GOLDFISH AND COMMON CARP POPULATION AND INTER-WATERBODY MOVEMENT ASSESSMENT IN LAKE CORNELIA SYSTEM

Proposal for the Nine Mile Creek Watershed District

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INTRODUCTION

Invasive goldfish have just been added to the MAISRC priority list for investigation. They are being released into lakes around the Twin Cities Metro. Clearly, education is needed to prevent initial infestations. But little is known about the risk of spread of this invasive species to other connected water bodies if an infestation has been confirmed. The results of this study and education initiative will work to prevent introductions as well as guide planning and management of watersheds to take rapid action to stop the spread of goldfish in this system and others in Hennepin County.

In addition to goldfish, common carp are well-known to be a significant driver of poor water quality parameters. While foraging, they root around in lake sediments where nutrients like phosphorous can be locked up in an inactive form. When disturbance occurs from an overabundance of carp, large amounts of phosphorous is reintroduced to the water column where it becomes available for algae. This in turn promotes green algae blooms as well as turbid water conditions. Both North and South Cornelia are on the Minnesota Pollution Control Agency's Impaired Waters list due to excess nutrient loads. The main parameters that are measured to decide if a water body belongs on this list are total phosphorous (TP), chlorophyll-a (algae abundance), and clarity (measured by secchi depth). Goldfish and common carp can contribute significantly to the internal loading of TP and management of their populations below a threshold of 100kg/ha (Bajer et al, 2009) is generally considered to be an inexpensive method of managing internal loading (Bartodziej et al, 2017).

In 2018, surveys completed by Riley Purgatory Bluff Creek Watershed District for Nine Mile Creek Watershed District identified carp in Cornelia Lake and surrounding potential nursery lakes. Goldfish and carp were found in numbers that warranted more rigorous assessment and understanding of inter-lake spatial usage in order to guide future long-term management. To properly assess for goldfish and carp biomass levels and the presence of YOY, WSB recommends that electrofishing surveys be properly completed as deemed by protocols in Bajer and Sorensen (2012).

It is also important to know the movement capabilities and patterns between and within lakes in the Cornelia system. WSB would utilize passive integrated transponder (PIT) tags to track movement via antennas at strategic locations in the Cornelia system. To understand the history of recruitment in this system, an age structure will be developed for goldfish and carp to connect past environmental conditions in which the lake system was at risk. That structure will also help determine how often biomass reduction efforts are needed over the long-term time scale moving forward. Finally, WSB will test a system for biomass reduction that has been found to be effective at species specific capture of carp. It will be tested in Nancy Lake where the population of goldfish was found to be very high.

This test will allow the watershed district to plan for the future of removals (if needed) and costs associated with that effort. In general, the data collected in this work will serve as the scientific baseline to determine if/what population reduction is needed to meet biomass goals, understand important pathways to movement, and strategize if/what management of goldfish and/or carp should be planned for the future in order to improve water quality and promote the health of the lake ecosystems.

To obtain approval of the Minnesota DNR Fisheries, a small amount of time has been included to account for this process. Any administrative expenditures to manage the accounting of this project will be covered by the project management line item. The following is a detailed description of the recommended work plan:

ELECTROFISHING SURVEYS TO ESTIMATE POPULATION AND IMPLANT PIT TAGS

To reduce cost, this effort will be coupled with electrofishing surveys for the project submitted to the Hennepin County Aquatic Invasive Species grant. A small amount of time will be added to the goldfish surveys in order to simultaneously collect data about the carp biomass and implant PIT tags while the carp are in hand. These surveys are best done between the months of July and September while carp are more evenly distributed around the lake. WSB would conduct at least three 20-minute transects in randomized sections of shoreline in each water body. We would conduct these surveys on three different days at least one week apart. This is to account for differences in environmental conditions that may bias the catch rate. We would use the catch per unit effort (CPUE) model described in Bajer and Sorensen (2012) to quickly determine the carp density, average size/weight and scale that to the lake for an overall goldfish and carp biomass (kg/ha).

We will measure, weigh, implant a PIT tag and give a pelvic fin clip before releasing back to the lake. In subsequent capture events, if enough individuals are recaptured, we will be able to calculate a mark/recapture population estimate. This is generally more reliable but requires more effort and cost.

From these data, we will report on the size structure of the populations in each lake with the CPUE data and a calculated carp biomass.

INSTALLING PIT ANTENNAS TO MONITOR CARP MOVEMENT BETWEEN LAKES

Antennas would be constructed, installed and tested to monitor the movements of goldfish and carp in the Cornelia Lake system. Four locations (Figure 1) would have antennas installed to determine which water bodies are important in the recruitment of carp in the system. It will determine what time of year, what proportion of the population is moving and how often use the pathway between bodies.

These antennas will be in place before PIT tags are implanted during the electrofishing surveys described above. The antennas will run for one year in order to capture the unbiased movement in the spring of 2021, when spawning migrations are anticipated to occur. Long term PIT monitoring data is very valuable, so we recommend considering further monitoring of these locations for the future.

If the results show a sizeable movement of tagged fish through one or more pathways, consideration and planning of barriers to impede movement and/or a trap to target the migrations for biomass removal can be built into a management plan.

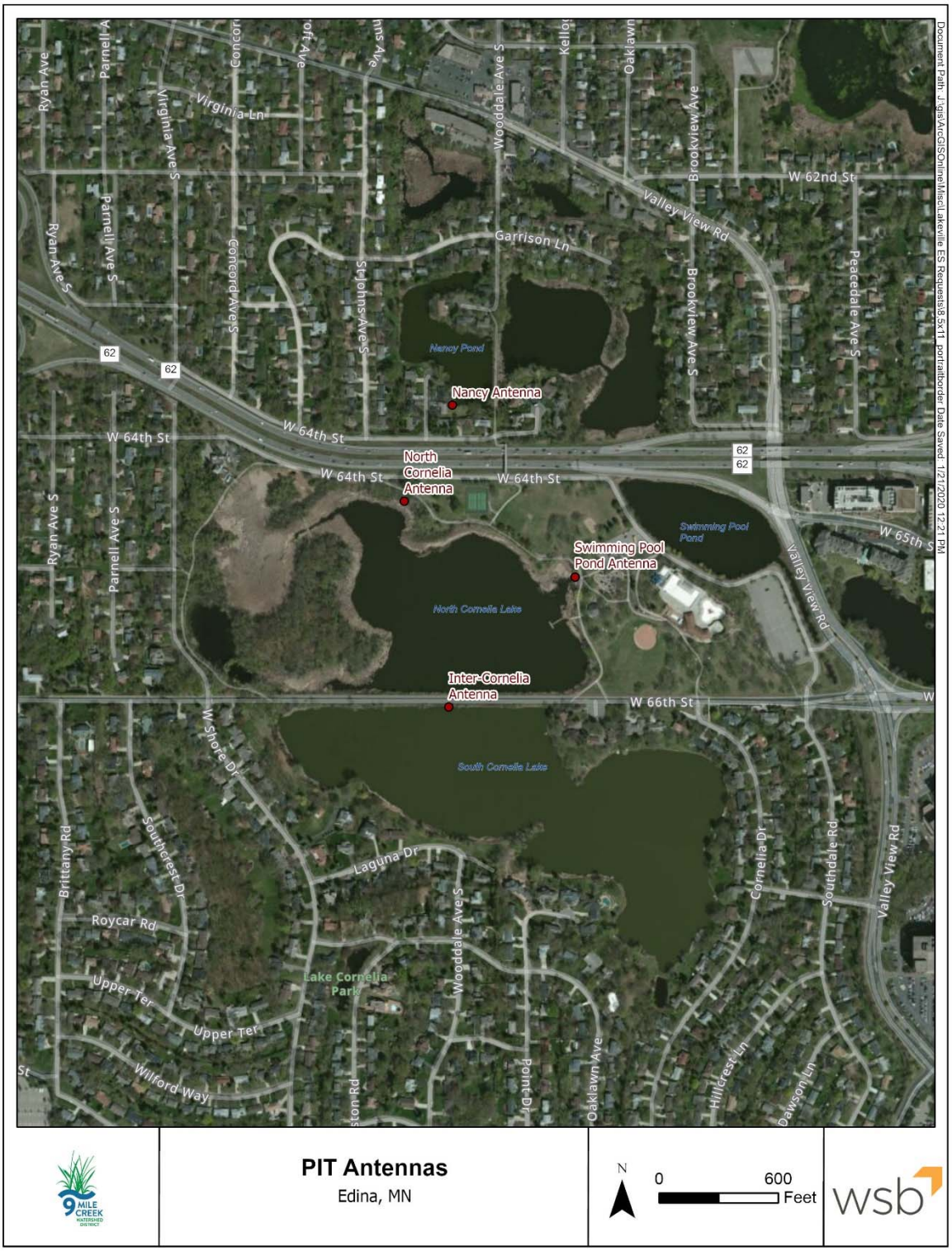

Figure 1: Illustration of locations of PIT antennas strategically placed in potential fish pathways.

TESTING RAPID MANAGEMENT ACTION TO ADDRESS LOCALIZED INFESTATIONS

We will employ a technique found to be successful in small water bodies with common carp to determine efficacy with goldfish. A box net trap refers to a mesh net that lays on the lake bottom with attached walls around the outside. These walls are attached to vertical metal pipes that extend above the water surface. The walls are attached to ropes that are run to shore and when the ropes are pulled in, the walls quickly rise above the surface trapping the fish within the trap area inside. The fish are corralled to a corner and removed with a dip net.

A modified baited-box-net trap (one with a mesh size appropriate for goldfish instead of adult carp) will be deployed in Nancy Lake and baited with cracked corn (or another bait seen to be effective). A bait bag will be placed on top of the net in order to draw in goldfish. Lake residents will tend the bait, filling it if the bag is empty, once per day for up to seven days of baiting and report to WSB. After the first removal attempt, we will drop the walls and bait for an additional week in order to test the trap a second time. This method has been found to be over 98% selective for carp. All fish captured will be counted and measured. All goldfish will be removed from the lake.

Figure 2: A box net trap with walls raised

UNDERSTANDING RECRUITMENT STATUS IN THE LAKE COMPLEX

WSB recommends that a sample of fish be euthanized during electrofishing surveys or the baited box net tests and examined to determine age. We would do this by removing the inner ear bones called otoliths and cross sectioning them under a microscope to document the growth rings (annuli). If otoliths are not able to be sampled with goldfish, we will also collect scales to examine. The ages will be grouped and examined to determine past year classes of recruitment.

Altogether, this helps gain a history of recruitment that impacted the current overall population. Using that history, we would draw insight into a long-term management plan for reduction of biomass and the "lifespan" of the work. The larger the sample the better, since low recruitment years can be missed with a small sample size. We recommend at least a sample of 50.

BUDGET TABLE:

	Cornelia Lake System Goldfish and Carp Assessment 2020	Expenses	Env. Scientist V hours	Env. Scientist VI hours	Line item total
	Hourly rate		$90	$97	
Overhead	Permitting and project management		7		$630
Part 1: Goldfish assessment	Electrofishing surveys and PIT tagging goldfish	$849	52	52	$10,573
	Construction and installation of PIT antennas		27	16	$3,982
	Testing baited box net trap for capture of goldfish ($500 for net, $350 for corn)	$850	24	16	$4,562
	Annual PIT antenna rental ($1,500/system)	$6,000			$6,000
	Age structure for goldfish (sample of 50)		34		$3,060
	Data analysis and reporting		24		$2,160
Part 2: Additional carp objectives	Additional surveying time to implant carp tags while electrofishing	$400	7	7	$1,709
	PIT antenna installs and monitoring		0	0	$0
	Ageing structure for carp (sample of 50)		30	4	$3,088
	Additional time for data analysis and reporting		6		$540
	Goldfish population and interwater body movement assessment				**$30,967**
	Carp specific additional objectives				**$5,337**
	Overall Project total				**$36,304**

TIMELINE:

	2020						2021				
	July	August	September	October	November	December	January	February	March	April	May
Construction and installation of PIT antennas											
Electrofishing surveys for population assessment and PIT tag implantation											
Ageing structure for goldfish and carp (sample of 50)											
Testing of baited box net trap in Nancy Lake											
Data analysis and reporting (preliminary and final)											

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