	Score:	80-100	60-80	40-60	20-40	0-20	
HYDROLOGY HEALTH INDEX:	**Description:**	**Least Impacted**		**Moderately Impacted**		**Heavily Impacted**	**DATA USED**
Perennial Cover	The amount of perennial cover remaining on the landscape compared to pre-settlement cover	80-100% perennial cover remains	60-80%	40-60% perennial cover remains	20-40%	0-20% perennial cover remains	• Marschner Circa 1890's Landcover; (MN DNR Forestry 1994) • National Land Cover Dataset (2001)
Flow Variability	Degree of deviation from expected flow patterns based on historic stream gage records and Indicators of Hydrologic Alteration	0-20% deviation from expected patterns	20-40% deviation	40-60% deviation from expected patterns	60-80%	80-100% deviation from expected patterns	• USGS Stream gage network -30 year period of record; • 5 flow pattern indicators based on the Indicators of Hydrologic Alteration http://conserveonline.org/workspaces/iha
Water Withdrawal	The total permitted water use (millions/gals/year) from all surface and groundwater sources plus estimate of water use from domestic wells	66-69000(mgy) permitted water use and domestic well use		200,000 - 265,000(mgy) permitted water use and domestic well use		536,600(mgy) permitted water use plus domestic well use estimate	• State Water Use Database (MN DNR 2009) permitted volume of use (excluding once-through power generation); • MN County Well Inventory (2007)
Impervious Cover	% of catchments within a watershed that have greater than 4% impervious surface. (Score is the inverse of the percentage)	0-20% of catchments have 4% or greater impervious surface	20-40%	40-60% of catchments have 4% or greater impervious surface	60-80%	80-100% of catchments have 4% or greater impervious surface	• Impervious Cover Satellite Data; (U of MN 2000) • MN DNR Watersheds, Level 08 - All Catchments (2009)
Loss of Hydrologic Storage	Mean of two inputs: 1. Ratio of stream miles to ditch miles (in-channel storage) 0 = all ditch, 100 = all stream 2. % remaining surface water (includes hydric soils as historic wetland indicator) 0 = no surface features remain, 100 = all surface features remain	100-80 % hydrologic storage remains; almost no ditching and almost all surface water features still remain on the landscape	60-80%	40-60% of storage remains. Around half of the streams are ditched, and /or half of the surface water storage remains.	20-40	8-20% hydrologic storage remains. Most streams are ditched and very little surface water storage remains on the landscape	Stream/Ditch ratio: • 1:24,000 Streams (MN DNR 2001) Surface storage (Historic): • Restorable Wetland Inventory (1992) • Ssurgo Hydric Soils (NRCS 2009) • Marschner Circa 1890's Land Cover (MN DNR Forestry 1994) Surface Storage (Current): • National Wetland Inventory • Lakes database (MN DNR)
HYDROLOGY MEAN SCORE:	Mean of 5 hydrologic health index values	100 -80	60-80	40-60	20-40	0-20	

	Score:	80-100	60-80	40-60	20-40	0-20	
GEOMORPHLOGY HEALTH INDEX	**Description:**	**Least Vulnerable**		**Moderately Vulnerable**		**Most Vulnerable**	
Soil Erosion Potential	Mean erodibility of soils weighted by slope (K value * slope factor)	100= No erodible soils		Much of watershed has erodible soil on slopes		50% or more of watershed has erodible soils on slopes.	• Ssurgo Soils Database - K (erodibility) value • Statsgo Soils Database • 10 Meter Digital Elevation Model (DEM)
Ground water Contamination Susceptibility	Area weighted mean of the Groundwater Contamination risk value assigned in 1978 PCA/DNR assessment	Least vulnerable ranking		Moderate vulnerability ranking		Most vulnerable ranking	• Groundwater Contamination Susceptibility model (Portscher etal. MPCA, MN DNR, 1989) groundwater contamination susceptibility report
Climate Vulnerability	Mean value of Precipitation and Evapotranspiration ratio	80-100 0-1.5" annual deficit or excess in balance of precipitation & transpiration	60-80 1.5-3"	40-60 3-4.5" annual deficit or excess in balance of precipitation & transpiration	20-40 4.5-6"	0-20 6-7"annual deficit or excess in balance of precipitation & transpiration	• Precipitation - Evapotranspiration 30 year trend data (MN Climatology 1961-1990)
GEOMORPHOLOGY MEAN SCORE:	Mean of 3 geomorphology index values	80-100	60-80	40-60	20-40	0-20	

	Score:	80-100	60-80	40-60	20-40	0-20	
BIOLOGY HEALTH INDEX:	**Description:**	**Least Impacted**		**Moderately Impacted**		**Heavily Impacted**	
Terrestrial Habitat Quality	% of terrestrial landscape in wetland, forest or grassland habitat cover, weighted by mean habitat quality value for the watershed (1-9 value range)	80-100 Much habitat cover with high quality ranking	60-80	40-60 Median amount of and quality of habitat cover	20-40	0-20 Small amount of fragmented habitat cover with low quality rank	Model of Terrestrial Habitat Quality • National Land Cover Dataset(2001) • MN County Biological Survey - Biodiversity Significance; (2009) • Roads (MN DOT, 2010) • National Agricultural Statistics Service (2008); NASS Data Service
Stream Species Quality	Mean of 1. mean observed and expected (o/e) fish species ratio 2. o/e aquatic invertebrate species ratio. 3. live/live and dead shell records of mussel species	80-100 % of sites within 1 SD of expected number of species present	60-80	40-60 of sites within 1 SD of expected number of species present	20-40	0-20 of sites within 1 SD of expected number of species present	• IBI Stream Survey Database (MPCA, 1996-2006) • Mussel Survey Database (MN DNR, 1989-2010)
Species Richness	Mean of: 1. mean species count of breeding birds, ranked 0-100 2. mean species counts of mussels, ranked 0-100 3. mean fish species counts, ranked 0-100 4. mean aquatic invertebrate species counts, ranked 0-100	80-100 100 = highest mean number of species present in a watershed	60-80	40-60 Median number of species present	20-40	0-20 0 = Lowest mean number of species present in a watershed.	• Breeding Bird Survey results (1995 - 2008) • Mussel Survey Database (MN DNR, 1989-2008) • IBI Stream Survey database (MPCA 1996 -2006)
At Risk Species Richness	Mean of: 1. mean count of SGCN breeding bird species 2. mean species count of SGCN mussels, 3. mean species count of SGCN fish (no aquatic invertebrates on SGCN list at this time.)	80-100 100 = highest number of SGCN species present	60-80	40-60 Median number of SGCN species present	20-40	0-20 0 = Lowest number of SGCN species present.	• Listed Species of Greatest Conservation Need (MN DNR Wildlife Conservation Strategy 2006) • Breeding Bird survey results (1978-2008) • MN DNR Mussel Survey Database (1989-2008) • MPCA IBI Stream Survey database (1996 -2006)
BIOLOGY MEAN SCORE:	Mean of 4 biology index values	80-100	60-80	40-60	20-40	0-20	

	Score:	80-100	60-80	40-60	20-40	0-20	
CONNECTIVITY HEALTH INDEX:	**Description:**	**Least Impacted**		**Moderately Impacted**		**Heavily Impacted**	
Terrestrial Habitat Connectivity	Area of potential connections between habitat patches weighted by the "permeability" of the land use between the patches based on computer modeling.	100 - all large patch of continuous very high quality habitat	60-80 Large amount of high quality connected habitat	40-60 Average amount and quality habitat with some connections	20-40 Low quality habitat with some connec-tions	0 - low quality isolated habitat	• 2001 National Land Cover Dataset; • MN County Biological Survey - Areas of Biodiversity Significance; • Roads • National Agricultural Statistics Service (2007); • Terrestrial Habitat Quality Index results
Aquatic Disruption	Number of dams, bridges and culverts per total miles of stream	100 - no structures disrupting the aquatic system	60-80	40-60 The median count of structures/miles of stream	20-40	0-20 = most structures/ total miles of stream	• National Dam Inventory (COE, 2008) • MDOT Bridge and Culvert Inventory • 1:24,000 Streams (MN DNR, 2009)
Riparian Connectivity	Amount of riparian area with development or agricultural cropland (within 200 meters of perennial streams and ditches or in FEMA Floodplain)	0-20% of riparian land in developed or ag cropland use	20-40%	40-60% of riparian land in developed or ag cropland use.	60-80%	80 -100% of riparian land in developed or ag cropland use.	• National Land Cover Data; Developed land classes (2001) • National Agricultural Statistics Service; Row Crop Classes (2007) • 200 M Buffer of 1:24,000 Streams (MN DNR, 2009) • Floodplain (Federal Emergency Management Agency, ongoing)
CONNECTIVITY MEAN SCORE:	Mean of three connectivity index scores	80-100	60-80	40-60	21-40	0-20	

	Score:	80-100	60-80	40-60	20-40	0-20	
WATER QUALITY HEALTH INDEX:	**Description:**	**Least Vulnerable**		**Moderately Vulnerable**		**Highly Vulnerable**	
Point Sources	Mean of: 1. Superfund sites per watershed area; ranked 0-100 2. Potential Contaminant sites per ws area; ranked 0-100 3. Feedlots per ws area; ranked 0-100 4. Open pit mines per ws area; ranked 0-100 5. Discharge permits per ws area; ranked 0-100	Fewest number of potential pollution sources per watershed area (7 point sources)		Moderate number of potential pollution sources per watershed area.		Highest number of potential pollution sources per watershed area. (2100 point Sources)	• Potential Contaminant Sites from Master Entity System, (MPCA, July, 2008) • MN County Feedlot Inventory (Nov. 2010) • Mines of Minnesota (MN DNR Lands and Minerals; 2008) • Water Discharge Permits (MPCA, January, 2009)
Non-Point Sources	Combined value based on: 1. Percent of 200 m riparian area in impervious surface 2. rate of application of agricultural chemicals per acre	Least non-point source risk		Moderate non-point source risk		Highest non-point source risk	• Impervious Cover Satellite Data (U of MN 2000) • National Agricultural Statistics Service, county chemical and nutrient application rates resampled to watershed boundary. (2007)
Water Quality Assessments	Percentage of streams and lakes assessed that were found to be impaired. (Same water body may be assessed multiple times for different impairment types.)	0-20% of water body assessments found impairments	20-40%	40-60% of water body assessments found impairments	60-80%	80-100% of water body assessments found impairments	• TMDL WQ Assessment Database, selected 5C? impairment or higher (MPCA, July 2009)
WATER QUALITY MEAN SCORE:	Mean of three WQ index scores	80-100	60-80	40-60	20-40	0-20	

This table shows the process for calculating the watershed health indices for Minnesota's major (HUC 8) watersheds for use in creating the Watershed Health Assessments. Using either actual or theoretical minimum and maximum values, the range of results for all indices are scaled from 0-100. An equal interval approach was applied to the scaled results to create a score. The color codes above indicate the relationship between the calculated results and the score used in reporting the results.