RECOVERY PLAN

for

Nashville Crayfish (*Orconectes shoupi*)

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Approved: _____
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C. NARRATIVE OUTLINE

1. Preserve Mill Creek population and presently occupied habitat of the Nashville crayfish. The protection of the one existing population and its habitat in the Mill Creek basin is essential to the species' survival.

   1.1 Emphasize to local state and Federal regulatory agencies the importance of strictly enforcing existing legislation and regulations (Federal Endangered Species Act, state endangered species laws, water quality regulations, stream alteration regulations, etc.) to protect the species and its habitat. Prior to and during implementation of this recovery plan, the species and its habitat can be protected by the full enforcement of existing laws and regulations.

   1.2 Conduct research necessary for the management and, where possible and required, the improvement of the species' status.

      1.2.1 Conduct life history research to include reproduction, food habits, age and growth, mortality factors, etc. Some work has been done by Stark (1986, in preparation) on the Nashville crayfish's micro-habitat and interspecific relationship with an undescribed Orconectes in Mill Creek and its tributaries. However, much is still unknown concerning the species' life history. Unless the species' life cycle and environmental requirements are understood, recovery efforts may be inconsequential or misdirected. As the Mill Creek basin population is very vulnerable, care must be taken to ensure research does not further threaten the species.

      1.2.2 Characterize the species' habitat (relevant physical, chemical, and biological components) for all life history stages. Before the species' habitat can be adequately protected, it must be completely characterized. Some of the generalized physical habitat requirements are understood (G. Stark, 1986, in preparation); but more needs to be learned, especially concerning the needs of ovigerous females and specific water quality and biological factors. Knowledge of the species' habitat will enable the recovery effort to focus management and protection efforts on the habitat

and ecological associations required for the survival of the species.

1.2.3 Identify the present and foreseeable perturbations in Mill Creek, assess their potential impact on the Nashville crayfish and its habitat, and, where necessary and feasible, implement preventive and/or protective measures. The Mill Creek watershed is extensively developed, and the area is under constant assault from land use changes, stream bank and channel disturbances, pollution events, and other factors impacting the stream habitat. To minimize and/or eliminate these threats where needed to meet recovery, the threats must be identified and correlated with the species' specific life history and habitat requirements gathered under 1.2.1 and 1.2.2, and measures must be taken to minimize or alleviate the sources of the problem.

1.2.4 Investigate the need and value of habitat improvement. Implement improvements if needed to secure viable populations. Specific components of the species' habitat may be missing or, because of some environmental degradation, the habitat may have been rendered unsuitable or marginal. These may be limiting the species' potential expansion. Habitat improvement programs may be needed to alleviate or minimize these limiting factors.

1.2.5 Determine the number of individuals required to maintain a viable population. Theoretical considerations by Franklin (1980) and Soulé (1980) indicate that 500 individuals represent a minimum population level (effective population size) which would contain sufficient genetic variation to enable that population to evolve and respond to natural habitat changes. The actual population size in a natural ecosystem can be expected to be larger, possibly by as much as 10 times. The factors which will influence actual population size include sex ratio, length of species' reproductive life, fecundity, and extent of exchange of genetic material within the population, plus other life history aspects of these species. Some of these factors can be addressed under Task 1.2.1, while others will need to be addressed as part of this task on a need-to-know basis.

1.3 Solicit help in protecting the species and its habitat. Section 7 consultation under the Endangered Species Act and Fish and Wildlife Coordination Act activities can assist in protection of the species, but these programs alone cannot recover the Nashville crayfish. The assistance of Federal and state agencies as well as local governments will be essential. Also, support of the local industrial and business community as well as local people will be needed to meet the goal of recovering the species. Without a commitment from the people in the Mill Creek basin who have an influence on habitat quality, recovery efforts will be doomed.

1.3.1 Meet with local government officials and regional and local planners to inform them of our plans to attempt recovery and request their support to protect the species.

1.3.2 Meet with local business and/or industry interests and try to elicit their support in implementing protective actions.

1.3.3 Meet with landowners adjacent to the species' population centers, inform them of the project, and try to get their support in habitat protection measures.

1.4 Develop an educational program using such items as slide/tape shows, brochures, etc. Present this material to business groups, civic groups, youth groups, church organizations, etc. Educational material outlining the recovery goals with emphasis on the other benefits of maintaining and upgrading habitat quality will be extremely useful in informing the public of our actions. However, care must be taken in the presentation of the educational material so that the species does not become more vulnerable to vandalism.

2. Search for additional populations and/or habitat suitable for reintroduction efforts. Studies of the species' distribution have been completed (Bouchard 1976, 1984; O'Bara et al. 1985). These studies involved extensive sampling of reported historic collection sites, areas adjacent to these sites, and numerous other streams in the Nashville basin. Although no other populations were encountered, further surveys may be warranted after studies under Tasks 1.2.1 and 1.2.2 better define the species' specific habitat requirements.

3. Develop a reintroduction plan and reintroduce the Nashville crayfish back into its historic habitat in Richland Creek and/or into other suitable stream reaches that are determined to have been historic habitat. Based on historic data, the only other possible historically occupied habitat outside the Mill Creek basin that can be verified with any assurance is Richland Creek. If the habitat is still suitable, it is essential to reintroduce the species. Although no other historic populations are presently known, other historic habitat may be found and may still be available for introductions. If another population can be established, it would help to prevent the extinction of the species.

   3.1 Develop a stocking technique and introduce the species into Richland Creek or other historic habitat. Because of the extent of the Nashville crayfish population in Mill Creek, it is likely that sufficient animals would be available for stocking. However, procedures for stocking (number of animals, size and sex, time of year, method of release, removal of competing species from release sites, etc.) would need to be developed before the release.

   3.2 Implement the same protective measures for any introduced populations as outlined for established populations.

4. Develop and implement a program to monitor population levels and habitat conditions of presently established populations as well as any introduced or newly discovered populations. This could be developed as separate tasks for introduced populations and the Mill Creek population. Once recovery actions are implemented, the response of the species and its habitat must be monitored to assess any progress toward recovery. This will likely require a biennial census schedule.

5. Annually assess overall success of the recovery program and recommend action (changes in recovery objectives, delist, continue to protect, implement new measures, other studies, etc.). The recovery plan must be evaluated periodically to determine if it is on track and to recommend future actions. As more is learned about the species, the recovery objectives may need to be modified.