are measured as particles 10 micrometers or less in diameter (PM_{10}) and 2.5 micrometers or less in diameter ($PM_{2.5}$).

Additionally, the CAA requires states to develop a general plan to attain and/or maintain the NAAQS in all areas of the country and to develop a specific plan to attain the standards for each area designated nonattainment and/or maintenance for a NAAQS. These plans, known as State Implementation Plans (SIPs), are developed by state and local air quality management agencies and submitted to the EPA for approval. An area with measured pollutant concentrations which are lower than the NAAQS is designated as an "attainment" area and an area with pollutant concentrations that exceed the NAAQS is designated as a "nonattainment" area. Once a nonattainment area meets the NAAQS and the additional re-designation requirements in the CAA, the EPA designates an area as being "maintenance".

Under the CAA, federal agencies (such as the FAA) must make a determination of conformity with the applicable SIP, before taking any action on a Proposed Project (e.g., setting aside money, granting a permit, etc.). The EPA has published a rule (referred to as the General Conformity Rule) that stipulates how applicable federal agencies are to make such a determination. A formal *Conformity Determination* must be performed when the emissions caused by a federal action (the "net" emissions when Proposed Project emissions are compared

[1] FAA, Order 5050.4B, NEPA Implementing Instructions for Airport Actions, April 26, 2006.
[2] FAA, Order 1050.1F, Environmental Impacts: Policies and Procedures, July 16, 2015.

to No Action emissions) equal or exceed what are known as *de minimis* levels. If emissions are below the *de minimis* levels, it can be presumed that a Proposed Project conforms to the CAA.

Maryland's Anne Arundel County (including the area surrounding BWI Marshall) is presently designated by the EPA as nonattainment for the pollutants O_3 and maintenance for $PM_{2.5}$. Therefore, emissions of nitrogen oxides (NO_x) and volatile organic compounds (VOC) – the two primary precursors to O_3 formation – as well as $PM_{2.5}$, were the focus of this air quality assessment. Because of these designations, the EPA's General Conformity Rule applies to the Proposed Project. The applicable *de minimis* thresholds are 100 tons per year of VOC, NO_x, or 100 tons of direct emissions of $PM_{2.5}$. Because emissions of SO_2 can be precursors to the pollutant $PM_{2.5}$, the EPA established a *de minimis* threshold of 100 tons per year for this pollutant as well. For disclosure purposes, emissions of CO were also evaluated in the air quality assessment.

Construction Emissions

Construction emissions were estimated using the EPA's Motor Vehicle Emissions Simulator (MOVES) and NONROAD[3] emission factor models, and other appropriate guidelines. Construction-related emissions are primarily associated with the exhaust from heavy equipment (i.e., cranes, backhoes, bulldozers, graders, rollers, etc.), delivery and haul trucks (i.e., cement trucks, dump trucks, etc.), and construction worker vehicles getting to and from the site; and with fugitive dust from site preparation, land clearing, material handling, equipment movement on unpaved areas, and demolition activities. These emissions are temporary in nature and generally confined to the construction site and the access/egress roadways.

Emissions from construction activities were estimated based on the projected construction activity schedule, the number of vehicles/pieces of equipment, the types of equipment/type of fuel used, vehicle/equipment utilization rates (including load factor or usage factor), the equipment size (horsepower), and the year in which construction occurs. The construction activities associated with the development of the Service Station Plaza at BWI Marshall are anticipated to occur from January 2018 through December 2019.

Construction Equipment

The horsepower assigned to each construction equipment type was based on the most frequently utilized equipment within Anne Arundel County as derived from the MOVES/NONROAD models. Emission factors for each equipment type were applied to the anticipated equipment work output (horsepower-hours of expected equipment use). **Table A-1** presents the assumed horsepower, load factor, and usage factor for each type of construction equipment. Operating times for the equipment were based on a six-day workweek and a ten-hour workday during which the equipment could be operating.

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[3] EPA, Motor Vehicle Emission Simulator (MOVES), *https://www3.epa.gov/otaq/models/moves/*; and NONROAD, *https://www3.epa.gov/otaq/nonrdmdl.htm*.

Table A-1: Construction Equipment Information

Equipment	Horsepower	Load Factor	Usage Factor
Diesel - Cranes	238	0.43	0.48
Diesel - Other Construction Equipment	443	0.59	0.29
Diesel - Crawler Tractor/Dozers	136	0.59	0.45
Diesel - Crushing/Proc. Equipment	61	0.43	0.46
Diesel - Pavers	135	0.59	0.39
Diesel - Graders	231	0.59	0.46
Diesel - Rollers	85	0.59	0.37
Diesel - Excavators	138	0.59	0.53
Diesel - Off-highway Trucks	420	0.59	0.79
Diesel - Tractors/Loaders/Backhoes	87	0.21	0.55
Diesel - Air Compressors	84	0.90	0.53
Diesel - Bore/Drill Rigs	132	0.43	0.22
Diesel - Aerial Lifts	22	0.21	0.18
Diesel - Welders	46	0.90	0.53
Diesel - Plate Compactors	5	0.43	0.23
Diesel - Pumps	8	0.90	0.53
Diesel - Concrete/Industrial Saws	33	0.59	0.28
Diesel - Paving Equipment	131	0.59	0.30
Diesel - Surfacing Equipment	22	0.59	0.27
Diesel - Chippers/Stump Grinders (com)	84	0.90	0.53
Diesel - Scrapers	423	0.59	0.44
Gasoline - Chain Saws	7	0.70	0.15
Diesel - Sprayers	128	0.90	0.53

Source: EPA, MOVES/NONROAD Models.

The following equation was used to obtain emission estimates for off-road construction equipment:

Equipment Emission Rate (tons/year) = Full Throttle Emission Factor (grams/hp-hour) x size (hp) x hours per year x Load Factor x Usage Factor x (1 pound/453.59 grams) x (1 ton/2,000 pounds)

Tables A-2 and A-3 present the construction equipment emission factors (grams per horsepower-hour) for 2018 and 2019, respectively.

Table A-2: Construction Equipment Emission Factors (grams/hp-hour) for 2018

Equipment	CO	VOC	NO_x	SO_2	PM_{10}	$PM_{2.5}$
Diesel - Cranes	0.32	0.17	1.43	<0.01	0.06	0.06
Diesel - Other Construction Equipment	1.17	0.21	2.77	<0.01	0.17	0.16
Diesel - Crawler Tractor/Dozers	1.96	0.56	3.42	<0.01	0.40	0.39
Diesel - Crushing/Proc. Equipment	1.41	0.21	3.36	<0.01	0.17	0.16
Diesel - Pavers	2.71	0.73	4.16	<0.01	0.46	0.44

Diesel - Graders	0.31	0.15	1.01	<0.01	0.05	0.05
Diesel - Rollers	1.73	0.20	1.77	<0.01	0.22	0.22
Diesel - Excavators	0.38	0.15	0.95	<0.01	0.08	0.08
Diesel - Off-highway Trucks	0.27	0.14	0.83	<0.01	0.03	0.03
Diesel - Tractors/Loaders/Backhoes	1.34	0.17	1.37	<0.01	0.16	0.16
Diesel - Air Compressors	1.38	0.24	2.28	<0.01	0.21	0.20
Diesel - Bore/Drill Rigs	1.00	0.32	3.57	<0.01	0.22	0.21
Diesel - Aerial Lifts	6.38	1.64	6.00	<0.01	0.90	0.87
Diesel - Welders	3.21	0.76	4.61	<0.01	0.52	0.51
Diesel - Plate Compactors	4.45	0.63	4.51	<0.01	0.41	0.40
Diesel - Pumps	4.46	0.67	4.71	<0.01	0.45	0.43
Diesel - Concrete/Industrial Saws	0.68	0.18	3.48	<0.01	0.10	0.10
Diesel - Paving Equipment	0.77	0.20	1.87	<0.01	0.18	0.17
Diesel - Surfacing Equipment	2.40	0.47	4.46	<0.01	0.35	0.34
Diesel - Chippers/Stump Grinders (com)	1.93	0.40	3.46	<0.01	0.34	0.33
Diesel - Scrapers	0.71	0.16	1.74	<0.01	0.11	0.10
Gasoline - Chain Saws	289.45	62.09	1.35	0.07	9.75	8.97
Diesel - Sprayers	1.53	0.40	3.59	<0.01	0.29	0.28

Source: EPA, MOVES/NONROAD Models.

Table A-3: Construction Equipment Emission Factors (grams/hp-hour) for 2019

Equipment	CO	VOC	NO_x	SO_2	PM_{10}	$PM_{2.5}$
Diesel - Cranes	0.26	0.16	1.21	<0.01	0.05	0.05
Diesel - Other Construction Equipment	1.06	0.20	2.51	<0.01	0.15	0.15
Diesel - Crawler Tractor/Dozers	1.80	0.51	3.12	<0.01	0.37	0.36
Diesel - Crushing/Proc. Equipment	1.24	0.19	3.25	<0.01	0.14	0.14
Diesel - Pavers	2.48	0.67	3.86	<0.01	0.42	0.41
Diesel - Graders	0.23	0.15	0.80	<0.01	0.03	0.03
Diesel - Rollers	1.46	0.18	1.48	<0.01	0.18	0.18
Diesel - Excavators	0.27	0.15	0.71	<0.01	0.05	0.05
Diesel - Off-highway Trucks	0.22	0.14	0.66	<0.01	0.03	0.03
Diesel - Tractors/Loaders/Backhoes	1.04	0.16	1.09	<0.01	0.11	0.11
Diesel - Air Compressors	1.23	0.22	1.99	<0.01	0.18	0.17
Diesel - Bore/Drill Rigs	0.90	0.30	3.28	<0.01	0.20	0.20
Diesel - Aerial Lifts	6.03	1.53	5.85	<0.01	0.85	0.82
Diesel - Welders	2.88	0.68	4.45	<0.01	0.47	0.46
Diesel - Plate Compactors	4.46	0.62	4.46	<0.01	0.39	0.38
Diesel - Pumps	4.46	0.65	4.61	<0.01	0.43	0.42
Diesel - Concrete/Industrial Saws	0.53	0.17	3.32	<0.01	0.07	0.07
Diesel - Paving Equipment	0.67	0.19	1.61	<0.01	0.16	0.15
Diesel - Surfacing Equipment	2.38	0.47	4.46	<0.01	0.35	0.34
Diesel - Chippers/Stump Grinders (com)	1.80	0.37	3.21	<0.01	0.31	0.31
Diesel - Scrapers	0.61	0.16	1.50	<0.01	0.09	0.09

Gasoline - Chain Saws	289.45	62.09	1.35	0.07	9.75	8.97
Diesel - Sprayers	1.40	0.38	3.34	<0.01	0.26	0.26

Source: EPA, MOVES/NONROAD Models.

On-Road Vehicles

Emission factors associated with the MOVES model for the construction years are presented in **Table A-4** for passenger autos and trucks, haul trucks, light commercial trucks, and pickup trucks.

For on-road vehicles, the anticipated vehicle miles traveled (VMT) were estimated to determine annual emissions. The following equation was used to obtain annual emission rates for on-road vehicles:

Emission Rate (tons/year) for on-road vehicles = Emission Factor (g/mile) x miles per day x days/year x (1 pound/453.59 grams) x (1 ton/2,000 pounds)

Emissions associated with on-road motor vehicles utilized for the purposes of security, escorting and project management, and personal employee vehicles, were based on a travel distance of 40 miles per work day (round trip) per vehicle. On-road trucks, including haul trucks, flatbed trucks and pick-up trucks were assumed to travel 100 miles per day per truck.

Table A-4: Emission Factors (grams/mile) for On-road Vehicles

Year	Vehicle Type	CO	VOC	NO_x	SO_2	PM_{10}	$PM_{2.5}$
2018	Passenger Cars and Trucks	1.06	0.013	0.127	0.003	0.026	0.010
2019		1.02	0.012	0.114	0.003	0.026	0.010
2018	Haul Trucks	2.31	0.079	1.19	0.004	0.098	0.045
2019		2.26	0.074	1.10	0.004	0.094	0.040
2018	Light Commercial Trucks	1.31	0.024	0.284	0.003	0.035	0.014
2019		1.27	0.022	0.259	0.003	0.034	0.014
2018	Pickup Trucks	1.27	0.018	0.184	0.004	0.032	0.012
2019		1.22	0.016	0.166	0.004	0.033	0.012

Source: EPA, MOVES/NONROAD Models.

The inventory of emissions from fugitive dust sources was calculated using emission factors from EPA's Compilation of Air Pollution Emissions Factors (i.e., AP-42) and other publications. Fugitive dust emissions can result from the following activities: grading, moving soil, and digging, loading/unloading of trucks, movement of trucks on unpaved surfaces, and wind erosion of stockpiles. A fugitive dust emission factor of 1.2 tons per acre disturbed per month during construction was used, consistent with AP-42, assuming that 25 percent of the construction project area would be disturbed per construction month. $PM_{2.5}$ was assumed to be 10 percent of PM_{10} based on AP-42. Erosion control measures and water programs are typically taken to minimize these fugitive dust and particulate emissions. A dust control efficiency of 75 percent due to daily watering and other measures was estimated (per AP-42).

Evaporative VOC emissions associated with the application of hot mix asphalt on areas requiring paving were estimated using raw materials quantities listed in the projected construction schedule. An emission factor of 0.053 tons of VOC per acre of asphalt material laid was also assumed, following the methodology outlined by the National Association of Clean Air Agencies (NACAA, formerly STAPPA-ALAPCO).

Results

The construction emissions associated with the Proposed Project are presented and compared to applicable *de minimis* thresholds in **Table A-5**. As shown, emissions are well below the *de-minimis* threshold of 100 tons for NOx, VOC, $PM_{2.5}$ and SO_2. Therefore, a Conformity Determination is not required and the Proposed Project is presumed to comply with the SIP and other requirements of the CAA.

Table A-5: Construction Emission Results (tons)

Year	2018	2019	de minimis	Conforms?
CO	1.0	<0.1	--	--
VOC	0.3	<0.1	100	Yes
NO_x	1.9	<0.1	100	Yes
SO_x	<0.1	<0.1	100	Yes
PM_{10}	0.1	<0.1	--	--
$PM_{2.5}$	0.1	<0.1	100	Yes

Source: EPA, MOVES/NONROAD Model.
-- Not applicable

Intersection Analysis

The Proposed Project is located adjacent to the intersection of Aviation Boulevard (MD 170) at Amtrak Way (MD 995) in Anne Arundel County. Because the Proposed Project may affect traffic operations at MD 170, a traffic study was prepared as part of the environmental assessment.[4]

EPA identifies CO, PM_{10}, and $PM_{2.5}$ as the primary pollutants of concern when assessing potential air quality impacts from motor vehicle exhaust. Increased concentrations of these pollutants can be expected in places where large numbers of motor vehicles (especially diesel vehicles for PM_{10} and $PM_{2.5}$) are present, including crowded intersections where traffic delays are common during peak traffic periods. To determine if the Proposed Project has the potential to affect concentrations of CO, PM_{10} and $PM_{2.5}$, traffic operating conditions at the following four intersections, on and adjacent to Aviation Boulevard (MD170), were reviewed:

1. Aviation Boulevard (MD 170) at Stoney Run Road
2. Aviation Boulevard (MD 170) at Amtrak Way (MD 995)

[4] HNTB, *Traffic Analysis to Support BWI Marshall Proposed Vehicular Service Station Environmental Assessment*, July 2016.

3. Aviation Boulevard (MD 170) at Northrop Grumman Gate 1A
4. Aviation Boulevard (MD 170) at SB I-195 Ramps

Following the requirements in EPA's *Project-Level Conformity and Hot-Spot Analyses*[5], an intersection analysis is required:

- for CO, for projects affecting intersections that are at Level-of-Service (LOS) D, E, or F, or those that will change to LOS D, E, or F because of increased traffic volumes related to the project; and

- for PM_{10} and $PM_{2.5}$, for projects affecting intersections that are at LOS D, E, or F with a significant number of diesel vehicles, or those that will change to LOS D, E, or F because of increased traffic volumes from a significant number of diesel vehicles related to the project.

Table A-6 presents the LOS and volumes for the AM and PM peak periods for the 2016 Existing, 2020 and 2025 future No Action and Proposed Action Alternatives as well as the 2025 Mitigated Proposed Action Alternative. As shown, the LOS of the Proposed Project intersections would not deteriorate as a result of increased traffic volumes and/or diesel vehicles (i.e., the LOS would be the same with or without the Proposed Project for both alternative years), except for the intersection of Aviation Boulevard (MD 170) at Amtrak Way (MD 995) in the PM peak period of the 2025 Proposed Action Alternative. Notably, this intersection is mitigated from a LOS D to a LOS C with the Mitigated Proposed Action Alternative. As such, it can be assumed that the Proposed Project would not cause a significant increase in motor vehicular emissions and, therefore, would not be of local air quality concern.

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[5] EPA, *Transportation Conformity Guidance for Quantitative Hot-spot Analyses in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas*, November 2015; *Using MOVES in Project-Level Carbon Monoxide Analyses*, March 2015; and *Guideline for Modeling Carbon Monoxide from Roadway Intersections*, November 1992.

Table A-6: Level of Service and Volume Data

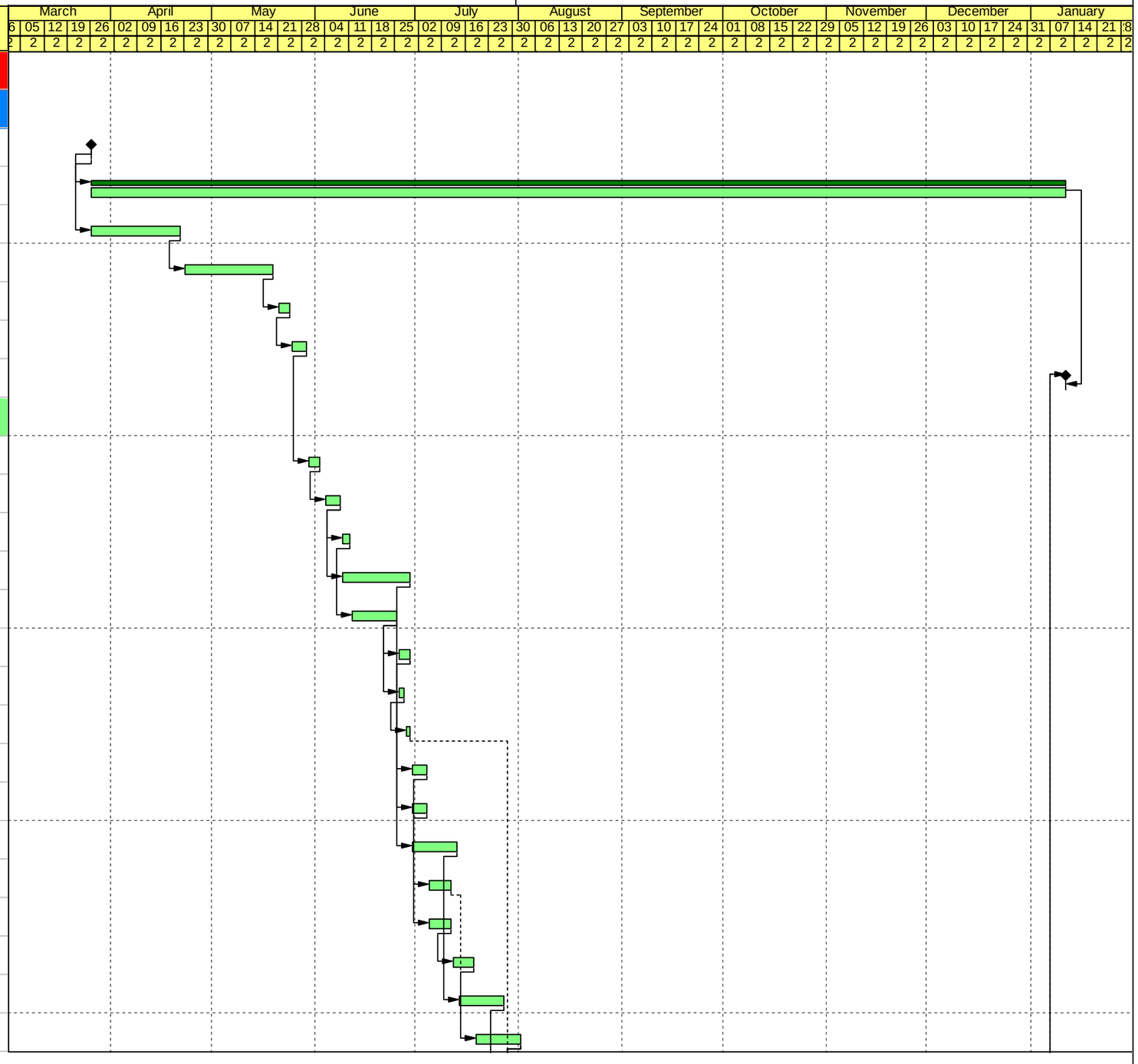
Intersections	2016 Existing		2020 No Action		2020 Proposed Action Alternative		2025 No Action		2025 Proposed Action Alternative		2025 Mitigated Proposed Action Alternative	
Level of Service	**AM**	**PM**	**AM**	**PM**	**AM**	**PM**	**AM**	**PM**	**AM**	**PM**	**AM**	**PM**
MD 170 at Stoney Run Rd	C	B	C	A	C	C	C	C	C	C	C	C
MD 170 at Amtrak Way (MD 995)	A	B	B	C	B	C	B	C	B	**D**	B	C
MD 170 at Northrop Grumman Gate 1A	A	B	A	B	A	B	A	B	A	B	A	B
MD 170 at SB I-195 Ramps	A	A	A	A	A	A	A	B	A	B	A	A
Volumes	**AM**	**PM**	**AM**	**PM**	**AM**	**PM**	**AM**	**PM**	**AM**	**PM**	**AM**	**PM**
MD 170 at Stoney Run Rd	3251	3643	3385	3791	3459	3870	3594	4027	3671	4109	3671	4109
MD 170 at Amtrak Way (MD 995)	3326	3676	3463	3828	3694	4065	3679	4065	3922	4315	3922	4315
MD 170 at Northrop Grumman Gate 1A	3514	3917	3659	4079	3733	4157	3886	4332	3964	4414	3964	4414
MD 170 at SB I-195 Ramps	2040	3067	2124	3194	2198	3273	2256	3392	2334	3475	2334	3475

Source: HNTB, Traffic Analysis to Support BWI Marshall Proposed Vehicular Service Station Environmental Assessment, July 11, 2016.

Construction Schedule Assumptions

(Air Quality Analysis)

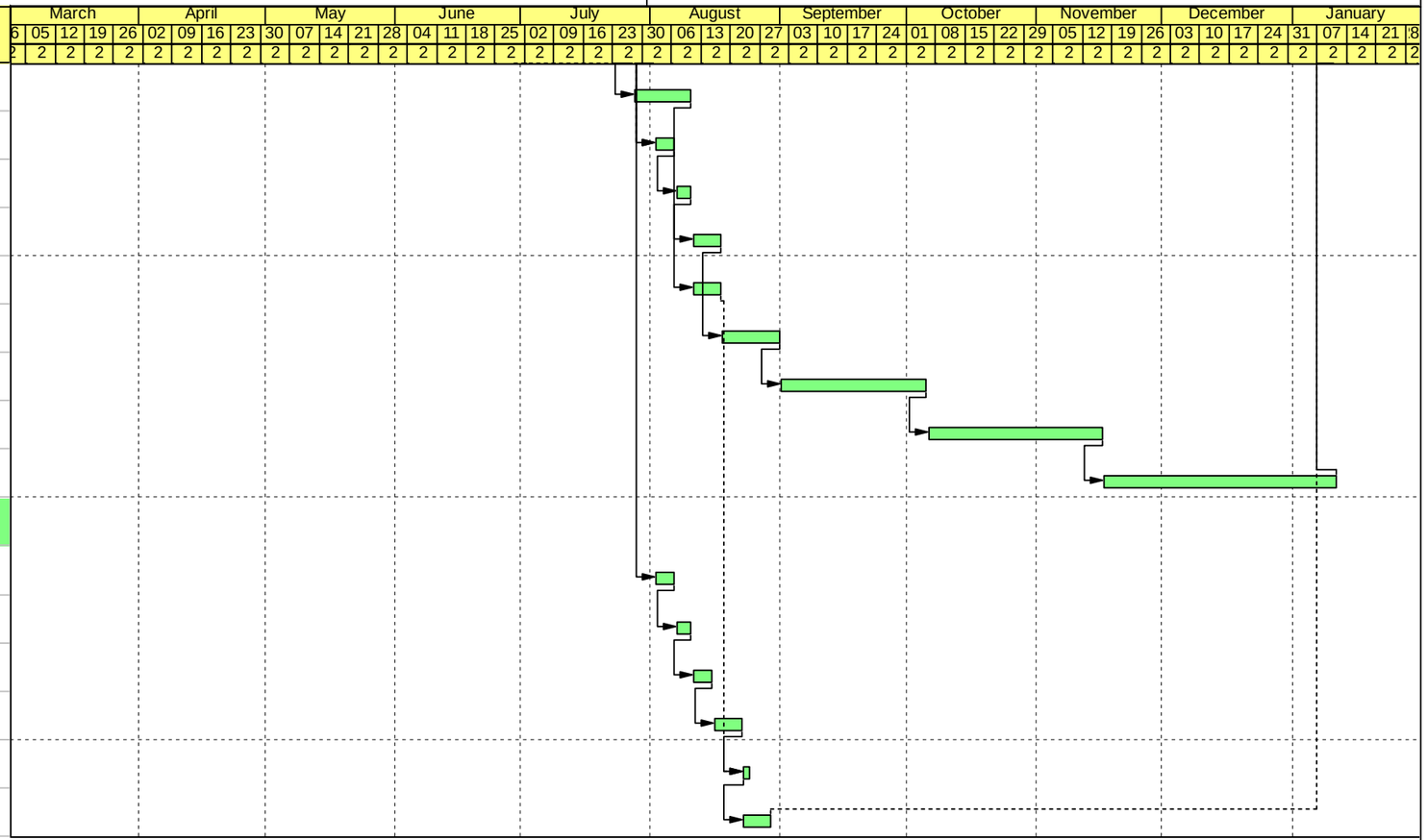
Activity ID	Activity Name	Original Duration	Start	Finish
BWI 2016 - 2020 Master Plan		251	26-Mar-18	11-Jan-19
Gas Station Construction (2018)		251	26-Mar-18	11-Jan-19
AQ26.10	NTP	0	26-Mar-18*	
AQ26.15	Management \ Oversight	251	26-Mar-18	11-Jan-19
AQ26.20	Mobilization	24	26-Mar-18	21-Apr-18
AQ26.30	Demo Existing Pavment as Needed	24	23-Apr-18	19-May-18
AQ26.40	Clear and Grub as Needed	4	21-May-18	24-May-18
AQ26.50	Grade Site	4	25-May-18	29-May-18
AQ26.240	Construction Complete	0		11-Jan-19
Main Building (Store, Restaurant, Maintenance, and Pump Sta		195	30-May-18	11-Jan-19
AQ26.60	Excavate for Foundation	4	30-May-18	02-Jun-18
AQ26.70	Excavate for Fuel Holding Tanks	5	04-Jun-18	08-Jun-18
AQ26.190	Form and Place Concrete Pad for Fuel Tanks	2	09-Jun-18	11-Jun-18
AQ26.80	Install Utilities	18	09-Jun-18	29-Jun-18
AQ26.193	Cure Fuel Tank Pad	12	12-Jun-18	25-Jun-18
AQ26.150	Form and Place Foundations for Gas Station Canopy	4	26-Jun-18	29-Jun-18
AQ26.195	Install Full Tanks	2	26-Jun-18	27-Jun-18
AQ26.200	Backfill Fuel Tanks	2	28-Jun-18	29-Jun-18
AQ26.130	Form and Place Foundations for Pump Islands	4	30-Jun-18	04-Jul-18
AQ26.155	Cure Canopy Foundations	4	30-Jun-18	04-Jul-18
AQ26.90	Form and Place Building Foundations	12	30-Jun-18	13-Jul-18
AQ26.140	Cure Pump Island Foundations	6	05-Jul-18	11-Jul-18
AQ26.160	Install Canopy Substructure	6	05-Jul-18	11-Jul-18
AQ26.170	Install Canopy Superstructure	6	12-Jul-18	18-Jul-18
AQ26.100	Cure Building Foundations	12	14-Jul-18	27-Jul-18
AQ26.180	Install Fuel Pumps and Other Finishings	12	19-Jul-18	01-Aug-18



Remaining Level of Effort | Actual Work | Critical Remaining Work
Actual Level of Effort | Remaining Work | Milestone

TASK filter: AQ__.

Activity ID	Activity Name	Original Duration	Start	Finish
AQ26.110	Form and Place Walls/Columns	12	28-Jul-18	10-Aug-18
AQ26.210	Fine Grade Site	4	02-Aug-18	06-Aug-18
AQ26.220	Place Surface Course	4	07-Aug-18	10-Aug-18
AQ26.120	Cure Walls/Columns	6	11-Aug-18	17-Aug-18
AQ26.230	Pave Building and Canopy Area	6	11-Aug-18	17-Aug-18
AQ26.250	Install Roof Structures	12	18-Aug-18	31-Aug-18
AQ26.260	Install Utilities	30	01-Sep-18	05-Oct-18
AQ26.270	Interior Framing	36	06-Oct-18	16-Nov-18
AQ26.280	Interior Finishings	48	17-Nov-18	11-Jan-19
Roadway (Inc. Parking Lots) and Landscaping		24	02-Aug-18	29-Aug-18
AQ26.500	Rough Grade Road Way	4	02-Aug-18	06-Aug-18
AQ26.510	Fine Grade	4	07-Aug-18	10-Aug-18
AQ26.520	Base Course	4	11-Aug-18	15-Aug-18
AQ26.530	Surface Course	6	16-Aug-18	22-Aug-18
AQ26.540	Sign and Stripe Roadway	2	23-Aug-18	24-Aug-18
AQ26.550	Install Lanscaping Features	6	23-Aug-18	29-Aug-18



Remaining Level of Effort
Actual Level of Effort
Actual Work
Remaining Work
Critical Remaining Work
Milestone

TASK filter: AQ__.

		2018																					
		March				April					May				June				July				
Resource Code	Resource Crew	5	12	19	26	2	9	16	23	30	7	14	21	28	4	11	18	25	2	9	16	23	30
MAA-DELIVR	Delivery / Removal Crew				6	6	6	6										1			1	1	1
MAA-CLEAR1	Clear and Grubbing Crew												4										
MAA-BKFLC	Backfill Crew																	2					
MAA-GRADE	Grading Crew												2	2									6
MAA-ACPC	Asphalt Paving Crew																						
MAA-SCPC	Structural Concrete Placement Crew														1	1						1	6
MAA-STRIPE	Striping Crew																						
MAA-PREF	Pre-Fabricated Structure Placement Crew																		3	6	3		
MAA-UTILI	Utility Installation Crew														1	6	6	5					
MAA-MISC	Micellaneous Labor Crew																	2					
MAA-PVDEM	Pavement Demolition Crew								6	6	6	6											
MAA-FOUND	Foundation Crew																	7	12	5			
MAA-EXCAV	Excavation Crew													4	5								
MAA-ADMIN	Administrative Support Team				6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6

		2018																					2019														
		August				September				October					November				Decemeber				January					February				March			
Resource Code	Resource Crew	6	13	20	27	3	10	17	24	1	8	15	22	29	5	12	19	26	3	10	17	24	31	7	14	21	28	4	11	18	25	4	11	18	25
MAA-DELIVR	Delivery / Removal Crew			1	2	1	1	1	1	2	1	1	1	1	1	2	1	1	1	1	1	1	1	1											
MAA-CLEAR1	Clear and Grubbing Crew																																		
MAA-BKFLC	Backfill Crew																																		
MAA-GRADE	Grading Crew	7	3																																
MAA-ACPC	Asphalt Paving Crew	5	8	3																															
MAA-SCPC	Structural Concrete Placement Crew	5																																	
MAA-STRIPE	Striping Crew			2																															
MAA-PREF	Pre-Fabricated Structure Placement Crew		1	6	5																														
MAA-UTILI	Utility Installation Crew																																		
MAA-MISC	Micellaneous Labor Crew			3	3																														
MAA-PVDEM	Pavement Demolition Crew																																		
MAA-FOUND	Foundation Crew																																		
MAA-EXCAV	Excavation Crew																																		
MAA-ADMIN	Administrative Support Team	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6											

BWI Improvements

ASSUMPTIONS and CREWS

June 2013

These assumptions are based upon information given in the available project documentation; and crew data from RS Means. In addition, because limited quantities are given, production rates of crews are rough estimates and illustrate what a builder could realize. Likewise this schedule is not to be used as an actual construction schedule; its production is intended only to create a rough estimate of equipment usage during construction.

ASSUMPTIONS:

1. The schedule will use days as its unit of time; 10hrs per day; 6 days per week.
2. Production rates were derived utilizing available data from previous airport projects such as Charlotte Douglas and Ellington Field. Other data was sourced from RS Means Productivity Standards for Construction and other web sources.
3. It is assumed that there will be 2 Owner's Representatives on site with Pickups for the duration of the work.
4. All crews will work 10 hour days as to minimize the need for night work; thereby increasing the quality of the work product.
5. Concrete and Dump trucks will travel a max "one-way" distance of 10 miles to their respective concrete plants or materials facilities.
6. All trucks are assumed to have a haul distance of no more than 10 miles one way.
7. At least one crane will be in place from beginning to end of building construction to set in place items such as exterior panels/glass, or to lift materials to designated floors.
8. The Haul Route for demoed materials will be no more than 20 miles from the site; 40 miles round trip.
9. Production rates and crew sizes are as follows:

Administrative Support Team (ADMIN)

Labor	Equipment
1 – Project Manager	1 – SUV
2 – Field Engineers	2 - Pick-ups
1 – Administrative Assistance	1 – Fuel Truck
1 – General Superintendent	1 – Maintenance Vehicle with Crane
1 – Safety Manager	
1 – Mechanic	
1 – Fuel Truck Operator	

This team will be in place for the duration of the contract and will provide managerial oversight for the project. Assume 10 miles per day.

Environmental Crew (ENVIR)

Labor	Equipment
1 – Foreman	1 - Pickup
1 – Laborer	

This team will be in place for the duration of the contract. They will be responsible for the day-to-day inspection and upkeep of all the environmental measures on the project.

Excavation Crew (EXCAV)

Labor	Equipment
1 – Foreman	1 – Water Truck
3 – Operators	1 –Loader
2 - Laborers	1 – Excavator
4 – Truck Drivers	1 – Pickups
	4 – 16 Cy/Dump Truck

Production rate of Excavation is 1,500 CY (40,500 CF) per Shift. Assume shift is 10hrs per day.

Pile Driving Crew (PILE)

Labor	Equipment
2 – Foreman	1 – Pile Driver
2 – Equipment Operators	1 – Crane
1 – Oiler	1 – Air Compressor
3 – Laborers	1 – Hammer, 15K Ft. Lbs

This crew will be responsible for pile driving. Assume 4 Piles per day.

Pavement Demolition Crew (PVDEM)

Labor	Equipment
1 – Foreman	1 – Pick-up
1 – Operator	1 – Backhoe Loader (48 H.P.)
4 – Laborers	1 – Hydraulic Hammer (1200 lb)
	1 – F.E. Loader (170 H.P.)
2 – Truck Drivers	2 – 16 CY / Dump Trucks

Production rate of pavement demolition is 420 Square Yards per day; 3,780 sqft / day.

Utility Installation Crew (UTILI)

Labor	Equipment
1 – Foreman	1 – Pick-up
10 – Operators	2 – Crew Truck
5 - Laborers	1 – Large Excavator
2 – Welders	2 – Front End Loaders
	2 - Low Boys
	1 - Backhoes
	3 – Dump Trucks
	1 – Vibratory Roller
	1 – Compressor
	2 – Arc Welders

Production rate of Trenching is 200 linear feet per day. Production rate for lighting installation is one light pole per hour

Pre-Fabricated Structures Placement Crew (PREF)

Labor	Equipment
1 – Superintendent	1 – Aerial Lift Trucks (2 person)
1 – Forman	1 – Crane 150 Ton
4 – Operators	1 – Pickup
2 – Laborers	

This crew will be used to place pre-fabricated panels for buildings and to construct/place the (prefabricated steel) walkways between terminals and parking garages. The production rate for this crew is 10 pre-fabricated panels per hour or two walk way sections placed per day.

Striping Crew (STRIPE)

Labor	Equipment
1 – Forman	1 – Paint Striper
3 – Laborer	1 – Flatbed Truck
1 – Truck Driver (light)	1 – Pick-Up Truck

This crew will be used to place temporary and permanent striping throughout the project; 8,000 Linear feet per day.

Structural Concrete Placement Crew (SCPC)

Labor	Equipment
1 –Pump Driver	1 – Concrete Pump
3– Concrete Drivers	3 – 10 CY / Ready Mix Trucks
1 – Finisher	1 – Vibrating Compactor

This crew will be used to install concrete sidewalks, bridge decks, foundations and other miscellaneous structures.

ACP Paving Crew (ACPC)

Labor	Equipment
1 – Foreman	1 – Asphalt Paver
4 – Equip. Operators	2 – Steel Wheel Rollers
7 – Laborers	1 – Pneumatic Wheel Roller
4 – Truck Drivers	1 – Pickup
	1 – Crew Truck
	4 – 16 CY/ Dump Truck

Production rate of Asphaltic paving is 4,000 S.Y. (36,000 S.F.) per day. Same crew used for Bituminous Paving yields 2,545 S.Y. (22,905 S.F.) per day.

PCCP Paving Crew (PCCP)

Labor	Equipment
1 – Foreman	1 – Concrete Paver
4 – Equip. Operators	2 – Belt Placer
7 – Laborers	1 – Cure / Texture Rig
4 – Truck Drivers	1 – Pickup
	1 – Crew Truck
	1 – Water Truck
	2 – Walk Behind Saws
	2 – 1 Ton Flat Beds
	4 – 16 CY/ Dump Truck

Production rate of paving is 1,500 S.Y. (13,500 S.F.) per day.

Building Demolition Crew(BLDEM)

Labor	Equipment
1 – Foreman	1 – Pick-up
2 – Operators	1– Front End Loaders
2 – Laborer	1 – Hyd. Crane 25 Ton
2 – Truck Drivers	2 – 16 Ton / Dump Trucks
1 – Equip Operator Oiler	

This crew will be used in the Demolition of the existing tower. The production rate is 20,100 CF per Day. This includes Haul a Route of up to 20 miles from the site.

Drainage Crew (DRNAGE)

Labor	Equipment
1 – Foreman	1 – Pick-up
2 – Operators	1 – Crew Truck
2 - Pipe layers	1 – Large Excavator
1 – Laborer	1 – Walk Behind Compactor
2 – Truck Driver	2 – Dump Truck

Production rate for this crew is assumed at 150 linear feet per day.

Curb & Gutter Crew (CNGC)

Labor	Equipment
1 – Foreman	1 – Pick-up
1 – Operators	1 – Crew Truck
1 – Cement Finisher	1 – Curb/Gutter Paver

Production rate 1,000 L.F. per day.

Backfill Crew (BKFLC)

Labor	Equipment
1 – Foreman	1 – Pick-up
2 – Operators	1 – Crew Truck
1 – Laborer	1 – 200 H.P. Dozer
	1 – 2K Lbs Compact Roller

Production rate 2,000 CY per day.

Grading Crew (GRADE)

Labor	Equipment
1 – Foreman	1 – Pick-up
4 – Operators	1 – 30,000 Lbs Grader
2 – Laborer	1 – Vibratory Roller
1 – Heavy Truck Driver	1 – 300 H.P. Dozer
	1 – F.E. Loader (1.5 C.Y.)
	1 – Water Truck (5,000 Gal.)
	1 – Tractor Trailer Truck (240 H.P)

Used for grading sites and placing base course material. Production rate 3,800 S.Y. (34,200 S.F.) per day.

Building Demolition Crew(BLDEM)

Labor	Equipment
1 – Foreman	1 – Pick-up
2 – Operators	1– Front End Loader
2 – Laborer	1 – Hyd. Crane 25 Ton
2 – Truck Drivers	2 – 16 Ton / Dump Trucks
1 – Equip Operator Oiler	

This crew will be used in the Demolition of existing buildings. The production rate is 20,100 CF per Day. This includes Haul a Route of up to 20 miles from the site.

Clear and Grubbing Crew -1 (CLEAR-1)

Labor	Equipment
1 – Foreman	1 – Pick-up
1 – Laborer	1 – 300 H.P. Dozer
	2 – Dump Trucks

Production rate: 0.6 Acres (26,136 S.F.) per day.

Clear and Grubbing Crew – 2 (CLEAR-2)

Labor	Equipment
1 – Foreman	1 – Pick-up
1 – Laborer	1 – F.E. Loader
	1 – Chipping Machine
	2 – Chain Saws (36”)
	1 – Hyd. Excavator
	2 – Dump Trucks

Production rate: 0.5 Acres (21,780 S.F.) per day. For use in dense clearing operations.

Foundation (FOUND)

Labor	Equipment
2 – Foreman	1 – Pile Driver
2 – Equipment Operators	1 – Crane
1 – Oiler	1 – Air Compressor
4 – Truck Driver	1 – Hammer, 15K Ft. Lbs
3 – Laborers	1 – Concrete Pump
2 – Concrete Finishers	4 – 10 CY / Ready Mix Trucks

This crew will be responsible for pile driving, and foundation construction (where piles may be necessary).

Delivery Crew (DELIVR)

Labor	Equipment
1 – Foreman	1 – Pick-up
1 – Laborer	2 – Tractor Trailer Trucks
2 - Drivers	

Assume usage of this crew for delivering materials to the site. 1 per week for activities in regards to building interior/exterior finishing work, equipment installation, etc.

Pavement Milling Crew (MILL)

Labor	Equipment
1 – Foreman	1 – Pick-up
1 – Laborer	3 – Dump Large Trucks
2 - Drivers	1 – Large Milling Machine

This crew will work in tandem with Pavement crews for operations which call for milling work.

Miscellaneous Labor Crew (MISC)

Labor	Equipment
1 – Foreman	1 – Pick-up
2 – Laborer	1 – Man lift
2 - Drivers	1 – Truck with small Crane.

This crew is on site to perform miscellaneous tasks such as utility and sign installations.