

3.0 Wetland Inventory Results

This section presents the results of the wetland inventory and field assessment for each of the five properties owned by UMD in Duluth. The results include a summary of the wetlands on each property and individual wetland details. The individual wetland details include:

- wetland classification (topographic setting, Cowardin, Circular 39, and Eggers and Reed)
- wetland size and location,
- dominant wetland vegetation,
- general wetland quality, and
- wetland susceptibility to stormwater degradation.

For each property, four figures have been developed as follows:

1. the USFWS National Wetland Inventory (NWI) mapped wetlands,
2. the Duluth Area Wetland Inventory (DAWI) mapped wetlands,
3. UMD's wetland inventory results over an aerial photo, and
4. UMD's wetland inventory results over the UMD base map.

The three sources of wetland mapping mentioned above and shown on the figures illustrate different configurations of wetlands on campus properties. The NWI wetlands were developed from interpretation of 1978 large scale (1:80,000) black and white aerial photography and should be considered the least accurate of the three maps. The DAWI was compiled from 1997 small scale (1:24,000) color infrared aerial photography interpretation, which provided much more detail and definition to the wetland boundaries than the NWI. UMD's wetland inventory, as described in this report, was developed through photointerpretation of 1-meter (1:40) resolution orthorectified aerial photography, review of historic aerial photography, and on-the-ground survey of the campus properties, which has resulted in the most accuracy of the three wetland maps presented.

There are no MnDNR Public Water Inventory wetlands mapped within the UMD property boundaries, as shown on Figure 1.1. MnDNR Public Water Inventory waterways are mapped on Figure 1.1 and discussed below. Typical photographs of the following wetlands are provided in Appendix B.

3.1 Main (Upper) Campus Wetland Inventory Results

UMD's Main Campus is located northeast of Lake Superior, in the heart of Duluth (Figure 1.1). This property is bounded to the north by West Arrowhead Road, Carver Road and Woodland Avenue to the east, West College Street to the south, and Brainerd Avenue to the west. The site encompasses over 244 acres of campus property. West Saint Marie Street splits most of the developed campus from the 55 acres of wooded property on the northwest side of campus referred to as the Bagley Nature Area.

As shown on Figures 2.3 and 2.4, the Main Campus is split into two watersheds, with the northern portion draining to the West Branch of Tischer Creek, a designated trout stream and Public Water, which follows the northeast border of campus. The southern third of the Main Campus drains to Oregon Creek. According to UMD's Storm Water Pollution Prevention Plan, there are two wet sedimentation ponds on campus: Fire Hall Pond, which was constructed in 1979, and Eric Clarke Pond, which was originally dredged in 1965 (UMD SWPPP). Both of these ponds were re-dug in February 2002 to their original capacities (Larson 2006). Rock Pond, in the Bagley Nature Area, acts

as a third sedimentation pond, filtering direct runoff from an adjacent parking lot along with overland runoff from surrounding areas.

The following description of wetlands on the Main Campus starts at the southwest corner moving clockwise (north) around the campus. These wetlands are shown on Figures 2.1 through 2.4.

Fire Hall Pond Complex

As shown on Figures 2.3 and 2.4, there are three wetland habitats associated with the Fire Hall Pond on the southwest corner of the Main Campus: a Type 6 (PSS1B) shrub-carr wetland, a Type 5 (PUBHx) shallow, open water pond (Fire Hall Pond), and a Type 1 (PEM1A) seasonally flooded basin. The shallow, open water pond is the only wetland shown on the DAWI in this area, and there are no wetlands mapped on the NWI in this area. The water enters the shrub-carr wetland through a culvert under Junction Avenue, draining stormwater from areas along the west side of the Main Campus and the surrounding neighborhood. This stormwater flows through this shrub-carr wetland in a channel through the middle of the complex discharging to the Fire Hall Pond. Fire Hall Pond has a raised outlet at the southeast end that allows storage and settling of the sediments in the pond prior to overflow back into the storm sewer system. Overall, this wetland complex is rated medium to low quality based on its human disturbances and the high percentage of invasive species. Each individual wetland is ranked in the discussion below.

This wetland complex gets the majority of its water from the storm sewer system, although there were wetlands present in this area prior to the installation and expansion of the storm sewers in this area. This wetland complex can be viewed on aerial photography dating back to 1953, although the size has greatly increased over the years, likely due to the increase in capacity of the storm sewer system that outlets to this wetland. The pond was not present on earlier photography (dating back to 1939). According to UMD's Storm Water Pollution Prevention Plan, this marsh was built in 1979 as a wet sedimentation pond. The location of the pond is forested in aerial photographs from September of 1967, with significant clearing and a change in the shape of the wetland occurring by the next available aerial from 1972. The pond area appears as a fresh (wet) meadow in the 1979 aerial photo. A 1980 oblique photos show a temporary access road to the pond, and open water is visible in the pond. According to UMD records, the outlet structure of this pond was raised in 1979, which is the only documentation they have regarding creation of this pond (UM Drawing 17612). The seasonally flooded basin is not visible on aerial photography before 1972.

The shrub-carr wetland (Type 6, PSS1B) is a flow-through wetland approximately 0.45 acres in total, including 0.21 acres within UMD's property boundaries. This wetland type accounts for approximately 40 percent of the wetland complex and is of medium quality due to the degree of impacts to the wetland from stormwater runoff and the mixture of invasive species that were found including reed canary grass (*Phalaris arundinacea*), cattails (*Typha glauca*), and buckthorn (*Rhamnus cathartica*). The channel that bisects this wetland is approximately 4 feet wide across the bottom with a depth of approximately 2 feet to ordinary high water, and a typical water depth of approximately 6 inches (Larson 2006). According to UMD, the City of Duluth dredged this channel in 1996. There is obvious downcutting (downward erosion) occurring in this channel, with approximately 4 feet to the floodplain elevation from the bottom of the channel. This is likely the result of large surges of stormwater through the channel. Throughout this channel, there are large accumulations of sediment deposited from storm events washing through the storm sewer. There are no monitoring wells positioned near this wetland complex, but it appears that the water table is near the surface throughout this wetland.

Dominant vegetation in this wetland includes speckled alder (*Alnus rugosa*), various willow species (*Salix spp.*), and a variety of species in the understory such as Canada bluejoint grass (*Calamagrostis canadensis*), ostrich fern (*Matteuccia struthiopteris*), jewelweed (*Impatiens capensis*), and stinging nettle (*Urtica dioica*). Several small topographic low areas throughout this wetland have saturated soils near the surface dominated by cattails or a variety of wetland grasses. The typical water depth in this wetland varies from near the surface to several feet below the surface for most of the growing season. Occasional flooding of this entire wetland may occur during large surges from the storm sewer. Shrub-carr wetlands are highly susceptible wetland types for degradation from stormwater impacts (see Table 4). This wetland type can tolerate inundation from 6 to 12 inches for short periods of time. This shrub-carr wetland does not likely see inundation from stormwater on a regular basis, particularly since the channel that bisects this wetland carrying the stormwater is downcutting.

The Type 5 (PUBHx) shallow, open water wetland is an excavated pond that UMD uses as a sedimentation pond. This flow-through wetland is approximately 0.35 acres in size and is ringed by a stand of cattails around the perimeter (predominantly *Typha angustifolia*) varying from 5 to 15 feet in thickness. This pond is rated low quality due to its degree of human disturbance as a stormwater pond and its lack of native plants. The pond is surrounded by berms lining the north, east and south sides to keep water from discharging out of the pond. This pond has a raised outlet to the storm sewer system once water levels get to a set height. The storm sewer system eventually drains to Oregon Creek on the northeast side of campus. At the time of this survey (June 28, 2006), no water was draining into the storm sewer, which is highly unusual, according to UMD staff. The water level in the pond was approximately one foot below the elevation of this drain, approximately three feet below the elevation of the wetland/upland boundary. This wetland was created specifically to retain storm water, so degradation due to stormwater impacts is not a concern with this wetland. This wetland will likely be continually dredged every 15 to 20 years in the future to maintain enough volume for proper retention and treatment of stormwater.

The Type 1 (PEM1A) seasonally flooded basin is a 0.3 acre floodplain wetland located along the south side of the shrub-carr wetland, with only 0.06 acres of the wetland occurring on UMD property. This wetland is likely dry most of the year other than during spring snowmelt and extreme rainfall events. This wetland is approximately 3 feet higher than the shrub-carr wetland and appears to be partially mowed on a regular basis. Due to the human disturbance, this wetland is rated medium quality. Dominant vegetation in this wetland include goldenrod (*Solidago gigantea*), Kentucky bluegrass (*Poa pratensis*), and other various wetland grasses. This wetland is a topographic low that collects surface runoff from the surrounding area including the Fire Hall prior to discharge into the shrub-carr wetland. This wetland appears to have been altered over the years along with the modifications of the adjacent areas as described earlier. Seasonally flooded basins are exceptionally susceptible to degradation from stormwater, and inundation should be avoided (Table 4). This wetland does not receive any direct stormwater from the storm sewer; it only receives overland flow from surrounding areas. There is no evidence of degradation from stormwater in this wetland.

Rock Pond is a 2.16 acre Type 5 (PUBHx) shallow, open water wetland in the Bagley Nature Area. This flow-through pond is mapped on both the NWI and DAWI. There is a weir located along the north side of the pond that controls the water level in the pond. According to historical aerial photos and the Hidden History of Bagley Nature Area (Temple 1996), the pond was a constructed feature, although there was historically a wetland in this area. The predecessor wetland was described as a swamp by local residents in remembrance of the area (Temple 1996) and appears to have been a bog with a stream running through it on aerial photos dating 1939, 1953, and 1961. A contract was granted in 1968 to construct the Rock Pond, which was originally 1.3 acres in size (Temple 1996). It

appears to have changed little since its original construction with the exception of the surrounding trails and wetlands. In 19994, a pea rock filter was installed to pretreat parking lot drainage (LOTT-2 Drawings). In 2004, the pond was drained to remove invasive species and to install a new outlet (Larson 2006).

According to bathymetry provided by UMD's Facilities Management Department, the pond gets as deep as 9 feet, with the majority of the pond between 6 and 8 feet deep. The water level does not likely fluctuate much, controlled by the weir which allows water levels to be maintained or released to the Tischer Creek complex to the north. It appears that the only storm water contribution this pond receives is from natural springs, direct drainage off the adjacent parking lot (through the pea rock filter), and overland runoff from surrounding areas. No active storm sewer pipes discharging to this wetland were located during the site visit or on UMD plans. Dominant vegetation surrounding the wetland includes cattails, alder, common buckthorn, and elderberry. This wetland is of medium quality based on the degree of open water with native aquatic vegetation, although there are dominant invasive species (cattails and buckthorn) in the shallow marsh/shrub-carr fringe wetlands. Impacts from human disturbances are also apparent such as the path across a portion of the wetland and up to the edge of the pond in other areas.

Wetland 1 is a 0.14 acre Type 6 (PSS1B) shrub-carr wetland that receives surface runoff from the adjacent Rock Hill and possibly overflow from the Rock Pond. This appears to have been created by the construction of the trail system that surrounds this wetland sometime between 1972 and 1975. This wetland did not appear in aerial photos prior to 1972. There are no inlets and two outlet culverts that allow surface water discharge from Wetland 1 to the Tischer Creek complex to the north; therefore it is classified as a tributary wetland.

This wetland is likely at its wettest during snowmelt and heavy rains, possibly holding some standing water at that time. The dominant vegetation in Wetland 1 includes red-osier dogwood (*Cornus stolonifera*), speckled alder (*Alnus rugosa*), sensitive fern (*Onoclea sensibilis*), and jewelweed (*Impatiens capensis*). Shrub-carr wetlands are highly susceptible to degradation from stormwater impacts, but there are no direct stormwater discharges to this wetland at the time of the survey. This wetland ranks high for vegetative quality due to the diversity of native species and few human impacts.

West Branch Tischer Creek Complex

As shown on Figures 2.3 and 2.4, the West Branch of Tischer Creek complex includes a series of forested wetlands that consist of the West Branch of Tischer Creek, its floodplain, and associated wetlands. One branch of the West Branch of Tischer Creek begins at a City storm sewer outlet from Arrowhead Road in the Bagley Nature Area, northeast of the Rock Pond. The West Branch of Tischer Creek is a MnDNR designated Public Watercourse from this starting point to its confluence with Lake Superior. This branch develops in and flows through a 4.49 acre Type 7 (PFO1B) hardwood swamp prior to joining the main channel of the West Branch of Tischer Creek in the northeast corner of the Main Campus, making this a tributary wetland. Just before this confluence, a Type 1 (PFO1A) floodplain forest begins and continues along the channel on the northeast side of the Main Campus until it outlets to the main channel of Tischer Creek downstream from the easternmost portion of the Main Campus property. There is approximately 5.87 acres of floodplain forest within the boundaries of the property. The floodplain forest was not mapped or measured off UMD property.

There are no direct discharges of UMD storm water into the West Branch of Tischer Creek through the hardwood swamp, although there is a large City-owned storm sewer discharging in this area. Hardwood swamps are typically exceptionally susceptible to degradation from stormwater impacts, although this swamp does not appear affected (Table 4). This hardwood swamp is rated high for vegetative quality due to its lack of degradation from stormwater impacts, absence of non-native species, and diversity of vegetation. Once the floodplain forest starts, there are several direct stormwater discharge points from collection along Arrowhead Road. Floodplain forests are only moderately susceptible to degradation from stormwater discharges, tolerating inundation of 1 to 6 feet or more (Table 4).

Water levels fluctuate greatly throughout the floodplain forest, dependent mainly on the stormwater influx and beaver movement throughout the area. All of the stormwater generated from the upper two-thirds of the Main Campus and residences immediately adjacent to the Main Campus eventually flows into the West Branch of Tischer Creek, which accounts for over half of its watershed to this point in the channel. The West Branch of Tischer Creek varies in size from 5 to 10 feet wide with 5 to 15 foot high banks up to a 130 foot wide floodplain through this area. The floodplain forest has been rated medium quality overall, mainly due to its stormwater and human impacts (encroachment), with a degradation of integrity from north to southwest. The vegetation in the wetland is rated high quality due to the diversity and lack of non-native species. The dominant vegetation includes black willow (*Salix nigra*), green ash (*Fraxinus pennsylvanica*), willow (*Salix spp.*), alder (*Alnus rugosa*), and a variety of species in the understory such as Canada bluejoint grass (*Calamagrostis canadensis*), sensitive fern (*Onoclea sensibilis*), jewelweed (*Impatiens capensis*), and green bulrush (*Scirpus atrovirens*).

Wetland 2 is a 0.02 acre Type 4 (PUBHx) deep marsh that was excavated in 2005 to contain storm water runoff from UMD's materials storage area (UMD Project 511-03-1002). The water table is very close to the surface at this point on campus, and the water levels have been above the ground surface in this isolated wetland since it was dug (Larson 2006). According to aerial photos, this wetland was dug in an upland area for treatment and would not be considered a water of the state, subject to wetland regulations. There is no direct stormwater discharge from pipes to this wetland, just overland runoff and groundwater inputs. Sparse cattails were planted to surround the wetland and are the only vegetation observed in the wetland. The area surrounding the wetland has been mowed up to the cattails. This wetland is rated low quality due to its lack of vegetation and man-made features.

Wetland 3 is a 0.19 acre Type 6 (PSS1B) alder thicket wetland that receives local surface runoff from Marion Street, a residence east of the wetland, and lawn areas located south of the wetland. This wetland appears to be a natural wetland, but has a constructed ditch within the southern part. This wetland appears to be a remnant of a larger wetland that was present in the 1950s, but had diminished in size by 1988 based on a review of aerial photos. There is one inlet on the north side from Marion Street and one outlet culvert on the south side that allows surface water discharge from Wetland 3 to the West Branch of Tischer Creek to the south; therefore it is classified as a tributary wetland.

This wetland is likely at its wettest during snowmelt and after heavy rains, apparently holding some standing water at that time. The dominant vegetation in Wetland 3 includes speckled alder (*Alnus rugosa*), red-osier dogwood (*Cornus stolonifera*), willow (*Salix sp.*), sedges (*Carex sp.*), avens (*Geum sp.*), and tall thimbleweed (*Anemone virginiana*). Alder thicket wetlands are highly susceptible to degradation from stormwater impacts. This wetland ranks high for vegetative quality due to the diversity of native species and few invasive species. The overall quality of the wetland

ranks medium due to the constructed outlet, direct stormwater runoff into the wetland, and altered land uses around the wetland.

Wetland 4 is a 0.06 acre Type 7 (PFO1B) hardwood swamp that receives surface runoff from Marion Street and lawn areas located south of the wetland. This wetland appears to be a remnant of a larger natural wetland that had diminished in size by 1988 based on review of historic aerial photos. There are no inlets and no defined outlets from the wetland. If surface water gets deep enough in the wetland, it will overflow a low berm and discharge into Wetland 3, therefore it is classified as an isolated wetland.

This wetland is likely at its wettest during snowmelt and after heavy rains, apparently holding some standing water at that time. The dominant vegetation in Wetland 3 includes black ash (*Fraxinus nigra*), quaking aspen (*Populus tremuloides*), white willow (*Salix alba*), speckled alder (*Alnus rugosa*), tartarian honeysuckle (*Lonicera tatarica*), red-osier dogwood (*Cornus stolonifera*), and mountain maple (*Acer spicatum*). Black ash swamps are exceptionally susceptible to degradation from stormwater impacts. This wetland ranks medium for vegetative quality due to the presence of invasive species, including box elder (*Acer negundo*), tartarian honeysuckle, common buckthorn (*Rhamnus cathartica*) and lily-of-the-valley (*Convallaria majalis*). The overall quality of the wetland ranks medium due to the direct stormwater inputs into the wetland, an apparently diminished hydrologic regime, altered land uses around the wetland, and dumping of yard waste and refuse into the wetland.

Eric Clarke Complex

The Eric Clarke Complex consists of two wetland communities, a 1.9 acre Type 7 (PFO1B) hardwood swamp and a 0.25 acre Type 5 (PUBHx) deep marsh (the Eric Clarke Pond). The history of the pond is a little unclear. There was a ditch dug to this area in 1959, directing surface water drainage to this forested area. A forested wetland can be seen in this location as far back as 1961. On a 1965 postcard, the pond is still not shown, although it does appear to have been dug prior to oblique photographs taken September 1967.

The pond was dug, and the surrounding area was raised to restrict discharge from the pond. Stormwater enters this complex from storm sewer culverts along the southwest end of the hardwood swamp. This water is channeled through the neck of the flow-through hardwood swamp to the sedimentation pond (Eric Clarke Pond). Dominant vegetation in the hardwood forest includes green ash (*Fraxinus pennsylvanica*), speckled alder (*Alnus rugosa*), jewelweed (*Impatiens capensis*), sneezeweed (*Helenium autumnale*), and patches of bare ground. The vegetative quality of this wetland is high with the lack of dominant invasive species and little sign of degradation from stormwater. Hardwood swamps are exceptionally susceptible to degradation from stormwater impacts (Table 4). There is currently little sign of degradation in this wetland complex except the accumulation of sediment at the culvert leading into the forested wetland.

The Eric Clarke Pond includes approximately 60 percent open water, 20 percent water-lilies, and 20 percent emergent vegetation consisting mainly of cattails (*Typha angustifolia*, *Typha latifolia*, *Typha glauca*) and yellow irises (*Iris pseudacorus*). Common buckthorn (*Rhamnus cathartica*) lines the wetland border around the pond and hardwood forest. Due to the overwhelming dominance of invasive species and its human influence of stormwater degradation, this wetland community has been rated low quality. This is a flow-through wetland with a spillway controlling the water levels of the pond by the elevation of the spillway and outlet culvert. This pond is mapped on both the NWI and DAWI.

Another consulting firm performed a wetland delineation of this complex in June 2005 prior to permitting the relocation of Kirby Drive (UMD Project 588-03-1343, Labovitz School of Business, SEH Delineation). The pink delineation flags that were used to mark the delineated wetland boundary were located at the wetland/upland border and were used to confirm the wetland edge for this inventory.

At the time of the site visit, the water level in the pond was approximately 6 inches below the top of the spillway and was running underneath the spillway to the outlet. The ordinary high water level (OHW) appears to be just above the spillway. The wetland edge is approximately 2 feet above the OHW, and the adjacent road is approximately 5 feet above the OHW. This wetland complex receives the majority of its flow from direct stormwater discharge, mainly draining stormwater from the western side of the Main Campus property, south of West St. Marie Street. This sedimentation pond will likely be continually dredged every 15 to 20 years in the future to maintain enough volume for proper retention and treatment of stormwater.

3.2 Lower (Old) Campus Wetland Inventory Results

The Lower Campus is located three blocks southeast of the Main Campus in central Duluth, Minnesota (Figure 1.1). The Lower Campus, which was the original college campus site in Duluth, is bounded by East Fifth Street to the southeast, North 24th Avenue East to the northeast, East Kent Road to the north, Woodland Avenue to the west, and North 21st Avenue East to the southwest. This campus consists of 3.5 acres, broken into two separate sites consisting of one building on each parcel. The western building, the Research Laboratory Building, was constructed over Oregon Creek, which flows underneath the building through a large concrete culvert. Upstream of this building, Oregon Creek is confined to stone walls to the edge of the property line. Downstream of the culvert, the creek is confined to stone walls for approximately 30 feet. No wetlands are mapped on either the NWI or DAWI for this property.

Oregon Creek is a Type 90 (R2UBH) riverine wetland, which consists of approximately 0.04 acres of wetland on this property (Figures 2.3 and 2.4). The portions of Oregon Creek confined to stone walls (banks) and bed do not meet the criteria of a wetland, because they lack wetland soils and vegetation. Due to the human-armoring of the channel with concrete and rock, Oregon Creek may not fall under the jurisdiction of the WCA and/or the CWA. Oregon Creek is not listed as a Public Water, and the campus is located more than 2,000 feet from Lake Superior.

3.3 NRRI Wetland Inventory Results

The Natural Resources Research Institute (NRRI) is located on Highway 53, immediately south of the Duluth Airport in the west end of Duluth (Figure 1.1). The property is bounded by Highway 53 to the southwest, Airport Road to the west and north, a large wetland to the northeast, and private parcels to the east. The property consists of 7.6 acres. The NWI map shows a large shrub scrub-emergent wetland (PSS/EMB) within the northeast corner of the property. This wetland is also mapped on the DAWI as a large emergent wetland (PEM1B). Historic aerial photos were not available for this site. The NWI mapping was based on aerial photographs from the 1970s. During the site visit, two wetlands were identified within the property boundary: the wetland mapped on the NWI and DAWI, and a ditched wetland along the road. These wetlands are described in more detail below.

Wetland 1 is a 0.17 acre Type 6/3 (PSS1Fx/PEM1Cx) ditched shrub-carr/shallow marsh, located in the northeast corner of the property between Airport road and a gravel road and parking lot. The first 95 feet of this ditched wetland (0.04 acres) is a shallow marsh, followed by approximately 210 feet of shrub-carr wetland (0.13 acres). This wetland is approximately 0.17 acres within the property boundary, although the ditched wetland continues northeast along Airport Road outside of the property boundary to Miller Creek, a designated trout stream and a 303(d) water for temperature and biota. This wetland had previously been delineated by another consulting firm, and delineation flags were located at the wetland/upland border, which was used to map the wetland edge. This wetland is assumed to be constructed based on the size and shape of the wetland, general practice of adding ditches for drainage along roadways, and the fact that it wasn't mapped on either the NWI or DAWI. This ditch will likely be dredged in the future to maintain enough volume for retention and treatment of roadway drainage.

Both of these wetlands would be defined as flow-through wetlands by the Wetland Conservation Act. There is a storm sewer pipe that discharges into the shallow marsh, which is dominated by Canada bluejoint grass (*Calamagrostis canadensis*), redtop (*Agrostis gigantea*), and cattails (*Typha angustifolia*). The shrub-carr wetland, downslope, is dominated by willow (*Salix spp.*), speckled alder (*Alnus rugosa*), paper birch (*Betula papyrifera*), and Canada bluejoint grass. This ditched wetland has medium vegetative quality with few non-native plants and few native herbaceous species, although it has low integrity due to human and stormwater influences and its location in the landscape rating this a low quality wetland overall. However, a small portion of this wetland may have been connected to Wetland 2 at some point in the past. This ditched wetland has water averaging 2-3 feet deep, 20 feet wide, averaging 10 to 15 feet between the ordinary high water level and the adjacent roads.

Wetland 2, a Type 2 (PEM1B) fresh (wet) meadow, is located along the east corner of the parcel and matches the wetland shown on both the NWI and DAWI. This isolated wetland, as defined by WCA, is bordered to the north by a temporary gravel access road connecting the paved NRRI parking lot to a large new gravel parking lot immediately adjacent to the NRRI property line. This temporary access road and new parking lot is part of the City of Duluth's project to extend Cirrus Drive to Airport Road. The gravel parking lot extends along the east side of the wetland at the property line. This wetland consists of approximately 0.56 acres within UMD's property boundary, which is just a small portion of the overall wetland that extends off the property. This wetland had previously been delineated by another consulting firm, and delineation flags were found all along the wetland border during Barr's site visit. The wetland border for this inventory was mapped along these delineation flags within UMD's property. The wetland is assumed to be natural based on surrounding topography and development in the area.

The dominant vegetation only includes Canada bluejoint grass and redtop resulting in low wetland quality. This wetland collects stormwater runoff from the two surrounding parking lots and gravel road, but these areas are sloped to direct most of their drainage to Wetland 1. There are no storm sewer pipes discharging into this wetland, only overland flow. The water table is likely below the surface for much of the growing season, with water level fluctuations likely less than 6 inches during spring snowmelt and large rainfall events. The general direction of drainage through the wetland is to the south-southeast. Fresh (wet) meadows are typically highly susceptible to stormwater impacts, tolerating inundation between 6 to 12 inches for short periods of time. There are no major signs of degradation occurring in this wetland from storm water runoff.

3.4 Limnology Wetland Inventory Results

The Limnology property is located on the shore of Lake Superior in northeastern Duluth (Figure 1.1). This property is bounded by London Road to the northwest, Lake Superior to the southeast, Lester River to the northeast, and a City right-of-way to the west. This property includes 2.8 acres. There are no wetlands shown on this property on the NWI or the DAWI maps, and no wetlands were found on the property during the site visit on June 29, 2006. Lester River is designated by the MnDNR as a Public Water in their Public Waters Inventory, a designated trout stream, and a 303(d) water for turbidity and mercury.

3.5 Glensheen Wetland Inventory Results

The Glensheen Mansion property is located on the shore of Lake Superior in northeastern Duluth (Figure 1.1). This property is bounded by London Road to the northwest, Lake Superior to the southeast, and private parcels (residential) to the southwest and northeast. The property encompasses 10 acres, including two streams, and is broken into three watersheds. Tischer Creek, a designated trout stream and Public Water, runs along the west edge of the property and drains approximately 17 percent of the property including mostly undeveloped areas along the creek. Bent Brook runs down the middle of the property and has been lined from the top of its banks to the bottom of the channel with cemented rock. Bent Brook drains approximately 35 percent of the property, consisting of the main buildings in the center of the property. The remainder of the property including the carriage house, gift shop, parking area, and boat house; all drain into Lake Superior. Neither the NWI nor the DAWI show any wetlands mapped on this property. Two wetlands were found on the western edge of the property, as described below, during Barr's site visit.

Tischer Creek Complex

The Tischer Creek complex consists of Tischer Creek and its associated floodplain forest (Wetland 1). Tischer Creek is a Type 90 (R2UBH) riverine wetland, located on the western edge of the property, as shown on Figures 5.3 and 5.4. Tischer Creek, a designated trout stream and a MnDNR Public Water, enters the property from a large concrete culvert under London Road (Highway 61) and flows into Lake Superior at the southwest corner of the property. The wetland encompasses approximately 0.42 acres within UMD's property. The substrate is mainly large rock, cobbles, and gravels, with very little sedimentation evident from the extensive storm sewer systems that discharge into the creek upstream of this property. The water depth at ordinary high water level is approximately 1.5 to 2 feet deep, approximately a foot above what it was during Barr's site visit. Water level fluctuations appear quite extreme, as evident by erosion along the stone walls that line portions of the river and the overflow channel, varying as much as 4 feet above ordinary high water.

Wetland 1 is a Type 1 (PFO1A) floodplain forest associated with Tischer Creek, located on the western edge of the property as shown on Figures 5.3 and 5.4. This floodplain wetland is approximately 0.09 acres in size and is located on an island between the main channel and an overflow channel of Tischer Creek.

Dominant vegetation includes green ash (*Fraxinus pennsylvanica*), white spruce (*Picea glauca*) (all dead), ostrich fern (*Matteuccia struthiopteris*), and jewelweed (*Impatiens capensis*). This wetland is rated high quality due to its lack of significant invasive species, its native herbaceous species, and its lack of human disturbance. This natural wetland had no standing water at the time of the site visit, although it likely floods during peak runoff events when storm water runs through the overflow channel, which is less than a foot below the elevation of the floodplain forest. Water levels are likely

below the surface for much of the year, although water may collect in the topographic depressions on the island. Floodplain forests are moderately susceptible to degradation from storm water impacts, but they can tolerate annual inundation of 1 to 6 feet, possibly more than once per year (Table 4).

Bent Brook also bisects the Glensheen property. Although this stream has all the characteristics of a Type 90 (R1UBH) riverine wetland prior to entering the Glensheen property, the characteristics of the former wetland system were eliminated when the channel was lined with cemented rock (bed and banks). This brook lacks two of the three required characteristics of a wetland: wetland soils (now concrete) and wetland vegetation (absent due to the concrete lining). Therefore, Bent Brook may not fall under the jurisdiction of the WCA and/or the CWA.

3.6 Research and Field Studies Center Wetland Inventory Results

The Research and Field Studies Center (RFSC), commonly referred to as the Farm, is located in rural Duluth, northeast of the urbanized center (Figure 1.1). The RFSC is bounded by Jean Duluth Road to the east, the East Branch of Amity Creek to the south, a snowmobile trail to the west, and Riley Road and a snowmobile trail to the north (Figure 6.1). The property encompasses approximately 116.7 acres, with general drainage from north to south to the East Branch of Amity Creek. The U.S. Geological Survey 7.5 minute Duluth quadrangle shows 3 streams crossing the property (Figure 6.4). The NWI shows two wetlands (PFO/SSC and PFOB) along the south border of the property (Figure 6.1). The DAWI shows three wetlands (PSS1B, PFO1B, and PFO1B) along the south border of the property (Figure 6.2). During the site visit, six wetlands and one wetland complex along Amity Creek were identified on the property, which are described below and are shown on Figures 6.3 and 6.4.

East Branch of Amity Creek Complex

There is an approximately 6.5 acre contiguous wetland complex bordering the East Branch of Amity Creek along the southern property boundary. The north bank of the creek defines much of the southern property boundary; therefore, a portion of the wetlands that were mapped, are outside the property. Approximately 4.67 acres are within UMD's property boundaries, including 1.59 acres of Type 1 (PFO1A) floodplain forest, 2.07 acres of Type 7/6 (PFO1/SS1B) hardwood/shrub-carr wetlands, and 1.01 acres of Type 90 (R3UBH) riverine wetland (Amity Creek). The East Branch of Amity Creek is a MnDNR designated Public Water, a designated trout stream, and a 303(d) water for turbidity.

These wetlands are fed by groundwater and surface water, supplied by Amity Creek. The only contribution storm water presents to this complex is through overland runoff from rainfall and snowmelt. No storm sewer pipes were identified during Barr's site visit or on the UMD site plans. Water depths in the creek ranged from a few inches to 2 feet, with small fry viewed in side pools in the river. No surface water was present in the floodplain forest or the wooded/shrub swamp during the site visit. The wooded/shrub swamp is located along a hillslope and appears partially spring-fed. The creek and floodplain forest are located in a ravine approximately 15 to 20 feet below the remainder of the farm property. The water level in the creek at the time of the survey was approximately 6 inches below the OHW in the channel. There was approximately 2 to 4 feet between the OHW and the floodplain elevation. Generally, hardwood swamps are exceptionally susceptible to degradation due to stormwater impacts, while shrub-carr wetlands are highly susceptible, and floodplain forests are moderately susceptible (Table 4). As mentioned, there appears to be little danger of degradation to this wetland complex due to stormwater impacts at the present time. This

wetland complex has high vegetative quality due to its abundance of native species and lack of human influence and dominant invasive species cover.

Wetland 1 is a 0.84 acre Type 2 (PEM1B) sedge meadow located in a topographic low in a previously farmed area along what the quadrangle map shows as an intermittent waterway, and is mapped by the MnDNR as a designated trout stream and Public Water. There appears to be an intermittent swale present on the aerial photos in the location of this intermittent waterway, although no defined stream (bed and banks) was found connecting this wetland to Amity Creek, which is approximately 23 feet below the wetland. There is little change in vegetation between Wetland 1 and Amity Creek to define a swale, although the drainage generally slopes through this area.

Wetland 1 is an isolated wetland, with several sedge species (*Carex spp.*) and reed canary grass (*Phalaris arundinacea*) dominating the vegetative community. This wetland is saturated, with water at or near the surface for extended periods of time throughout the growing season, and occasionally with a few inches of standing water. The only stormwater contribution to this wetland is overland runoff, although it would be sufficiently buffered by the thick vegetation surrounding the wetland. Sedge meadows are exceptionally susceptible to degradation from stormwater impacts. This wetland has medium diversity and quality with a mixture of native sedges and non-native grasses in a previously farmed area.

Wetlands 2 through 6 are a series of excavated holes that appear to have developed wetland characteristics. These holes have been excavated in an upland area to various depths, which has dictated their water regime. Two of these wetlands, Wetlands 2 and 5, have developed into Type 3 (PEM1Fx) shallow marshes totaling less than 0.01 acres. Wetlands 3, 4, and 6 are Type 4 (PUBFx) deep marshes totaling less than 0.03 acres together. The water level in these isolated wetlands appears to be controlled by groundwater, with very little contribution from overland flow. The water level is at the same elevation in each pond. These wetlands are obviously constructed, with spoil piles adjacent to each one. Duckweed covers the two deep marshes with cattails (*Typha spp.*) and willow (*Salix spp.*) around the edges. Cattails are dominant in the shallow marshes with Canada bluejoint grass and young willow lining the outer boundaries. These wetlands are rated low quality due to their artificial nature, human influence, and invasive species.

There was no sign of the second intermittent stream that is shown on the quadrangle map, which is also mapped by the MnDNR as a designated trout stream and Public Water (see Figure 6.4). This area was traversed with no sign of bed, banks, or sloughs connecting to Amity Creek. There is a faint outline of a drainageway visible on the aerial photo (dated Summer 2003) in Figure 6.3, but nothing was found in the field. An intermittent stream was found approximately 150 feet from the Creek, but it did not extend across the farm property as mapped on Figure 6.4. This short section of intermittent stream was mapped as part of the Amity Creek complex southeast of Wetland 6, as shown on Figure 6.4. According to UMD records, old farm drawings of the property show extensive tile drain systems networking across the farm fields of this property (Larson 2006).