APPENDIX I

FLOODPLAINS/WETLANDS ASSESSMENT*

Executive Orders 11988 (Floodplains Management) and 11990 (Protection of Wetlands) and U.S. Department of Energy (DOE) regulation "Compliance with Floodplain/Wetlands Environmental Review Requirements (10 CFR 1022)" specify the requirements for a floodplain/wetlands assessment.

DOE issued a floodplain/wetlands notice regarding the proposed reactivation of L-Reactor on July 14, 1982 (47 FR 30563). A floodplain/wetlands determination regarding no practical alternative was published in the Federal Register on August 23, 1982 (47 FR 36691-2). The updated and/or modified floodplain/wetlands determination will follow the completion of this EIS.

This appendix describes the effects on floodplains and wetlands that would result from the direct discharge of L-Reactor cooling water to Steel Creek, or from the implementation of alternative cooling systems, as discussed in Section 4.4.2. Some estimates of wetlands losses have been revised since the DEIS due to the availability of new data. These alternatives include the following:

Once-through alternatives

- Direct discharge to Steel Creek (reference case)
- Spray canal
- Small lakes
- Small lakes with spray cooling (1-2 sets)
- 500-acre lake
- 500-acre lake with spray cooling (1-2 sets)
- 1000-acre lake
- Diversions to Pen Branch

Mechanical-draft cooling tower alternatives

- Once-through with discharge to Steel Creek
- Once-through - canal to swamp
- Once-through - spray canal and canal to swamp
- Once-through - canal to swamp; pipe to river
- Total recirculation - blowdown to Steel Creek
- Total recirculation - blowdown treatment
- Partial recirculation - with discharge to Steel Creek
- Partial recirculation - with refrigeration

Other recirculation alternatives

- Recirculation through creation of L-Pond
- Recirculation through creation of Kal Pond
- Recirculation through creation of High-Level Pond
- Recirculation through Par Pond

---

*Vertical change bars have not been used in this appendix because of the extensive revisions that have been made.

Other alternatives

- Thermal cogeneration
- Low-head hydropower
- Modified reactor operation
- Fisheries management programs
- Protect similar wetlands

I.1 WETLANDS

I.1.1 Direct discharge to Steel Creek (reference case)

Direct discharge would release about 11 cubic meters of thermal effluent per second from L-Reactor directly to Steel Creek, as was done during the pre-1968 operation of L-Reactor. Modeling of L-Reactor liquid discharges indicates that the thermal effluent will be discharged to Steel Creek at a maximum temperature of 73°C. Cooling will occur as the effluent flows to the Savannah River. The thermal effluent will enter the swamp at temperatures between 41°C (spring) and 46°C (summer). When L-Reactor is operating, the segment of Steel Creek above the swamp will be subjected to temperatures 19° to 38°C above ambient in summer, spring, and winter.

The species found in Steel Creek today are typical of those in similar nonthermal streams at the Savannah River Plant. The presence of stoneflies, mayflies, caddisflies, and dragonflies indicates that Steel Creek is recovering from prior cooling-water discharge impacts. Collections of species of crustaceans (crayfish) have been similar in both Steel Creek and the nonthermal Upper Three Runs Creek. About 50 species of fish have been collected from 1981 to 1983 from Steel Creek (Smith, Sharitz, and Gladden, 1981, 1982, 1983). The present diversity of organisms in Steel Creek indicates that post-thermal recovery of the macroinvertebrate communities has progressed during the past 15 years.

L-Reactor discharge is expected to have effects similar to those that occurred during previous operations; this is described in Section 4.1. Flooding and siltation associated with the thermal discharge are expected to adversely affect aquatic habitat in the Steel Creek floodplain and delta area. An estimated 730 to 1000 acres of wetlands will receive adverse impacts from the direct discharge of thermal effluent to Steel Creek. These wetlands, which have become established during the past 15 years through the process of natural succession, are structurally different from the closed canopy of mature cypress and tupelo gum that existed before the SRP began operation. These wetlands include approximately 420 to 580 acres of the Steel Creek corridor and between 310 to 420 acres of swamp (approximately 250 acres of swamp are expected to receive adverse impacts almost immediately; the remainder would be affected at a rate of about 7 to 10 acres per year). The wetlands that would be impacted by this alternative are classified as Resource Category 2 by the U.S. Fish and Wildlife Service. This resource category and its designation criteria include "high value for evaluation species and scarce or becoming scarce." The mitigation planning goal specifies that there be "no net loss of inkind habitat value" (USDOI, 1981). The delta is expected to expand into the swamp at a rate of about 3 acres per

year. Aquatic macrophytes and woody plants will be eliminated in the Steel Creek corridor. Species that inhabit cooler backwater pools or other suitable substrates might experience a reduction in productivity.

After the resumption of operations, emergent wetland flora and submergent hydrophytes will be eliminated and their substrates will revert to mudflats. Some herbaceous flora will become established on exposed floodplain sediments and elevated stumps, and logs of fallen trees. Most shrubland communities also will probably be eliminated. Riverine vegetation in the vicinity of the mouth of Steel Creek consists primarily of bottomland hardwood forests; emergent and submergent macrophytes are sparse or absent. It is improbable that the thermal effluent would impact these riverine flora.

During thermal discharge, Steel Creek above the delta will be inhabitable for most aquatic life. In addition, the water temperature of Steel Creek might isolate the floodplain swamp from river fish. Most, if not all, spawning activity will probably be eliminated. The most common fish remaining in the Steel Creek area probably will be the mosquitofish, although a few centrarchids might occur in backwater areas and tributary streams such as Meyers Branch (Cherry et al., 1976; Falke and Smith, 1974; Ferens and Murphy, 1974; McFarlane, 1976; McFarlane et al., 1978).

Although 2280 acres of the wetlands along Steel Creek above L-Area and along Meyers Branch above its confluence with Steel Creek will not receive direct thermal discharges, access to these areas by fish from the Savannah River will be restricted. The entrance to Boggy Gut Creek, an offsite tributary immediately downriver of Steel Creek, could be blocked at times by the thermal plume; fish access would be limited. Wetland areas of Boggy Gut Creek total about 230 acres.

Except for backwater pools or other cool-water refuges, the high water temperatures from the outfall to the delta will make this section of Steel Creek uninhabitable for amphibian eggs and larvae. Adult life forms might survive along the stream margins or relocate to adjacent habitats.

Reptiles depend more on aquatic habitat for food (i.e., insects, fish, amphibians) and shelter than for reproduction. The elevated water temperature and the elimination of prey organisms will eliminate the habitats of semiaquatic snakes and turtles upstream from the delta, and will cause a marked decrease in species richness. Portions of the delta might provide marginal habitat for water snakes and turtles following L-Reactor restart.

The endangered American alligator inhabits all parts of Steel Creek from the L-Reactor outfall to the cypress-tupelo forest adjacent to the Steel Creek delta; it also uses areas lateral to Steel Creek, including Carolina bays, backwater lagoons, and beaver ponds. The number of alligators inhabiting the Steel Creek area has ranged from 23 to 35 individuals. Telemetry studies showed that adult males had larger home ranges than juveniles and females. Males sometimes moved from the delta into the Savannah River swamp (Smith, Sharitz, and Gladden, 1982).

Direct discharge will eliminate alligator habitat in Steel Creek from the reactor outfall to the Savannah River, except for backwater pools or other cool-water refuges, by increasing the water temperature above limits that are

physiologically tolerable, eliminating its principal food sources, and possibly inundating its nests and shallow-water wintering habitats (Smith, Sharitz, and Gladden, 1981, 1982). Adult alligators can avoid thermal waters and migrate considerable distances overland. Overwintering alligators could be killed by thermal effluent if they were in a torpid condition. Juveniles could also avoid thermal effluents, but smaller alligators might experience difficulty in migrating to suitable habitats and could be more subject to predation. Nesting sites and eggs could be inundated and destroyed. Red sore, a bacterium-caused disease that affects fish and reptiles, could become more prevalent with thermal loading and could affect the American alligator. Conditions conducive to the reproduction of this bacterium, however, are very specific (i.e., water temperature, pH, etc.), and are associated more with lentic (nonflowing) ecosystems such as Par Pond. This bacterium currently appears isolated in Par Pond, and its presence has not been confirmed in SRP stream ecosystems.

Formal consultation on the American alligator was held under the Endangered Species Act in September 1982 with representatives of DOE-SR, Du Pont, NUS Corporation, the Savannah River Ecology Laboratory (SREL), and the U.S. Fish and Wildlife Service (FWS). A Biological Opinion was received from the FWS in which FWS judged that protection of the lagoons at SRP Road A should provide sufficient mitigation for the American alligator potentially impacted by L-Reactor restart. Protection of these lagoons has been completed. DOE has reinitiated consultations with FWS (Sires, 1983).

The Savannah River swamp and Steel Creek delta provide an important regional sanctuary and refuge for waterfowl. More than 400 wood ducks and nearly 1200 mallards have been observed roosting and feeding in the Steel Creek delta. Seven other species of waterfowl also use this area. These habitats will be eliminated by direct discharge.

The Steel Creek delta also provides important foraging habitat for the wood stork, a large wading bird that is listed as an endangered species (USDOI, 1984). A total of 478 observations of foraging wood storks was made in the Savannah River swamp in 1983, of which 102 were in the Steel Creek delta. Thermal discharge will eliminate these feeding habitats. DOE has initiated a consultation process with the U.S. Fish and Wildlife Service on the wood stork.

Semiaquatic mammals that will be affected by the thermal effluent include the beaver, river otter, mink, and muskrat. Except for the muskrat, these species are common throughout the Savannah River Plant. Adults should not experience mortality due to increased flow and temperature.

I.1.2 Once-through alternatives

I.1.2.1 Once-through spray canal system

This alternative would provide a spray canal to reduce L-Reactor effluent temperatures before the effluent is discharged to Steel Creek. During the summer, effluent entering this spray canal at a rate of about 11 cubic meters per second would be cooled by about 5°C and discharged to Steel Creek at about 73°C. Based on thermal modeling, extreme summer effluent temperatures at Road A and Steel Creek delta would be 53°C and 45°C, respectively. These temperatures

are slightly cooler than those of the direct-discharge effluent at the same locations. Given this slight reduction in effluent temperature and identical flow rates, the impact of a spray canal on wetlands would not differ significantly from that of direct discharge. Delta growth would be about 3 acres per year, and as many as 785 to 1005 acres of wetlands would be impacted. Additionally, approximately 110 acres, half of which are wetlands, would have to be cleared in the vicinity of the spray system in order to enhance cooling performance. If this alternative is implemented before the restart of L-Reactor, the environmental impacts would be as described above. If it is implemented after direct discharge occurs, the environmental impacts would be essentially the same. Any mitigative effects resulting from the small lakes alternative would not begin until the end of the 18- to 24-month construction period. Furthermore, this system offers no mitigation to the habitat of the endangered American alligator, the endangered wood stork, migratory waterfowl, or other aquatic species.

Wetland impacts expected from implementation of the spray canal system would not differ appreciably if this system was implemented either before or after L-Reactor restart (a maximum of 1060 acres compared to 1005 acres).

I.1.2.2 Small lakes on Steel Creek

A series of rubble dams on Steel Creek could provide several small lakes with a combined area of about 120 acres. The thermal effluent discharged through these lakes at 11 cubic meters per second and under maximum summer conditions would be cooled to about 45°C on discharge from the last lake and 40°C where Steel Creek enters the swamp. This cooling system would provide limited use of Steel Creek below Road A by some thermally tolerant aquatic organisms. However, this system would not maintain alligator habitat below Road A, because of the general loss of prey organisms. Although this alternative provides some mitigation below Road A, thermal impacts will occur. Delta growth would be about 2 acres per year, and as many as 1000 acres of wetlands would be adversely affected by flooding, siltation, and thermal impacts. Flooding, controlled by the reactor operation schedule, would be intermittent and would cause fluctuating water levels. The cooler temperatures near the delta would result in a decreased rate of vegetative mortality. However, flooding, siltation, and fluctuating water levels, when coupled with the thermal effects, would have adverse impacts on wetlands that are classified as Resource Category 2 by the U.S. Fish and Wildlife Service (USDOI, 1981). This resource category and its designation criteria include "high value for evaluation species and scarce or becoming scarce." The mitigation planning goal specifies that there be "no net loss of inkind habitat value." In addition, about 2500 acres of wetlands could be physically isolated by the dams and thermal temperatures.

I.1.2.3 Small lakes with spray cooling (1-2 sets)

The combination of small rubble dams to create approximately 120 acres of shallow lakes combined with a spray cooling system (1-2 sets) would mitigate some of the environmental effects of a direct discharge system. The gravity spray canal system would be installed to obtain about 5°C cooling before the

water enters the first lake. The small dams would create pools that would slow the movement of the water and enhance cooling. Maximum exit temperatures in the summer would be 44°C with one spray system or 39°C with two spray systems. In the swamp the effluent would be cooled to 34°C and 37°C, respectively.

The use of small lakes without sprays would impact between 420 and 580 acres of wetlands in the Steel Creek corridor and between 310 and 420 acres of wetlands in the delta and swamp. The use of sprays (1 or 2 sets) would impact an additional 55 acres of wetlands in the vicinity of the spray canal. However, the cooling achieved by sprays would reduce the impacts to the delta and swamp to between 215 and 335 acres of wetlands. Thus, the total wetlands impacted by small lakes without sprays would range between 730 and 1000 acres. Small lakes with sprays (1 or 2 sets) would impact between 690 and 970 acres of wetlands. The wetlands that would be impacted by this alternative are classified as Resource Category 2 by the U.S. Fish and Wildlife Service. This resource category and its designation criteria include "high value for evaluation species and scarce its becoming scarce." The mitigation planning goal specifies that there be "no net loss of inkind habitat value" (USDOI, 1981).

Erosion and transport of sediment will increase because the flow rate will be about 11 cubic meters per second. A delta growth rate of about 2 acres per year is anticipated. In addition to sedimentation and erosion from flow, some sedimentation will be associated with construction of the embankment; however, it will be covered by an erosion/sedimentation plan. Spoil removed from the embankment site will contain small amounts of radioactivity. Spoil from the surface portion of the embankment foundation in the Steel Creek floodplain, estimated to contain a total of 0.2 curie of cesium-137 and 0.02 curie of cobalt-60, would be separated, contained, replaced outside the jurisdictional wetlands upstream of the embankment, and covered with subsurface spoil to prevent erosion during the construction period. This relocation would have no effect on net cesium transport estimates. All other material would be removed and used for backfill in the borrow areas.

If the small lakes alternative (1-2 sets) is implemented before direct discharge occurs, the environmental effects would be as described above. If it is implemented after direct discharge starts, the environmental effects would be the same as those described in Section 4.4.2.2.1 (i.e., loss of 730 to 1000 acres of wetlands, etc.). The mitigative effects resulting from small lakes with sprays (1-2 sets) would not begin until the end of the 18- to 24-month construction period.

I.1.2.4 500-acre lake

The impacts on wetlands from a 500-acre lake on Steel Creek would generally be similar to those for the spray canal and small lakes systems. Although lower maximum summer effluent temperatures are projected at Road A (37°C) and the delta (36°C), the high rate of flow and fluctuating water levels would adversely affect the wetland vegetation. Macrophytes would be uprooted by strong currents, and woody flora would be eliminated due to prolonged inundation. Reproduction of wetlands vegetation in most areas would be uncommon because of the flooding and fluctuating water levels associated with reactor operation. Roosting and feeding habitat for waterfowl will be lost. In addition, the

fluctuating water levels are expected to discourage spawning and inhibit the successful reproduction of fish. Even with lower effluent water temperatures below Road A, vegetation will be lost in the Steel Creek corridor and on the delta. Habitat quality for the American alligator will be reduced in Steel Creek below Road A because of the loss of prey organisms.

Delta growth is projected to be 2 acres per year. Between 650 and 930 acres of wetlands would be impacted by this action. This includes between 435 and 595 acres in the Steel Creek corridor and between 215 and 335 acres in the delta and swamp. The wetlands that would be impacted by this alternative are classified as Resource Category 2 by the U.S. Fish and Wildlife Service. This resource category and its designation criteria include "high value for evaluation species and scarce or becoming scarce." The mitigation planning goal specifies that there be "no net loss of inkind habitat value" (USDOI, 1981). Approximately 2280 acres of riparian wetlands associated with Meyers Branch and the upper headwaters of Steel Creek could be isolated. As many as 360 acres of upland vegetation would be inundated by the impoundment. The principal difference between this option and direct discharge or spray canal options is not the magnitude, but the rate and location of impacts. Cooler temperatures in peripheral areas of the delta should enable limited vegetative establishment. Flooding, siltation, and fluctuating water levels, when coupled with thermal effects, would halt the vegetative succession that has been progressing in the swamp since 1968.

If this alternative is implemented before the restart of L-Reactor, the environmental impacts to wetlands would be as described above. If it is implemented after direct discharge occurs, there would be some limited mitigation, but this would not begin until the end of the 18- to 31-month construction period. The construction of this alternative could be expedited to about 6 months.

I.1.2.5 500-acre lake with spray cooling (1-2 sets)

Combinations of several once-through cooling-water systems could have fewer thermal effects than a single system. The combined system discussed in Section 4.4.2 consists of a 500-acre lake with a spray cooling system (1-2 sets). The gravity spray canal system would obtain about 5°C cooling before the water enters the lake. This water (at 73°C) would be cooled to about 38°C during its travel through the lake (under extreme meteorological conditions). A system with two sprays would cool the water to less than 32°C before discharging it to Steel Creek. With a single spray system located above the 500-acre lake, the maximum summer discharge temperature from the lake would be 37°C.

Approximately 705 to 985 acres of wetlands habitat would be lost with one or two sets of sprays. This would consist of 490 to 650 acres in Steel Creek corridor and 215 to 335 acres in the delta and swamp. This system would not mitigate flooding and fluctuating water levels in the Steel Creek system. Therefore, the principal differences between the combined system and other once-through systems would be a decreased rate of vegetative mortality in the Steel Creek corridor and delta below the final spray lake; it is possible that fish and other organisms would be able to use the creek below the dam.

If the 500-acre lake with spray cooling system (1-2 sets) is implemented before direct discharge occurs, the environmental impacts would be as described above. If it is implemented after direct discharge occurs, the environmental impacts would be the same as those described in Section 4.2.2.2.1 (i.e., loss of 730 to 1000 acres of wetlands, etc.). The mitigative effects resulting from this alternative would not begin until the end of the 31- to 36-month construction period.

I.1.2.6 1000-acre lake

This alternative consists of the construction of a 1000-acre once-through cooling lake on Steel Creek. The normal water surface elevation would be 61 meters above mean sea level. The embankment for this cooling lake would be at the same location as the embankment for the 500-acre lake described in Section 4.4.2. The impacts from the 1000-acre lake were bracketed by those from the 500-acre lake and the 1300-acre lake described in the Draft EIS.

Projected water temperatures in the summer (5-day, worst-case) at the Steel Creek delta, mid-swamp, and the mouth of Steel Creek would be within about 1°C of ambient. In the spring, water temperatures at the delta would be 3°C above ambient. Water temperatures would be near ambient at the mouth of Steel Creek. These conditions do not pose any adverse impacts to aquatic and semiaquatic biota. In the winter, however, projected temperatures at Road A and points downstream would be 7°C to 9°C above ambient. These warmer conditions could concentrate fish at the mouth of Steel Creek. Reactor shutdowns during the winter would result in a gradual heat loss in this area, which would minimize any cold shock effects. This alternative would not adversely affect access to, and the spawning of riverine and anadromous fishes in, the Savannah River swamp below the Steel Creek delta.

The habitat impacted by the 1000-acre lake would include between 520 and 680 acres of wetlands in the Steel Creek corridor. The flow of discharge water would have adverse impacts on between 215 and 335 acres of wetlands in the Steel Creek delta and swamp. This area, which is dominated by forested (45 percent) and scrub-shrub (36 percent) wetlands, provides foraging habitat for the endangered wood stork and American alligator. These wetlands also represent important feeding and roosting habitat for as many as 1200 mallard and 400 wood duck. A delta growth rate of about 1 to 2 acres per year is anticipated. These wetlands are classified as Resource Category 2 by the U.S. Fish and Wildlife Service. This resource category and its designation criteria include "high value for evaluation species and scarce or becoming scarce." The mitigation planning goal specifies that there be "no net loss of inkind habitat value" (USDOI, 1981).

If this alternative is implemented before the restart of L-Reactor, the environmental impacts would be as described above. If it is implemented after direct discharge occurs, the environmental impacts would be the same as those described in Section 4.4.2.2.1 (i.e., loss of 730 to 1000 acres of wetlands, etc.). Any mitigative effects resulting from the 1000-acre lake alternative would not begin until the end of the 35-month construction period. Construction of this alternative could be expedited to about 6 months.

I.1.2.7 Once-through cooling by diversions to Pen Branch

This alternative includes two options: (1) a diversion to Pen Branch by penstock and canal, and (2) a diversion to Pen Branch by lake and canal.

The lower segment of Pen Branch presently receives thermal effluent from K-Reactor. Depending on the diversion option, approximately 2 to 5 kilometers of Pen Branch above Indian Grave Branch that have never received thermal discharge would receive heated effluent from L-Reactor. Flows in this reach would be about 10 times the natural rate at the point of L-Reactor discharge, resulting in appreciable stream erosion. Portions of Pen Branch are expected to be severely eroded by the downcutting, widening, and straightening of its channel. A mixture of sand and mud would be deposited in its delta region, resulting in the growth of the delta by 18 acres or more per year during the first 7 to 10 years of combined K- and L-Area discharges to Pen Branch and eventually modifying the heat dissipation characteristics of the swamp. Below the confluence of Pen Branch and Indian Grave Branch, the combined K- and L-Reactor discharges would double the flow of Pen Branch. The effluent temperature is estimated to be 58°C when it enters the swamp. Approximately 1280 acres of wetlands are expected to be adversely impacted: this would consist of (1) a small portion of Steel Creek (60 acres), (2) a previously unimpacted part of Pen Branch (50 acres), (3) the Pen Branch delta (210 acres), and (4) 960 acres of the Savannah River floodplain. No mitigation of swamp habitat for the endangered American alligator or wood stork would be achieved by this alternative.

The diversion of L-Reactor cooling water by a penstock canal to Pen Branch would eliminate thermal discharges to Steel Creek. Therefore, between 730 and 1000 acres of wetlands in Steel Creek, delta, and Savannah River floodplain would receive no impact. However, about 1220 acres of previously undisturbed wetlands in the Pen Branch (55 acres), its delta (210), and the Savannah River swamp (960 acres) would be affected by the diversion. Implementation after restart would impact between 730 and 1000 acres of wetlands and wetland habitat in the Steel Creek, Steel Creek delta, and Savannah River floodplain. After the completion of the diversion, the wetlands in the Steel Creek and portions of the Savannah River swamp system could reinitiate a successional recovery.

The implementation of the lake-diversion system before or after L-Reactor restart would be similar to that for the penstock canal diversion except for (1) the 60-acre lake caused by damming Steel Creek and (2) the smaller reach of Pen Branch that has not previously received thermal discharges.

I.1.3 Mechanical-draft cooling towers

Mechanical-draft cooling towers added to the L-Reactor site could utilize three principal modes of operation: (1) once-through with direct discharge to Steel Creek, the swamp via a canal, or the Savannah River via a canal and pipeline, (2) total recirculation via the 186-Basin, or (3) partial recirculation with and without refrigeration. A summary of the impacts to floodplains and wetlands from the various alternative cooling systems is given below.

I.1.3.1 Cooling towers with once-through and direct discharge

I.1.3.1.1 Once-through and direct discharge to Steel Creek

This alternative would discharge cooling effluent into Steel Creek at a somewhat lower rate of flow (10.2 cubic meters per second) due to evaporation losses. The temperature of the effluent would be lowered by the towers, and would vary according to the approach to the design wet bulb temperature (i.e., 2.8° or 5.6°C). Temperature of Steel Creek in summer and spring would be at or near ambient above Steel Creek delta (2.8°C approach); in winter temperatures would be 7°C above ambient at the delta. The 5.6°C approach could have adverse effects on Steel Creek because the discharge temperatures would be about 31°C during a 5-day period that is expected to occur once about every 5 years. Otherwise the 5.6°C approach tower will meet the 32°C water-quality standard about 99 percent of the time.

The towers would substantially mitigate the effects associated with direct discharge temperatures; the environmental impacts of this alternative would be less than those for direct discharge; they are summarized as follows:

- High flow rate would eliminate between 420 and 580 acres of wetlands within the Steel Creek corridor. Because the effluent would not have markedly elevated temperatures, high flow rate would impact between 70-80 percent of the delta and swamp area predicted for direct discharge. Thus, between 215 and 335 acres of delta or swamp wetlands would be eliminated (or a total of 635 to 915 acres) due to high flow rate from this alternative cooling system. This would include foraging habitat of the endangered wood stork and the endangered American alligator.

- The spring temperatures should not affect approximately 2500 acres of wetlands and aquatic habitat for spawning riverine and anadromous fishes and other semiaquatic biota because spring temperatures in the swamp and delta would be within 4°C of ambient.

- No impacts to substrate, water quality, or water levels due to dredging and filling.

If this alternative is implemented before restart occurs, environmental impacts would be as described above (i.e., loss of about 635 to 915 acres of wetland due to high flow). If it is implemented after restart occurs, the environmental impacts would be the same as those described in Section 4.4.2 (i.e., loss of 730 to 1000 acres of wetlands, etc.). Any mitigative effects resulting from this alternative would not begin until the end of the 27-month construction period.

I.1.3.1.2 Once-through - canal to swamp

This alternative would directly discharge cooling-water effluent into a canal at a rate of 10.2 cubic meters per second. This canal would bypass the Steel Creek corridor and discharge through a diffuser in the vicinity of Steel Creek delta.

This alternative (all approaches) would avoid Steel Creek down to the swamp, allowing approximately 420 to 580 acres of wetland to continue successional recovery in the Steel Creek corridor, including habitat for the endangered American alligator. The effluent would reach the swamp via the canal near Steel Creek and enter the swamp through a diffuser at temperatures between 23°C and 28°C during the spring, which would allow riverine and anadromous fish and other biota to have access to the swamp during the spawning season. Temperatures at the delta during the summer would be 28°C and 31°C for the 2.8°C and 5.6°C approaches, respectively. However, the impacts on the swamp from the 10.2-cubic-meter-per-second flow would be almost the same as those described for direct discharge.

The canal would be routed adjacent to Steel Creek above the floodplain and extend for approximately 10.4 kilometers before discharging at the delta. The canal would impact about 120 acres of upland pine forest and open fields, and require the disposal of approximately 850,000 cubic meters of spoil.

This alternative cooling system would have no impact on endangered and threatened species that inhabit Steel Creek above its delta because the creek corridor would not receive thermal effluent. The discharge of 10.2 cubic meters per second through a diffuser located at the Steel Creek delta might channelize portions of the existing wetlands. Between 215 and 335 acres of wetlands in the delta and swamp would be impacted. However, the discharge temperatures (28°C and 34°C for 2.8°C and 5.6°C approaches in summer, respectively) would not adversely impact the American alligator. The greatest potential impact would result from elevated water levels, which could eliminate foraging habitat for the endangered wood stork. The shortnose sturgeon would be unaffected by this alternative.

Dredge material from the canal and the area in the swamp around the diffuser would be monitored and handled to meet applicable regulatory requirements. Thus, no significant changes in water quality, suspended particulates, or turbidity are expected to occur in the swamp or Savannah River due to dredge and fill activities.

If this alternative is implemented before restart occurs, the environmental impacts would be as described above (successional recovery of 420 to 580 acres of wetland in Steel Creek corridor and losses of 215-335 acres in the swamp). If it is implemented after restart occurs, the environmental impacts would be the same as those described in Section 4.4.2.2.1 (i.e., loss of 730 to 1000 acres of wetlands, etc). Any mitigative effects resulting from this alternative would not begin until the end of the 27-month construction period.

I.1.3.1.3 Once-through - spray canal and canal to swamp

This alternative would discharge cooling-water effluent into the swamp via a canal at a somewhat lower rate of flow (10.2 cubic meters per second) than direct discharge due to evaporation losses. The temperature of the effluent under this alternative would be identical in summer and spring to that of the alternative described in Section 4.4.2.3.1.2, minus the spray system. It would be lower in winter due to cooling by the spray system.

This alternative would include complete avoidance of Steel Creek down to the swamp, allowing approximately 420 to 580 acres of wetland to continue successional recovery in the Steel Creek corridor, including habitat for the endangered American alligator. The effluent would reach the swamp via a canal near Steel Creek and enter the swamp through a diffuser at temperatures between 28°C and 30°C (essentially 2°C below summer ambient temperatures; 2.8°C approach). This would allow access in the spring to the entire swamp and Steel Creek by spawning riverine and anadromous fish and other aquatic biota. However, the impacts on the swamp from the 10.2-cubic-meter-per-second flow would be the same or slightly less than those described for direct discharge.

Except for water temperatures slightly cooler (2°C) than ambient in the swamp and mouth of Steel Creek (with a 2.8°C approach tower), the environmental impacts of this alternative would be the same as those for cooling towers having once-through discharge via a canal to the swamp. These impacts are summarized as follows:

- No impact to the Steel Creek corridor, but increased flow rate would eliminate 215 and 335 acres or wetlands in the swamp.

- Approximately 120 acres of upland pine forest and open fields would be disturbed for construction of the canal; 850,000 cubic meters of spoil would have to be removed and stored or utilized. About 30 acres of upland pine forest would be removed for the construction of the towers. In order to achieve optimal cooling performance with one set of sprays, vegetation within 300 meters of the sprays must be cleared to enhance evaporative rates. This would eliminate approximately 55 acres of wetlands and 55 acres of upland habitat.

- No impact to the American alligator and shortnose sturgeon; foraging habitat of the endangered wood stork would be adversely impacted due to increased water levels.

- Modification of the bottom contour of the swamp in the vicinity of the diffuser.

- No impact to water quality or increased suspended particulates and turbidity would result from the dredging of the canal. Short-term impacts might be associated with the installation of the diffuser.

If this alternative is implemented before restart occurs, the environmental impacts would be as described above (successional recovery of 420 to 580 acres of wetlands in Steel Creek and loss of about 215 to 335 acres in the swamp due to high flow rate). If it is implemented after restart occurs, the environmental impacts would be the same as those described in Section 4.4.2.3.1.2 (i.e., loss of 730 to 1000 acres of wetlands, etc.). Any mitigative effects resulting from this alternative would not begin until the end of the 27-month construction period.

I.1.3.1.4 Once-through - canal to swamp - pipe to river

This alternative would completely avoid Steel Creek and the swamp, allowing approximately 730 to 1000 acres of wetland to continue to undergo successional recovery and fish would have full access to Steel Creek and Swamp. However, access of fish to Boggy Gut Branch would be limited, especially during the spring and summer.

The diffuser would be constructed to mix the effluent rapidly with the river. Based on seasonal outfall temperatures, a zone of passage would be maintained to allow movement of anadromous fish past SRP; the mouth of Steel Creek would not be blocked by temperatures high enough to exclude riverine and anadromous fish from entering and spawning in the Steel Creek swamp system (for both 5.6°C and 8.2°C approach temperatures). Discharge temperatures might attract some fish species into the thermal plume during the winter; however, insignificant impacts are expected on riverine species due to overwintering stress.

The greatest impact to wetlands from this alternative would result from the construction of the pipeline. This raised structure would extend from a point near the Steel Creek delta to the Savannah River, a distance of 2500 meters. Pipeline construction could have adverse impacts on the Savannah River swamp because of: (1) piles driven into the substrate to support the pipeline, (2) the use of heavy equipment affecting wetlands through the compaction of substrate, and (3) increased erosion and sedimentation due to disturbances of the substrate.

The pipeline would be constructed above the high-flood mark (about 7 to 9 meters), so it could not act as a dam and impede water flow during flooding.

Proper buffers would be installed during construction to prevent movement of suspended particulates, which might cause turbidity impacts. Discharge water quality would be the same as that described for direct discharge. No significant changes in water quality, suspended particulates, or turbidity are expected to occur in the swamp or the Savannah River.

If this alternative is implemented before the restart of L-Reactor, the environmental impacts would be as described above (successional recovery of about 730 to 1000 acres of wetland). If it is implemented after direct discharge, the environmental impacts would be the same as those described in Section 4.4.2.2.1 (i.e., loss of 730 to 1000 acres of wetlands, etc.). Any mitigative effects resulting from this alternative would not begin until the end of the 27-month construction period.

I.1.3.2 Cooling towers - recirculation

I.1.3.2.1 Total recirculation - blowdown to Steel Creek

The 2.8°C and 5.6°C approaches recirculation alternatives would greatly reduce temperatures discharging to Steel Creek, and would result in a minimal impacts to the biota of the creek, its delta, the floodplain, and the Savannah River in comparison to the effects caused by direct discharge (see Section

I.1.3.1.1). The 2.8°C approach tower would continually meet the 32°C thermal standard except during extreme summer meteorological conditions; during these conditions it would exceed the limit by less than 1°C. The 8.3°C approach tower would not meet the 32°C thermal standard from late spring to early fall. All three approaches have low discharge rates (about 0.6 cubic meters per second), thus, impacts due to flow would be minimum.

The blowdown-to-Steel Creek ion-concentration ratio is expected to be about 3. Thus, the chemical constituents in the creek water near the L-Reactor outfall would be about 1.7 times their normal concentration without the blowdown. At Road A, the increases in concentration would be only about 1.4 times normal. The blowdown is not expected to have an appreciable impact on the water quality of Steel Creek, the swamp, or the Savannah River.

If this alternative is implemented before the restart of L-Reactor, the environmental impacts would be as described above (successional recovery of about 730 to 1000 acres of wetland). If it is implemented after direct discharge occurs, the environmental impacts would be the same as those described in Section 4.4.2.2.1 (i.e., loss of 730 to 1000 acres of wetlands, etc.). Any mitigative effects resulting from this alternative would not begin until the end of the 27-month construction period.

I.1.3.2.2 Total recirculation - blowdown treatment

This cooling-system alternative (2.8°C approach) would discharge 0.6 cubic meter per second of blowdown effluent at essentially the same temperatures in summer and spring as those achieved by cooling towers having total recirculation. However, in winter and at other times as required, the blowdown would be treated to reduce its temperature and to assure compliance with the 2.8°C delta-T thermal standard. In summer and spring, near ambient temperatures would be achieved from the outfall to the Savannah River. Near-ambient winter temperatures would be reached along the creek, delta, swamp, and at the mouth of Steel Creek.

This alternative would have essentially the same environmental impacts as those resulting from the implementation of cooling towers having total recirculation (2.8°C approach) without blowdown cooling; these impacts are summarized as follows:

- Construction of the towers would affect approximately 30 acres of upland pine forest. There would be no impact to wetlands or the biota that inhabit the Steel Creek ecosystem and swamp.

- There would be no impact to endangered and threatened species, nor would any critical habitat, as designated by the U.S. Fish and Wildlife Service, be affected.

- Because of low discharge rate little or no change in present erosion or sedimentation patterns is expected. There would be no impacts to aquatic substrate or water quality from dredging and filling activities, because they are not required.

If this alternative is implemented before the restart of L-Reactor, the environmental impacts would be as described above (successional recovery of about 730 to 1000 acres of wetlands). If it is implemented after direct discharge occurs, the environmental impacts would be the same as those described in Section 4.4.2.2.1 (i.e., loss of 730 to 1000 acres of wetlands, etc.). Any mitigative effects resulting from this alternative would not begin until the end of the 27-month construction period.

I.1.3.3 Cooling towers - partial recirculation

Cooling towers (2.8°C or 8.3°C approach temperature) that only recirculate a portion of the cooling water could be added to the L-Reactor site. From April through October the towers would cool water on a once-through basis and discharge all the effluent directly to Steel Creek. Based on equilibrium temperature calculations for these months, the discharge to Steel Creek under normal weather conditions would continuously meet the 32°C/+2.8°C temperature standard if a 2.8°C approach cooling tower is used. Equilibrium temperature calculations indicate that, from November through March, a portion of the cooling water must be recirculated to the 186-Basin, the remainder of the water discharged to the creek at 10.9 cubic meters per second would be obtained by blending ambient river water with cooling-tower blowdown.

I.1.3.3.1 Partial recirculation - discharge to Steel Creek

Except for the mitigating effects associated with lower discharge temperatures (maximum summer discharge temperatures of 27°C to 28°C, depending on approach), the environmental impacts caused by this alternative (2.8 and 8.3°C approach) would be similar to those for direct discharge; they are summarized as follows:

- High flow rate would eliminate between 420 and 580 acres of wetlands within the Steel Creek corridor. Because the effluent will not have markedly elevated temperatures, high flow rate would impact between 70 to 80 percent of the delta and swamp area predicted for direct discharge. Thus between 215 and 335 acres would be eliminated (or a total of 635 to 915 acres) due to high flow rate from this alternative cooling system. The wetlands that would be impacted by this alternative are classified as Resource Category 2 by the U.S. Fish and Wildlife Service. This resource category and its designation criteria include "high value for evaluation species and scarce or becoming scarce." The mitigation planning goal specifies that there be "no net loss of inkind habitat value" (USDOI, 1981).

- Foraging sites for the endangered wood stork would be eliminated due to increased water levels.

- No impacts to substrate, water quality, or water levels due to dredging or filling.

- Increased sedimentation and erosion due to effluent discharge; delta growth is anticipated to be 3 surface acres per year.

If this alternative is implemented before the restart of L-Reactor, the environmental impacts would be as described above (i.e., loss of 635 to 915 acres of wetlands). If it is implemented after direct discharge occurs, environmental impacts would be the same as those described in Section 4.4.2.2.1 (i.e., loss of 730 to 1000 acres of wetlands, etc.). Any mitigative effects resulting from this alternative would not begin until the end of the 27-month construction period.

I.1.3.3.2 Partial recirculation - with refrigeration

This alternative is the same as the partial recirculation case described above except that a refrigeration unit would be used primarily at night during the winter, to meet state thermal discharge standards. The refrigeration system would operate about 2 to 5 hours per night from January through March. During those hours, about 1 cubic meter per second would be diverted through the refrigeration unit to give a maximum mixed Steel Creek temperature difference of about 2.8°C. The maximum summer discharge temperatures to Steel Creek would not exceed 30°C for either approach.

High flow rate would eliminate between 420 and 580 acres of wetlands within the Steel Creek corridor. Because the effluent would not have markedly elevated temperatures, high flow rate would impact between 70 to 80 percent of that predicted for direct discharge. Thus between 215 and 335 acres would be eliminated (or a total of 635 to 915 acres) due to high flow rate from this alternative cooling system. The wetlands that would be impacted by this alternative are classified as Resource Category 2 by the U.S. Fish and Wildlife Service. This resource category and its designation criteria include "high value for evaluation species and scarce or becoming scarce." The mitigation planning goal specifies that there be "no net loss of inkind habitat value" (USDOI, 1981).

- Foraging sites for the endangered wood stork would be eliminated due to increased water levels.

- No impacts to substrate, water quality, or water levels due to dredging or filling.

- Increased sedimentation and erosion due to effluent discharge; delta growth is anticipated to be 3 surface acres per year.

If this alternative is implemented before restart occurs, the environmental impacts would be as described above (i.e., loss of 635 to 915 acres of wetlands). If it is implemented after restart occurs, the environmental impacts would be the same as those described in Section 4.4.2.2.1 (i.e., loss of 730 to 1000 acres of wetlands, etc.). Any mitigative effects resulting from this alternative would not begin until the end of the 27-month construction period.

I.1.4 Recirculation alternatives

I.1.4.1 Recirculation through creation of L-Pond

Under this alternative, a recirculating lake would be constructed in the Steel Creek floodplain below L-Reactor; this lake would inundate approximately 1300 acres of floodplains, bottomland hardwood forest, and stands of upland pine. Under extreme meteorological conditions, discharges from this lake are expected to be about 33°C in the summer; the average discharge temperature would be about 31°C. Near ambient temperatures would be reached in Steel Creek near the delta. L-Pond would support minimal aquatic life because of a continually high water temperature. Isolated cool-water refuges might be utilized minimally by aquatic (fish) and semiaquatic biota (herpetofauna, wading birds, beaver). Approximately 7.6 kilometers of Steel Creek would be eliminated, including existing habitats of the American alligator. Approximately 240 acres of wetlands would be adversely impacted by the impoundment. The wetlands that would be impacted by this alternative are classified as Resource Category 2 by the U.S. Fish and Wildlife Service. This resource category and its designation criteria include "high value for evaluation species and scarce or becoming scarce." The mitigation planning goal specifies that there be "no net loss of inkind habitat value" (USDOI, 1981).

The creation of L-Pond before restart occurs would eliminate thermal discharges to Steel Creek. Approximately 605 to 875 acres of wetlands in Steel Creek below the embankment, Steel Creek delta, and Savannah River floodplain would not be impacted and would remain in post-thermal recovery, unaffected by cooling-water effluents from L-Reactor. However, about 240 acres of wetlands would be inundated.

Implementation after restart occurs would impact between 730 and 1000 acres of wetland habitat in Steel Creek, Steel Creek delta, and Savannah River floodplain. After the completion of the L-Pond, between 605 and 875 acres of these wetlands in Steel Creek below the embankment and the Savannah River swamp would reinitiate a successional recovery.

I.1.4.2 Recirculation through creation of Kal Pond

This alternative would create one large recirculating lake to cool both K- and L-Reactors. Constructing dams across both Steel Creek and Pen Branch would inundate approximately 2620 acres of floodplain, bottomland hardwood forest, and upland conifers. This would include 7.2 kilometers along Pen Branch, 7.6 kilometers along Steel Creek, and 4.0 kilometers on Indian Grave Branch. This impoundment would flood forested habitats that once contained the endangered red-cockaded woodpecker, and would eliminate some alligator habitat. The wetlands that would be impacted by this alternative are classified as Resource Category 2 by the U.S. Fish and Wildlife Service. This resource category and its designation criteria include "high value for evaluation species and scarce or becoming scarce." The mitigation planning goal specifies that there be "no net loss of inkind habitat value" (USDOI, 1981).

Maximum summer discharge temperatures would be about 33°C, but typically would be less. At the Steel Creek and Pen Branch deltas, near ambient water temperatures would exist. Little or no change is expected in the erosion or sedimentation patterns in Steel Creek or Pen Branch because the overflow, about 0.5 cubic meter per second to each creek, would not produce large increases to the normal flows of these streams. Both deltas should remain unchanged.

Kal Pond, which is expected to show thermal behavior much like that of Par Pond, is expected to have adverse impacts on approximately 615 acres of wetlands. However, because it would terminate the existing thermal effluent down Pen Branch, approximately 1170 acres of swamp could undergo successional recovery.

The creation of Kal Pond before restart occurs would eliminate thermal discharges to Steel Creek; approximately 650 to 920 acres of wetlands in the Steel Creek, Steel Creek delta, and Savannah River floodplain would not be impacted and would be allowed to remain in post-thermal recovery, unaffected by cooling-water effluents from L-Reactor. However, about 425 acres of wetlands along Indian Grave Branch and Pen Branch and 2005 acres of uplands would be adversely affected. In addition, the lake would allow approximately 1170 acres of previously disturbed wetlands to recover because the thermal effluent down Pen Branch from K-Reactor would be eliminated.

Implementation after restart occurs would impact between 730 and 1000 acres of previously affected wetlands and wetland habitat in the Steel Creek, Steel Creek delta, and Savannah River floodplain. After the completion of Kal Pond, the wetlands below the dam in the Steel Creek and Pen Branch floodplain and the Savannah River swamp would reinitiate a successional recovery.

I.1.4.3 Recirculation through creation of High-Level Pond

Two dam sites on the Pen Branch drainage area north of L-Reactor have been studied for creating a recirculating High-Level Pond. The first and second dam sites would create pond areas of approximately 1225 and 1785 acres, respectively. This area of upland forest habitat, including 9.4 kilometers of Pen Branch which has not previously received thermal effluent, would be inundated. Thermal discharges (about 0.5 cubic meters per second) could reach 36°C under adverse summer conditions, but would average 34°C in the summer. Near-ambient temperatures would occur at the Steel Creek delta.

Approximately 610 acres of wetlands associated with upper tributaries of Pen Branch and 1175 acres of uplands are expected to be adversely impacted. This alternative would not adversely affect endangered species. After construction of the impoundment, a portion of Pen Branch would remain between the High-Level Pond and the thermally-impacted reach below K-Reactor. However, surviving fishes in this segment would become essentially landlocked; their access to upstream portions would be precluded by the dam and their access to downstream portions and the floodplain swamp would be limited to periods when K-Reactor is shut down.

The creation of a High-Level Pond before L-Reactor restart would eliminate thermal discharges to Steel Creek. Therefore, between 730 and 1000 acres of

wetlands in the Steel Creek, Steel Creek delta, and Savannah River floodplain would not be impacted and would remain in post-thermal recovery.

If this alternative is implemented before restart occurs, the environmental impacts would be as described above. Implementation after restart occurs would impact between 730 and 1000 acres of previously affected wetlands in Steel Creek, Steel Creek delta, and Savannah River floodplain plus 1175 acres of uplands and 610 acres of wetlands in upper Pen Branch. After the completion of the High-Level Pond, wetlands in the Steel Creek and Savannah River swamp could reinitiate a successional recovery.

I.1.4.4 Recirculation through Par Pond

Under this alternative, Par Pond would be used to cool the effluent from both P- and L-Reactors. A new pipeline would run northeast from L-Area and discharge into an excavated canal that would connect to Pond A near the R-Reactor effluent canal. From this point, the cooling water from L-Reactor would follow the same path through Par Pond that R-Reactor cooling water followed when that reactor was active. A new underground return pipeline would be constructed from near P-Reactor to the L-Reactor reservoir.

Because Par Pond already exists, any modifications of terrestrial habitat would be limited to a temporary disturbance to approximately 50 acres to construct the new discharge canal. This 2700-acre pond, however, contains a diversified and abundant assemblage of aquatic and semiaquatic biota, including more than 100 American alligators (Murphy, 1981). Based on previous thermal conditions when two reactors were operating, this alternative should not greatly increase water temperatures in the pond as a whole. However, a few acres of wetland habitat adjacent to Ponds A and B and the North Arm of Par Pond would be adversely impacted; some revegetation has occurred along the edges of these bodies since R-Reactor was shut down. This alternative would affect the alligator and aquatic biota through reduction in available habitat and avoidance of the heated effluent, primarily in the North Arm of Par Pond. Under adverse summer conditions, the discharge from Par Pond, about 0.5 cubic meters per minute could reach 33°C, but average summer discharges would be 31°C. Near-ambient temperatures would exist at Steel Creek delta.

The implementation of the Par Pond alternative before restart would eliminate thermal discharges to Steel Creek. Therefore, between 730 and 1000 acres of wetlands in the Steel Creek, Steel Creek delta, and Savannah River floodplain would not be impacted and would be allowed to remain in post-thermal recovery, unaffected by cooling-water effluents from L-Reactor.

Implementation after restart occurs would impact between 730 and 1000 acres of previously affected wetlands and wetland habitat in the Steel Creek, Steel Creek delta, and Savannah River floodplain. After the completion of the Par Pond diversion, the wetlands in the Steel Creek and the Savannah River swamp system would reinitiate a successional recovery.

I.1.5 Other alternatives

I.1.5.1 Thermal cogeneration

Although a feasibility study of various cogeneration options has not been completed, it is anticipated that the most effective use of waste heat would involve utilization of the reactor thermal effluent as a heat source. The use of a Rankine cycle would cool the reactor thermal effluent from 71°C to 49°C. However, three to five times the flow of reactor thermal effluent would be required to cool the condenser in the Rankine cycle and would result in a temperature increase to 3° to 6°C to the ambient-temperature water used for cooling. Thus, approximately 58 cubic meters per second of cooling water will be discharged to Steel Creek at a temperature of about 49°C.

The temperature reduction of thermal effluent would probably be offset by the increased flows and water fluctuation levels to Steel Creek from the Rankine cycle coolant. The expected loss of wetlands would be significantly greater than direct discharge due to the major increase in flow, flow fluctuations, and increased sedimentation, rather than temperature effects.

The principal difference in the implementation of a thermal cogeneration system using the Rankine cycle before or after L-Reactor restart would be the rates of vegetative mortality due to thermal effects versus flow effects.

I.1.5.2 Low-head hydropower

The implementation of a low-head hydropower option either at the L-Reactor outfall or below a 500-acre impoundment would not significantly alter wetland effects, as described either for discharge to Steel Creek (Section I.1.1.1) or for direct discharge to a 500-acre lake (Section I.1.3.2).

I.1.5.3 Modified reactor operation

The total heat load discharged into Steel Creek is a direct function of reactor power. Therefore, power could, in theory, be limited to a level below that achieved at normal operating limits to control this heat load. If the power were reduced, cooling-water flow could also be set to reduce either the total flow or the temperature of Steel Creek. This alternative could be used in combination with other alternatives to reduce heat loading.

As power is reduced, the temperature (under extreme summer conditions) is reduced from 80°C at the outfall at 2400 megawatts thermal to 71°C at 2000 megawatts thermal, to 53°C at 1200 megawatts thermal and to 40°C at 600 megawatts thermal. Temperatures within the Steel Creek system are also affected by reactor power levels. The temperature experiences at various locations below the outfall are presented in Table 4-36.

Under generating levels of 600 megawatts thermal, 30°C is reached prior to entry to the Savannah River. Further temperature reduction in the Savannah River would require simultaneous reduction in power and flow (see Figure 4-2).

This simultaneous reduction would increase the outfall temperatures higher than those reported above and, therefore, offer little benefit to the upper portions of Steel Creek. Although some thermal mitigation is achieved in the swamp, flooding, fluctuating water levels and siltation impacts would still result during periods of reduced power. Therefore, about 730 to 1000 acres of previously impacted wetlands that are beginning a successional recovery would again be affected.

While low power operation is not practical for extended periods of time, it can provide a means of meeting thermal limitations for short periods. The potential reduction of reactor power to reduce the cooling-water temperature is directed at ensuring a sufficient zone of passage in the Savannah River. However, at reduced power, production efficiency would be reduced.

Under extreme meteorological conditions, reducing power by a factor of four could reduce the temperature of the effluent entering the swamp by about 10°C and reduce the creek-to-river delta-T by about 3°C.

I.1.5.4 Fisheries management programs

The direct discharge of L-Reactor cooling water to Steel Creek with fish management programs would essentially have the same wetland impacts as those described in Section I.1.1. Between 730 and 1000 acres of previously impacted wetlands that are beginning a successional recovery would again be impacted.

No designs or site selection for an onsite hatchery facility and rearing ponds have been made. If a hatchery and rearing ponds were established onsite, their construction would occur in upland areas or existing facilities would be used. Therefore, the only impact to wetlands in addition to that from a direct discharge would be the possible construction of an outfall from a wastewater treatment lagoon that might be required for rearing-pond effluent.

The implementation of fish management programs would provide a partial replacement for the productivity of wetland habitat and Steel Creek and Savannah River swamp spawning areas that would be lost due to the resumption of direct discharge.

I.1.5.5 Protect similar wetlands

If available, a property comparable in size and wetlands value to the impacted Steel Creek/swamp area could be designated on SRP or purchased and set aside as a fisheries/wildlife preserve. Thermal discharges from L-Reactor could reduce the spawning/rearing habitat currently utilized by fish species in the Steel Creek/swamp system. Other creeks and associated wetlands with similar spawning/rearing habitat exist between the New Savannah Bluff Lock and Dam and the lower tidal reaches of the Savannah River. A large parcel of land (greater than 1000 acres) would cost approximately $500 per acre.

I.2 FLOODPLAINS

Several of the alternative cooling systems require the construction of dams or structures in the floodplains of streams (Steel Creek, Pen Branch, Indian Grave Branch, and Meyers Branch) on the Savannah River Plant. Because these dams or structures must direct or use onsite streams to achieve a reduction in thermal or flow effects, locating them outside the floodplain would not be possible.

The construction and operation of dams or structures on SRP streams would, to the maximum extent possible, avoid adverse impacts associated with the use and modification of the floodplain for the following reasons:

- There would be no appreciable modification of water levels or flow regimes in offsite streams and rivers. Thus, the natural and beneficial values of offsite floodplains would be maintained.

- If the onsite floodplains were flooded, the dams and structures would not create additional consequences to any emergency conditions.

- Access to the Savannah River Plant is strictly controlled; no dwellings, hospitals, schools, nursing homes, or other structures are located within the floodplain. Thus, no individuals or private property would be affected.

- No essential and irreplaceable records, utilities, and/or emergency services would be affected or lost in the event of flooding.

Impacts to water quality and ground water, archeological sites, wildlife habitat, and other resource uses were described in Section I.2 and in Section 4.4.2.

REFERENCES

Cherry, D. S., R. K. Gathrie, J. H. Rogers, Jr., J. Carins, Jr., and K. L. Dickson, 1976. "Response to Mosquitofish (Gambusia affinis) to Ash Effluent and Thermal Stress," Transactions of the American Fisheries Society, Volume 105(6), pp. 686-694.

Falke, J. D., and M. H. Smith, 1974. "Effects of Thermal Effluent on Fat Content of Mosquitofish," in J. W. Gibbons and R. R. Sharitz (eds.), Thermal Ecology, AEC Symposium Series (CONF-730505), pp. 100-108.

Ferens, J. C., and T. M. Murphy, 1974. "Effects of Thermal Effluents on Regulations of Mosquitofish," in J. W. Gibbons and R. R. Sharitz (eds.), Thermal Ecology, AEC Symposium Series (CONF-730505), pp. 237-247.

Gibbons, J. W., and R. R. Sharitz, 1974. "Thermal Alteration of Aquatic Ecosystems," American Scientist, Vol. 62, pp. 660-670.

McFarlane, R. W., 1976. "Fish Diversity in Adjacent Ambient, Thermal, and Post Thermal Fresh-water Streams," in G. W. Esch and R. W. McFarlane (eds.), Thermal Ecology II, ERDA Symposium Series 40 (CONF-750425), pp. 268-271.

McFarlane, R. W., R. F. Frietsche, and R. D. Miracle, 1978. Impingement and Entrainment of Fishes at the Savannah River Plant, DP-1494, E. I. du Pont de Nemours and Company, Savannah River Laboratory, Aiken, South Carolina.

Murphy, T. M., 1981. The Population Status of the American Alligator on the Savannah River Plant, South Carolina, Savannah River Plant National Environmental Research Park Publication, SRO-NERP-4, Aiken, South Carolina.

Smith, M. H., R. R. Sharitz, and J. B. Gladden, 1981. An Evaluation of the Steel Creek Ecosystem in Relation to the Proposed Restart of L-Reactor, SREL-9, Savannah River Ecology Laboratory of Georgia, Aiken, South Carolina.

Smith, M. H., R. R. Sharitz, and J. B. Gladden, 1982. An Evaluation of the Steel Creek Ecosystem in Relation to the Restart of the L-Reactor: Interim Report, SREL-11, Savannah River Ecology Laboratory, University of Georgia, Aiken, South Carolina.

Smith, M. H., R. R. Sharitz, and J. B. Gladden, 1983. An Evaluation of the Steel Creek Ecosystem in Relation to the Proposed Restart of L-Reactor, SREL-14, Savannah River Ecology Laboratory, University of Georgia, Aiken, South Carolina.

USDOI (U.S. Department of the Interior), 1984. "U.S. Breeding Population of the Wood Stork Determined to be Endangered; Final Rule," Federal Register, Volume 49, Number 40, pages 7332-7335.