

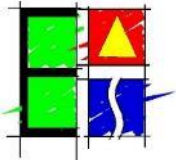
FRONTEER WIND FARM

Estimated Water Demand



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Prepared by:



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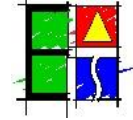
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Fronteer Wind Farm

Estimated Water Demand



Construction Phase

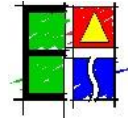
A: Road Construction Requirements	Length (m)	Depth (m)	Width (m)	Volume (m ³)
New Greenfields Roads (Spine and Access)	23450	0,15	4,5	15828,75
Farm Tracks (Spine and Access)	3310	0,15	4,5	2234,25
District Upgrading	0	0,15	6	2943
	<u>26760</u>			<u>18063</u>
Water use calc (KI) = (L x W x D x 2.25x 0.07) Total				2844,92
Construction Period	30	months		
Water demand per month @ 22 days per month	94,83	kl /month		
Water demand per day	4,31	kl / day		

B: Platform Layer-works	Length (m)	Depth (m)	Width (m)	Volume (m ³)
1 Platform	68,5	0,45	35,5	1094,29
Therefore for 38 Platforms	68,5	0,45	35,5	41582,93
Water use calc (KI) = (L x W x D x 2.25x 0.07) Total				6549,31
Construction Period	30	months		
Water demand per month @ 22 days per month	218,31	kl /month		
Water demand per day	9,92	kl / day		



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C: Foundations Layer-works		Diameter (m)	Depth (m)	Volume (m ³)
1 Platform	$V = \pi r^2 h$	23	0,45	186,96
Therefore for 38 Platforms				7104,48
Water use calc (kl) = (L x W x D x 2.25x 0.07)		Total		1118,96
Construction Period	30 months			
Water demand per month @ 22 days per month	37,30 kl /month			
Water demand per day	1,70 kl / day			

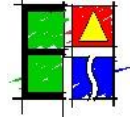
D: Concrete Batching Plant Requirements				
Number of turbines	38			
Construction period	30 months			
Concrete per Foundation	500 m ³			
Concrete Total	19000 m ³			
Concrete (m3) required per month	633	@ 200 litres / m ³		
Water demand per Turbine (kl)	100			
Total water demand (kl)	3800			
Water use calc (kl) = Concrete volume x 200 / 1000		Total		3800
Construction Period	30 months			
Water demand per month @ 22 days per month	126,67 kl / month			
Water demand per day	5,76 kl / day			

Total Estimated Water Demand for Construction	
Total Water demand (A+B+C+D)	14313,19 kl
Total water consumption	21,69 kl / day
Total water abstraction rate required	0,38 l/s



Fronteer Wind Farm

Estimated Water Demand



E: Staff Accommodation and Estimated Durations	Start Up (2 months)	Growth (12 months)	Peak (12 months)	Commissioning (4 months)	30 Months
Roads Construction Teams	14	24	24	0	
Foundation Construction Teams	0	93	93	0	
Electrical Teams	10	34	34	21	
Crane and Erection Teams	0	0	18	18	
On-site Staff	24	151	169	39	100 litres pppd
Off-site Staff	21	34	34	21	60 litres pppd
Total Number of Staff on Site	45	185	203	60	
Water Demand for <u>on-site staff</u> (litres per day)	2400	15100	16900	3900	
Water Demand for <u>off-site staff</u> (litres per day)	1260	2040	2040	1260	
	Total (kl per day)	3,66	17,14	18,94	5,16
	Total (kl per phase)	161,04	4524,96	5000,16	454,08

Estimated staff figures excludes Truck operators, importing / delivery of materials to site and off-site, and only spending short periods on the construction site. This also exclude all non-permanent skilled / professional staff, performing ad-hoc duties, not being on a daily basis on site.

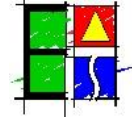
Total Estimated Water Demand For Human Consumption	
Max Water Demand =	18,94 kl / day
Total Water Demand =	10140,24 kl
Average Water consumption = kl / month (avg)	338,01 kl / month
Maximum Water consumption = kl / month (peak)	416,68 kl / month
Max Water consumption = kl / day (peak) [Estimated storage required]	18,94 kl / day
Max Water Abstraction Rate = l/s (based at 16h pump p/d)	0,329 l/s

Water consumption will typically cover all water demands for washing, toilets, showers, food preparation, etc, as the temporary Staff Accommodation Areas and the permanent Control Office facility.



Fronteer Wind Farm

Estimated Water Demand



F: Staff Sewage	Start Up (2 months)	Growth (12 months)	Peak (12 months)	Commissioning (4 months)	30 Months
Roads Construction Teams	14	24	24	0	
Foundation Construction Teams	0	93	93	0	
Electrical Teams	10	34	34	21	
Crane and Erection Teams	0	0	18	18	
Total Workers living on site	24	151	169	39	Grey Water and Sewage = 85 litres pppd
Off-site Staff	21	34	34	21	Grey Water and Sewage = 51 litres pppd
Total Number of Staff on Site	45	185	203	60	
Sewage for <u>on-site staff</u> (litres per day)	2040	12835	14365	3315	
Sewage for <u>off-site staff</u> (litres per day)	1071	1734	1734	1071	
Total (kl per day)	3,11	14,57	16,10	4,39	
Total (kl per phase)	136,88	3846,22	4250,14	385,97	

Notes

Length (m)

Width (m)

Depth / Thickness (m)

Density - 2250kg/m³ or 2.25 (converted to ton or kl)

Moisture - 7% or 0.07

Timeline	Start Up		Growth												Peak												Commissioning				
	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12	Month 13	Month 14	Month 15	Month 16	Month 17	Month 18	Month 19	Month 20	Month 21	Month 22	Month 23	Month 24	Month 25	Month 26	Month 27	Month 28	Month 29	Month 30	
A: Road Construction (kl)	94.83	94.83	94.83	94.83	94.83	94.83	94.83	94.83	94.83	94.83	94.83	94.83	94.83	94.83	94.83	94.83	94.83	94.83	94.83	94.83	94.83	94.83	94.83	94.83	94.83	94.83	94.83	94.83	94.83	94.83	
B: Platform Layer-works Construction (kl)	218.31	218.31	218.31	218.31	218.31	218.31	218.31	218.31	218.31	218.31	218.31	218.31	218.31	218.31	218.31	218.31	218.31	218.31	218.31	218.31	218.31	218.31	218.31	218.31	218.31	218.31	218.31	218.31	218.31	218.31	
*C: Turbine Foundation Layer-works Construction (kl)	37.30	37.30	37.30	37.30	37.30	37.30	37.30	37.30	37.30	37.30	37.30	37.30	37.30	37.30	37.30	37.30	37.30	37.30	37.30	37.30	37.30	37.30	37.30	37.30	37.30	37.30	37.30	37.30	37.30	37.30	
**D: Turbine Concrete Foundation Construction (kl)	126.67	126.67	126.67	126.67	126.67	126.67	126.67	126.67	126.67	126.67	126.67	126.67	126.67	126.67	126.67	126.67	126.67	126.67	126.67	126.67	126.67	126.67	126.67	126.67	126.67	126.67	126.67	126.67	126.67	126.67	
E: Site Camp and Staff Accommodation Requirements (kl)	80.52	80.52	377.08	377.08	377.08	377.08	377.08	377.08	377.08	377.08	377.08	377.08	377.08	377.08	416.68	416.68	416.68	416.68	416.68	416.68	416.68	416.68	416.68	416.68	416.68	416.68	416.68	113.52	113.52	113.52	113.52
Total (kl/month)	557.63	557.63	854.19	854.19	854.19	854.19	854.19	854.19	854.19	854.19	854.19	854.19	854.19	854.19	893.79	893.79	893.79	893.79	893.79	893.79	893.79	893.79	893.79	893.79	893.79	893.79	590.63	590.63	590.63	590.63	
Total (kl/day)	25.35	25.35	38.83	38.83	38.83	38.83	38.83	38.83	38.83	38.83	38.83	38.83	38.83	38.83	40.63	40.63	40.63	40.63	40.63	40.63	40.63	40.63	40.63	40.63	40.63	40.63	26.85	26.85	26.85	26.85	
***Total incl. Unavoidable Losses (kl/day)	27.88	27.88	42.71	42.71	42.71	42.71	42.71	42.71	42.71	42.71	42.71	42.71	42.71	42.71	44.69	44.69	44.69	44.69	44.69	44.69	44.69	44.69	44.69	44.69	44.69	44.69	29.53	29.53	29.53	29.53	
Water Abstraction Rate in litres / sec (based on a 16hr / day pumping rate)	0.48	0.48	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.51	0.51	0.51	0.51	

Notes
 * C: Turbine Foundation Layerworks Construction (kl) consumption per month will not be spread over the 22 day month but may be over a period of 3 days.
 **D: Turbine Concrete Foundation Construction (kl) consumption per month will not be spread over the 22 day month but will be over a period of 3 days.
 *** 10% Unavoidable losses catering for evaporation, leaks, spillages, etc
 All groundwater abstraction will be at a constant rate and all attenuation will be catered for in storage reservoirs