

Table 1. Inventory of Iowa NPDES permitted constructed wetlands for wastewater treatment conducted in 2000-2001.

Wetland	Startup Year	Location	Wastewater System	Type of Wetland	Number of Cells and Dimensions	Depth and Type of Media	Liner	Design and Actual Flow System (mgd)	Flow/Ac (gal/Ac)	Final Discharge
Agency STP Pop. 616	1994	Wapello County, Southeast IA	2 aerated lagoons, 1 non-aerated lagoon, continuous flow	Surface Flow; open	1Cell- 3.5 Acre	Native soil	Native soil	0.06 design, 0.03 actual	Design flow/Acre 0.017	Cedar Creek
Blencoe STP Pop. 250	1998	Monona County, West Central IA	2 facultative lagoons, winter storage	Surface Flow; open and vegetated	2 Cells- 1.84 Acre, 40,075 ft ²	6" Native soil	Native soils	0.03 actual (No discharge out of wetlands during summer of 2000)	0.016	McNeil ditch to Monona Harrison River
Buchanan County Fontana Campground Seasonal	1998	Buchanan County, Northeast IA	Septic Tank effluent from bathhouse and dump station, 6 mouths	Subsurface Flow	1 Cell- 0.07 Acre, 3000ft ²	12" Washed pea gravel, 12" mulch on top	Synthetic (45 ml)	0.001 design	0.014	Natural Wetland then to Otter Creek
Burr Oak STP Less than 100 pop.	1993	Winneshiek County, Northeast IA	20,000 gal septic tank to two sand filters to wetland	Subsurface Flow	1 Cell- 0.24Acre, 250ftx41ft	11" Gravel	On-site clay	0.018 actual	0.075	Silver Creek
Chelsea STP Pop. 336	1990	Tama County, East Central IA	2 aerated lagoons, continuous flow	Surface Flow; open and vegetated	2 Cells- 0.26 Acre, Each 155 ft x 37 ft	18" Native soil	Unlined	0.043 design, 0.022 actual	0.16	Unnamed tributary to Otter Creek
Dows STP Pop. 660	1991	Wright County, Central IA	1° and 2° aerated lagoons, continuous flow	Surface Flow; open and vegetated	1Cell- 2.3 Acres, 100,188 ft ²	Native soil	Native soils	1.09 design, 0.105 actual	0.47	Iowa River
Four Oaks group Home, Bertram (System just approved)	2001	Linn County, Eastern IA	2 septic tanks, 1 collector tank, 1 dosing tank to 4 Multi-Flo units	Subsurface Flow	2 Cells-0.03 Acre, each 600 ft ²	Under construction	Under Construction	0.006 design		
Granger STP Pop. 624	1986	Dallas County, Central IA	1° and 2° aerated lagoons, continuous flow	Surface Flow; vegetated	2 Cells- 3.6 Acres, Each 156,816 ft	Native sand and silty clay soils, alluvial	Unlined	0.420 design, 0.125 actual	0.58	Beaver Creek
IAMU Variable pop.	1999	Polk County, Central IA	Septic tank effluent from training complex	Subsurface Flow	1 Cell (kidney- shaped)- 0.15 Acre, 49 ft x 139 ft x 44 ft x 128 ft	18" of 1" Crushed gravel overlain by 6" pea gravel	Bentonite	0.003 design, .000133 actual	0.02	Carney Marsh to Four Mile Creek
Iowa City STP Pop. 60,148 (Research study on performance of wetland species)	1998-99	Johnson County, Eastern IA	Activated sludge plant, post chlorinated effluent to wetland	Surface Flow; vegetated, treated only a portion of plant flow for study	4 Cells (rectan- gular)- 0.55 Acre, 20 ft x 300 ft each, 2 ft open water spacing between each vegetated sub-cell	Native soil	Unlined	0.029 actual	0.52	Iowa River

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Lake Park STP Pop. 996	1997	Dickinson County, Northwest IA	1 ^o to 2 ^o facultative lagoons, winter storage	Surface Flow; open and vegetated	1 Cell (L-shaped, with windy flow)- 9 Acres, 392, 040 ft ²	18" Native soil, Webster, Clarion, Nicollet	Bentonite	0.125 design, 0.11 actual	Design flow/Acre 0.014	West Fork Little Sioux River
Lake Vista Motel (Out of business as of 1998)	1997	Lucas County, Southern IA	2,000 gallon septic tank	Subsurface Flow, vegetated and surface flow, open	1 Subsurface Flow Cell 25'x125' followed by 3 Surface Flow Cells, 0.88 Acre, 35ftx250ft, 30ftx450ft, 40ftx320ft	6" of 3/8" Gravel with a underlay of 18" of 3/4" gravel	Unlined, native clay soils	0.002 design	0.002	Lake Ellis
Laurel STP Pop. 581 (Combined with Haverhill and Ferguson)	1991	Marshall County, Central IA	2 aerated lagoons in series, continuous flow	Surface Flow; vegetated	2 Cells (parallel)- 0.6 Acre each, 88 ft x 308 ft	Native soils	Unlined, drainage tile	0.074 design, 0.013 actual	0.06	2 Unnamed drainage ditches to Snipe Creek to Lates Creek to South Timber Creek
LeGrand STP Pop. 854	1992	Tama County, Northeast IA	2 facultative lagoons, continuous flow	Surface Flow; open and vegetated	2 Cells (with windy flow, dikes)- 10 Acres total	Native silty to clayey soil	Native soils	0.315 design, 0.18 actual	0.032	Iowa River
Maharishi Resort Variable pop.	1993	Jefferson County, Southeast IA	SBR, continuous flow	Surface Flow; open	1 Cell- 0.23 Acre, 95 ft x 110 ft	Unknown	Unknown	0.02 design, 0.011 actual	0.09	Unnamed Creek
Norwalk STP (No longer used replaced by Biolac)	1988	Warren County, South Central IA	1 ^o to 2 ^o facultative lagoons	Surface Flow; open	2 Cells- 14.4 Acres each, 627, 264 ft ²	Native soil, 7.75 ft water depth	Unlined	0.4 design, 0.300 actual	0.03	North River Drainage Swale
Norway STP Pop. 583	1992	Benton County, Eastern IA	2 aerated lagoons, continuous flow	Surface Flow; vegetated with open areas	3 Cells- Approx. 2 Acres, 86,400 ft ²	Native soil	Lined with native soil	0.05 actual, 0.0622 actual	0.03	Mud Creek
Riverside STP Pop. 928	1981	Washington County, Eastern IA	1 facultative 3- cell lagoon	Non-engineered surface flow	Diked natural wetland	Native soil	Non-engineered	Non-engineered	N/A	English River
Springbrook State Park (System over designed)	2000	Guthrie County, Central IA	2 aerated lagoons, system being redesigned	Surface Flow;	2 Cells- 0.28 Acre, 50 ft x 120 ft	Unknown	Unknown	0.005 design (No discharge to wetland yet)	0.018	Raccoon River
Neil Smith Wildlife Refuge Variable	1997	Jasper County, Central IA	Septic tank effluent from visitors center	Subsurface Flow	3 Cells (load and rest cells)- 0.37 Acre, 180 ft x 30 ft, 5400 ft ²	12" Pea gravel	Synthetic- 30 ml, rock riprap along berm	0.013 design	0.035	Walnut Creek

Table 2. Vegetation, maintenance and special management of Iowa constructed wetlands for wastewater treatment.

Wetland	Types of Vegetation	Condition of Vegetation	Spring/Summer Maintenance	Fall/Winter Maintenance	Special Management	Comments
Agency STP	Cattail, bulrush, duckweed	Along edges, duckweed covers surface	Mowing	None	None	None
Blencoe STP	Cattail and bulrush	Cell 1 thick stand, Cell 2 sparse vegetation	Maintain 9" water level, mowing berm, muskrat control; high ET	Maintain 6" water level no discharge, control muskrats	Water level management, lost vegetation in one cell in summer due to dry weather conditions	Pleased with wetland. Have geese, ducks, cranes, herons, turtles, frogs, minnows, deer, and mink.
Buchanan County Fontana Campground	Cattail, smartweed, jewelweed, aster, goldenrod, catnip, butterfly weed, pokeweed, daisy fleabane, cord grass	Thick and lush prairie and wetland species, jewelweed	Trim out cottonwood and willow trees, some weeds	Steel trimmer used in fall after frost	During startup used compost as mulch, collected plants locally and from Ion Exchange	Pleased with wetland system. They use it for educational purposes at the nature center.
Burr Oak STP	Cattail	Thick stand of vegetation	Trim out willows	None	None	Very happy with the system, low maintenance. They think that the sand filter that precedes the wetland does most of the final polishing of effluent.
Chelsea STP	Cattail	Sparse stand of cattail	Trap muskrats	Trap muskrats and remove cattails above water line	None	Dissatisfied with wetland due to difficulties in establishing cattails.
Dows STP	Cattail	Thick stand	None	None	None	None
Granger STP	Cattail and bulrush	Thick and lush with some pond areas	Must add water during drought, trim out tree seedlings, and remove snapping turtles.	Mow plants and burn, trap animals such as muskrats.	Reseeded cattail during startup and first 5 to 7 years trimmed out tree seedlings. Cleaned plant/algal growth out of discharge pit	Have geese, sandhill cranes, coots, turtles, snakes and an assortment of small birds. Suggests riprap around wetland berms.
IAMU	Cattail, bulrush, iris, sedge, prairie flowers	Young stand, sparse in some areas	Trim grass and prairie vegetation around berm	None	Mow and use plant mulch	Songbirds are attracted to wetland. Satisfied with system.
Iowa City	Cattail, bulrush, sweet flag, iris, cord grass, arrow head, invasion of duckweed	Thick stand after established	Trap muskrats, remove weeds and tree saplings, berm washed-out in rain	Water level management, increase to 2 ft	Berm management, groundwater monitoring wells, deer eat bulrush, hire summer help to weed by hand	Wetlands have attracted birds, frogs, and deer. Like the wildlife benefits, not sure about large land requirements for wetlands for their treatment needs as it requires more management.

Table 2 continued. Vegetation, maintenance and special management of Iowa constructed wetlands for wastewater treatment.

Wetland	Types of Vegetation	Condition of Vegetation	Spring/Summer Maintenance	Fall/Winter Maintenance	Special Management	Comments
Lake Park STP	Cattail	Areas of thick cattail and open water areas	Flock of sheep graze grassy areas, some spraying of weeds, trap muskrats. Trim out tree saplings, turtle removal	None	Water level management	Happy with the performance of the system. Have some pipe jetting and concerns with wind blown cattail seed and odors.
Lake Vista Motel (Out of business as of 1998)	Cattail	Unknown	Unknown	Unknown	Unknown	Unknown
Laurel STP	Cattail	Thick stand of cattail	Trim out cottonwoods, willows, mow grassy areas, lower water level in spring; summer high ET	Raise water level to 24" depth	Unique design with drainage system beneath the wetland, have badger holes and mink	Very pleased with technology, excellent finishing area. Their system could use more acres of wetlands to increase the detention time.
LeGrand STP	Cattail	Pockets of open water, 70% vegetative cover	Tree seedlings, muskrat trapping	None, wetlands used for winter storage	None	No comments.
Maharishi Resort	Lemna (duckweed)	Open water, some vegetation	None	None	None	Satisfied, considering expansion. No way to control flow or water level in wetland.
Norwalk STP	Mostly cattail	Thick vegetation	Mow around edges	Maintain 18" water level in Cell 1, 8-10" in Cell 2, Feb-Mar hold water in wetland	Managed water levels in winter, trap muskrats	No longer use wetland, have Biolac system. Turtles, snakes, frogs, geese, ducks, heron, crane.
Norway STP	Cattail	Unknown	Unknown	Unknown	Unknown	Unknown
Neil Smith Wildlife Refuge	Variable between cells, patches of cattails, smartweed, prairie plants, bulrush, slough grass, sedges, and some weeds	Sparse in some areas depending on cell loading, some biomass buildup on surface of gravel	Biomass management on gravel surface, clear biological growth from flow meter	None	None	Weed management is needed around cells. They should discontinue discharge of paint waste to septic tank and manage water levels to maintain vegetation in cells. Operator suggested aerator in septic tank.
Riverside STP	Mixed	Unknown	None	None	None	None

Table 3. Construction information and operating costs for Iowa constructed wetlands and associated treatment systems.

Wetland	Engineering Firm	Construction Contractor	Construction Costs	Costs for Alternatives	Annual Wetland Operating Costs	Annual Treatment System Operating Costs
Agency STP	Garden & Associates, LTD Oskaloosa, IA	Sammons Construction	\$30,000	Not available	Not available	Not available
Blencoe STP	Dewild, Grant, Rickert and Associates, Co. Rock Rapids, IA	Nelson and Rock Co. Onawa, IA	Not available	Not available	Operator 20 hrs/mo.	Lagoons 80 hrs/mo
Buchanan County Fontana Campground	North American Wetland Engineer Forest Lake, MN	Local construction company	\$19,000 for wetland and septic tank, \$32,500 for wetland, RV dump, piping, boardwalk and dosing chamber	No alternatives considered, wanted wetland because outdoor education facility	None	None
Burr Oak STP	Erdman Engineering, P.C. Decorah, IA	Local construction company	\$ 38,000 for wetland, \$637,436 for entire septic tank, sand filter, wetland system	Aerated 3-cell lagoon was \$222,200	Minimal	Minimal
Chelsea STP	Van Winkle-Jacob Engineering Coralville, IA	Shiplely Construction	\$20,000 for wetland	Quiescent 3 rd cell \$25,000	None	Lagoons \$3,900/yr
Dows STP	Wallace, Holland, Kastler, Schmitz & Company Mason City, IA	Weidemann, Inc. Dows, IA	\$53,201 for wetland; lagoon and wetland \$495,000	Act. SI expanded \$645,000 New Act SI. \$1,140,000 #-Cell Stab. Pond \$1,156,000	None	\$33,000/yr including labor and benefits
Granger STP	Veenstra and Kimm West Des Moines, IA	C.L. Carroll Co., Inc. Des Moines, IA	\$775,000 for conversion to aerated lagoons and adding wetlands	Initial estimates: Conversion to aerated lagoons and adding wetlands \$451,000 Aerated lagoon \$539,000 Controlled discharge lagoon \$1.86 million Mechanical plant \$1.91 million	\$500/year estimate for managing system	Approximate \$1,000/year operation and maintenance for alternatives, Conversion and wetlands \$15,000, Aerated lagoon \$20,000, Controlled dish Lagoon \$12,000, Mechanical plant \$40,000
IAMU	Gjersvik and Associates Pleasant Hill, IA	R.G. Elder & Son Co.	\$18,000 for wetland, \$40,000 for septic tank, wetland, manholes, and piping	Drain field	None	Minimal
Iowa City STP	University of Iowa Department of Geosciences Iowa City, IA	Iowa City STP	Approximately \$25,000, part of a research program	Wetland research, no alternatives	Estimate <\$2,000/yr	Activated sludge plant

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Lake Park STP	Howard R. Green Company Cedar Rapids, IA	Bernard Cohrs Construction	Not available	Not available	None, sheep graze grassy area surrounding wetlands and lagoons	\$2495 a year in electricity costs for aerators
Lake Vista Motel (Out of business as of 1998)	Gjersvik & Associates, Inc. Pleasant Hill, IA	A.R.S. Construction	Wetland approximately \$23,000	Pump to Chariton \$66,000 Controlled discharge lagoon \$41,000	Only costs would be sampling	Pumping septic tank every 3 years
Laurel STP	Van Winkle-Jacob Engineering Coralville, IA	Construction Inc. Marshalltown, IA	Wetland and lagoon system \$900,000 for 3-community system receiving septic tank effluent from two communities	Alternatives were separate treatment systems for each community	\$200-300 a year to maintain vegetation	\$4,800 a year for electricity for lagoons
LeGrand STP	Veenstra and Kimm West Des Moines, IA	C.L. Carroll Co., Inc. Des Moines, IA	Wetlands and sludge removal from lagoons \$298,528 (wetlands require more testing than controlled discharged lagoon)	Controlled discharged lagoon approx. \$497,547 Aerated lagoons approx. \$398,038 (higher operation costs)	Minimal	Not available
Maharishi Resort	Shive Hattery Iowa City, IA	Winger Ottumwa, IA	Not available	None	None	\$360 a year for electricity for lift stations and SBR
Norwalk STP	Williams and Works Grand Rapids, MI Detroit, MI Omaha, NE	MacAnich Construction Company Norwalk, IA	Not available	Have replaced lagoon/wetland system with Biolac activated sludge system	Minimal	Unavailable
Norway STP	Hart Engineering Iowa City, IA	Weber Construction Co.	Not available	Not available	Minimal	Electricity costs for aerators
Walnut Creek (Neil Smith) Wildlife Refuge	Butts-Gjersvik Engineering Pleasant Hill, IA	Butts-Gjersvik Engineering Pleasant Hill, IA	Wetland system plus septic tank \$150,000	Wanted wetland system because of education facility	Flow, and weed management	Minimal