A STUDY TO DETERMINE THE NEED FOR A FISHWAY AND ASSESS CERTAIN IMPACTS ASSOCIATED WITH THE ADDITION OF HYDROPOWER AT TOSTON DAM

FOR

MONTANA DEPARTMENT OF NATURAL RESOURCES AND CONSERVATION

BY

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INTRODUCTION

The Department of Natural Resources and Conservation (DNRC) was granted a license by the Federal Energy Regulatory Commission (FERC) for the addition of hydropower at Broadwater Dam (Toston Dam) on the Missouri River. At the time the license was issued, there remained unanswered questions concerning the impact of the project on the wildlife of the area and the necessity and desirability of fish passage facilities at the site.

Article 42 of the Broadwater FERC license required DNRC to fund a study to determine the desirability of a fish ladder, investigate potential wildlife impacts and recommend mitigation measures. On April 15, 1985, DFWP entered into an agreement with DNRC to supply the necessary information to comply with Article 42 of the Broadwater FERC license.

The agreement called for three phases of investigation designed to produce the necessary information. Phase I was a fisheries field investigation to determine whether the existing migrant trout fishery warrants a fish ladder. The fisheries field study analyzed the timing and extent of the fall brown trout and spring rainbow trout spawning run. Attempts were made to locate trout spawning areas in the Missouri River below Toston Dam.

Phase II of the agreement called for an assessment of wildlife impacts associated with the Broadwater Power Project and development of mitigation recommendations.

Phase III required a literature review intended to provide insight into questions related to fishways and their anticipated impacts on a recreational fishery and an investigation of possible alternatives to a fish ladder. Phase III was also to discuss the implications and desirability of a fish ladder in relation to present and future fisheries management options and develop a recommendation.

Phase IV of the agreement requires a completion report to be submitted to DNRC containing the information necessary to respond to Article 42. This report is intended to meet the requirements of Phase IV by presenting the results of Phases I, II, and III.

BACKGROUND - PHASE I

Canyon Ferry Reservoir contains a substantial self-sustaining brown trout population. Food and growth conditions in the reservoir are very favorable for the brown trout and the population contains a large proportion of fish 18 inches and greater. Trophy brown trout in the 6 to 10 pound plus category are not uncommon.

Spawning areas for this trout population are limited. Tributary streams to Canyon Ferry reservoir are few and generally not suitable for trout reproduction. The main spawning area is the Missouri River between the upper end of Canyon Ferry Reservoir and Toston Dam. The brown trout provide a popular trophy fishery during their fall spawning run in this reach of river.

Canyon Ferry reservoir also supports a rainbow trout population consisting of several different stocks. These rainbow also utilize the Missouri River upstream from Canyon Ferry for spawning. This phase of the study was designed to determine the rate and extent of the fall brown trout and spring rainbow trout spawning runs. It would also attempt to locate existing spawning areas used by migrant trout in the river below Toston Dam. This information would be used in combination with other study results to prepare a fish ladder recommendation required under Item 4, Phase III.

METHODS AND RESULTS - PHASE I

The Missouri River between Toston Dam and Canyon Ferry Reservoir is 22.7 miles long. Within this reach of river are four sampling study sections (Table 1 and Figures 1 and 2). The Toston-Deepdale Section was utilized to make spring population estimates for resident brown trout from 1979-83 (Rehwinkel, 1980, 81, 82, 83). Estimated numbers and average lengths by age class are given in Appendix Table 1. All four of the sampling sections have been used to monitor seasonal movement of brown and rainbow into the Missouri River from Canyon Ferry Reservoir.

Table 1. Sampling sections located on the Missouri River between Canyon Ferry and Toston Dam.

Section Name	Length (miles)
Toston Dam	3.0
Toston-Deepdale	7.3
Deepdale-Townsend	6.0
Townsend-Canyon Ferry	2.2

The Canyon Ferry Reservoir brown trout population consists solely of wild fish. This population has been sampled sporadically within the reservoir utilizing sinking gill nets. Table 2 lists the results of replicate bottom sets of 33 experimental mesh 125' gill nets in the years indicated.

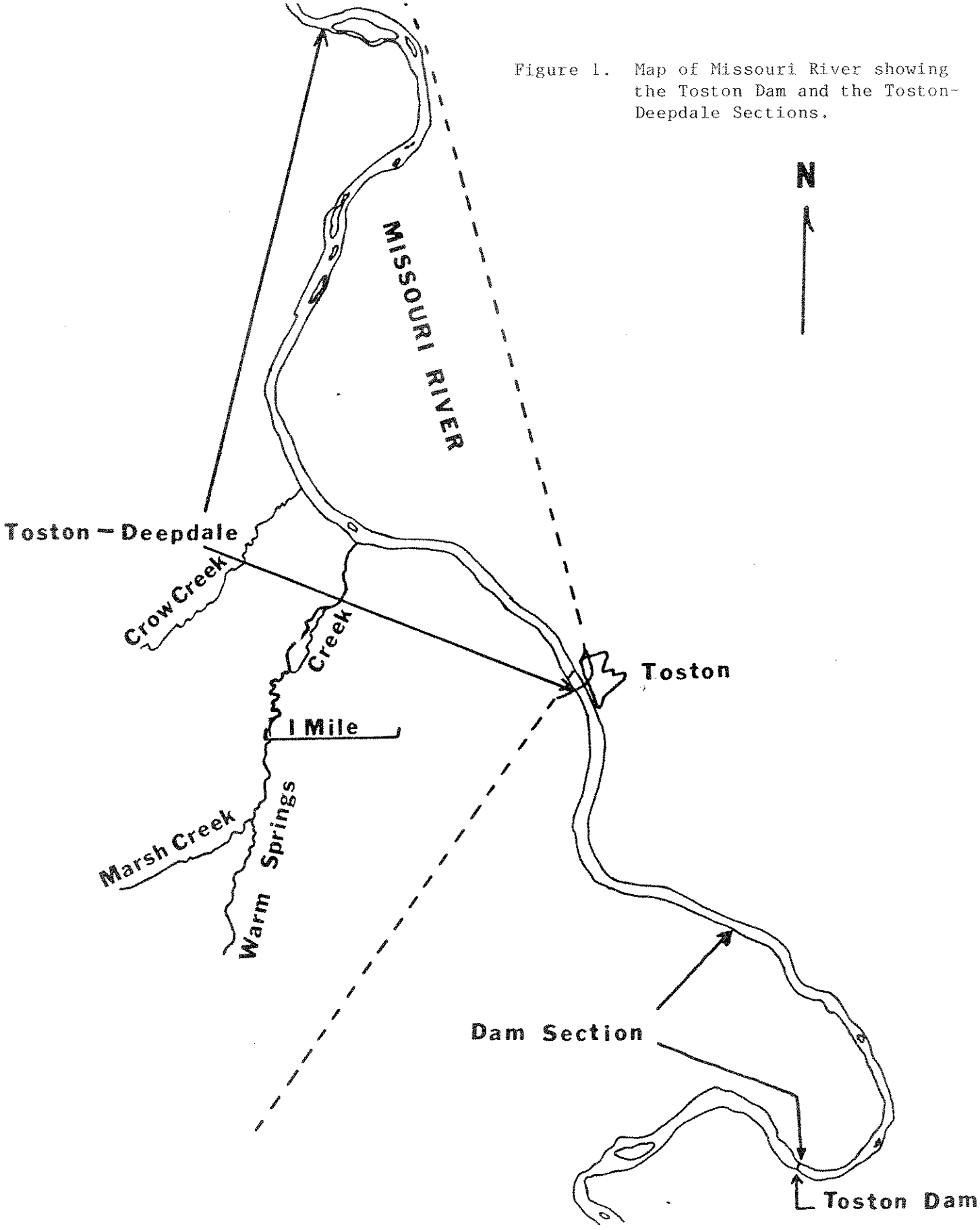

Figure 1. Map of Missouri River showing the Toston Dam and the Toston-Deepdale Sections.

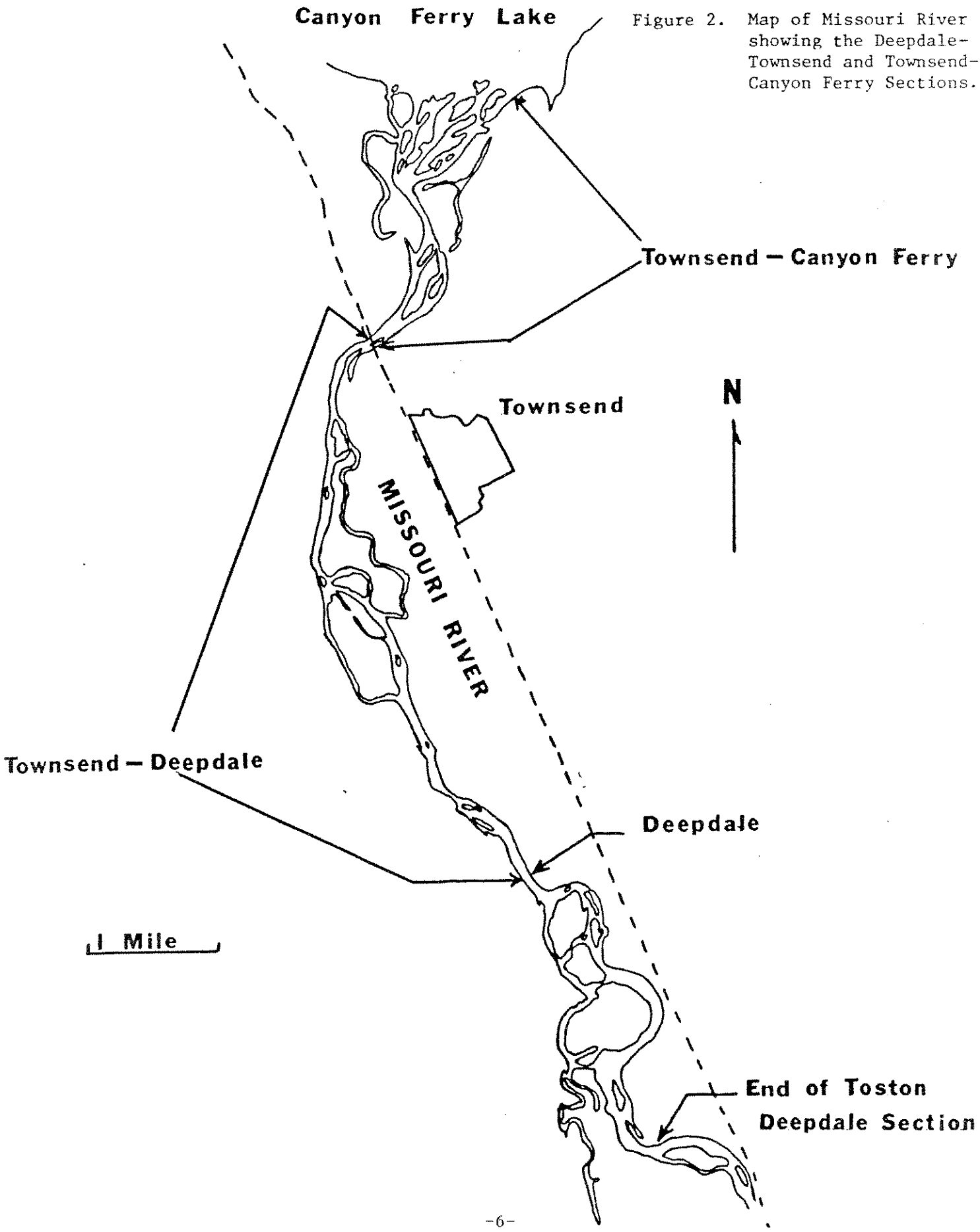

Figure 2. Map of Missouri River showing the Deepdale-Townsend and Townsend-Canyon Ferry Sections.

Table 2. A summary of brown trout sampling from Canyon Ferry Reservoir (33 net sets).

Year	Total Brown Trout Sampled	Percent Composition of total fish sampled
1955	103	1.19
1958	73	1.19
1960	51	1.10
1964	65	1.33
1967	78	2.76
1968	91	2.49
1983	60	1.42
1984	77	1.77
$\bar{x}$	75	1.66

Table 2 suggests that the brown trout population has been similar in each of the years sampled, both in terms of numbers captured and percent composition of all fish species captured.

Monitoring of fall brown trout runs into the Missouri River utilizing boat mounted electrofishing equipment was carried out in 1978, 80, 82, 83 and 1985 (Table 3).

Sampling was carried out in all four study sections and included tagging all brown trout in excess of 16" in length with individually numbered floy tags in all years except 1983. Sampling intensity varied from year to year.

Table 3. Voluntary angler tag returns from brown trout tagged in the Missouri River.

Year	# Brown Trout Tagged	# Tags Returned	% From Reservoir
1978	318	22	36%
1980	173	8	50%
1982	559	46	72%
1983	0	--	--
1985	192	--	--
	1242	76	59%

Table 3 and Appendix Tables 2-4 suggest that the bulk of the brown trout in excess of 16 inches found in this reach of the Missouri River during the fall months are migrants from the reservoir.

The Canyon Ferry Reservoir rainbow trout population consists of planted, fall variety Arlee strain; a small, wild, spring spawning population and most recently spring spawning DeSmet rainbow which were first introduced in 1983. The presence of both spring and fall running rainbow strains in the reservoir has made it very difficult to accurately assess the resident rainbow population in the Missouri River downstream from Toston Dam. Monitoring of spring runs of rainbow trout into the Missouri River from Canyon Ferry Reservoir was carried out in 1979, 81, 82, 83, 84 and 1985 (Table 4). All rainbow trout in excess of 13 inches were affixed with individually numbered floy tags. The sampling effort varied from year to year.

Table 4. Voluntary angler tag returns from rainbow trout tagged in the Missouri River.

Year	# Rainbow Tagged	# Returned	# Returned From Reservoir	%
1979	85	5	0	-
1981	301	21	11	52%
1982	281	18	7	39%
1983	198	10	9	90%
1984	104	10	9	90%
1985	227	5	0	-
	1196	69	36	52%

Table 4 and Appendix Tables 5-10 suggest that the bulk of rainbow trout in excess of 13 inches in length in this reach of the Missouri River during the spring are migrants from Canyon Ferry Reservoir.

Timing and Extent of Fall Brown Trout and Spring Rainbow Trout Spawning Runs

Brown Trout

Electrofishing information collected since 1978 suggests that brown trout enter the Missouri River beginning in early August with major concentrations from late October into November. While the exact magnitude of the runs are not known, they probably number several thousand fish.

Sampling has indicated that numbers of migratory brown trout peak in the Townsend-Canyon Ferry study section in late September or early October. Further upstream in the Toston-Deepdale section, numbers of migratory brown trout peak in mid-October and in the section beneath the dam (Toston Dam Section), numbers reached a high in late October.

Ripe, male brown trout were first observed in 1982 on October 8 while the first gravid female with loose egg skeins was observed on October 14. The first spent female was observed on October 29 during 1982.

It appears that the majority of brown trout migrants move upstream as far as the upper two study sections in their attempts to spawn. The greatest concentrations as indicated by number captured per mile have occurred in the Toston Dam Section. Another area of concentration involves the Warm Springs-Marsh Creek tributary system (3.3 miles upstream from the reservoir).

Rate of Migration by Tagged Brown Trout

Data collected from tagged brown trout to assess rate of movement was inconclusive. In general, tagged fish tended to be recaptured within the same study section although instances of upstream and downstream movement were observed.

Concentrations of Gravid Brown Trout

Water clarity in this reach of the Missouri River does not allow observation of fish on redds. However, seven different areas of concentrations of gravid females were noted during 1985 (Fig. 3) within the upper 12.5 miles of this reach of the Missouri. These areas included Marsh Creek and three areas just downstream from Toston Dam in the mainstem river.

Rainbow Trout

Electrofishing has indicated that rainbow trout move into the Missouri River from mid-March through mid-May. In 1985, peak numbers of migrant rainbow were captured on May 9 in the Toston Dam Section.

While it has not been determined which strains of rainbow make up the spring run, it is more than likely a mix of wild and Arlee strain fish. DeSmet rainbow are not expected to enter the run until 1986 when their first year class will be three years old. Tag return data from spring tagged rainbow also suggests that more than one strain of rainbow may ascend the river in the spring.

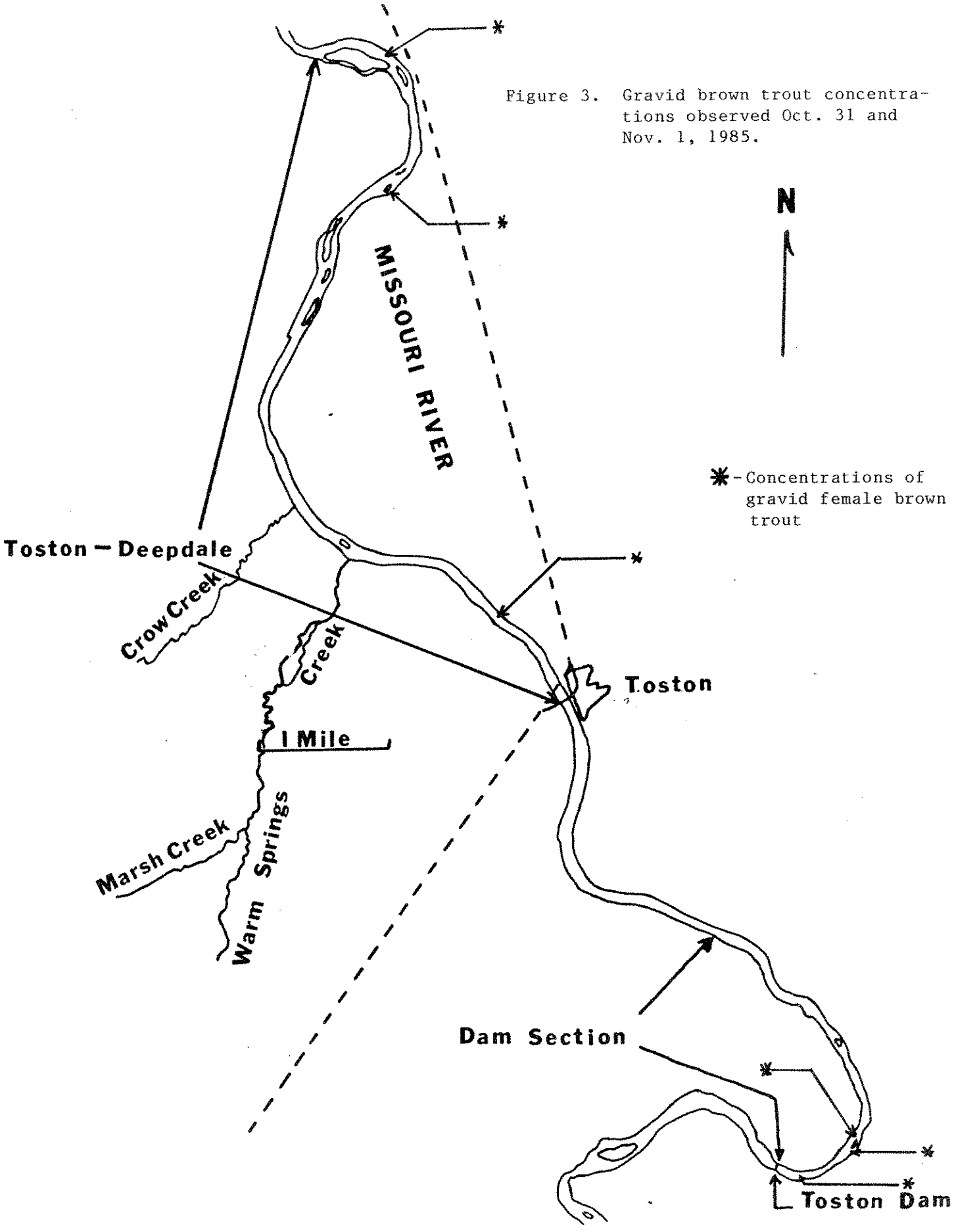

Figure 3. Gravid brown trout concentrations observed Oct. 31 and Nov. 1, 1985.

Spring running rainbow trout move all the way up the river to Toston Dam based on angler tag returns. Rainbow trout also use at least three miles of Warm Springs and Marsh Creeks when irrigation demands allow.

Spawning, as indicated by gravid females extruding eggs, was first detected on April 9 of 1985 and appeared to peak in early May, 1985.

Rate of Movement of Migrating Rainbow Trout

Data collected from tagged migrating rainbow trout was inconclusive.

Concentrations of Gravid Rainbow Trout

Water clarity did not allow direct observation of spawning activities. Electrofishing, however, revealed three concentrations of gravid female rainbow trout in the spring of 1985 (Figure 4). The two major concentrations are immediately adjacent to spring discharges (Big Spring and Warm Springs Creek). Cold water tributaries (Crow and Dry Creeks) did not attract migrating rainbow.

DISCUSSION - PHASE I

Suitable substrate for spawning by rainbow and brown trout in the Missouri River from Toston Dam to Canyon Ferry Reservoir appears to be limited. Fish sampling during the peak of the spawning runs revealed few areas of concentration of ripe adult trout. Several concentration areas for both rainbow and brown trout were noted within the first several miles below Toston Dam. The remainder of the reach produced very few areas where ripe fish were concentrated.

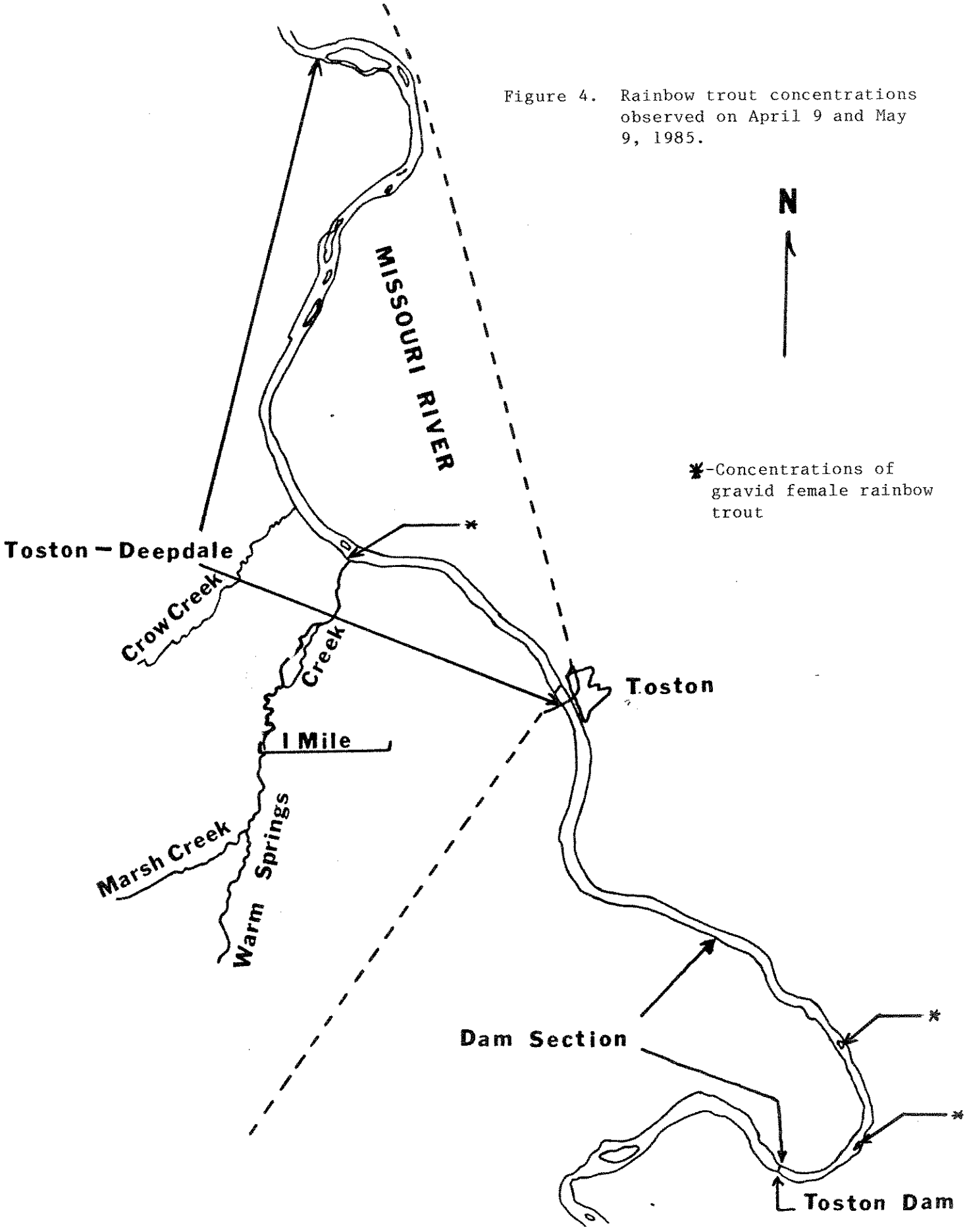

Figure 4. Rainbow trout concentrations observed on April 9 and May 9, 1985.

BACKGROUND - PHASE II

The Broadwater Power Project will increase the pool level behind the Toston Dam by approximately 1½ feet and maintain that elevation year round. There are significant wildlife values associated with the island and riparian areas in the affected reach. This phase of study was designed to document the wildlife resource in the project area upstream from the dam, determine potential impacts to that resource and recommend suitable mitigation.

METHODS - PHASE II

Documentation of waterfowl, shorebird and furbearer distribution on the Missouri River from Toston Dam to approximately two miles upstream of Lombard was accomplished during the spring and early summer of 1985. Two aerial surveys were flown to record the number of geese present during the spring nesting season and the early summer brood rearing period. Six island complexes were searched during each of two float trips and observations were made on both waterfowl and furbearer use on this stretch of the river. The inventory work was accomplished in the following, chronological order:

Breeding ground survey, aerial	April 22
Float survey/nest search	April 29
Float survey/nest success check	May 25
Goose production survey, aerial	June 16

RESULTS - PHASE II

Although the projected increase in pool elevation is expected to extend only to Lombard, several islands were searched above this area. The flooding of the islands in the lower pool area could displace nesting waterfowl. Therefore it was important to document current waterfowl use on those islands that will not be flooded above the impoundment.

The breeding ground survey was flown in a super-cub and all geese were classified into a pair, single or group category. This flight is made annually and this particular survey section extends from the Toston Bridge to Clarkston (just downstream of the major island complexes). The surveyed total for the 1985 flight was 82 geese which represents the most geese that have been observed during the ten year period, 1976 to 1985 (Table 5). However, the number of birds in the pairs and single category represented the lowest count during the period. The biggest contribution was made by the non-breeding segment. The observed increase in the number of non-breeding geese may indicate strong recruitment from the previous year's nesting effort. It may also reflect lower nesting densities due to the conditions that existed during the nest initiation period. It was noted during the flight that ice was still evident on the islands above Toston Dam. Delayed nesting and/or no nesting by younger geese was observed on the river islands in the delta area of Canyon Ferry Reservoir this year. Late ice melt results in a reduced number of acceptable nest sites that are available to the geese.

Table 5. Canada Goose breeding ground survey, Toston to Clarkston, 1976-85.

Year	Pairs	Singles	Groups	Total
1985	6	7	63	82
1983	14	10	5	43
1982	24	16	15	79
1981	10	5	33	58
1980	15	10	3	43
1979	11	3	13	38
1978	21	10	20	72
1977	13	6	7	39
1976	7	7	13	34

A float search was conducted on April 29 to quantify the number of nests located on the islands in the study section. The islands were labelled A, B, C, D, E and F and the progression corresponds to the designations made in the DNRC proposal (Figure 5). Islands E and F are located approximately one and two miles above Lombard. All islands were searched on foot and the location of the nests were recorded. Table 6 presents the nest information that was collected. An additional nest located by a DNRC survey team along the railroad right-of-way was not relocated.

Figure 5. Map of Missouri River showing Toston Dam, reservoir area and islands surveyed for goose nesting.

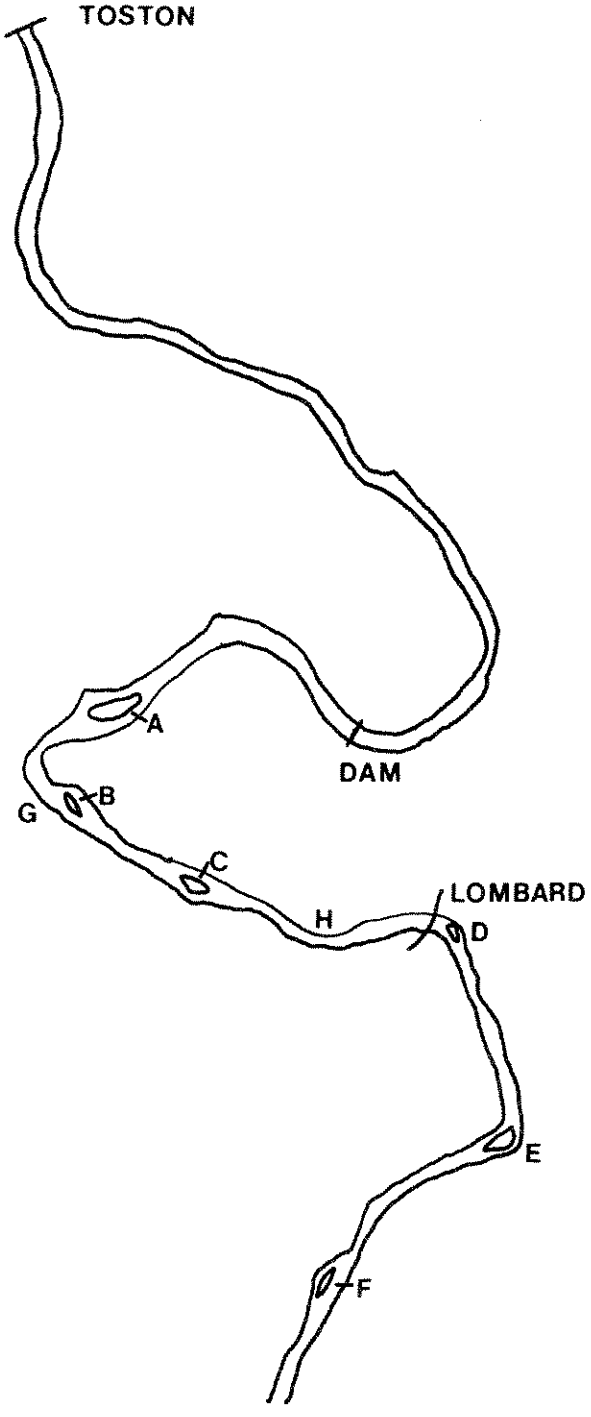

Table 6. Canada Goose nest information, Islands A-F, April 29, 1985

Island	Nest No.	Clutch Size	Fate[1] (Successful/Unsuccessful)
A	1	5	S
A	2	6	S
B	3	9	S
B	4	5	S
C	5	2	Uns
Cliff	6	?	S
E	7	5	S
E	8	Hatched	S
F	9	6	S
F	10	7	S

[1]Determined during the May survey

A total of 9 nests were located on the islands and one nest was found on a rocky ledge adjacent to the river. The only island that was not used in the series was island D at the mouth of Sixteenmile creek near Lombard. During the search it was apparent that this island had only recently lost its ice cover and was probably not available to the geese during the nest initiation process. Had ice cover gone off earlier, it probably would have been used for nesting.

Multiple nesting was observed on all islands except C. On those islands that were more linear in shape (B, E & F), the nests were located at the opposite ends of the island. Islands A, B. and C could definitely accommodate more nests based on their size and vegetation structure.

Nest success rates for the island nesting geese were high at 90 percent. The average clutch size of 5.6 eggs per nest is comparable to those observed on the Canyon Ferry Wildlife Management Area. Nest sites were predominantly willow clumps or driftwood piles although one nest was located under a large juniper on island E. The nest on island C was destroyed during the egg laying stage and it appeared to be a case of mammalian depredation. Both raccoon and mink tracks were observed on the island. Any goose nest located on the shoreline adjacent to the railroad were probably destroyed by the burning program conducted by Burlington Northern.

Duck observations were made during the two float surveys and are presented in Table 7. Mallards were the most common species observed.

Table 7. Duck observations documented during the April and May floats, 1985.

	April		May	
Species	Singles	Pairs	Singles	Pairs
Mallard	4	11		3
Mergansers[1]	3	3	2	
Green-wing Teal		4		
Blue-wing Teal		2		
Widgeon		2		
Gadwall	1			

1/ Both common and red-breasted mergansers observed.

No duck nests were located during the searches although the behavior of lone drakes and pairs indicated nesting was probably occurring in the area. Most of the species observed could have been using the mainland for nesting, selecting grasslands or low growing shrub communities such as snowberry. Searches of the islands during the May survey were not as efficient due to the denser nature of the cover. Again burning by Burlington Northern destroyed a majority of the cover along the railroad right-of-way. Island A provides some of the best structural cover types for duck nesting.

Shorebird observations included groups of willet, avocet, yellow legs and snipe. Coots were commonly observed in association with stands of emergents while the shorebirds were associated with gravel bars or bare shorelines. Shorebird numbers probably decrease during the high water phase of early to mid-summer and then increase during late summer and fall period when water levels are receding.

Goose brood observations were made during both the May float and the June production survey. Typical behavior of geese on a river is to brood downstream from the nest site, generally selecting areas with an open and accessible grass-legume understory. Potential brood rearing sites of this type become more limited as the geese move downstream towards the dam.

Observations made during the May float included five broods found on the south shoreline of the river adjacent to island B and 3 broods associated with the island A complex. These two observations include most of the broods that would have resulted from the nests on those islands that were inventoried.

During the June aerial survey, a total of 153 geese were counted on the river from the Toston Bridge to Three-Forks. This included 40 adults and 113 goslings. This section of the river is not typically flown during the production survey and therefore comparable trend data is not available. However, of the total 153 geese that were observed, 86 percent (32 adults and 100 goslings) were located on the shoreline area adjacent to island B. It is apparent that geese nesting in the Clarkston area and above are moving with their broods, downstream into the pool area and are dependent upon the brood rearing sites available in this vicinity.

Brood rearing sites for ducks generally include escape cover in the form of emergents and feeding sites comprised of open water areas supporting submergent vegetation and aquatic insect communities. In the study area, these sites are limited, and are confined to the major cattail stands associated with island A and certain shoreline sections. These vegetation types would be extremely vulnerable to increased water elevations. Inventory work on furbearers was non-systematic in nature and general notes were made relative to the distribution of these mammals. Activity by the various species was recorded for all the islands and is presented in Table 8.

Table 8. Furbearer observations on Islands A-F, 1985

Species	Island	Type of Activity
Beaver	A B C E	Bank dens, lodges, cuttings & caches
Otter	A, D & mouth of Sixteenmile	Foraging
Muskrat	A, C	Houses, cuttings
Raccoon	C	Foraging
Mink	C	Foraging

Furbearers associated with the riverine-marsh environment seem to be well represented. Shoreline areas were not inventoried but where suitable vegetation cover types exist use by these animals should be expected.

Distribution of big game species is restricted primarily to deer although a substantial elk herd is present during the winter north and east of the river. Whitetail deer are more numerous upstream in the vicinity of Clarkston where a more well developed and extensive riparian habitat type occurs. Mule deer are generally restricted to the slopes adjacent to the river. Tracks and pellets were observed on islands C and F during the April float and deer were heard on island C during the May float.

Vegetation types in the study area were described by Thompson (1983). Of primary concern to this work is the relationship that Thompson develops between existing plant communities and pool elevations of the reservoir. The present water management policy involves seasonal fluctuations of the reservoir pool level. These fluctuations, if not too severe, encourage the semiaquatic vegetation communities that have developed. Island size was measured from aerial photos using a planimeter and the approximate acreage and dominant vegetation type are presented in Table 9.

Table 9. Size and dominant vegetation type for Islands A-F, 1985.

Island	Acreage (Acres)	Vegetation Type
A	8.5	Willow-Cattail
B	2.1	Willow
C	7.5	Cottonwood-Juniper, Willow
D	.7	Willow
E	4.4	Cottonwood-Juniper
F	1.4	Willow

Several gravel bars may be present depending on water elevations. These are used by waterfowl and shorebirds as loafing sites.

Impact Analysis

The increase in the reservoir pool elevation related to the proposed DNRC facility could be significant to this section of the Missouri River. The increase in the pool elevation combined with stabilized pool elevations throughout the year would adversely impact existing vegetation cover types and island size.

Survey data are unavailable to accurately predict the reductions in island size relative to the new proposed pool levels. Therefore, assessment of potential flooding impacts will be approximate.

Islands: Island A may be reduced by as much as 50 percent in size. The majority of this reduction would be in the cattail cover type. The willow dominated aspects would probably not be flooded but the increased water levels may reduce the vigor of these shrub stands and possibly eliminate some. The remaining portions of this island complex could accommodate a minimum of two pairs of geese and possibly more, depending on the vegetation structure that remains. Willow densities are important because they provide visual barrier between nesting pairs of geese and thus allow for greater densities of nesting birds.

Island B is a linear island with steep banks and thus overall size reduction would probably be minimal. A zone of emergents on the downstream end of the island will be lost which constitutes approximately 20 percent of the island. This island should be able to accommodate several pairs of geese.

Island C could potentially loose 25 percent of its size with the reduction occurring along the south and west (downstream) sides. The emergent zone and the lower lying willow areas would again represent the cover types lost. Increased water levels may drown out the existing juniper-cottonwood overstory type. The reduction in island size and the change in vegetation cover types may improve nesting conditions for geese by making the island less attractive to predators (mink and raccoon).

Island D is a small island with a very low profile. Even though it is situated at the upper end of the pool, any increase in water elevations will impact its availability for nesting waterfowl. It was not used by geese during the spring

of 1985 and probably reflects the residual ice conditions that existed during that period. It is probably used by geese for nesting in more normal years.

Islands E and F are situated above the proposed pool and should not be impacted. However, the ability of these islands to accommodate additional pairs of geese as a result of displacement from the lower islands is minimal. Island E because of its size may be able to accommodate one additional pair; Island F could not.

The problems related to the reduction in island size may be compounded by the water management policy during the winter period. Under the current operation water levels are drawn down in the pool area after the irrigation season and during the winter period. Even with this drawdown ice jams occur in the pool river area and result in the flooding of the islands. With an increase in the pool elevation, a corresponding decrease in the height of the islands above the water line and no drawdowns, the potential exists for increasing the ice load on the islands. This could significantly impact nesting conditions for geese and the early nesting species of ducks (mallards).

Shoreline Areas: Shoreline cover types will be impacted to approximately the same extent as those found on the islands. Emergent zones, primarily cat-tail, will be flooded and lost. Willow types will be affected in varying degrees dependent on their height above the proposed pool level. The composition and distribution of both herbaceous and woody shrub cover types may be impacted by additional sub-irrigation, although it is difficult to predict to what extent.

An important consideration relative to these vegetation types is the potential for the semi-aquatic types to re-establish within the new pool level. Seed germination for both cattail and willow requires a wetting and drying process on exposed mud or gravel bars. A relatively constant water elevation will minimize the amount of area exposed to these conditions. Furthermore, the elevated water level will result in a pool area characterized by steeper banks rather than gradually sloping shoreline areas. Both of these conditions would limit the recovery of the emergent zone.

Additionally, some of the shoreline and island areas have resulted from the deposit of silt over time. These areas have been pioneered by the emergents and/or willow cover types. The degree to which this process will repeat itself is difficult to predict.

Impacts on the wildlife resource, which is dependent on specific vegetation types and/or island sites varies with species. Those species which are less diversified in their requirements would be the most severely affected. Beaver would be adversely affected if the willow and cottonwood cover types are reduced. Muskrats which depend heavily on the emergent zone for both food and cover would decrease if these zones are flooded. Waterfowl use of these cover types is most common during the nesting and brooding rearing phases. This applies more so to ducks than geese.

A concern with the geese is to maintain adequate brood rearing sites both above and in the pool area. The survey work indicates that the majority of the geese produced on this section of the river move downstream to the reservoir pool to brood. Potential sites below the dam at least to Toston are quite limited. In

fact, the present dam may inhibit the movement of the geese downstream and result in the geese building up in the pool area. Preliminary indications are that the important brooding area G opposite island B should remain available even with the elevated water levels. Brood rearing sites located above the pool should not be impacted. Consideration should be given to monitoring post-impoundment conditions in brood rearing areas in terms of brood use by the geese.

Mitigation Recommendations

On-site mitigation efforts are limited by the configuration of the shoreline, the proximity of the railroad to the river and physical access to the river in the pool area. Mitigation recommendations to be considered to maintain island goose nesting habitat in the pool area include the following:

1 - use of artificial nest structures on existing islands.

2 - enlarge size of existing islands.

A stable water level in the reservoir at full pool during the winter could create significantly greater ice cover on the islands. If this routinely occurs, goose nesting on the islands could be impacted. In addition, the usefulness of artificial nest structures on the islands could be limited by extensive ice cover or the structures themselves could be damaged.

The extent of ice cover on the islands under the current operating regime should be documented. After construction, the characteristic's of ice cover and any adverse affect it may have on Canada Goose nesting should be determined. If the

ice cover under winter full pool conditions is having an adverse affect, various mitigation options should be explored.

The maintenance of existing brood rearing areas is considered very important. The reservoir pool area provides brood rearing for birds hatched in upstream areas as well as those coming from the immediate vicinity. At this time, we do not expect the brood rearing areas to be adversely affected, however DFWP will monitor the brood rearing areas after construction to insure that they remain accessible. If, for some reason, access to the brood rearing areas becomes limited, we will recommend measures to maintain gradual, accessible slopes on existing shoreline areas that the geese are now using.

METHODS - PHASE III

The DFWP does not have the necessary background and expertise to determine the proper design or judge the effectiveness of fish passage facilities at Toston Dam. Most of this expertise is with agencies or consulting firms in coastal regions which specialize in anadromous salmon fisheries. Recognizing this, the DFWP solicited proposals from a number of firms to address the question of fish passage at Toston Dam.

The firm of CH2M Hill was selected for the project and on August 19, 1985 was authorized by MDFWP to conduct a study that would lead to a recommendation to include or exclude a fishway. On December 27, 1985, CH2M Hill delivered to MDFWP a final report entitled "A Report On Fish Passage Facilities For Toston Dam, Montana". A copy of that report is included as Attachment A. Some of the relevant findings are presented below.

RESULTS

1. Salmonids, particularly brown trout, will ascend a fish ladder at Toston Dam. Initial passage may be limited until a number of generations have passed the dam installation. After spawning, adult trout would generally migrate back downriver.

2. The capacity of the Missouri River between Toston Dam and Canyon Ferry Reservoir to rear trout is not limited by the barrier to upstream migration.

3. Recruitment of trout juveniles or fry to below Toston Dam would not necessarily increase; the source of recruitment may only shift upstream with no net change to the fishery below the dam, including Canyon Ferry Reservoir.

4. The possibility of tributaries in the upper Missouri drainage being used for spawning and rearing by trout from below Toston Dam is doubtful given the abundant population of trout already using these streams.

5. The brown trout run at Toston Dam originates from Canyon Ferry Reservoir, and if the progeny have an innate tendency to migrate upstream, it would be undesirable for these fish to spawn with the resident in-river stock above the dam. This would introduce the risk of altering the genetically based migration and distribution characteristics of the upstream population.

6. It must be assumed that undesirable, piscivorous fish species (such as the walleye pike and northern pike) can and will ascend a fish ladder at Toston Dam, thereby gaining access to the upper Missouri River drainage.

7. Fish screens on turbine intakes will be required to protect downstream migrating trout. It can be expected that 10 to 20 percent of the fish passing through the vertical-axis turbines will be killed; tube-type turbines would result in 5 to 10 percent mortalities.

8. Among downstream passage systems available, inclined plane screens would appear to have the best potential for application at Toston Dam. Basic

screening costs are estimated between $2 million and $12 million for maximum flows. The minimum acceptable alternative would cost $2,076,000.

9. Upstream passage can best be achieved with a 4-foot by 6-foot pool and weir type of ladder with a 4-foot by 10-foot trap with manual crowding at the upper end, a trash rack, and an exit channel. The total fish ladder costs could approach or exceed $1 million. The minimum acceptable alternative (combined ladder and hydro construction) would cost $174,000.

10. An alternative to upstream passage facilities would be a fish trap below the dam and transportation of adult trout to upper Missouri River spawning sites. The principal cost of this program would be in annual operation and maintenance labor time and transportation equipment.

In determining the desirability of a fish ladder at Toston Dam, it is necessary to consider both the technical and economical requirements of such a facility and the biological prudence of bypassing what is now an upstream barrier. We will begin with a discussion of the feasibility and merits of constructing a fish passage facility at Toston Dam. This discussion is based largely on the evaluation of the project conducted by the consulting firm of CH2M Hill and a copy of their report is included in this report.

The target species for a fish passage facility at Toston Dam are brown and rainbow trout. These species, unlike salmon, do not die after spawning and can be expected to spawn in subsequent years. Therefore it is necessary to pass adult fish both upstream and downstream over Toston Dam. CH2M Hill indicates that adult trout experience unacceptable rates of mortality if they must pass

downstream through turbines. While there are both operational and technological solutions to the downstream passage problem, their costs appear to be prohibitive.

The purpose of passing fish beyond Toston Dam would be to increase natural reproduction and subsequent recruitment to the reservoir and river trout populations. However, surveys of the Missouri River upstream from Toston Dam suggest that suitable spawning areas are uncommon below the confluence of the three forks of the Missouri. If adult trout were allowed to pass over Toston Dam, their opportunities for successful reproduction would not be great until they ascended at least as far as the forks of the Missouri where they would be competing with resident trout for spawning areas. The impact of whatever additional reproduction might occur on the reservoir trout population may be minimal.

The brown trout population in Canyon Ferry Reservoir is presently maintained by natural reproduction taking place downstream from Toston Dam. Opportunities for enhancing natural reproduction also appear to be centered below Toston Dam. Concentrations of both brown and rainbow trout have been documented at spring water sources that enter the Missouri River downstream from Toston Dam. The development of an artificial spawning channel associated with the largest of these springs is presently being investigated under a separate effort and appears to have potential.

Toston Dam presently serves as an upstream barrier to all fish that might ascend the Missouri from Canyon Ferry Reservoir. The Missouri River Drainage upstream from Toston Dam contains many of the finest wild trout streams in the country.

Rivers such as the Madison, Big Hole, Gallatin and Beaverhead attract fishermen from throughout the country on an annual basis and are an important part of the economies of many communities in southwestern Montana. The protection and maintenance of these valuable fisheries is dependent in part on their protection from introduced, undesirable species.

Unauthorized introductions of fish have already occurred in Canyon Ferry Reservoir. Of greatest concern to date has been the unauthorized introduction of northern pike which have been caught by anglers in the last two years. There is also growing sentiment to plant walleye into Canyon Ferry Reservoir. The introduction of predator species such as these is a matter of concern both to the management of Canyon Ferry Reservoir and to the Missouri drainage upstream. As long as Toston Dam serves as a barrier to upstream migration, the valuable wild trout fisheries of the upper Missouri drainage would be protected from undesirable and potentially destructive species.

Maintaining a fish barrier at Toston Dam would also increase the management opportunities for Canyon Ferry Reservoir. Introductions of forage fish as well as game fish to prey on this forage would be more feasible if fish managers were assured that Toston Dam would remain a barrier to upstream migration. The presence of an upstream barrier would allow fish managers the option of planting species that might be desirable in the reservoir but undesirable in the upper-Missouri drainage above Toston Dam.

Based on the report by CH2M Hill and the information that our department has collected, we do not support the construction of a fish passage facility at Toston Dam.

LITERATURE CITED

Thompson, Larry S. Shoreline vegetation in relation to water level at Toston Reservoir, Broadwater County, Montana. Proc. Mont. Acad. Sci. 42: 7-16 (1983).

APPENDIX

Appendix Table 1. Resident brown trout population estimates conducted in the Toston-Deepdale section of the Missouri River.

	1979		1980		1981		1982	
Age	#/mi.	$\bar{L}$ (in.)	#/mi.	$\bar{L}$ (in.)	#/mi.	$\bar{L}$ (in.)	#/mi.	$\bar{L}$ (in.)
III	102	13.3	68	13.8	44	13.9	53	13.8
IV	87	15.4	55	16.0	79	17.0	42	15.8
V and older	35	18.1	30	18.8			48	18.8
Total	224		153		123		143	

Appendix Table 2. Chronological listing of brown trout tag returns for fish tagged in the fall of 1978.

Return Date	Return Location
April 5, 1979	Missouri River
April 8, 1979	Missouri River, Townsend
April 29, 1979	Reservoir, Goose Bay
May, 1979	Reservoir
May, 1979	Reservoir, Beaver Creek Bay
June 21, 1979	Reservoir
July 4, 1979	Missouri River, Deepdale
July 6, 1979	Reservoir, Beaver Creek Bay
July 29, 1979	Missouri River, Townsend
Sept. 22, 1979	Missouri River, Townsend
Feb., 1980	Missouri River, Toston
Feb. 13, 1980	Reservoir
March 17, 1980	Missouri River, Toston
March 18, 1980	Missouri River, Toston
March 20, 1980	Missouri River, Toston
March 25, 1980	Missouri River, Toston
April 7, 1980	Missouri River, Toston
April 7, 1980	Missouri River, Toston
April 8, 1980	Missouri River, Toston
June 13, 1980	Reservoir, Beaver Creek Bay
Sept. 24, 1980	Reservoir, Goose Bay
Oct. 29, 1980	Missouri River, Toston

Appendix Table 3. Chronological listing of brown trout tag returns for fish tagged in the fall of 1980.

Return Date	Return Location
Nov. 29, 1980	Missouri River, Toston Dam
Dec., 1980	Missouri River, Marsh Creek
Feb. 1, 1981	Reservoir, Beaver Creek Bay
Feb. 16, 1981	Missouri River, Townsend
May 22, 1981	Reservoir, Beer Can Bay
June 14, 1981	Below Canyon Ferry Dam
June 21, 1981	Reservoir, Beaver Creek Bay
March 3, 1984	Reservoir, Goose Bay

Appendix Table 4. Chronological listing of brown trout tag returns for fish tagged in the fall of 1982.

Return Date	Return Location
Oct. 17, 1982	Missouri River, Toston-Deepdale
Nov. 4, 1982	Missouri River, Toston-Deepdale
Dec. 5, 1982	Missouri River, Toston-Deepdale
Dec. 18, 1982	Missouri River, Toston-Deepdale
Jan., 1983	Missouri River, Mouth of Dry Creek
Jan. 31, 1983	Reservoir, Silos
Feb. 10, 1983	Missouri River, Toston-Deepdale
Feb. 10, 1983	Missouri River, Toston-Deepdale
Feb. 10, 1983	Missouri River, Toston-Deepdale
Feb. 13, 1983	Missouri River, "FLUME"
Feb. 24, 1983	Reservoir, Confederate
March 3, 1983	Reservoir, Whitehorse
March 4, 1983	Reservoir, Beaver Creek Bay
March 6, 1983	Reservoir, Whitehorse
March 12, 1983	Reservoir, White Earth
March 13, 1983	Missouri River, Deepdale
March 13, 1983	Reservoir, White Earth
March 13, 1983	Reservoir, Goose Bay
March 19, 1983	Reservoir, White's Bay
March 26, 1983	Reservoir, Confederate
April 1, 1983	Reservoir, Confederate
April 17, 1983	Reservoir, White Earth
April 17, 1983	Reservoir, Hellgate
April 23, 1983	Reservoir, Duck Creek Bay
April 23, 1983	Reservoir, Near Canyon Ferry Dam
April 23, 1983	Reservoir
May 1, 1983	Reservoir, Beer Can Bay
May 11, 1983	Reservoir, Confederate
May 26, 1983	Reservoir
May 29, 1983	Reservoir, Ski Bay
June, 1983	Reservoir, Silos
June 4, 1983	Reservoir, Hellgate
June 8, 1983	Reservoir, Goose Bay
June 15, 1983	Reservoir, Snaggy Bay
June 15, 1983	Reservoir, Snaggy Bay
June 24, 1983	Reservoir, Scuda Bay
July 4, 1983	Reservoir, Silos
August 31, 1983	Missouri River, "FLUME"
March 25, 1984	Reservoir, Silos
May 10, 1984	Reservoir, Goose Bay
June 9, 1984	Reservoir, Goose Bay
June 28, 1984	Reservoir, Magpie Bay
Dec. 13, 1984	Reservoir, Silos
Feb. 28, 1985	Reservoir, Silos
August 16, 1985	Missouri River, Toston
Sept. 29, 1985	Missouri River, Toston Dam

Appendix Table 5. Chronological listing of rainbow trout tag returns for fish tagged in the spring of 1979, Toston-Deepdale Section.

Return Date	Return Location
April 7, 1979	Missouri River, Toston Dam
May 8, 1979	Missouri River, Big Spring
June, 1979	Missouri River, Toston Dam
June 14, 1979	Missouri River, Townsend Bridge
April 7, 1980	Missouri River, Toston-Deepdale

Appendix Table 6. Chronological listing of rainbow trout tag returns for fish tagged in the spring of 1981, Toston-Deepdale Section.

Return Date	Return Location
April 5, 1981	Missouri River, Toston Dam
April 5, 1981	Missouri River, Toston Dam
May 12, 1981	Reservoir, Goose Bay
May 15, 1981	Reservoir, Cemetary Island
May 17, 1981	Reservoir, Cemetary Island
May 28, 1981	Reservoir, Cemetary Island
June 5, 1981	Reservoir, Beer Can Bay
June 11, 1981	Reservoir, Hellgate
June 28, 1981	Reservoir, Silos
July 4, 1981	Missouri River, Crow Creek
July 10, 1981	Reservoir, Snaggy Bay
August 1, 1981	Reservoir, Silos
August 21, 1981	Reservoir, Ski Bay
August 22, 1981	Reservoir, Beaver Creek Bay
Oct. 23, 1981	Missouri River - Mouth
Jan. 10, 1982	Holter Lake
March 22, 1982	Missouri River, Toston-Deepdale
March 25, 1982	Missouri River, Toston-Deepdale
March 31, 1982	Missouri River, Toston-Deepdale
May 8, 1982	Missouri River, Toston-Deepdale
June 10, 1982	Holter Lake

Appendix Table 7. Chronological listing of rainbow trout tag returns for fish tagged in the spring of 1982, Toston-Deepdale Section.

Return Date	Return Location
April 14, 1982	Missouri River, Toston-Deepdale
May 2, 1982	Missouri River, Toston Dam
May 7, 1982	Reservoir
May 15, 1982	Missouri River, Toston Dam
May 21, 1982	Reservoir, West Shore
May 26, 1982	Reservoir, Hellgate
June 10, 1982	Reservoir, Yacht Basin
June 19, 1982	Reservoir, White Earth
August 8, 1982	Missouri River, Below Hauser Dam
Sept., 1982	Missouri River, Townsend Bridge
Sept. 13, 1982	Missouri River, Townsend Bridge
Oct. 1, 1982	Reservoir, Silos
Dec. 10, 1982	Missouri River, Toston Dam
Dec. 10, 1982	Missouri River, Toston Dam
Jan., 1983	Missouri River, "FLUME"
Jan., 1983	Missouri River, Toston Dam
May 12, 1983	Missouri River, "FLUME"
June 14, 1984	Reservoir, Beer Can Bay

Appendix Table 8. Chronological listing of rainbow trout tag returns for fish tagged in the spring of 1983, Toston-Deepdale Section.

Return Date	Return Location
April 30, 1983	Reservoir, Cemetary Island
May 14, 1983	Reservoir, Cemetary Island
May 28, 1983	Reservoir, Orchard Bay
June 1, 1983	Reservoir, East Shore
June 24, 1983	Reservoir, Ski Bay
July, 1983	Reservoir, Beaver Creek Bay
July 3, 1983	Reservoir, Hauser Lake
July 13, 1983	Reservoir, Goose Bay
June 15, 1984	Reservoir, Hellgate
May 8, 1985	Missouri River, Below Toston

Appendix Table 9. Chronological listing of rainbow trout tag returns for fish tagged in the spring of 1984, Townsend-Canyon Ferry Section.

Return Date	Return Location
April 7, 1984	Reservoir, Duck Creek Bay
April 13, 1984	Missouri River, Townsend
April 14, 1984	Reservoir, Confederate
May 10, 1984	Reservoir, Cemetary Island
May 28, 1984	Reservoir, Canyon Ferry Dam
May 31, 1984	Reservoir, Canyon Ferry Dam
June 10, 1984	Reservoir, Goose Bay
June 20, 1984	Reservoir, White Earth
Dec., 1984	Reservoir, Silos
May 21, 1985	Reservoir, White Earth

Appendix Table 10. Chronological listing of rainbow trout tag returns for fish tagged in the spring of 1985, Toston Dam Section.

Return Date	Return Location
April 27, 1985	Missouri River, Toston Dam
May, 1985	Missouri River, Marsh Creek
May, 1985	Missouri River, Marsh Creek
June 28, 1985	Missouri River, Toston Dam
Oct. 13, 1985	Missouri River, Deepdale