United States Department of the Interior
FISH AND WILDLIFE SERVICE
Snake River Fish and Wildlife Office
1387 S Vinnell Way, Suite 368
Boise, Idaho 83709
http://idahoes.fws.gov

TAKE PRIDE IN AMERICA

MAY 19 2004

Magalie Salas, Secretary
Federal Energy Regulatory Commission
888 First Street Northeast
Washington, DC 20426

Subject: Proposed Relicensing of Five Idaho Power Company Hydroelectric Projects—Snake River, Idaho—Biological Opinion—Erratum
Shoshone Falls FERC #2778, Upper Salmon Falls FERC #2777, Lower Salmon Falls FERC #2061, Bliss FERC #1975, C.J. Strike FERC #2055
Files FERC #1975R, FERC #2055 OALS #04-441

Dear Secretary Salas:

The Snake River Fish and Wildlife Office sent a Biological Opinion (Opinion) to your office on May 17, 2004 via FedEx to be received May 18, 2004. It has since been noted that the Table of Contents section of the Opinion has a printing error. The Table of Contents page *iii* is missing and is enclosed. Please add it to your copies of the Opinion. We are sorry for any inconvenience this has caused. If you have any questions or concerns please contact Michael Morse of my staff at (208) 378-5261.

Sincerely,

Stephen D. Duke

Acting Jeffery L. Foss, Supervisor
Snake River Fish and Wildlife Office

Enclosure

cc: FWS, Washington, D.C. (Patrick Leonard)
FWS—RO, Portland, OR (Dave Allen, Larry Salata)
DOI Office of the Solicitor, Portland, OR (Frank Wilson)
FERC, Portland, OR (Jim Hastreiter)
Idaho Power Company, Boise, ID (John Prescott, Jim Tucker)
Idaho Department of Fish and Game—HQ, Boise, ID (Scott Grunder)
Bureau of Reclamation—HQ, Boise, ID (William McDonald, Ellen Bergerren)
State of Idaho—Office of the Attorney General, Boise, ID (Harriet Hensley)

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TAKE PRIDE IN AMERICA

Magalie Salas, Secretary
Federal Energy Regulatory Commission
888 First Street Northeast
Washington, D.C. 20426

Subject: Proposed Relicensing of Five Idaho Power Company Hydroelectric Projects—Snake River, Idaho—Biological Opinion
Shoshone Falls FERC #2778, Upper Salmon Falls FERC #2771, Lower Salmon Falls FERC #2061, Bliss FERC #1975, C.J. Strike FERC #2055
Files FERC #1975R, FERC #2055 OALS 04-441

Dear Secretary Salas:

In the enclosed Biological Opinion for the subject projects, the Fish and Wildlife Service (Service) has concluded that proposed relicensing by the Federal Energy Regulatory Commission (Commission) is not likely to jeopardize the continued existence of any species listed under the Endangered Species Act (Act). You requested formal section 7 consultation with the Service in a letter dated February 26, 2004. The Commission proposes to issue new licenses to Idaho Power Company for the Shoshone, Upper Salmon Falls, Lower Salmon Falls, Bliss, and C.J. Strike hydroelectric projects on the Snake River in south central Idaho. At issue in this Opinion are likely adverse effects from one or more of the projects on the threatened Bliss Rapids snail, endangered Idaho springsnail, and endangered Utah valvata. In addition to providing our Opinion of the likely effects on those species, the Service is using the same document to provide concurrence that the actions as proposed are not likely to adversely affect the threatened bald eagle, endangered Banbury Spring lanx (limpet), or endangered Snake River physa.

The proposed action is described in two Environmental Impact Statements (EISs) developed by the Commission, one for the C.J. Strike project, and another for the remaining four projects. Those EISs also served as the Commission's Biological Assessment for purposes of section 7 of the Act. In a February 2004 Offer of Settlement, the applicant proposed amending the action to incorporate actions described in their Settlement Agreement with the Service. The Service endorsed incorporating of the provisions of the Agreement in the licenses for these projects in a letter to the Commission dated February 11, 2004. Provisions of the Agreement are considered to be

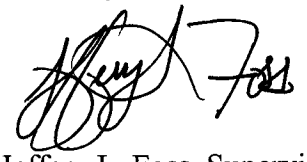
part of the action in the attached Opinion. Briefly, the Agreement calls for cooperative research by the applicant and the Service over a five year period. That work will focus on operational effects of the projects on listed Snake River snails, and, upon its completion, the Agreement calls for the Company to develop a snail conservation plan that addresses operational impacts and conservation needs of the species. Except for two years during the study period, the Agreement calls for the Lower Salmon Falls and Bliss projects to be operated in a run of river mode rather than the load following mode proposed in the EIS. It is possible that the Company will ask the Commission to take action on any proposal in the snail conservation plan to change operations. If the action is changed at that time, there may be a need to reinitiate section 7 consultation.

In your February 2004 letter to us requesting formal consultation, the Commission noted that certain riparian and wetland mitigation proposals described in the EISs for the five projects would be deferred until after research called for in the Settlement Agreement is completed. We have not considered effects of that proposed mitigation. The Service agrees that for the upper four projects, it is appropriate to develop and implement riparian and wetland mitigations after completion of studies and a snail conservation plan in 2010. However, as noted in the Conservation Recommendations of the Opinion, we suggest that it is appropriate for the Commission and Company to proceed now with developing and implementing riparian and wetland mitigation for the C.J. Strike project. The reason we have not considered effects of the project's overall mitigation in this Opinion is that it is not sufficiently developed for an analysis of potential effects on listed species.

Please note that the Service is providing paper copies of this Opinion to the FERC via Federal Express. We are also filing it electronically with the Commission.

This completes consultation under section 7 of the Act for the Commission's proposed relicensing of the Shoshone, Upper Salmon Falls, Lower Salmon Falls, Bliss, and C.J. Strike hydroelectric projects. The Service looks forward to continued cooperation between the Service, Commission, and Company as the licensing process is completed and the Settlement Agreement implemented. If you have questions or need further assistance feel free to contact me, Alison Beck Haas, or Michael Morse at the Service's Snake River Fish and Wildlife Office. Our main office telephone number is (208)378-5243.

Sincerely,



Jeffery L. Foss, Supervisor
Snake River Fish and Wildlife Office

Enclosure

cc: FWS, Washington D.C. (Patrick Leonard)
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DOI Office of the Solicitor, Portland OR (Frank Wilson)
FERC, Portland OR (Jim Hastreiter)
Idaho Power Company, Boise ID (John Prescott, Jim Tucker)
IDFG--HQ, Boise (Scott Grunder)
Bureau of Reclamation--HQ, Boise (William McDonald, Ellen Bergerren)
State of Idaho-Office of Attorney General, Boise ID (Harriet Hensley)

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DRAFT, Author	DRH	16 Apr. 2004	
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DRAFT, Reviewer			
FINAL, Typist			
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Admin	Admin	Admin
Biologist	Biologist	Biologist
Budget Code:	Budget Code:	Budget Code:

Please put in the exact time that you worked on this project

Staff: ABH Date In: Due Date: 05-14-04 Date Out 5/19/04 - 441

Project Name: Mid-Snake/C.J. Strike Relicensing (FERC Nos. 1975R, 2055)

County: ~~039, 041, 083~~ 16047 State: ID Action Agency: 13 FWS

Involvement: C Service Action: 2B Type Work: P2 Endangered

SP Position: H Other Position Number of Actions: 5

Land Management Unit (ex. WWNF, BNF, Shoshone RD)

DLat: 42.9135 DLong: -115.0701 Quad: Ticeska HUC 17040212

Township: ~~Hagerman/Bliss~~ 065 Range: 12E Section: 07

File Number: FERC1975R, 2055 Permit #: Permit Date

Species Involved: SO12, SO19, SO27, SO22, BO21

Comments:

Image: FERC\0441 .max Scanned 20N Finalized 20N

BIOLOGICAL OPINION

for the

FEDERAL ENERGY REGULATORY COMMISSION PROPOSED RELICENSING OF FIVE HYDROELECTRIC FACILITIES ON THE MIDDLE SNAKE RIVER, IDAHO: SHOSHONE FALLS (FERC No. 2778), UPPER SALMON FALLS (FERC 2777), LOWER SALMON FALLS (FERC 2061), BLISS (FERC 1975), AND C.J. STRIKE (FERC 2055), AND THEIR IMPACTS ON FIVE MOLLUSC SPECIES AND BALD EAGLES

U.S. Fish and Wildlife Service
Boise, Idaho

May 2004

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INTRODUCTION

This document is the U.S. Fish and Wildlife Service's (Service) Biological Opinion (Opinion) of the effects of the proposed relicensing of five hydroelectric projects on the middle Snake River (Mid-Snake) on federally listed species. The five hydroelectric projects are: Shoshone Falls (FERC Project No. 2778), Upper Salmon Falls (FERC No. 2777), Lower Salmon Falls (FERC No. 2061), Bliss (FERC No. 1975), and C.J. Strike (FERC No. 2055). The new licenses will permit operations for a period of 30 to 50 years. The listed species covered in the Opinion are the Idaho springsnail (*Pyrgulopsis* (=*Fontelicella*) *idahoensis*), Utah valvata snail (*Valvata utahensis*), Snake River physa snail (*Haitia* (*Physa) natricina*), Bliss Rapids snail (*Taylorconcha serpenticola*), Banbury Springs limpet or lanx (*Lanx* sp.), and the bald eagle (*Haliaeetus leucocephalus*). Orginally, the C.J. Strike project was considered in a separate consultation from the four projects; those four are referred to here as the Mid-Snake projects. Pursuant to section 7 of the Endangered Species Act (Act), the Federal Energy Regulatory Commission (Commission) originally requested formal consultation with the Service for the Shoshone Falls, Upper Salmon Falls, Lower Salmon Falls, and Bliss projects in 2002. Consultation on the relicensing of the C.J. Strike Project began on August 20, 2002. On January 22, 2003, the Commission granted Idaho Power Company's (Company) request that the relicensing and consultations for the five projects be held in abeyance pending an independent review of the Company's data on listed snails in the Snake River.

In August 2003, the Commission agreed to suspend the consultation process temporarily, allowing for negotiations and development of a Settlement Agreement between the Service and the Company. This Settlement Agreement acknowledged the fact that project-related effects on listed snails, as proposed in the original EISs, could not be adequately quantified. The Settlement Agreement proposes implementation of a series of laboratory and field studies that will better quantify the effects of load following operations on the listed Snake River snails, allowing for adaptive management of operations to eliminate or reduce operations-related effects on these snails and provide for the conservation and recovery of the species.

The Service has combined all five of the subject hydroelectric projects into one Biological Opinion. This is appropriate because of their proximity to one another on the Snake River and because the species under consideration occur in the action area of some or all of the projects. In addition, the five projects are considered together in the Settlement Agreement between the Company and the Service. This Opinion is based on the revised action which includes a series of studies needed to better understand determine project-related effects to the listed Snake River snails, and operations outlined in the Settlement Agreement. Consultation for this new action includes all five of the Company's projects and was initiated by the Commission on February 26, 2004.

Effects Determinations

Table 1 provides a summary of the Commission's effects determinations, and the Services conclusions, for five species for each of the five projects. This Opinion provides an analysis of baseline conditions for the affected species and the direct, indirect, and cumulative effects of the action, as well as effects of interrelated and interdependent actions. operations on aquatic.

Snake River Snails

The Commission determined that issuing a new license to the Company for operation of the Shoshone Falls and Upper Salmon Falls projects as proposed would not adversely affect any of species that occur in the project area. The Service has determined that the Upper Salmon Falls Project will likely adversely affect the Utah valvata. The Commission determined that issuing a new license for the Lower Salmon Falls facility would likely adversely affect the Snake River physa and the Bliss Rapids snail, and the Service concurs with this determination for the Bliss River snail, but has determined that the Snake River Physa is not likely to be adversely affected by the project as proposed. The Commission determined that licensing the Bliss facility as proposed would likely adversely affect the Snake River physa, Bliss Rapids snail, and the Idaho springsnail, and the Service concurs with this determination with the exception of the Snake River Physa, which is not likely to be adversely affected by this project as proposed. For the Banbury Springs limpet or lanx, the Commission determined that licensing all four of the Mid-Snake facilities would not likely adversely affect this snail and the Service concurs with this determination. The Commission determined that licensing the C.J. Strike facility, as proposed, would likely adversely affect the Idaho springsnail and the Service concurs with this determination.

Bald Eagle

The Commission determined that licensing of the Lower Salmon Falls and Bliss facilities would likely adversely affect the bald eagle. The Service does not concur with this finding, but rather concludes that some of the project-operations would be beneficial or neutral to bald eagles and that any negative effects would be insignificant and discountable. The Service's determination is based on the limited use of this area by nesting bald eagles and the use of both river and reservoir habitats for foraging. There is a regular bald eagles nesting site within the project area, and the Hagerman area is primarily used for over-wintering birds (FERC 2002a). The most recent documented nesting occurred in 2002 and was located in southeast Gooding County, along the Snake River below the Shoshone Project (Sallabanks 2003). There is also a winter roost tree in the same area that was recently used by an estimated 27 individuals (FEIS). The FEIS states that actions beneficial to riparian health would provide minor benefits to bald eagles since this would result in a gradual increase in the number of potential roosting and nesting trees over time. The Service agrees with the Commission's determination that project-related effects of the four upper projects are likely to be insignificant and discountable, at least over the short term. The Service also acknowledges that appropriate riparian protection and management could contribute to long-term benefits to bald eagles and we provide recommendations for this in the section on Conservation Recommendations at the end of this Opinion. The Commission determined that licensing of the C.J. Strike facility would have discountable or insignificant effects to the bald eagle and the Service concurs with this determination. This completes the analysis for the bald eagle in this Opinion.

Taxonomy of the Idaho Springsnail

On January 2, 2004, a taxonomic assessment of the Idaho springsnail was published in The Veliger, a nationally recognized scientific journal (Hershler and Liu 2004). This publication

provides information on genetic sequencing (mitochondrial DNA) and morphological characters (shell measurements, reproductive structures, and radular teeth) that suggest the Idaho springsnail is not different from three other species of springsnail (*Pyrgulopsis*) inhabiting the Snake and Columbia River system and tributaries of the Snake River. Adoption of this taxonomic revision by the biological community could place this species now recognized as *P. idahoensis*, into the taxon *P. robusta*, a species that currently has no Federal status under the Act. Such a revision could cause for the Service to reconsider the endangered status of the Idaho springsnail. For purposes of this Opinion, Idaho Springsnail is considered listed endangered as designated in 1992.

Table 1. Federal Energy Regulatory Commission determination and Fish and Wildlife Service Conclusions relative to the effects of the proposed relicensing of the five Mid-Snake River hydroelectric projects on listed species. The Commission determinations were provided in two independent EISs and were modified in the letter from the Commission sent on February 26, 2004

Project Species:	Shoshone Falls	Upper Salmon Falls	Lower Salmon Falls	Bliss	C.J. Strike
Idaho Springsnail	**Commission Determination:** ***No Effect.*** **Service Conclusion:** ***Concur.*** Run-of-river (ROR) operation should not impact shallow water habitats; known range of the Idaho springsnail is downstream of project	**Commission Determination:** ***No Effect.*** **Service Conclusion:** ***Concur.*** ROR operation should not impact shallow water habitats; known range of the Idaho springsnail is downstream of project.	**Commission Determination:** ***No Effect.*** **Service Conclusion:** ***Concur.*** Known range of the Idaho springsnail is downstream of project.	**Commission Determination:** ***Likely to Adversely Affect.*** **Service Conclusion:** ***Concur.*** The entire recovery area of this species is located between Bliss Dam and C.J. Strike Reservoir. Load following operations are likely to result in direct mortality of the Idaho springsnail and negatively affect the habitat and trophic dynamics in this species' habitat. Proposed studies on the effects of load following should provide information on project operations compatible with species recovery.	**Commission Determination:** ***Likely to Adversely Affect.*** **Service Conclusion:** ***Concur.*** Approximately 9% of this species' recovery area lies within the upper portion of C.J. Strike Reservoir, and operations will affect some portion of this population. Hydropower load following downstream of this facility are likely to result in direct mortality of the Idaho springsnail and negatively affect the habitat and trophic dynamics in this species' habitat. Proposed studies should help determine the level of incidental take.

Table 1. Continued Federal Energy Regulatory Commission determination and Fish and Wildlife Service Conclusions relative to the effects of the proposed relicensing of the five Mid-Snake River hydroelectric projects on listed species. The Commission determinations were provided in two independent EISs and were modified in the letter from the Commission sent on February 26, 2004

Project Species:	Shoshone Falls	Upper Salmon Falls	Lower Salmon Falls	Bliss	C.J. Strike
Utah Valvata	**Commission Determination:** ***Not Likely to Adversely Affect.*** **Service Conclusion:** ***Concur.*** ROR operation will not affect Utah valvata within reservoir or any snails that might occur downstream of the dam.	**Commission Determination:** ***Not Likely to Adversely*** **Affect.** **Service Conclusion:** ***Do Not Concur.*** ROR operation will result in minor effects to Utah valvata within reservoir or any snails that might occur downstream of the dam. Fluctuations of reservoir level will result in some incidental harm or mortality of Utah valvata.	**Commission Determination:** ***Not Likely to Adversely Affect.*** **Service Conclusion:** ***Concur.*** There are no documented colonies of the Utah valvata within the action area of this hydroelectric project.	**Commission Determination:** ***Not Likely to Adversely Affect.*** **Service Conclusion:** ***Concur.*** There are no documented colonies of the Utah valvata within the action area of this hydroelectric project.	**Commission Determination:** ***Not Likely to Adversely Affect.*** **Service Conclusion:** ***Concur.*** Project lies within the known range of this species, but no recent surveys have found live specimens. Any project-related effects are anticipated to be insignificant.
Snake River Physa	**Commission Determination:** ***Not Likely to Adversely Affect.*** **Service Conclusion:** ***Concur.*** ROR operations should not affect the Snake River physa because no stranding or habitat disturbance will occur	**Commission Determination:** ***Not Likely to Adversely Affect.*** **Service Conclusion:** ***Concur.*** ROR operations should not affect Snake River physa because no stranding or habitat disturbance will occur	**Commission Determination:** ***Likely to Adversely Affect.*** **Service Conclusion: Do Not** ***Concur.*** Load following operations may have a minor, indirect effect on the species, but the proposed minimum flows will ensure that the deep water habitat of this species will not be dewatered and little or not direct mortality should occur.	**Commission Determination:** ***Likely to Adversely Affect.*** **Service Conclusion: Do Not** ***Concur.*** Load following operations may have a minor, indirect effect on the species, but the proposed minimum flows will ensure that the deep water habitat of this species will not be dewatered and little or no direct mortality should occur.	**Commission Determination:** ***Not Likely to Adversely Affect.*** **Service Conclusion:** ***Concur.*** Project lies within the historic range of this species, but no recent surveys have found live specimens. Any project-related take is anticipated to be insignificant.

Table 1. Continued Federal Energy Regulatory Commission determination and Fish and Wildlife Service Conclusions relative to the effects of the proposed relicensing of the five Mid-Snake River hydroelectric projects on listed species. The Commission determinations were provided in two independent EISs and were modified in the letter from the Commission sent on February 26, 2004

Project Species:	Shoshone Falls	Upper Salmon Falls	Lower Salmon Falls	Bliss	C.J. Strike
Bliss Rapids Snail	**Commission Determination:** ***Not Likely to Adversely Affect.*** **Service Conclusion:** ***Concur.*** ROR operations will not impact colonies or populations of the Bliss Rapids snail along this river reach.	**Determination:** ***Not Likely to Adversely Affect.*** **Service Conclusion:** ***Concur.*** There is no longer any river habitat within this project area in which the Bliss Rapids snail is likely to be found and surveys have failed to confirm its presence.	**Commission Determination:** ***Likely to Adversely Affect.*** **Service Conclusion:** ***Concur.*** This river reach accounts for about 35% of the Bliss Rapids snail's habitable recovery area within the main stem Snake River. Load following operations will result in direct mortality of this species and negatively affect the trophic dynamics within the snail's habitat.	**Commission Determination:** ***Likely to Adversely Affect.*** **Service Conclusion:** ***Concur.*** This river reach accounts for about 56% of the Bliss Rapids snail's habitable recovery area within the main stem Snake River. Load following operations will result in direct mortality of this species and negatively affect the trophic dynamics within the snail's habitat.	**Commission Determination:** ***No Effect.*** **Service Conclusion:** **Concur.** Area of project effects fall outside of species' known range.
Banbury Springs Lanx/Limpet	**Commission Determination:** ***Not Likely to Adversely Affect.*** **Service Conclusion:** ***Concur.*** ROR operations will not impact colonies or populations of the Bliss Rapids snail along this river reach.	**Commission Determination:** ***Not Affect.*** **Service Conclusion:** ***Concur.*** There is no longer any river habitat within this project area in which the Bliss Rapids snail is likely to be found and surveys have failed to confirm its presence.	**Commission Determination:** ***No Effect.*** **Service Conclusion:** ***Concur.*** Known populations of the Banbury Springs lanx will not be affected by this project which is downstream of known lanx-occupied springs.	**Commission Determination:** ***No Effect.*** **Service Conclusion:** ***Concur.*** Known populations of the Banbury Springs lanx will not be affected by this project which is well downstream of known lanx-occupied springs.	**Commission Determination:** ***No Effect.*** **Service Conclusion:** ***Concur.*** Known populations of the Banbury Springs lanx will not be affected by this project which is well downstream of known lanx-occupied springs.

Table 1. Continued Federal Energy Regulatory Commission determination and Fish and Wildlife Service Conclusions relative to the effects of the proposed relicensing of the five Mid-Snake River hydroelectric projects on listed species. The Commission determinations were provided in two independent EISs and were modified in the letter from the Commission sent on February 26, 2004

Project Species:	Shoshone Falls	Upper Salmon Falls	Lower Salmon Falls	Bliss	C.J. Strike
Bald Eagle	**Commission Determination:** ***Not Likely to Adversely Affect.*** **Service Conclusion:** ***Concur.*** The proposed ROR operation conducted at this facility will not adversely affect the riparian habitats used by bald eagles within the project area.	**Commission Determination:** ***Not Likely to Adversely Affect.*** **Service Conclusion:** ***Concur.*** The proposed ROR operation conducted at this facility will not adversely affect the riparian habitats used by bald eagles within the project area.	**Commission Determination:** ***Not Likely to Adversely Affect.*** **Service Conclusion:** ***Concur.*** The impacts of proposed load-following operations of this facility on bald eagles and their prey will be insignificant and discountable. Mitigation may benefit riparian habitat.	**Commission Determination:** ***Not Likely to Adversely Affect.*** **Service Conclusion:** ***Concur.*** The impacts of proposed load-following operations of this facility on bald eagles and their prey will be insignificant and discountable. Mitigation may benefit riparian habitat.	**Commission Determination:** ***Not Likely to Adversely Affect.*** **Service Conclusion:** ***Concur.*** The impacts of proposed load-following operations of this facility on bald eagles and their prey will be insignificant and discountable. Mitigation may benefit riparian habitat.

CONSULTATION HISTORY

The Service has been engaged with the Company in the identification of natural resource issues and opportunities in relicensing process for several years. During that time, we provided correspondence to the Commission on a number of issues, including those related to potential project effects on listed species. Following is a summary of correspondence and other actions specifically relevant to our consultation with the Commission and development of this Opinion. A complete administrative record of this consultation is on file at the Service's Snake River Fish and Wildlife Office in Boise, Idaho.

Under the initial phases of consultations, the four Mid-Snake projects and the C.J. Strike Project were addressed in separate license applications and EISs. Since the five projects lie adjacent to one another and include a shared subset of affected species, the Service has included the five projects in a single Opinion.

Mid-Snake Projects (FERC # 2778, 2777, 2061, 1975) Consultation History: June 20, 2000 to December 16, 2002.

June 20, 2000 — The Service sent a letter to the Commission inviting them to participate in informal consultation for the relicensing of the Company's Shoshone Falls, Upper Salmon Falls, Lower Salmon Falls, and Bliss hydroelectric projects. This letter included a list of threatened, endangered, proposed, and candidate species that may occur in the counties where the projects are located. No response was received from the Commission.

January 15, 2002 — The Service received a letter dated January 16, 2002, from the Commission requesting formal consultation for the relicensing of the Company's Shoshone Falls, Upper Salmon Falls, Lower Salmon Falls, and Bliss hydroelectric projects. The letter indicated that the draft Environmental Impact Statement (DEIS) for the project was to serve as their Biological Assessment of effects of the action on listed species. The Commission concluded that three of the projects would have adverse effects on one or two species of listed snails; all other determinations were may affect or not likely to adversely affect."

January 17, 2002 — The Service received the Commission's DEIS regarding the proposed relicensing of the Shoshone Falls, Upper Salmon Falls, Lower Salmon Falls, and Bliss hydroelectric projects.

February 13, 2002 — The Service sent a letter to the Commission acknowledging receipt of their request for formal consultation and stated that insufficient information had been provided for formal consultation to proceed. In that letter the Service also: (1) requested that the Commission prepare a Biological Assessment; (2) recommended that the Commission combine four projects Mid-Snake projects (Bliss, Upper and Lower Salmon Falls, and Thousand Springs) under one action and a single license; (3) provided an updated species list

	(1-4-02-SP-375); and (4) requested informal consultation with the Commission to develop the information needed as a basis for initiating formal consultation.
February 28, 2002	The Commission held a public meeting in Boise, Idaho, regarding the DEIS for the proposed action.
March 22, 2002	The Service received a letter dated March 23, 2002 from the Commission that reiterated its request for formal consultation on the proposed action, disagreed with the Service's position that insufficient information had been provided to initiate the formal consultation process, and requested that an Opinion addressing their proposed action be issued by May 31, 2002.
March 28, 2002	The Department of the Interior's Office of Environmental Policy and Compliance sent a letter to the Commission providing comments on the DEIS; that letter included Service comments on a wide range of resource issues, including listed species and issues that would affect section 7 consultation.
April 18, 2002	The Service sent a letter to the Commission: (1) restating that there was insufficient information to initiate formal consultation; (2) specifying the information needed; (3) noting that formal consultation could not be completed by May 31 as the Commission requested; and (4) requesting a meeting on May 28, 2002, in Boise, Idaho, to discuss unresolved issues with the Commission and the Company.
May 7, 2002	The Service sent a letter to the Commission stating that additional information had been received from the company and that formal consultation could proceed; the letter also stated that a final Opinion would be provided by August 23, 2002 which represents the end of the 135-day statutory time frame for completing the formal consultation process and development of an Opinion.
June 4, 2002	The Company sent a letter to the Commission requesting that the Service provide a draft copy of the Opinion to the Commission, and that they provide a copy of the draft Opinion to the Company.
June 10, 2002	The Service provided the Commission with Federal Power Act section 10(j) comments and recommendations on fish and wildlife resources and impacts of project operations, including listed species.
June 26, 2002	A meeting was held in Boise, Idaho, that included representatives of the Service, Commission, Company, Idaho Department of Fish and Game, Idaho Department of Environmental Quality, and the Company's consultants, EcoAnalysts, Inc. The status of listed Snake River snail

species, recovery planning, and recent research relative to these species were discussed.

June 26, 2002 — Commission staff member John Blair telephoned Bob Ruesink, then Supervisor of the Service's Snake River Fish and Wildlife Office (Boise, Idaho), to request that a draft Opinion for the proposed action be provided by August 1, 2002, to both the Commission and to Lewis Wardle of the Company; Mr. Ruesink agreed.

July 3, 2002 — In a letter to the Service the Commission formally confirmed the June 26, 2002, agreement (reached during a telephone conversation) under which the Service would provide a draft Opinion to the Commission and the Company by August 1, 2002.

July 22, 2002 — The Service's Pacific Regional Office in Portland, Oregon received a petition, dated July 19, 2002, from Idaho Governor Kempthorne on behalf of the State of Idaho, Office of Species Conservation, and the Company to delist the Bliss Rapids snail. The petition contained new information on this species that was not provided to the Service previously.

July 24, 2002 — Bob Ruesink telephoned Ann Miles of the Commission to advise her that the Service could not provide a draft Opinion by August 1 because of new information provided in the de-listing petition and the Service's preliminary finding that a potential jeopardy determination may be included in the Opinion. Mr. Ruesink further conveyed that an additional 60 days would be necessary to prepare the draft Opinion.

July 26, 2002 — John Blair of the Commission telephoned Bob Ruesink of the Service to advise him that the Commission would not agree to a 60-day extension of formal consultation.

August 1, 2002 — The Service sent a letter to the Commission extending by 60 days the 135-day period for completion of the formal consultation process and development of an Opinion based on Service receipt of new information, including a July 19, 2002, petition from the Company to remove the Bliss Rapids snail from the threatened and endangered species list. The letter also noted that jeopardy determinations might be made for one or more species of snail in relation to one or more of the projects proposed for re-licensing; in that regard, the Service also offered technical assistance to plan this action in a manner that would avoid a jeopardy determination.

August 9, 2002 — The Commission provided the Final Environmental Impact Statement (FEIS) for the Mid-Snake projects to the Service.

October 3, 2002 — In a telephone conversation between the Commission and the Service (Boise Office) the parties discussed the estimated time line for completion

of the draft Opinion. A follow up voice mail message from the Commission to Bob Ruesink of the Service requested that draft Opinion not be provided and the final Opinion be issued.

October 4, 2002 — In a telephone call between the Commission and the Service (Boise Office), the parties confirmed the message received the day before regarding issuance of the final Opinion only. This was confirmed by the Commission, stating that a draft document be omitted and the final Opinion be issued since they were under time constraints.

October 7, 2002 — The Service's Pacific Regional Office in Portland, Oregon received a petition, dated October 1, 2002, from Idaho Governor Kempthorne on behalf of the State of Idaho, Office of Species Conservation, and the Company to delist the Idaho springsnail. The petition contained new information on this species that was not provided to the Service previously.

October 7, 2002 — The Service sent a letter to the Commission that summarized telephone conversations between Commission and Service staff on October 3 and 4, 2002 regarding the status of this consultation. In those conversations, the Service recommended that the Commission review a draft of the Opinion addressing the proposed relicensing of the four Mid-Snake projects. The Commission reiterated its previous position that a final Opinion should be issued as soon as possible.

October 18, 2002 — In a telephone conversation, staff from the Commission and the Service's Snake River Fish and Wildlife Office discussed the current status of the consultation. The Commission was advised that a preliminary jeopardy determination had been discussed with the Service's Pacific Regional Director relative to re-licensing of the Mid-Snake projects that an early alert with this finding was forwarded to the Service's Washington Office. The Commission was also informed that portions of the draft Opinion were provided to six species experts for peer-review, and that the draft Opinion included a reasonable and prudent alternative. The Commission was asked again if it would like to review a draft of the Opinion; the Commission reiterated its previous position that a final Opinion should be issued as soon as possible. The time line for completing this consultation was also discussed.

November 19, 2002 — The Service received the last of six peer-reviews on the analytical portion of the draft Opinion. All reviews were supportive of the Service's analysis.

December 16, 2002 — The Service received a letter from the Company dated December 13, 2002, withdrawing the State and Company-submitted delisting petitions for the Idaho springsnail and Bliss Rapids snail, pending re-analysis of

	Company data and conclusions and requesting that the formal consultations for the four Mid-Snake and C.J. Strike relicensings be held in abeyance.
December 16, 2002	A letter from the Service's Portland Regional Office was sent to the Commission requesting that formal consultation be extended to allow the Company to conduct review of their pertinent biological data.

C.J. Strike Project (FERC # 2055) Consultation History: June 20, 2000 to December 16, 2002.

June 20, 2000	A letter was sent to the Commission from the Service inviting their participation in section 7 consultation for the relicensing of all Company projects on the Snake River, including C.J. Strike.
March 2, 2001	The Department of Interior (Interior) sent a letter to the Commission transmitting the comments, recommendations, terms and conditions, and prescriptions for the draft C.J. Strike license application.
May 5, 2001	The Department of Interior sent a letter to the Commission recommending wildlife resource protective measures for the C.J. Strike project.
May 17, 2002	The Service received a draft Environmental Impact Statement (DEIS) from the Commission for the relicensing of the C.J. Strike Project.
May 22, 2002	The Service received a copy of a letter from the Commission to the Department of Interior, dated May 21, 2002, stating that they will not recommend the adoption of four of the 17 protective measures recommended by the Service in their May 5, 2001 letter.
May 22, 2002	The Commission sent a letter to the Service, dated May 21, 2002, requesting initiation of formal consultation for relicensing of the C.J. Strike facility and requesting a Biological Opinion within 135 days.
June 10, 2002	The Service provided the Commission with Federal Power Act section 10(j) letter addressing fish and wildlife concerns for the C.J. Strike relicensing, including listed Snake River snails that might be affected by the project.
June 20, 2002	The Service sent a letter to the Commission acknowledging the receipt of their request for formal consultation and stating that the draft EIS does not provide sufficient information to proceed with consultation. The Service recommended that the Commission consider project effects on the threatened Bliss Rapids snail and the endangered Snake River physa snail.

July 11, 2002	The Department of Interior provided comments to the Commission on the draft EIS, including Service issues regarding fish and wildlife resources.
July 26, 2002	The Commission sent a letter to the Service (received July 20, 2002) responding to the Service letter of June 20, 2002. The Commission letter stated that they have determined that relicensing of the C.J. Strike Project would have "no effect" on the Bliss Rapids snail or the Snake River physa, stating that neither of these snails were found in the project area during surveys conducted by the Company. The Commission further stated that all pertinent information had been provided in the draft EIS and that they would expect a Biological Opinion on or before October 3, 2002.
August 20, 2002	The Service provided a letter responding to the Commission's communication of July 26, 2002. The Service acknowledged the Commission's "no effect" determinations for the Bliss Rapids snail and Snake River physa and stated that with this additional information the Service would initiate formal consultation as of July 29, 2002, the Opinion to be delivered by December 11, 2002.
October 7, 2002	A petition to remove the Idaho springsnail from the Federal endangered species list was received in the Service's Region 1 Office in Portland, Oregon. The delisting petition, submitted by Idaho Governor Dirk Kempthorne on October 1, 2002 on behalf of the Idaho Office of Species Conservation and the Company, represented new information on the status of the species.
November 18, 2002	The Commission provided the final EIS for the relicensing of the C.J. Strike Project to the Service.
December 16, 2002	The Service received a letter from the Company dated December 13, 2002, withdrawing the State and Company-submitted delisting petition for the Idaho springsnail, pending re-analysis of Company data and conclusions and requesting that the formal consultations for the four Mid-Snake and C.J. Strike relicensings be held in abeyance.
December 16, 2002.	The Service's Portland Regional Office sent a letter to the Commission requesting that formal consultation be extended to allow the Company to conduct review of their pertinent biological data.

Mid-Snake and C.J. Strike Combined Consultation History: January 7, 2003 to March 23, 2004.

January 7, 2003	The Company provided a letter to the Commission outlining the general inconsistencies of their biological data for listed snails and supporting the Service request for an extension of the formal consultation in order to

ensure that the best scientific information is used in the relicensing process.

January 22, 2003 — The Commission provided a letter to the Service acknowledging receipt of their December letter requesting that section 7 consultation be suspended until the Company's data review could be completed and assessed and pointing out that the Service did not include the C.J. Strike project in this request. They stated they anticipated that consultation would resume beginning in early April 2003.

January 22, 2003 — The Commission provided a letter granting the Company additional time to conduct an independent review of their biological data and provide their findings to the Commission by April 30, 2003.

April 29, 2003 — The Service received a report entitled the "Taxonomic status of the Idaho springsnail (*Pyrgulopsis idahoensis*)." The report, submitted by Dr. R. Hershler and H-P. Liu provided scientific evidence suggesting that the Idaho springsnail and three other species of springsnail from the Snake/Columbia River drainage should be placed into a single species, *Pyrgulopsis robusta*. On May 14, 2003, the Service submitted this report to five independent scientific reviewers for critical evaluation.

May 2, 2003 — The Service received information on the Company's initial assessment of its snail data and needed corrections. This review provided general and specific examples of data inconsistencies. In the report cover letter the Company requested an additional 150 days for their contracted reviewer to further assess data errors and revise previous annual reports to reflect the corrected data.

May 28, 2003 — In a public-noticed telephone conversation, the Commission and Service discussed the current consultation scenarios and time lines for reinitiation of section 7 consultation for the C.J. Strike and Mid-Snake projects, considering the Company's ongoing data review and other pending actions related to listed Snake River snails. Other participants in the conference call were representatives of the Company, The State of Idaho, and Idaho Rivers United.

May 30, 2003 — Dr. R. Hershler provided a prepublication manuscript regarding the taxonomic revision of the Idaho springsnail to the Service. This manuscript, Reappraisal of the North American Freshwater Gastropod *Natricola* Gregg & Taylor (Rissooidea: Hydrobiidae), was under review for publication in a scientific journal.

June 5, 2003 — In a telephone conversation, John Blair of the Commission and Dave Hopper of the Service reviewed relicensing scenarios and time lines for the project. Scenarios included the issuance of revised/corrected

biological information from the Company and the possible taxonomic revision of the Idaho springsnail. The Service stated that no firm time line could be provided on the issuance of the Opinion because time for Service review at the Regional and Washington D.C. levels could not be predicted at that time.

June 16, 2003 — The Service received a letter from the Commission, dated June 13, 2003 requesting that formal section 7 consultation be reinitiated for both the Mid-Snake and C.J. Strike projects. The letter requested that a final Opinion for both of these projects be provided within 60 days of the date of their letter.

June 19, 2003 — The Service received a copy of a letter from the Commission dated June 13, 2003 addressed to the Company, confirming that formal section 7 consultation was being reinitiated.

August 4, 2003 — The Service received a copy of a letter from the Commission dated July 25, 2003, addressed to the Company, stating that if the Service provides Biological Opinions for the Mid-Snake and C.J. Strike projects by the requested August 11, 2003 deadline, that the Company would be provided time to review those Biological Opinions and provide comment before the Commission takes action on the licenses for those projects.

August 5, 2003 — The Company provided a letter to the Commission notifying them that the Company and the Service have initiated discussions with the intent of reaching a cooperative resolution of issues related to the Snake River snails for both the Mid-Snake and C.J. Strike projects. This letter requested an additional 90 days to allow the cooperative effort to proceed.

August 5, 2003 — The Service provided a letter to the Commission informing them that the Company and the Service have entered into discussions to reach cooperative resolution of the outstanding issues regarding listed snails and hydropower projects on the Mid-Snake River. The letter requested that an additional 90 days be granted for completion of the ongoing negotiations.

August 14, 2003 — The Commission provided a letter to the Company stating that it will not take action on the licenses of the Mid-Snake or C.J. Strike projects prior to the 90 days requested by the Company and Service.

August 25, 2003 — The Company provided a letter to the Service describing the technical team made up of members of the cooperating parties for the purpose of developing needed studies on listed snails and the completion of a Settlement Agreement.

September 25, 2003 — The Company sent a letter to the Commission informing them that the independent review of the Company's snail data would not be completed

	until October 15, 2003, and that cooperative discussions between the Company and the Service were continuing.
October 17, 2003	The Company provided six of seven of the final of the revised snail reports to the Commission and the Service.
November 4, 2003	The Company provided the seventh revised snail report to the Commission and the Service.
November 4, 2003	The Service provided a letter to the Commission stating that discussions with the Company have been productive, that cooperative studies were being planned for the first five years of the new license, and that the Opinions would be revised based on the pending Settlement Agreement. The Service stated that an additional 90 days would be required before the Settlement Agreement was completed.
December 3, 2003	The Commission provided a letter to the Service acknowledging their letter of November 4 and stating that they will not take action on the five Snake River hydropower projects prior to the 90-day period requested.
December 3, 2003	The Commission provided a letter to the Company, granting a 90 day extension for completion of the Settlement Agreement and completion of a Biological Opinion on the new action.
December 11, 2003	During the Hydroelectric Licensing Status Workshop, the Commission, Company, and Service discussed timelines and procedures for preparation of the Settlement Agreement, reinitiation of consultation, and preparation of a new Biological Opinion. The Service participated by telephone.
December 23, 2003	The Commission provided written notice that two of its staff, Merrill Hathaway (Office of the General Counsel) and Jim Hastreiter (Office of Energy Projects) would be available to assist in completing the pending Settlement Agreement between the Service and the Company.
January 2, 2004	An article was published in the journal, The Veliger recommending a taxonomic revision of the Idaho springsnail, placing it under the species name *P. robusta*, a species lacking formal status under the Act.
February 9, 2004	The Settlement Agreement between the Company and the Service was signed. The Settlement Agreement outlined specific studies and project operations that would occur over the first five years of operation under the new license.
February 11, 2004	The Service provided a letter to the Commission recommending that the recently signed Settlement Agreement be incorporated into the proposed action and new license for the five Snake River hydropower projects. The

Service also recommended that the Commission provide a formal request for a Biological Opinion.

February 26, 2004 — The Service received a letter from the Commission requesting that consultation on the five projects, Shoshone Falls (FERC 2778), Upper Salmon Falls (2777), Lower Salmon Falls (2061, Bliss (1975), and C.J. Strike (2055), resume.

March 23, 2004 — The Service provided a letter acknowledging receipt of the Commission's February 26 letter and confirming that formal consultation was underway and a Biological Opinion for the project was being prepared. This letter also discussed the need to address the status of proposed project mitigation measures that were being reconsidered.

February 9, 2004 to April 20, 2004 — Continuing information sharing between the Company and the Service to define the proposed action and establish the extent of project related effects for the development of the Opinion.

April 16, 2004 — In a telephone conversation between the Company and the Service, the participants discussed the need to better define the frequency and magnitude of unusual operations outlined in the Settlement Agreement.

April 20, 2004 — In a phone conversation between the Company, the Service, and representatives of the Commission, the participants discussed the means by which to determine an appropriate number of emergency and unusual events to be permitted under the Incidental Take Statement, that might occur during run-of-river operations.

April 26, 2004 — A meeting was held involving representatives of the Company, Commission, and Service, to discuss information needs and components pertaining to emergency and unusual events.

May 10, 2004 The Service received a letter from the Company defining unusual and exception operational scenarios for Lower Salmon Falls and Bliss, and providing an estimate of the frequency and duration of such operations.

BIOLOGICAL OPINION

I. DESCRIPTION OF THE PROPOSED ACTION

A. Background

The Mid-Snake is typically defined as the reach of river from Swan Falls Dam, at river mile (RM) 457.7, upstream to American Falls Dam, at RM 714. There are a total of 10 dams on the Mid-Snake and these, in order from upstream to downstream, are: American Falls, Minidoka, Milner, Twin Falls, Shoshone Falls, Upper Salmon Falls, Lower Salmon Falls, Bliss, C.J. Strike, and Swan Falls (Figure 1). The Company owns and operates all of these dams except Milner, Minidoka, and American Falls which are either privately owned or Bureau of Reclamation facilities.

The Service has prepared the following Opinion based, in part, on information in two EISs prepared for the relicensing of five hydropower generating facilities on the Mid-Snake, Idaho (FERC 2002a, b). The first of these EISs was for relicensing of the Company's Mid-Snake facilities, Shoshone Falls, Upper Salmon Falls, Lower Salmon Falls, and Bliss projects, which have been in operation since 1907, 1937, 1910, and 1950 respectively. The final EIS (FEIS) for the relicensing of these four projects was issued on August 9, 2002. Relicensing for the C.J. Strike Project was addressed in a separate FEIS that was issued on November 18, 2002. The Company is seeking relicensing for these five projects for periods of 30 to 50 years. Under the two FEISs the proposed actions are to operate these facilities in essentially the same fashion as they have been operated over the past 15 years, with slight modifications to their operations and the addition of a number of mitigation measures. A Settlement Agreement (2004) signed by the Company and the Service on February 9, 2004, further modifies the proposed action.

Following is a description of each of the five projects being considered in this Opinion.

B. Project Descriptions

1. Shoshone Falls

The Shoshone Falls Project (Figure 2) is located about 3 miles northeast of the city of Twin Falls, Idaho, at river mile (RM) 614.8. Of the five projects, this is the most upstream. The dam and associated facilities occupy about 4.9 acres of Federal lands administered by the Bureau of Land Management. The dam consists of a series of concrete weirs, is about 800 feet (ft) long, and is divided into four sections by rock islands along the crest of Shoshone Falls. The average height of the dam is 16 ft and directs flows to a penstock and powerhouse on the north side of the Snake River. The project reservoir is about 1.8 miles long, covers an area of approximately 88 acres, and has a capacity of about 1,500 acre-feet (ac-ft). Project capacity is 950 cubic feet per second (cfs) and the three turbine generators provide a total installed capacity of 12.5 megawatts (MW). The Shoshone Falls facility comprises approximately 0.68 percent of the Company's electricity production (Bluefish, in litt. 2001).

This facility presently operates in a year-round run-of-river mode. Run-of-river (ROR) operation is where water entering the dam's reservoir is approximately equivalent to that volume of water passing through the turbines at any one time, that is, the reservoir is not used for storage. As a result, minimum flows leaving this dam are approximately equivalent to flows entering the reservoir at any time. This mode of operation differs from that of load-following or peak-loading, in which flows through the turbines vary depending on energy demand and unused water is stored in the reservoir.

2. Upper Salmon Falls

The Upper Salmon Falls Project (Figure 3) is located about 3 miles south of the town of Hagerman, Idaho, downstream of Shoshone Falls at RM 581.4. This project does not involve any Federal lands. The project consists of a 610-ft long gravity dam, with a 274-ft long intake structure, a 240-ft long variable-height gated spillway that ranges from 5 to 14 ft in height, and two gravity sections at the abutment which measure 450 ft in total length. There is an additional 1,380-ft long gravity dam diversion structure with a 200-ft long gravity canal. The reservoir is about 5.8 miles long and covers 50 acres, with a gross storage capacity of 600 ac-ft. This project is a diversion facility, its reservoir diverting water from and lying adjacent to the natural river channel. Under the current license, this bypass reach can be seasonally dewatered. There are four generator turbines housed in two separate power plants, with a maximum operating capacity of 13,860 cfs and total generation capacity of 34.5 MW of electricity. This facility provides approximately 1.7 percent of the Company's power generation (Bluefish, in litt. 2001). The Upper Salmon Falls Project is presently operated in a year-round run-of-river mode and empties into the upstream end of the Lower Salmon Falls Reservoir. Although the facility is basically operated in a run-of-river mode, reservoir depth periodically drops by an estimated 0.4 ft from full pool. There are no fish-passage or fish screen structures at Upper Salmon Falls Dam, although resident and migratory fish species passed the falls prior to construction of the project. Minimum flows leaving this dam are approximately equivalent to flows entering the reservoir at any time.

3. Lower Salmon Falls

Lower Salmon Falls Dam (Figure 4) is about 2 miles north of the town of Hagerman, Idaho, at RM 573. The project area includes 29.3 acres of BLM land and 58.1 acres of National Park Service land within Hagerman Fossil Beds National Monument. The 38-ft high dam is about 983-ft long, including a 314-ft long powerhouse section, a 312-ft long spillway, and a 80-ft long gravity section. The 750-acre reservoir is about 6.6 miles long and has a gross storage capacity of 10,900 ac-ft. The powerhouse has four turbine generators with a maximum capacity of 60 MW of electricity at a flow of 17,200 cfs and accounts for approximately 1.6 percent of the Company's power generation (Bluefish, in litt. 2001). This dam presently operates in a load-following mode, regulating water releases through the turbines to track short-term daily energy demands. The proposed minimum flow from this dam is 3,500 cfs.

4. Bliss

The Bliss Project (Figure 5) is located about 6 miles west of the town of Bliss, Idaho, at RM 560. The Bliss Project includes 184 acres of BLM land. The project consists of a 364-ft long, 84-ft high gravity dam with gravity intakes to three turbine generators. The reservoir is 5 miles long and covers an area of about 255 acres, with a gross storage of 11,100 ac-ft. Peak power generation is 75 MW at a hydraulic capacity of 15,000 cfs. The Bliss facility provides approximately 2.4 percent of the Company's electricity production (Bluefish, in litt. 2001). The project is presently operated in a load-following mode, holding water to be released for maximum electricity generation at times of daily peak demand. Under the proposed mode of operation, the guaranteed minimum flow below Bliss Dam would be 4,500 cfs.

5. C. J. Strike

The C.J. Strike Project is located about eight miles southeast of the town of Grandview, Idaho, just below the confluence of the Snake and Bruneau Rivers (Figure 6). The project area includes upward of 1,839 acres of emergent Federal land managed by the Bureau of Land Management. This area includes lands on which the facility is located and lands adjacent to the reservoir. An additional 377 acres of BLM land are associated with electrical transmission lines. The dam is comprised of a 3,220 foot long earthfill structure that measures up to 115 feet in height. The concrete spillway is 340 foot wide and 78 feet high. The 65 foot high concrete intake has three openings each of which connects to a separate generator. The three turbine-generators have a nameplate capacity of 82.8 megawatts. There is a 750 foot unlined tailrace that drains the powerhouse draft tube outlets. The 35-mile reservoir (27 miles on the Snake and 8 miles on the Bruneau River) has a gross capacity of 220,000 ac-ft and covers an area of approximately 7,600 acres. Pool elevation at maximum is 2,455 feet above mean sea level. Approximately 90 miles of aerial transmission lines conduct electricity from the dam to substations in Caldwell and Mountain Home.

The facility's three independent generators allow the facility to be operated in a block-loaded fashion to accommodate increasing or diminishing power demand. Under the current and proposed operation, load-following operations cause the reservoir to fluctuate a maximum of 1.5 feet during each ramping episode and results in fluctuations up to four feet in the tailwaters below the dam. The maximum rate of river stage fluctuation is 2.5 feet per hour. Minimum flow from C.J. Strike Dam into the Snake River is proposed as 3,900 cfs.

C. Proposed Actions

1. Proposed and Alternative Actions in the FEISs

In the FEIS, the Commission analyzed the Proposed Action and three alternative licensing actions for the Mid-Snake projects. The Proposed Action is as described in the Company's license application, and is generally the same as current operations with additional mitigation actions aimed at providing environmental, cultural, aesthetic, and recreational benefits. The action alternatives include the following: the No-action Alternative, a Seasonal Run-of-river Alternative, and a Year-round Run-of-river Alternative. The Commission also considered but

eliminated other alternatives, which included: Federal Government Takeover, acquisition of a non-power license, and project retirement (with and without dam removal).

In the FEIS, the Commission analyzed the Proposed Action and three alternative licensing options for the C.J. Strike project. The Proposed Action is as described in the Company's license application, and is generally the same as current operations with additional non-operational mitigation actions aimed at providing environmental, cultural, aesthetic, and recreational benefits. The other action alternatives include the No Action Alternative, Company Proposal with alternative, nonoperational environmental mitigation measures, and a Year-round Run-of-River Alternative. The Commission also considered but eliminated other alternatives, which included: Federal Government Takeover, acquisition of a non-power license, and project retirement (with and without dam removal).

2. Proposed Action Amended by the Settlement Agreement

The proposed actions for Lower Salmon Falls and Bliss Projects were modified in a Settlement Agreement between the Company and the Service signed on February 9, 2004 (Agreement 2004). This Settlement Agreement stated that the two cooperators (Company and Service) would work to obtain additional information on project-related effects to the listed Snake River snails while allowing for the issuance of a new license for the five Mid-Snake hydropower projects (Shoshone Falls, Upper and Lower Salmon Falls, Bliss, and C.J. Strike). The Settlement Agreement outlined a number of laboratory and field studies to be funded by and/or conducted by the Company and the Service to address information needs on some of the listed Snake River snails regarding project-related impacts, specifically those resulting from the practice of load following and the resulting dewatering of shallow benthic habitats.

The Agreement also outlined planned flow regimes at the Lower Salmon Falls and Bliss projects that would facilitate field studies to provide for comparisons of snail distributions and abundance under differing operational flow regimes, load following versus run-of-river. The Settlement Agreement prescribed operations to be conducted as load following at the two projects in two years of the five year study period. All remaining years they are to be operated as run-of-river. The Agreement anticipates that the parties will use the data gathered to develop an agreement for long-term operations that provides for maximum operating flexibility while providing for conservation of listed Snake River snails. The outcome of both the studies and any future negotiations between the Service and the Company are unknown, and it is not possible to anticipate any future action by the Commission in response to any agreement among the parties. Therefore, the Service assumes in this Opinion that the Lower Salomon Falls and Bliss projects will operate in a load following mode for two of the first five years and in a run of river mode at all other times. All other projects will be operated as proposed in the EISs. When and if the Commission approves alternative operations, the conclusions of this Opinion must be revisited and reinitiation of consultation may be necessary.

3. Proposed Mitigation Measures

The proposed action includes license provisions for a number of mitigation measures. Those relevant to this Opinion are described below.

a. Mitigation for All Projects

The FEISs describe the following measures to be implemented for all five projects.

- Stocking game fish in selected areas;
- Development and implementation of conservation plans for the white sturgeon and federally listed aquatic snails;
- Development and implementation of plans to improve water quality in portions of the Snake River and its tributaries (e.g., development and implementation of TMDL criteria);
- Purchase and management of lands for riparian and wetland habitat values;
- Implementation of weed control activities on all Company lands; and
- Enhancement of selected recreation sites.

b. Mitigation for the Mid-Snake Projects

- Maintenance of channel flows at Upper Salmon Falls (North Channel) at a minimum of 50 cfs and a target flow of 200 cfs except during years of low flow Dolman Rapids;
- Providing funds for land acquisition and/or protection of selected springs and spring resources; and
- Development of about 30 acres of artificial wetlands downstream of Shoshone Falls.

c. Mitigation for the C.J. Strike Project

- Protection and enhancement of upland habitats and
- Implementation of programs for shoreline sheet erosion influenced by Company water operations.

4. Unusual Operations at Lower Salmon Falls and Bliss

While the proposed action, as amended by the Settlement Agreement, calls for run of river operations for the license period except for two of the first five years of operation, there are a number of circumstances that could result in other operations. Such unusual operations are described in Attachment 2 of the Settlement Agreement. In a May 10, 2004 letter to the Service, the Company provided additional information about circumstances when operation of the two projects may temporarily deviate from run of river.

Each year on the second Sunday of August, the town of Glenns Ferry conducts a reenactment of historic fording of the Snake River at Three Island Crossing. The event takes place about 21 miles downstream of the Bliss Dam. In order to ensure the safety of the wagons and participants in that event, the Company may be called on to reduce river stage at this location. This is done by reducing flows from the Bliss Project. The Company does not expect it will be necessary to reduce flows below the 4,500 cfs minimum; however, during some water years run of river operations would need to be suspended immediately prior to and during the Three Island Crossing event. During a year when flows are above the 4,500 cfs minimum, operations could be modified, holding water behind the Bliss Dam for the duration of the event. River volumes could be reduced, followed by a release of water at volumes higher than run of river. For this

Opinion, the Service assumes two days' altered operations each year at Bliss Dam for this event, acknowledging that in some years operational alterations will not be necessary.

In addition to the Three Island Crossing event, the Company anticipates a number of other circumstances where they would operate in a mode other than run of river. These are associated with uncommon but predictable events outside the control of the Applicant. Such unusual operations may be prompted by local events such as bird collisions or lightning strikes that would result in emergency generator shutdowns at the Lower Salmon or Bliss project. In such cases, run of river operations may be ceased and alternative operations carried out temporarily. Drawdowns of the reservoirs or reduced flows below the dams may be needed to accommodate search and rescue efforts in the event of an accident or drowning.

Also, under the terms of its license and in coordination with the Western Energy Coordinating Council and North American Electric Reliability Council, the Company is obliged to contribute to reliable and stable electric energy supplies. Events outside the action area could prompt the Company to operate the Lower Salmon Falls or Bliss projects in a mode other than run of river. Among those unusual but predictable events are power shortfalls associated with outages elsewhere, periods of severe weather, and energy shortages. In these exceptional circumstances, one or both of the projects may need to be operated in a load following manner in order to compensate for lost capacity or to provide additional power.

It is necessary for the Service to provide an analysis of the likely effects of these exceptional operations in this Opinion, and to base that analysis on a reasonable estimate of frequency and duration so that we may adequately assess the implications of such operations on listed Snake River snails. The Company's May 10, 2004 letter to the Service provided an estimate of likely frequency, based on recent history and current requirements of the Western Energy Coordinating Council. Based on that information, the proposed action is expected to include exceptional operations at the two projects during run of river years at a frequency of two to four events annually with an estimated duration of three to four days per event. It is important to note that this is a prediction of unplanned events and exceptional circumstances, which by their nature are highly variable. Actual operations over the life of the license could vary from what is analyzed here. If the frequency is greater or significantly less than anticipated in this Opinion for any given year, or over a period of years, it may be necessary to revisit our analysis and conclusions to determine whether they are still valid. Section 7 consultation for the projects may need to be reinitiated.

Operations other than run of river may occur at Lower Salmon Falls and Bliss two to four times annually with durations of three to four days, amounting to a maximum 16 days total for both projects. This applies only to years when the projects are to be operated in a run of river mode. During the two years load-following operations proposed in the Settlement Agreement, responses to unusual circumstances are within the range of operations for Lower Salmon and Bliss already considered by the Service. No similar provisions for the Shoshone Falls, Upper Salmon, and C.J. Strike projects are considered in this Opinion, as none are described in either the EISs or the Settlement Agreement.

In this Opinion, the Service is only considering operations that maintain flows at or above the 3,500 cfs minimum for Lower Salmon Falls and 4,500 cfs minimum at Bliss. Any operations that would reduce flows below those levels are not considered here and would require the Commission to initiate separate consultation under section 7 of the Act, potentially under emergency procedures set forth at 50 CFR 402.05.

During the five year study period called for in the Settlement Agreement, unusual operations at Lower Salmon and Bliss could affect research efforts. Run of river operations of adequate duration are critical to determining where listed snails occur in the river (zonal distribution) and how project operations affect them. Depending on the magnitude or timing of unusual operations, study results may be compromised or rendered invalid.

5. Actions Not Considered in this Opinion

There are several potential project-related actions that the Service is not considering in this Opinion, either because they are not specifically described in the proposed action or because they are not described in sufficient detail. First, actions or events that result in operating the lower three projects at water volumes less than the proposed minimum flows are not analyzed in this Opinion. They cannot be readily anticipated at this time and are not described in the Commission's proposed action. This includes any maintenance or repair activities that would involve operations that vary from the proposed action. Second, as noted elsewhere in this Opinion, many of the mitigation measures proposed in the Commissions EISs for the five projects have yet to be developed to an extent that the Service can assess their effects on listed species. As such, they are not considered in our conclusions.

Only operations explicitly described in this Opinion are accounted for in our analysis. Future actions by the Commission or Company that involve operating any of the five projects in some other way would require separate consideration under section 7 of the Act, either as a discrete action or as an amendment to the proposed action considered here.

II. DESCRIPTION OF THE ACTION AREA

The action area is defined in regulation implementing section 7 of the Act. (50 CFR (402.02) as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action." For the five projects being assessed in the Opinion, the action area includes the upstream and downstream limits of their influence. The action area extends from the upstream limit of effects of the Shoshone Falls Dam on natural, incoming river flows (about RM 617) to areas downstream of C. J. Strike Dam. The area of project-related effects for the C. J. Strike project are not easily definable. The Swan Falls Dam downstream (RM 457.7) operates in a ROR modes and cannot be used for water storage. Hence, the load following operations carried out at C. J. Strike may influence river stage height to some degree over 156 miles downstream until the Snake River enters Brownlee reservoir, but stage fluctuations appear to be attenuated with increasing distance from C. J. Strike Dam (Figure 7) (IPC, unpub. data, 2004a). Given this, it is difficult to determine at what point along the river the operational effects, specifically river stage change, of that dam become insignificant to the river's biota.

The Action area includes approximately 160 miles for these five projects from Shoshone Falls to Swan Falls dams, including tributary streams and springs that may be affected by river stage fluctuations. These confluence habitats may provide important habitat to some species of listed snails (e.g., Bliss Rapids snail) and many of which provide an important source of quality water that benefit all of the listed snails and other cold water species.

III. STATUS OF THE SPECIES

Table 2 provides a summary description of each species and factors affecting them in the action area.

A. Idaho Springsnail

1. Description of the Species

The Idaho springsnail (*Pyrgulopsis* (=*Fontelicella*) *idahoensis*), also known as the Homedale Creek springsnail, was listed as endangered on December 12, 1992 (57 FR 59244). A recovery plan that included this snail was prepared in 1995 (Service 1995) and is still being used as a recovery guidance document. Critical habitat for this species has not been designated. On October 7, 2002, the Service received a petition, dated October 1, 2002, from Governor Kempthorne of Idaho to delist this species on behalf of the State of Idaho's Office of Species Conservation and the Idaho Power Company (IOSC 2002a). On December 13, 2002, the Company withdrew the petition for delisting when it found inconsistencies in the data used in the petition. The Company's data from 1995 to 2001 has undergoing independent review to correct many of these inconsistencies, but due to difficulties in field identification of this species, the current distribution of the Idaho springsnail is in question (see below).

The Idaho springsnail has a narrowly elongated shell reaching a height of 0.2 to 0.25 inches, with up to 6 whorls. The empty shell has a pale, olive-tan color that can appear white at the apex. The body of live snails is pale with areas of grey to black with a reddish-brown operculum. When properly preserved the body and snout are typically light to moderate brown, the foot being pale with a brown anterior margin and the visceral coil being black. Unlike most other molluscs, individuals are not hermaphroditic, but instead are either male or female (dioecious). This species is a Blancan (Pliocene-Pleistocene) Lake Idaho relict.

2. Status and Distribution

The Idaho springsnail was historically found from Homedale (RM 416) to Bancroft Springs (RM 553) (Service 1995). This species has declined due to degradation of habitat (e.g., water quality) and habitat fragmentation due to river impoundments and associated habitat changes (Service 1995). The target recovery area includes the main stem of the Snake River between RM 518 to RM 553. With the exception of locations within the Bruneau River arm of C.J. Strike Reservoir, this species is not known to occur outside of the mainstem of the Snake River.

Surveys conducted by Taylor in 1982 placed the distribution of this species from Bancroft Springs downstream to C.J. Strike Reservoir (RM 495) at that time. Taylor (1982a) stated that it had vanished from river areas below C.J. Strike Reservoir. Work by Dianne Cazier Shinn, a

former Company biologist, provided insight into the possible current distribution of the Idaho springsnail. She reported finding the species throughout its historic range, as far downstream as the town of Weiser (RM 338) (Shinn 2002, as revised 2003). Recent Company reports (Stephenson and Bean 2003) include density estimates for known colonies of this species upstream of Grandview, C.J. Strike Reservoir (two locations), and Weiser, with densities ranging from zero to 1,460 snails per square meter, from surveys conducted in Spring, Summer, and Fall of 2002.

A presumed colony of springsnails that had been monitored at Frank Lloyd Wright Rapid (RM 570) was recently determined instead to be the invasive New Zealand mudsnail. Although, springsnails have been reported from multiple locations from Grandview to Weiser, most of these colonies have only been sampled once and difficulties in making positive identification of this species in the field (R. Myers, IPC, in litt., 2004) leave these sightings unconfirmed and questionable. At this time, the status and distribution of this species is not well established and makes the assessment of project-related effects difficult.

3. Life History

Very little is known about the life history of the Idaho springsnail. This species is primarily found in permanent, unimpounded waters of the mainstem Snake River, although live specimens have been collected from three locations within C.J. Strike Reservoir; one colony within the Bruneau arm of the reservoir contains the highest recorded densities of this species. Frest (in litt. 2002) noted that although the Idaho springsnail may occur in lake habitats, it requires moving water; this species is not known to persist in "slow water" habitats (*ibid*). This snail has not been found in other Snake River tributaries or in cold-water springs adjacent to the river (Taylor 1982a). The Idaho springsnail may spend some time as an interstitial dweller occurring on mud or sand with gravel-to-boulder size substrate, but may also be found on the surface of rocks and sometimes on aquatic macrophytes (Frest, in litt. 2002). It often attaches to vegetation (e.g., *Potamogeton*) in riffles. There is currently no conclusive information on the depth distribution of this species in the river profile.

Researchers conclude that on average, the Idaho springsnail lives for about a year, with females laying eggs between February and May, but the number of eggs produced per female is not known. Juvenile snails appear in the population between March and July. Laboratory studies have shown that Idaho springsnails are active in water temperatures ranging from 48.5E to 92.7E F (S. Lysne, Boise State U., unpublished M.S. thesis, 2003), but that snails died within one week if temperatures exceeded 87E F. The Idaho springsnail has been found in lake habitats where summer temperatures are believed to exceed 71.6E F. It is not known how such elevated temperatures or other eutrophic conditions might affect this snail's numbers, reproduction, or survival. Although their presence in warmer waters is noteworthy, this does not necessarily indicate that they can persist as viable populations under such conditions (Frest, in litt. 2002). The Idaho springsnail has been described by most authors as being dependent on cold water of high quality (Taylor 1982a, Frest et al. 1991). While this snail has been found, in one case in high densities, within C.J. Strike Reservoir, initial reports only record it from two of 168 sampled sites (1.2%) (Cazier 1997b). The revised report for these survey results do not provide

sufficient detail to assess the abundance of the species within the C.J. Strike Reservoir. Additional information is needed to better understand the habitat requirements of this species.

4. Population Dynamics

There is a paucity of information on the population dynamics of the Idaho springsnail. The Company has provided some density estimates for some river colonies, but given the naturally patchy distribution and high variation in snail numbers, there are no good sample techniques have been established to provide confident estimates of population size or trends. In addition, there are no data to confirm the long-term persistence of known colonies. The colony at Bancroft Springs could not be detected over a 5-year period (1995-2000), but was recently re-detected (Shinn 2002, as revised 2003). Other colonies have also been detected both within C.J. Strike Reservoir and in the Snake River downstream of that dam, but long-term monitoring of those colonies has not been conducted. The species is declining due to deteriorating water quality and fragmentation of previously continuous habitats with free-flowing waters by dams (Service 1995). There is evidence that a non-native snail, the New Zealand mudsnail (see below), may compete with or otherwise negatively impact the Idaho springsnail. To date, no population viability studies have been conducted for the Idaho springsnail.

5. Conservation Needs

Viable subpopulations/colonies need to become established and be protected on the main stem of the Snake River from RM 518 to RM 553 in mud or sand habitats associated with gravel to boulder-sized substrates throughout the river profile with good water quality (average water temperature below 64E F, DO concentrations greater than 6 mg/1 (ppt), and pH levels of 6.5 to 9.5 mg/l).

This species is historically known from the Bliss Reach to Homedale. Currently, colonies are known from the Bliss Reach and may occupy habitats as far downstream as Weiser (~RM 339). As discussed above under "*Status and Distribution*" of the Idaho springsnail, there are five known modern colonies of the species: one between Grandview and C.J. Strike Dam; two in C.J. Strike Reservoir; one below Bliss Dam (Bancroft Springs to C.J. Strike Reservoir), one near the town of Weiser, and one in the area of Celebration Park (the size and spatial limits of these "colonies" are subjective and used to identify broad geographic areas only, i.e., we do not know to what extent there is gene flow between known colonies). Recent surveys conducted by the Company have documented this species, sometimes in large numbers, at some locations on the Snake River between Grandview and Weiser. However, little is known about the long-term persistence of these colonies and the species was believed to have been extirpated from this reach until recently (Taylor 1982a; Frest and Johannes, in litt., 2003). Some colonies may be able to tolerate periodic dewatering from load following, but more data are needed to better assess colony viability under these conditions.

B. Utah Valvata Snail

1. Description of the Species

The Utah valvata snail was listed endangered on December 12, 1992 (57 FR 59244). Critical habitat for this species has not been designated. The shell of the Utah valvata measures about 0.2 inches in height, is turbinate, and contains as many as four whorls. An angular carina or ridge runs perpendicular to the raised, transverse threads and attenuates toward the circular aperture margin.

2. Status and Distribution

The Utah valvata is documented from Utah Lake, Utah, from which it is now extirpated, and in the Snake River of southern Idaho from the Henry's Fork as far downstream as Grandview (RM 487). This snail was most likely found in slow-moving portions of the river through southwestern Idaho prior to agricultural development and subsequent changes to the Snake River. Taylor (1982d) reported that empty shells were found downstream of C.J. Strike Reservoir and at Indian Cove Bridge (RM 525.4). There is one collection of this species from the Big Wood River (Gustafson, Montana State University, in litt., 2001). These sightings could represent relict populations or more recent colonization from irrigation returns via canals originating from Lake Walcott and/or Milner Reservoir. A single, empty shell was recovered from the Bruneau Arm of C.J. Strike Reservoir (S. Lysne, U.S. Fish & Wildlife Service, pers. Comm., 2004), but extensive surveys by the Company have failed to locate a living colony or other shell deposits. The target recovery area for this snail is RM 572 to RM 709, and includes the mainstem of the Snake River as well as associated cold water spring tributaries (Service 1995). Population strongholds of the Utah valvata include areas in Lake Walcott, American Falls Reservoir, and the Thousand Springs Preserve. Populations of the Utah valvata have been regularly monitored in Lake Walcott and upstream reaches up to and including American Falls Reservoir (Irizarry 1999; Weigel 2002, 2003) and are known or reported from cold water springs or spring-influenced portions of the river within the project area such as Thousand Springs (Frest and Johannes 1992a) and Box Canyon Springs (Taylor 1985). The most recent reports of this species indicate that it is found in scattered colonies as far upstream as the Henry's Fork of the Snake River, Idaho (Gustafson, Montana State U., in litt., 2003).
The most current information on the distribution and status of the Utah valvata indicates that this species occurs in numerous colonies and reaches its greatest numbers in river and lake habitats upstream of the Shoshone Falls Project area from Minidoka Dam upstream into American Falls Reservoir. The status of the species upstream of American Falls Reservoir is poorly known, but numerous viable colonies could be present.

3. Life History

Very little is known about the life history of the Utah valvata. In the Snake River, this snail inhabits a diversity of habitats, such as shallow shoreline waters, deep pools, and perennial flowing waters associated with large spring complexes. Numerous colonies are known to occur throughout Lake Walcott and American Falls Reservoir, indicating the ability of these snails to adapt to lake habitats. Frest (in litt. 2002) noted that although the Utah valvata may occur in lake

habitats, it requires moving water; this species is not known to persist in "still water" habitats. The Utah valvata generally avoids areas with heavy currents or rapids (Taylor 1982d). This species appears to prefer well-oxygenated areas of non-reducing calcareous mud or mud-sand substrate among beds of submergent aquatic vegetation. Cazier (1997a) has observed the Utah valvata burrow into soft substrates (mud/sand), apparently an evasive behavior. However, preliminary work conducted by Steve Lysne (Boise State University, unpublished M.S. Thesis, 2003) suggests that under laboratory conditions this snail may spend considerable time on gravel- to cobble-sized substrates. Chara, an aquatic plant that concentrates both calcium carbonate and silicon dioxide, is a common associate with the Utah valvata (Service 1995). The Utah valvata prefers cool water habitats, however, laboratory studies have shown that they are active in water temperatures ranging from 45.1E to 89.1E F (S. Lysne, Boise State U., unpublished M.S. Thesis, 2003), but that snails died within one week if temperatures exceeded 87E F. This snail may consume diatoms, plant debris, aquatic plants, and sessile organisms, but is generally regarded as a detritivore. The species is hermaphroditic. Observations by Cazier (1997a) suggest that reproduction in the colony at The Nature Conservancy's Thousand Springs Preserve occurs in the fall, followed by a seasonal die-back in December. Analysis of size classes in Lake Walcott suggests that these colonies reproduce between June and September (Weigel 2003).

4. Population Dynamics

Surveys conducted by Frest and Johannes (1992a) identified only two areas within the Thousand Springs Preserve with colonies of the Utah valvata snail. Their population estimate was 6,000 snails per colony with an average population density of 2.2 snails per ft^2 (57 FR 59244). Periodic surveys conducted by the Company suggest one of these colonies has been persistent over time (Frest and Johannes 1992a; Stephenson and Bean 2003). The Utah valvata appears to have relatively large and persistent colonies in Lake Walcott (RM 674-690), where they were found to occur on mud-sand to mud-gravel substrates at depths ranging from 5 to 45 ft. The average life span of this species is believed to be one year, but may slightly exceed this. The reproductive potential of the Utah valvata is unknown, but egg masses with up to 12 eggs have been observed (Lysne, Boise State U., unpublished M.S. Thesis, 2003).

5. Conservation Needs

The Service has determined that viable subpopulations/colonies must be established and protected In both the main stem of the Snake River and in tributary cold-water spring complexes from RM 572 to RM 709 in mud or sand substrates throughout the river profile with good water quality (average water temperature below 64E F, DO concentrations greater than 6 mg/l and pH levels of 6.5 to 9.5 mg/l).

C. Snake River Physa Snail

1. Description of the Species

The Snake River physa snail was listed as endangered on December 12, 1992 (57 FR 59244). Critical habitat for this species has not been designated. The shells of adult Snake River physa

snails are 0.2 to 0.25 inches long with 3 to 3.5 whorls, and are amber to brown in color (Service 1995). This species occurs on the underside of gravel- to boulder-sized substrate in swift currents in the main stem of the Snake River. Live specimens have been found on boulders in the deepest part of the river, accessible to divers, at the margins of rapids.

2. Status and Distribution

The Service (1995) reported that the Snake River physa's "modern" range extended from Grandview (RM 487) to the Hagerman Reach (RM 573), and possibly upstream from Salmon Falls. It is believed to be confined to the main stem of the Snake River, never having been reported from tributary streams. Taylor (1982c, 1988) stated that the Grandview sub-population was extirpated in the early 1980's "...as the native bottom fauna has been virtually eliminated in this sediment-laden section of the Snake River." There are recent (late 1995), unconfirmed accounts of this species as far upstream as RM 671 and the Company reports its presence within the Hagerman area as recently as 1996 (Cazier 1997a), but the identity of these specimens were not confirmed. The status of this species remains unknown, but it appears to be very limited in its range and has always been rare. Recent surveys (September 2003) for this species at several of its early collection sites, within apparently good habitat, failed to locate either living specimens or empty shells (Frest, pers. comm., 2003). More recent sampling by the Bureau of Reclamation may have recovered empty shells of this species in the river reach below Minidoka Dam, but positive identification of these shells has not yet been made (J. Keebaugh, OJSMNH, pers. comm., 2004a). The target recovery area is designated as the Snake River between RM 553 and RM 675 (Service 1995).

The most recent confirmed collections of live specimens of this snail were by Taylor and Bowler (Taylor 1988). Taylor's collections occurred between 1959 and 1985 and were conducted between the Malad River confluence and Grandview, with live specimens coming from the Hagerman Reach, downstream of Lower Salmon Falls Dam (Taylor 1988, Frest et al. 1991). Recent communications from Taylor suggests that the species might lie upstream in areas of good water quality, but there have been no confirmed collections of the Snake River physa upstream of Lower Salmon Falls Dam.

3. Life History

Very little is known about the life history of the Snake River physa snail. This species existed in the Pleistocene-Holocene lakes and rivers of northern Utah and southeastern Idaho, and is thought to have persisted for at least 3.5 million years in the Snake River (Taylor 1982c, 1988; Thompson 1996). It has been collected only rarely so little is known of its habits other than it appears to prefer rocky substrates in fast-flowing portions of the main Snake River. Based on the life histories of related species of *Physa*, the Snake River physa likely lives for up to, or just over, one year. Nothing is known about its reproductive biology.

4. Population Dynamics

Nothing is known of the Snake River physa's population size or natural population dynamics. Surveys conducted by the Company recorded the Snake River physa on two or three occasions

over two years (Cazier 1997a, 1999a), but because of because of the difficulty of distinguishing this species from a more common species of *Physa,* make these observations are unconfirmed. In each of these observations, the snail was found near turbulent, deeper water and on large cobble- to bolder-sized substrate. Live Snake River physa snails have always been rare at collection sites and fewer than 50 live snails had been collected in the Snake River (Frest et al. 1991).

5. Conservation Needs

Viable subpopulations/colonies must become established and be protected on the main stem of the Snake River at from RM 553 to RM 675 on rock/boulder substrates in deep water at the margins of rapids with good water quality (average water temperature below 64E F, DO concentrations greater than 6 mg/l, and pH levels of 6.5 to 9.5 mg/l).

D. Bliss Rapids Snail

1. Species Description

The Bliss Rapids snail was listed as threatened on December 12, 1992 (57 FR 59244). Critical habitat for this species has not been designated. Adult snails measure from about 0.08 to 0.10 inches in length, with three whorls, and are ovoid in shape. There are two color variants of the Bliss Rapids snail, the colorless or "pale" form and the orange-red or "orange" form. The pale form is slightly smaller with rounded whorls and more melanin pigment on the body (Hershler et al. 1994). The Bliss Rapids snail represents a monotypic genus that is restricted to the Mid-Snake River and numerous cold-water tributaries along that river reach.

2. Status and Distribution

The Bliss Rapids snail is discontinuously distributed in the mainstem Snake River and is especially associated with spring tributaries between Clover Creek (RM 547) and Twin Falls (RM 610.5). Colonies are concentrated in the Hagerman reach in cold water springs (e.g., Thousand Springs, Banbury Springs, Box Canyon Springs, Malad River, and Niagara Springs) and in lower densities in portions of the main stem Snake River (Service 1995), the latter, likely being influenced by cold water spring discharges (Hershler et al. 1994). Surveys for this snail in pools and reservoirs have failed to locate it. Although the Company reports this species within every river mile of the main stem Snake River from Bliss Reservoir to Lower Salmon Falls Dam, it is not abundant within the main stem. This species was reportedly collected in a short section of river below Hell's Canyon Dam (RM 225-229), but review of these specimens by qualified taxonomist have called their identity into question (Myers and Foster 2003; Stephenson and Bean 2003). At this time the species is not confirmed to occur outside of its historic range.

The Company (Shinn 2002, as revised 2003) reported reproduction and persistence of selected Bliss Rapids snail colonies in both cold water tributaries and within the main stem of the Snake River, but corroborative data to support these findings are not available. Frest and Johannes (1992a) noted that this snail was absent from irrigation return waters entering the Snake River at the Thousand Springs Preserve, but were relatively widespread in pristine springs and were able

to colonize uncontaminated springs. Even so, those authors noted that water quality alone could not completely explain the species distribution at all locations, as it is absent from some of the more pristine areas within the Thousand Springs Preserve. The target recovery area includes the main stem of the Snake River and cold water spring complexes between RM 547 and RM 585 (Service 1995). Other researchers have noted the decline and disappearance of the Bliss Rapids snail from habitats where they were once common (Frest et al. 1991; Frest and Bowler 1992a; Bowler, pers. comm. 2003, 2004).

On July 22, 2002, the Service received a petition, dated July 19, 2002, from Governor Kempthorne of Idaho to delist this species on behalf of the State of Idaho, Office of Species Conservation and the Company (IOSC 2002b). On December 13, 2002, that petition was withdrawn due to inaccuracies and inconsistencies found in the Company's data. The Service is currently conducting an internal review of the species' status in order to ascertain the current status.

3. Life History

Very little is known about the life history of the Bliss Rapids snail. It occurs on hard substrates in spring habitats, primarily within the Hagerman Valley, and in portions of the mainstem Snake River, primarily in areas influenced by springs and tributaries (Hershler et al. 1994). The species does not burrow and avoids fine depositional sediment and surfaces with attached macrophytes (Service 1995), but has been found in association with smaller, pebble- to gravel-sized substrates (Stephenson and Myers 2003). This species is considered negatively phototaxic and primarily resides on the lateral sides and undersides of rocks (Bowler 1990; Hershler et al. 1994). The Bliss Rapids snail can be locally quite abundant, especially in large spring complexes in the Hagerman Valley on smooth rock surfaces with common encrusting red algae (Service 1995). Reproduction appears to occur at different times of the year in different populations of snails. Those populations found in the main stem of the Snake River lay eggs from December to March, while those located in cold water springs lay eggs from January to June. Eggs are laid individually on the sides and undersides of rocks and require about one month to hatch into fully developed juveniles. The Bliss Rapids snail has been found inhabiting waters ranging from 45.7E to 67.6E F.

4. Population Dynamics

Little is known about the population dynamics of the Bliss Rapids snail. This snail reaches its highest densities in cold water springs and tributaries of the Hagerman reach of the Mid-Snake. Population densities of this snail are typically much lower in the main stem of the Snake River (Frank Lloyd Wright Rapid, 2001 annual mean = 9.3 per m^2) than they are within tributary springs (Thousand Springs Preserve, 2001 annual mean = 205 per m^2) (Shinn, 2002, as revised 2003). The differences between populations occurring in cold water springs and in the Snake River are likely attributable to water quality, but may also be influenced by other undetermined factors. The Bliss Rapids snail lives for one year and undergoes an annual die-off after reproduction is complete.

5. Conservation Needs

Viable subpopulations/colonies must be established and protected on the main stem of the Snake River and in tributary cold-water spring complexes from RM 547 to RM 585 on cobble to boulder substrates throughout the river profile with good water quality (average water temperature below 64E F, DO concentrations greater than 6 mg/l, and pH levels of 6.5 to 9.5 mg/l).

Although the sparsely distributed populations of this species in the main stem of the Snake River may not be as important to the species' immediate conservation as are the densely distributed and highly fecund colonies that occupy cold-water springs and tributaries, the current threats to the spring and tributary habitats (see section on *Spring Discharges* under "Current Threats to the Four Snake River Snail Species" discussed below) indicate that we cannot rely on those populations alone for the future conservation of the Bliss Rapids snail. In addition, river populations of snails may, to some degree, be reliant on the presence of the highly fecund spring and tributary colonies that may provide recruits to the river colonies/populations that lie downstream. Such source and sink population dynamics (Pulliam 1988) are known for other invertebrates (Murphy et al. 1990) and it is likely that the densely populated spring and tributary habitats provide some degree of recruitment (i.e., rescue effect; Brown and Kodric-Brown 1977) to the river populations/colonies. For these reasons, maintaining the viability of both spring and river populations of this species is important to its survival and recovery. Based on our current level of understanding of this snail, the Service concludes that immediate conservation activities should focus on identifying and preserving the large, viable spring and tributary colonies/populations.

Table 2. Species description, distributions, and threats for the four listed snail species under consideration in this Opinion. Note the Banbury springs lanx (limpet) and the bald eagle are excluded from this table since the Service concludes that there are no project related effects and/or that these impacts are negligible and discountable.

Snail Species	Description	Range	General Threats	Project-related Threats
Idaho springsnail (*Pyrgulopsis idahoensis*)	0.2 to 0.25 inches in length with up to 6 shell whorls, body grey-black, shell olive-tan with reddish-brown operculum; hermaphroditic (separate sexes); interstitial dweller on boulders, cobble, or finer sediments and vegetation, only found in river habitats (absent from cold-water tributaries); feeds on diatoms and other periphyton; lives approx. one year and typically reproduces from February-May; there is little information on population or colony persistence and viability.	Main stem Snake River and C.J. Strike Reservoir; known historically from Homedale (RM 416) to Bancroft Springs (RM 553), recovery area from RM 518-553; surveys by Idaho Power Co. have identified snails within and below C.J. Strike Reservoir	Dam construction and other on-river construction projects; dam operation and maintenance; reduced water quality and quantity due to human use of water resources (e.g., contaminants, nutrient input, irrigation); depleted spring discharges (=water quality); spring development; habitat destruction and fragmentation (attributable to dams, reservoirs, altered sediment and flow regimes, and water quality); competition with and/or predation from non-native species.	Habitat degradation and stranding due to altered flow regimes and water levels due to load-following operations for daily peak-loading of hydroelectric generation (in tailwaters and potentially reservoirs); reduced water quality (elevated temperature, reduced dissolved oxygen, altered sediment transport/deposition); population/habitat fragmentation.
Utah valvata (*Valvata utahensis*)	Turbinate shell with up to 4 whorls and to 0.2 inches in height, ornamented with fine transverse lines running parallel with aperture and with an angular carina (ridge) perpendicular and adjacent to the whorl suture; shell grey to grey-brown; interstitial dwellers in habitats with fine sediments to gravel bottoms and on aquatic vegetation, snails are known from spring, river and reservoir habitats, avoiding fast-flowing water; feed on diatoms and other periphyton; lives approx. one year and is believed to reproduce through the summer months (June-September); there is little information on population or colony persistence and viability.	Currently known only from the main stem of the Snake River in Idaho; recovery area includes the Snake River and its coldwater tributaries from RM 572-709; historically reported from below American Falls Dam to Grandview and from lakes in the Salt Lake group (Bear Lake and Lake Utah), with fossils found in Wyoming and Utah; most recent collections are scattered from the lower Henry's Fork downstream to Lower Salmon Falls Reservoir.	Dam construction and other on-river construction projects; dam operation and maintenance; reduced water quality and quantity due to human use of water resources (e.g., contaminants, nutrient input, dewatering for irrigation); depleted spring discharges; spring development; habitat destruction and fragmentation (attributable to dams, reservoirs, altered sediment and flow regimes, and water quality); competition with and/or predation from non-native species.	Habitat degradation and stranding due to altered flow regimes and water levels due to load-following operations for daily peak-loading of hydroelectric generation (in tailwaters and reservoirs); reduced water quality (elevated temperature, reduced dissolved oxygen, altered sediment transport/deposition); population/habitat fragmentation.

Table 2. Continued. Species description, distributions, and threats for the four listed snail species under consideration in this Opinion. Note the Banbury springs lanx (limpet) and the bald eagle are excluded from this table since the Service concludes that there are no project related effects and/or that these impacts are negligible and discountable.

Snail Species	Description	Range	General Threats	Project-related Threats
Snake River physa (*Physa natricina*)	Shells are amber to brown in color with up to 3.5 whorls and to 0.25 inches in length; found on large cobbles to boulders in swift-flowing waters of the main stem Snake River, avoiding still water habitats; believed to feed on periphyton; rarely collected, there is little information on population or colony persistence and viability.	Currently known only from the main stem of the Snake River in Idaho; recovery area is restricted to the Snake River from Rkm 890-1,086; historically reported from below American Falls Dam to Grandview; most recent collections are from: Malad River confluence to near King Hill, with unconfirmed sightings from Murtaugh and American Falls.	Dam construction and other on-river construction projects; dam operation and maintenance; reduced water quality and quantity due to human use of water resources (e.g., contaminants, nutrient input, irrigation); depleted spring discharges; spring development; habitat destruction and fragmentation (attributable to dams, reservoirs, altered sediment and flow regimes, and water quality); competition with and/or predation from non-native species	Habitat degradation and stranding due to altered flow regimes and water levels due to load-following operations for daily peak-loading of hydroelectric generation (in tailwaters); reduced water quality (elevated temperature, reduced dissolved oxygen, altered sediment transport/deposition); population/habitat fragmentation
Bliss Rapids snail (*Taylorconcha serpenticola*)	Oviod shell with up to 3 whorls and to 2.5 mm in length, with two color morphs (colorless and orange-red); a periphyton feeder restricted to fast-flowing habitats of the Snake River and spring tributaries; locally abundant in some coldwater tributaries, but believed restricted to a relatively small portion of the Mid-Snake; reproduction may be prolonged, August through March.	Originally described as being restricted to appropriate habitats within the Mid-Snake and its tributaries between Indian Cove Bridge and Twin Falls; recovery area is the Snake River and coldwater tributaries from Rkm 880-942; scattered observations reported from above American Falls Reservoir to below Hells Canyon, but typically encountered along the main stem Snake River below Shoshone Falls and above C.J. Strike	Dam construction and other on-river construction projects; dam operation and maintenance; reduced water quality and quantity due to human use of water resources (e.g., contaminants, nutrient input, irrigation); depleted spring discharges; spring development; habitat destruction and fragmentation (attributable to dams, reservoirs, altered sediment and flow regimes, and water quality); competition with and/or predation from non-native species.	Habitat degradation and stranding due to altered flow regimes and water levels due to load-following operations for daily peak-loading of hydroelectric generation (in tailwaters); reduced water quality (elevated temperature, reduced dissolved oxygen, altered sediment transport/deposition); population/habitat

E. Information Limitations for Snake River Snail Species

As required by the Endangered Species Act, the Service uses the best available scientific and commercial data to develop our Biological Opinions regarding actions that may affect listed species and their critical habitat. In many cases, these data are experimentally sound, peer-reviewed, and scientifically accepted. In other cases, the data may be anecdotal, observational or derived from scientific efforts with less than desirable experimental rigor. As discussed in this document, there are significant limitations to our understanding of the status of the listed Snake River snails. This Opinion is based on the best available scientific and commercial data for the snail species considered herein. To assure our assessments were valid and defensible, pertinent sections of a draft version of the Mid-Snake Opinion were provided to six species experts for their peer review. The comments of these experts have been fully considered in finalizing this document. The comments received from the peer reviewers are on file at the Service's Snake River Fish and Wildlife Office in Boise, Idaho; a summary of these comments is provided in Appendix A.

As is clear from the species descriptions above, little is known about the status, distribution, life history, or population dynamics of the four threatened and endangered Snake River aquatic snails at issue in this consultation. Based on review of available information is not possible to accurately or precisely derive density estimates or current distributions for any of these species. Due to information limitations, the patchy and dynamic distribution of snail colonies, and highly variable fluctuations in colony size, it is likewise not possible to identify population trends to a high or moderate degree of confidence. On that basis, a conservative approach has been used in analyzing the effects of the proposed action and any cumulative effects on the four affected snail species at issue in this consultation in accordance with national policy for implementing section 7 of the Act (Service 1998).

Studies conducted by the Company have expanded our understanding of both the biology and current distribution of the Idaho springsnail, Utah valvata, and the Bliss Rapids snail, but it is difficult to draw conclusions about the status of these species based on this information for a number of reasons. First, most of the reports provided by the Company provide only presence/absence data from river locations that were sampled during a single visit. While this information is critically important for establishing where these species may be found in the Snake River, it is not sufficient to estimate the number of individuals present, nor is it sufficient to evaluate the viability or persistence of those colonies and the species' populations over time. Very limited trend information can be derived by combining data collected by the Company and comparing it to other, earlier density estimates (e.g., Frest and Johannes 1992a). The work done to date involves small sample sizes over limited time periods such that the data are not sufficiently robust to estimate population size, species distribution, or trends in the species' status. The patchy distribution and highly variable population sizes of many of the listed snails makes the collection of reliable data difficult and unreasonably time consuming. In addition, some of the information provided by the Company has recently come into question since field identifications of some species may have been in error (e.g., nonnative New Zealand mudsnails were mistakenly identified as the endangered Idaho springsnail (R. Myers, IPC, in litt., 2004)).

Another limitation of the available data is that it does not allow for an adequate understanding of preferred habitat type, species distribution, or other factors that would allow an evaluation of whether the information is unique to certain study sites or can be generalized over time and space. Past reports lack data about site-specific habitat variables, including substrate, depth, or other site-specific factors like cold water spring inflows. Reports from the Company have not provided information about how sample sites were selected. Locations of recommended sample sites were provided in the Service's snail recovery plan (Service 1995), and such post-priori selection of sample sites within known populations of snails would be valid for monitoring population trends. Without this information, the Service cannot fully evaluate occurrence data in terms of its relationship to any of the species' populations or predict occurrences in areas that have not been sampled. Only the most recent reports provided by the Company (Stephenson and Bean 2003) have begun to provide detailed information on species distributions and status.

Detailed information on species distribution and densities are lacking in the revised Company reports. For example the Company provides information showing the Bliss Rapids snail to be present or absent from 10-mile reaches of the main stem Snake River (Cazier 1996, 2001a, b, c, d, all as revised 2003), but provides no information snail densities. Subsequent discussions with the Company have indicated that Bliss Rapids snail densities were typically very low in most of these main stem (river) reaches. Similarly, the distribution of Idaho springsnail within C.J. Strike Reservoir is poorly reported (Cazier 2002, as revised 2003) and no conclusions can be made from the information provided.

Finally, there is a gap in information available to the Service in developing this Opinion in terms of factors influencing the species' distributions. We are unaware of any work having been conducted to identify factors that influence the distribution and abundance of the listed Snake River snails. Since the time of the listing of the species in 1992 and publication of the snail recovery plan in 1995, no significant new information has been collected to identify specific factors that may limit or control snail populations or distributions. As a result, there is no predictive tool to aid the Service in understanding what anthropogenic (e.g., impaired water quality, altered flows) or natural (e.g., drought, high flows) factors contribute to the persistence or decline of any of the listed snail species.

As acknowledged in the Consultation History section of this document, in July and October of 2002, the Service received petitions from Idaho Governor Kempthorne on behalf of the State of Idaho, Office of Species Conservation, and the Company to delist the Bliss Rapids snail and the Idaho springsnail, respectively. Both of these delisting petitions were withdrawn when inconsistencies in the Company's data were discovered. A revised analysis of these data provided some new information and revealed that previous findings are not confirmable and are potentially incorrect. For instance, listed snails were reported from locations from which they are now not believed to be present, and errors in species identification have been acknowledged (Myers, IPC, in litt., 2004).

The Service and the Company have entered into a Settlement Agreement to cooperatively conduct surveys and controlled experiments through 2009 to obtain additional information on species status and project-related effects. This Settlement Agreement is reflected in the Proposed Action in this Opinion.

IV. ENVIRONMENTAL BASELINE

Regulations implementing the Endangered Species Act (50 CFR 402.02) define the environmental baseline as the past and present impacts of all Federal, State, or private actions and other human activities in the action area. Also included in the environmental baseline are the anticipated impacts of all proposed Federal projects in the action area which have undergone formal section 7 consultation, and the impacts of State, tribal, local, and/or private actions that are reasonably certain to occur and are contemporaneous with the consultation in progress. The following environmental baseline information was taken from the two FEISs and other cited sources.

Actions that form the environmental baseline for this consultation include but are not limited to: dam presence and operation and the resulting impacts to the Snake River environment (creation of reservoirs, disruption of river flows, redistribution and retention of sediments, solar heating, reduced DO, creation of physical [dams] and habitat [reservoirs] barriers to dispersal); diversion and nutrient loading of spring and river waters; complete dewatering of some riverbed areas (water diverted for urban and agriculture use); and degradation of water quality due to non-point sources of pollutants or nutrient enrichment (e.g., run-off and aquifer recharge from range or farm land). These activities represent a combination of State, private, and Federal actions, conducted on State, private, and Federal lands.

Aside from anadromous and resident salmonids and the white sturgeon, little is known regarding the distribution and abundance of the endemic biota of the Snake River prior to dam construction. Early accounts note the abundance of salmon that used this river and its tributaries as spawning grounds (Gilbert and Evermann 1895, Steward 1938). Fish movement, and the movement and dispersal of other aquatic species, was unimpeded by dams and human use of the river at that time had not resulted in the highly degraded water quality and altered flows characteristic of the river today. Given the early distribution of salmon, it is very likely that most of the Snake River snails were far more widespread throughout the river system and historic collections indicate this to be the case. As with the salmon that once thrived in the Mid-Snake and its tributaries, the native snail fauna has been negatively impacted by the multitude of human alterations to this river.

A. Factors Affecting Listed Snake River Snails

The free-flowing, cold water environments where the listed Snake River snail species evolved have been affected by, and are vulnerable to, continued adverse habitat modification and deteriorating water quality from one or more of the following human activities: hydroelectric development, operations, and maintenance; water withdrawal and diversion; water pollution (point and non-point source); inadequate regulatory mechanisms which have failed to provide protection to the habitats; and adverse effects associated with non-native species (57 FR 59244). Development of water impoundments and hydroelectric dams have changed the fundamental character of the Snake River. This has resulted in fragmentation of previously continuous river habitat, affected fluvial dynamics, and contributed to the degradation of water quality. Habitat fragmentation has resulted in the isolation of extant snails into smaller subpopulations, which are now more vulnerable to extirpation from stochastic events and the factors outlined above. Table

2 provides summary information for each species including the description, distribution, and threats.

1. Dams and Hydroelectric Project Facilities

The six main stem hydroelectric projects on the Mid-Snake reach (Swan Falls, C.J. Strike, Bliss, Lower Salmon Falls, Upper Salmon Falls, and Shoshone Falls) have reduced the amount of free-flowing river habitat by about 30 percent. Remaining free-flowing sections exist discontinuously in this reach, separated by impoundments and diversions. The presence of dams and their alteration of flows have affected the timing, magnitude, and duration of seasonal changes in river stage and velocity, which has many associated effects to lotic habitats. The drop in water velocity in the Snake River reservoirs increases water residence time and results in elevated water temperatures and reductions in DO. Water-transported sediments that would, under unimpeded river flows, be flushed downstream, transported, deposited, and redeposited in pools, eddies, and other still water environments with each high water event, are now restricted to areas between dams and transportation events are of greatly reduced magnitude given the flood-control mechanisms provided by these dams. Water-born sediments that were transported and deposited throughout the river, are now deposited in each reservoir, withholding river-born sediments from the tailwater areas. The habitat now provided by the reservoirs is suitable to only two of the snail species (the Idaho springsnail and the Utah valvata), with the other listed species unable to adapt to the lentic conditions. The extant river populations of snails are now separated by dams and reservoirs, with those species that have the ability to use both lake and reservoir habitats, the Idaho springsnail and the Utah valvata are unlikely to move over the dams and disperse to adjacent river stretches. Hence, hydroelectric projects isolate all these snail species into distinct stretches of river, making them demographically, if not also genetically, separate from one another (see section on *Habitat Fragmentation* below).

The reservoir habitats are vastly different from the river habitats they have replaced and have changed the water characteristics (e.g., temperature, DO, sediment deposition, and nutrient load) (Krenkel et al. 1979). These conditions are ideal for the growth of aquatic algae and macrophytes, and many miles of reservoir and river habitats become densely packed with plant biomass during the summer months. Seasonal plant production of this type is extremely detrimental since respiration of the plants and bacteria during nocturnal hours can deplete DO and elevate carbon dioxide to levels that are toxic to many aquatic species. These waters can then be transported downstream through the turbines where they then impact the biota within the post-dam river reaches.

The four species of affected Snake River snails addressed herein prefer different types of substrates. The Bliss Rapids snail and the Snake River physa primarily dwell on stable and relatively clean (little benthic plant growth), rocky substrates. Although the Idaho springsnail and the Utah valvata may be found on or amongst larger cobble, they are often found in association with smaller-grained sediments (i.e., mud or sandy substrates). The Utah valvata has been reported to burrow into sediments as an alarm response (Cazier 1997a) and may be found in association with some aquatic macrophytes. Given the various substrate preferences of these snails, human alteration of water flow regimes (e.g., impoundments and water-release regimes) plays an important role in the distribution and size of snail populations. Reduced water

velocities encountered in reservoirs result in the deposition of fine sediments which may, in some instances, be beneficial for some species (e.g., Utah valvata, Idaho springsnail), although detrimental to others. High flow events, such as those that occurred in the spring of 1997, may have redistributed large quantities of fine and gravel-sized substrates in the Snake River still river channels immediately below dams will continue to be stripped of sediments given the presence of the upstream reservoir and scouring effects of the regulated flows, and are documented to alter the trophic dynamics of the river ecosystem (Osmundson et al. 2002).

River populations of snails are currently isolated from one another rather than being part of a larger, continuous and interbreeding population as was the case prior to dam construction. These smaller populations are at greater risk of extinction/extirpation due to normal fluctuations in their population numbers and are also at greater risk due to localized catastrophic events (e.g., toxics spills, sedimentation events, future development) (Soulé 1980, 1987; Shaffer 1981; Holsinger 2000) and population declines due to sublethal effects of poor water quality; e.g., low densities of river populations of the Bliss Rapids snail (Frest and Johannes 1992a; IOSC 2002b). Recent findings on western fishes have show isolated river populations to be far more prone to local extirpation and extinction (Fagan et al. 2002). Several other hydroelectric projects have been proposed for the Mid-Snake in the past and at least one of those, Auger Falls, has recently been proposed for reconsideration (City of Twin Falls, in litt. 2002).

2. Hydroelectric Operations – Mid-Snake and C.J. Strike Projects

Not only do the lentic conditions of reservoirs exclude species that require free-flowing lotic habitats, but the altered flows of the river below the dams that are affected by load-following also impact the river-reliant members of the biotic community. Of the five projects addressed in this document, Lower Salmon Falls, Bliss, and C.J. Strike have historically and currently operate in a load-following mode. Load-following results in a substantial amount of habitat being dewatered at frequent and regular intervals above and below a dam. Figures 8 and 9 illustrate how dramatic daily habitat flooding and dewatering can be as a result of load-following operations. Species that are vagile enough to recolonize flooded areas of the dewatered riverbed may be stranded and exposed to desiccation and/or predators following dewatering episodes. For shallow-water species that are more sedentary and not able to recolonize dewatered zones, dewatered areas represent a loss of habitat. Species that are stranded when water is withheld during peak-loading makes them more vulnerable to terrestrial predators that are excluded from deeper habitats (e.g., raccoon predation on exposed mussel beds). In addition, the frequent dewatering greatly reduces the diversity and productivity of this otherwise productive river zone, reducing or eliminating its trophic contribution to the river ecosystem.

With daily water fluctuations of the magnitude of those that can currently be conducted at the above projects, the amount of mid- and deep-water habitat in stretches of river that are affected by load-following also undergo sizable fluctuations. The rapid, daily changes in water volume and velocity in the tailrace and downstream also make this zone less habitable for more sedentary species (e.g., mollusks). Because the level of dewatering can fluctuate between days, seasons, and water year types, more sedentary organisms (e.g., snails) may have time to recolonize zones that will be dewatered during subsequent days. The magnitude of effect is related to speed with which water levels fluctuate. The more quickly levels change, the more

severe the effects to benthic species. The effects of load-following is apparent well downstream of these dams. Irving and Cuplin (1956) who measured tailrace dewatering of 7.5 ft per day below Bliss Dam, documented dewatering of 5 ft 13.7 miles downstream of the dam (see *Effects of the Action* section below and Figures 7 and 8). Load-following at the Lower Salmon Falls project has substantial effects on the four-mile section of river above Bliss Reservoir. River habitats from below Lower Salmon Falls Dam to the upper reaches of C.J. Strike Reservoir are impacted by current hydroelectric operations and are subject to daily fluctuations in water levels. Data from a pressure transducer site near the town of Murphy, approximately 31 miles downstream of the C.J. Strike Project, suggests that changes in river stage due to load following are substantially attenuated over a relatively short distance downstream (Fig. 7; IPC, unpub. data. 2004a). These data do not allow us to determine at what distance below a dam the effects of load following become insignificant or discountable.

3. Other Hydroelectric Project Operations

Three additional hydroelectric projects in addition to those that are under consideration in this Opinion lie within the action area. The presence and operation of these projects will impact some of the listed Snake River snails and a description of these projects is included here.

The Malad Project diverts water from the Malad River at two locations starting at 2.1 miles upstream from its confluence with the Snake River at RM 571.2. This water is diverted into two separate powerhouses, one at the Snake River and one at Malad RM 1. Generating capacity for this project is 8,270 kilowatts. The source of the Malad River is from numerous aquifer springs, the Big Wood River, and irrigation returns. This project is in the process of being relicensed by the Commission, the new license application being issued in July 2002. The confluence of the Malad and Snake Rivers is between the Lower Salmon Falls and Bliss projects. This river is important in that it provides habitat for the Bliss Rapids snail.

The Thousand Springs hydroelectric facility is located between Shoshone Falls and Upper Salmon Falls Dams at RM 584.7 where it diverts water away from the multiple spring sources as they emerge from the cliff face. This facility uses three generators and has a generation capacity of about 8,800 kilowatts. This site is extremely important to a number of endemic Snake River species, including at least three species of listed snails (Utah valvata, Bliss Rapids snail, and the Banbury Springs lanx). It is a relatively old project, predating the Federal Power Act, and has not been licensed by the Commission. The unlicensed status of this facility means that it does not receive Federal oversight and this may have consequences for the snails that occupy this area (see Effects of the Action section below). The Thousand Springs Preserve owned and operated by The Nature Conservancy, lies adjacent to the hydropower facility.

A third spring hydroelectric facility, Clear Lake Power Plant, is located at RM 593 and provides a generation capacity of 2,500 kilowatts. It is not known if listed snails are present or potentially impacted by this facility.

4. Water Quality

Changes in water temperature and DO have been noted as critical parameters for species typically associated with cold water habitats. Although the listed Snake River snails have been noted as being restricted to habitats with high water quality, at least two (the Idaho springsnail and the Utah valvata) have been recorded in, or are known to tolerate, elevated water temperatures and slow-moving waters. It is not known how impaired water quality may affect the reproduction, survival, or other life history characters of these snails because little research addressing these specific effects has been conducted for these species prior to or after their listing in 1992. Although controlled experiments have not been conducted, published and unpublished field observations suggest that snail species restricted to river habitats are not tolerant of pollution and low-oxygen environments (Hershler et al. 1994). For species that require free-flowing water and rocky substrates (i.e., the Bliss Rapids snail and the Snake River physa), siltation associated with erosion, reduced flow velocity, water impoundment, and other water uses, may be particularly detrimental. It is noteworthy that comparative data on the Bliss Rapids snail from colonies in the Snake River and clean, cold water tributaries and springs show snail densities to be substantially larger in the springs and tributaries (Cazier 1997, 2001d as revised 2003). Any factor that leads to chronic or acute deterioration of water quality is likely to result in the death, injury, or decline of the snails considered herein.

Factors that degrade water quality include reduced water flow velocity, warming due to impoundments, and increases in the concentration of nutrients, sediment, and other pollutants reaching the river. The Snake River is affected by runoff from feedlots, dairies, fish hatcheries, municipal sewage effluent sources (e.g., the Twin Falls Sewage Treatment facility; OMI, in litt. 2002-2003), irrigation returns, and other point and nonpoint discharges (EPA 2002). In a study conducted by Brockway and Robison in 1990-91, it was found that an estimated 173 tons of sediment were delivered into the Snake River daily (Brockway and Robison 1992). In addition, commercial, State, and Federal fish culture facilities divert cold spring waters for use in aquaculture activities and discharge untreated warmer hatchery effluent downstream of the hatchery and into the Snake River. These factors, coupled with periodic drought-induced low flows, have contributed to reduced DO levels and increased plant growth, and a general decline in Snake River species that are adapted to or dependent on cold, free-flowing waters (Griffith and Kuda 1994; Service 1995; Clark et al. 1998). A number of other important threats to the species involve impaired water quality and are addressed below.

Reservoirs contribute to reduced water quality by elevating temperatures, reducing DO, and elevating nutrient load (Krenkel et al. 1979). Many of the toxicants that enter reservoirs in low quantities are bound up in deposited sediments (Clark et al. 1998) where they may be more readily bioaccumulated by the resident infauna (sediment-dwelling organisms). Reduced water quality currently found within reservoirs in the action area due to macrophyte growth, nutrient loading, and altered dissolved gases was discussed above under *Dam and Hydroelectric Project Construction*.

5. Spring Discharges

A large proportion of water-born nutrients enter the Snake River via springs which have received these nutrients (nitrogen and phosphorous) from aquifer recharge coming from agricultural lands (irrigated farm lands and cattle grazing areas). The contribution of nutrient enrichment from this source is seen in measurements of spring waters which measure at over 27,000 kg of total nitrogen daily, accounting for 64 percent of the detected total nitrogen and 17 percent of the detected total phosphorous to the system (MacMillan 1992 and Clark 1994, in EPA 2002). Degraded water quality in alcove and tributary springs within the action area as well as streams in the Hagerman Valley area have adversely affected snails (Frest and Johannes 1992a), although not as severely as on the main stem of the Snake River. Despite the often high nutrient content of spring discharges, free-flowing, cold-water spring tributaries are recognized as the most important habitats for some of the listed Snake River snails and other cold water-dependent species such as the Shoshone sculpin (*Cottus greenei*) and the native redband trout (*Oncorhynchus myskiss gairdneri*). These springs provide refuge habitat for species that cannot tolerate the degraded waters of the Snake River and strongholds for species that may be able to tolerate habitats with marginal water quality. Most of the cold water springs in the Hagerman reach and throughout the Mid-Snake have been diverted for aquaculture, power generation (i.e., Malad River), or other agricultural uses, making the remaining unaltered springs extremely important for the conservation of some of the listed snails and other cold water-dependent Snake River species. Unfortunately, protection of these pristine spring systems is not guaranteed. They are threatened by continuing development, as reflected by pending National Pollutant Discharge Elimination System (NPDES) permits, and the contamination and depletion (drawdown) of the Snake River Basin aquifer (Clark et al. 1998).

In the early 20th Century, agriculture and the use of flood irrigation experienced a dramatic increase in the area of the Snake River Plain. Flood irrigation contributed significant quantities of water to the underlying aquifer and this is reflected in the increases in spring discharges until about the 1950s (Ondrechen, IDWR, in litt. 2004). Since the mid-1900s, flood irrigation has increasingly been converted to sprinkler irrigation systems and this has led to a steady decline in aquifer recharge and corresponding decreases in spring discharges in the Hagerman area. USGS records at three major springs derived from the Snake River Aquifer all show declines that correspond to increasing use of sprinkler irrigation systems (Box Canyon, Blue Lakes, and Devils Washbowl springs; Figs. 10-12). While the continuing declines in spring discharges may be approaching those prior to agricultural development (pre-1900s), it also comes at a time when over-all water quality in the Snake River Basin has declined from numerous human activities. Continuing aquifer-wide declines in output, coupled with degraded water quality, will ultimately have negative effects on listed spring-inhabiting snails in the Mid-Snake.

The unique hydrogeology of the Hagerman area provides conditions for several thousand cfs of cold-water recharge to the river from the Snake River Plain aquifer, which lies to the north of the river. However, most of the cold-water springs are diverted for use in fish hatcheries, resulting in these discharges being substantially warmed and nutrient-enriched relative to spring and tributary waters that have not been diverted for aquaculture. These conditions have degraded important spring habitats occupied (or previously occupied; Bowler, pers. comm., 2004) by listed snails and reduced the recharge value of these springs to the Snake River (Clark et al. 1998).

Several spring habitats important for listed snail conservation (including Thousand Springs, Box Canyon, and Banbury Springs) have a long history of diversion and modification that has, over time, reduced their value as refugia for these snails. For example, more than half of the spring-derived flow in Box Canyon is diverted into a pipe that carries its waters under the Snake River to a commercial trout production facility. In the case of Thousand Springs, virtually all of the water that historically cascaded down the south wall of the Snake River canyon to form a diverse and unique habitat is now diverted into a series of concrete flumes that divert this water into the penstock of the Thousand Springs Hydropower Project. At Banbury Springs, also owned by Idaho Power, a third party altered some of the spring habitats to a point where they are degraded from their natural state. Much restoration work remains to be done at Banbury Springs including the removal of a dike that impounds the springs' flow over its natural confluence with the Snake River, but the Company has designated this as a snail conservation area.

6. Aquaculture

One Federal and numerous private aquaculture operations are located at cold water springs in the action area, mostly within the Hagerman reach of the river (Clark et al. 1998). These operations contribute significant quantities of nutrients to the river. Most of these nutrients are derived from metabolic wastes of the fish (nitrogenous waste and feces) and unconsumed fish food. A number of aquaculture facilities also include fish-processing facilities and some of the processing wastes make their way into the Snake River. Other wastes and residues from fish farms include disinfectants, bacteria, and residual quantities of drugs used to control disease outbreaks. Of the standard contaminants, aquaculture facilities contribute a sizable proportion of the total measured nutrients (13 percent nitrogen, 35 percent phosphorous) as well as an estimated 29,700 pounds of suspended sediments to the Snake River per day, which represents 6 percent of the total measured (Clark et al. 1998; Brockway in EPA 2002).

Many aquaculture facilities are located in the Hagerman Valley and directly impact spring habitats that are or were occupied by listed snail species and cold water-adapted fauna. Recent work has quantified the eutrophic effects of aquaculture facilities in downstream reaches, finding nitrogen and phosphorous to be significantly elevated downstream of these facilities (Falter and Hinson, in litt., 2003). Falter and Hinson's work also showed significant increases of most of the trace metals sampled during most sample periods. Given the large number of aquaculture facilities using and discharging into aquifer springs (over 80 facilities operating over the past 30 years; EPA 2002), their impacts to these aquifer springs and the Snake River are substantial. Most of the Snake River aquaculture occurs upstream of the C.J. Strike Project, (Service 1995). Not only do these fish farms contribute to declining water quality in the Snake River, but degrade the creek habitat downstream from each farm. It is questionable whether listed or any sensitive snail species (i.e., Bliss Rapids snail, Utah valvata) persist in spring/tributary habitats downstream of fish farms (Bowler, pers. comm., 2004).

7. Sewage Treatment

There are four main urban centers in the Snake River Basin that contribute large amounts of urban discharge to the Snake River: Idaho Falls, Pocatello, Rexburg, and Twin Falls. Together

they contribute an annual discharge of 7.5 billion gallons into the river. The Twin Falls sewage treatment facility, the largest in the Mid-Snake region, can treat 7.8 million gallons per day of wastewater, which contributes nutrients, ammonia, suspended and settleable solids, and organic matter (EPA 2002). In addition to these background levels of discharge, sewage treatment facilities periodically experience treatment spills in excess of their maximum daily limit (OMI 2002-2004) that may significantly exceed their allowable discharge levels. Discharges from numerous other cities and townships up and downstream of Twin Falls contribute pollutants in a cumulative fashion in the action area, decreasing water quality downstream.

8. Irrigation

Water diversions for agriculture and other purposes have a severe impact on current flows in the Snake River. During the irrigation season, the Snake River below Milner Dam can be completely dewatered for agricultural use. Dewatering of the river is most typically a concern during drought years when agricultural and other competing water uses may result in extreme low flows in the river. Low and zero flows below Milner Dam which is upstream of the Shoshone Falls project, are illustrated by the USGS data in Figure 13.

Return of irrigation water to the Snake River plays a major role in degrading water quality, which impacts the river's native biota (Bowler 1995, Clark et al. 1998, EPA 2002). Irrigation water returned to the Snake River has greatly increased in temperature (with a subsequent decrease in DO), contains both herbicide and pesticide residues, has been enriched with nutrients due to crop fertilization (nitrogen and phosphorous), and frequently contains elevated sediment loads.

Return irrigation water is the largest contributor of sediments to the Snake River. Over 150,000 acres of irrigated land in counties adjacent to the Mid-Snake are believed to lose an average 4.9 tons of eroded topsoil per acre per year. Along with other sources of erosional sediment, it is estimated that, on average, over 300,000 pounds of soil are washed into the Snake River daily (EPA 2002). Coming from fertilized fields, these irrigation returns also contribute a significant quantity of nutrients to the river, totaling 16 percent of the total nitrogen and 13 percent of the total phosphorous. Clark et al. (1998) found pesticides in most streams, tissues, and irrigation canals that were sampled. Some irrigation drains were found to contain insecticide concentrations exceeding the aquatic-life criteria established by the EPA. Although some irrigation return water enters the talus slopes above the river, providing some degree of filtration and aeration before entering the river, this is not always the case and some irrigation return water enters the river directly. For example, the Perrine Coulee Hydroelectric facility uses irrigation return water to power an electricity-generating turbine. These waters are conveyed directly through the penstock and turbine to the river without settlement or filtration (EPA 2002).

9. Elevated Temperature and Reduced Dissolved Oxygen

With the exception of the spring discharges, all of the above water uses result in elevated water temperature and reduced DO levels. However, spring discharges along the river provide cooling effects so that water temperatures do not continue to warm with downstream flow. Despite this, with the exception of measurements taken near Minidoka, most river locations on the Mid-Snake

have recorded summer temperatures that exceed the State's water quality standards for cold-water biota (<64EC) and had DO concentrations that drop below that required for such species (<6 mg/l) (EPA 2002). Species that rely on cold-water conditions for part of their life history are thus largely restricted to cold-water springs and tributaries.

10. Contaminants

In addition to the pollutants described above, infrequent and unpredictable contaminant spills represent an historic and ongoing threat for listed snail in the action area. Examples of the contaminant spills include underground leak(s) of petroleum compounds into the Snake River at the Burley Terminal and PCB contamination at Marsing (Service files, 1998). Devastating contaminant spills on other western rivers (e.g., John Day, Sacramento) provide clear examples of the "sterilizing" effects that such one-time events can have on the aquatic biota over many miles of stream (Service et al. 1994, CDFG 2000). Given the very restricted range of many of the listed Snake River snails, such a spill could result in or greatly increase the chances of species extinction. Early surveys conducted in the Snake River below C.J. Strike Dam failed to locate living native molluscs, and Taylor (1982a) suggested that this absence was due to chemical pollutants or other contaminants used for agriculture.

Depending on the toxicity of the compounds that are introduced into the river in the event of a spill, the impacts to the river ecosystem, its biota, and the downstream human users could be severe (e.g., PCBs from a generator transformer leak). Whatever its source, the introduction of toxic compounds into the river has significant lethal and sublethal affects on a large portion of the river's biota, both at the point of contamination and for miles downstream.

11. Regulated River Flows

Changes in the use of stored water in the Snake River Basin to assist recovery efforts for other threatened and endangered species may also impact the listed snail species and their habitats. For example, the Bonneville Power Administration (BPA), State of Idaho (State), Bureau of Reclamation (Reclamation), and the Company continue to explore alternatives to assist outmigrating endangered Snake River sockeye salmon (*Oncorhynchus nerka*) and threatened spring and summer chinook salmon (*Oncorhychus tshawystscha*) by using water from the upper Snake River Basin.

In average or higher than average water years in the Snake River basin there is usually adequate water to meet irrigation demands, preserve conservative reservoir carryover capacity and still have enough water to allow Reclamation to meet its goal of delivering 427,000 ac-ft of water for listed salmon recovery. In the middle to late 1990's that goal was either achieved or exceeded annually. However, over the last 3 years (2000, 2001, 2002) Snake River runoff has been less than average and the goal of delivery of water to meet the 427,000 ac-ft goal has not been met. The majority of water storage in the basin has recently reverted to agricultural use and this is reflected in the withholding of flows below Milner Dam (U.S. Geological Survey in litt. 2004a; Fig. 13). The agreement between the Service, the Company, NOAA Fisheries, and Reclamation to regulate flow deliveries on the main stem of the Snake River downstream of Milner Dam to

around 1,200 cfs during the summer critical water quality period expired at the end of 1999 and has not been renewed.

The minimum flow of 200 cfs downstream of Milner Dam required by the Commission's license for the hydroelectric facility on that Federal dam (Project No. 2899 owned by Idaho Power) was waived by the Commission in 2000 based on a petition from the Company, the licensee, to benefit power generation. The license for Project No. 2899 requires that 200 cfs be delivered through a small power house at Milner Dam and allowed to flow downstream as fish and wildlife habitat mitigation from water delivered from the Company's 44,275 ac-ft of storage in American Falls reservoir. In December 2000, Idaho Power called for and Reclamation immediately delivered this entire block of water for power production at its 11 mainstem hydropower facilities. Figure 14 illustrates this rapid water delivery from American Falls Reservoir at that time. The following spring (2001), the Company and Reclamation contacted the Service to report that the 200 cf, Milner Dam minimum flow was not available for delivery to benefit aquatic resources downstream and in addition that very little of the 427,000 ac-ft salmon flows was going to be delivered because of power generation needs. Low flows in 2001 prompted the BPA to declare a water emergency. As a result, flows downstream of reservoirs in the Snake and Columbia River basins were severely curtailed in the critical early summer period. Similar low flows were recorded at this location during the summer 2002 and 2003 (USGS, in litt., 2004a).

In a report completed by Idaho Department of Fish and Game (IDFG) for the BPA in December 2000 (IDFG 2000), the results of several years of operating for downstream flow augmentation were analyzed. The report also contained important flow recommendations for native fish and wildlife species such as the white sturgeon in the Mid-Snake largely based on work and analysis performed by the Company and their contractors. Sturgeon water needs remain an important consideration in the determination of flow quantities and regimes for the Mid-Snake because they require many of the same water quality criteria as listed Snake River snails (Service 1995). Relevant flow recommendations (rounded to the nearest 10 cfs) from that report for the Milner Dam to Brownlee Reservoir reach of the Mid-Snake are presented in Table 3.

12. Inadequate Regulatory Mechanisms

The Idaho Department of Water Resources (IDWR) regulates water development in the Snake River Basin. At present, there is no specific allocation of water on the main stem of the Mid-

Table 3. Recommended flow augmentations (rounded to the nearest 10 cfs) from the Idaho Department of Fish and Game (IDFG 2000). These values, for the reach from Milner Dam to Brownlee Reservoir provides minimum flow required to support white sturgeon reproduction in the Mid-Snake.

MONTH	FLOW (cfs)
October	4,850
November	4,080
December	3,800
January	3,800
February	3,800
March	6,700
April	7,230
May	12,300
June	13,530
July	8,400
August	5,600
September	5,050

Snake for fish and wildlife despite Federal protection under the Endangered Species Act for several species including the four Snake River snail species considered herein, although maintenance flows for fish and wildlife on several tributary streams to the Snake River have been established. Present management regulations are still inadequate or inadequately enforced to protect fish and wildlife, and water withdrawals from groundwater spring outflows or tributary spring streams may still be excessive. Further, ground water pumping continues in the Snake River Plain aquifer and the potential exists for severe aquifer depletion in the future. Figures 10, 11, and 12 illustrate the steady downward trend in measured spring flows from three major aquifer springs from the 1950s to the present. IDWR has studied the possibility of recharging this aquifer through diversion of surface flows from the Snake River.

The Total Maximum Daily Load (TMDL) program was established by EPA under section 303(d) of the Clean Water Act to quantify and set limits on allowable loading of pollutants into water waters not meeting water quality standards. TMDLs quantify specific waste load allocations for point source pollutants, load allocations for non-point sources and natural background quantities, and a margin of safety for those allocations (Dodson 1998, in FERC 2002a). Factors addressed under TMDLs include: nutrients, sediments, DO, temperature, pesticides, petroleum compounds, and flow alteration. National TMDL allocations were approved by EPA in August of 2000. In 2001, over 700 river or stream segments in Idaho that have been formally recognized by EPA as water quality-impaired were reported to have exceeded TMDL limits; 23 of those segments are located on the Snake River and many more in its tributaries (EPA 2002).

Identification of waters that exceed TMDL limits is the first step in their cleanup (National Research Council 2001). Adaptive implementation of cleanup activities also needs to be funded

and supported by the involved parties. Timely attainment of achieving TMDL standards is limited by: 1) the number of factors that impact the water body, 2) severity of the problem, 3) number of watershed stakeholders and agencies involved, and 4) the completion and evaluation of appropriate monitoring (National Research Council 2001). Despite established criteria for TMDLs on the Snake River and its tributaries, adaptive implementation of cleanup activities to rectify causative factors has not occurred.

The Idaho Department of Environmental Quality (IDEQ), under authority of the State Nutrient Management Act, is coordinating efforts to identify and quantify contributing sources of pollutants (including nutrient and sediment loading) to the Mid-Snake and other Idaho watershed areas (IDEQ 2002). The TMDL approach is meant to address pollution control strategies for the Mid-Snake (and other waters) through several of the following programs: State Agricultural Water Quality Program, Clean Water Act section 401 Certification, Bureau of Land Management land management plans, the State Water Plan, and local ordinances. Despite these efforts to better comprehend and halt the deterioration of water quality on the Mid-Snake, it is unlikely these programs will reverse the present downward trend in the short-term. It may be several years before recommended measures to improve water quality, as outlined in comprehensive resource management plans for the Snake River, are funded and implemented. Even though IDEQ has established water quality standards for cold-water biota relative to water temperature and DO in the Mid-Snake (with the exception of the Milner reach upstream), actual conditions within the river periodically exceed these limits, and the standards for these parameters for rainbow trout are frequently (>40 percent of the time) exceeded (EPA 2002).

The EPA is responsible for regulating point-source pollutant discharges into waters of the United States. This, in part, is accomplished through the issuance of permits through the NPDES, which is designed to restrict point-source discharges. There are 80 private or public-owned aquaculture facilities on the Mid-Snake now permitted under the NPDES and over 20 additional facilities have applied for permits (EPA 2002). Although the NPDES system may help control such discharges, many violations have been reported and the EPA is currently considering transferring the program to the State. Given the increase in permit applications, the record of NPDES violations, and the unknown capability of the EPA to adequately implement the NPDES system, discharges are not likely to be eliminated in the immediate future.

There are at least two State agencies that include the identification and protection of rare taxa and their habitats as part of their goals and objectives. The Idaho Parks and Recreation has authority to protect plants on Idaho lands (Idaho Code section 18-3913, 1967), and the Idaho Department of Fish and Game is mandated to preserve, protect, perpetuate, and manage all wildlife (Idaho Code section 36-103). However, these mandates do not extend protection to invertebrates.

The Commission is the Federal agency responsible for issuing licenses for hydroelectric projects. The Commission solicits input from the Service regarding environmental impacts that may affect listed species or their habitat as a result of proposed projects that they oversee, permit, or carry out. Authority for the Service to provide fish and wildlife conservation and enhancement recommendations to the Commission is derived from the Federal Power Act, the Fish and

Wildlife Coordination Act, NEPA, the Federal Migratory Bird Treaty Act, the Endangered Species Act and other laws and executive orders.

Under section 7 of the Act, the Commission is required to consult with the Service to assure that their license actions do not jeopardize the continued existence of listed species or destroy or adversely modify their critical habitat. The presence of declining, endangered salmonid stocks on the lower Snake River (sockeye, spring and summer-run chinook), warrant the Commission to also enter into consultation with NOAA Fisheries under section 7 of the Act. In addition, section 18 of the Federal Power Act gives the Service and NOAA Fisheries authority to prescribe mandatory fish passage conditions to be included in any license issued by the Commission for these projects. Under section 10(j) of the Federal Power Act, resource agencies and tribes make recommendations that they have determined are necessary for the protection, mitigation and enhancement of fish, wildlife, and associated habitats that have and continue to be adversely affected by hydropower developments. At present, there are no functional fish passage facilities at the five hydroelectric facilities covered in this Opinion, and three major Company dams (Hells Canyon Complex) downstream of C.J. Strike are barriers to anadromous fish.

The U.S. Army Corps of Engineers (Corps) also has regulatory authority on projects affecting listed aquatic snails through the permitting of projects on the Snake River under section 404 of the Clean Water Act. The Corps issues individual and nationwide permits for projects that would result in the fill of waters or wetlands of the United States. Nationwide permits are often issued for some hydroelectric projects and some bridge crossings that presumably have minimal environmental impacts. Projects requiring individual permits undergo more extensive environmental review and the permits often include conditions that require avoidance or mitigation for environmental impacts. Nearly all any projects within the range of the listed Snake River snails that involves discharge of fill is likely to require an individual Clean Water Act permit. Issuance of such a permit requires that the Corps consult with the Service if the permitted activity may affect listed species or critical habitat. Under the Fish and Wildlife Coordination Act the Corps typically solicits input from the Service regarding impacts to fish and wildlife resources.

Last, although there is a 1999 Executive Order to help control nonnative species (Executive Order 13112, 1999), there is currently no legal tool that provides funding or regulatory authority to combat adverse affects from exotic species. Invasive species are often highly injurious to listed species and/or their habitat and have been shown to cost the Federal and State governments billions of dollars annually (Pimentel et al. 2000). At present, there are few regulatory mechanisms in place that effectively address the threat of non-native species in the Snake River (see below).

13. Non-native Species

Invasive, non-native (alien) species are now estimated to cost the United States about $137 billion annually (Pimentel et al. 2000) and the problem is likely to increase in the years to come. Noteworthy aquatic species that have invaded the waters of North America include the sea lamprey and the Ponto-Caspian cladoseran (*Cercopagis pangoi*) to the great lakes, and the zebra mussel (*Dreissena polymorha*), which is continuing to spread throughout North America. These

species have had significant and costly impacts on fisheries, recreation, and industry, and their spread and/or the introduction of new species is likely to continue. Invasive species have had negative impacts on rare and listed species either through preying upon or displacing them, or altering their habitat.

In its altered state, the Mid-Snake provides suitable habitat for numerous alien species, and these species have the potential to impact endemic rare and federally listed species such as the Snake River snails. Most notable of these is the New Zealand mudsnail (*Potamopyrgus antipodarum*), which is now present, and locally abundant, throughout most of the Mid-Snake, its distribution overlapping with most of the threatened and endangered Snake River snails. The New Zealand mudsnail appears to flourish in watercourses with relatively low DO and with substrates of mud or silt, but has also been recorded to reach high densities within some of the cold water spring complexes of the Mid-Snake (e.g., in excess of 46,000 per ft^2 at Banbury Springs; Richards et al. 2001). Although the New Zealand mudsnail can occupy aquatic habitats with higher water velocities, they appear to reach higher densities in slow-moving waters (Richards *et al.* 2001), and observations suggest that river sections that are impacted by impoundments, restricted flows, and/or macrophyte growth may give this alien snail a competitive advantage over native endemic species. Both Cada (2001) and Kerans (2001) found evidence that high densities of New Zealand mudsnails resulted in reduced densities of native aquatic insects (diptera larvae, mayflies, stoneflies, and caddisflies), and others (D. Gustafson, in Richards 2001) have noted declines in native snails in the presence of growing mudsnail populations. Bowler and others have observed these snails densely packed on rock surfaces formally occupied by the Bliss Rapids snail (Bowler et al. 1993). The competitive interactions of the mudsnail with native, North American aquatic species is ongoing; these snails have been shown to spread and reproduce rapidly, and greatly deplete the standing crop of aquatic algae and periphyton (Cada 2001, Hall 2001). The physiologic plasticity of the New Zealand mudsnail allows it to thrive in eutrophic reservoir habitats, as well as some cold water tributaries. It is possible that the anthropogenic alterations of the Mid-Snake, including the presence of dams and hydroelectric operations, have increased and/or are partially responsible for this invading snails' success (Bowler et al. 1993).

The New Zealand mudsnail provides a well documented case of the negative impacts of non-native species. Numerous other alien species of fish and plants are also present in the Mid-Snake, but their impacts on native species have not been well studied and are not well Understood.

14. Habitat Fragmentation and Small Population Size

The snails of the Mid-Snake have existed for thousands of years in a dynamic and continuous river system that was free-flowing and comprised of spatially heterogeneous, but connected, habitats; these snails were typically separated from one another by relatively short distances, with populations in close proximity to one another. Seasonal fluctuations in water levels flushed and deposited sediments throughout the river's length. Snails that might be flushed during seasonal freshets from one colony would likely be transported to areas downstream where appropriate habitats would also be present; hence, most of these snails lived in semi-contiguous, interbreeding sub-populations that were distributed throughout their range in the Snake River.

The major river impoundments now in place along the Mid-Snake represent impassible barriers to most of the native snails that cannot survive in the low velocity, low oxygen, sediment-laden benthic habitats present in the reservoirs. In addition, the rapid, daily fluctuations in water level and velocity that result from load following, do not represent natural habitat conditions. These impacts also reduce the amount of adequate snail habitat within the non-impounded, flowing, sections of the river. These factors have resulted in the extant populations of snails occupying smaller linear units of the river in isolation from one another. These smaller, isolated sub-populations are now more vulnerable to the threats outlined above, loss of genetic variability, and extirpation due to demographic stochasticity within each of the sub-populations. The fragmentation of habitats and populations have been demonstrated to result in an elevated risk of extinction in other aquatic species in the western United States (Fagan et al. 2002).

Prior to construction of dams in the Mid-Snake, the area from Swan Falls to Twin Falls dams represented approximately 160 miles of diverse riverine habitats that supported most, if not all, of the listed snails and other native species. This formerly continuous river system has been reduced by 29.5 percent (47.2 miles) of what is now slow- to still-water lake habitat, to which most of the listed Snake River snails are not adapted. Of the species considered herein, only the Idaho springsnail and the Utah valvata have been documented to occur in reservoir habitats; the other two species (the Bliss Rapids snail and the Snake River physa) require cold, moving, and well oxygenated water and rocky substrates, habitat characteristics not encountered in the Mid-Snake reservoirs. Although little is known about the Snake River physa, its preference for deep, fast flowing stretches of the main river indicates that habitat destruction and fragmentation due to dam construction, reservoir operation and maintenance, and water withdrawls have restricted this species' distribution. The Bliss Rapids snail is the most abundant of the listed Snake River snails, but is still absent from reservoir habitats (Hershler et al. 1994; Cazier 2001a, as revised 2003). For this reason, and with rare exception, extant populations of this species are isolated from one another by reservoirs along the Snake River.

For spring-dwelling species such as the Bliss Rapids snail, habitat fragmentation had occurred both at a macro and a micro scale. Not only are subpopulations of this species separated from one another along the main stem Snake River due to impoundments, dams, and poor water quality, but habitat destruction within springs and tributaries has isolated many small colonies of snails from the Snake River. Aquaculture development not only physically destroys spring habitat, but degrades water quality downstream to a point where Bliss Rapids snails are no longer components of the snail fauna (Bowler, pers. comm. 2004). Hence, while many spring sources may still contain colonies of Bliss Rapids snail, these are isolated from downstream areas and the Snake River. These colonies cannot receive recruits from areas downstream of the local aquaculture facility and cannot provide them to areas downstream.

B. Project Specific Baseline Conditions for Listed Snake River Snails

1. Shoshone Falls

Extant colonies of the Utah valvata and Bliss Rapids snail are known from the river reach below this project (Approximately 27.6 miles). Due to flow diversions upstream of this project (Milner) water quality may be seasonally low, but the run-of-river operation at Shoshone Falls

Dam and the lack of storage at that facility make project-related effects minimal. Numerous cold water springs enter the river along the lower river reach, north and east bank, below the dam, many of which provide important habitat for listed snails and help improve water quality within the Snake River (e.g., Thousand Spring, Box Canyon Springs, Blue Heart Springs). This river reach receives municipal wastes, waste water from fish farms, and agricultural returns that degrade water quality.

2. Upper Salmon Falls

Extant colonies of the Utah valvata and Bliss Rapids snail are known from the river and springs upstream of this facility (Shoshone Reach). The diverted flows and any bypass flows (North Channel and Dolman Rapids) at this facility, when present, enter directly into the Lower Salmon Falls Reservoir, impounding approximately 14.2 river miles from that Lower Salmon Falls Dam to the head of Upper Salmon Falls Reservoir (RMs 573-587.2). This area is not suitable for either the Bliss Rapids snail or the Snake River physa, but earlier records document the presence of Utah valvata. This project operates in a run-of-river mode. Approximately 9.5 percent of the Bliss Rapids snails' recovery area within the Snake River lies within this project area, but none of it represents suitable, unimpounded, habitat.

3. Lower Salmon Falls

The river reach below this facility contains extant colonies of the Bliss Rapids snail, both in spring tributaries and the main stem, and contains the most recently documented colony of the rare Snake River physa. The 8-mile river reach below this dam is influenced by the load following operations of the Lower Salmon Falls Dam, which can raise river stage height by as much as 7.5 ft below the dam within minutes (FERC 2002a). Numerous small springs and the Malad River enter the Snake River from the north and east bank and provide substantial quantities of high quality, cold water to the Snake River and support colonies of the Bliss Rapids snail. Wastes from numerous fish farms and agricultural return contribute to water degradation in this reach. Approximately 43 percent of the Bliss Rapids snails' recovery area within the Snake River lies within this project area, but only half of that (21 percent, or 8 miles, of the entire recovery area) is regarded as suitable habitat (unimpounded). Approximately 12 percent of the Snake River physa's recovery area lies within this project area, but only half of that (6.6 percent of the entire recovery area) is regarded as suitable habitat (unimpounded). This is the only reach in the Snake River from which live Snake River physa have been collected; only shells have been found in other river reaches).

4. Bliss

This river reach contains colonies of the Idaho springsnail, the Bliss Rapids snail, and potential habitat for the Snake River physa. The 39-mile river reach below this dam is influenced by the load following operations of the Bliss facility, which can raise river stage height by as much as 6.8 ft below the dam within minutes (EIS). Water quality in this reach is heavily influenced by agricultural return flows and there are relatively few cold water springs along this reach. Approximately 91 percent of the Idaho springsnail's recovery area is located within this river reach, the remaining 9 percent being within the upper reaches of C.J. Strike Reservoir (see

below). Approximately 47 percent of the Bliss Rapids snails' recovery area within the Snake River lies within this project area, but only 34 percent is regarded as suitable habitat (13 percent of the 47 percent being impounded). Approximately 9.8 percent of the Snake River physa's recovery area lies within this project area, but only slightly more than half of this (5.7 percent of the total recovery area) is regarded as suitable habitat (unimpounded).

5. C. J. Strike

This project reach is reported to contain colonies of the Idaho springsnail throughout its area of potential project effects, from Brownlee Reservoir (RM 338) to the upstream end of C.J. Strike Reservoir (RM 521). Water quality in this reach is heavily influenced by agricultural returns and there are relatively few cold water springs along this reach. Approximately 9 percent of the Idaho springsnail's recovery area is located within this project area, the remaining 91 percent being within the river reach below Bliss Dam (see above). Load following operations conducted at C.J. Strike influence river stage downstream to Brownlee Reservoir, but these effects are attenuated with distance, being insignificant at locations farther downstream (Fig. 7). The status of Idaho springsnail in the reach between these two projects is uncertain, but it is possible that there are many colonies within this reach. Load following operations are anticipated to affect springsnail colonies present in the areas downstream of the C.J. Strike facility, but it is not known at what distance from the dam these effects would become insignificant or negligible. Snail colonies appear to have persisted in or adjacent to areas that regularly experience river stage changes due to load following operations.

C. Relevant Section 7 Consultations

1. Past Consultations

a. Bureau of Reclamation

Reclamation is currently operating under a 1999 Biological Opinion issued by the Service regarding effects of the continued operation and maintenance of all of their projects in the Snake River Basin upstream of Lower Granite Dam Reservoir. In that Opinion, the Service provided effects determinations for the four Snake River snails under consideration herein. The Service's 1999 Biological Opinion also analyzed the effects of the delivery of 427,000 ac-ft of salmon flow augmentation water, to be provided during critical summer months, that was part of the Reasonable and Prudent Measures from a NOAA Fisheries Biological Opinion on Reclamation projects and operations. Effects determinations could not be conclusively provided for either the Idaho springsnail or the Snake River physa in the Service's 1999 Opinion. Hydrologic effects of the high water year of 1997 masked the effects of impoundments and diversions so project-related effects on the springsnail could not be determined. No determination could be made on Reclamation operations on the Snake River physa because of its rarity and the lack of known colonies to be studied. Reclamation operations were determined to not likely adversely affect the Bliss Rapids snail, but it was concluded that the Utah valvata did experience adverse effects from Reclamation operations, specifically due to drawdown of Lake Walcott. While beneficial effects could not be conclusively shown, the Service determination was that the 427,000 ac-ft of salmon augmentation water may benefit listed Mid-snake snails. Reclamation is implementing a

number of Reasonable and Prudent Measures included in the Incidental Take Statement of the 1999 Biological Opinion, as well as monitoring snail status, distribution, and effects of their operations. Reclamation has initiated informal consultation with the Service for reissuance of their incidental take permit which expires at the end of 2004.

b. Army Corps of Engineers

The Service has completed several formal consultations with the Army Corps of Engineers for dredge and fill permits they issue under section 404 of the Clean Water Act. Most of these are for small-scale actions, such as boat ramp construction, with localized and short-term impacts on listed snails.

On August 6, 1999, the Service provided the Corps with a Biological Opinion for their authorization of the Company's dredging of the tailrace at Bliss Dam. This action involved the removal of about 5,000 cubic yards of rock and the loss of about 57,000 individuals of the Bliss Rapids snail. The Service concluded that the adverse effects of the project did not constitute jeopardy for the species. Following completion of the project, Shinn reported that Bliss Rapids snails had colonized or recolonized project rip rap and excavated areas, and found evidence of snail recruitment (Shinn, IPC, pers. comm., 2001). These findings suggest that colonies or subpopulations of the Bliss Rapids snail may be able to rebound after localized, large-scale disturbances.

On April 14, 2000, the Service issued a non-jeopardy Biological Opinion to the Corps regarding the construction of a boat ramp below Bliss Bridge (aka Shoestring Bridge) at RM 565.7. Based on snail densities found near the project location, the Company estimated that this action would result in the loss of an estimated 770 individuals of the Bliss Rapids snail, although the project occurred downstream of the known snail colony and it is likely that the construction had no effect on the snails.

c. Environmental Protection Agency

The Service has completed a number of formal and informal consultations with the EPA on NPDES permits issued under section 402 of the Clean Water Act to limit point source discharge of pollutants into the Mid-Snake. In addition to the 80 aquaculture facilities currently holding permits, there are numerous proposed facilities awaiting permits in the Mid-Snake area. Some of the other sources of point source discharges include sewage treatment plants, and food-processing facilities. The cumulative impacts of point source pollutants are considered to be an important threat to the conservation of resident fauna along the entire length of the Snake River (Frest and Johannes 1992a; Bowler 1995; Clark et al. 1998; EPA 2002). Several studies have noted a shift in the Mid-Snake snail fauna from one rich in endemic cold water taxa to one with an increasing number of pollution- tolerant species (Frest and Johannes 1992a; Bowler et al. 1993). The 1998 Biological Assessment submitted by the EPA for the reissuance of NPDES Permits for Middle Snake River (EPA 1998), made a not likely to adversely affect determination for the Idaho springsnail. However, based on numerous published studies the Service did not concur with their determination, and provided a Biological Opinion with eight reasonable and prudent measures along with non-discretionary terms and conditions to minimize the anticipated

incidental take of listed snails, including the Idaho springsnail (Service 1999). The Service has concluded that EPA is currently not in compliance with the terms and conditions of the Service's 1999 Opinion (Service in litt. 2003).

d. Bureau of Land Management

In June 2002, the Service entered into informal section 7 consultation with the Bureau of Land Management (Bureau) for improvements to the Cove Recreation Area on C.J. Strike Reservoir. The project entailed the construction or rebuilding of 11 fully accessible fishing docks and maintenance of the existing boat ramp. Although impacts to the area are not anticipated to be severe, the Idaho springsnail was located adjacent to the project site. However, no project-related take was anticipated and, in a letter dated January 30, 2003, the Service concurred that the project was not likely to adversely affect the Idaho springsnail.

e. Department of Agriculture

On August 28, 2002, the Service received a request for formal consultation from the Rural Development Program, U.S. Department of Agriculture (USDA) regarding the proposed construction of a water intake structure and water treatment plant for the city of Glenns Ferry. This project temporarily impacted approximately 5,500 ft^2 of river bottom which was trenched and backfilled over the water intake pipe. Due to the short duration and localized impacts of this project, it was anticipated that there would be no long-term effects and that most of the affected area would recover to a point where the local habitat quality would be restored. The Service issued a Biological Opinion that the action would not jeopardize the Idaho springsnail and provided exemption for incidental take expected to result from the project.

f. Federal Highway Administration

On December 31, 2003, the Service issued a Biological Opinion for a bridge replacement project on the upper Snake River near the town of Firth, Idaho. This project was anticipated to result in the incidental take of Utah valvata snails that were known to occur at this river location. Given the temporary nature of the project, the short-term impacts of construction, and the relatively large distribution of this species, project-related impacts were anticipated to be discountable and that these effects were not anticipated to appreciably reduce the survival and recovery of the species.

2. Ongoing Consultations

a. Environmental Protection Agency

The Service is consulting with EPA on their approval of numeric water quality standards criteria for toxic pollutants for the State of Idaho.

b. Federal Energy Regulatory Commission

In July 2002, the Company issued an application to the Commission for a new license for the Malad hydroelectric facility (FERC 2726) which diverts all water from the Malad River about two miles upstream from its confluence with the Snake River. Presently, neither a biological assessment nor a draft EIS have been submitted for this project, but it is likely that this action may affect the Bliss Rapids snail. The nearest documented colony of Snake River physa occur downstream within the Snake River at RM 570 (Frank Lloyd Wright Rapid/Snake River Pottery study area). Utah valvata have been reported from locations upstream of the Malad facilities (Big Wood River) and other important aquatic natural resources are present within the project area.

The relicense application for the Hells Canyon Complex (Hell's Canyon, Oxbow, and Brownlee dams; FERC 1971) is currently under review by the Service and other Federal agencies. The construction and operation of this project has had impacts on numerous natural resources and may, in part, be a limiting factor in the distribution of Idaho springsnail.

c. Bureau of Land Management

The Bureau of Land Management has initiated informal consultation with the Service to assess the effects of several cattle grazing allotments along the Snake River on Idaho springsnail, Utah valvata, Bliss Rapids snail, and the Snake River physa. Effects determinations have yet to be made for most of these allotments.

V. EFFECTS OF THE ACTION

Regulations implementing section 7 of the Act define effects of the action as "the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated and interdependent with that action. These effects are considered along with the environmental baseline and predicted cumulative effects to the species for the purposes of preparing a Biological Opinion on the proposed action" (50 CFR 402.02).

The Service's handbook for interagency consultation under section 7 of the Act (Service 1998) provides guidance for evaluating effects of ongoing hydroelectric projects

> Under the Federal Power Act, as amended by the Electric Consumers Protection Act of 1986, the Federal Energy Regulatory Commission issues new licenses for existing hydropower projects as the original licenses expire. The Commission has determined that these new licenses represent a new commitment of resources. Therefore a section 7 analysis of the project's effects on listed species is done in the same way as with new projects. When analyzing these projects. . . use the same approach as for other types of section 7 analyses.
>
> - The total effects of all past activities, <u>including effects of the past operation of the project</u>, current non-Federal activities, and Federal projects with completed consultation, form the environmental baseline.

- To this baseline, future direct and indirect effects of operation over the new license or contract period, including the effects of any interrelated or interdependent activities, and any reasonably certain future non-Federal activities (cumulative effects), are added to the environmental baseline to determine the total effect on listed species and their habitat.

The following analysis was developed in accordance with the above guidance.

A. General Effects of the Proposed Action

1. Altered Flow Regimes

The five hydroelectric projects, individually and collectively, will continue to alter the natural flows of the Snake River. Prior to dam construction, the resident and seasonally present organisms that occupied the river were adapted to high velocity river flows that provided clean, cold, and well-oxygenated waters. Unimpeded, seasonally variable flows maintained diverse and heterogeneous habitat that included rapids, runs, and pools which supported a number of cold-water species, including anadromous fishes, a high diversity of aquatic insects, the listed Mid-Snake snails, and other native mollusks.

An early study by Irving and Cuplin (1956) provided information on the effects that hydropower load-following had on the aquatic organisms of the Mid-Snake. Their work showed a pronounced decrease, both in number (reduced by 84 percent) and biomass (reduced by 92 percent), of benthic invertebrates in the shallow tailwaters of both the Lower Salmon Falls and Bliss dams as compared to reaches of the river where load-following was not conducted and flows were maintained at more natural levels.

Subsequent studies have also shown negative impacts to benthic invertebrates such as stranding and desiccation, and all of these studies inferred or noted reduced abundance of benthic invertebrates in de-watered areas (Fisher and LaVoy 1972; Kroger 1973; Brusven et al. 1974; Brusven and MacPhee 1976; Gersich 1980; Gislaison 1980). Brusven et al. (1974) provided mortality estimates for a number of benthic insect naiads that were exposed during dewatering episodes. Although their values showed fairly high rates of survival for most taxonomic groups, this short experiment was conducted during March when air temperatures were mild. The authors asserted that the rates of mortality would be substantially higher when stranding and exposure occurred during sub-freezing winter and elevated summer temperatures.

In a later study, Brusven (1985) showed that the mean insect biomass in near-shore habitats (0 to 18 inches in depth) of unregulated and semi-regulated stretches of the Clearwater River in Idaho was typically an order of magnitude greater than below a dammed portion of the north fork of that river which was subjected to daily load-following. At all of the sample depths of the regulated river, biomass was consistently low (about .003 ounces (oz) per ft^2), whereas it reached an excess of 0.01 oz per ft^2 in the unregulated stretch of river. The unregulated reach also had substantially greater (by about 2-3 times) biomass values than the semi-regulated stretch. While

orthocladiine worm (Chironomidae) biomass was extremely high in the regulated stretch of river, overall species diversity was significantly reduced.

Dewatering associated with hydropower project operation has also been shown to adversely affect snails. Although adult and juvenile snails might be able to move to microhabitats to avoid exposure (e.g., under rocks or macrophytes), eggs would be exposed to extreme temperature fluctuations which would likely result in the death of the embryo. Frest and Johannes (1992b) observed egg-laying by the rare shortface lanx (*Fisherola nuttalli*) during dewatering (draw down) of the Lower Granite Reservoir on the lower Snake River, and commented on the negative impacts that reservoir drawdown could have on this population of snails. The authors noted the stranding and mortality of numerous individuals of a rare freshwater bivalve (*Anodonta californiensis*) due to reservoir drawdown. In a study addressing the impacts of dewatering on endangered snails, Christman et al. (1996) found extremely high mortality rates (93 percent) of the study species *Tulotoma magnifica* in the Coosa River, Alabama. Fisher and LaVoy (1972) showed benthic molluscs to be greatly reduced (by 90 percent in biomass and 68 percent in numbers) in edge-water zones that were dewatered due to load-following at frequencies at or greater than 40 percent of the time relative to areas dewatered for 13 percent of the time or less. And, finally, Morgan et al. (1991) showed snail populations to increase significantly, by about 200 percent, in aquatic habitats when hydropower stage fluctuations were reduced. Listed Snake River snail species that might be exposed to these conditions within the action area include the Idaho springsnail, Utah valvata, Snake River physa, and the Bliss Rapids snail.

Controlled laboratory studies on the Idaho springsnail and the Utah valvata showed these snails were able to survive dewatering for periods greater than 20 hours; but these studies were conducted indoors at "room temperature" (estimated at 19°-21° C; S. Lysne, Boise State U., unpublished M.S. thesis, 2003). A laboratory study investigating the impacts of dewatering at different air temperatures was conducted with the New Zealand mudsnail, an introduced hydrobiid snail now widely distributed in the Snake River (Richards et al., in press, 2004). This study found that all snails died within one hour when exposed to temperatures of 40° C or -3° C. Temperatures in or exceeding (greater or lower) these ranges would be frequently encountered within the project area during the summer and winter. It is not known definitively if the listed snails could tolerate exposure and air temperature ranges such as these, but given the similar size and taxonomic relationship (New Zealand mudsnail, Idaho springsnai,l and Bliss Rapids snail are hydrobiids), the Service concludes that exposure to seasonal extreme air temperatures would likely result in mortality to the listed species as well.

Frequent and rapid dewatering of shallow water areas are anticipated to be particularly detrimental to the Bliss Rapids snail and its eggs which are typically found in edgewater habitats (Hershler et al. 1994) where they can be stranded and exposed during periods of low water. Dewatering of shallow, edgewater habitats will also strand and expose Idaho springsnails, which is frequently found at water depths of less than 6 ft. The magnitude of effect is related to speed with which water levels fluctuate. The more quickly levels change, the more severe the effects to benthic species. All of the listed Mid-Snake snails addressed herein are probably able to undergo some degree of exposure due to dewatering of habitat and survive. However, exposure as a result of dewatering during periods of seasonal temperature extremes is likely to prove fatal to some individuals of these snails and their eggs.

In addition to the mortality that will occur as a result of stranding and exposure, frequent dewatering will greatly disturb the floral community within edgewater habitats and impact production of periphyton (e.g., diatoms) which is cited as food for the listed Snake River snails (Kroger 1973; Baily 1974; Taylor 1982 a, c, d; Frest and Johannes 1992a). Only a few studies are available on the impacts of dewatering on periphyton production. Irving and Cuplin (1956) state that the growth of submergent, aquatic plants is poor in zones that are frequently de-watered. Kroger (1973) stated that dewatering below Jackson Lake Dam (Snake River, Wyoming) resulted in high mortality of algae and aquatic plants as well as large numbers of aquatic insects. Data presented by Bailey (1974) indicated that periphyton production (as measured in dry weight) was lowest in areas that were exposed for the longest periods of time. His work also showed that algal productivity declined in the deep, submerged portion of the river in his study area, which suggests that daily dewatering will reduce primary productivity (plant growth) in affected stream reaches. Gislason (1980) also reported significantly reduced densities of periphyton in fluctuating waters below the Gorge Dam Powerhouse on the Skagit River, Washington; this decrease was correlated with increasing exposure (i.e., hydropower-associated dewatering). Finally, and most pertinent to this discussion, Radford and Hatland-Row (1971) demonstrated that benthic invertebrates associated with periphyton were particularly susceptible to sudden fluctuations in water volume. Reduced periphyton production, an outcome of flow-fluctuations from project opertions, would likely lead to reduced numbers of periphyton grazers.

Both river habitat and reservoirs undergo regular draw-down for load-following operations. Both the Utah valvata and the Idaho springsnail are known to occupy reservoir habitats within the project area and these species would be subjected to exposure as a result of the proposed operations. Water velocities within the tailraces are subjected to daily extremes. For this reason, fluctuations in tailrace flows have impacts on the native Snake River snails and other species that occupy zones that remain submerged since flows will vary from relatively slow waters to rapid, scouring flows. Like dewatering, high velocity flows make some habitat areas unusable because it scours snails, their eggs, and periphyton (food) from substrates.

The above published studies contradict unpublished Company reports which assert that species richness of benthic invertebrates in the Mid-Snake were similar in the variation zone (periodically dewatered by load following operations) and in the mid-water zone (Shinn 2001a, as revised 2003). Importantly, Company conclusions are based on surveys conducted when load following dewatering was much less extensive than that which will occur under parts of the proposed action. River gage records (USGS, referenced in the FERC 2002a) for the period leading up to the Company's surveys indicate that tailwaters fluctuated by no more than two feet during and several months prior to the Company's sampling, and the Company utilized depths of zero to six feet as their default zone of dewatering when making comparisons. Hence, many of the sample sites had not been de-watered for months and were not representative of near-shore habitats that had been exposed to the more standard load-following dewatering and inundation regimes (FEIS).

Cazier (2001a, as revised 2003) stated that observations have suggested that Bliss Rapids snails were found to survive for various periods (up to 14 days) under de-watered conditions. However, no data or details on the conditions under which these observations have been provided. At least one published account has addressed and quantified the impacts of

hydropower-associated habitat dewatering on an endangered snail (*Tulotoma magnifica*). Christman et al. (1996) measured rates of mortality of marked snails found within the zone of dewatering as high as 93 percent, but the authors note that mortality may have actually been higher. In addition, the laboratory studies of Richards et al. (in press, 2004) show another species of hydrobiid gastropod, the New Zealand mudsnail, to die when exposed to air temperatures similar to those that would be encountered by dewatered snails in the Mid-Snake area.

At this time, controlled field studies have not been conducted that allow for an assessment of the impacts that dewatering would have on individuals or populations of the four listed Snake River snails considered herein. However, observations of researchers in reports and published articles show that habitat dewatering is likely to impact adults, juveniles, and the eggs of one or more species of the listed Mid-Snake snails (Irving and Cuplin 1956; Radford and Hartland-Row 1971; Fisher and LaVoy 1972; Kroger 1973; Brusven et al. 1974; Gersich and Brusven 1981; Morgan et al. 1991; Munn and Brusven 1991; Frest and Johannes 1992b; Christman et al. 1996; Richards et al., in press, 2004). Based on this information and until further, controlled studies have been conducted to better assess the impacts hydroelectric operations have on the Mid-Snake snails, the Service concludes that the dewatering of shallow tailwater and reservoir habitats will negatively affect the listed snails through direct desiccation and exposure to temperature extremes, mortality due to frequent scouring, and/or from associated, ecological impacts (e.g., predation from terrestrial foragers, reduced food productivity and availability).

Under the proposed action, shallow water habitat dewatering associated with load-following operations would continue to occur twice daily for some part of two of the first five years of the license period at the Lower Salmon Falls and Bliss projects. At C.J. Strike load following operations would be implemented throughout the life of the license. Based on the observations of Fisher and LaVoy (1972), Frest and Johannes (1992b), Morgan et al. 1991, Christman et al. (1996), and others, there will be impacts to Snake River snails that occupy depths that will be dewatered during load-following operations, suffering mortality and sublethal effects. Depending on the ability of the snails to tolerate dewatering and associated threats, load-following may cause daily mortality of some or all affected individuals of native snail species that occur within dewatered areas during some seasons, both below the dams and within the reservoirs. Published accounts also indicate that the proposed action will result in lowered periphyton and food production within the zone of water fluctuations (Baily 1974; Brusven et al. 1974; Lowe 1979; Gislason 1980; Munn and Brusven 1991), and that this change in the trophic structure will have negative impacts that will extend throughout the aquatic community, including the listed Snake River snails (Radford and Hartland-Row 1971; Power et al. 1996). These effects on the snail food base are likely to extend to deeper water habitats that are not exposed during load-following. The productive, shallow water habitats will be frequently exposed to desiccation and the frequent and rapid water releases (during load-following operations) will scour periphyton and invertebrates from substrates within tailwater habitats and reduce habitat quality of adjacent deeper areas (Radford and Hartland-Row 1971; Lowe 1979; Gislason 1980; and Munn and Brusven 1991).

In summary, load following and other operations that involve from fluctuations would have negative effects to federally listed snail species. If load following, as proposed in the FEISs were

to be conducted throughout the life of the license, these effects would continue to impact isolated subpopulations and colonies of some snail species and could increase their vulnerability to extirpation from other threats. Under the terms of the Settlement Agreement (Agreement 2004) load following at Lower Salmon Falls and Bliss would be limited to two of the first six years of the license study period. For the remainder of the license period, those two projects would operate as run-of-river. C.J. Strike would operate as proposed (FERC 2002b) and impacts associated with load following would persist for the life of the license. The Settlement Agreement does anticipate a future possible proposal to amend operations based on information developed from study results. Because it is not known what operational changes, if any, may be proposed or implemented, our analysis cannot anticipate their effects on the four species of threatened and endangered snails.

2. Water Quality

The five hydroelectric projects at issue herein, along with a number of other important factors, contribute to degraded water quality in the Mid-Snake. All five dams alter flows, increasing retention time of water behind them; this is true even of those projects that operate in a run-of-river mode. The result is increased temperatures, lower levels of dissolved gases, impaired nutrient cycling, and altered transport of sediment. While these effects are common to reservoirs in general, they are likely greater under the load following operations at Lower Salmon Falls, Bliss, and C.J. Strike projects since they may retain water for greater lengths of time. With implementation of the proposed action these adverse effects will continue at C.J. Strike and will occur at lower Salmon Falls and Bliss for the two years of the license (Agreement 2004).

Although studies have not been conducted to determine the tolerance of the listed Snake River snails to reduced water quality, inferences can be made from the current, known distribution and abundance of these snails. Both the Idaho springsnail and the Utah valvata appear to be at least somewhat tolerant of elevated water temperatures and sediment-laden habitats. By contrast, the Bliss Rapids snail is largely restricted to cold, well oxygenated waters with rock or cobble substrates and is absent or found in reduced numbers in the warmer waters of the Snake River (Frest and Johannes 1992a; Hershler, et al., 1994; Shinn 2002, as revised, 2003). Very little is known about the Snake River physa, but it is assumed to be reliant on good water quality and found in deeper portions of the main stem Snake River on stable, rock substrates. Water quality is believed to be far more restrictive and limiting for the Bliss Rapids snail and the Snake River physa.

Implementation of the proposed action will continue to contribute to poor water quality conditions for all of the snail species considered herein. Water impoundment within all of the reservoirs will slow river flow, exposing the water to increased solar warming and reduced DO levels during warm months in the spring, summer, and fall. Poor water quality conditions will not be restricted to reservoir areas and will occur in tailwater areas below each reservoir as well. Warming effects will, to some degree, be additive as water moves downstream into each reservoir. Solar warming and slowed water velocities within the reservoirs are likely to stimulate macrophyte and microbial growth that may also reduce water quality through respiration and decomposition, resulting in further reductions of DO, elevated carbon dioxide levels, and eutrophication (Clark et al. 1998; EPA 2002). These effects, in combination with other factors

affecting water quality discussed above under the "Environmental Baseline" section of this document, are likely to physiologically affect individuals and eggs of each of the snail species considered herein, may result in their death, and will likely have other sublethal effects.

3. Non-native Species

Given the high reproductive potential and extremely high densities that the New Zealand mudsnail can attain where it has been introduced, both in the Snake River and elsewhere in North America, the Service concludes this species will compete with and displace the native Snake River snails, including listed species. Given the apparent inverse relationship of the New Zealand mudsnail with water velocity (Richards et al. 2001) and their ability to tolerate poor water quality conditions (Frest and Bowler 1992), we conclude that water impoundments and controlled flows (e.g., load-following) will likely contribute to increasing populations of New Zealand mudsnails. This is likely to adversely impact the resident snail fauna by competing with them for space and/or food resources (Cada 2001; Hall et al. 2002; Cada and Kerans 2002; Bowler and Frest, manuscript in prep. B). For snails that are reliant on river habitats with high velocity flows, such as the Snake River physa, there may be some degree of habitat segregation that reduces their interactions with the mudsnail. However, species such as the Idaho springsnail, Utah valvata, and the Bliss Rapids snail frequently occupy habitats with slow to moderate water velocities that can be occupied by mudsnails (Richards et al. 2001). In some stream systems where mudsnails are present, native snails have been noted to decline (D. Gustafson in Richards 2001; Bowler 1991). It is anticipated that the mudsnail will continue to spread throughout the Snake River in the action area where it represents a threat to native snails and their aquatic ecosystems. The proposed action will contribute to conditions that provide for persistence and proliferation of mudsnails, thereby affecting the four species of native listed snails considered here.

4. Habitat Fragmentation and Small Population Size

The four Mid-Snake projects, along with other human activities, have resulted in fragmentation of habitats and populations of the native fauna. Not only do the dams present a physical barrier by preventing movement of aquatic organisms, but these structures substantially alter miles of habitat both up and downstream of the dam. Implementation of the proposed action will perpetuate habitat fragmentation and the isolation of previously interconnected populations of each snail species considered herein.

Depending on the habitat tolerance of the snail species, dams and reservoirs increase the likelihood that isolated populations or colonies will not receive recruits from upstream sources (i.e., lack of "rescue effect"; Brown and Kodric-Brown 1979), increasing the risk of localized extinction (Holsinger 2000). The effects of dam-induced river fragmentation, with subsequent loss of fitness and localized extinction of isolated subpopulations has been well documented for a number of fish species (Winston et al. 1991; Morita and Yamamoto 2002 and references; Fagan et al. 2002). Fausch et al. (2002) cite several examples of fish extirpations due to the barrier effects of dams. Although many snail species are more sedentary in their habits, their populations will still be subjected to habitat fragmentation and its detrimental effects, and depending on the life history of the molluscs in question, may be as vulnerable to the impacts of

dams as are fish populations (Watters 1996). Last, small, isolated populations or colonies of snails may eventually suffer from lack of gene flow, leading to reduced fitness and population declines (Dudash and Fenster 2000). The action, as proposed, will perpetuate such effects. Presuming populations continue to decline, these impacts will be amplified over the life of the license.

5. Proposed Snail Studies

Under a Settlement Agreement recently signed by the Company and the Service, five studies would be carried out during the first five years of the license. These studies will address: 1) depth distributions of selected listed snails; 2) laboratory experiments on exposure of snails to air; 3) habitat preferences and habitat distribution; 4) Snail reproductive success under different operational flows; and 5) significance of spring and tributary habitats. During the sixth year, study results are expected to be used to develop a snail conservation plan that addresses operational effects of the Lower Salmon, Bliss, and C.J. Strike projects. These studies focus on stage-related effects due to load following at Company facilities on the Mid-Snake. The primary goals of these studies are to better define the distribution and densities of two of the listed snails, those most effected by proposed load following operations, within the area of project-related effects (Idaho springsnail and Bliss Rapids snail) and to quantify the impacts of operations (reservoir and river stage changes) on these species. Based on the study results, operations could then be modified to eliminate or reduce negative, stage-related impacts to a level that is consistent with the conservation and recovery of these snails. Although this adaptive management effort does not set forth detailed actions that will eliminate or reduce project-related impacts at this time, the intent is to gather the information that will allow for the development of a meaningful snail conservation plan using data gathered. The Company and Service intend to seek agreement on operating scenarios for the two projects that do not unnecessarily limit power generation without providing meaningful conservation benefits to the listed snails. With the exception of two years of planned load following operations at the Lower Salmon Falls and Bliss facilities, the Settlement Agreement calls for run-of-river operations at those facilities, which should eliminate stage-related effects to the listed snails. The two years of load following will allow for the collection of field data to assess specific project-related impacts and adopt modified operations to adjust changes in reservoir and river stage that better allow for the conservation and recovery of the listed snails. Impacts due to the two years of planned load following are discussed in the section on Effects of the Action and Conclusion, and quantified in the section on Incidental Take.

The Service expects that the studies themselves will have some impacts on listed snails beyond the effects of load following operations. Collection of snails for surveys to determine abundance and distribution as well as removal of snails for laboratory experiments will result in injury and death to individuals. Those effects will not be analyzed in this Opinion. Instead, this intentional take of listed snails will be authorized under section 10(A)(1)(a) of the Act, and effects will be analyzed by the Service in its internal consultation under section 7 of the Act for permit issuance. The Company's section 10 permit would address purposeful take of threatened and endangered snails for a number of activities in addition to studies specific to these licenses.

B. Effects of Proposed Protection, Mitigation and Enhancement Measures

1. Mitigation for the Mid-Snake Projects

The Company has proposed mitigation measures that have potential to benefit listed species and habitats. However, there is relatively little information provided in the EISs on how, where, or when these measures are to be carried out. As such, it is difficult for the Service to fully assess how these measures might affect listed species. Following is the Service's evaluation of the effects of proposed mitigation measures on the four species of Snake River snails.

Stocking of Game Fish. The EIS does not provide specific information on the Company's proposed stocking program. It is not clear whether native stocks of game fish (i.e., redband rainbow trout, *Oncorhynchus mykiss gairdneri*) or nonnatives (i.e., commercial varieties of rainbow trout) will be used. While rainbow trout are known to consume snails they are typically not a primary source of prey (Scott and Crossman 1973, Simpson and Wallace 1982) and the listed Snake River snails have coexisted for thousands of years with resident rainbow trout in the Snake River and its tributaries. Presuming that stocked hatchery fish are similar to natives in terms of diet, stocking of rainbows is not likely to have significant effects on listed snails.

Stocking programs by the IDFG utilize sterile fish as a conservation measure to help ensure the genetic integrity of native stocks. A fish stocking program that enhances native stocks of fish and ensures protection against detrimental, non-native species is not anticipated to adversely affect the listed Snake River snails.

Conservation Plans for White Sturgeon and Listed Snails. To date, no complete, final management plan for either the white sturgeon or the listed Snake River snails has been provided for review or comment. Therefore it is not possible for the Service to provide a determination on the effects of any proposed mitigation or conservation activities.

Water Quality Improvement Plans. As discussed above, the Service is unable to assess effects on snails from undetermined future mitigation measures because the specific content of these plans as well as the certainty of their funding and implementation are not known at this time. If, in the future, plan implementation results in effects on listed species, either negative or beneficial, or change conditions for the species, reinitiaion of consultation on these licenses may be warranted.

Dolman Rapids and North Channel Minimum Flows. Habitat mitigation for relicensing of the four upper Mid-Snake projects includes maintaining minimum flows of 50 cfs in the bypassed North Channel of the Upper Salmon Falls Project. In addition, the Company proposes target flows of 200 cfs for Dolman Rapids, an area that receives spill-over from the Upper Salmon Falls impoundment and enters the North Channel at its down-stream end. The minimum flow proposed for North Channel is an estimate based on several iterations of data generated from hydraulic simulation originally designed to quantify flows needed to promote trout survival and fishing recreation in this reach of river (FERC 2002a). Also, as stated in the FEIS, the 50-cfs flow is a condition of the Section 401 Water Quality Certification, under the IDEQ consent order. Under the current license, the bypass reach (North Channel) could be subject to total de-

watering when flows become seasonally limiting and are diverted into the diversion flumes of the Upper Salmon Falls Project (Fig. 11). Under the proposed 50 cfs minimum flow for the new license, the FEIS states that dissolved oxygen concentrations would not drop below 5.5 mg/l (FEIS). This is below the 6 mg/l criteria established for the water quality standards for cold water species. According to the models developed by the Commission, bypass flows in the North Channel would have to be maintained at 90 cfs to "reliably achieve DO concentrations of 6.0 mg/L", the DO criteria for cold water quality standards (FEIS). Despite this analysis, the Commission concluded that the proposed 50 cfs minimum flow would not adversely affect cold water fish and invertebrate species since DO would drop below the required 6 mg/l criteria only for short periods (FEIS).

Acquisition of Spring Habitats. The Company proposes to provide funds to IDEQ or The Nature Conservancy for the acquisition of spring resources and habitats, and this is listed as a proposed mitigation activity for dam relicensing. The study and identification of spring resources important for the conservation of listed snails is included as an information need in the Settlement Agreement between the Company and the Service (Agreement 2004). Once this information is obtained it can be used to develop a management plan that can then be implemented to achieve appropriate conservation goals for spring-inhabiting species, including some of the listed snails. This is further addressed in the Conservation Recommendations section of this Opinion. Given the lack of detail contained in the FEIS on protection of spring resources, the Service cannot assess the effects of such monetary mitigation until specific plans until they are developed and provide more detailed information on the areas to be purchased and how they will be managed.

Establishment of Artificial Wetlands Downstream of Shoshone Falls. Under the proposed action, the Company proposes to develop about 30 acres of wetlands below the Shoshone Falls Project. The 27.6 mile free flowing reach below Shoshone Falls provides habitat for Utah valvata, Bliss Rapids snail, and potentially the Snake River physa. Because of the limited efficacy of developing artificial wetlands, there is no basis to conclude that snails would benefit from this proposed mitigation. Depending on the placement and configuration of the constructed wetlands, alteration of existing habitats could have negative effects on native species, including listed snails. As with other mitigation proposals, without more specific information, the Service cannot assess effects on listed snails from the proposal to create wetlands in the Shoshone Reach.

Purchase and Management of Riparian/Wetland Mitigation Parcels. Under the proposed action, the Company would purchase and/or manage additional riparian and wetland habitats in the action area to mitigate for project-related operations. The Service agrees with the Commission's Assessment that 245 acres of such habitat would help off-set project related effects resulting from fluctuations of river stage. In a letter to the Service dated February 26, 2004, the Commission stated that acquisition and management of additional riparian habitats would ultimately be based on the finalized load following operations adopted in the license and that this would be based on recommendations contained in the, as yet unfinished, Snail Conservation Plan. As correctly stated in that letter, load following operations could be altered at both the Lower Salmon Falls and Bliss project pending the study findings as outline in the Settlement Agreement. Given that the FEIS does not provide adequate detailed information on the wetland

and riparian mitigation plan for the Mid-Snake, the Service is unable to provide effects determination on this part of the proposed action at this time.

Weed Control. This action is required by State law and as such is redundant in its inclusion in the licensing action. While the control of non-native weeds is a necessary tool for land management, the methods that are employed for this activity need to be carefully weighed before the appropriate methods are selected. Weed control programs can employ herbicides, mechanical, or biocontrol methods, each of which have specific benefits, limitations, and costs associated with them. As an example, there is growing evidence that herbicides and/or their residues may negatively impact species that rely on aquatic systems (Clark et al. 1998; Pickrell 2002; Raloff 2002). The FEIS does not provide any plan or discussion on where the proposed weed control program will be carried out, what species will be targeted, or what methods will be used. Without a more detailed description of the proposed weed control program to be employed, the Service cannot provide a determination on the effects of this proposed mitigation action on listed snails.

2. Mitigation for C. J. Strike Project

Stocking of Rainbow Trout and Channel Catfish. For the proposed stocking of rainbow trout, see the section on Mitigation for the Upper Four Projects (above). The omnivorous, bottom-feeding habits of channel catfish suggest that they could have a negative effect on the Idaho springsnail which primarily resides on bottom substrates. As noted in the FEIS, channel catfish are likely to feed on the Idaho springsnail and the New Zealand mudsnail. The FEIS also states that the springsnail has "persisted in the project area in high numbers" despite the periodic stocking of catfish since 1977, leading the Commission to conclude that these non-native fish do not have a notable effect on the springsnail. The Service does not agree with this conclusion. There has been no long-term monitoring of the Idaho springsnail in C.J. Strike Reservoir prior to the work conducted by the Company prior to 1995 (Cazier 2001a, as revised, 2003), so we do not know how reservoir or river populations of springsnail have responded to the introduction of catfish. While the springsnail may be present in the reservoir, they are not widespread and there is insufficient information available to allow us to assess how catfish may have affected springsnail populations within the reservoir. Finally, we find the Commission's assertion in the FEIS that channel catfish may control the New Zealand mudsnail to the benefit of the Idaho springsnail to be flawed. Predation on mudsnails would likely not offset adverse effects on springsnails because predation would likely have a more serious impact on the prey species like the springsnail, that is more limited in number and distribution relative to the species, that are more widespread and abundant (Howarth 1991). Rare species are more vulnerable to demographic stochasticity or other threats when its population numbers are low (Gilpin and Soulé 1986). Given this, the Service concludes that stocking channel catfish may have an adverse effect on the Idaho springsnail.

Participate in Development and Implementation of the C.J. Strike Total Maximum Daily Loads (TMDLs) Criteria and Provide $50,000 Annually for Watershed Improvements. Implementation of TMDLs may have positive effects on listed snails in the Snake River, including the Idaho springsnail in the C.J. Strike project area. However, until these TMDLs are completed and specific implementation plans are developed, we cannot provide a determination of how Idaho

springsnail may be affected. If implementation of watershed improvement actions by the Company results in changed conditions for listed species at C.J. Strike in the future, reinitiation of consultation may be warranted.

Acquisition and Improvement of Riparian Wetland, and Upland Habitat. As with the Mid-Snake relicensing mitigation (above), the Company and the Commission proposed acquisition and management of riparian habitats in order to mitigate for project operations, specifically stage fluctuations and its negative impacts to shore-line vegetation zones (not specifically for mitigation to impacts to listed snails). The Service agrees in principle with acquisition (approximately 170 acres in total) and appropriate management of riparian zones below C.J. Strike, as evaluated by the Commission in the FEIS, as mitigation for operations of that facility. Since the details of the proposed C.J. Strike mitigation were not provided in the FEIS, the Service is unable to provide a determination as to how these activities will impact Idaho springsnail within or outside of the project area.

Provide Operation and Maintenance Funding for Resource Stewardship of Idaho Power Lands within the WMA. Without more detailed information, the Service cannot evaluate the effects of these stewardship programs at C.J. Strike on Idaho springsnail.

Protect Rare Plant Species and Communities from Disturbance within or adjacent to the Project area. Without more detailed information on how these programs will be carried out, the Service cannot provide a determination of effects on listed Idaho springsnail.

Protect and Enhance Wetland and Upland Plant Communities on Proposed Land Acquisitions and Company Lands within the C.J. Strike WMA. As with some of the items above, the proposed protection and enhancement measures are not clearly enough defined to allow the Service to provide a determination of their effects on Idaho springsnail within or adjacent to the project area.

Control Shoreline Sheet Erosion on Company Lands and Sites Directly Influenced by Reservoir Management. The control of erosion would likely be beneficial to the Idaho springsnail and other aquatic species within the project area. This is especially pertinent since high-water flushing events are far less effective at transporting and redistributing sediments with the current series of dams now in place along the Snake River. The Service is in agreement that developing and implementing a plan to prevent sheet (and bank) erosion is needed within the project area and should be pursued by the Company and appropriate agencies. However, the FEIS lacks sufficient information to allow the Service to evaluate the short term and long term effects of such an activity on the Idaho springsnail.

C. Project and Species Effects

1. Shoshone Falls

Of the four hydroelectric projects addressed herein, the Shoshone Falls facility is the uppermost on the Snake River, with the dam located at RM 614.8 and its reservoir extending upstream to RM 616.6. The Shoshone Falls Dam is about 27 miles upstream of the Upper Salmon Falls

Reservoir headwaters and operates in an instantaneous run-of-river mode. Under the proposed action, the hydroelectric operations at the Shoshone Falls facility would remain the same as it has for the past 15 years.

The run-of-river operation at Shoshone Falls means that the volume of water flow at the base of the falls is essentially equal to that entering the reservoir at all times (i.e., there are no hourly or daily fluctuations in tailwater flow volumes that are attributable to facility peaking operations); water either goes through the powerhouse or over the falls. Hence, extreme low flows will be determined by unusually low snow melt and spring discharge into the river upstream, by water removal or control upstream (agricultural and urban), and by evaporative losses from other facilities such as American Falls Reservoir and Lake Walcott. Higher flows would be associated with greater than average precipitation and runoff, and with upstream releases of water for salmon flow augmentation. The steady, but seasonal, flows from Shoshone Falls Dam means that dewatering of the shallow benthic habitats in the tailwater reaches will, with the exception of the non-Company-related factors noted above, occur gradually throughout the summer and fall, in a fashion that is similar to natural, unimpounded flows.

Although the run-of-river operation mimics that of natural flow conditions, there are some decreases flow velocity and increases in water retention time behind the dam which facilitate solar heating resulting in elevated temperatures, reduced DO concentrations, and conditions that are conducive to increased growth of macrophytes and microbes (i.e., eutrophication). These conditions are detrimental to cold water-dependent biota. Although water quality conditions may begin to improve when water leaves the facility and enters the river system below, most of these effects linger, degrading river conditions for cold water-dependent biota residing in the tailwaters. However, it is not possible to analytically distinguish between those water quality-related effects caused specifically by the Shoshone Falls Project and those that are present due to other, unrelated factors (i.e., warm waters released from Milner Reservoir, municipal and industrial waste water, agriculture returns, and fish farms). Therefore, the Service concludes that water quality effects on listed snails from project operation at Shoshone Falls are insignificant and discountable.

a. Idaho Springsnail

The Service concurs with the Commission that the proposed relicensing of the Shoshone Falls hydroelectric facility will not adversely affect the Idaho springsnail. The primary rationale for our concurrence is the absence of the species in the area of the Snake River affected by the Shoshone Falls project. Based on the most recent available data (Stephenson and Bean 2003, R. Myers, IPC, in litt., 2004), the current upstream range of the Idaho springsnails is at RM 553 (Bancroft Springs; Service 1995), which is 61.8 miles downstream of Shoshone Falls Dam. Given that there are three dams that lie between the most upstream population of the springsnail and the Shoshone Falls Project area, any indirect effects on the Idaho springsnail from changed water quality at Shoshone Falls would be dissipated or indistinguishable from similar effects of the lower projects and those present due to other, unrelated projects or activities.

b. Utah Valvata

The Service concurs with the findings of the Commission that the proposed operation of the Shoshone Falls facility is not likely to adversely affect the Utah valvata. The primary rationale for our concurrence is that the current and proposed run-of-river operation of the project would not result in stranding of the Utah valvata or its eggs or negatively modify the benthic habitats used by this species.

The recovery area for the Utah valvata includes the main stem of the Snake River from RM 572 to RM 709 (Service 1995), which includes the Shoshone Falls Project area. Information provided by the Company and included in the FEIS states that this species is neither "known nor thought to inhabit the project area" at Shoshone Falls. However, details on the surveys for this species in this area were not provided, and their analysis does not include the tailwater reach where the Utah valvata is documented to occur (e.g., Box Canyon; Taylor 1985; Thousand Springs; Frest and Johannes 1992a; Stephenson and Bean 2003).

Surveys and historical species accounts of the Utah valvata note the presence of this snail in the Shoshone Falls Project area. The Utah valvata has been found about one mile upstream of the Upper Salmon Falls Dam in relatively shallow waters (#3 ft; IPC 1995) as well as at Thousand Springs and Box Canyon. This suggests that this species could occur within the Shoshone Falls Reservoir although this has not been documented there. During recent years the Utah valvata has been found regularly within Lake Walcott, Minidoka tailwaters, other free-flowing upstream sections of the river (e.g., Eagle Rock and Neeley), within portions of American Falls Reservoir (Irizarry 1999; Weigel 2002), and at locations in the upper Snake River (D. Gustafson, Montana State U., in litt., 2003). At sample stations within Lake Walcott, snails have been reported to reach densities as great as 34 per ft^2 (Weigel 2002). More recent surveys have located this species in the Big Wood River and the upper Snake River (eastern Idaho).

The most current information on the distribution and status of the Utah valva indicates to the Service that this species occurs in numerous colonies and reaches its greatest numbers in river and lake habitats within, adjacent to, and upstream of the Shoshone Falls Project area, from Minidoka Dam upstream and into American Falls Reservoir. In addition, the proposed year-round run-of-river mode of operation for the Shoshone Falls Project is not likely to adversely affect the scattered colonies of Utah valvata within the project area (Shoshone Reach) because, as discussed above, this mode of operation is similar to natural flow conditions.

c. Snake River Physa

The Service concurs with the Commission that the proposed operation of the Shoshone Falls hydroelectric facility is not likely to adversely affect the Snake River physa. The primary rationale for our concurrence is the low probability that the species occurs in the project area. All confirmed collections of the Snake River physa have occurred below Lower Salmon Falls Dam, about 44 miles below Shoshone Falls Dam. As such, the risk of adverse effects on the species is insignificant and discountable.

d. Bliss Rapids Snail

The Service concurs with the Commission that the proposed operation of the Shoshone Falls hydroelectric facility is not likely to adversely affect the Bliss Rapids snail. The primary rationale for our concurrence is that the current and proposed run-of-river operation of the project is not anticipated to have negative effects on the species or its habitat because, as discussed above, this mode of operation is similar to natural flow conditions. The designated recovery area for the Bliss Rapids snail is between RM 547 and RM 585 (Service 1995); the upstream boundary of the recovery area occurs 29.8 miles below Shoshone Falls Dam. The nearest extant colony of this snail is reported to occur at Niagra Springs, about 15.8 miles downstream of Shoshone Falls Dam. Given the project's proposed operation and its distance from known occurrences of the snail, we conclude that risks of adverse effects are insignificant and discountable.

2. Upper Salmon Falls

Upper Salmon Falls Dam is located at RM 581.4, about 33.4 miles downstream of Shoshone Falls Dam. Upper Salmon Falls Reservoir extends upstream about 5.8 miles to RM 587.2. Upper Salmon Falls Dam lies about 8.4 miles upstream of Lower Salmon Falls Dam and 1.8 miles upstream of its reservoir. Upper Salmon Falls Dam operates in an instantaneous run-of-river operational mode, so tailwater flows reflect the seasonal inflow of the river. The reservoir lies adjacent to, but separate from the natural river channel, with the bypass reach (North Channel) flows in the river channel being greatly reduced through most of the year and seasonally dewatered during dry periods. The outflow from the generators of this project enter directly into Lower Salmon Falls Reservoir, hence the entire river reach from Lower Salmon Falls Dam to the upper end of Upper Salmon Falls Reservoir, with the exception of the North Channel (with reduced or zero flows), constitute a contiguous impounded reach. The FEIS notes that daily fluctuations in reservoir depth are not expected to occur, but that document also states that the reservoir may fluctuate by as much as 0.4 ft over 10 percent of the time.

The FEIS also states that there may be periodic dewatering (drafting) of Upper Salmon Falls Reservoir as great as 10.4 ft, but such draw downs represent rare events (J. Bowling, IPC, pers. comm., 2004) and are not addressed in this analysis. Under the proposed action, hydroelectric operations at the Upper Salmon Falls facility would remain the same as it has for the past 15 years, with no more than a 0.4 ft fluctuation in the reservoir stage. Changes in operations for power generation, maintenance, or repairs that would drop reservoir levels below 0.4 ft below full pool would require consultation in the event that they occur or are planned.

As with the Shoshone Falls facility, the run-of-river operational mode employed at the Upper Salmon Falls facility will ensure that shallow water habitats in the reservoir will not undergo frequent or rapid dewatering. This means that natural shallow water biotic communities can become established and not be subjected to frequent dewatering-associated stresses such as stranding and exposure to extreme climatic conditions. However, the close proximity of the Upper Salmon Falls facility to the Lower Salmon Falls Reservoir, which is subjected to daily load-following operations, may limit the beneficial effects that result from run-of-river operations. There is no flowing river reach receiving water from the Upper Salmon Falls Project

and limited flows in the North Channel and adjacent Dolman Rapids reduce or eliminate the value of these areas as habitat for species reliant on cold water. As is true of the Shoshone Falls Project, water leaving Upper Salmon Falls Dam will have become slightly more degraded (elevated temperature, reduced DO, eutrophic) compared to the river water entering the Upper Salmon Falls Reservoir. However, overall water quality degradation is due to the aggregate effects of a large number of upstream factors, including the warm water releases from Milner Reservoir, municipal, agricultural, and aquaculture wastes, and the project's negative effects are likely unmeasurable given these other contributions. Water quality in this reach may be somewhat improved by the input of high quality water from springs such as Thousand Springs and Box Canyon that lie just upstream of the project.

Under the current license the Snake River channel at the Upper Salmon Falls project (North Channel) can be completely dewatered during low flow periods (Fig. 15), all flows being diverted such that they bypass the main river channel and are diverted into "canals" that direct the flow into the generators for hydropower generation. The proposed action provides that a minimum flow of 50 cfs will be maintained through North Channel and that minimum flows of 200 cfs will be targeted in the Dolman Rapids area except during extreme low-flow periods. The proposed minimum and target flows represent a minor, but beneficial, contribution to the water quality of the Mid-Snake since there are no minimum flow requirements under the current license. These flows may help increase DO concentrations and reduce water temperatures in the upper section of Lower Salmon Falls Reservoir, into which waters from North Channel, Dolman Rapids, and the tailrace from Upper Salmon Falls power plant empty. No listed snails are documented from North Channel, Dolman Rapids, or Lower Salmon Falls Reservoir, so any water quality benefits provided by the proposed minimum flows will not directly translate into habitat improvements for the listed snails.

Degraded water quality will result in the physiological stress of the listed Snake River snails and this may affect the species' reproduction, survival, and numbers. Impaired water quality due to the presence of Upper Salmon Falls Reservoir may have some adverse affect on the listed snails that occur below the dam, but the Service concludes the water quality degradation is insignificant relative to the other upstream sources of water quality degradation (e.g.,warm water releases from Milner Reservoir, municipal and industrial waste water, agriculture returns, and fish farms). The contribution of spring tributaries in the Hagerman Reach likely help to offset poor water quality from upstream reservoirs and other water uses.

a. Idaho Springsnail

The Service concurs with the Commission's conclusion that operating the Upper Salmon Falls project under the proposed new license will not affect the Idaho springsnail. The primary rationale for this determination is the absence of the species in the area of this project. At present, the Idaho springsnail is not reported to occur above Bliss Dam, its most upstream distribution being reported at RM 553 (Service 1995).

b. Utah Valvata

The Commission has determined that the proposal to relicense the Upper Salmon Falls project may affect, but is not likely to adversely affect, the Utah valvata. The Service does not concur with this determination and concludes that operation of Upper Salmon Falls is likely to adversely affect the Utah valvata. Utah valvata are documented to occur at river mile 581.9, approximately one mile upstream of Upper Salmon Falls Dam and within the reservoir (Konopacky, unpub. data, 1987; IPC 1995) This collection was in water of less than 3 ft depth. Density estimates were not provided in the Company's report and the FEIS did not acknowledge the data indicating their presence in the project area. The recovery area for the Utah valvata lies between RM 572 and RM 709 and includes the Upper Salmon Falls project area. Although the Upper Salmon Falls Project area accounts for about five percent of the recovery area for this species, the species is not believed to be abundant in this area and there are large and persistent colonies of this species in the Snake River and its reservoirs upstream of Minidoka Dam. Regular operations of Upper Salmon Falls that result in the dewatering/drafting of the reservoir to a depth 0.4 below full pool, would adversely affect Utah valvata in the reservoir, resulting in exposure of snails within the zone of dewatering.

c. Snake River Physa

The Service concurs with the Commission that the proposed operation of the Upper Salmon Falls hydroelectric facility is not likely to adversely affect the Snake River physa. The primary rationale for our concurrence is the low probability that the species occurs in the project area. The Service acknowledges that this species may be highly sensitive to impaired water quality; however, we conclude that water quality degradation due to this project is insignificant relative to the contribution of other upstream sources such as municipal and industrial waste water, and agriculture and fish farm returns. All confirmed collections of live Snake River physa have occurred below Lower Salmon Falls Dam, about 7 miles below Upper Salmon Falls Dam. Even though the Upper Salmon Falls project area lies within the recovery area of this snail, the Service concludes that the continued operation of this facility will not contribute to any habitat degradation beyond the current conditions and the run-of-river operation will not influence flowing river reaches where this species may be present. Prior dewatering of the North Channel/Dolman Rapids area, and this species' reliance on deeper, well oxygenated river flows, along with its general rarity, strongly suggest that it may no longer be present in this short stretch of river channel and it will not occur in the reservoir habitats. As such, any impacts on the species are likely to be insignificant and discountable.

d. Bliss Rapids Snail

The Service concurs with the Commission's determination that the Bliss Rapids snail may be affected, but is not likely to be adversely affected, by the proposed operation of the Upper Salmon Falls project. Upper Salmon Falls Reservoir represents 9.5 percent of the designated recovery area for the Bliss Rapids snail, but neither the reservoir or bypass reach provide suitable habitat for the species. Water from the Upper Salmon Falls and North Channel empties directly into Lower Salmon Falls Reservoir, which extends 8.4 miles downstream. Hence the entire river reach from the upper end of Upper Salmon Falls to Lower Salmon Falls Dam, a total of 14.2

miles, is unavailable to the Bliss Rapids snail. In addition, while the North Channel and Dolman Rapids areas could provide habitat for the Bliss Rapids snail throughout much of the year, the poor water quality that will frequently occur in this area, as well as large impounded reaches both up and downstream of this bypass reach, will limit chances of colonization and habitation by this species. Improving habitat in the North Channel bypass reach would be consistent with the species' recovery (Service 1995). Given its current absence from the project area, risks of adverse effects are insignificant and discountable.

3. Lower Salmon Falls

Lower Salmon Falls Dam is located at RM 573, about 8.4 miles below Upper Salmon Falls Dam, 13 miles above Bliss Dam, and 8 miles above upper Bliss Reservoir. Lower Salmon Falls Reservoir extends upstream to the base of Upper Salmon Falls Dam, so this impounded reach represents a contiguous and extensive area of reservoir habitat. The Lower Salmon Falls facility presently operates in an instantaneous load-following mode so depths can fluctuate greatly; 2 ft per day and 5 ft per day for the reservoir and tailwaters, respectively (FEIS). The load-following effects from this project extend upstream of the dam to the headwaters of Lower Salmon Falls Reservoir (RM 579.6) where it abuts Upper Salmon Falls Dam, and downstream to where the Lower Salmon Falls reach enters the headwaters of Bliss Reservoir (RM 565). Under the Proposed Action outlined in the FEIS, these water depth fluctuations were anticipated to occur twice daily for the life of the license. However, under the Settlement Agreement (Agreement 2004) load following operations will only occur for two years in the first five years of the license. Run-of-river operations will be conducted at all other times. During all but the two years of load following, river stage changes will be a result of flow alterations unrelated to project operations. Under those run-of-river operations, the adverse effects of dewatering by the Company will be avoided. In addition, as described previously in this Opinion, unusual circumstances in any year could require that the Company operate the Lower Salmon and/or Bliss projects in a manner other than run of river up to 16 days total for the projects combined.

Degraded water quality will result in the physiological stress of the listed Snake River snails and this may affect the species' reproduction, survival, and numbers. Impaired water quality due to Lower Salmon Falls Reservoir may have some adverse affect on the listed snails that occur below the dam, but the Service concludes that the water quality degradation is insignificant relative to the other upstream sources of water quality degradation (i.e., warm water releases from Milner Reservoir, municipal and industrial waste water, agriculture returns, and fish farms). The contribution of spring tributaries in the Hagerman Reach likely help to offset poor water quality from upstream reservoirs and other water uses.

a. Idaho Springsnail

The Commission determined that issuing a new license to operate the Lower Salmon Falls Project as proposed will not adversely affect the Idaho springsnail and the Service concurs with this determination. Based on new information on the distribution of this snail provided by the Company (Stephenson and Bean 2003; R. Myers, IPC, in lit., 2004) and others (Bowler, U. California, pers. comm., 2002), the Service concludes that the Idaho springsnail is not present in

the Lower Salmon Falls Reach. Based on this information, we conclude that licensing the Lower Salmon Falls facility would have insignificant and discountable effects on the Idaho springsnail.

b. Utah Valvata

In the FEIS, the Commission determined that operation of the Lower Salmon Falls Project was not likely to adversely affect the Utah valvata. The Service concurs with this determination because this species is not believed to be present in the project area. Prior reports indicated that the Utah valvata did occur within Lower Salmon Falls Reservoir, but reviews of the Company data could not find this report and their extensive sampling of the area that indicates that the species was not present (R. Myers, IPC, in litt., 2004). Based on the most current information provided by the Company, the Service does not anticipate any direct or indirect adverse impacts from this project on the Utah valvata.

c. Snake River Physa

The Commission determined that the operation of the Lower Salmon Falls Project is likely to adversely affect the Snake River physa. The Service does not concur with this finding, concluding instead that the proposed operation, as modified by the Settlement Agreement (Agreement 2004), of the Lower Salmon Falls Project is not likely to adversely affect this species. This is primarily because the proposed minimum flows are sufficient to assure that neither Snake River physa nor their habitat would be dewatered.

The Bliss and Lower Salmon Falls area was noted by Taylor (1982c) as the primary known range of this species. The rarity of the Snake River physa makes it difficult to assess the current distribution and status of this species. Early, unconfirmed sightings by the Company (Cazier 1997a) noted that the species had only been located three times in two years, in each case near turbulent, deeper water on large rocky substrates. More recent surveys of some of the type localities of this snail failed to locate it (Frest, pers. comm., 2003).

Although the recovery area has been designated from Bancroft Springs to Minidoka Dam (RM 553 to 675) (Service 1995), the only confirmed live specimens of the Snake River physa have come from the Lower Salmon Falls reach, just downstream of Lower Salmon Falls Dam (RM 570.3) (Taylor 1988). Given Taylor's (1982c) suggestion that the single known population occurred between Lower Salmon Falls Dam and Bancroft Springs, the river reach below the Lower Salmon Falls project is considered to be of critical importance to the species.

Under the proposed action, for the two years of load following operation tailwater depths below Lower Salmon Falls Dam will vary by as much as 5 ft per day, but would not drop below a guaranteed minimum flow of 3,500 cfs leaving the dam. This flow volume equates to a stage depth of 5.2 ft as measured below Lower Salmon Falls Dam at USGS gage 13135000. Taylor (1982c) states that the Snake River physa typically occurred in water depths of $\geq$ 3 ft on rocky substrates in fast-flowing water, but his collections of live animals were conducted when water releases below Lower Salmon Falls Dam were at levels lower than 3600 ft (1959 flows $\geq$ 2,400 (at 10 MW), 1961 flows $\geq$ 2,400 cfs (at 10 MW), 1980 flows $\geq$ 6,000 cfs (at 25 MW), and 1981 flows of 5,500 cfs (23 MW) that were conducive to collection of this deep-dwelling species.

Review of Company records during the years following the species' initial collection (1959) show that flows may have periodically dropped to below 1,000 cfs, which would have likely resulted in exposure of physa habitat.

Given the presumed occurrence of this species in deeper habitats, the Service concludes that the proposed minimum flow of 3,500 cfs at Lower Salmon Falls Dam will ensure that physa occupied habitats in this river reach will not be dewatered. This conclusion is based on the fact that collections of this species were at flows at Lower Salmon Falls $\geq$ 2,400 cfs, so the proposed minimum flow of 3,500 cfs will maintain river stage above the lower levels when live specimens were collected. While the dewatering of benthic habitats above the depth range of the Snake River physa may have some indirect effects on the trophic dynamics of the river, we lack information on such potential impacts. In addition, records of flows in this reach (IPC, unpub. data, 1958) suggest that this species could withstand periods of extreme low flows since most live specimens were collected three years later in 1961. During 1958, there were extended periods of load following that reduced flows to 1,200 cfs from Lower Salmon Falls Dam, with occasional periods where flows leaving the dam approached or equaled zero cfs. At such times, the Malad River (approx. 1,000 cfs) likely made up the majority of flow contributions at the collection site near Frank Lloyd Wright Rapid in 1961, when eleven Snake River physa were collected (Taylor 1988). Under the current license application and Settlement Agreement (Agreement 2004) the proposed minimum flows for the Lower Salmon Falls Project will not drop below 3,500 cfs, over 1,000 cfs greater than at the time live specimens were collected $\geq$ in 3 ft of water (1959 or 1961). Under the proposed operations, Snake River physa will remain submerged. Based on this, the Service concludes that while operations may affect this species, those effects will be insignificant or discountable.

d. Bliss Rapids Snail

The Service agrees with the Commission's determination that issuing a license to operate the Lower Salmon Falls project as proposed would likely have adverse effects on the Bliss Rapids snail. The most prolific known colonies of the Bliss Rapids snail occur in cold water springs (e.g., Thousand Springs, Box Canyon, Banbury Springs, Cove Creek), while more sparsely populated colonies occur in the main stem of the Snake River in association with springs and tributary streams. Most river colonies of these snails are located between Clover Creek (about RM 547.5) and Banbury Springs (RM 589), a river stretch heavily influenced by cold water springs. The designated recovery area for the Bliss Rapids snail lies between RM 547 and RM 585 (Service 1995). Of the total recovery area, the Lower Salmon Falls Reservoir represents 17 percent of that area but is currently unsuitable for occupation by the Bliss Rapids snail. Of the remaining suitable river habitat within the recovery area, the reach downstream of Lower Salmon Falls accounts for 35 percent of the recovery area. All of this area will be exposed to load following operations during two of the first five years of the license (Agreement 2004).

The Company has collected data on presence/absence and the abundance of this species in the Hagerman area from below Lower Salmon Falls (RM 570) to Bancroft Springs (RM 553); these data include some information on the long term persistence of colonies (Stephenson and Bean 2003). Given this distribution and this species' frequent occurrence in shallow-water habitats (Frest and Johannes 1992a; Hershler et al. 1994; Stephenson and Bean 2003), the two years' load

following mode of operation proposed for the Lower Salmon Falls project are likely to adversely affect the river populations of the Bliss Rapids snail, exposing them to desiccation, freezing, heat stress, and predation in dewatered habitat. Exposure to extreme air temperatures is likely to be detrimental to this species since it resides on rocky substrates rather than being a sediment-dweller. These same effects may occur during unusual operations, as described in this Opinion and Attachment 2 of the Settlement Agreement, for up to 16 days each run of river year at this project and the Bliss Dam combined. Given the limited frequency and duration of these unusual events, the severity and significance of the impacts may be attenuated. Still, these represent chronic and repeated impacts that could limit the numbers and distribution of Bliss Rapids snails in the action area.

Load following operations may exclude the Bliss Rapids snail from preferred, productive river habitats (e.g., shallow and fast-flowing river habitats). Load following will alter the trophic dynamics of the river (Radford and Hartland-Row 1971; Power et al. 1996) in a zone frequently inhabited by this species, reducing the amount of food available to the snails by frequently dewatering the productive shallow-water zones (when water is withheld) and frequently scouring diatoms and other foods from substrates where these snails forage (when water is rapidly released). These impacts will reduce the population size of river-inhabiting subpopulations/colonies to levels that increase the likelihood of their local extirpation (Soulé 1980, 1987; Terborgh and Winter 1980; Shaffer 1981; Quinn and Hastings 1987).

Monitoring of Bliss Rapids snails at various locations have shown colonies within the Snake River to be much smaller (less densely populated) than those within spring and tributary habitats (Shinn 2002, as revised 2003). Not only are Bliss Rapids snails less numerous in their Snake River colonies, but these colonies appear to be more ephemeral in nature, disappearing from locations where they had been recorded during previous visits (R. Myers, IPC, in litt., 2003; Stephenson and Bean 2003), while colonies in springs and tributaries appear to be stable and/or persistent (Frest and Johannes 1992a; Stephenson and Bean 2003). The more ephemeral nature of river-dwelling colonies is likely due to numerous factors that include water quality, fluvial dynamics, and river regulation (including load following). Given the low densities of Bliss Rapids snails within the main stem of the Mid-Snake, long term load following operations could contribute to the local extirpation of colonies. However, recolonization from tributaries in the action area may occur.

4. Bliss

Bliss Dam is located at RM 560, about 13 miles below Lower Salmon Falls Dam. Bliss Reservoir extends upstream for about 5 miles to RM 565. Under the proposed action, the Bliss facility operates in a load following mode for two of the first five years of the license. Both reservoir and tailwater depths may fluctuate greatly; 2 ft per day and 6 ft per day for the reservoir and tailrace respectively (FEIS). The load following effects from this project extend upstream of the dam to the headwaters of Bliss Reservoir (RM 565) where it meets the Lower Salmon Falls reach (which is also influenced by load following operations), and downstream to where the Bliss reach enters the headwaters of C.J. Strike Reservoir (RM 518 to 521), which is also being operated in a load following mode. During run of river years, operations at Bliss Dam may be altered for up to two days each August for the town of Glenns Ferry's annual Three Island

Crossing event. If needed, flows would be reduced to allow safe crossing of the river. In addition, as described previously in this Opinion, unusual circumstances in any year could require that the Company operate the Lower Salmon and/or Bliss projects in a manner other than run of river up to 16 days total for the projects combined.

As discussed above for the Lower Salmon Falls project, the proposed load following mode of operation at the Bliss project alters aquatic habitat in a number of ways as discussed in detail in the section entitled "General Effects of the Proposed Action" in this document. Within riverine systems, the shallow-water, benthic habitats are typically the most species diverse and productive. The frequent disturbance brought about by load following operations, daily dewatering and inundation, do not allow the normal benthic communities or ecological processes to become established and/or scour the substrates during the daily peak water releases. Under these conditions, primary productivity, the establishment and growth of algae and other plants, is inhibited (due to dewatering and/or scouring) and the diversity greatly diminished. Periodic exposure and scouring reduces the diversity and abundance of primary producers (food base), making the zone of dewatering largely unusable to all but a subset of the resident benthic grazers, including snails. In addition, any organisms that are able to colonize this zone during periods of inundation may become stranded during the rapid dewatering and exposed to seasonal temperature extremes that are likely to result in their injury or death. During all but the two years of load following, river stage changes will be a result of flow alterations unrelated to project operations. Under those run-of-river operations, the adverse effects of dewatering by the Company will be avoided.

Degraded water quality will result in the physiological stress of these snails that may affect the species' reproduction, survival, and numbers. Impaired water quality due to Bliss Reservoir may have some adverse affect on the listed snails that occur below the dam, but the Service concludes that the water quality degradation is insignificant relative to the other upstream sources of water quality degradation (e.g., municipal and industrial waste water, agriculture returns, and fish farms). The contribution of spring tributaries in the Hagerman Reach likely help to offset poor water quality from upstream reservoirs and other water uses.

a. Idaho Springsnail

The Commission determined that operation of the Bliss Project, as proposed, is likely to adversely affect Idaho springsnail; the Service concurs with this determination.

Various Company reports (Shinn 2002, as revised 2003) have described colonies of this species at five river locations: above Grandview to C.J. Strike Dam, two colonies within C.J. Strike Reservoir; at Celebration Park; and near the town of Weiser. The recovery plan for Snake River snails (Service 1995) predates monitoring by the Company and established the recovery area for this species entirely within the Bliss Reach, from upper C.J. Strike Reservoir (RM 518) to Bancroft Springs (RM 553).

The Service still relies on the designated recovery area within the Bliss Reach as the most important part of the historic range of the springsnail and the Service concludes this river reach to be critical to the long term survival and recovery of the Idaho springsnail (Service 1995).

Further, we conclude that data are not sufficient to establish that the species is absent from the action area. Operation of the Bliss hydroelectric facility in a load following mode will impact the entire river reach that lies within the designated recovery area of the Idaho springsnail; this reach represents 91 percent of the total recovery area with the remaining nine percent located within C.J. Strike Reservoir.

Based on the published literature, the Service concludes that operation of the Bliss Project in a load following mode for two years will kill and harm Idaho springsnails. Load following operations conducted at Bliss Dam will strand and expose Idaho springsnails residing in shallow-water habitats below the dam, resulting in the death or injury of adult snails and their eggs. It will also alter the trophic dynamics of the river (Radford and Hartland-Row 1971, Power et al. 1996), reducing the amount of food available to the snails by frequently dewatering the productive shallow-water zones (when water is withheld) and frequently scouring diatoms, detritus, and other foods from substrates where these snails forage (when water is rapidly released). These impacts could reduce the number of individuals in these populations/colonies to levels that could increase the likelihood of their local extirpation (Terborgh and Winter 1980; Quinn and Hastings 1987). These effects will occur during the two years' load-following operations in the proposed action as amended by the Settlement Agreement, and would generally be avoided during the remaining years when the project will operate in a run of river mode. The exceptions to these operations are described in the Proposed Action section of this Opinion and in Attachment 2 of the Agreement. Each year, during August, Idaho springsnial may be affected by altered operations for up to two days if the Company receives a request to reduce flows to facilitate safety during the Three Island Crossing events. During any run of river year, for up to 16 days at this project and Lower Salmon Falls combined, operations may involve dewatering of snail habitat and associated effects on Idaho springsnails. Given the limited frequency and duration of these unusual events, the severity and significance of the impacts may be attenuated. Still, these represent chronic and repeated impacts that could limit the numbers and distribution of Idaho springsnails.

b. Utah Valvata

The Service concurs with the Commission's determination that the proposed action may affect, but is not likely to adversely affect the Utah valvata. This determination is based primarily on the fact that the current distribution of the Utah valvata lies upstream of the Bliss Project, the closest known colonies being located in Upper Salmon Falls Reservoir (IPC 1995; R. Myers, IPC, in litt., 2004).

c. Snake River Physa

The Commission determined that the proposed operation of the Bliss Project is likely to adversely affect the Snake River physa. The Service does not concur with this finding, concluding instead that the proposed operation as modified by the Settlement Agreement is not likely to adversely affect this species. This is primarily because the minimum flows are sufficient to assure that neither the snails or their habitat would be dewatered during project operation.

The Bliss and Lower Salmon Falls area was noted by Taylor (1982c) as the primary known range of this species. The rarity of the Snake River physa makes it difficult to assess the current status of this species. Early, unconfirmed sightings by the Company (Cazier 1997a) notes that the species had only been located three times in two years, in each case near turbulent, deeper water on large rocky substrates. More recent surveys of some of the type localities of this snail failed to locate it (Frest, pers. comm., 2003). The Snake River physa has been reported from only the main channel of the Snake River and is not known to occupy spring or tributary habitats. Taylor (1988) reported that it had been extirpated from the Grandview area because of extensive deposition of sediment and reduced water quality.

Although the recovery area for this species has been designated from Bancroft Springs to Lake Walcott (RM 553 to RM 675) (Service 1995), most observations and the only confirmed live specimens of the Snake River physa have come from the Lower Salmon Falls reaches, live animals being collected in the area of Frank Lloyd Wright Rapid and Snake River Pottery (approx. RM 570) (Taylor 1988). Surveys conducted by the Company recorded the Snake River physa on two or three occasions over two years within the Lower Salmon Falls and Bliss reaches (Cazier 1997a, 1999a), but these were unconfirmed. There are no records of live Snake River physa being collected from the Bliss reach, only empty shells having been recovered.

Under the proposed action, during the two years of load following operations, tailwater depths below Bliss Dam will vary by as much as 6 ft per day, but, as proposed, should not drop below 4,500 cfs leaving the dam. This flow volume equates to a stage depth of seven (7) ft as measured below Bliss Dam at USGS gage 13154500. Taylor (1982c) states that the Snake River physa typically occurred in water depths of 3 ft or more on rocky substrates in fast-flowing water. It is likely the physa is present in the project area, but there are no records of live Snake River physa being collected from this river reach. Therefore, it cannot be definitively determined what volumes of water are needed to ensure colony protection. Review of the Company operations records from July of 1961 (when live Snake River physa were collected upstream below the Lower Salmon Falls Project) indicate the water volumes released were substantially greater than those released from Lower Salmon Falls Dam in the years prior to the specimens' collection (with lows of 960 cfs and 0 (zero) cfs in 1960 and 1958 respectively). Despite these prior low flows, live snails were collected in 1961. The guaranteed minimum flow of 4,500 cfs for the Bliss project is greater than the flows that were present when live snails were collected and greater than many flows provided in the past. The proposed flows appear to be substantially greater than when these snail had been collected upstream in 1961 and the early 1980s. Given this species' deep-dwelling habits, these flows should be sufficient to ensure that any extant colonies of Snake River physa in this reach remain submerged. As such, the risk of adverse effects is insignificant.

d. Bliss Rapids Snail

The Service agrees with the Commission's determination that issuing a license to operate the Bliss project, as proposed, would likely have adverse effects on the Bliss Rapids snail. The most prolific known colonies of the Bliss Rapids snail occur in cold water springs (e.g., Thousand Springs, Box Canyon, Banbury Springs), while more sparsely populated colonies occur in the main stem of the Snake River. Most known river colonies of these snails are located between

Clover Creek (approximate RM 547.5) and Banbury Springs (RM 589), a river stretch heavily influenced by cold water springs. The designated recovery area for the Bliss Rapids snail lies between RM 547 and RM 585 (Service 1995) and includes all of the Bliss Project. Bliss Reservoir encompasses 13 percent of the designated recovery area but is currently unsuitable for habitation by the Bliss Rapids snail. Of the suitable river habitat within the recovery area, the Bliss reach accounts for about 50 percent; all of it subject to daily load-following fluctuations for two years under implementation of the proposed action. Colonies of the Bliss Rapids snail are most numerous in the river reach and in springs upstream of Bliss Reservoir. Colonies of this species below Bliss Dam are known from the mouth of Clover Creek (RM 547), Bancroft Springs (RM 553), "Zig-zag" (RM 568.5), and Ken's Rock (RM 555.3) (Hershler et al. 1994; IPC, in litt., 2004). The Company has collected data on presence/absence and/or the abundance of this species in the Hagerman area from below Lower Salmon Falls (RM 570) to Bancroft Springs; these data include some information about the long-term persistence of selected Bliss Rapids snail colonies (Cazier 2001, as revised 2003).

Given the distribution and the frequent occurrence of the Bliss Rapids snail in shallow-water habitats (Frest and Johannes 1992a; Hershler et al. 1994), the load following mode of operation proposed for the Bliss Project will adversely affect populations/colonies of this species in the river reach below Bliss Dam. Load following operations conducted at Bliss Dam will strand and expose Bliss Rapids snails residing in shallow-water habitats below the dam, resulting in the death or injury of adult snails and their eggs. Load following operations will alter the trophic dynamics of the river (Radford and Hartland-Row 1971; Power et al. 1996), reducing the amount of food available to the snails by frequently dewatering the productive shallow-water zones (when water is withheld) and frequently scouring diatoms and other foods from substrates where these snails forage (when water is rapidly released). These impacts will reduce the population size of these subpopulations/colonies, both in the main stem and spring tributaries, to levels that increase the likelihood of their local extirpation (Soulé 1980, 1987.

Terborgh and Winter 1980; Shaffer 1981; Quinn and Hastings 1987; Fagan et al. 2002). In summary, during the two years load-following operation the viability of the river populations/colonies will be compromised relative to snail populations that have stable (e.g., natural or run-of-river flows), shallow-water habitats. These same effects may occur during unusual operations, as described in this Opinion and Attachment 2 of the Settlement Agreement, for up to 16 days each run of river year at this project and the Bliss Dam combined. Flows from the Bliss Dam may also be regulated for the Three Island Crossing event for two days each August. Given the limited frequency and duration of these unusual events, the severity and significance of the impacts may be attenuated. Still, these represent chronic and repeated impacts that could limit the numbers and distribution of Bliss Rapids snails.

Monitoring of Bliss Rapids snails at various locations has shown colonies within the Snake River to be much smaller (less densely populated) than those within spring and tributary habitats (Shinn 2002, as revised 2003). Not only are Bliss Rapids snails less numerous in their Snake River colonies, but these colonies appear to be more ephemeral in nature, disappearing from locations where they had been recorded during previous visits (R. Myers, IPC, in litt., 2003; Stephenson and Bean 2003), while colonies in springs and tributaries appear to be stable and/or persistent (Frest and Johannes 1992a; Stephenson and Bean 2003). The more ephemeral nature

of river-dwelling colonies is likely due to numerous factors that include water quality, fluvial dynamics, and river regulation (including load following). Given the low densities of Bliss Rapids snails within the main stem of the Mid-Snake, load following operations could contribute to the local extirpation of colonies. However, recolonization from tributaries or springs in the action area may occur.

5. C. J. Strike

C.J. Strike Dam is located at RM 494, about 66 miles below Bliss Dam. C.J. Strike Reservoir extends upstream for about 27 miles to RM 521. Under the proposed action, the facility will operate in a load following mode for the life of the license. Depths will fluctuate by 1.5 ft and 4 ft per day for the reservoir and tailrace respectively (FEIS). The load following effects from this project extend upstream of the dam to the headwaters of Reservoir (RM 521) where it meets the Bliss Reach (which is also influenced by load following operations). River stage fluctuations resulting from load following at C.J. Strike are attenuated with increasing distance from the dam. Records from Swan Falls Dam (approximately 37 miles downstream of C.J. Strike) indicate substantial attenuation of load following within this river segment (Fig. 7).

The proposed load following mode of operation of C.J. Strike alters aquatic habitats in a number of ways as discussed in detail in the section entitled "General Effects of the Proposed Action" in this document. Within riverine systems, the shallow-water, benthic habitats are typically the most species diverse and productive. The frequent disturbance brought about by load following operations, daily dewatering and inundation, do not allow the normal benthic communities or ecological processes to become established and/or scour the substrates during the daily peak water releases. Under these conditions, primary productivity, the establishment and growth of algae and other plants, is inhibited (due to dewatering and/or scouring) and the diversity greatly diminished. Periodic exposure and scouring reduces the diversity and abundance of primary producers (food base), making the zone of dewatering largely unusable to all but a subset of the resident benthic grazers, including snails. In addition, any organisms that are able to colonize this zone during periods of inundation may become stranded during the rapid dewatering and exposed to seasonal temperature extremes that are likely to result in their injury or death.

At this time, no controlled field experiments have been conducted to determine the impacts of load following on the aquatic snails of the Snake River. However, comparative studies of habitat dewatering from hydroelectric operations elsewhere have demonstrated the negative effects of these conditions on other aquatic invertebrates as discussed above under the "General Effects of the Proposed Action" section of this document. More specific research on these effects on the listed snails of the Snake River is planned as part of the 2004 Settlement Agreement between the Company and the Service (Agreement 2004).

Degraded water quality will result in the physiological stress of these snails that may affect the species' reproduction, survival, and numbers. Impaired water quality due to C.J. Strike Reservoir may have some adverse affect on the listed snails that occur below the dam, but the Service concludes that the water quality degradation is insignificant relative to the other upstream sources of water quality degradation (e.g., municipal and industrial waste water, agriculture returns, and fish farms).

a. Idaho Springsnail

The Commission determined that operation of the C.J. Strike Project, as proposed, is likely to adversely affect Idaho springsnail and the Service concurs with this determination. Company reports (Shinn 2002, as revised 2003; Stephenson and Bean 2003) have described colonies of this species at five river locations: above Grandview to C.J. Strike Dam, two colonies within C.J. Strike Reservoir; at Celebration Park; and near the town of Weiser. The recovery plan for Snake River snails (Service 1995) predates monitoring by the Company and established the recovery area for this species entirely within the Bliss reach, from upper C.J. Strike Reservoir (RM 518) to Bancroft Springs (RM 553). Although the discovery of colonies within and downstream of C.J. Strike Reservoir are promising, their size, relationship with other colonies, and long-term viability have not been established.

Operation of the C.J. Strike Project will have negative effects on habitat within nine percent of the Idaho springsnail's designated recovery area (Service 1995). The remaining 91 percent lies within the area of the Bliss hydroelectric facility. Colonies of springsnails that occur downstream of C.J. Strike, outside of the designated recovery area, will be subjected to frequent dewatering from load following operations. Based on published and grey literature, the Service concludes that operation of the C.J. Strike Project in a load following mode will kill and harm Idaho springsnails. Load following operations conducted at C.J. Strike Dam will strand and expose Idaho springsnails residing in shallow-water habitats below the dam, resulting in the death or injury of adult snails and their eggs. It will also alter the trophic dynamics of the river (Radford and Hartland-Row 1971; Power et al. 1996), reducing the amount of food available to the snails by frequently dewatering the productive shallow-water zones (when water is withheld) and frequently scouring diatoms, detritus, and other foods from substrates where these snails forage (when water is rapidly released). These impacts will reduce the number of individuals in these subpopulations/colonies to levels that could increase the likelihood of their local extirpation (Terborgh and Winter 1980; Quinn and Hastings 1987).

b. Utah Valvata, Snake River Physa, and Bliss Rapids Snail

Early surveys noted the presence of other listed snails in the Snake River as far downstream as Grandview. These include the Utah valvata (Taylor 1982d) and the Snake River physa (Taylor 1982c). However, neither of these species is believed to currently occupy habitats below C.J. Strike. For this reason, the Service concurs with the determination of the Commission that neither the Utah valvata nor the Snake River physa are likely to be adversely affected by the licensing and proposed operation of the C.J. Strike Project. We note that the Commission concluded that relicensing the project would have no effect on Bliss Rapids snail.

D. Summary of Project Effects

Operation as proposed is anticipated to adversely affect Utah valvata at Upper Salmon Falls due to occasional drafting of Lower Salmon Falls Reservoir. The lack of adverse affects to most of the snail species at the Shoshone and Upper Salmon Falls projects is due to the fact that these

species are not found within the area affected by the project (e.g., the Idaho springsnail) and the fact that these projects operate in a run-of-river mode that mimics natural flow conditions.

Operation of the Lower Salmon Falls Project, as proposed, will adversely impact the Bliss Rapids snail. Adverse affects will be due to the load-following mode of operation that will result in instantaneous drops in water level in the tailwater river reach. These rapid and dramatic changes in water level will strand and expose snails and their eggs residing in shallow-water habitats; result in reduced food productivity in the zone of dewatering; and frequently scour habitats making them less suitable for occupation by snails or their food resources. The effects on Snake River physa are anticipated to be insignificant or discountable since the proposed minimum flows will ensure that deeper water habitats are not exposed.

Operation of the Bliss Project, as proposed, will adversely affect the Idaho springsnail and the Bliss Rapids snail. Adverse affects will be due to the two years load-following mode of operation that will result in instantaneous drops in water level in both the reservoir and tailwater river reach. These rapid and dramatic changes in water level will strand and expose snails and their eggs residing in shallow-water habitats; result in reduced food productivity in the zone of dewatering; and/or frequently scour habitats making them less suitable for occupation by snails or their food resources. The effects on Snake River physa are anticipated to be insignificant or discountable since the proposed minimum flows will ensure that deeper water habitats are not exposed.

Operation of the C.J. Strike Project will adversely affect the Idaho springsnail. Adverse affects will be due to the load-following mode of operation that will result in instantaneous drops in water level in both the reservoir and tailwater river reach. These rapid and dramatic changes in water level will strand and expose snails and their eggs residing in shallow-water habitats; result in reduced food productivity in the zone of dewatering; and frequently scour habitats making them less suitable for occupation by snails or their food resources.

E. Cumulative Effects

Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Endangered Species Act.

A large number of activities take place in south central Idaho that have effects on the four listed snails considered here, as described in the Environmental Baseline section of this document. Many of those activities (such as agriculture, aquaculture, sewage treatment, degradation of springs, and contaminants) will continue into the future and as such their impacts constitute cumulative effects. The effects associated with these activities will continue to threaten the persistence of the snail species considered herein. In addition, a number of human activities that affect these species are likely to increase in the future, increasing the potential adverse effects on snails and their habitats.

1. Agriculture

Agriculture is extremely important to the economy of the Mid-Snake region. Irrigated croplands are pervasive in the region and contribute to factors that adversely affect the listed snail species and their habitats in several ways: diversion of water from the Snake River, evaporation of water from reservoirs and irrigation canals, runoff and return of irrigation water polluted with pesticides and fertilizers, depletion of groundwater through pumping, and wind and water erosion of disturbed soil. In addition, livestock operations adversely affect water quality in the Snake River, through erosion of range, containment, and pasture lands, and runoff from these operations. Spring habitats important to snails are also being adversely affected by livestock. Although many agricultural activities may require consultation under section 7 of the Act, there will be no Federal nexus for numerous other activities.

Most of the water used for agriculture that is not lost to evaporation, evapotranspiration, photosynthesis, or groundwater recharge, are returned into the Snake River via return canals or from aquifer-derived springs. Irrigation water discharging to the river undergoes considerable physical and chemical changes since its diversion from the river or being pumped from the aquifer. Changes include warming, nutrient enrichment due to fertilizer use, elevated levels of contaminants from pesticide use, elevated turbidity, and transport of substantial amounts of sediment. These effects will contribute to the continued significant degradation of water quality in the Snake River over the long-term.

All of these activities and their impacts on snails (as described in detail in the Environmental Baseline section of this Opinion) will continue into the future, and it is reasonable to expect that there may be increases in some of those activities. For instance, there have been recent proposals to develop large-scale hog farms in the region. These operations are known to have significant issues related to animal waste and water pollution. Given population increases in southern Idaho, it is reasonable to anticipate that there will be increased demands for agricultural products. Associated with that are likely to be increased input of polluted water from non-point agricultural sources that will further degrade water quality in the Snake River and its tributaries.

Diversion of Snake River water for irrigation is not presently expected to decrease in the life of the proposed new licenses for the four Mid-Snake hydroelectric projects considered herein. The region's water is over-allocated in general, and adjudication of Snake River water rights is underway in an effort to reconcile competing water uses. The State of Idaho does not recognize in-stream flows for fish and wildlife as a designated beneficial use, so it is likewise unlikely that diversion will decrease for the purpose of improving aquatic habitats.

2. Aquaculture

Private fish culture facilities, raising fish for commercial use, will continue to operate in the action area and continue to contribute to impaired habitat quality and quantity for listed Snake River snails. Water that historically was exceptionally clean and cold and provided pristine habitat for snails and other native aquatic species is degraded by its use in raising and processing fish. Water is diverted from springs through aquaculture facilities and discharged at down gradient locations. The quantity and quality of spring habitats are reduced as water flows are

reduced or contaminated. In addition, return water from fish farms is considerably warmer and polluted with fish and fish food waste, processing waste, disinfectants, bacteria, and drugs used to control disease. Aquaculture facilities contribute significant amounts of sediment and nutrients (nitrogen and phosphorus) to springs and the Snake River (Brockway in EPA 2002). Approximately 80 aquaculture facilities currently operate under permit (Clean Water Act, NPDES) by the EPA (see section on Past Consultations), but NPDES permits are only required for facilities that produce greater than 20,000 pounds per year of cold water fish, more than 5,000 pounds of warm water fish in any one calendar month, or greater than 100,000 pounds of warm water fish per year, and aquaculture facilities that produce quantities below these are not required to obtain a Federal permit. At this time there are likely only a few such aquaculture facilities, but it is anticipated that this number will grow (Fromm, USEPA, in litt. 2003). For this reason, numerous commercial fish farms will have adverse effects on the listed Mid-Snake snails and their habitat, and constitute a cumulative effect.

3. Urban and Rural Development

There has been significant population growth in the Mid-Snake region, and efforts are ongoing by communities and businesses to draw more new residents to the area. It is reasonable to expect that the human population in south central Idaho will continue to increase, and with it the effects on listed Snake River snails and their habitats. Urban and rural land uses for residential housing, and commercial, industrial and recreational activities like boating and golf all contribute pollutants and sediment to the groundwater and to the Snake River and its tributaries. With urban growth will come an increased demand for surface and ground water. Impacts of urban development and growth will play an increasingly important role in degradation of aquatic habitat and threats to listed molluscs.

4. Unlicensed Hydroelectric Project at Thousand Springs

A critically important spring habitat for listed snails, Thousand Springs, is the site of an unlicensed hydropower facility located in the Shoshone Reach at RM 584.7. Thousand Springs provides essential habitat for the endangered Banbury Springs lanx, which is restricted to such cold water spring habitats. and is a stronghold area for the Utah valvata, and the Bliss Rapids snail. Diversion of spring waters into the hydropower facility has an ongoing effect on listed snails by altering flows and the distribution of water. The Service has observed operational practices that are of concern because of their potential direct effects on listed snails. As an example, during maintenance activities conducted in May of 2002, all flows were diverted from the generators and discharged into an area of the spring where normal flows are typically of low volume (Fig. 16). This rapid and voluminous inundation almost certainly had negative impacts on the resident snails.

The Thousand Springs hydropower project has been in operation since 1912. Because this facility predates the Federal Power Act and is not licensed, the Company is not obligated to provide information on its operation or potential impacts. For this reason, little is known about the number of spring sources that have been harnessed or the amount of snail habitat lost. However, it appears that the majority of spring flows at this location have been captured for hydropower generation. Extensive surveys of non-diverted subsprings in this spring complex

conducted in 1991 documented a diverse and abundant population of rare mollusks (Frest and Johannes 1992a). Whether or not current operations of the Thousand Springs Power Plant are resulting in snail mortality or degradation of their habitat is not known at this time. However, it is highly likely that operations of this facility could be modified in ways that would greatly improve the quality of this important habitat and contribute to the conservation of the resident listed snails.

5. Contaminant Spills

Large scale contaminant spills represent a catastrophic event that may impact extensive areas of habitat, and are of significance where populations of snails are small and/or localized. They present a serious concern in that while they may not occur for many years, in the event that one does occur it could impact water resources throughout a substantial portion of the Snake River and the severity of the impacts could be serious depending on the nature of the contaminants involved. Such spills are likely to injure and kill snails through direct toxicity as well as by impacting the food base and degrading other needed habitat parameters (e.g., contamination of substrates). Examples include the petroleum leaks at the Burley Terminal and the Gentry Subdivision PCB Site in Marsing in 1998 (Service files, 1998). Although it is not known specifically how either of these particular spills may have impacted listed snails, the toxicity of such materials is not in question. These examples illustrate the potential for toxics-induced mortality and habitat degradation within the Mid-Snake and elsewhere along the Snake River. Other western river systems have been exposed to contaminant spills with devastating effects (e.g., John Day River, Oregon, Service et al. 1991; Upper Sacramento River, California, CDFG 2000). Although they are largely unpredictable, large-scale contaminant spills have occurred in the past, and continuing or increased human activity associated with agriculture, aquaculture, and urban and rural development make it likely they will occur in the future. Taylor (1982a, c, d) suspected a prior toxicant spill as an explanation for the large deposits of empty shells of listed and common snails in the area below Grandview on the Snake River.

6. Water Quality Improvement Efforts

The Idaho Division of Environmental Quality, under authority of the State Nutrient Management Act and in coordination with the EPA's Clean Water Act section 303(d) process, is undertaking efforts to identify and implement actions which will reduce nutrient loading to the Mid-Snake below Milner Dam. These efforts are intended to address pollution control strategies for this section of river through several of the following program areas: State Agricultural Water Quality Program, Clean Water Act section 401 Certification of Projects, Bureau of Land Management resource management plans, the State Water Plan, and local ordinances. Despite these efforts to better comprehend and halt the deterioration of water quality in the Mid-Snake, it is unlikely these programs will reverse the present downward trend in the short term. There is no certain schedule for funding and implementation of recommended measures to improve water quality, as outlined in comprehensive resource management plans for the Snake River. In the meantime, as noted above, there are new and increasing sources of pollutants to the Snake River and its tributaries, including via the Snake River aquifer, and not all of these sources will be subject to Federal oversight.

7. Summary of Cumulative Effects

Ongoing and increased human activities in the action area are likely to alter the quality and quantity of surface waters of the Snake River and its tributaries, and reduce the quality of spring habitats through ground water depletion, diversion of flows, and the infiltration of degraded water from irrigation. As we have noted elsewhere in this document, there is a paucity of reliable information available to assess population trends for the four snail species considered herein. There is, however, substantial data indicating that snail habitat quality and quantity is degraded and is trending toward increased degradation.

Of most concern in terms of future impacts to listed Snake River snails is ground water depletion, the introduction of polluted waters into the aquifer, and the associated decline in the quality of spring habitats. These effects are particularly significant for stronghold habitats of listed snails and other aquatic life that are dependent on spring habitats. There is growing evidence that these strongholds are not protected from anthropogenic and/or natural impacts, and that degradation of water quality, especially, is increasing in severity. The Utah valvata and Bliss Rapids snail are associated to varying degrees with spring habitats and are vulnerable to reduced flows and degraded water quality in them. At this time, Bliss Rapids snail colonies in spring habitats are more common and densely populated than those in the main channel of the Snake River, likely because of the higher quality habitats in the spring systems. With the ongoing trend of decreasing water quality in spring habitats, strongholds for this species can reasonably be expected to be progressively impaired. This will affect the distribution and resilience of the species overall, as these strongholds are likely source habitats for colonies in the main channel of the Snake River into the foreseeable future.

Habitat quality in the main Snake River channel is not likely to improve measurably in the near future because efforts to address water quality problems are likely to be offset by increased human activity in the region. Available information indicates that sediment and chemical and nutrient pollution input to the river will continue to degrade habitat quality for listed Snake River snails over the life of the proposed licenses (EPA 2002). Timing and levels of flow in the river are affected by a suite of activities, and, at best, the status quo will be maintained with respect to non-Federal activities. Overall, the suite of threats to the snail species that inhabit the main channel will likely increase during the life of the proposed actions under consideration in this document.

The Snake River physa occurs only in the main stem of the Snake River. It is rarely encountered and poorly understood, though it seems to be dependent upon deeper water more than the other snail species found in the Mid-Snake. Changed stream dynamics and continued water quality impairment represent ongoing and increasing threats to the species.

The Idaho springsnail is confined to permanently flowing waters of main channel habitats within the Snake River and C.J. Strike Reservoir. Although the species' range and numbers may now have been extended and increased, populations of springsnails are limited in size and are at risk of continued and increased degradation to the Snake River.

Likewise, the Bliss Rapids snail is found in unimpounded reaches (as well as spring habitats) and is vulnerable to dewatering of near-shore, shallow water habitats. Its depressed numbers in the main stem of the Snake River, compared to springs, indicate that they are being adversely affected by impaired river conditions. As noted above, degradation of spring habitats is ongoing and represents a significant threat to stronghold populations of the main channel. The Utah valvata, while evidently able to tolerate reservoir habitats, is frequently found in near-shore habitats where a number of non-Federal actions contribute to threats to its habitat quality and quantity

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VI. CONCLUSION

The Service has evaluated the current status of listed Snake River snails, the environmental baseline in the action area, effects of the proposed action as modified by the Settlement Agreement, along with cumulative effects, and we conclude the proposed action will not jeopardize any threatened or endangered species. The Service anticipates adverse effects from the proposed action on three species of Snake River snails, the Idaho springsnail, Utah valvata, and Bliss Rapids snail. It is our opinion that relicensing the Upper Salmon, Lower Salmon, Bliss, and C.J. Strike is not likely to jeopardize the continued existence of the three species. None of the individual projects would reduce the reproduction, status, or distribution of any of the species to a point where the likelihood of their survival and recovery is appreciably reduced. We also conclude that the projects in combination do not jeopardize the species. Specific rationales for our conclusions for each of the three species are provided below.

Our conclusions are based on the best available scientific and commercial information available. The Settlement Agreement between the Service and the Company modifies the proposed action as proposed by the Commission. Under the terms of the Agreement, studies will be undertaken during the first five years of the new licenses for the projects considered in this Opinion. The Service anticipates that the information gathered will refine our understanding of how operating the projects affects listed snails, enabling us to address some of the uncertainties about the species' status and distribution and their responses to the proposed action. When those data have been gathered and interpreted, it may be necessary to revisit the conclusions drawn in this Opinion. If that is the case, the Service would advise the Commission to reinitiate consultation at that time. It is our position, based on current knowledge and our analysis of the effects of the action as proposed, that in the first five years of the license none of the species will have declined irretrievably. Any new information can be considered under section 7 of the Act in sufficient time to consider alternative actions, and the species would still be viable at that time.

A. Idaho Springsnail

Relicensing the Bliss and C.J. Strike projects as proposed, including implementation of the Settlement Agreement, will have adverse effects on Idaho springsnail. Adverse effects on Idaho springsnail are anticipated to result from flow fluctuations associated with load following operation at both projects. Similar effects when the Company alters operations in response to unusual circumstances, including managing flows for two days each August for the Three Island Crossing event. Other exceptional circumstances are anticipated to affect operation of the Bliss and Lower Salmon Falls projects combined for up to 16 days a year; some or all of which could involve the Bliss project and affect Idaho springsnail. The Service concludes that these effects

will not jeopardize the species, as they will not appreciably reduce the likelihood of survival and recovery of the species. While the reproduction, distribution, and numbers of the Idaho springsnail are not well understood, it is the Service's opinion that the projects' effects will not reduce them to a point where there are local or broad scale extirpations. This is based on the following lines of evidence.

First, the species is unlikely to be confined to the dewatered zones, so not all individuals present would be directly affected by load following and other manipulation of water levels. Information on the depth distribution of the Idaho springsnail is limited, but based on preliminary numbers provided by the Company (IPC, unpub. data, 2003), this species occupies depths up to seven ft (deeper zones were not sampled or reported), both in reservoirs (C.J. Strike) and at least one river location (Grandview). The data provided are inconclusive with regard to determining if there is a preferred depth of habitation for this species, or if load following influences depth distribution.

Second, data suggest that Idaho springsnails likely have some tolerance to exposure from load following operations. Based on the persistence of Idaho springsnail colonies within the C.J. Strike Reservoir and downstream areas, the Service has determined that the proposed operation of the Bliss and C.J. Strike projects will not jeopardize the continued existence of the Idaho springsnail. For example, at least one large and densely populated colony of springsnails occurs below the C.J. Strike dam, upstream of the town of Grandview, where changes in river stage due to load following are pronounced (estimated at 2.9 ft maximum daily fluctuation; Stephenson and Bean 2003). Despite regular load following operations from 1997 to present (IPC, unpub. data, 2004b), monitoring has shown this colony to have persisted throughout this period. Although regular load following has occurred at this location, the persistence of such a colony suggests that stage fluctuations do not pose an immediate threat of extinction to this or other colonies that occur further down stream (e.g., Celebration Park, Weiser) where the effects of load following become greatly attenuated (Fig. 7; IPC, unpub. data, 2004a). Also, the sediment-dwelling nature of this snail may provide it some refuge from extreme air temperatures when its habitats become dewatered.

Third, load following effects on Idaho springsnail will be limited in time and location. At the Bliss project, load following operations will occur during two of the first six years of the new license. In other years, the species will not be subjected to effects of water level fluctuations associated with operations at Bliss except during unusual events. Such exceptional operations are expected to occur no more than 16 days per year, between the Lower Salmon Falls and Bliss projects combined. C.J. Strike Reservoir goes through minimum stage fluctuations, 1.5 feet under the proposed action, so planned operations will not result in the dewatering of most of the snails present there.

B. Utah Valvata

The Service anticipates adverse effects to Utah valvata from operation of the Upper Salmon Falls project. The effects are associated with stage fluctuations in the reservoir; individuals and colonies of the species are expected to be affected by exposure associated with dewatering of a 0.4 foot zone of the reservoir. Because the species has been noted to occur at depths ranging from 5 to 45 feet, only a small portion of suitable habitat at Upper Salmon Falls Reservoir will

be affected by proposed operations. In addition, project site represents a relatively small part of the overall range of the Utah valvata. The species is widely distributed in the Middle Snake River, ranging from American Falls and Lake Walcott above the project and Thousand Springs and Box Canyon Spring below. Given this, the impacts at Upper Salmon Falls are not expected to have a significant effect on the numbers, distribution, or reproduction of the species.

C. Bliss Rapids Snail

Bliss Rapids snails occur below the Lower Salmon and Bliss projects, but not in the reservoirs of the two projects. As described in this Opinion, the projects, as proposed, will affect the species during two of the first five years of the licenses, when load-following operations will take place. Also, exceptional circumstances are anticipated to affect operation of the Bliss and Lower Salmon Falls projects combined for up to 16 days a year during all other years. Bliss Rapids snails that are present in the fluctuation zones will be subjected to desiccation and other exposure effects when river levels drop and may be subject to adverse effects of flushing flows. The species may be harmed by being precluded from habitat that is subject to exposure during load following. The Service expects that changes in food base associated with load following will also affect the snails. The Service anticipates that there may be some local extirpations in the action areas of the Lower Salmon and Bliss projects. It is the Service's opinion that these adverse effects will not rise to level of jeopardy to the species, based on the following rationales.

First, the colonies affected represent a relatively small portion of the range of the species. Bliss Rapids snails occur in multiple areas outside the action area, particularly in springs and tributaries to the Snake River.

Second, under the present baseline conditions, riverine colonies of the snail appear to be less important to the species' long-term survival than spring and tributary colonies (Shinn 2002, as revise 2003; Frest and Johannes 1992a; Stephenson and bean 2003). Colonies in the river's main channel have been observed to be smaller and less persistent than those in springs and tributaries (R. Myers, IPC, in litt., 2003). In the river, they are subjected to more flow fluctuations and greater impacts on water quality, especially large variations in temperature. By contrast, the springs and tributaries provide a more stable environment in terms of water quality and quantity. While springs and tributaries where Bliss Rapids snails are affected by human activity and are not in pristine condition in all cases, they continue to support large densities of the snail. Several springs where Bliss Rapids snails occur are protected to some extent, including the Thousand Springs Preserve, Box Canyon Springs, Banbury Springs, and the Malad River.

Third, in addition to supporting important colonies that are not affected by the Lower Salmon Falls and Bliss projects, springs, and tributaries may serve to offset effects of local extirpations. It is likely that river colonies currently rely, to some degree, on recruitment of snails from spring and tributary sources. It is also likely that the densely populated spring and tributary habitats provide some degree of recruitment (i.e., rescue effect; Brown and Kodric-Brown 1977) to the river colonies/populations. Thus, with load following occurring only under limited conditions early in the licenses, where Bliss Rapids snails may recolonize areas where the projects cause elimination of colonies. As such, local extirpations from the projects may be temporary in nature.

Fourth, although the river reach below Lower Salmon Falls and Bliss dams have been subjected to intensive periods of load following since the dam's licensing in 1910, river colonies of Bliss Rapids snails have managed to persist in these reaches. While it is clear that they are affected by the projects, to date they have not been eliminated from the action area indicating some tolerance and resiliency of the species from the effects of the two projects.

VII. INCIDENTAL TAKE STATEMENT

Section 9 Federal regulations pursuant to Section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, unless special exemption is granted. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of Section 7(b)(4) and Section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

In general, take resulting from the proposed actions will be in the form of death, injury, and harassment to listed snails and their eggs exposed to air, extreme temperatures, and excessive predation during periods of dewatering. Snails may be harassed when flows and water velocities are rapidly increased during load following and unusual operations. Harm may occur to listed snails, resulting from the above activities, when their habitat is exposed to air during rapid flow reductions or exposed to shearing water flows during rapid flow increases. This harm is expected to be associated with reduced production of periphyton and other plant food within the dewatered zone.

Amount and Extent of Take Anticipated

1. Considerations in Determining Amount of Take

Quantification of anticipated take of the three species of listed snails at four hydroelectric projects in the Middle Snake River is difficult. As noted previously in this Opinion, no reliable density estimates are available for the species in the action area or elsewhere in their ranges. The listed Snake River snails exhibit great variation in numbers over temporal and spatial scales, exhibiting seasonal variation in numbers and occurring in patchy distributions (uneven distribution of colonies and clumped distributions within colonies), and neither the Service or the Company know how many colonies occur in the river reaches that will be affected.

Relicensing the Bliss and C.J. Strike projects is expected to result in incidental take of Idaho springsnail. No density estimates for this species are provided for colonies in the river reach

below the Bliss Project, all colony density estimates being obtained from colonies in C.J. Strike Reservoir and downstream of that facility. Monitored river colonies downstream of C.J. Strike had maximum densities of 56 to 584 snails per square meter. These estimates are derived from uniform censored counts (15-minute) and may underestimate the total number of individuals per unit area (Shinn, as revised, 2002). Due to temporal (seasonal) and spatial (patchy distribution of colonies and clumped distributions within colonies) variation (sampling frequently recovered no snails), developing an exact estimate of take is further complicated by the variation in magnitude and frequency of operations-related disturbance events (e.g., dewatering and elevated flows), and neither the Service or the Company know how many colonies occur in the river reaches that will be affected.

Likewise, few density estimates are available for the Utah valvata in the Mid-Snake. All density estimates for this species in this region of the river have come from the known colony at The Nature Conservancy's Thousand Springs Preserve, located between the Shoshone and Upper Salmon Falls projects. Frest and Johannes (1992a) provided a mean estimate of 8.8 snails per m^2, while Company estimates have ranged from 0.8 to 113.6 snails per m^2 (Shinn, as revised, 2002). The Service knows of no density estimates for this species within the main stem of the Mid-Snake, and the Thousand Springs colony(ies) likely have higher densities than those in the river. Based on this lack of data in the Snake River, the high variation in densities in known colonies, and the patchy distribution of colonies in river and spring habitats, the Service cannot provide a reliable or defensible estimate of the number of snails that would die or be harassed as the result of relicensing the Upper Salmon Falls Project.

The Company has obtained some data on the densities of Bliss Rapids snail within the main stem of the Snake River in the area of Frank Lloyd Wright Rapid (FLWR) and Bancroft Springs, which are in the Lower Salmon Falls and Bliss reaches respectively. These estimates range from zero to 24.8 per m^2 for FLWR and zero to 9.9 per m^2 at Bancroft Springs (Shinn 2002, as revised 2003). Obtaining sound density estimates to be used for developing estimates of incidental take is unreliable.

2. Amount and Extent of Take: Upper Salmon Falls

The Service anticipates that relicensing the Upper Salmon Falls project will result in incidental take of Utah valvata in the reservoir. Numbers of individuals or colonies that may be affected cannot be quantified. All individuals in the reservoir fluctuation zone will be at risk of incidental take in the form of mortality, injury, harm, and harassment. This will occur within the reservoir (approximate RM 581.4 to 587.2) to a depth of 0.4 ft below the reservoir at full pool (2,878.2 ft from mean sea level; FEIS). This take will occur throughout the life of the license, at all times that the reservoir fluctuates as a result of project operation.

3. Amount and Extent of the Take: Lower Salmon Falls

Incidental take of the Bliss Rapids snail is anticipated to occur in the river habitats below the Lower Salmon Falls project. The form of take is likely to include death, injury, harassment, and harm, and will result from water level fluctuations and periodic increased velocities, both associated with load-following operations and occasional unusual operations. As noted above, the amount of take in terms of snail numbers cannot be estimated, and as such is expressed here

as all Bliss Rapids snails present in the habitat to be dewatered during operations. This will not go below the river stage at the proposed 3,500 cfs minimum flow, which is further defined as a stage level of 5.2 ft as measured at USGS gage 13135000 located below Lower Salmon Falls Dam (Q/Rating Table 7.V1; IPC, in litt., 2003). This take will extend to all individuals present in exposed habitat at that flow/stage level in the river corridor from Lower Salmon Falls to Bliss Reservoir, approximate river miles of 573 to 565. It will occur during load following operations during two of the first five years of the license period, and during no more than 16 days of unusual operations throughout the life of the license, for Lower Salmon and Bliss combined. No such take is anticipated to occur during run-of-river operations proposed for all but two years of the license.

4. Amount and Extent of the Take: Bliss

Incidental take of Idaho springsnail and Bliss Rapids snail is expected to result from relicensing the Bliss Project. The form of take is likely to include death, injury, harassment, and harm, and will result from water level fluctuations and periodic increased velocities, associated with two years load-following operations and occasional unusual operations. Take of both species will occur below the Bliss Dam, upstream of the C.J. Strike Reservoir. As noted above, the amount of take in terms of snail numbers cannot be estimated, and as such is expressed here in terms of the amount of snail habitat to be dewatered. The extent of the take will be all areas dewatered, from maximum river stage to the proposed 4,500 cfs minimum flow. The 4,500 cfs minimum flow is further defined as a stage level of 7.0 ft as measured at USGS gage 13153776 located below Bliss Dam (Q/Rating Table 6.V1; IPC, in litt., 2003), and all exposed habitat at that flow/stage level in the river corridor from Bliss Dam to C.J. Strike Reservoir, approximate river miles of 560 to 518. All individuals associated with this dewatered zone will be subject to incidental take during two years' load following operations in the first five years of the license. Take is also anticipated during unusual operations over the life of the license, expected to occur up to 16 days annually at the Lower Salmon Falls and Bliss projects combined. Some or all of those days could be at the Bliss project. Finally, for up to two days in August each year, there is potential for the Company to operate in a mode other than run of river to accommodate the Three Island Crossing event at the town of Glenns Ferry. Take of all snails in the dewatered zone may occur each year during these unusual operations.

5. Amount and Extent of the Take: C.J. Strike

Relicensing the C.J. Strike project is expected to result in incidental take of Idaho springsnail. The form of take is likely to include death, injury, harassment, and harm, and will result from water level fluctuations and periodic increased velocities, associated load-following operations over the 30 to 50 year life of the license. The location of the expected take is all affected and occupied habitat within the reservoir and downstream. As noted above, the amount of take in terms of snail numbers cannot be estimated, and as such is expressed here in terms of the amount of snail habitat to be dewatered. Incidental take anticipated for C.J. Strike is defined by the amount of snail habitat to be dewatered above the river stage at the proposed 3,900 cfs minimum flow. The 3,900 cfs minimum flow is further defined as a stage level of approximately 4.38 ft as measured at USGS gage 13171620 located below C.J. Strike Dam (Q/Rating Table 3.V1; IPC, in litt., 2003), and all exposed habitat at that flow/stage level in the river corridor from C.J. Strike

Dam to Brownlee Reservoir, approximate river miles of 494 to 339.2. In addition, all Idaho springsnails in the reservoir fluctuation zone of 1.5 feet would be subject to potential take.

B. Effect of the Take

In the preceding Opinion, the Service has determined that the level of anticipated take is not likely to result in jeopardy to the species addressed as a result of implementing the actions as proposed. The Service anticipated adverse effects from the proposed actions on three species of listed Snake River snails, the Idaho springsnail, Utah valvata, and the Bliss Rapids snail. It is our opinion that relicensing the Upper Salmon Falls, Lower Salmon Falls, Bliss, and C.J. Strike facilities is not likely to jeopardize the continued existence of the three species. None of the individual projects would reduce the reproduction, status, or distribution of any of the species to a point where the likelihood of their survival and recovery was appreciably reduced. We also conclude that the projects in combination do not jeopardize the species. Specific rationales for our conclusions for each of the three species are provided in the previous section (VI. CONCLUSION).

Briefly, take of the Idaho springsnail associated with relicensing the Bliss and C.J. Strike projects would be limited to a portion of their habitat within those projects' action areas—the species occurs at depths below their minimum flow levels. In addition, the species appears to have some tolerance to take associated with the projects, as it has persisted in the action area over time. The take associated with the Bliss project would be confined to two years' load following operation and occasional unusual operations. Therefore, while we expect numbers and distribution to be affected by the proposed action, those impacts should not result in significantly reduced distribution or reduced likelihood of the long-term survival of the Idaho springsnail.

Utah valvata will likely be taken incidentally as a result of relicensing the Upper Salmon Falls project, but only a portion of its expected distribution will be affected. Much of the suitable habitat in the reservoir will remain inundated during operation. Also, the species occurs in a number of areas outside the Upper Salmon Falls action area.

Likewise, take of the Bliss Rapids snail at the Lower Salmon Falls and Bliss projects will not diminish the likelihood of the species survival. While local extirpations of the species may result from relicensing these projects, it is widely distributed outside the affected area. In addition, the anticipated take will be confined to two years load following operations over the life of the license and occasional unusual operations. Spring and tributary strongholds of Bliss Rapids snails will contribute to its persistence throughout its range and provide for possible recolonization of habitat in the action area.

C. Reasonable and Prudent Measures

The Service concludes that the following reasonable and prudent measures are necessary and appropriate to minimize take of Idaho springsnail, Utah valvata, and Bliss Rapids snails associated with relicensing the Upper Salmon Falls, Lower Salmon Falls, Bliss, and C.J. Strike projects.

1. Upper Salmon Falls

No measures beyond the proposed action have been identified by the Service as necessary to reduce incidental take of the Utah valvata. The license, as proposed, minimizes incidental take to the extent practicable.

2. Lower Salmon Falls and Bliss

The Service concludes that no measures beyond the proposed action can be taken to reduce or minimize the amount or extent of incidental take of Bliss Rapids snail or Idaho springsnail associated with the two years' load following operations at the Lower Salmon Falls and Bliss projects. For the remaining years of the license, when the projects are operating as run of river, the following reasonable and prudent measures have been identified.

A. During years of run of river operations at the Lower Salmon Falls and Bliss projects, whenever exceptional events result in unusual operations, minimize the extent and amount of incidental take associated with dewatering of snail habitat.

B. During the Three Island Crossing event in August of each year of run-of-river operations, minimize the extent and amount of incidental take associated with dewatering of snail habitat.

3. C.J. Strike

The Service concludes that the action as proposed limits incidental take of Idaho springsnail to the extent practicable.

B. Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, the Commission must comply with the following terms and conditions, which implement the reasonable and prudent measure for the Lower Salmon Falls and Bliss projects. These terms and conditions are nondiscretionary.

A.1. When operating under unusual circumstances during any run of river year, the duration of altered flows (i.e. other than run of river) shall be minimized to the extent possible.

A.2. Whenever possible when unusual operations are undertaken in a run of river year, maintain ramping rates to a maximum one foot per hour as measured as a USGS gage 131350000 for Lower Salmon Falls at USGS gage 13153776 for the Bliss project.

A.3. Provide notification to the Service within 72 hours, via telephone or electronic mail, when unusual operations are undertaken during a run of river year.

A.4. Whenever unusual operations are undertaken during the five year study period identified in the Settlement Agreement, convene a meeting of the technical team within two weeks of the beginning of the event. The team shall evaluate any effect of the altered operations on

the studies and determine whether the integrity of the research has been compromised. If it has, the technical team shall recommend remedial measures to the management team identified in the Settlement Agreement. Management team members shall decide whether and how to amend the studies.

A.5. On or before June 1 of each year, provide a written report to the Service regarding operations for the previous operating year (April 1 through March 31). The report shall detail dates, times, and duration of each event involving unusual or exceptional operations. It shall also describe spatial extent of the unusual operations in terms of reservoir level and river stage eleveation changes as well as ramping rates. If listed snails are monitored during such events, provide results of that work in the report. If no unusual operations are carried out, inform the Service of this in writing.

B.1. During run of river years, alter operations at Bliss Dam only as needed to protect human safety and property for the Three Island Crossing event. Whenever flows levels at the site of the event are sufficiently low to assure safe crossing of people and property, maintain run of river operations.

B.2. During run of river years, when flows are altered to accommodate the Three Island Crossing event, ramping rates shall not exceed a maximum 1 foot per hour as measured at USGS gage 13153776 for Bliss project.

B.3. Within the annual report called for in term and condition A.5., provide information about whether and how operations were altered for the Three Island Crossing event the previous August. The report shall detail dates, times, and duration of operational changes, including reservoir level and river stage elevation changes, as well as ramping rates. If listed snails are monitored during such events, provide results of that work in the report.

VIII. CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Endangered Species Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse affects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. The Service is providing the following Conservation Recommendations to the Commission and Company for the proposed relicensing of five Snake River hydroelectric projects.

1. Minimum Flows in Dolman Rapids The Service concludes that maintaining minimum flows over the Dolman Rapids and North Channel will benefit aquatic species in this bypass reach, but the 50 cfs proposed as guaranteed flows through the North Channel (FEIS) will not fully support recovery of listed Snake River snails. The recommended 50 cfs at North Channel falls short of the flows necessary to achieve the State water quality standards for cold water biota (FERC 2002a) and these standards are stated as one of the recovery criteria for the listed Snake River snails (Service 1995). Although there are no listed snails documented from this reach, it is plausible that threatened and endangered

snails could recolonize the North Channel area if conditions were appropriate. Based on the information provided in the FEIS, the Service recommends that the North Channel of the Upper Salmon Falls Project receive guaranteed flows that will ensure water quality criteria for cold water species are met for this reach (estimated DO and temperature requirements of 6 mg/l and average 18° C respectively). Maintaining flows that ensure these cold water criteria are met would be consistent with the recovery goals for the listed Snake River snails (Service 1995).

2. Stocking of Game Fish Introduction of channel catfish and other nonnative species in C.J. Strike Reservoir is strongly discouraged because the Service concludes that it is likely these fish will have negative impacts on the Idaho springsnail. In addition to their potential impacts to Idaho springsnail, the bottom-feeding habits of the introduced channel catfish will likely place them in direct competition with native white sturgeon, a State species of special concern, as well as other species of native fish (e.g., suckers). Although white sturgeon have persisted despite prior introductions of catfish, there are no studies, of which we are aware, that provide information on the effects of one species on the other. While it is plausible that the introduction of 7,500 6-inch channel catfish (FEIS) might provide some benefit to white sturgeon (e.g., a food source), given their nonnative status, trophic overlap, and the toxic dorsal spine, the Service concludes that the introduction of these fish is far more likely to be detrimental to white sturgeon in the Snake River. For this reason, as well as the potential effects to the Idaho springsnail, we recommend against the continued introduction of this species into C.J. Strike or other locations in the Snake River or its tributaries.

   In addition, fish stocking programs conducted by the Company should be consistent with fish management programs of IDFG. Future fish stocking should be conducted by professional fisheries biologists using fish and equipment that are sterile to ensure that non-native species (e.g., New Zealand mudsnail, zebra mussel) or damaging pathogens (e.g., whirling disease) are not introduced to the Snake River or its tributaries. Further, the Service recommends that stocking of the Snake River and its tributaries be conducted with native strains of redband trout and that introduction and/or stocking of non-native fish (e.g., bass, catfish, yellow perch) be discouraged.

3. Spring Conservation and Protection Based on our current level of understanding of the Bliss Rapids snail and its conservation needs, the Service concludes that immediate conservation activities should focus on preserving the large, viable spring and tributary colonies/populations of this species while determining the importance and conservation needs of river colonies/populations of this species. This approach is in accordance with the proposed research to be conducted as part of the Settlement Agreement (Agreement 2004) and will help establish such guidelines.

4. Water Quality Improvement The Commission should continue to participate in the development or implementation of applicable provisions of the Idaho Division of Environmental Quality nutrient management planning effort and/or the Environmental Protection Agency's TMDL process for the Mid-Snake. The goal of these efforts is the improved condition of the Mid-Snake so that this river reach can be removed from the list of Idaho waters that are water quality limited. Accomplishment of this goal will

contribute to the conservation of listed snails and other listed species that occur in the Snake River downstream of these hydropower projects.

5. Flow Management The Commission should coordinate with the Service on the development of suitable methods for determining flow rates and hydroelectric operations on the Snake River during years of low water availability as indicated by runoff predictions and reservoir content estimates that are most compatible with the conservation needs of listed snails.

6. Snail Conservation and Management Planning A comprehensive Snake River snail conservation plan should be prepared in cooperation with the Service, other interested agencies, and non-governmental organizations. The Commission should work with cooperators to assure that such a plan will provide adequate habitat protection and enhancement to promote recovery of federally listed snails. The plan should provide for continued work with and funding of monitoring, protection, and management of priority habitat areas for the conservation of listed snails and other native species in the Mid-Snake area. Participants should include: Idaho Departments of Recreation, Fish and Game, Water Resources and Environmental Quality; U.S. EPA, Bureau of Land Management, Bureau of Reclamation, Park Service, and the Service; Nature Conservancy, Idaho Rivers United, American Rivers, and others.

7. Bald Eagle Management The Commission and Company should prepare and implement a bald eagle habitat management plan for the Mid-Snake project areas. This plan should emphasize the protection and restoration of native riparian communities that include the planting of nest trees and include bank stabilization where necessary. This plan should include management of flow releases and monitoring of these restoration projects and adaptive implementation to ensure the long term health and success of such a restoration program.

8. C.J. Strike-Land Acquisition and Management for Riparian Mitigation The Commission and Company should proceed immediately after issuance of the license for C.J. Strike to fully develop and implement the mitigation measure for acquiring mitigation lands. As noted by the Commission in its February 26, 2004 letter to the Service, it is appropriate to delay development of riparian mitigation proposals for the Mid-Snake projects until completion of studies under the Settlement Agreement. The Service agrees with this because the Settlement Agreement anticipates discussion and development of a plan to address operational impacts on snails. Because the Company may ultimately propose changed operations for the Lower Salmon Falls and Bliss projects, development of riparian mitigation now may be premature. For the C.J. Strike project, however, study results will not specifically address operations, and as such are not critical to developing mitigation measures to offset riparian habitat losses from project operations. Under the proposed action, as modified by the Settlement Agreement, the C.J. Strike project will operate in a load following mode for the life of the license and the Service hass no reason to believe changed operations will be proposed in the near future. Therefore, there is no should be no to delay in acquisition and management of lands for riparian mitigation for C. J. Strike.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, we request notification of implementation of any conservation recommendations.

IX. REINITIATION NOTICE

This concludes formal consultation on the Commission's proposal to issue licenses to the Idaho Power Company for continued operation of five hydroelectric projects on the Snake River in Idaho. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been maintained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

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USGS 2004b. SnakeRiver flows for selected dates at Glenns Ferry. Idaho Surface Water Quality Statewide Network. //Waterdata.usgs.gov/id/nwis/discharge? search site_no=13154500

APPENDIX A

PEER REVIEW SUMMARY

for the

BIOLOGICAL OPINION:

FEDERAL ENERGY REGULATORY COMMISSION

PROPOSED RELICENSING OF FIVE HYDROELECTRIC

FACILITIES ON THE MIDDLE SNAKE RIVER, IDAHO:

SHOSHONE FALLS (FERC No. 2778), UPPER SALMON FALLS (FERC 2777),

LOWER SALMON FALLS (FERC 2061), BLISS (FERC 1975),

AND C.J. STRIKE (FERC 2055), AND THEIR IMPACTS

ON FIVE MOLLUSC SPECIES

(peer review for FERC projects: 2778, 2777, 2061, 1975)

Table 4. Summary of peer reviewer's comments on portions of the Mid-Snake Biological Opinion (BO) for the relicensing of four hydroelectric facilities (FERC Nos.2778, 2771, 2061, 1975). Abbreviations: IPC: Idaho Power Company, NZMS: New Zealand mudsnail, ISS: Idaho springsnail, BRS: Bliss Rapids snail, UV: Utah valvata snail, EIS: Environmental Impact Statement, FERC: Federal Energy Regulatory Commission, ROR: run-of-river.

Peer	Dates of contact/ response	Response summary
Bowler, Peter A., Ecology & Evolutionary Biol., 321 Steinhaus Hall, U. Calif. at Irvine, Irvine, CA 92697 Contact:	Responded to e-mail on 2 Sept. 2002 - **Will Review BO**	Received comments 1 November 2002. 1) Dr. Bowler states that sediment dynamics are altered and that river reaches below these dams are often sediment-denied, he names a number of species (including one of the listed snails) that have declined with the loss of in-sediment habitats; 2) Notes that species richness is greatly reduced in the frequently de-watered habitats, with more stress-tolerant species (e.g., NZMS) becoming dominant; 3) Due to disturbance to Hagerman Valley springs and within the Snake River, most springs that support snails represent habitat islands that are now isolated from formerly connected habitats and represent small populations of snails; reduced water quality and physical barriers from the operation of fish hatcheries have contributed to this isolation effect. 4) Notes the impacts of small, spring-fed hydropower projects on the listed snails and a need for mitigation. 5) Notes that IPC=s collection of ISS at Frank Lloyd Wright Rapid represents an important range extension and is good news, but needs to be confirmed. 6) States that the distribution of BRS is essentially unchanged from its early distribution description and that hydropower load-following Aseasonally eliminates this species@ from some Snake River locations; reiterates findings of Irving and Cuplin (1956) that benthic invertebrates in zone of dewatering are significantly reduced (reduced by 84% by number and 92% by biomass) and believes that recovery of listed snails is not possible if load-following is permitted. 7) States that flows at North Channel/Doleman Rapids should be maintained at no less than 200 cfs and that this area would likely be colonized by listed snails and contribute to species recovery. 8) Discusses plausible mitigation measures, including dam decommissioning and altered project maintenance schedules, that substantially increase the chance of snail recovery and decrease negative impacts of earlier dam construction and operation. 9) Details project-related damage to anadromous fish and other native fish and molluscs. 10) Provides warning that toxicant spills can threaten the entire river and as such the number of snail populations or their relative sizes do not ensure their protection. 11) The author provides numerous literature citations.
Frest, Terrence J., DEIXIS Consultants 2517 NE 65th St. Seattle, WA 98115 Contact:(206) 527-6764	Phoned on 10 Oct. 02 **- Will Review BO**	Received Comments on 19 Nov. 2002 - 1) The author believes that inclusion of the tributary hydropower projects in the BO is justified given the importance of these habitats to snail conservation. 2) Believes that the EIS should have included a greater number of alternatives and that the BO could have been more thorough in its review of the alternatives. 3) States that the proposed (FERC EIS) mitigation are not adequate to address the documented problems and that some of the mitigation could be detrimental. 4) The author provides substantial improvements to the section on Status of the Species including species descriptions and habitat needs. Specifically, he points out that ISS is not entirely (or at all) an interstitial dweller and the greater vulnerability of river populations of snails; UV snails may be more threatened (and declining) than acknowledged in the BO. 5) Notes that current anthropogenic conditions (notably from dams) within the Mid-Snake have certainly resulted in fragmenting the habitat and isolating snail populations, subjecting the remaining colonies to greater risk of extinction/extirpation. He further notes that there may be

Table 4. Continued. Summary of peer reviewer's comments on portions of the Mid-Snake Biological Opinion (BO) for the relicensing of four hydroelectric facilities (FERC Nos.2778, 2771, 2061, 1975). Abbreviations: IPC: Idaho Power Company, NZMS: New Zealand mudsnail, ISS: Idaho springsnail, BRS: Bliss Rapids snail, UV: Utah valvata snail, EIS: Environmental Impact Statement, FERC: Federal Energy Regulatory Commission, ROR: run-of-river.

Peer	Dates of contact/ response	Response summary
		substantial differences in the river and tributary populations of BRS, which would place greater importance on the conservation of these groups. 6) Reiterates the fact that the detection of listed snails in certain areas does not mean that those areas provide good habitat or that these colonies/subpopulations are viable. 7) The author suggests using caution on acceptance of taxonomic identification of species by researchers who are not experts in that field; misidentification can result in an invalid determination of the status or distribution of the species which can lead to inappropriate management decisions. 8) Reiterates the negative impacts of load-following (frequent disturbance): reduced species diversity and biomass, and states that frequent disturbance could negatively impact native species while benefitting aliens such as the NZMS. 9) Notes that the ISS and UV are not Astill water@ dwellers since they are never found to persist in such habitats. They may occur in lake habitats, but require moving water. He reiterates the fact that finding a species at a certain location does not mean the area supports a viable population. 10) States that the BRS is not found throughout its range of the Snake River, but is restricted to a limited number of locations, in a patchy distribution. 11) Provides caution that the stocked rainbow trout do not represent the native redband trout and that these fish are not native and thus could potentially pose a threat to the native snails. 12) The author supports the FWS finding that weed control could be detrimental, but that insufficient information is provided to allow for evaluation of this proposed mitigation measure. 13) States that the sections dealing with agricultural impacts (e.g., irrigation and feedlot runoff, grazing) and contaminant spills are not strong enough. These threats are major contributors to poor water quality. Contaminant spills have had serious impacts on freshwater benthos in the Snake and other Rivers and how such spills could threaten the existence of aquatic species with limited ranges. 14) States that the continued operation of the projects will continue to have negative impacts on the listed snails despite the proposed mitigation measures. 15) The author provides numerous literature citations.
Hershler, Robert, National Museum of Natural History, Smithsonian Inst. Contact:	E-mailed on 14 Oct. 2002 - **Will Review BO**	Received Comments 22 Oct. 2002 - 1) Believes that the threats to the 4 snail species are adequately reviewed, though there is a general lack of good information available. 2) Literature fairly well covered, although recommends other references specifically on habitat/population fragmentation due to dams (some of which has already been added in a later draft). 3) Evidence provided in BO clearly indicates the impacts of hydroelectric facilities on the listed snails; reiterates the barrier-effect of dams and the potential impacts to isolated snail populations, especially with regard to long-term genetic consequences; notes the negative impacts of load-following activities (stranding, scour, turbidity, loss of habitat). Notes that under the baseline status of and threats to the species, that current hydroelectric operations will not be conducive to snail conservation. States that if these hydroelectric facilities are to remain in place/operation, that ROR operations and guaranteed minimal flows will help ensure persistence and stability of

Table 4. Continued. Summary of peer reviewer's comments on portions of the Mid-Snake Biological Opinion (BO) for the relicensing of four hydroelectric facilities (FERC Nos.2778, 2771, 2061, 1975). Abbreviations: IPC: Idaho Power Company, NZMS: New Zealand mudsnail, ISS: Idaho springsnail, BRS: Bliss Rapids snail, UV: Utah valvata snail, EIS: Environmental Impact Statement, FERC: Federal Energy Regulatory Commission, ROR: run-of-river.

Peer	Dates of contact/ response	Response summary
		habitats and this should be desirable to snail conservation. 4) Recommends continuing funding of research to fill information needs for conservation of the species, including ecological requirements, threats, and genetics; specifically notes the need to study and consider the potential impacts of the New Zealand Mudsnail
Falter, Michael, University of Idaho, Professor Emeritus. Contact: (208) 882-3676	Phoned on 29 Aug. 2002 - **Will not provide review**	Interested in issue and wishes to be involved. Will be departing early in September for 2-mo and may not be available to receive or provide response to BO in a timely fashion.
Johnson, Paul, (PJ) Research Associate Tennessee Aquarium Research Institute 5385 Red Clay Rd. Cohutta, GA 30710 (706) 694-4419 Contact: pdj@sari.org	Responded to e-mail on 12 Sept. 2002 - **Will Review BO**	Received Comments 15 Nov. 2002 1) The author provided comments that would eliminate redundancy and condense the document. 2) States that dam/reservoir effects in the American southeast (SE) are more a result of cold, anoxic conditions of release flows. 3) States that the Arapid daily fluctuations in river levels@ in the Mid-Snake Aare undoubtedly having considerable impacts on snail populations.@ 4) The author discusses unique dam operation strategies that have been used in the SE and had positive effects on the endemic fish and mollusc fauna. Of these, maintenance of minimum flow volumes is suggested as an important practice that has benefitted at least one species of federally listed snail. 5) PJ notes that dams above and below the project will likely affect river flows and should thus be considered in the conservation of the spp. 6) He also notes that most of the mitigation measures outlined in the EIS will have minimal beneficial effects on the listed snails. 7) Conservation measures (to be included in the proposed Snail Conservation Plan) suggested by the author include: captive propagation and population augmentation, fixed monitoring sites to follow population trends, and considering other concessions and compromises in projects operation that would provide better conservation outcomes in some river reaches.
Dr. Alan P. Covich Dept. Fisheries and Wildlife Colorado State U. Fort Collins, CO 80523 (970) 491-2372	Contacted by S. Lysne, 3 Sept. 2002 - **Will review BO.**	Received Comments 17 Nov. 2002 1) The author notes that the spread of the New Zealand mudsnail likely poses an substantial risk to the native Snake River snails. 2) Notes the lack of biological literature on the listed snails and provides the names of experts and of peer-reviewed articles that might provide additional pertinent information. 3) Notes the likely importance of natural river flows to the listed snails and the associated value of ROR operations for the conservation of native species. 4) The author does state that despite the benefits of ROR, water quality issues are largely unaddressed and will continue to impact the native snail fauna.
Dr. Jack Stanford (Univ. Montana) C/O Michelle Anderson Flathead Lake Biological Stn. Polson, MT 59860-9659	Contacted by S. Lysne mid-Sept. **Will Review BO**	Received comments 7 November 2002. The authors: 1) state the BO does not provide adequate discussion on the impacts of habitat fragmentation (due to dams), specifically loss of dispersal and population connectivity and the resulting loss of genetic variation (the authors provided pertinent literature citations); 2) provide discussion that aquifer springs may receive a substantial amount of nutrient loading from sources, some of which are natural, other than irrigation waters that

Approximate Locations of Listed Mollusk Species
Middle Snake River, Idaho

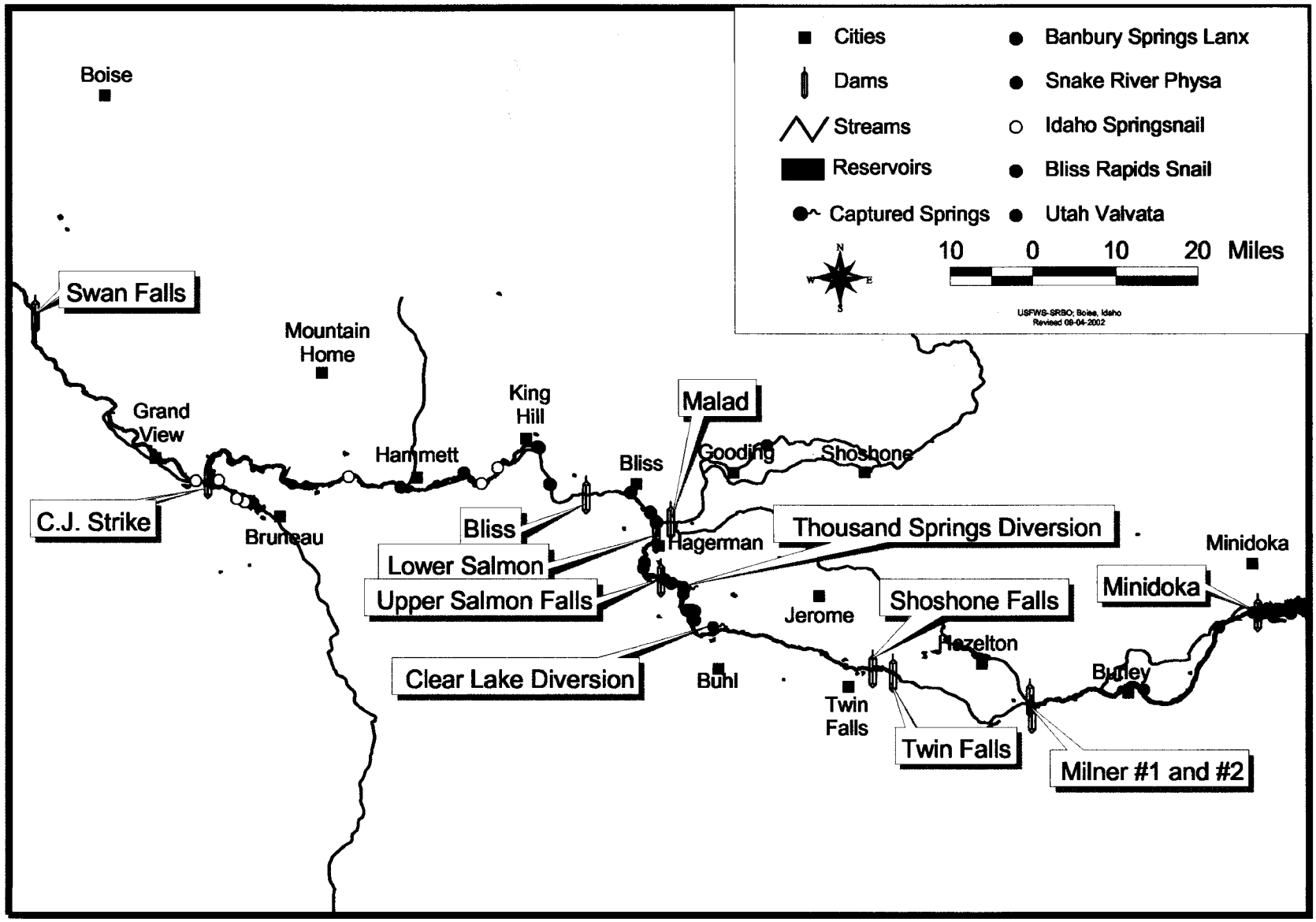

Figure 1. Middle Snake River Basin showing the location of major towns, dams, and hydroelectirc facilities and some of the primary snail locations.

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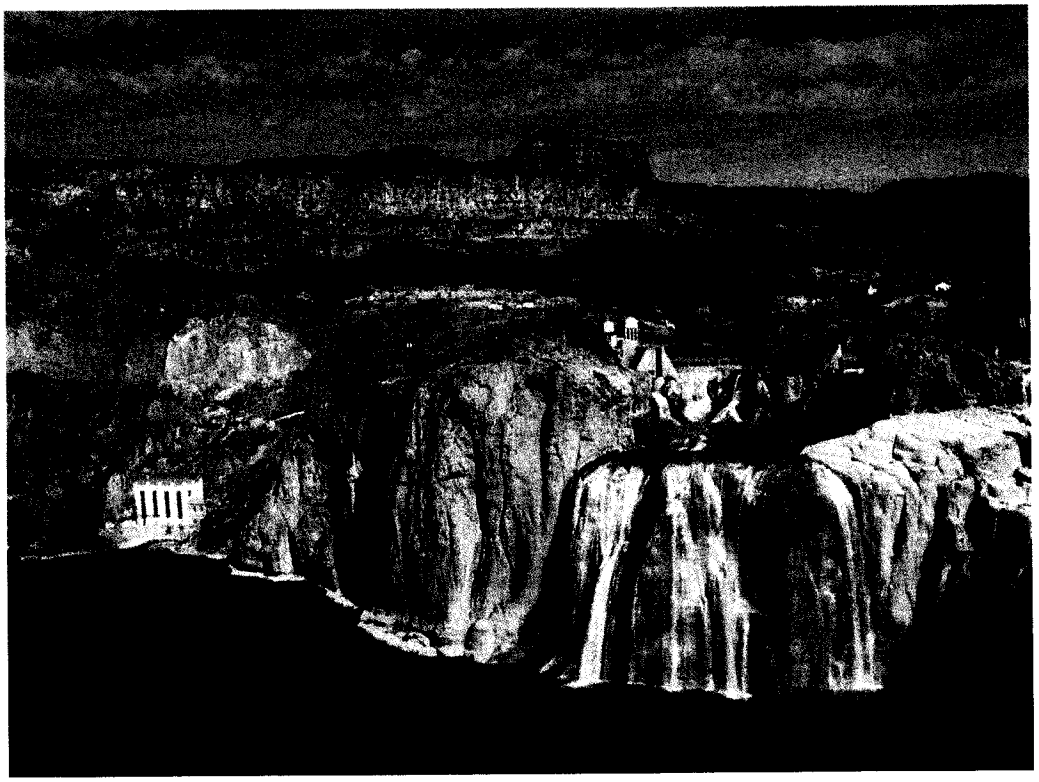


Figure 2. Shoshone Falls Hydroelectric Project is located at river mile 614.8, near the town of Twin Falls.

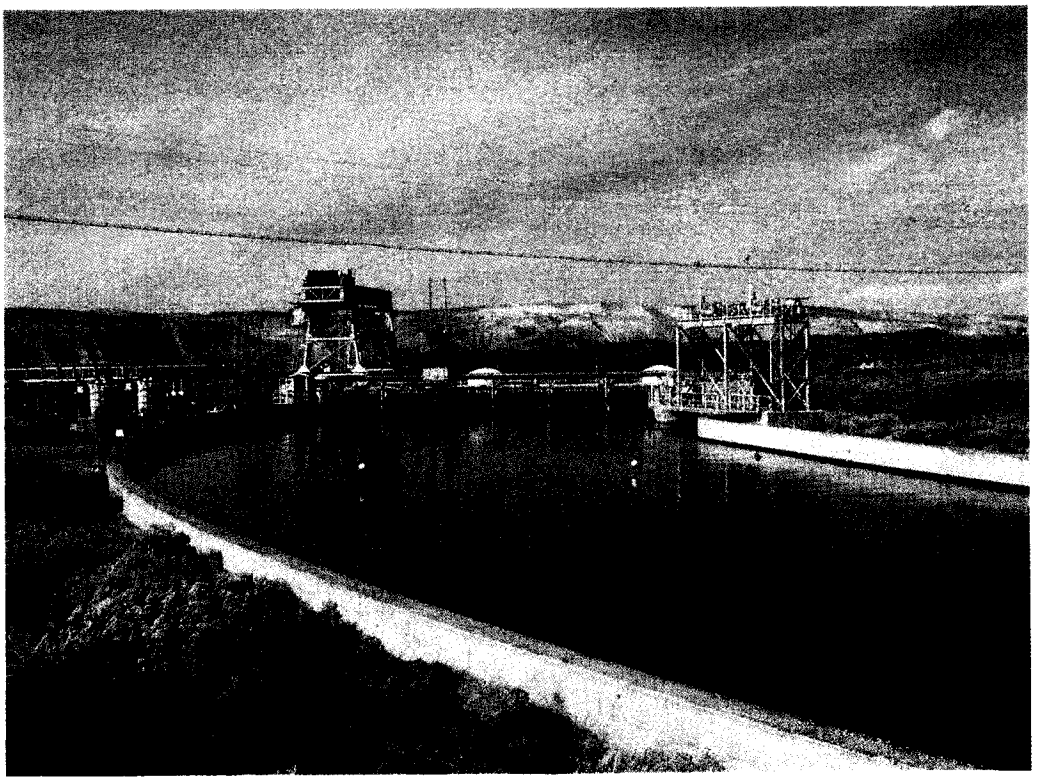


Figure 3. Upper Salmon Falls Hydroelectric Project, flume to generator. The bypassed Snake River channel is located to the right of the flume.

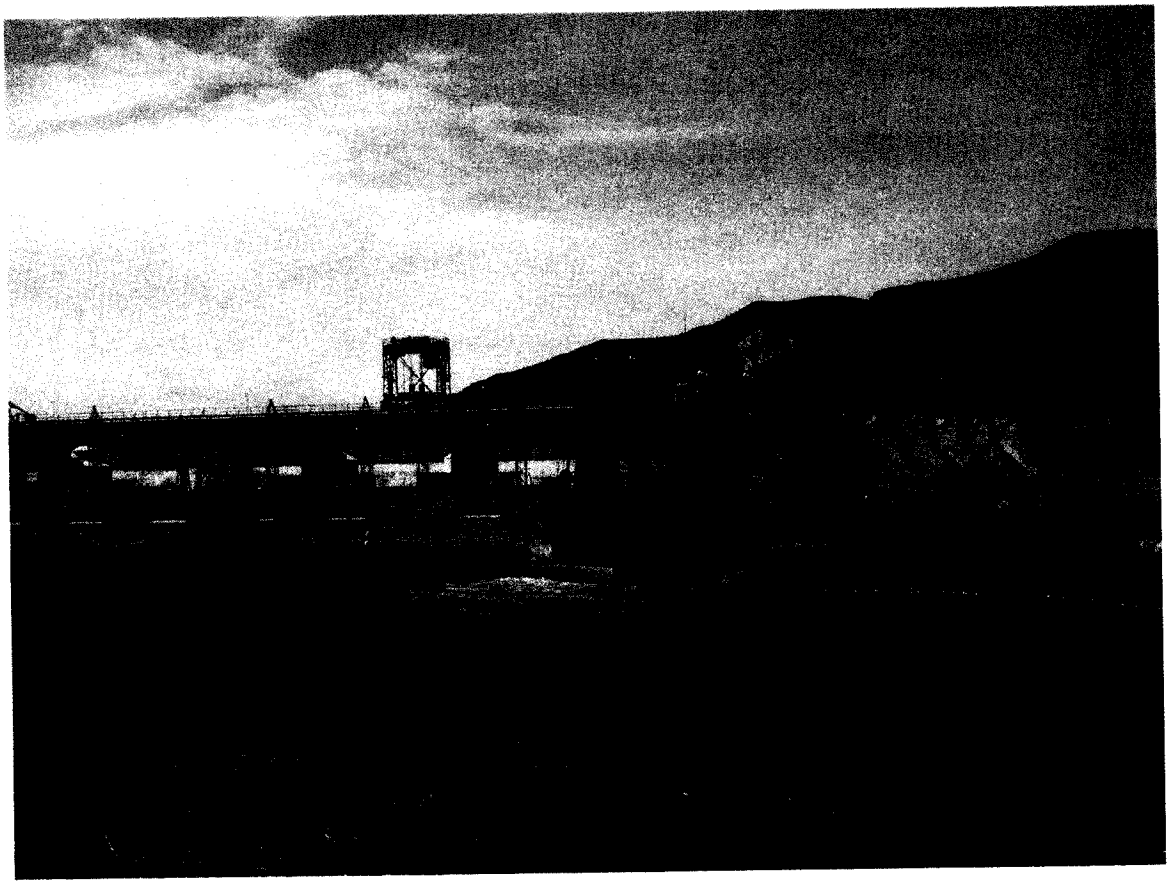


Figure 4. Lower Salmon Falls Dam located near Hagerman, Idaho.

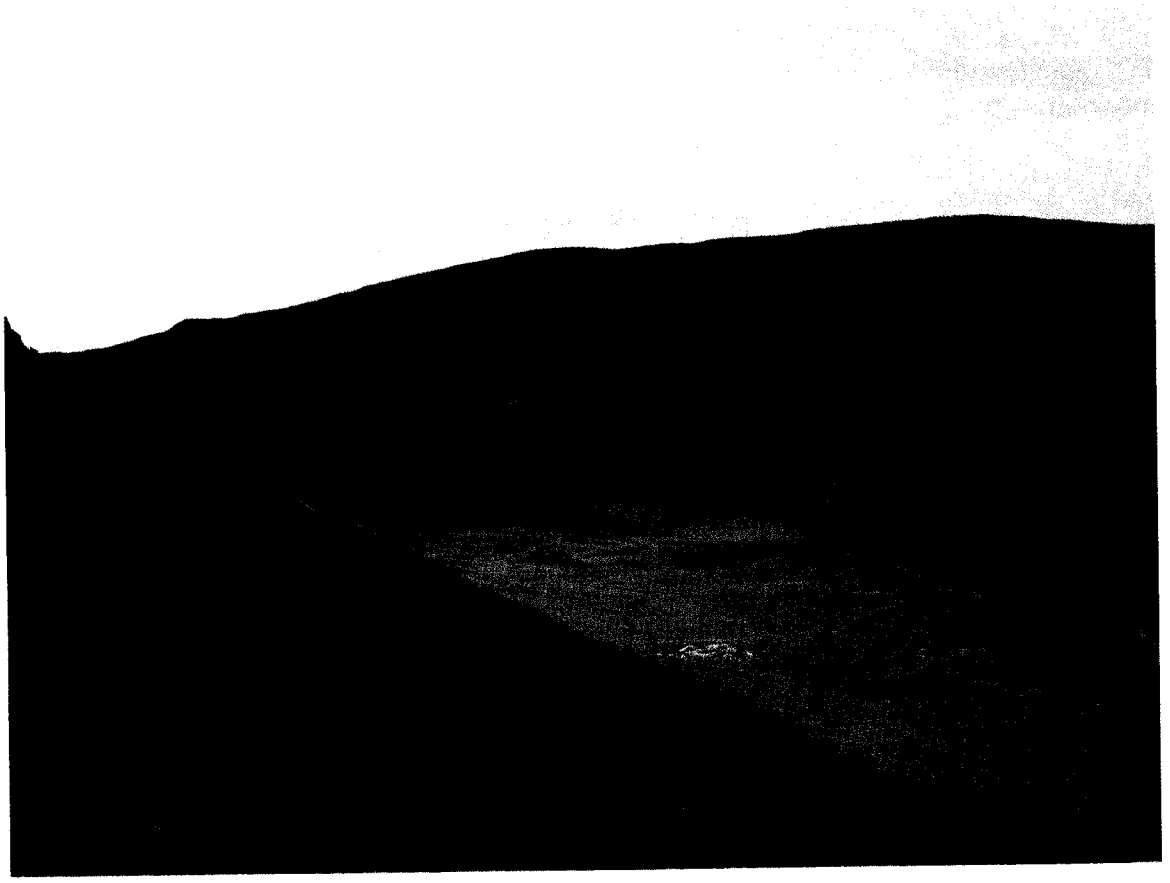
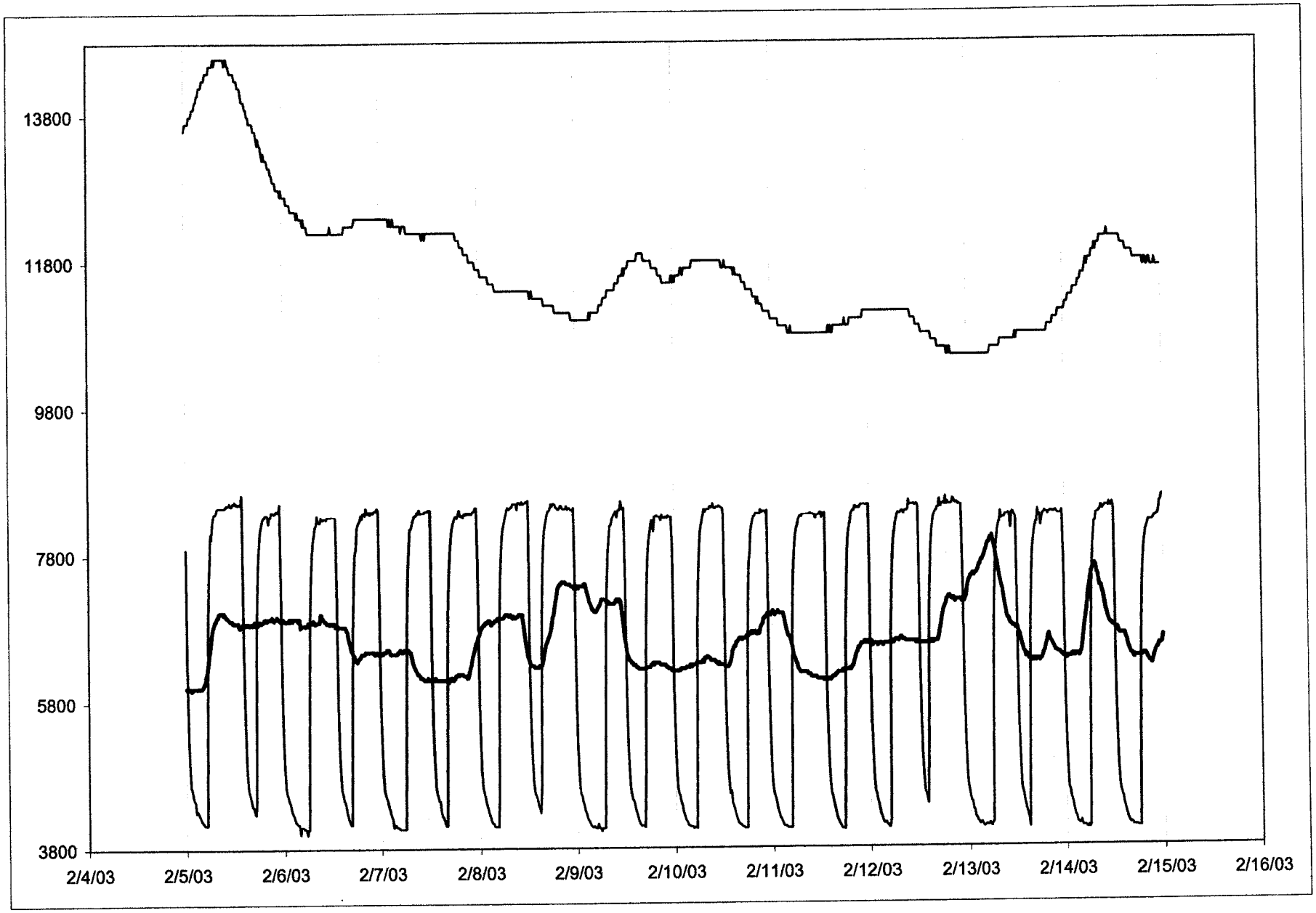


Figure 5. Bliss Dam, located at river mile 560, south west of the town of Bliss.

Figure 6. C.J. Strike Project viewed from the south side of the Snake River looking north, showing the project's three generators (foreground), the earthen dam (right), and the spillgates (center).

Figure 7. River stage data from three Snake River USGS gages below C.J. Strike Dam over a 10 day period (February 2003), illustrating stage attenuation downstream of load following operations at C.J. Strike. X-axis is time in days from February 5 to February 15, 2003. Y-axis is river volume in cfs. The heavy blue line shows flow records taken below C.J. Strike dam (RM 494) and clearly illustrates water withholdings and releases during load following operations, the mauve (heavy red) line shows the flow records near Murphy (RM 461), and the red line shows flows during that period near Weiser (RM 342). The graph illustrates that load following operations at C.J. Strike are greatly dampened (attenuated) and masked by other water uses such as irrigation withdrawls and returns to the Snake River. Also cited as IPC, Unpublished Data, 2004a.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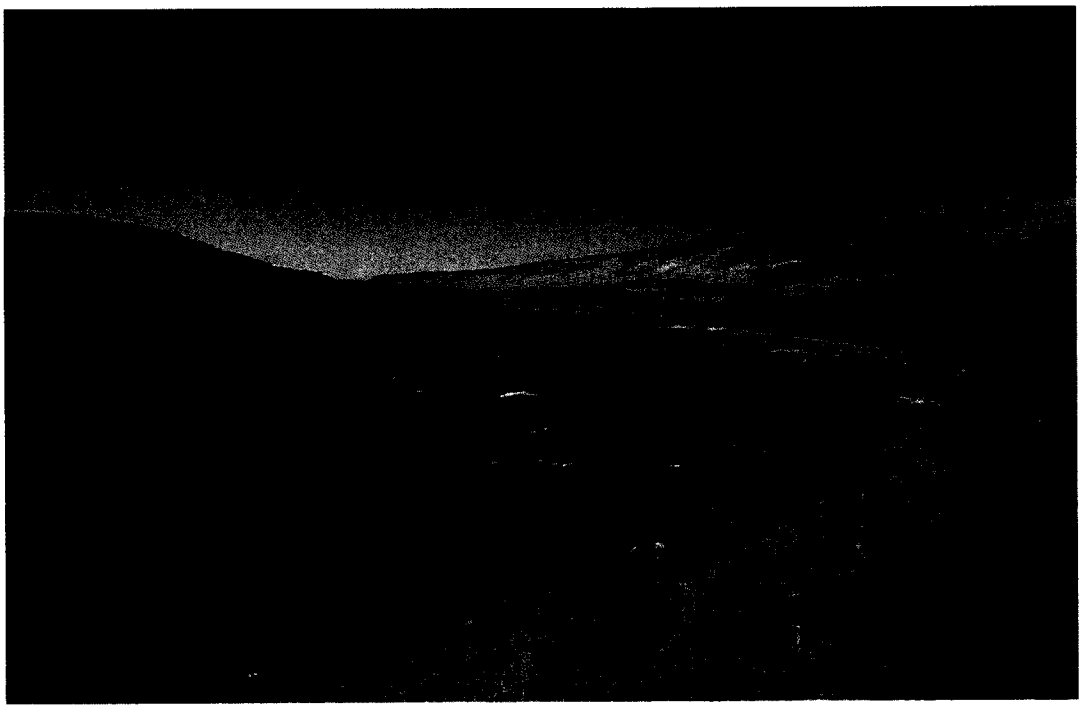

Figure 8. The Snake River immediately below Bliss Dam illustrating the river at high flows (estimated at 20,000 cfs). Photo taken in October 1999 and provided by D. Parrish, Idaho Fish and Game.

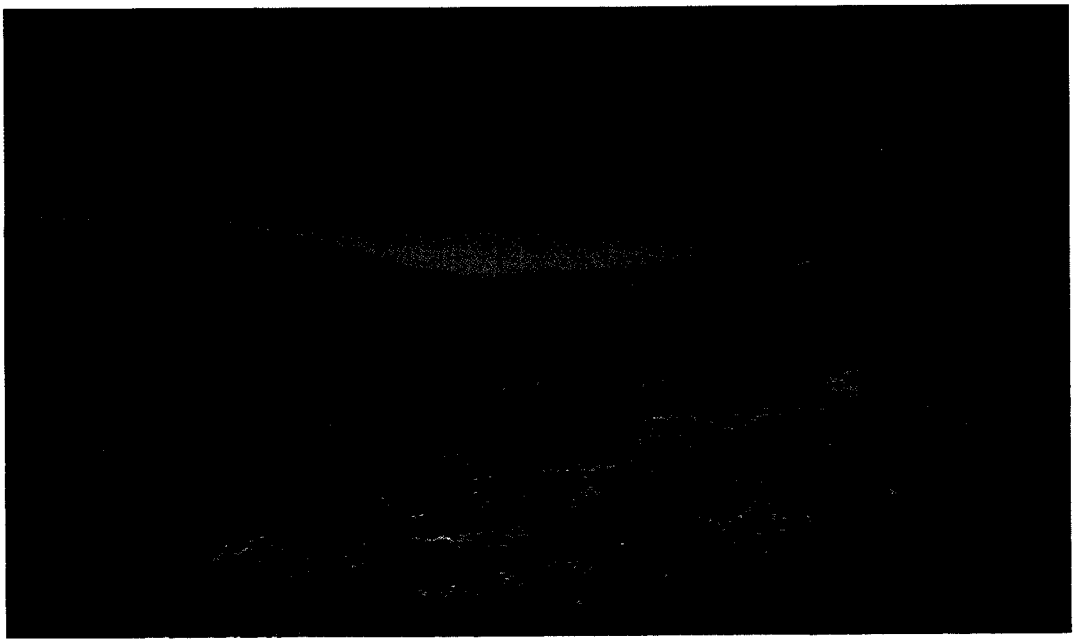

Figure 9. The Snake River approximately 30 minutes after the above photo, when flows were reduced to about 3,000 cfs. Aggressive load following would typically not be so pronounced, but would result in large areas of the visible shallow water habitat being exposed.

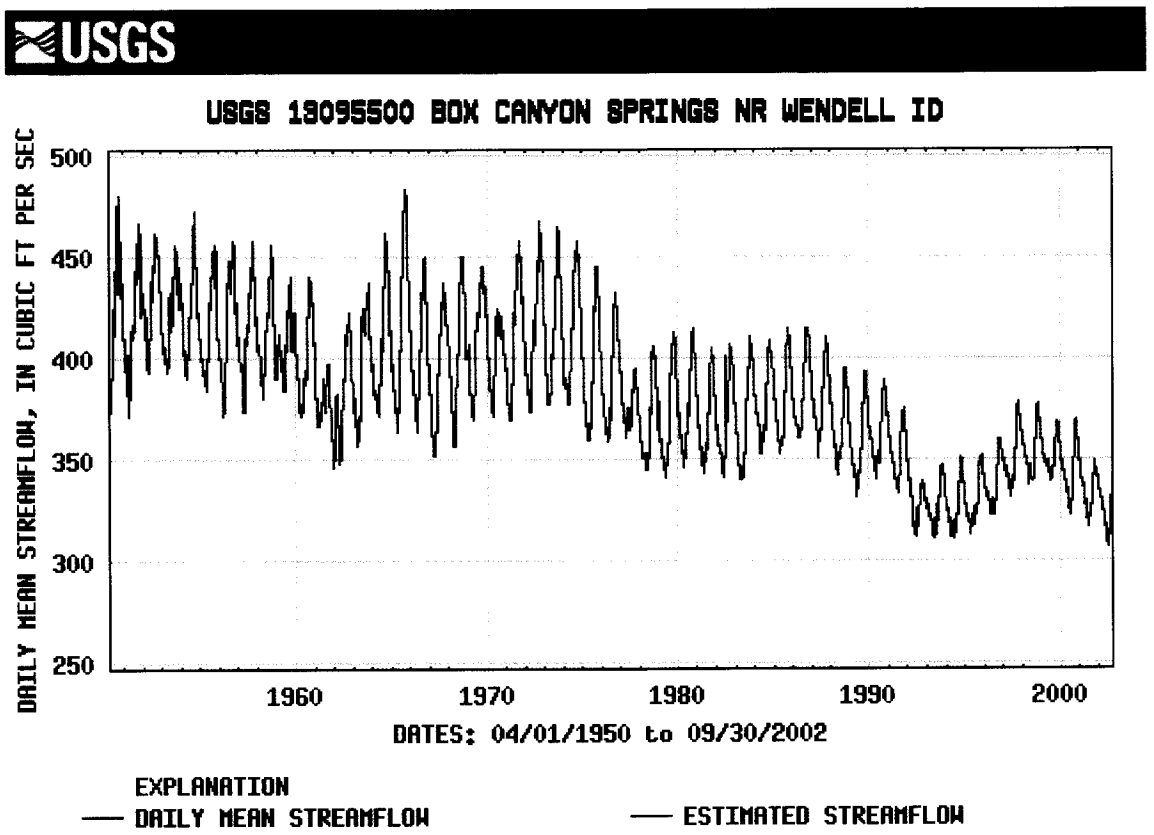

Figure 10. 50-year flow discharge record for Box Canyon Spring, near Wendell Idaho (USGS data).

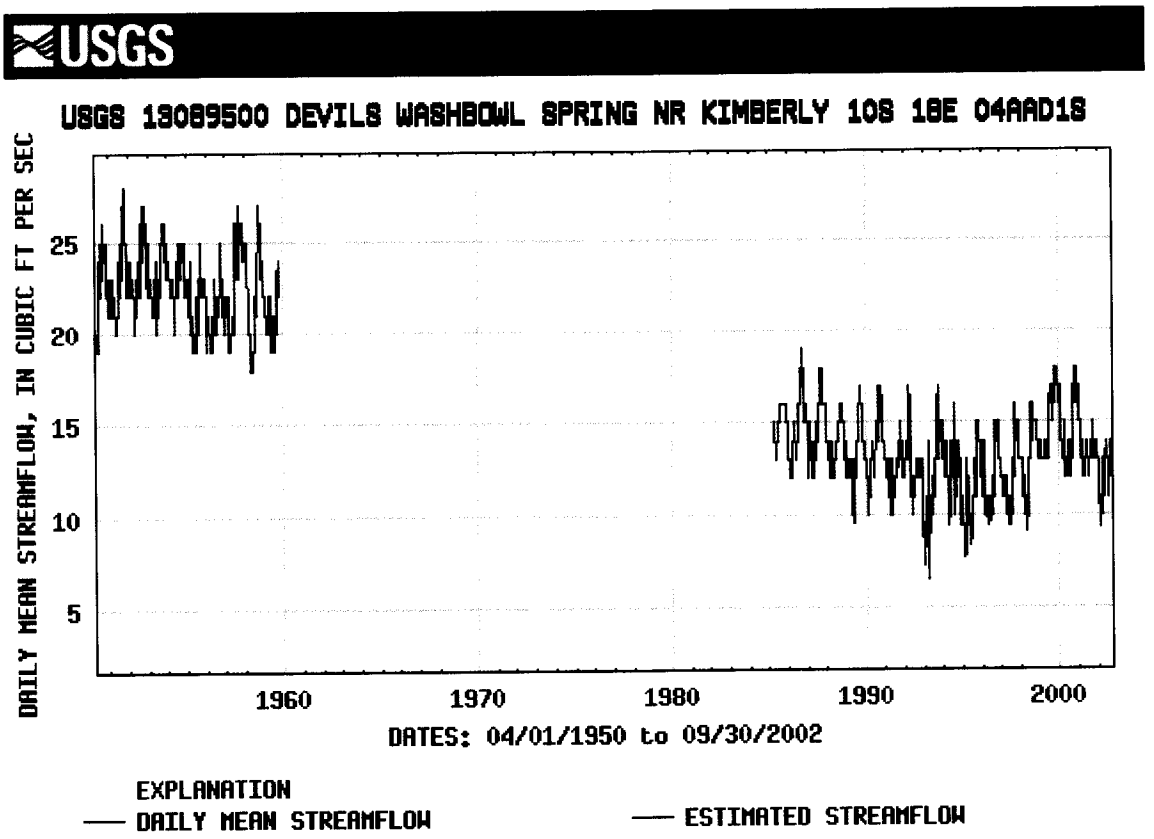

Figure 11. 50-year flow discharge record for Devils Washbowl Spring near Kimberly, Idaho (USGS data).

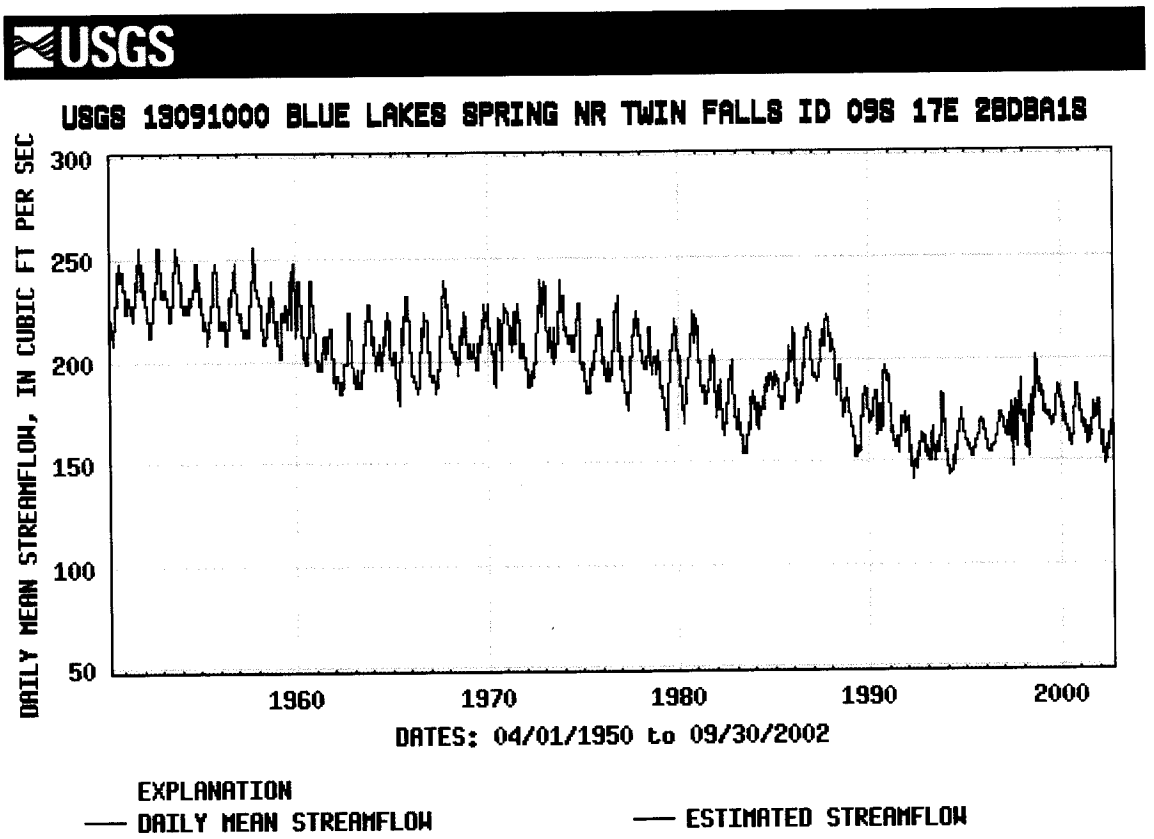

Figure 12. 50-year discharge flow record for Blue Lakes Spring near Twin Falls, Idaho (USGS data).

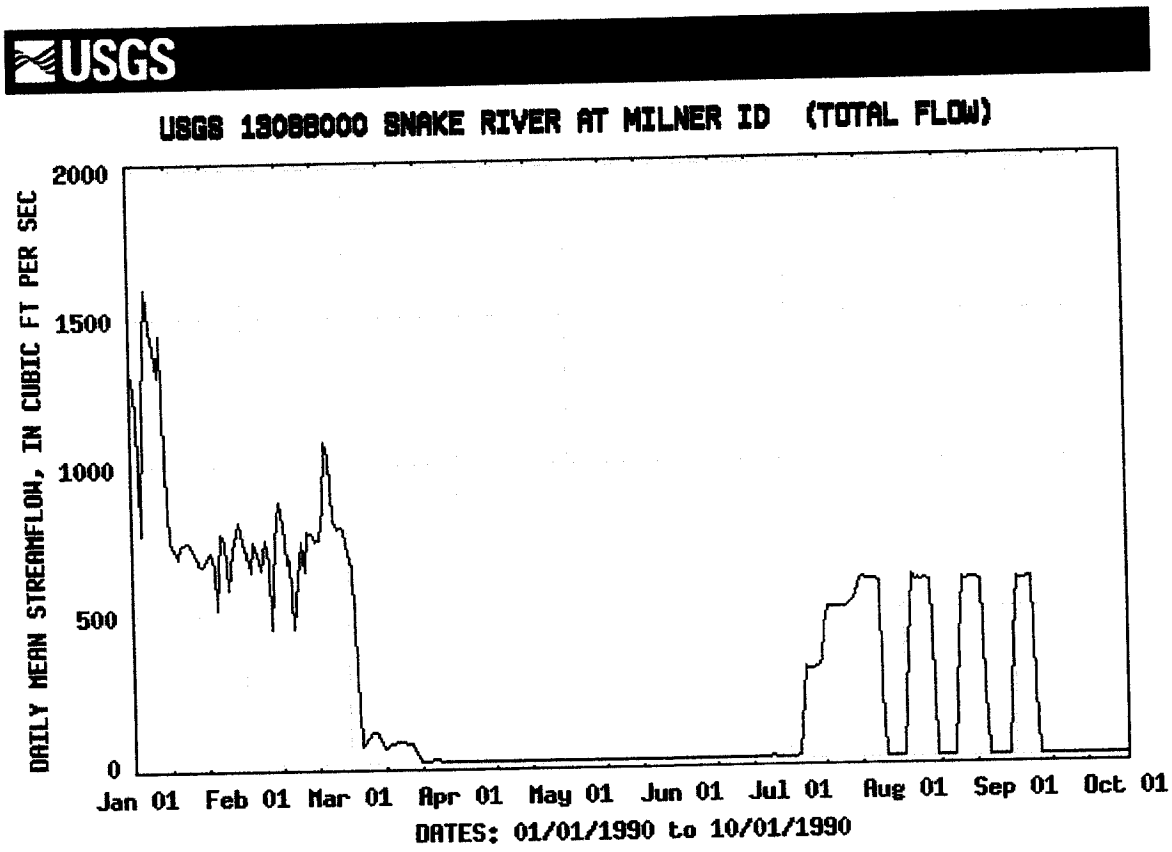

Figure 13. During some years, all water may be diverted into irrigation canals, none of it passing below Milner Dam as shown here in 1990. Similar dewaterings occurred in 1987, 1988, 1989, 1991, and 1992 (USGS data).

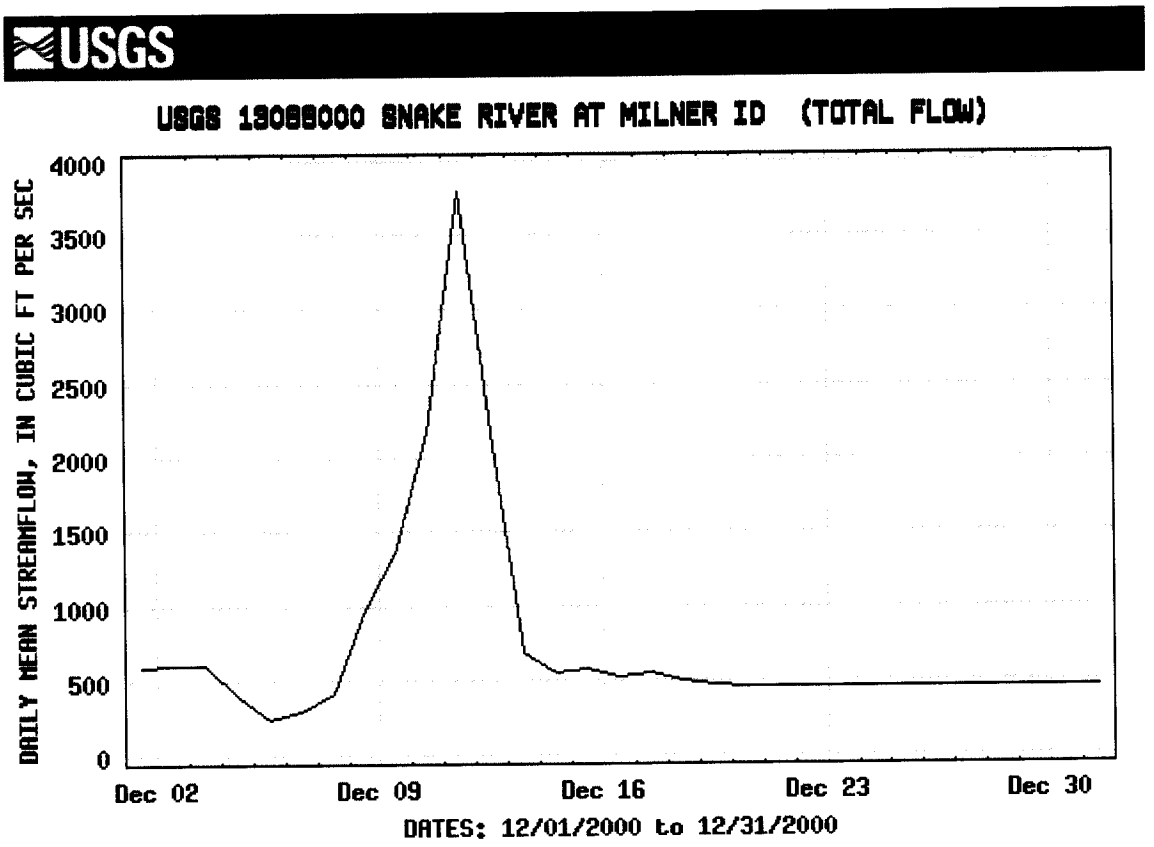

Figure 14. The spike in water release by the Bureau of Reclamation, upon request by Idaho Power Company for power generation. In the spring of 2001 the Bureau of Reclamation declared a water emergency and were not able to provide adequate flows for salmon augmentation water as required under a biological opinion with NOAA Fisheries.

Figure 15. The bypassed North Channel adjacent to the Upper Salmon Falls Project. Under the current license, all water could be diverted out of the river channel to maintain generation capacity. Under the new license, the Company proposes that a minimum of 50 cfs be maintained at all times.

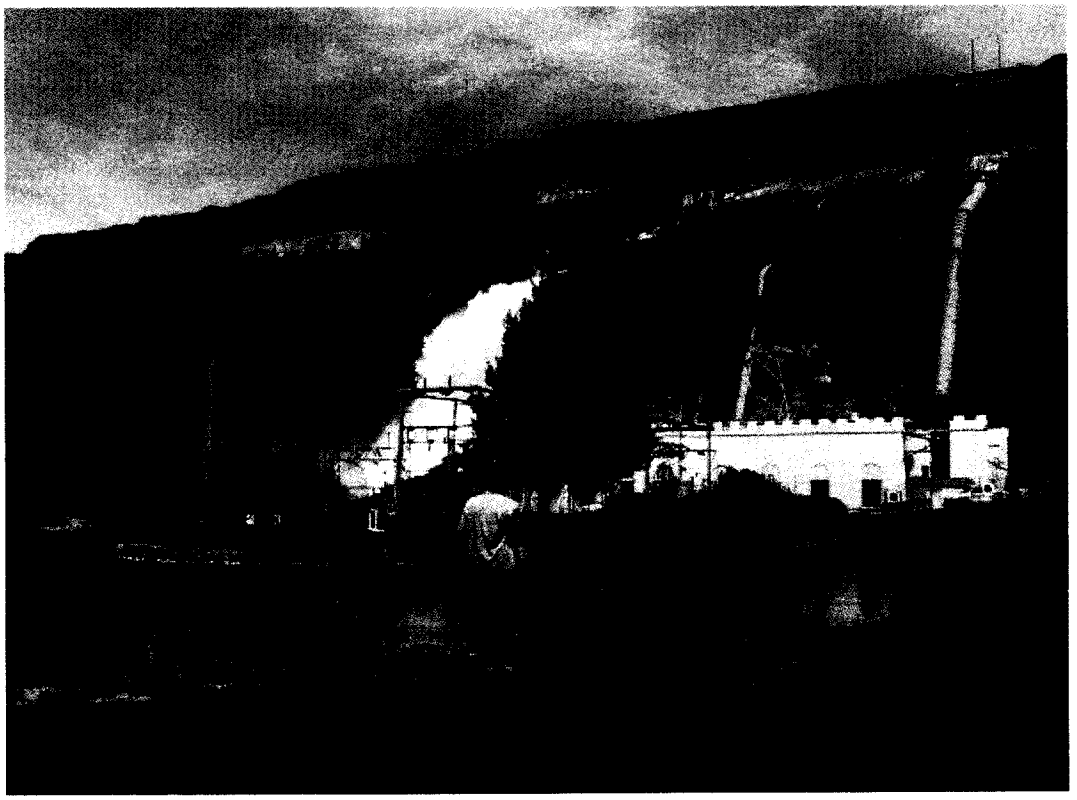

Figure 16. Idaho Power Company's Thousand Springs Hydroelectric Project (river mile 584) during facility maintenance by-pass flows. The Thousand Springs spring system is regarded as an important site for three of the listed snails (Utah valvata, Bliss Rapids snail, and Banbury Springs lanx) and provides important could water habitat for the Shoshone sculpin and trout. This hydroelectric facility is unlicensed and unregulated. Unregulated ramping rates, maintenance, and repair could seriously impact listed snails. Changes in operations could provide substantial benefits to listed snails and their habitat.