

HIGHTOWER MDP ENVIRONMENTAL ASSESSMENT ERRATA SHEET

1. Section 1.7, Decision Framework, page 14. 3rd bullet should include reference to the 20-11 drilling location as part of the Minor Forest Plan Amendment.
2. Section 3.1, Air Quality, part 3.1.4.2, page 82. The heading “Mitigation” should be changed to read “Monitoring”.
3. Section 3.13, Visual Resources, part 3.13.2, 4th paragraph, 4th sentence beginning on page 200. Change sentence to read, “In the area of the compressor, 20-6 drilling location **and 20-11 drilling location** the area will be changed from partial retention to modification due to the long term disturbance of these areas.”
4. Appendix B was not included in its entirety. See attached pages for the entire Appendix.

HIGHTOWER MDP ENVIRONMENTAL ASSESSMENT

APPENDIX B.

CHEMICALS USED IN DRILLING, FRACING AND CEMENTING

APPENDIX B - LIST OF CHEMICALS USED
Hightower Master Development
Plan Environmental Assessment

MUD

Product Trade Name	MSDS sheet provided?	Chemical(s)	Composition (from MSDS)*	Amount on location (for one well)	Units of measure	Initial concentration	Units of measure	Amount left in wellbore	Units of measure	Residual concentration	Chemical Function
ALUMINUM STEAR.	yes	Aluminum,Carbon	As Needed	50	lbs.	As Needed		None	lbs.	0.00%	Defoaming Agent
CAUSTIC SODA	yes	Sodium Hydroxide	1.6%	5400	lbs.	0.25	lb/bbl	None	lbs.	0.00%	pH modifier
CEDAR FIBER CHIP	yes	Cellulose Fiber	As Needed	8000	lbs.	As Needed		None	lbs.	0.00%	Lost circulation Material
CF DESCO II	yes	Lignite	As Needed	750	lbs.	As Needed		None	lbs.	0.00%	Thinner and Filtration Control
DEFOAM X	yes	Glycol Blend	As Needed	50	gal.	As Needed		None	gal.	0.00%	Defoaming Agent
FED PAC R	yes	Polyanionic Cellulose (Polymer	As Needed	500	lbs.	As Needed		None	lbs.	0.00%	Fluid Loss Control
FED PAC UL	yes	Polyanionic Cellulose (Polymer	12.5%	3500	lbs.	2	lb/bbl	None	lbs.	0.00%	Fluid Loss Control
HYDROCHLORIC AC	yes	Hydrogen Chlorine	NA	220	gal.	NA		None	gal.	0.00%	pH modifier
LIME	yes	Calcium Hydroxide	As Needed	2500	lbs.	As Needed		None	lbs.	0.00%	Calcium Source and pH Modifier
M-1 GEL	yes	Bentonite	75.0%	25000	lbs.	12	lb/bbl	None	lbs.	0.00%	Viscosifier
M-1 WATE (BARITE)	yes	Barium sulfate	As Needed	32000	lbs.	As Needed		None	lbs.	0.00%	Weighting Agent
MAGNAFLOC 24	yes	Polyacrylamide	NA	1000	lbs.	NA		None	lbs.	0.00%	Flocculant
MICA MEDIUM	yes	Mica (Mineral)	As Needed	2500	lbs.	As Needed		None	lbs.	0.00%	Lost circulation Material
POLY-PLUS	yes	Polyacrylamide	As Needed	320	gal.	As Needed		None	gal.	0.00%	Viscosifier
POLY-PLUS LV	yes	Polyacrylamide	As Needed	25	gal.	As Needed		None	gal.	0.00%	Viscosifier
SAPP	yes	Sodium Acid Pyrophosphate	As Needed	250	lbs.	As Needed		None	lbs.	0.00%	Thinner
SAWDUST	yes	Wood Fiber	As Needed	7500	lbs.	As Needed		None	lbs.	0.00%	Lost circulation Material
SODA ASH	yes	Sodium Carbonate	As Needed	1500	lbs.	As Needed		None	lbs.	0.00%	Calcium Source
SODIUM BICARBON	yes	Sodium Bicarbonate	As Needed	1500	lbs.	As Needed		None	lbs.	0.00%	Calcium Source
TANNATHIN	yes	Lignite	10.9%	8000	lbs.	1.75	lb/bbl	None	lbs.	0.00%	Thinner and Filtration Control
WALNUT NUT PLUC	yes	Shells	As Needed	8000	lbs.	As Needed		None	lbs.	0.00%	Lost circulation Material

*Assumes 650 bbl Mud System

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FRAC

Product Trade Name	MSDS provided?	Chemical(s)	Composition (from MSDS)	Amount on location (for one well)	Units of measure	Initial concentration	Units of measure	Amount left in wellbore	Units of measure	Residual concentration	Remarks on residual materials	
Water		H ₂ O		370100	gals	91.00%	by volume	129535	gals	10.50%	Approximately 65% recovery of frac fluids	
Hydrochloric Acid	Yes	HCl	15%	2500	gals	15%	by volume	0	gals	0%	Acid neutralizes to water and CO ₂	
HAI-404	yes		5-10% Chloromethylnaphthalene quinoline quaternary amine, 10-30% Isopropanol, 10-30% Aldehyde, 10-30% Methanol	12	gals	0.10%	by volume	3	gals		Acid Inhibitor bonds to formation leaving behind chloride	
			Chloromethylnaphthalene quinoline quaternary amine.	0.6-1.2	gals	0.00030%	by volume	0.15-0.3	gals		Minimal residual amount	
			Isopropanol	1.2-3.6	gals	0.00080%	by volume	0.3-0.9	gals		Minimal residual amount	
			Methanol	1.2-3.6	gals	0.00080%	by volume	0.3-0.9	gals		Minimal residual amount	
			Aldehyde	1.2-3.6	gals	0.00080%	by volume	0.3-0.9	gals		Minimal residual amount	
Sand	yes	SiO ₂		322500	lbm	8.29%	lbs/gal	322500	lbm	N/A	Small amounts of sand are produced in flowback	
LoSurf 300M	yes		0-1% naphthalene, 0-1% 1,2,4 Trmethylbenzene, 10-30% Heavy aromatic petroleum naphtha, 30-60% Ethanol	370	gals	0.10%	by volume	120	gals		Minimal residual amount	
			Napthalene	0-1%	0-3.7	gals	0.00080%	by volume	0-1.2	gals		Minimal residual amount
			1,2,4 Trimethylbenzene	0-1%	0-3.7	gals	0.00080%	by volume	0-1.2	gals		Minimal residual amount
			Heavy aromatic petroleum naphtha	10-30%	37-111	gals	0.02%	by volume	12-36	gals		Minimal residual amount
			Ethanol	30-60%	111-222	gals	0.04%	by volume	36-72	gals		Minimal residual amount
Liquichlor	yes		9-16% sodium hypochlorite, 0.1-2.0% sodium hydroxide	370	gals	0.10%	by volume	120	gals		Minimal residual amount	
			Sodium Hypochlorite	9-16%	33-59	gals	0.01%	by volume	11-19	gals		Minimal residual amount
FR-56	yes		10-30% hydrotreated light petroleum distillate	185	gals	0.05%	by volume	65	gals		Minimal residual amount	
			Hydrolated light petroleum distillate	10-30%	19-56	gals	0.01%	by volume	7-20	gals		Minimal residual amount
KCl / Water	Yes	Potassium Chloride	1-5%	42,000	gals	3.00%	by weight	0	gals		None expected all returned to surface	

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CEMENT

Product Trade Name	MSDS provided?	Chemical(s)	Composition (from MSDS)	Amount on location (for one well)	Units of measure	Initial concentration	Units of measure	Amount left in wellbore	Units of measure	Residual concentration	Remarks on residual materials
Class G Cement	yes	Portland Cement and Crystalline Silica	<3% crystalline silica; 60 - 100% Portland cmt	37,812	lbs.	25-50%	by weight	100%	lbs.	0%	Used to isolate formations from each other and support steel casing
Type I/II Cement	yes	Portland Cement and Crystalline Silica	1-5% crystalline silica; 60 - 100% Portland cmt	22,936	lbs.	100%	by weight	100%	lbs.	0%	Used to isolate formations from each other and support steel casing
Type V Cement	yes	Portland Cement and Crystalline Silica	<3% crystalline silica; 60 - 100% Portland cmt	16,243	lbs.	80-100%	by weight	100%	lbs.	0%	Used to isolate formations from each other and support steel casing
Pozmix	yes	Crystalline Silica, Flyash	1-5% crystobalite, 5-10% quartz, 60-100% flyash	50,122	lbs.	20-75%	by weight	100%	lbs.	0%	When cement hardens the chemicals become inert
Gel / Bentonite	yes	Crystalline Silica, Bentonite	0-1% crystobalite, 0-1% tridymite, <3% quartz, 60-100% bentonite	4709	lbs.	2-8%	by weight	100%	lbs.	0%	Lightweight additive
Salt	yes	NaCl	60-100%	2148	lbs.	4-6%	by weight	100%	lbs.	0%	No hazardous decomposition chemicals
Lime	yes	Calcium hydroxide	60-100%	4056	lbs.	10%	by weight	100%	lbs.	0%	No hazardous decomposition chemicals
CalSeal	yes	Calcium sulfate	60-100%	459	lbs.	2%	by weight	100%	lbs.	0%	No hazardous decomposition chemicals
Econolite	yes	Sodium Metasilicate	60-100%	459	lbs.	2%	by weight	100%	lbs.	0%	No hazardous decomposition chemicals
Silicalite	yes	Amorphous Silica	60-100%	1617	lbs.	3 lb/sk	by weight	100%	lbs.	0%	No hazardous decomposition chemicals
Versaset	yes	Sodium aluminate	60-100%	202	lbs.	0.30%	by weight	100%	lbs.	0%	No hazardous decomposition chemicals
Halad-23	yes	Sulfonated organic salt, Hydroxyethyl cellulose	30-60%, 60-100%	266	lbs.	0.60%	by weight	100%	lbs.	0%	Fluid Loss Additive
Halad-322	yes	Sodium Formate, Cellulose derivative	1-5%, 10-30%	207	lbs.	0.30%	by weight	100%	lbs.	0%	Fluid Loss Additive
Super-CBL	yes	Aluminum	60-100%	89	lbs.	0.20%	by weight	100%	lbs.	0%	Flammable Hydrogen Gas, Metal Oxides
HR-601	yes	Modified Lignosulfonate	60-100%	155	lbs.	0.1-0.35%	by weight	100%	lbs.	0%	Increases thickening time
Poly-E-Flake	yes	Cellophane	60-100%	352	lbs.	0.125-0.25 lb/sk	by weight	100%	lbs.	0%	Lost circulation additive
Gilsonite	yes	Natural asphalt	60-100%	2695	lbs.	1-5 lb/sk	by weight	100%	lbs.	0%	Lost circulation additive
PhenoSeal	yes	Cellulose	60-100%	2695	lbs.	5 lb/sk	by weight	100%	lbs.	0%	Lost circulation additive
D-Air	yes	Alkenes, Diatomaceous Earth	10-30%, 60-100%	61	lbs.	0.25 lb/sk	by weight	100%	lbs.	0%	Defoamer
KCl	yes	Potassium Chloride	60-100%	1200	lbs.	10 lb/bbl	by weight	100%	lbs.	0%	No hazardous decomposition chemicals
MudFlush II	yes	Modified Lignosulfonate	60-100%	80	lbs.	1 sk/10 bbl	by weight	100%	lbs.	0%	Oxides of Sulfur