ATTACHMENT 1: Black Lake Bog Water Monitoring Data

Table 1: Water Quality, Precipitation and Flow Data for the Premier Horticulture Black Lake Site 2005-2014
SD-001 (Sedimentation Basin Outfall), Surface Discharge, Effluent to Surface Water

Mean annual ***flow*** (MG)	**40.402385**
Maximum annual ***flow*** (MG)	**122.347236**
Minimum annual ***flow*** (MG)	**0.385946**
Mean annual ***flow per acre*** (gallons/acre)	**143,191**
Maximum annual ***flow per acre*** (gallons/acre)	**453,138**
Minimum annual ***flow per acre*** (gallons/acre)	**1,812**

Note: The original discharge volumes calculated for October 2010 (296.218217 million gallons) and November 2008 (86.491560 million gallons) were due to the flow measurements being taken after exceptionally high, short-lived rain events that were extrapolated to the entire month. Because these volumes were not representative of the entire month, the numbers were substituted with the average October and November flows calculated from the other years. More representative flows substituted were 7.193682 million gallons for October 2010 and 1.997088 million gallons for November 2008.

Note: NPDES Permit water quality exceedances are in bold and outlined.

Date	Total Flow (MG)	Daily Flow (MGD)	TSS (mg/L)	pH (SU)	Phosphorus (mg/L)	Mercury (ng/L)	Specific Conductance (umh/cm)	Turbidity (NTU)	Area Drained (acres)	Monthly Precipitation (inches)	Annual Flow (MG)	Annual Flow/Acre (gallons)
Jan-14	********	No flow	********	********	********	********	********	********	304	0.56	11.97534	39,393
Feb-14	********	No flow	********	********	********	********	********	********	304	1.93		
Mar-14	********	No flow	********	********	********	********	********	********	304	1.84		
Apr-14	********	No flow	********	********	********	********	********	********	304	2.49		
May-14	********	No flow	********	********	********	********	********	********	304	4.79		
Jun-14	3.248758	0.108292	3	5.3	0.061	4.09	57	13	304	3.98		
Jul-14	2.333864	0.075286	14	6.8	0.12	********	162	26.6	304	3.1		
Aug-14	3.248758	0.104799	0	6.1	**9.2**	********	56	6.6	304	5.1		
Sep-14	3.143959	0.104799	6	3.9	0.079	3.34	80	38	304	0.93		

Date	Total Flow (MG)	Daily Flow (MGD)	TSS (mg/L)	pH (SU)	Phosphorus (mg/L)	Mercury (ng/L)	Specific Conductance (umh/cm)	Turbidity (NTU)	Area Drained (acres)	Monthly Precipitation (inches)	Annual Flow (MG)	Annual Flow/Acre (gallons)
Oct-14	********	No flow	********	********	********	********	********	********	304	1.86		
Nov-14	********	No flow	********	********	********	********	********	********	304	0.78		
Dec-14	********	No flow	********	********	********	********	********	********	304	1.03		
Jan-13	********	No flow	********	********	********	********	********	********	300	0.8	36.74986	122,500
Feb-13	********	No flow	********	********	********	********	********	********	300	0.48		
Mar-13	********	No flow	********	********	********	********	********	********	300	1.34		
Apr-13	********	No flow	********	********	********	********	********	********	300	4.15		
May-13	13.04032	0.420655	6	6.6	0	********	53	6.7	300	3.33		
Jun-13	14.982954	0.499432	25	5.8	0.153	4.74	85	100	300	5.83		
Jul-13	2.333864	0.075286	16	7.1	0	********	120	39.2	300	1.62		
Aug-13	********	No flow	********	********	********	********	********	********	300	1.79		
Sep-13	3.143959	0.104799	8	6.1	0.118	1.81	179	55	300	1.51		
Oct-13	3.248758	0.104799	12	7.6	0	********	69	19.5	300	4.42		
Nov-13	********	No flow	********	********	********	********	********	********	300	0.61		
Dec-13	********	No flow	********	********	********	********	********	********	300	1.94		
Jan-12	********	No flow	********	********	********	********	********	********	296	0.32	35.18219	118,859
Feb-12	********	No flow	********	********	********	********	********	********	296	0.64		
Mar-12	********	No flow	********	********	********	********	********	********	296	1.57		
Apr-12	5.262367	0.175412	8	7.1	0	********	59.5	10	296	2.98		
May-12	9.837576	0.317341	5.3	8.5	0.1	********	61.6	6.3	296	7.93		
Jun-12	8.601544	0.286718	15	4.4	0.053	**8.94**	32	12	296	12.52		
Jul-12	8.888262	0.286718	18	6.1	0.19	********	61.6	12.2	296	4.32		
Aug-12	********	No flow	********	********	********	********	********	********	296	1.84		
Sep-12	1.669694	0.055656	11	7.3	0.124	2.89	185	50	296	0.82		
Oct-12	0.626865	0.020221	25	7.4	0.1	********	188.2	70	296	1.47		
Nov-12	0.295877	0.009863	**84**	7.4	1.7	********	186	42.4	296	0.94		
Dec-12	********	No flow	********	********	********	********	********	********	296	0.85		

Date	Total Flow (MG)	Daily Flow (MGD)	TSS (mg/L)	pH (SU)	Phosphorus (mg/L)	Mercury (ng/L)	Specific Conductance (umh/cm)	Turbidity (NTU)	Area Drained (acres)	Monthly Precipitation (inches)	Annual Flow (MG)	Annual Flow/Acre (gallons)
Jan-11	********	No flow	********	********	********	********	********	********	296	0.73	20.57755	69,519
Feb-11	********	No flow	********	********	********	********	********	********	296	0.22		
Mar-11	********	No flow	********	********	********	********	********	********	296	1.1		
Apr-11	3.143664	0.104789	10	7.3	0.1	********	100.6	16	296	3.1		
May-11	8.887824	0.286704	17	6.6	0.1	********	80.9	16	296	3.45		
Jun-11	2.258496	0.075283	6	5.3	0.086	6.36	56	12	296	3.28		
Jul-11	2.356713	0.076023	38	6.7	0.12	********	100.4	50	296	3.82		
Aug-11	1.016273	0.032783	**80**	6.4	0.1	********	96.8	34	296	6.2		
Sep-11	2.32803	0.077601	28	6.4	0.123	2.26	165	71	296	1.4		
Oct-11	0.586551	0.018921	32	7.5	0.11	********	89	43	296	1.54		
Nov-11	********	No flow	********	********	********	********	********	********	296	0.48		
Dec-11	********	No flow	********	********	********	********	********	********	296	0.3		
Jan-10	********	No flow	********	********	********	********	********	********	296	0.91	69.93132	236,254
Feb-10	********	No flow	********	********	********	********	********	********	296	0.25		
Mar-10	10.845243	0.349847	10.5	7.4	0.1	4.9	40.4	7.4	296	0.95		
Apr-10	2.258539	0.075285	12	7.3	0.12	********	101.5	26.1	296	0.91		
May-10	0.58657	0.018922	18	7.8	0.1	********	135.7	5.24	296	2.19		
Jun-10	2.281392	0.076046	44.7	7.6	0.11	********	58.4	38.1	296	3.81		
Jul-10	18.180086	0.586454	11	7	0.1	********	63.9	8	296	5.19		
Aug-10	24.375493	0.786306	**49**	6.8	0.16	********	60.2	13.7	296	6.2		
Sep-10	4.210315	0.140344	11	7.1	0.1	3.06	136.4	5.24	296	3.51		
Oct-10	7.193682	0.232054	23	6.6	0.1	********	32.5	27.7	296	4.52		
Nov-10	********	No flow	********	********	********	********	********	********	296	1.5		
Dec-10	********	No flow	********	********	********	********	********	********	296	1.69		
Jan-09	********	No flow	********	********	********	********	********	********	317	0.46	60.7841	191,748
Feb-09	********	No flow	********	********	********	********	********	********	317	1.12		
Mar-09	********	No flow	********	********	********	********	********	********	317	0.62		
Apr-09	11.28	0.376	8	6.7	0.1	********	34.8	13.7	317	1.35		

Date	Total Flow (MG)	Daily Flow (MGD)	TSS (mg/L)	pH (SU)	Phosphorus (mg/L)	Mercury (ng/L)	Specific Conductance (umh/cm)	Turbidity (NTU)	Area Drained (acres)	Monthly Precipitation (inches)	Annual Flow (MG)	Annual Flow/Acre (gallons)
May-09	4.898	0.158	22.5	6.8	0.16	********	87.6	37.5	317	1.35		
Jun-09	0.99	0.033	24	7.2	0.16	3.3	82.7	14.8	317	2.25		
Jul-09	19.096	0.616	28.5	5.7	0.16	********	65.2	21	317	4.75		
Aug-09	3.2457	0.1047	15.3	7.4	0.1	********	73.9	30.2	317	5.75		
Sep-09	0.981	0.0327	27	6.8	********	2.5	78.2	********	317	1.35		
Oct-09	15.4814	0.4994	4	6.6	0.1	********	43.2	8.11	317	4.6		
Nov-09	4.812	0.1604	34	7.4	0.1	********	55.9	33.9	317	0.51		
Dec-09	********	No flow	********	********	********	********	********	********	317	1.76		
Jan-08	********	No flow	********	********	********	********	********	********	270	0.2	122.3472	453,138
Feb-08	********	No flow	********	********	********	********	********	********	270	0.22		
Mar-08	********	No flow	********	********	********	********	********	********	270	0.15		
Apr-08	64.606914	2.153564	1.6	4.8	0.1	********	37.9	5.3	270	2.95		
May-08	3.269266	0.10546	12	7.6	0.15	********	60.5	25.9	270	3.1		
Jun-08	3.1638	0.10546	8	6	0.15	6	22.2	11.1	270	4.7		
Jul-08	5.988144	0.193166	35.7	7.3	0.17	********	53.7	35.7	270	2.95		
Aug-08	********	No flow	********	********	********	********	********	********	270	1.4		
Sep-08	23.58936	0.786312	7	********	********	4.5	********	********	270	4.75		
Oct-08	19.732665	0.636538	1.3	4.5	0.1	********	53	9.6	270	4.05		
Nov-08	1.997088	0.06657	**89**	4	0.27	********	40	83.4	270	1.75		
Dec-08	********	No flow	********	********	********	********	********	********	270	1.13		
Jan-07	********	No flow	********	********	********	********	********	********	238	0.11	25.37832	106,632
Feb-07	********	No flow	********	********	********	********	********	********	238	0.48		
Mar-07	********	No flow	********	********	********	********	********	********	238	1.96		
Apr-07	10.279872	0.342662	4	3.5	<0.1	********	49.5	12	238	1.65		
May-07	0.912876	0.029448	12	4.5	0.14	********	47.6	10	238	1.66		
Jun-07	0.883386	0.029446	34	7.1	0.18	3.1	109	100	238	2.25		
Jul-07	0.912876	0.029448	39	6.3	0.17	********	64.7	31	238	4.65		
Aug-07	********	No flow	********	********	********	********	********	********	238	1.75		

Date	Total Flow (MG)	Daily Flow (MGD)	TSS (mg/L)	pH (SU)	Phosphorus (mg/L)	Mercury (ng/L)	Specific Conductance (umh/cm)	Turbidity (NTU)	Area Drained (acres)	Monthly Precipitation (inches)	Annual Flow (MG)	Annual Flow/Acre (gallons)
Sep-07	0.883386	0.029446	25	7.4	0.14	3.8	77.2	23	238	6.2		
Oct-07	10.622534	0.342662	2	8.2	0.1	********	43.5	6.7	238	8.9		
Nov-07	0.883386	0.029446	21	7.7	0.24	********	114.6	34	238	0.63		
Dec-07	********	No flow	********	********	********	********	********	********	238	1.7		
Jan-06	********	No flow	********	********	********	********	********	********	213	0.21	0.385946	1,812
Feb-06	********	No flow	********	********	********	********	********	********	213	0.42		
Mar-06	********	No flow	********	********	********	********	********	********	213	0.45		
Apr-06	0.055482	0.001849	5.6	4.4	<0.1	********	38.1	2	213	1.5		
May-06	0.330464	0.01066	6	3.5	<0.1	********	37.9	8.4	213	3.16		
Jun-06	********	No flow	********	********	********	********	********	********	213	2.82		
Jul-06	********	No flow	********	********	********	********	********	********	213	4.1		
Aug-06	********	No flow	********	********	********	********	********	********	213	3.1		
Sep-06	********	No flow	********	********	********	********	********	********	213	1.68		
Oct-06	********	No flow	********	********	********	********	********	********	213	1.44		
Nov-06	********	No flow	********	********	********	********	********	********	213	0.76		
Dec-06	********	No flow	********	********	********	********	********	********	213	1.81		
Jan-05	********	No flow	********	********	********	********	********	********	225	1.95	20.712	92,053
Feb-05	********	No flow	********	********	********	********	********	********	225	0.47		
Mar-05	********	No flow	********	********	********	********	********	********	225	1.2		
Apr-05	10	0.333333	1	3.9	<0.1	********	26.8	0.7	225	1.19		
May-05	10.6	0.341935	5	4.9	<0.1	********	27	10.2	225	5.75		
Jun-05	********	No flow	********	********	********	********	********	********	225	6.7		
Jul-05	********	No flow	********	********	********	********	********	********	225	2.4		
Aug-05	********	No flow	********	********	********	********	********	********	225	1.45		
Sep-05	0.055	0.001833	7	4.7	0.32	<0.1	35.6	13.1	225	3.25		
Oct-05	0.057	0.001839	4	3.9	<0.1	********	45.9	1.5	225	3.78		
Nov-05	********	No flow	********	********	********	********	********	********	225	2.66		
Dec-05	********	No flow	********	********	********	********	********	********	225	1.12		

ATTACHMENT 2: Black Lake Bog Mercury Monitoring Data

Table 2: Mercury Water Quality Data for the Premier Horticulture Black Lake Site 2007-2014 SD-001 (Sedimentation Basin Outfall), Surface Discharge, Effluent to Surface Water

Note: Minnesota's non-Lake Superior Basin water column mercury standard of 6.9 ng/L was exceeded once in June 2012 (8.94 ng/L).

Date	Total Flow (MG)	Daily Flow (MGD)	Mercury Concentration (ng/L)	Area Drained (acres)	Mercury Loading (g/month)	Mercury Loading (g/acre/month)
Jun-14	3.248758	0.108292	4.09	304	0.050298	0.000165455
Sep-14	3.143959	0.104799	3.34	304	0.03975	0.000130756
Jun-13	14.982954	0.499432	4.74	300	0.268837	0.000896123
Sep-13	3.143959	0.104799	1.81	300	0.021541	0.000071804
Jun-12	8.601544	0.286718	**8.94**	296	0.29109	0.000983411
Sep-12	1.669694	0.055656	2.89	296	0.018266	0.000061710
Jun-11	2.258496	0.075283	6.36	296	0.054374	0.000183695
Sep-11	2.328030	0.077601	2.26	296	0.019916	0.000067285
Mar-10	10.845243	0.349847	4.9	296	0.201163	0.000679605
Sep-10	4.210315	0.140344	3.06	296	0.04877	0.000164762
Jun-09	0.990000	0.033000	3.3	317	0.012367	0.000039012
Sep-09	0.981000	0.032700	2.5	317	0.009284	0.000029286
Jun-08	3.163800	0.105460	6	270	0.071858	0.000266140
Sep-08	23.589360	0.786312	4.5	270	0.401829	0.001488257
Jun-07	0.883386	0.029446	3.1	238	0.010366	0.000043556
Sep-07	0.883386	0.029446	3.8	238	0.012707	0.000053391

Mean monthly mercury ***concentration*** (ng/L)	**4.10**
Maximum monthly mercury ***concentration*** (ng/L)	**8.94**
Minimum monthly mercury ***concentration*** (ng/L)	**1.81**
Mean monthly mercury ***loading*** (g/month)	**0.095776**
Maximum monthly mercury ***loading*** (g/month)	**0.401829**
Minimum monthly mercury ***loading*** (g/month)	**0.009284**
Mean monthly mercury ***loading per acre*** (g/acre/month)	**0.000332766**
Maximum monthly mercury ***loading per acre*** (g/acre/month)	**0.001488257**
Minimum monthly mercury ***loading per acre*** (g/acre/month)	**0.000029286**

ATTACHMENT 3

Minnesota Department of Natural Resources

Division of Ecological and Water Resources, Box 25

500 Lafayette Road

St. Paul, Minnesota 55155-4025

Phone: (651) 259-5091 E-mail: samantha.bump@state.mn.us

November 17, 2015 **Correspondence # ERDB 20060830-0002**

Mr. Kurt Johnson
University of Minnesota Duluth
Natural Resources Research Institute
5013 Miller Trunk Highway
Duluth, MN 55811

RE: Natural Heritage Review of the proposed Wright Bog Horticultural Peat Extraction;
T49N R21W Sections 16, 17, 20, 21, 27, 28 & 29; Carlton County

Dear Mr. Johnson,

As requested, the Minnesota Natural Heritage Information System has been queried to determine if any rare species or other significant natural features are known to occur within an approximate one-mile radius of the proposed project. Based on this query, rare features have been documented within the search area. Please note that the following **rare features *may* be adversely affected** by the proposed project:

Ecologically Significant Areas

- The proposed peat mine is entirely within an area that the Minnesota Biological Survey (MBS) has identified as a Site of Moderate Biodiversity Significance. Sites of Biodiversity Significance have varying levels of native biodiversity and are ranked based on the relative significance of this biodiversity at a statewide level. Sites ranked as Moderate contain occurrences of rare species and/or moderately disturbed native plant communities, and/or landscapes that have a strong potential for recovery. This particular site contains a large undisturbed peatland with good quality examples of Northern Spruce Bog, Northern Open Bog, Northern Poor Fen, Northern Poor Conifer Swamp, Northern Rich Fen, Northern Wet Meadow, and Northern Shrub Swamp. The biodiversity ranking is based on the good quality, large peatland native plant communities that are free of ditches and utility corridors and have good potential for rare plants. There are no known occurrences of rare species in in this Site. Gary Walton conducted plant surveys at eight sample sites in 2005 and did not document any rare plants. Given the ecological significance of this MBS Site, we recommend that disturbance within the Site be minimized to the extent feasible and that measures be taken to avoid/minimize disturbance to the surrounding native plant communities.

- If the Wetland Conservation Act (WCA) is applicable to this project, please note that one or more of the wetlands listed above may qualify as a "rare natural community" under this Act. Minnesota Rules, part 8420.0515, subpart 3 states that a wetland replacement plan for activities that modify a rare natural community must be denied if the local government unit determines that the proposed activities will permanently adversely affect the natural community. If you have any questions regarding this provision of the WCA, please contact Doug Norris, DNR Wetlands Program Coordinator, at 651-259-5125.

- Within the MBS Site, the best quality upland forests are in T49N R21W Section 16. This includes an old-growth forest in that is in relatively close proximity to the proposed discharge ditch (see enclosed map). Old-growth forests are natural forests that have developed over a long period of time, generally at least 120 years, without experiencing severe, stand-replacing disturbances such as fires, windstorms, or logging. Old-growth forests are a unique, nearly vanished piece of Minnesota's history and ecology; less than 5% of Minnesota's old-growth forests remain. We recommend that the project be designed to avoid impacts to this old growth forest. Indirect impacts from runoff or the spread of invasive species should also be considered during project design and implementation.

State-Listed Species

- Although there are no known occurrences of state-listed species within an approximate mile of the proposed project boundary, state-listed mussels of special concern are known to occur in the Tamarack River, downstream of the proposed discharge. Mussels may be negatively affected by changes in water flow or deterioration in water quality, including sedimentation or siltation.

Federally Listed Species

- The northern long-eared bat (*Myotis septentrionalis*), a state-listed species of special concern, can be found throughout Minnesota. During the winter this species hibernates in caves and mines, and during the active season (approximately April-October) it roosts underneath bark, in cavities, or in crevices of both live and dead trees. Activities that may impact this species include, but are not limited to, wind farm operation, any disturbance to hibernacula, and destruction/degradation of habitat (including tree removal).

  Effective May 4, 2015, the U.S. Fish and Wildlife Service (USFWS) listed the northern long-eared bat as threatened under the Endangered Species Act (ESA) and implemented an interim 4(d) rule. If you believe that your project may adversely affect ("take") the northern long-eared bat, you should determine whether the "take" is exempt under the interim 4(d) rule or whether you need a Federal permit. To make this determination, please refer to the USFWS Key to the Interim 4(d) Rule available at http://www.fws.gov/midwest/endangered/mammals/nleb/Interim4dRuleKeyNLEB.html. Please note that the NHIS does not contain any known occurrences of northern long-eared bat roosts or hibernacula within an approximate one-mile radius of the proposed project.

Environmental Review and Permitting

- The Environmental Assessment Worksheet should address whether the proposed project has the potential to adversely affect the above rare features and, if so, it should identify specific measures that will be taken to avoid or minimize disturbance.

- Please include a copy of this letter in any DNR license or permit application.

The Natural Heritage Information System (NHIS), a collection of databases that contains information about Minnesota's rare natural features, is maintained by the Division of Ecological and Water Resources, Department of Natural Resources. The NHIS is continually updated as new information becomes available, and is the most complete source of data on Minnesota's rare or otherwise significant species, native plant communities, and other natural features. However, the NHIS is not an exhaustive inventory and thus does not represent all of the occurrences of rare features within the state. Therefore, ecologically significant features for which we have no records may exist within the project area. **If additional information becomes available regarding rare features in the vicinity of the project, further review may be necessary.**

For environmental review purposes, the results of this Natural Heritage Review are valid for one year; the results are only valid for the project location (noted above) and the project description provided on the NHIS Data Request Form. Please contact me if project details change or for an updated review if construction has not occurred within one year.

The Natural Heritage Review does not constitute review or approval by the Department of Natural Resources as a whole. Instead, it identifies issues regarding known occurrences of rare features and potential effects to these rare features. To determine whether there are other natural resource concerns associated with the proposed project, please contact your DNR Regional Environmental Assessment Ecologist (contact information available at http://www.dnr.state.mn.us/eco/ereview/erp_regioncontacts.html). Please be aware that additional site assessments or review may be required.

Thank you for consulting us on this matter, and for your interest in preserving Minnesota's rare natural resources. An invoice will be mailed to you under separate cover.

Sincerely,

Samantha Bump

Samantha Bump
Natural Heritage Review Specialist

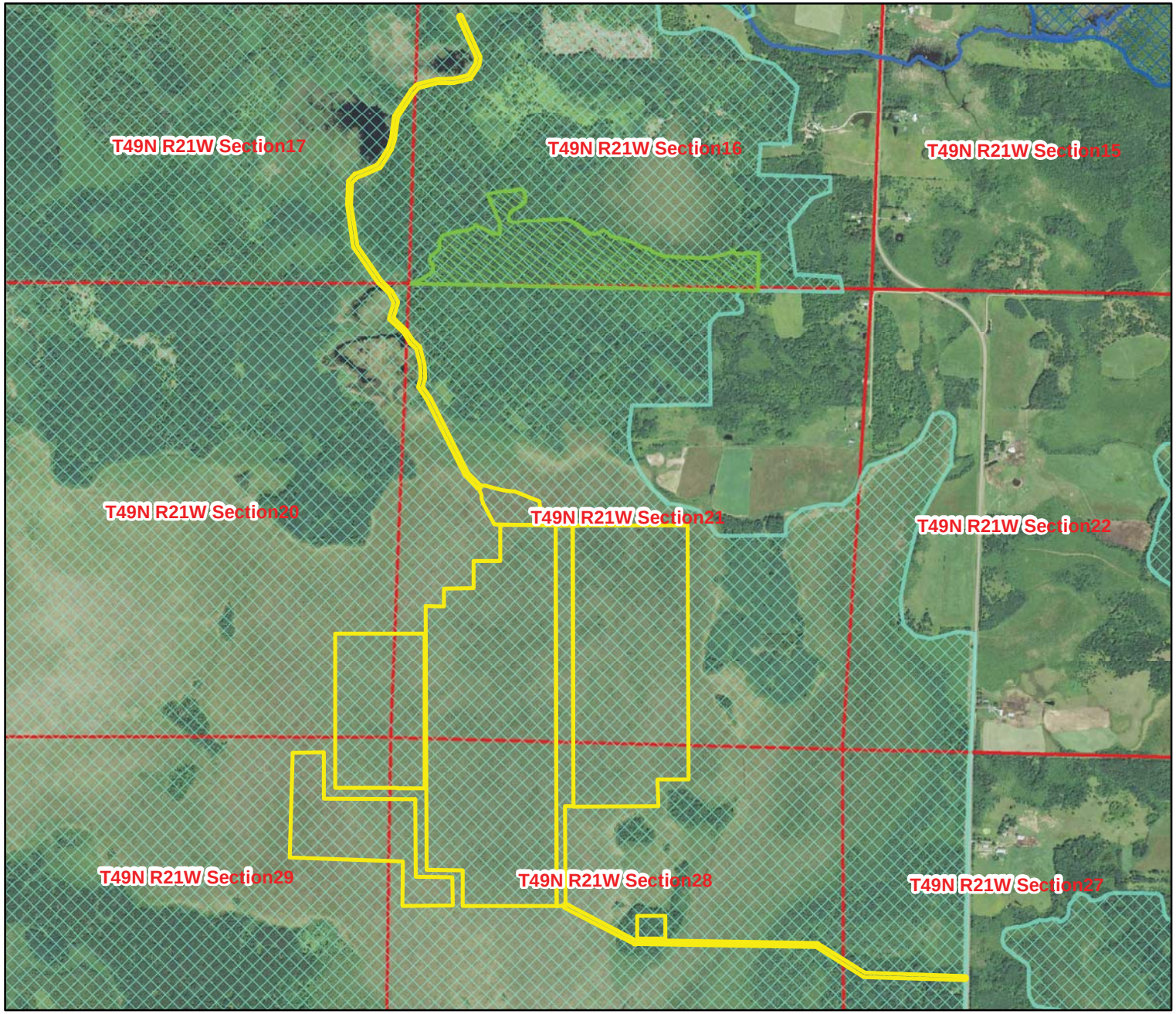
enc: Map

Links: MBS Sites of Biodiversity Significance
http://www.dnr.state.mn.us/eco/mcbs/biodiversity_guidelines.html
DNR Native Plant Communities
http://www.dnr.state.mn.us/npc/index.html
Old Growth Forests
www.mndnr.gov/forests_types/oldgrowth

cc: Rian Reed, Brooke Haworth, Joe Rokala, Doug Norris, Patricia Fowler

ERDB# 20060830-0002 - Wrght Bog Hroticultural Peat Project
T49N R21W Section 16,17,20,21,27-29
Carlton County

GIS shapefiles of MBS Sites of Biodiversity Significance and DNR Native Plant Communities can be downloaded from the MN Geospatial Commons at https://gisdata.mn.gov/.



Legend

- WrightBogOperationAreas_2015_09_10

Forest Stand Inventory - Old Growth

- Designated Old Growth
- Designated Future Old Growth
- Candidate Old Growth (Pending)

MBS Sites of Biodiversity Significance

- Outstanding
- High
- Moderate
- Below
- Confluences and Flow Direction
- PLS Section

0 0.125 0.25 0.5 Miles

N

Rare Feature, Prairie Railroad Survey, Native Plant Community, and Sites of Biodiversity Significance data are from the Natural Heritage Information System. The absence of rare features for a particular location should not be construed to mean that the DNR is confident rare features are absent from that location.

ATTACHMENT 4

Wright Bog Vegetation Assessment and Rare Plant Survey

November 20, 2005 Gary B. Walton

At the request of the NRRI an assessment of vegetation and to survey for rare plant species on a 300 acre bog sight in Wright, MN. Eight sites were chosen and relevés done at each to measure the extent of aerial coverage and record species composition. Relevés recorded per cent aerial coverage within vegetation strata. The numbers may not always add up to 100%. This reflects the layering of different species within their respective strata when branches overlap as well as gaps within the strata.

The bog is open with a dense cover of *Sphagnum* moss and various ericaceous shrubs especially *Chamaedaphne calyculata* and *Ledum groenlandicum*. *Eriophorum spissum* was frequently noted. In some areas where the bog contacts upland forest the vegetation cover is dominated by willows, alders, and shrub birches with *Carex lasiocarpa* and other sedges such as *C. lacustris*.

Minnesota listed rare plant species potentially present in an open bog site in northern Minnesota include *Drosera anglica*, *D. linearis*, *Eleocharis quinqueflora*, *Juncus stygius*, *Platanthera clavellata*, *Rhynchospora fusca*, and *Xyris montana*. Habitat for these species is essentially absent at the Wright bog site. No rare plant species were found.

Relevé 1
15T 0498915
UTM 5173074

Species	Per cent cover	Strata
Picea mariana (10-15 feet tall)	10%	Small tree layer
Picea mariana (5-10 feet tall)	30%	Tall shrub layer
Picea mariana (<5 feet)	5%	Low shrub layer
Chamaedaphne calyculata	60%	Low shrub layer
Ledum groenlandicum	20%	Low shrub layer
Kalmia polifolia	1%	Low shrub layer
Eriophorum spissum	15%	Ground layer
Vaccinium oxycoccos	1%	Ground layer

Level terrain and hummocky. Tamarack and bog rosemary nearby.

Relevé 2
15T 0499258
UTM 5172656

Species	Per cent cover	Strata
Picea mariana (<3 feet tall)	5%	Low shrub layer
Larix laricina (<3feet tall)	P	Low shrub layer
Chamaedaphne calyculata	60%	Low shrub layer
Kalmia polifolia	5%	Low shrub layer
Carex oligosperma	25%	Medium herb layer
Eriophorum spissum	15%	Ground layer
Eriophorum virginicum	P	Ground layer
Vaccinium oxycoccos	20%	Ground layer
Sarracenia purpurea	1%	Ground layer

Smilacina trifolia outside plot. Winter trail with *Eriophorum virginicum*, *Scheuzeria palustris*, *Drosera rotundifolia*, *Vaccinium oxycoccos*, *Chamaedaphne calyculata*, *Kalmia polifolia*, and thick growth of *Carex oligosperma*.

Relevé 3
15T 0499653
UTM 5172722

Species	Per cent cover	Strata
Chamaedaphne calyculata	65%	Low shrub layer
Kalmia polifolia	P	Low shrub layer
Andromeda glaucophylla	P	Low shrub layer
Carex rostrata	P	Medium herb layer
Eriophorum spissum	15%	Ground layer
Scheuzeria palustris	35%	Ground layer
Sarracenia purpurea	5%	Ground layer
Smilacina trifolia	40%	Ground layer
Vaccinium oxycoccos	15%	Ground layer

Flat, hummocky, and soggy. Transitions into *Alnus incana* thicket with various willows (*Salix pedicellaris*, *S. pyrifolia*, *S. serissima*, *S. petiolaris*) and sedges (*Carex lasiocarpa*, *C lacustris*, *C. rostrata*, and *C. stricta*.

Relevé 4
15T 0499635
UTM 5172770

Species	Per cent cover	Strata
Betula pumila	30%	Tall shrub layer
Betula papyrifera	P	Tall shrub layer
Alnus incana	25%	Tall shrub layer
Chamaedaphne calyculata	30%	Low shrub layer
Carex lacustris	40%	Medium herb layer
Carex lasiocarpa	45%	Medium herb layer
Smilacina trifolia	35%	Ground layer
Lysimachia thyrsiflora	5%	Ground layer

Relevé 5
15T 0498482
UTM 5173077

Species	Per cent cover	Strata
Picea mariana (5-10 feet tall)	35%	Tall shrub layer
Chamaedaphne calyculata	40%	Low shrub layer
Ledum groenlandicum	40%	Low shrub layer
Kalmia polifoia	5%	Low shrub layer
Eriophorum spissum	25%	Ground layer
Vaccinium oxycoccos	5%	Ground layer
Sphagnum moss	100%	Ground layer

Relevé 6
15T 0499818
UTM 5172618

Species	Per cent cover	Strata
Picea mariana (5-10 feet tall)	45%	Tall shrub layer
Picea mariana (<3 feet tall)	45%	Low shrub layer
Chamaedaphne calyculata	P	Low shrub layer
Ledum groenlandicum	50%	Low shrub layer
Kalmia polifolia	P	Low shrub layer
Eriophorum spissum	25%	Ground layer
Carex disperma	50%	Ground layer
Smilacina trifolia	P	Ground layer
Vaccinium oxycoccos	5%	Ground layer

Flat, hummocky, soggy with dry moss clumps.

Relevé 7
15T 0498636
UTM 5173062

Species	Per cent cover	Strata
Picea mariana (5-10 feet tall)	35%	Tall shrub layer
Picea mariana (5-10 feet tall)	40%	Low shrub layer
Ledum groenlandicum	15%	Low shrub layer
Chamaedaphne calyculata	5%	Low shrub layer
Kalmia polifolia	10%	Low shrub layer
Eriophorum spissum	15%	Ground layer
Carex oligosperma	60%	Ground layer
Sphagnum mosses	100%	Ground layer

Flat, hummocky, soggy.

Relevé 8
15T 0499321
UTM 5172477

Species	Per cent cover	Strata
Picea mariana (>15 feet tall)	10%	Tree layer
Picea mariana (5-10 feet tall)	70%	Tall shrub layer
Larix laricina (5-10 feet tall)	P	Tall shrub layer
Picea mariana (<5 feet tall)	40%	Low shrub layer
Ledum groenlandicum	60%	Low shrub layer
Chamaedaphne calyculata	10%	Low shrub layer
Kalmia polifolia	5%	Low shrub layer
Andromeda glaucophylla	5%	Low shrub layer
Vaccinium oxycoccos	P	Ground layer
Eriophorum spissum	P	Ground layer
Carex oligosperma	1%	Ground layer
Carex paupercula	2%	Ground layer
Carex disperma	P	Ground layer
Sphagnum mosses	100%	Ground layer

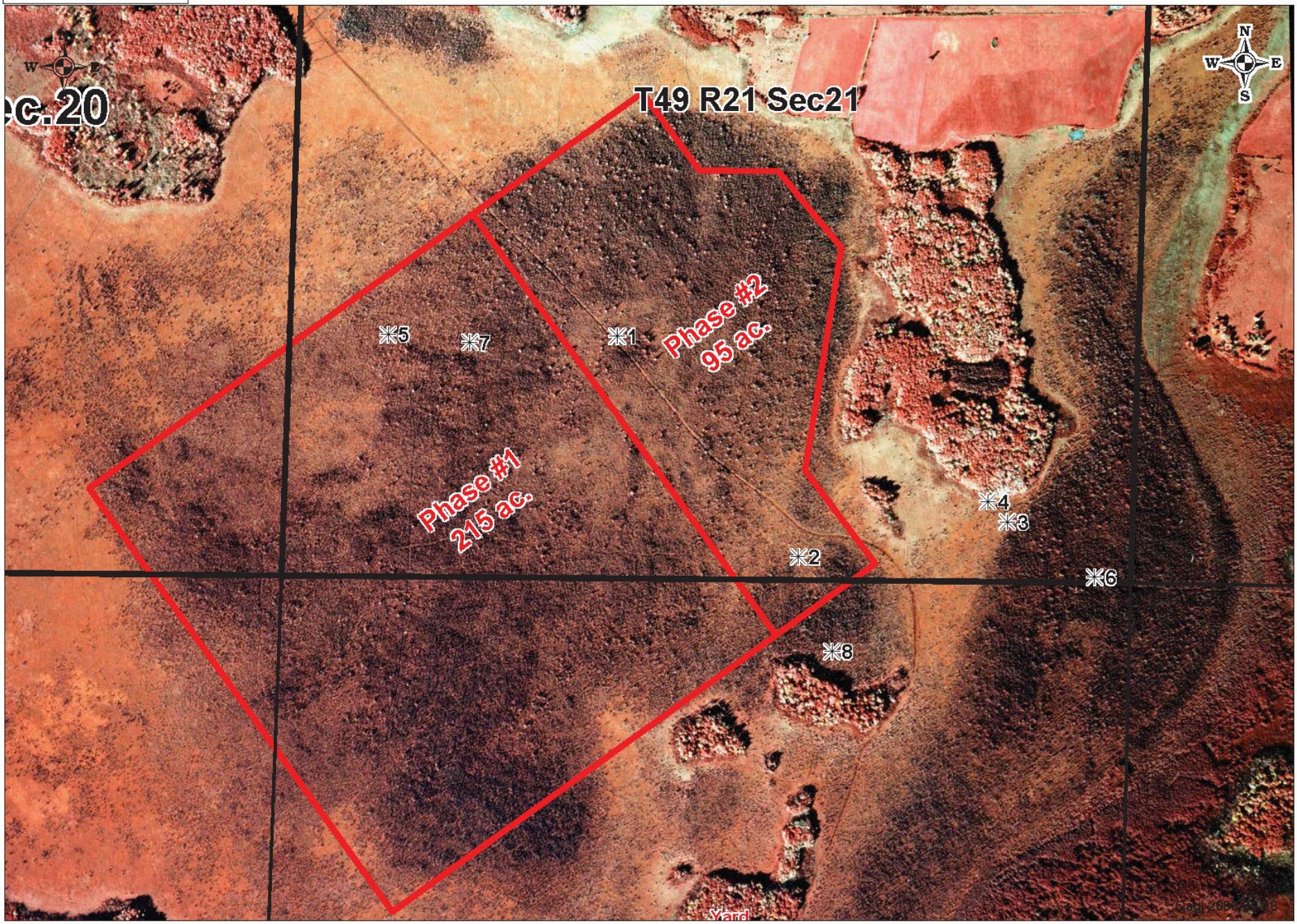
Flat, hummocky, soggy.

General species checklist of plants seen in relevé plots and between plots

Picea mariana	Black spruce
Larix laricina	Tamarack
Andromeda glaucophylla	Bog rosemary
Chamaedaphne calyculata	Leatherleaf
Ledum groenlandicum	Labrador tea
Kalmia polifolia	Bog laurel
Vaccinium oxycoccos	Small cranberry
Vaccinium angustifolium	Blueberry
Vaccinium myrtilloides	Blueberry
Betula pumila	Bog birch
Betula papyrifera	Paper birch
Alnus incana	Tag alder
Salix pedicellaris	Bog willow
Salix pyrifolia	Balsam willow
Salix serissima	Autumn willow
Salix petiolaris	Meadow willow
Eriophorum spissum	Cotton-grass
Eriophorum virginicum	Tawny cotton-grass
Carex oligosperma	Few-seeded sedge
Carex paupercula	Poor sedge
Carex disperma	Two-seeded sedge
Carex lacustris	Lake sedge
Carex lasiocarpa	Fen sedge
Carex stricta	Tussock sedge
Calamagrostis canadensis	Canada bluejoint grass
Agrostis scabra	Tickle grass
Smilacina trifolia	Bog Solomon's seal
Scheuzeria palustris	Pod grass
Iris versicolor	Wild iris
Lysimachia thyrsiflora	Loosestrife
Campanula uliginosa	Marsh bellflower
Epilobium leptophyllum	Willow-herb
Potentilla palustris	Marsh potentilla
Sarracenia purpurea	Pitcher plant
Drosera rotundifolia	Sundew
Monotropa uniflora	Corpse plant
Equisetum fluviatile	Water horsetail

Premier Horticulture

Wright bog
Botanical Survey Points



STATE HISTORIC PRESERVATION OFFICE

June 27, 2017

ATTACHMENT 5: SHPO CORRESPONDENCE

Kurt Johnson
Research Program Manager
Natural Resources Research Institute
University of Minnesota-Duluth
5013 Miller Trunk Highway
Duluth, MN 55811

RE: Wright Bog Horticultural Peat Project
T49 R21520,521,527,528 and529, Beseman Twp,
Carlton County SHPO Number: 2017-2174

Dear Mr. Johnson:

Thank you for consulting with our office during the preparation of an Environmental Assessment Worksheet for the above referenced project.

We have reviewed the documentation that was submitted for this project. Because this project is located within an area that has the potential to contain archaeological sites and because there are no current methods that provide a means for archaeological survey in wetlands, we recommend that the Minnesota Department of Natural Resources prepare an Unanticipated Discoveries Plan (UDP) so that the mining operators have a protocol to follow in the event that human remains or artifacts are discovered during mining operations. The UDP should include a section that describes the types of material remains that may be found during peat mining operations, a section laying out the protocol for mining personnel in the event that human remains or archaeological resources are encountered, and a list of people to contact in the case of a discovery. For your information we have included a UDP that was prepared for a different type of project here in Minnesota. We thought this might be helpful, particularly Section II through Section V of the document.

Please note that this comment letter does not address the requirements of Section 106 of the National Historic Preservation Act of 1966 and 36 CFR § 800. If this project is considered for federal financial assistance, or requires a federal permit or license, then review and consultation with our office will need to be initiated by the lead federal agency. Be advised that comments and recommendations provided by our office for this state-level review may differ from findings and determinations made by the federal agency as part of review and consultation under Section 106.

Please contact David Mather, National Register Archaeologist, at (651) 259-3454 if you have any questions regarding our review of this project.

Sincerely,

Sarah J. Beimers

Sarah J. Beimers, Manager
Government Programs and Compliance

cc: Amanda Gronhovd, Office of the State Archaeologist (OSA)

ATTACHMENT 5a: UNANTICIPATED DISCOVERIES PLAN

Unanticipated Discoveries Plan
Wright Bog Horticultural Peat Project
Beseman Township, Carlton County, Minnesota
Completed by Blondo Consulting, LLC
September 12, 2017

I. Introduction

Premier Horticulture, Inc. proposes the development of Wright Bog to provide Sphagnum moss peat for an existing processing plant located west of Cromwell, Carlton County, Minnesota. Wright Bog is located approximately three miles west of the existing Black Lake (Peatrex) horticultural peat harvesting operation in Township 49N Range 21W Sections 20, 21, 27, 28 and 29, Beseman Township, Carlton County, Minnesota.

The Wright Bog Horticultural Peat Project ("The Project") will involve clearing the area and the creation of ditches to carry drainage water. Sedimentation basins will be added and the drainage ditch would discharge into the Tamarack River. The total area proposed for development would be 316.4 acres, which will include 255.2 acres for peat harvesting, 2.7 acres for access roads in the harvesting area, 2.1 acres for access roads to the harvesting area, 5.1 acres for sedimentation basins, 5.7 acres for a drainage outlet, 15.6 acres for peat storage, 2 acres used as an equipment yard, and 28 acres as a restoration donor site. The method proposed to be used for peat harvesting will include the vacuum method, used currently at the Black Lake location. The peat will then be transported in covered trucks to existing processing plant facilities. The Project area has been divided into Phase 1 and Phase 2 harvesting areas. The Phase 1 areas would be fully in use within ten years continuing for an additional fourteen years. The Phase 2 areas would begin to be harvested at year ten as some of the Phase 1 areas are retired. The Wright Bog Horticultural Peat Project is proposed to provide harvestable peat for approximately 25 years. Following the end of harvesting, The Project area will be restored to a Sphagnum-dominated, bog-like wetland, using the "Canadian Approach" used by the Canadian Sphagnum Peat Moss Association.

Permitting for the Wright Bog Horticultural Peat Project will be provided by the Minnesota Department of Natural Resources, Permit to Mine Peat, and the Federal Section 404 Clean Water Act Permit. This requires review of the project under Section 106 of the National Historic Preservation Act (NHPA) as regulated by 36 CFR Part 800. An Environmental Assessment Worksheet was prepared and reviewed by the Minnesota State Historic Preservation Office (SHPO). In their response dated June 27, 2017 (SHPO Number 2017-2174), the Minnesota SHPO recommends:

> *Because this project is located within an area that has the potential to contain archaeological sites and because there are no current methods that provide a means for archaeological survey in wetlands, we recommend that the Minnesota Department of*

Natural Resources prepare an Unanticipated Discoveries Plan (UDP) so that the mining operators have a protocol to follow in the event that human remains or artifacts are discovered during mining operations. The UDP should include a section that describes the types of material remains that may be found during peat mining operations, a section laying out the protocol for mining personnel in the event that human remains are discovered during mining operations, and a list of people to contact in the case of a discovery.

II. Environmental Setting and Potential for Cultural Resources

The Project area falls within Minnesota Archaeological Region 5: Central Lakes Coniferous. Within this region, hilly terminal moraines exist in the central portion with less rugged terrain such as ground moraines, outwash plains, and lake plains throughout the rest of the region. The Mississippi River flows through this region and lake distribution is generally dense. Soils in this region are typically coarse to medium textured forest soils. Peat deposits are present in the northeast within the Glacial Lakes Upham-Aitkin Lakebed (Anfinson 1990).

H.E. Wright (1972) identifies the physiographic regions overlaying the state. Overlaying The Project area is the Sugar Hills-Mille Lacs Moraine Area (#8). This area features several moraines from Mille Lacs Lake to Grand Rapids. One very distinctive moraine bounds the Mille Lacs Lake on the south and west and consists of sandy till and outwash that is related to the Superior lobe. A cap of clay till is located on the inner side that was deposited when the St. Louis sublobe spread from the Glacial Lake Aitkin basin (Wright 1972).

Beginning approximately 5,000 to 6,000 years ago the climate began to cool with an increase in precipitation. The change in climate helped to form the peatlands that exist today. "Peat formation requires low-oxygen conditions that prevent normal decomposition of plant debris. This occurs in areas of poor drainage where precipitation exceeds evaporation. The water table lies at or near the surface in these areas, saturating dead plant material. As a result, organic materials accumulate year-after-year, forming the partially decomposed mass known as peat" (MnDNR 2017).

At the time the climate was cooling and conditions were right for the creation of peat bogs, native peoples in Minnesota were living in primarily small nomadic groups. The Archaic Tradition (8,000 to 2,800 years before present) is marked by a shift in diet and settlement patterns from the earlier Paleoindian Tradition (12,000 to 8,000 years before present). People living during the Archaic Tradition were beginning to use more diverse plant and animal resources, which is reflected archaeologically through a broader range of tools. The Woodland Tradition (2,800 years before present to European Contact) follows the Archaic Tradition and is typically divided into two distinct periods in Minnesota, Initial and Terminal. These periods are marked by technological advancement, and changes in lifestyle. Populations increase during this Tradition and groups of

people become more sedentary, developing larger and more permanent villages and relying more on cultivated plants. Woodland period sites are located either in areas where a community could focus on a specific resource or in environments capable of sustaining larger communities over longer periods of time.

No known sites are located in the direct area of potential effect or in the immediately surrounding areas. Few archaeological sites have been recorded in the region surrounding The Project area. Those sites that have been recorded in the vicinity mainly consist of sparse artifact scatters or single, isolated finds.

Should the unanticipated discovery of archaeological resources, human remains, or burial sites occur during the process of ground disturbing activities for The Project, the following steps will be used to comply with federal and state regulations such as the NHPA, the Native American Graves Protection and Repatriation Act (NAGPRA), the Minnesota Field Archaeology Act (Minn. Stat. § 138.31-138.42), and the Minnesota Private Cemeteries Act (Minn. Stat. § 307.08).

III. Unanticipated Discovery—Human Remains/Possible Burial Sites

Within this Unanticipated Discovery Plan for the Wright Bog Horticultural Peat Project, possible burial sites are defined as areas that show evidence of a high probability of the presence or former presence of human remains including burial, cremation, or otherwise. This evidence may include a defined burial pit or grave shaft outline, coffin fragments, or bone that is undetermined to be human or animal. In the event that human remains or burial sites are discovered during the construction for this project:

1. The Contractor will immediately cease all activity in the vicinity of the discovery. Measures will be taken by the Contractor to protect the discovery (by flagging or fencing off a buffer that is at least 50 feet around the area to signify it as a protected zone), but in a way that will not cause additional harm to the remains or their context (including soils, or coffin) within which they were found.

2. The Contractor will immediately notify Premier's Wright Bog Site Director:

   Name: (currently) Ronald Richard, Site Director, Premier Tech Horticulture
   Phone Number: 218-644-3321
   Address: 1320 Kalli Road
   Cromwell, Minnesota 55726

3. Site Director will contact the Archaeological Consultant in the case of a possible burial site for their professional assessment of the exposed evidence. The Archaeological Consultant will have 36 hours from the time of notification to arrive onsite to assess the

discovery:

Name: (currently) Steven J. Blondo, MA, Blondo Consulting, LLC
Phone Number: 218-485-1174
Address: 3939 Sand Hill Road
Kettle River, MN 55757

Should the assessment reveal a strong suspicion or confirmation of the area as a possible burial site, no excavation will be conducted by the Archaeological Consultant prior to completing the following steps and all parties are in agreement:

a) Site Director will immediately notify the local law enforcement who will be able to determine if the possible burial site/human remains are associated with a crime scene and/or are a recent event (less than 50 years old):

Contact: (currently) Kelly Lake, Carlton County Sherriff
Phone Number: 218-384-3236 (administration office)
218-384-9426 (Dispatch)
Address: Carlton County Sherriff's Office
Law Enforcement Center
317 Walnut Ave
PO Box 530
Carlton, MN 55718

If the area is determined to be associated with a crime scene and/or the discovery is less than 50 years old, further action will fall under the local law enforcement jurisdiction.

b) If the area is not determined to be associated with a crime scene and the discovery is 50 years old or older, Site Director will immediately notify the State Archaeologist following clearance from the local law enforcement agency. The State Archaeologist will authenticate the human remains/possible burial site, which will determine the presence of or high possibility of human remains or human burials located in a discrete area, boundaries will be delimited around the burial or grave site, and an attempt will be made to determine the ethnic, cultural, or religious affiliation of the individuals:

Name: (currently) Amanda Gronhovd, State Archaeologist
Phone Number: 651-725-2411
Address: Office of the State Archaeologist

Fort Snelling History Center
200 Tower Avenue
St. Paul, MN 55111

c) If the human remains/burial site are determined to be Native American, the State Archaeologist will initiate consultation with the Minnesota Indian Affairs Council (MIAC) and other tribal representatives to determine the appropriate measures for the treatment of the remains.

d) If the burial site/human remains are determined to be non-Native American, or their ancestry cannot be determined, then the appropriate measures for their treatment will be the responsibility of the State Archaeologist.

IV. Unanticipated Discovery—Archaeological Resources

Within this Unanticipated Discovery Plan for the Wright Bog Horticultural Peat Project, archaeological resources are defined as intact subsurface artifacts, features (such as trash pits, privy pits, hearths), and structural remains (such as foundation walls) 50 years old or older. If archaeological resources are encountered during construction of The Project:

1. The Contractor will immediately cease all activity in the area of the discovery. Measures will be taken by the Contractor to protect the discovery (by flagging or fencing off a buffer that is at least 50 feet around the area to signify it as a protected zone), but in a way that will not cause additional harm to the remains or the context within which they were found.

2. The Contractor will immediately notify Premier's Wright Bog Site Director:

   Name: (currently) Ronald Richard, Site Director, Premier Tech Horticulture
   Phone Number: 218-644-3321
   Address: 1320 Kalli Road
   Cromwell, Minnesota 55726

3. Site Director will contact the Archaeological Consultant. The Archaeological Consultant will have 36 hours from the time of notification to arrive onsite to assess the discovery. Once onsite, the Archaeological Consultant will conduct a preliminary assessment of the area:

   Name: (currently) Steven J. Blondo, MA, Blondo Consulting, LLC
   Phone Number: 218-485-1174
   Address: 3939 Sand Hill Road

Kettle River, MN 55757

4. If the Archaeological Consultant determines that the discovery is less than 50 years old, they will notify Site Director that construction may continue.

5. If the Archaeological Consultant determines the discovery is 50 years old or older, they will notify Site Director, who will direct the Archaeological Consultant to conduct a more detailed examination of the discovery. If it is determined that the discovery lacks significance or integrity (it is not intact), the Archaeological Consultant will notify Site Director that construction may continue and will submit a letter report documenting the discovery via Site Director to the Minnesota State Historic Preservation Office (SHPO).

   Name: (currently) Sarah Beimers, Manager Government Programs and Compliance
   Phone Number: 651-259-3456
   Address: Minnesota Historic Preservation Office
   345 Kellogg Boulevard West
   St. Paul MN 55102

   and the State Archaeologist:

   Name: (currently) Amanda Gronhovd, State Archaeologist
   Phone Number: 651-725-2411
   Address: Office of the State Archaeologist
   Fort Snelling History Center
   200 Tower Avenue
   St. Paul, MN 55111

6. If the Archaeological Consultant finds that the discovery appears to retain integrity and is potentially significant:

   a) Site Director will notify SHPO, and the State Archaeologist of the discovery, and will notify any additional interested parties as directed by the SHPO, and the State Archaeologist.

   b) If continued construction activities will not avoid impacting the discovery, Site Director and the Archaeological Consultant will consult with the SHPO and the State Archaeologist, onsite if possible, to obtain recommendations for the appropriate treatment of the discovery. These may include:

      i. Phase II testing and *National Register of Historic Places* eligibility evaluation.

ii. Preparation and implementation of a data recovery plan (such as mitigation efforts).
iii. Completion of a report that documents the findings and recommendations.

c) When the treatment measures are completed, Site Director will consult with SHPO, and the State Archaeologist to determine a need for further treatment measures, or if none are required, to obtain approval for the continuation of construction.

V. Conclusion

Due to the long-term nature of this project, it is recommended that this Unanticipated Discoveries Plan be revisited every five years. At that time, it should be checked for any necessary updates (including personnel, address, phone, or contact changes) or policy changes that may affect this plan.

VI. Works Cited

Anfinson, Scott

1990 Archaeological Regions in Minnesota and the Woodland Period. In The Woodland Tradition in the Western Great Lakes: Papers Presented to Elden Johnson, edited by Guy Gibbon, pp. 135-166. University of Minnesota Publications in Anthropology No. 4, Minneapolis.

Gibbon, Guy E., Craig M. Johnson, and Elizabeth Hobbs

2002 Minnesota's Environment and Native American Culture History. Minnesota Department of Transportation Mn/Model.

Minnesota Department of Natural Resources (MnDNR)

2017 Minnesota Scientific and Natural Areas Patterned Peatlands. Website accessed 8 September at http://www.dnr.state.mn.us/snas/peatlands.html.

Wright, H. E.

1972 Quaternary History of Minnesota. and Physiography of Minnesota. In Geology of Minnesota: A Centennial Volume, edited by P. K. Sims and G. B. Morey. Minnesota Geological Survey, University of Minnesota, St. Paul.

ATTACHMENT 6

Basis and Calculation for Estimating GHG Emissions from *In Situ* Peat Decomposition

EAW Item 16a for the Wright Bog Horticultural Peat Project provides an estimate of greenhouse gas (GHG) emissions due to *in situ* decomposition of organic peat material. Project-related ditching and draining of peat lands for peat mining, and the removal and stockpiling of peat materials, results in GHG emissions. Potential GHG emissions can be calculated by using appropriate emission factors for mining activities due to biomass clearing, site drainage (including ditches), and peat stockpiling. What follows is a discussion of how this was accomplished for proposed project activities at the Wright Bog to respond to EAW Item 16a.

Calculated Emissions from *In Situ* Peat Decomposition

To determine the estimated emissions due to *in situ* peat decomposition, emission factors from Table A3-60 "Parameters and Emission Factors for Estimating Emissions from Peat Extraction" (Environment and Climate Change Canada, 2017) were used for each project-related peat mining activity. Calculations are based on a 255 acre (103.2 hectares) peat harvesting area, a 12.8 acre (5.2 hectares) drainage ditch area, and peat stockpiles with a total surface area of 12.2 acres (4.9 hectares). Emission values were adjusted assuming 1 t C equals 3.67 t CO_2 equivalent (CO_2 Eq). It should be noted that the estimate for land biomass clearing is one time only; this is because site clearing occurs only once at the start of the project. Estimates for the remaining three activities are annual occurring over the course of the project.

EAW Table 2 Estimated Emissions from *In Situ* Peat Decomposition

Emission Factor	**Hectares**	**Emission Value**	**Estimated Emissions (One Time Only)**	
			t CO_2 Eq	**T CO_2 Eq**
Land biomass cleared	103.2	2.8 t C ha^{-1} (10.3 t CO_2 ha^{-1} yr^{-1})	1,063	1,172
Emission Factor	**Hectares**	**Emission Value**	**Estimated Emissions (Annual)**	
			t CO_2 Eq	**T CO_2 Eq**
Drained areas	103.2	11.4 t CO_2 ha^{-1} yr^{-1}	1,176	1,296
		0.008 t CH_4 ha^{-1} yr^{-1} x 25 (CO_2 Eq)	20	22
		0.001 t N_2O ha^{-1} yr^{-1} x 298 (CO_2 Eq)	31	34
Drainage Ditches	5.2	0.15 t CH_4 ha^{-1} yr^{-1} x 25 (CO_2 Eq)	20	22
Peat stockpiles (Surface Area)	4.9	50 t C ha^{-1} (183.5 t CO_2 ha^{-1} yr^{-1})	899	991
Estimated total CO_2 Eq per year			**2,146**	**2,366**

Reliance on Canadian Emission Factors

The estimate relies on emission factors derived from conversion and management of Canadian peatlands in accordance with the 2006 Intergovernmental Panel on Climate Change (IPCC 2006) and the 2014 IPCC Wetlands Supplement (IPCC 2014). See insert: Table A3-60: Parameters and Emission Factors for Estimating Emissions from Peat Extraction. Environment and Climate Change Canada. 2017. *National Inventory Report 1990-2015: Greenhouse Gas Sources and Sinks in Canada*.

Using Canadian-based emission factors is appropriate because bogs harvested for horticultural purposes in both Canada and the northern-tier United States are mainly ombrotrophic and dominated by *Sphagnum*-type mosses. Ombrotrophic bogs suitable for market purposes exhibit fibric peats that only develop within a certain range of precipitation and climate conditions. Although the climate normal ranges for Minnesota are highly comparable to several Canadian provinces, especially southeastern Manitoba, there are however differences that are likely to affect peat decomposition rates. Review of the studies behind Table A3-60 indicate that the climate in Wright, Minnesota, is within the range of what has been reported for Quebec and Alberta. Given this similarity, it is reasonable to assume the rate of peat decomposition and resulting GHG emissions in *Sphagnum* bogs in Minnesota and Canada are similar for the purposes of estimating GHG emissions for the EAW.

Emission Factors in Table A3-60 Relevant to *In Situ* Peat Decomposition

Table A3-60 lists various emission factors associated with the full range of peat mining activities including biomass clearing, site drainage, peat stockpiling and product production, and rewetting and restoration. Only biomass clearing, site drainage (including ditches), and peat stockpiling are relevant to developing an estimate of potential *in situ* peat decomposition releases of GHGs with the project; these are highlighted in the table below. This is a "cradle-to-gate" estimate that does not account for GHG releases once the peat is marketed for various horticultural uses.

Derivation of Table A3-60 Emission Factors

The emission factors in Table A3-60 are based on research using the IPCC Tier 2 method in accordance with guidance from a combination of the 2006 IPCC Guidelines and the 2014 IPCC Wetlands Supplement (IPCC 2014). In general Table A3-60 relies on multiple studies for any given emission factor and the values provided are an average of these sources.

Treatment of Peat Stockpiles in Calculations

Harvested peat is typically stored in stockpiles prior to processing for market, which requires deriving an estimated surface area for the stockpiles to estimate GHG emissions. Assuming for any given year a maximum of 3,000,000 cubic feet of inventory placed in a typical peat pile measuring 31 m long, 15 m wide, and 4 m high, this would require 64 piles with a total surface area of 49,361 m^2. Relying on the stockpile emission factor in Table A3-60 results in an annual GHG contribution of 906 t CO_2/yr.

Emissions	=	Total Surface Area	X	Yearly Rate
	=	49,361 m^2	X	18,350 g CO_2 m^2/yr
	=	906 t CO_2/yr		

Reporting of Baseline Emissions

The EAW does not report likely baseline emissions from the undisturbed Wright Bog. Cleary et al. (2005) estimated undisturbed Canadian peatlands are net GHG sources based on CO_2 and CH_4 estimates in Gorham (2001). Assuming the Wright Bog is also a net GHG source prior to disturbance, then it is

estimated the proposed project area would produce 35.1 t (or 38.7 T) of CO_2 equivalents per year (prior to disturbance. This is negligible compared to estimated post-disturbance (i.e., mining) GHG emissions.

Table A3–60 Parameters and Emission Factors for Estimating Emissions from Peat Extraction

Emission Factor/Parameter	Unit	Value	Sources
Biomass Clearing			
Forest land biomass cleared	t C ha^{-1}	19.2	Hayne and Verbicki 2011
Other land biomass cleared	t C ha^{-1}	2.8	Hayne and Verbicki 2011
Drainage			
CO_2 from Drained Areas	t CO_2 ha^{-1} yr^{-1}	11.4	Moore et al. 2002 as cited in Cleary 2003; Glatzel et al. 2003; Waddington et al. 2010; Strack and Zuback 2013; Strack et al. 2014
CO_2 -DOC from Drained Areas	t CO_2 ha^{-1} yr^{-1}	0.60	Waddington et al., 2008; Strack and Zuback 2013
CH_4 from Drained Fields	t CH4 ha-1 yr^{-1}	0.008	Moore et al. 2002 as cited in Cleary 2003; Waddington and Day 2007; Strack and Zuback 2013; Strack et al., 2014
CH_4 from Drainage Ditches	t CH_4 ha^{-1} yr^{-1}	0.15	Waddington and Day 2007
N_2O from Drained Areas	t N_2O ha^{-1} yr^{-1}	0.001	IPCC 2014 Wetlands Supplement (Table 2.5, Default value for Boreal & Temperate climate zone)
CO_2 from Abandoned Block-Cut Areas	t CO_2 ha^{-1} yr^{-1}	"8.6"	Waddington and Price 2000; Waddington and Warner 2001; Waddington et al. 2002; McNeil and Waddington 2003
CH_4 from Abandoned Block-Cut Areas	t CH_4 ha^{-1} yr^{-1}	0.012	Waddington and Price 2000
CO_2 Tree Plantation Biomass Uptake	t CO_2 ha^{-1} yr^{-1}	-0.32	Garcia Bravo 2015
Peat Stockpiling & Product Production			
Amount of Stockpiled Peat	t C ha^{-1}	50	Cleary 2003
Exponential decay constant, Stockpiled Peat		0.05	Cleary 2003
Carbon Fraction of Peat Products	t C t air-dry $peat^{-1}$	0.26	Hayne et al. 2014
Rewetting & Restoration			
CO_2 from Restored Areas	t CO_2 ha^{-1} yr^{-1}	7.60	Moore et al. 2002 as cited in Cleary 2003; Petrone et al., 2001; Petrone et al., 2003; Waddington et al. 2010; Strack and Zuback 2013; Strack et al. 2014
CO_2-DOC from Restored Areas	t CO_2 ha^{-1} yr^{-1}	0.13	Waddington et al., 2008; Strack and Zuback 2013
CH_4 from Restored Fields	t CH_4 ha^{-1} yr^{-1}	0.03	Moore et al. 2002 as cited in Cleary 2003; Waddington and Day 2007; S track and Zuback 2013; Strack et al., 2014
CH_4 from Restored Ditches	t CH_4 ha^{-1} yr^{-1}	0.28	Waddington and Day 2007; Strack and Zuback 2013
N_2O from Restored Areas	t N_2O ha^{-1} yr^{-1}	N/A	IPCC 2014 Wetlands Supplement, Default assumption of no N_2O emissions from rewetted/restored areas

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ATTACHMENT 7: Wright Bog and Black Lake Bog Operation Timelines

Table 1. Model showing the operations timeline for Wright bog, MN and Black Lake bog, MN.

WRIGHT BOG

	Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Operations																															
Opening Phase 1																															
Harvest Phase 1																															
Opening Phase 2																															
Harvest Phase 2																															
Restoration work																															

BLACK LAKE BOG

	Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Operations																															
Harvest																															
Restoration work																															

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Table 2. Model showing an estimate of acreages destined to various types of operations through time.

	Phase 1			Phase 2			Opening	Undisturbed harvest area
Year	Harvested	Closed	Restored	Harvested	Closed	Restored		
0	0	0	0	0	0	0	0	255
1	0	0	0	0	0	0	100	155
2	100	0	0	0	0	0	50	105
3	150	0	0	0	0	0	25	80
4	175	0	0	0	0	0	25	55
5	200	0	0	0	0	0	12	43
6	212	0	0	0	0	0	0	43
7	212	0	0	0	0	0	0	43
8	212	0	0	0	0	0	0	43
9	212	0	0	0	0	0	0	43
10	212	0	0	0	0	0	33	10
11	187	25	0	33	0	0	10	0
12	162	25	25	43	0	0	0	0
13	137	25	50	43	0	0	0	0
14	112	25	75	43	0	0	0	0
15	87	25	100	43	0	0	0	0
16	87	0	125	43	0	0	0	0
17	87	0	125	43	0	0	0	0
18	87	0	125	43	0	0	0	0
19	87	0	125	43	0	0	0	0
20	87	0	125	43	0	0	0	0
21	87	0	125	43	0	0	0	0
22	87	0	125	43	0	0	0	0
23	62	25	125	43	0	0	0	0
24	25	37	150	43	0	0	0	0
25	0	25	187	43	0	0	0	0
26	0	0	212	0	43	0	0	0
27	0	0	212	0	20	23	0	0
28	0	0	212	0	0	43	0	0
29	0	0	212	0	0	43	0	0
30	0	0	212	0	0	43	0	0