Cle Elum Improvements Project
Final Cost Estimate
April 2000

Final Cost Estimate - CLIP
Cle Elum Improvements Project
a.k.a. 3' Pool Raise Project
April 2000

From: Stan Isley
To: Cle Elum Core Team - CLIP
Date: 4/3/00 4:52PM
Subject: Cle Elum Fish Passage Briefing & Cost Estimate from Steve Croci and Walt Larrick

4/3/00

Hi Everyone;

I just received the attached briefing paper that Walt and Steve Croci wrote (and sent to Jim Esget today). They reviewed the Harza fish passage report and came up with a refined and simplified proposal that will provide for fish passage at Cle Elum Dam in a majority of years. It calls for perhaps using the existing Roza Dam fish trap to collect returning adult sockeye (possible construction of an adult trap below Cle Elum Dam as an alternative); and construction of a new stand-alone intake structure and overspill gate in the right abutment area of the dam, westerly of the existing spillway, to provide juvenile passage (outmigration) past the dam.

This new overspill gate would operate, at a minimum, from full pool elevation (now at 2240 feet, 2243 feet if the pool is raised) down to the base of the existing spillway at elevation 2223 feet. Alternatively, this new overspill gate could be constructed to operate from full pool elevation down to elevation 2210 feet. The physical ability to pass juveniles down to elevation 2210 feet, coupled with some reservoir operation changes to maximize storage water elevation during smolt outmigration periods, would enable us to successfully pass the juvenile salmonids past Cle Elum Dam most years.

Steve and Walt estimate that $250,000 annually would cover the costs of capturing the adult sockeyes using Roza Dam facilities (personnel costs mostly) and transporting the fish above Cle Elum Dam. They estimate the new juvenile outmigration facilities at Cle Elum Dam would cost $5 million. All of this (cost and engineering designs) would need further investigation.

Walt and Steve recommend proceeding with this fish passage plan. Their proposal is designed to provide fish passage at Cle Elum Dam in most years, but at a much-lower cost than the cost estimates for the options described in the Harza fish passage report.

This proposal means that **CLIP cost estimates** would become:
$16,687,100 (other CLIP costs); plus $5,000,000 for fish passage facilities at Cle Elum Dam; plus $250,000 annual adult fish capture costs at Roza Dam; for a grand total of:

$21,687,100 plus $250,000 in annual adult fish capture costs at Roza Dam.

For your info...

Stan

Attachment
cle elum briefing.wpd

CC: Croci, Stephen; Esget, James; Tiedeman, John

Adult trapping to Rearing $252,000/year.
Juvenile passage facilities at Cle Elum Dam: ~$5 million.

April 3, 2000

Memorandum

To: Jim Esget, USBR, YRBWEP Manager

From: Walt Larrick, USBR, Fisheries Biologist
Steve Croci, USFWS, YRBWEP Staff - Fisheries Biologist

Subject: Cle Elum Fish Passage

This letter is to recommend support for providing fish passage at Cle Elum Dam as suggested in the 1994 Yakima River Basin Water Enhancement Project Act (YRBWEP; Section1206 of Title XII, P.L. 103-434). Of all the reservoirs in the basin, Cle Elum is the best option for providing passage because of an abundance of habitat that could be made available. Initial investigations suggest that suitable habitat exists for many species native to Cle Elum Lake including ones that have been extirpated as a result of damming the lake (USFS 1996 and NMFS 1988). These species include bull trout, steelhead, sockeye, chinook, and coho salmon. Additionally, the National Marine Fisheries Service (NMFS; 1988 - 1994) conducted a feasibility study to determine the potential for reestablishment of sockeye into Cle Elum Lake. Although a final report is not yet available, they observed good survival of juveniles in the reservoir and did observe some adults returning. The main problem they noted was that juveniles were not leaving the system under current operational and structural conditions. Options are now available to make operational and structural changes that could significantly assist passage around the dam. Additionally, in-river and ocean conditions are likely favorable for the reestablishment of self-sustaining populations of anadromous salmon produced in Lake Cle Elum if passage issues are addressed. To move this project forward, coordination and cooperation with other agencies and interested parties is a must.

The action should be considered an experiment, building on NMFS findings, and the results can then be applied to other reservoir dams in the basin. The approach should be very simple and focused. Although year-round passage is preferred, initial attempts should aim to achieve spring-time passage for reservoir emigrants and should build from there. Flexibility should be considered in any modification or operational adjustment to account for future changes. Initial efforts should focus on reestablishing sockeye and coho salmon to Cle Elum Lake. The reasons include: life histories that generally conform to current operations of the system; hatchery fish may be easily available (this would allow for adequate evaluation and initial seeding); little or no negative effects on native species would be expected; able to withstand some loss; and, represent an important source of nutrition to the energy cycle. Other species could be passed incidentally until a better understanding is gained.

Initially, hatchery fish could be used for initial seeding of the lake. This could supply an adequate number for evaluation. Both stocks were extirpated from the basin so genetic concerns of the wild stock in the Yakima River are non-existent. Additionally, both are indigenous to Cle

Elum Lake and evolved with other native species so negative interaction would not be expected. The Yakama Nation already propagates coho in the basin and could be a source for coho. A source for sockeye would have to be determined, however NMFS used the Lake Wenatchee stock when conducting previous investigations. Marking salmon for evaluation is common and techniques are well developed.

Most juvenile sockeye and coho are spring migrants. NMFS noted that sockeye emigrating from Cle Elum Reservoir appeared to occupy the upper levels of the water column and were generally unwilling to dive to go under a radial gate opening or orifice submerged below the surface. Sockeye that did pass through the openings and make it down the spillway survived as well as juvenile sockeye released below the dam. Survival estimates of juveniles were made at Prosser Dam. Additionally, NMFS felt that the amount of water being released through the radial gates may not have been enough to provide a sufficient surface attraction for the fish to find the opening. These two factors were likely the key limiting factor for the initial sockeye tests. In the Elwha Basin coho and chinook have successfully utilized a surface spill to bypass a dam while moving downstream. Specific information regarding other species migration in Cle Elum Reservoir is unknown.

Harza (1999) provided several conceptual designs for upstream and downstream fish passage at Cle Elum Reservoir. The designs were to pass fish at all reservoir levels and cost approximately 40 million dollars (approximately 20 million for upstream and 20 million for downstream passage). This appears to be quite expensive for a largely unproven technology. However, using the available life history information (primarily from NMFS studies) and the designs Harza presented, seasonal passage could be designed for the Cle Elum Dam. Again the approach must be simple, focused and flexible.

Adult passage above the dam particularly for coho poses little problems. A weir could be deployed just downstream of the dam to capture returning adults, who would then be placed in a fish truck and released above the dam. Flows are generally low (200 cfs) and stable below the dam during the time when coho adults are present (October - December). High flows can occur but coordination with the Cle Elum Reservoir operators can ensure safety to the trap and operators.

The capture and passage of adult sockeye could occur at one of two places, Roza Dam or below Cle Elum Dam. Roza has facilities already in place to capture adult salmon and can operate at various flow levels. High flow releases from Cle Elum Reservoir (3,000 cfs) in July and August (expected return time of adult sockeye) may preclude capture below the dam.

Costs associated with upstream passage of adults would mainly involve expenditures for personnel. Initial annual cost would be approximately $250,000. Equipment and in kind services could be borrowed or agreed upon to make this work through the "testing phase." Collecting of adults would not need to occur until two years after the first juveniles are released. A more permanent weir or ladder could be constructed to operate in all or most flow scenarios if results are promising.

Sockeye and coho emigrate in the spring and early summer when reservoir levels are at or near full pool. Both species will utilize surface water spills when emigrating from the reservoirs as long as there is a sufficient attraction flow. Modification to the operations and facilities of Cle Elum Dam can provide conditions favorable to passage. Harza (1999) provided initial designs for a "Multi-level Gravity Intake with Open Channel Bypass Conduit" to function at all reservoir levels for a cost of 15 to 20 million dollars. This design could be modified to provide passage for fish migrating in the spring at a substantial cost savings. A stand alone intake structure with an overspill gate could be constructed adjacent to the existing dam / spillway to release most of the bypass water during the spring. This gravity intake would connect to the existing spillway. Attraction flow should be sufficient as the outlet works and overspill gate are relatively close guiding the fish to the same general area. Given an option, fish will generally choose to follow a surface release as opposed to a submerged outlet works. Any overflow gate should be designed to operate, at a minimum, from the full pool elevation (currently at 2240 feet or 2243 with the three foot raise) down to the bottom or base of the current spillway elevation (2223 ft). At this time it is believed that this design may cost about $5 million, however, engineering designs and costs need further investigations.

Under current operational guidelines, the reservoir was at or above the spillway level (2223 feet) from 1 March to 31 June, expected emigration of sockeye and coho from the reservoir, about 46% of the time (from1938 to present). If Cle Elum Reservoir were raised three additional feet then operational guidelines would likely increase that percentage of time. A closer examination of current operations may reveal additional strategies to increase the percentage of time the reservoir is at the spillway elevation.

Thought should be given to the possibility of constructing the above-envisioned new stand-alone intake structure and overspill gate so that it would operate from full pool elevation down to elevation 2210 feet (not just down to elevation 2223 feet as proposed above). This would provide fish passage capability at Cle Elum for the upper 30 to 33 feet of operational pool elevation. This elevation would result in the potential for surface release nearly 65% of the time between 1 March and 31 June. It would also provide reservoir operators a second outlet structure for release of irrigation water or water to maintain downstream target flows during any period when the existing outlet tunnel might need emergency repairs.

Adult return of coho from Cle Elum Reservoir is expected to be good. The current coho supplementation program has produced successful returns in recent years and this is expected to continue. Juvenile sockeye released during the NMFS studies did return as adults; however, the numbers were not quantified so it is difficult to say whether they could support a self sustaining run particularly since conditions in the lower Yakima River in July, August and September, the expected return migration of adults, can be unfavorable.

authorized

Other issues to consider include passage at other reservoirs particularly Keechelus Dam and the ~~appropriated~~ funds for modifications at Cle Elum Dam. Lately there has been much discussion of providing fish passage at Keechelus Dam by Washington Department of Fish and Wildlife and the Yakama Nation. Passage at Keechelus Reservoir should be explored further, however,

conditions within Keechelus Basin are not as promising as Cle Elum for natural production. Much of the riverine habitat associated with Keechelus Basin is not accessible due to past gravel mining and railway construction. If there is only one option to provide fish passage at a Yakima Basin reservoir, then Cle Elum Reservoir is the best. Much effort in the form of scientific study and conceptual design has already gone into Cle Elum Reservoir and it is ready to "test" at the next level.

Authorized

Concerns also revolve around the costs to modify Cle Elum Reservoir. Costs associated with the three foot rise have escalated to 16 million dollars and that does not include fish passage. ~~Appropriated~~ funds are around 3 million in 1990 dollars. Additional funds would need to be requested or decisions will have to be made whether to provide fish passage without an increase in storage or vice-versa. Questions like these will need to be discussed further with a larger audience.

This will likely be a relatively complicated and costly action. The ideas presented above can be used as a starting point that can be built upon, modified or disregarded. At this time it is important to make it known that Reclamation (YRBWEP) is interested in pursing this action. Coordination with other agencies and interested parties should begin soon so their ideas, opinions and stances can be made known and addressed.

Cle Elum Improvements Project (CLIP) Cost Estimate Summary Report
($16,687,100 plus Fish Passage Costs, or $26,687,100 to $51,687,100)
April 11, 2000

Summary of Costs

1) CLIP Dam Safety Related Cost Estimate	-$0-
2) CLIP Engineering Cost Estimate	
Shoreline Protection Costs	$7,385,000
Radial Gate Modification Costs	$135,450
Upstream Inundation Impacts Costs	$1,020,200
Total Estimated CLIP Engineering Costs	$8,540,650
3) CLIP Environmental Cost Estimate	
NEPA/Environmental Compliance Costs	$918,000
Cultural Resources Costs	$275,000
Contingency Costs on the Two Items above, @ 25%	$298,250
Recreation Costs	$1,312,000
Total Estimated CLIP Environmental Costs	$2,803,250
4) CLIP Land-Related Cost Estimate	
✓ Ken Todd's Detailed Land Acquisition Cost Estimate	$4,170,000
Additional Lands Acquisition Cost Estimate	$910,200
Land-Related Staff Time and Travel Costs	$263,000
Total Estimated CLIP Land-Related Costs	$5,343,200
See Separate Items	
5) CLIP Fish Passage Cost Estimate	$10,000,000 to $35,000,000

Total Estimated Costs for the CLIP Project

..... $16,687,100 plus Fish Passage Costs

..... Or, $26,687,100 to $51,687,100

See attached cost estimates for more detailed cost estimate information.

Background

Section 1206 of the 1994 Yakima River Basin Water Enhancement Project Act (YRBWEP), Title XII of Public Law 103-434, authorizes the appropriation of $2,934,000, cost indexed to September 1990 prices, to: (A) modify the radial gates at the Cle Elum Dam spillway to raise the reservoir pool in Cle Elum Reservoir 3 feet, thus storing an additional 14,600 acre-feet of water. This additional storage water is dedicated exclusively to instream flows for fish and wildlife; (B) provide for shoreline protection of Lake Cle Elum; and (C) construct juvenile fish passage facilities at Cle Elum Dam. Section 1206 further authorizes the appropriation of "such additional amounts as may be necessary which may be required for environmental mitigation." Section 1206 also authorizes the appropriation of "such sums as may be necessary for that portion of the operation and maintenance of Cle Elum Dam determined by the Secretary to be a Federal responsibility."

CLIP Core Team

Reclamation decided in late 1997 to move into preparations for Lake Cle Elum improvements. Activities began in earnest in February 1998, with the establishment of a Cle Elum Improvements Project (CLIP) Core Team organized by YRBWEP manager Jim Esget. Core Team members are:

Stan Isley, Upper Columbia Area Office (UCAO), is CLIP project coordinator.

Eduardo Lopez Owsley, Pacific Northwest Construction Office, Yakima, is the lead for engineering design and is a member of the Cle Elum Dam Risk Analysis Team. Eduardo took over for Steve Brown as engineering lead when Steve Brown departed the Design/Specification group in the Pacific Northwest (PN) Regional Office.

Berney Tafoya represents the Yakima Field Office (YFO) engineering group on the CLIP Core Team.

Candy McKinley of the UCAO Environment group is the lead on CLIP environmental issues.

Jim Blanchard of the Ephrata Field Office (EFO) and Ron Cochran of the YFO are co-leads on CLIP realty issues.

Ken Todd, PN Region appraiser, provides land acquisition cost estimates for the CLIP team.

And Walt Larrick, UCAO biologist, is the CLIP Core Team lead on fish passage issues.

Other Staff Assisting with CLIP

The Core Team received many hours of assistance from other Reclamation staff:

Dave Curran, of the Denver Technical Service Center Geotechnical Engineering Group was the team leader for the Cle Elum Dam Risk Analysis Team. Dave and his entire team provided assistance to the CLIP Core team, expediting the completion of the risk analysis.

Dick Link, PN Region Geology group, assisted Eduardo with the shoreline protection cost estimate and was a member of the Cle Elum Dam Risk Analysis Team.

Cory Stolsig's EFO staff assisted with shoreline surveying at Cle Elum Reservoir.

Dave Jackson, Jill Armer (rotation engineer from PN Region in Boise), and Wendy Christensen, of the PN Construction Office, assisted Eduardo with shoreline surveying, etc.

Warren Sharp and Ed Young, UCAO Planning Group, have provided assistance with maps, LIDAR flight coverage, and upstream flood impact assessment at Cle Elum Reservoir.

Pete Hoffmann, of the Denver Technical Service Center Hydraulic Equipment Group provided a cost estimate for radial gate modifications on the Cle Elum Dam spillway.

Bob Hamilton, of the PN Region, conducted a strategic planning, project scoping work session for the CLIP Core Team.

Denny Hudson, of the PN Region, assisted with fish passage issues, particularly with providing information about the NMFS sockeye salmon study at Cle Elum Reservoir.

Mark DeLeon, UCAO Environment Group, provided a cultural resources cost estimate.

Other staff helping the CLIP Core Team effort were: Jim Faith (YFO); Terry Hawkins and Dave Kaumheimer (UCAO Environment); Jim Esget and Al Scherzinger (UCAO YRBWEP); John Manfredi (PN Construction); Dave Jennings (PN Region Design); Roberta Ries, Brooks Brown, Pat Contraro, and Rex Crumrine (UCAO Grants/Administrative Programs); Norbert Ries (UCAO Planning); Catherine Stephenson, Floyd Rogalski, Roger Skistad, and Steve Carter of the US Forest Service; Don Haley of the US Fish and Wildlife Service; and Brent Renfrow of the Washington State Department of Fish and Wildlife. Steve Croci/Tao (YRBWEP/USFWS)

Dam Safety

Dave Curran's Cle Elum Dam Risk Analysis Team completed the Cle Elum Dam Risk Analysis Report in December 1999. The report evaluates the safety of Cle Elum Dam: 1) under current reservoir pool operating conditions, and 2) with the additional 3 feet of reservoir pool contemplated by the proposed CLIP project.

The risk analysis report concludes that Cle Elum Dam poses an acceptably low level of risk to the current downstream population at risk. The report also finds that the 3-foot additional head resulting from the proposed raise of the reservoir normal water surface to elevation 2243 feet (CLIP proposal) would have negligible effect on the probability of failure and risk for each of the dam failure modes analyzed. The radial gate analysis found that the two lowermost horizontal wide flange beams (W24x94), which stiffen the faceplate of the gates, are undersized and slightly over-stressed for the current normal water surface (2240 feet elevation).

Among the risk analysis report recommendations are the following two recommendations which directly relate to the proposed CLIP project: 1) before increasing the hydrostatic loading on the spillway gates, particularly from that proposed by the 3 feet of additional reservoir storage (CLIP proposal), the radial gates' horizontal wide flange beams should be reinforced. The proposed spillway gate flashboards should not be installed until the flange beams have been properly reinforced; and, 2) consider filling in the low areas of the right abutment. This would raise the topography of the reservoir rim in this area to bring it up to elevation 2250 (i.e., the crest of the dam embankment). Also consider adding riprap to the shoreline in this vicinity to reduce wave-induced erosion.

Eduardo has integrated the risk analysis report's recommendation to place riprap along the shoreline of the low areas of the dam's right abutment into his December 15, 1999 Shoreline Protection cost estimate. Thus, the costs of implementing that recommendation have already been estimated as a part of the proposed CLIP budget.

The costs of filling in the low areas of the dam's right abutment would seem to be a responsibility of the Dam Safety Program modification budget. This action may need to be taken (filling of low spots) regardless of whether the proposed CLIP project is pursued and implemented. The issue needs further analysis by the Dam Safety Program. Reinforcing of the horizontal wide flange beams on the spillway radial gates is an action that needs to be done whether or not CLIP is implemented. Any such repairs undertaken by Reclamation Safety of Dams staff should be done in close coordination with the CLIP Core Team to ensure proper allocation of costs between programs, and to ensure that improvements are made with proper timing to minimize costs and maximize benefits to the public. Filling of low spots on Cle Elum dam's right abutment should be done in concert with CLIP-related shoreline protection activities. Reinforcement of radial gate horizontal wide flange beams should be done in concert with CLIP-funded installation of flashboards on the radial gates, unless, of course, Reclamation decides not to proceed with the CLIP project.

Engineering

Eduardo Lopez Owsley (with the help of his colleagues at the Pacific Northwest Construction Office) spent a large amount of time surveying and mapping the Cle Elum Lake shoreline, defining the new takeline required for land acquisition, identifying areas needing shoreline protection, and identifying sources of riprap. Peter Hoffman provided a cost estimate for the required modifications (flashboards) to the dam spillway radial gates. Dick Link helped with the search for sources of riprap.

Reclamation has contracted for a LIDAR (aerial photography and more) flight to provide topographical mapping of the entire Cle Elum Lake area to 2-foot contour level accuracy. The flight will be completed in the fall of 2000, with the data mapping being delivered to Reclamation soon thereafter. This will allow Eduardo and Warren Sharp to complete a HEC-RAS inundation analysis to determine if a segment of the USFS French Cabin Creek Road will be affected immediately west of the Cle Elum River bridge, where the road crosses the Cle Elum River valley upstream of Cle Elum Lake. In the worst case scenario, the bridge would have to be replaced/raised. The worst case bridge replacement cost estimate is provided in this CLIP cost estimate.

Environmental

Candy McKinley and Mark Deleon worked with USFS staff and provided cost estimates for NEPA/environmental compliance; cultural resources surveying, etc.; and recreation facility impacts that would be caused by implementation of CLIP. Mark reports that USFS staff would like to proceed with the class III cultural resources survey work at Cle Elum Lake in the summer

of 2000, if Reclamation decides to proceed with implementation of CLIP. USFS would like as much advance notification as possible of a decision by Reclamation to proceed with CLIP implementation, so that it may allocate staff time and resources to complete the class III survey in the coming year-2000 survey / field work season.

Land Acquisition

Ron Cochran, Jim Blanchard, and Ken Todd spent a large amount of time identifying existing land ownership boundaries, obtaining title reports for all Cle Elum Lake shoreline properties, and determining what acreage would have to be acquired by Reclamation in implementing the CLIP project. Eduardo provided detailed survey maps for portions of three sections to Ken Todd showing the proposed new takeline required for CLIP implementation. Ken provided detailed land acquisition cost estimates for these properties. These detailed survey maps and cost estimates were completed for the areas of subdivided shoreline which have the most serious shoreline erosion problems and for the properties most likely to be significantly affected by the proposed CLIP project.

Where the lakeshore lands are not developed and remain largely in a natural forested state, a more simple analysis was performed to assess land acquisition acreage and costs. Much of the remaining non-federal land along the Cle Elum Lake shoreline is owned by Plum Creek Timber Company. A more detailed analysis of the land acquisition needs and costs of these lands will be required if Reclamation decides to proceed with CLIP.

Land acquisition work associated with CLIP implementation would require a substantial amount of realty staff time. Ron Cochran and Jim Blanchard both provided estimates of the potential staff time costs for CLIP.

Fish Passage Facilities

The 1994 YRBWEP Act authorizes funding to "...(C) construct juvenile fish passage facilities at Cle Elum Dam." The August 1, 1994 Report of the Committee on Natural Resources to the US House of Representatives that accompanied the YRBWEP Act notes that: "as a part of the Northwest Power Planning Council's Fish and Wildlife Program, the Bonneville Power Administration is studying the possibility of reintroducing sockeye salmon into Cle Elum lake. If this is determined to be feasible, fish passage facilities to provide for the outmigration of juvenile smolts from the lake would be required."

Indeed, the Bonneville Power Administration funded a study, conducted by the National Marine Fisheries Service (NMFS) from 1987 through 1992. The study included releasing sockeye salmon fry (from Lake Wenatchee broodstock) into Cle Elum Lake over these several years and monitoring the success of their outmigration as smolts and their return as adults. The study was never formally completed. Study results were somewhat inconclusive, but preliminary results seemed to show that the potential habitat available in Cle Elum Lake and upstream in the Cle Elum River could sustain a viable population of sockeye salmon. NMFS' study leader for the

Cle Elum Lake sockeye study, Tom Flagg, had not completed the final report for the study as of the start of this year. Mr. Flagg has completed the final report now, in April 2000.

Reclamation, to date, has not received any formal determination from the Bonneville Power Administration as to the feasibility of reintroducing sockeye salmon into Cle Elum Lake. Reclamation must review the final report from NMFS on the results of the 1987-1992 study and seek additional input from local and regional biologists regarding the feasibility of salmon reintroduction into Cle Elum Lake. Then Reclamation must determine whether the benefits of salmon reintroduction justify the costs of constructing fish migration facilities at Cle Elum Dam.

Reclamation contracted with Harza Engineering in July 1999 to provide a report on potential downstream and upstream fish passage concepts at Cle Elum Dam with an "order of magnitude" estimate of costs associated with each of the concepts. Harza submitted a draft fish passage concepts report in September 1999 and a final report in December 1999, presenting three general design concepts for downstream passage and two upstream passage concepts. Downstream juvenile salmon passage options analyzed are: 1) outlet conduit, 2) surface attraction to a trap and haul facility, and 3) surface outlet to an open channel bypass. Upstream adult passage options analyzed are: 1) fish ladder to a trap and haul facility, and 2) fish ladder with a slide to the lake.

Even the least expensive pairing of downstream and upstream fish passage facilities at Cle Elum Dam is estimated to cost between $10,000,000 and $20,000,000. The most expensive pairing of downstream and upstream fish passage facilities at Cle Elum Dam is estimated to cost between $25,000,000 and $35,000,000.

These costs are very high, but installation of such fish passage facilities at Cle Elum Dam would provide several benefits to the public. Providing anadromous fish passage into Cle Elum Lake and upstream river segments would potentially restore the extirpated sockeye salmon to the Yakima River basin, would potentially restore fish access to the historic spawning grounds once used by ESA-threatened steelhead and candidate spring chinook salmon, would potentially provide spawning habitat to coho salmon (a species which also historically utilized this habitat), and may also benefit resident populations of ESA-threatened bull trout.

A new open channel bypass conduit constructed in the right abutment of Cle Elum Dam to provide for fish passage could also double as a second outlet conduit for releasing irrigation water from Cle Elum Lake, during any period when repairs would be required on the main reservoir outlet tunnel. Currently only the one main outlet tunnel allows for the release of water from the reservoir when the reservoir pool is below the bottom of the spillway, at elevation 2223 feet. Thus, the possibility exists that Reclamation currently would not be able to release water from Cle Elum Lake to satisfy its contract water users for a period of time if emergency repairs were needed on the main outlet tunnel during the irrigation season.

Reclamation must carefully weigh the benefits and costs of providing fish passage facilities at Cle Elum Dam, and make a difficult decision as to whether fish passage facilities are feasible and warranted.

CLIP Budget Discussion

The 1994 YRBWEP Act authorized the expenditure of $2,934,000, cost-indexed to September 1990 prices, plus "such additional amounts as may be necessary... for environmental mitigation," plus "such sums as may be necessary... for that portion of the operation and maintenance of Cle Elum Dam determined... to be a Federal responsibility," to fund the entire CLIP project. Based on the cost estimate prepared by the CLIP Core Team and presented on the first page of this report, the 1994 CLIP funding authorization (about 3 million dollars) represents only about 18% of the low-side estimate of CLIP project costs (about 16.7 million dollars), even without the cost of fish passage facilities added in. Factoring in even the least expensive pairing of fish passage facilities jumps the project cost to about 26.7 million dollars, almost nine times the authorized CLIP funding level.

Additionally, Rex Crumrine reports that a total of about $376,000 has already been charged against the cost accounting codes for the CLIP project. This money has been used to pay for staff time expended in preparing the CLIP project cost estimate over the last two years, including a $10,000 funding agreement entered with the USFS Wenatchee National Forest to compensate USFS for the time spent by USFS staff assisting with CLIP cost estimate preparation.

Current Authorization
$2,934,000 (Sept. 1990 Dollars), plus...

CLIP Funds Expended to Date
$376,000

Estimated Total CLIP Project Cost Range
$16,687,100 without Fish Passage Facilities
$26,687,100 to $51,687,100 with Fish Passage Facilities

This funding shortfall will require authorization, by Congress, of a substantial additional funding amount for implementation of the proposed CLIP project.

Report Written by: _____ Date: 4/11/00

Cle Elum (CLIP) Dam Safety Related Cost Estimate

(-$0-)

January 14, 2000

Background

The Risk Analysis Report for Cle Elum Dam was completed in December 1999 by Dave Curran, Geotechnical Engineer in Reclamation's Technical Service Center in Denver, and the Cle Elum Dam Risk Analysis Team. The report evaluates the safety of Cle Elum Dam: 1) under current reservoir pool operating conditions, and 2) with the additional 3 feet of reservoir pool contemplated by the proposed CLIP project.

The risk analysis report concludes that Cle Elum Dam poses an acceptably low level of risk to the current downstream population at risk. The report also finds that the 3-foot additional head resulting from the proposed raise of the reservoir normal water surface to elevation 2243 feet (CLIP proposal) would have negligible effect on the probability of failure and risk for each of the failure modes analyzed. The radial gate analysis found that the two lowermost horizontal wide flange beams (W24x94), which stiffen the faceplate of the gates, are undersized and slightly over-stressed for the current normal water surface (2240 feet elevation).

Among the risk analysis report recommendations are the following two recommendations which directly relate to the proposed CLIP project: 1) before increasing the hydrostatic loading on the spillway gates, particularly from that proposed by the 3 feet of additional reservoir storage (CLIP proposal), the radial gates' horizontal wide flange beams should be reinforced. The proposed spillway gate flashboards should not be installed until the flange beams have been properly reinforced; and, 2) consider filling in the low areas of the right abutment. This would raise the topography of the reservoir rim in this area to bring it up to elevation 2250 (i.e., the crest of the dam embankment). Also consider adding riprap to the shoreline in this vicinity to reduce wave-induced erosion.

Costs to CLIP Budget

Eduardo Lopez Owsley was a member of both the CLIP Core Team and the Cle Elum Dam Risk Analysis Team. Eduardo has integrated the risk analysis report's recommendation to place riprap along the shoreline of the low areas of the dam's right abutment into his December 15, 1999 Shoreline Protection cost estimate. Thus, the costs of implementing that recommendation have already been estimated as a part of the CLIP budget.

The costs of filling in the low areas of the dam's right abutment would seem to be a responsibility of the Dam Safety Program modification budget. This action may need to be taken (filling of low spots) regardless of whether the proposed CLIP project is pursued and implemented. It does not currently represent a dam safety issue. The issue needs further analysis

by the Dam Safety Program. In such a future analysis, a "fuse-plug" scenario should be considered in conjunction with fine tuning the Early Warning System (EWS). The "fuse-plug" scenario would act as an auxiliary spillway.

The reinforcement of the dam spillway radial gates' horizontal wide flange beams should be completed whether the proposed CLIP project is pursued. Therefore, it would seem to be a responsibility of Reclamation's Dam Safety Program modification budget. The CLIP budget will be responsible for the costs of fabricating and installing the 3-foot high flashboards on the dam spillway's five radial gates. Reinforcement of the horizontal wide flange beams should occur either before, or if Reclamation decides to proceed with the proposed CLIP project, at the same time as the installation of the flashboards (to minimize costs).

Implementation of the risk analysis report's dam safety-related recommendations at Cle Elum Dam must be done in close coordination with the CLIP Core Team, particularly Eduardo Lopez Owsley. Close coordination among Dam Safety staff and managers, the CLIP Core Team, and the manager of the Yakima River Basin Water Enhancement Project, Jim Esget, will ensure proper allocation of costs among the program budgets. Such coordination will ensure that improvements are made with proper timing to minimize costs and maximize benefits to the public.

Summary

Dam Safety-related costs at Cle Elum Dam will be assumed by Reclamation's existing Dam Safety Program modification budgets, in close communication and coordination with the CLIP Core Team. Shoreline protection costs along the dam's right abutment, and costs of fabrication and installation of the flashboards on the five radial gates at the Cle Elum Dam spillway will be the responsibility of the CLIP budget. Cost estimates for shoreline protection and flashboards are included in the CLIP engineering costs estimate, and are not restated here. If Reclamation management determines the CLIP project is not feasible or cost-effective and chooses not to proceed with the proposed CLIP project, shoreline protection of the right abutment of Cle Elum Dam would become a responsibility of Reclamation's Dam Safety Program.

Total Estimated CLIP Dam Safety-Related Costs ..... -$0-

(See CLIP Engineering Cost Estimate for Related Costs)

Cle Elum (CLIP) Engineering Costs Estimate
($8,540,650)
March 22, 2000

I. Shoreline Protection

Includes costs of: site development; material production; shoreline placement; shoreline earthwork; site maintenance; mobilization costs; bonds, B & O, and insurance costs; contingencies, construction administration and inspection, and design costs (see Eduardo Lopez Owsley's December 15, 1999 Shoreline Protection cost estimate for details).

. . . . . $7,385,000

II. Radial Gate Modifications

Includes costs for: fabrication and installation of five 3-foot high by 37-foot wide stiffened flashboards for the five radial gates on the Cle Elum Dam spillway. Costs include contingency costs, etc. (see Peter Hoffmann's August 12, 1999 Flashboards cost estimate, as revised March 22, 2000 per John Manfredi's recommendations, for details).

. . . . . $135,450

III. Upstream Inundation Impacts

A possibility exists that a segment of the USFS French Cabin Creek Road may be affected immediately west of the Cle Elum River bridge, where the road crosses the Cle Elum River valley upstream of Cle Elum Lake. Under a worst case scenario, the bridge would have to be replaced/raised. Aerial photography data (LIDAR flight) scheduled to be completed in the fall of 2000 will allow the CLIP Core Team to complete a HEC-RAS inundation analysis to determine if this road segment will be impacted by the proposed CLIP 3-foot pool raise. Eduardo Lopez Owsley will estimate any associated costs at that time. The worst case bridge replacement cost estimate is provided here.

. . . . . $1,020, 200

Total Estimated CLIP Engineering Costs $8,540,650

(This is the sum of costs for Items I. through III. above.)

CLE ELUM IMPROVEMENT PROJECT
Feature: Shoreline Protection
January 28, 2000

CONSTRUCTION ESTIMATE

DESCRIPTION	QUANTITY	UNIT*	UNIT PRICE ($)	AMOUNT ($)
SITE DEVELOPMENT				
USBR geology borrow selection and testing			Lump sum	150,000
Surveying, conventional, topographical	10	AC	2100	21,000
Haul road widening & improvement (0.7 mi @ 20')	8,215	SY	5.10	41,900
Haul road construction along shoreline (0.8 mi @ 20')	9,800	SY	5.10	50,000
Borrow area clearing & restoration	10	AC	3000	30,000
MATERIAL PRODUCTION (riprap, bedding, road gravel)				
Drilling and Blasting (88,000 CY use; 12,000 CY waste)	100,000	CY	6.40	640,000
Pit excavation, material handling, & grizzly (88,000 CY use; 12,000 CY waste)	100,000	CY	6.50	650,000
Crusher	50,000	CY	5	250,000
Haul (riprap & bedding: 80,000 CY + 8,000 CY loss)	88,000	CY	20.50	1,804,000
SHORELINE PLACEMENT (80,000 CY use + 8,000 CY loss)				
Riprap placement (57%: 45,600 use + 4,400 loss)	50,000	CY	7.50	375,000
Bedding placement (43%: 34,400 use + 3,600 loss)	38,000	CY	6	228,000
SHORELINE EARTHWORK				
Clear and grub (USFS harvest trees, grub stumps)	4	AC	3000	12,000
Shoreline excavation	143,000	CY	2.00	286,000
Slope toe backfill	28,000	CY	1.40	39,200
In-reservoir disposal	104,000	CY	0.50	52,000
SITE MAINTENANCE				
Haul road maintenance	100	day	1000	100,000
Dust control, heavy	100	day	1000	100,000
Flaggers (2: 1 @ borrow road/hwy & 1 @ shoreline/hwy)	200	day	280	56,000
Subtotal				4,885,100

DESCRIPTION	QUANTITY	UNIT*	UNIT PRICE ($)	AMOUNT ($)
... Amount from previous page (Subtotal)				4,885,100
Mobilization			Lump Sum	50,000
Bonds, B&O, insurance	2	%		97,700
CONSTRUCTION CONTRACT COST				5,032,800
Contingencies	30	%		1,509,800
FIELD COSTS				6,542,600
Construction Administration & Inspection	7.5	%		490,700
CONSTRUCTION COST				7,033,300
Design Cost	5	%		351,700
Total GROSS BUDGET (Factored to 1999 prices)				7,,385,000

NOTE: This estimate does not include R.O.W., Permits, and USFS requirements.

* AC = acre, CY = cubic yard, SY = square yard

N:\WPfiles\CleElum\Shrlnest.wpd

From: Stan Isley
To: Hoffmann, Peter
Date: Fri, Aug 13, 1999 11:01 AM
Subject: Re: Cle Elum - Revised Estimated - 3-foot high Flashboard Furnish and Install Costs.

8-13-99

Pete;

I also would like to say THANKS for your revised cost estimate for the Cle Elum flashboards that we would need for the CLIP project. This helps us out a bunch. Good work.

Stan Isley

>>> Peter Hoffmann 08/12/99 06:37AM >>>
Revised Cost Estimate for Installation of Five Flashboards:

The total cost estimate for fabrication and installation of **five** 3-foot high flashboards, installed on the **five** 37-foot wide by 17-foot high spillway radial gates is **$120,000** as explained below:
*** Per John Manfredi's 2/28/00 suggestion, we must add 1) Construction Administration and Inspection Costs (@ 7½%), and 2) Design Costs (@ 5%) to this $120,000 fabrication and installation cost estimate. Therefore, the grand total cost estimate for the five flashboards at Cle Elum Dam (CLIP) is $135.450.** *(SI, 3/22/00)*

Fabrication Costs Include:

Weight of one 3-foot high x37-foot wide stiffened flashboard with an additional 8" of flashboard above that serving as a splashboard is 2,500 lbs (using a 1/4-inch thick skinplate). The stiffening for the skinplate would be small M-shape beams. Two flashboard arms (W6x16) on either end of the flashboard would carry the flashboard load into the existing arms. The fabricated cost, including paint would be at $3/pound. Hence, total cost to fabricate **5** flashboards is approx. **$37,500**.

Flashboard Installation Costs Include:

1. Contractor mobilizaton/demobilization @ $10,000 (one time);
2. Installation crew consisting of 1 crane operator (@$75/hr), mobile crane (@$65/hr), 1 foreman (@$65/hr), 2 mechanics/welders (@$55/hr each), 1 laborer (@$45/hr);
3. The hourly rate of the crew and crane is approx $360/hr;
4. Given installation of 1 flashboard is 20 hours (= 2-10hr days);
5. Hence, total installation cost is approx **$46,000**.
6. Add in contractor overhead, profit, contingencies, @ 43% = **$35,905**.
7. Total cost for flashboard installation is **$119,405**.
8. For estimate purposes, round cost to **$120,000**.

Additional Engineering Costs Include:

1. Add in construction administration and inspection cost, @ 7½% = **$9,000**.
2. Add in design cost, @ 5% = **$6,450**.

Total CLIP Engineering Cost Estimate for Five Flashboards: $135,450.

CC: Cle Elum Core Team - CLIP; Curran, David; Esget, Jim; Scherzinger, Alan (The Cle Elum Core Team - CLIP includes Jim Blanchard, Ron Cochran, Stan Isley, Walt Larrick, Eduardo Lopez Owsley, Candy McKinley, Berney Tafoya, and Ken Todd.)

CLE ELUM IMPROVEMENTS PROJECT - CLIP
Feature: Upstream Inundation Impacts
(Replacement of the French Cabin Creek Road Bridge over the Cle Elum River)
February 28, 2000

CONSTRUCTION ESTIMATE

DESCRIPTION	QUANTITY	UNIT	PRICE	($) AMOUNT
Bridge demolition		L.S.*		35,000
River diversion during demolition		L.S.*		31,000
New bridge construction[1]		L.S.*		629,200
CONSTRUCTION CONTRACT COST				695,200
Contingencies	30	%		208,600
FIELD COSTS				903,800
Construction Management	7.5	%		67,800
CONSTRUCTION COST				971,600
Design Cost	5	%		48,600
Total GROSS BUDGET (Factored to 1999 prices)[2]				1,020,200

NOTES: 1) Bid price for 1998 construction of USFS bridge with same span and width (Rattlesnake Bridge), adjusted to 1999 prices. Source: Roger Skistad, USFS, Cle Elum Ranger District.
2) This estimate does not include R.O.W., Permits, and USFS requirements.

* L.S. = Lump Sum

Cle Elum (CLIP) Environmental Costs Estimate
($2,803,250)

I. NEPA/Environmental Compliance

A. EIS		$500,000
B. Spotted Owl Survey (U.S. Forest Service)		$7,000
C. U.S. Fish and Wildlife Coordination Act Report, ESA Consultation	35 days	$23,000
D. Managed Species Survey (USFS)		$30,000
E. Ute's Ladies Tresses Survey (USFW)	3 days	$2,000
F. Wetland Delineation (Contractor)		$30,000
G. Wetland Mitigation		$300,000
H. Environmental Permits/Compliance	40 days	$26,000

Corps Section 401/404 (COE)
Kittitas County Shoreline Exemption
Water Quality Certification (WDOE)

Total NEPA/Environmental Compliance Costs $918,000

II. Cultural Resources

A. Cultural Resources Survey - Class I	job	$5,000
B. Cultural Resources Survey - Class III Field	30 days	*$60,000
C. Cultural Resources Survey - Report	30 days	$25,000
D. HABS/HAER Recording	job	$20,000
E. TCP Coordination	job	$5,000
F. Mitigation, if Needed		**$150,000
G. Other UCAO Direct Charges		$10,000

* *Need Acreage*

Total Cultural Resources Costs ***$275,000

*** *FY2000 Costs*

- Subtotal 1 ..... ($1,193,000)
(Sum of Costs for Items I. and II.)

III. Contingencies on Items I. and II.

An Added 25% of Subtotal 1 for Miscellaneous Non-itemized Costs

Total Contingencies Costs on Items I. and II. above $298,250

- Subtotal 2 ..... ($1,491,250)
(Sum of Costs for Items I. through III.)

IV. Recreation

A. Roads
1. Wish Poosh Campground (CG) $524,700
2. Cle Elum River CG $13,200

B. Parking
1. Wish Poosh CG $176,100
2. Cle Elum River CG $15,000

C. Utilities
1. Wish Poosh CG $33,000
2. Cle Elum River CG $0

D. Facilities
1. Wish Poosh CG $56,100
2. Cle Elum River CG $28,300

- Subtotal ..... ($846,400)
(Sum of Costs for Items A. through D. above)

E. Contract Administration & Construction Administration $127,000
(An Added 15% of Costs of A. through D. above)

F. Contingencies $127,000
(An Added 15% of Costs of A. through D. above)

G. NEPA, Planning, Survey, and Design $211,600
(An Added 25% of Costs of A. through D. above)

Total Recreation Costs ****$1,312,000
*****This Cost Estimate Is Based on All Impacted Facilities Being Replaced.*

TOTAL ESTIMATED CLIP ENVIRONMENTAL COSTS $2,803,250
(This is the sum of Costs for Items I. through IV. above.)

PN-3905
LND- 3.00

January 14, 2000

To: Area Manager, Upper Columbia Area Office, Yakima, Washington
Attention: UCA-1200 (Esget), UCA-1205 (Isley)

From: Kenneth B. Todd, Regional Appraiser
Edits by Stan Isley, CLIP Team Leader (& Ron Cochran & Jim Blanchard)

Subject: Supplemental Land Acquisition Cost Estimate with Consolidated Summary of Proposed Land Acquisitions as of January 14, 2000, for Cle Elum Improvements Project - CLIP (3-foot Dam Raise Project), Yakima River Basin Water Enhancement Project, Upper Columbia Area Office, Yakima, Washington.
(Total CLIP Land-Related Cost Estimate as of January 14, 2000 ..... $5,343,200)

Additional lands were identified in December 1999 for acquisition for the proposed CLIP Project for raising the reservoir pool impounded by Cle Elum Dam by 3 feet. These lands are in the SE Quarter of Section 4, Township 20 North, Range 14 East, W. M., Kittitas County, Washington. These lands are a 300 foot wide strip along the Cle Elum Lake shoreline. Four land ownerships are being affected by the acquisitions with 4.12 acres proposed for acquisition from Lot 1, 5.93 acres from Lot 2, 0.23 acres from Lot 3, and 5.12 acres from Lot 4, for a total of 15.4 additional proposed acres to add to the lands acquisition cost estimate.

Supplemental Value:

Estimated Acquisition Cost	$ 60,000
Plus 33% Contingencies	$ 19,800
Contract Appraisal & Appraisal Review & Cleanup Costs	$ 20,200
Total Supplemental Value	$ 100,000

Consolidated Summary:

Total Estimated Costs as of September 20, 1999	$ 3,900,000
Additional Estimated Costs as of October 14, 1999	
House Demolition & Clean Up Costs	$ 75,000
Contract Appraisal & Appraisal Review Costs	$ 75,000
Water Supply Replacement (4 homes)	$ 20,000
Supplemental Value (from above)	$ 100,000

Consolidated Land Acquisition Costs:

Total Estimated Costs as of January 7, 2000	$ 4,170,000

Other Additional Lands:
Other additional lands along the Cle Elum Lake shoreline are owned by Plum Creek Timber Company (PCTC), the State of Washington, and individual private landowners. No detailed analysis of affected acreage and acquisition acreage has been completed on these additional lands as of January 14, 2000.

Jim Blanchard estimated that the land acquisition costs for these additional ownerships would not exceed $830,000, and suggested the CLIP team estimate an even $5,000,000 for total land acquisition costs for CLIP.

Ron Cochran reviewed title reports, plat maps, and other data, and provided a more detailed estimate of these remaining land acquisition costs. Ron's estimate is a rough "range of magnitude" estimate, but provides an estimate of costs in close agreement with Jim Blanchard's estimate above. Details of Ron's analysis for these remaining lands follow:

Rationale:
Ron Cochran and Stan Isley decided to utilize Ken Todd's land cost estimate for the lands in the SE¼ of Section 4, T. 20 N., R. 14 E.W.M., described above under "Supplemental Value," as a model. Estimating the total acreage contained within a 300 foot wide strip of land along the Cle Elum Lake shoreline for each of the identified parcels provided a rough total acquisition acreage figure for these additional lands. We assume these parcels have the same type of use (timber land) and land value as those lands in the SE¼ of Section 4. Using the same per-acre costs as identified by Ken for the lands in the SE¼ of Section 4, we derived a ballpark estimate of land acquisition costs for these remaining parcels. 1) Ron estimated a "low side" per-acre value for these lands by dividing Ken's $60,000 acquisition cost estimate by the 15.4 affected acres in the SE¼ of Section 4, yielding a value of $3896 per acre (low). 2) Ron estimated a "high side" per-acre value by dividing Ken's $100,000 acquisition plus contingencies, etc. (total) cost estimate by the 15.4 affected acres in said SE¼ of Section 4, yielding a value of $6493.50 per acre (high).

Additional "Eastside of Lake" Land Parcels and Affected Acreage:

1) Green Crow Corporation; Parcel 21-14-3400-0001-00; 1900 feet of shoreline by 300 foot wide acquisition strip totals ..... 13.09 acres
2) Marc Warner; Parcel 21-14-2820-0002-00; 1116 feet by 300 feet totals ... 7.69 acres
3) Tyke Riley; Parcels 21-14-2820-0003-00 and 21-14-2820-0005-00; 877 feet by 300 feet totals ..... 6.04 acres
3) Franklin Hull; Parcel 21-14-2820-0004-00; 2227 feet by 300 feet totals .. 15.34 acres
4) A. Monjazeb; Parcels 21-14-2100-0006-00; 21-14-2100-0007-00; and 21-14-2100-0008-00; 2300 feet by 300 feet totals ..... 15.84 acres
5) State of Washington, ...Wildlife...; Parcel 21-14-2100-0002-00; 1000 feet by 300 feet totals ..... 6.89 acres
6) Plum Creek Timber Company - PCTC; Parcel 21-14-2100-0003-00 (NW¼ of Section 21, T. 21 N., R. 14 E.W.M.); 800 feet by 300 feet totals ..... 5.51 acres
7) Plum Creek Timber Company - PCTC; SW¼ of Section 9, T. 21 N., R. 14 E.W.M.; 2640 feet by 300 feet totals ..... 18.18 acres

8) Plum Creek Timber Company - PCTC; Section 8, T. 21 N., R. 14 E.W.M.; 1300 feet by 300 feet totals ..... 8.95 acres

Additional "Westside of Lake" Land Parcels and Affected Acreage:

9) Plum Creek Timber Company - PCTC; SW¼SW¼ of Section 33, T. 21 N., R. 14 E.W.M.; 550 feet by 300 feet totals ..... 3.79 acres

10) Plum Creek Timber Company - PCTC; SW¼ of Section 3, T. 20 N., R. 14 E.W.M.; 2640 feet by 300 feet totals ..... 18.18 acres

11) Unknown (possible PCTC or individual landowner); NE¼ of Section 4, T. 20N., R. 14 E.W.M.; 3000 feet by 300 feet totals ..... 20.67 acres

Total Additional Acreage: ..... 140.17 acres

Land Acquisition Costs for These Other Additional Lands:

Assigning a per-acre value of $3896.00 to these 140.17 total additional acres provides the "low side" land acquisition cost estimate for these additional lands, given below. Assigning a per-acre value of $6493.50 to these 140.17 total additional acres provides the "high side" land acquisition cost estimate for these additional lands, given below:

"Low Side" Cost $546,102.32
"High Side" Cost $910,193.89

These estimates are consistent with Jim Blanchard's "not to exceed $830,000" cost estimate for these other additional lands. For the CLIP cost estimate, it is valid and prudent to use the rounded "high side" cost estimate for these other additional lands of ..... $ 910,200

Total CLIP Land Acquisition Costs:

Total Estimated Costs as of January 7, 2000 ..... $ 4,170,000
"High Side" Cost Estimate for the Other Additional Lands ..... $ 910,200

Total CLIP Land Acquisition Costs, January 14, 2000 Estimate: ..... $ 5,080,200

Land-Related Staff Time and Travel Costs:

Jim Blanchard estimated staff time costs for CLIP realty and lands work at 1 "person-year,"or $125,000. Jim suggested adding another $25,000 in travel costs, for a total CLIP land-related staff time cost of $150,000.

Ron Cochran provided a detailed CLIP staff time cost estimate on August 20, 1999. Ron estimates 5.26 "person years" (FTEs) at $50,000 per year will be required, for a total CLIP land-related staff time estimate of $263,000.

"Low Side" CLIP Land-Related Staff Time Cost Estimate ..... $ 150,000
"High Side" CLIP Land-Related Staff Time Cost Estimate ..... $ 263,000

For the CLIP cost estimate, it is valid and prudent to use the "high side" land-related staff time cost estimate of ..... $ 263,000

Grand Total CLIP Land-Related Costs:

Total CLIP Land Acquisition Costs as of January 14, 2000 ..... $ 5,080,200
"High Side" CLIP Land-Related Staff Time Cost Estimate ..... $ 263,000

Grand Total CLIP Land-Related Cost Estimate as of January 14, 2000:
..... $5,343,200

If Reclamation decides to proceed with the proposed CLIP project, take lines will have to be developed by the CLIP Core Team and a more detailed acquisition cost estimate will need to be made for these other additional lands, and for any other extraneous land ownerships (not yet identified) that are identified in the future that will be affected.

The undersigned has no present or contemplated interest in the properties proposed to be acquired.

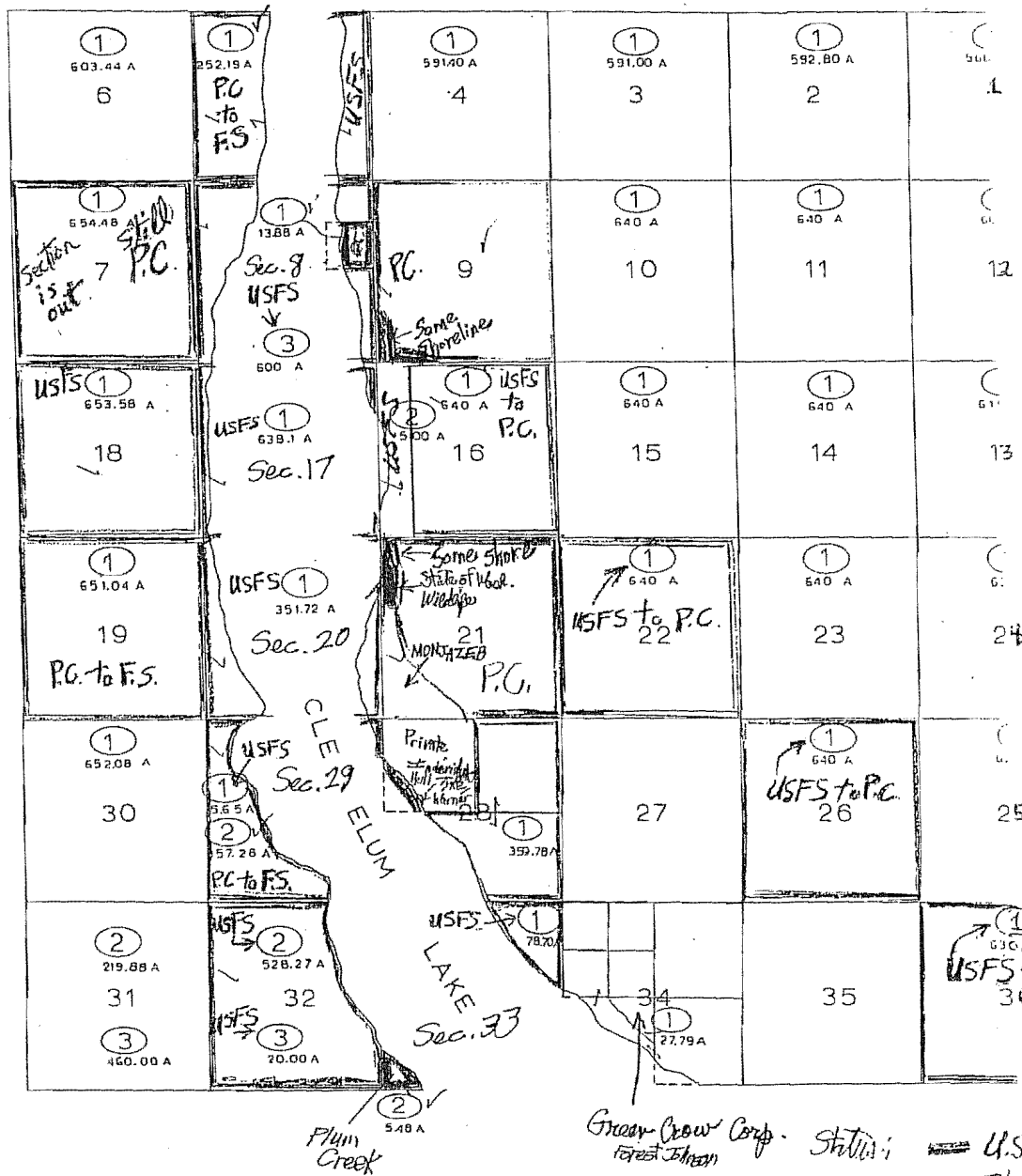
Please refer to and review the basis of the cost estimates outlined in the partial cost estimate dated September 20, 1999.

Attached are 1) a plat map showing the proposed acquisition areas in Section 4 detailed in this memorandum and 2) plat maps showing the other additional lands.

T. 21N., R. 14E.

SCALE:

JAN., 2000



ITY ASSESSOR

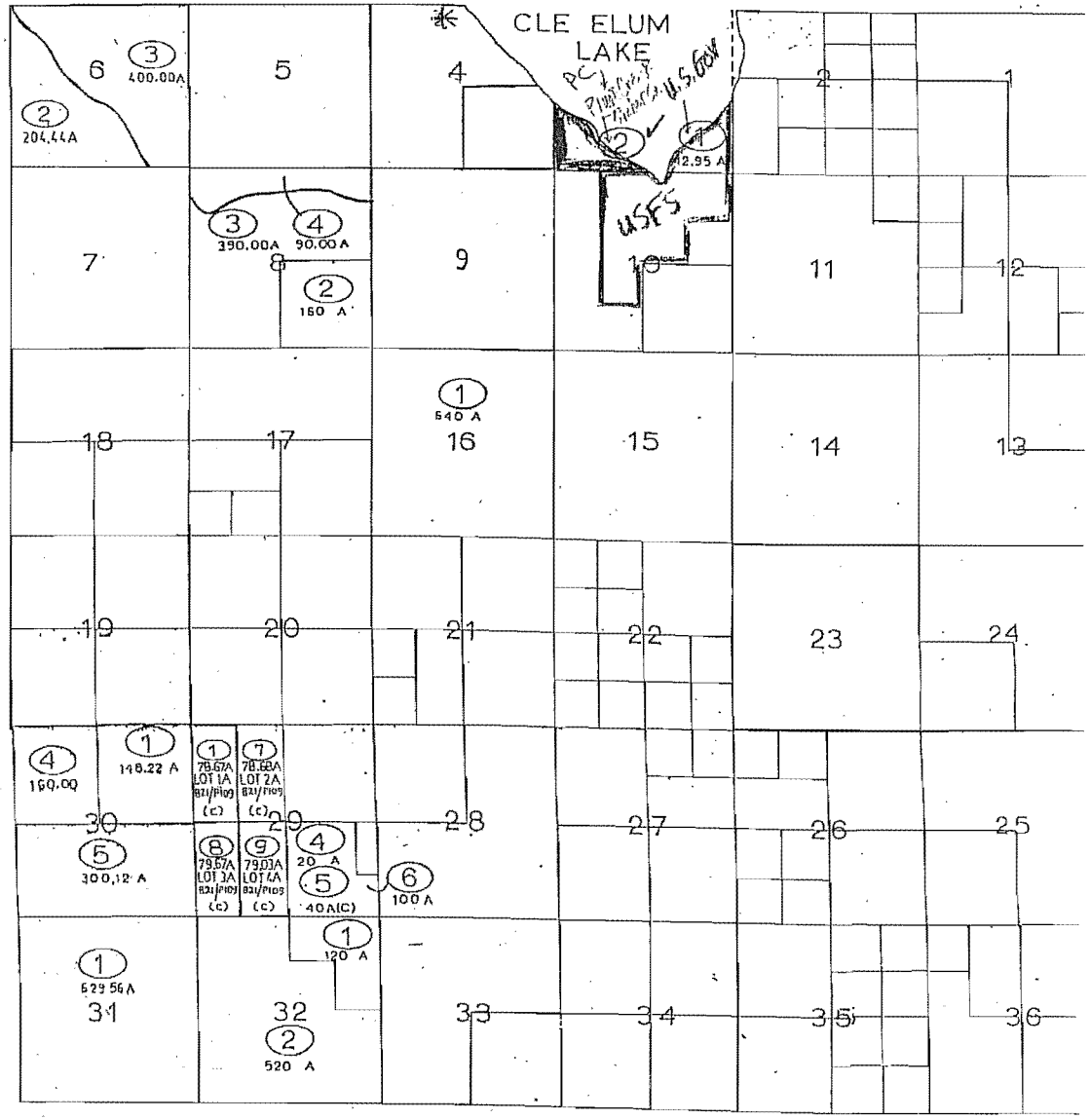
OFFICIAL MAP

T. 20 N., R. 14E.

EPRODUCED WITHOUT WRITTEN CONSENT OF COUNTY ASSESSOR

SCALE: 1 INCH

*Note:

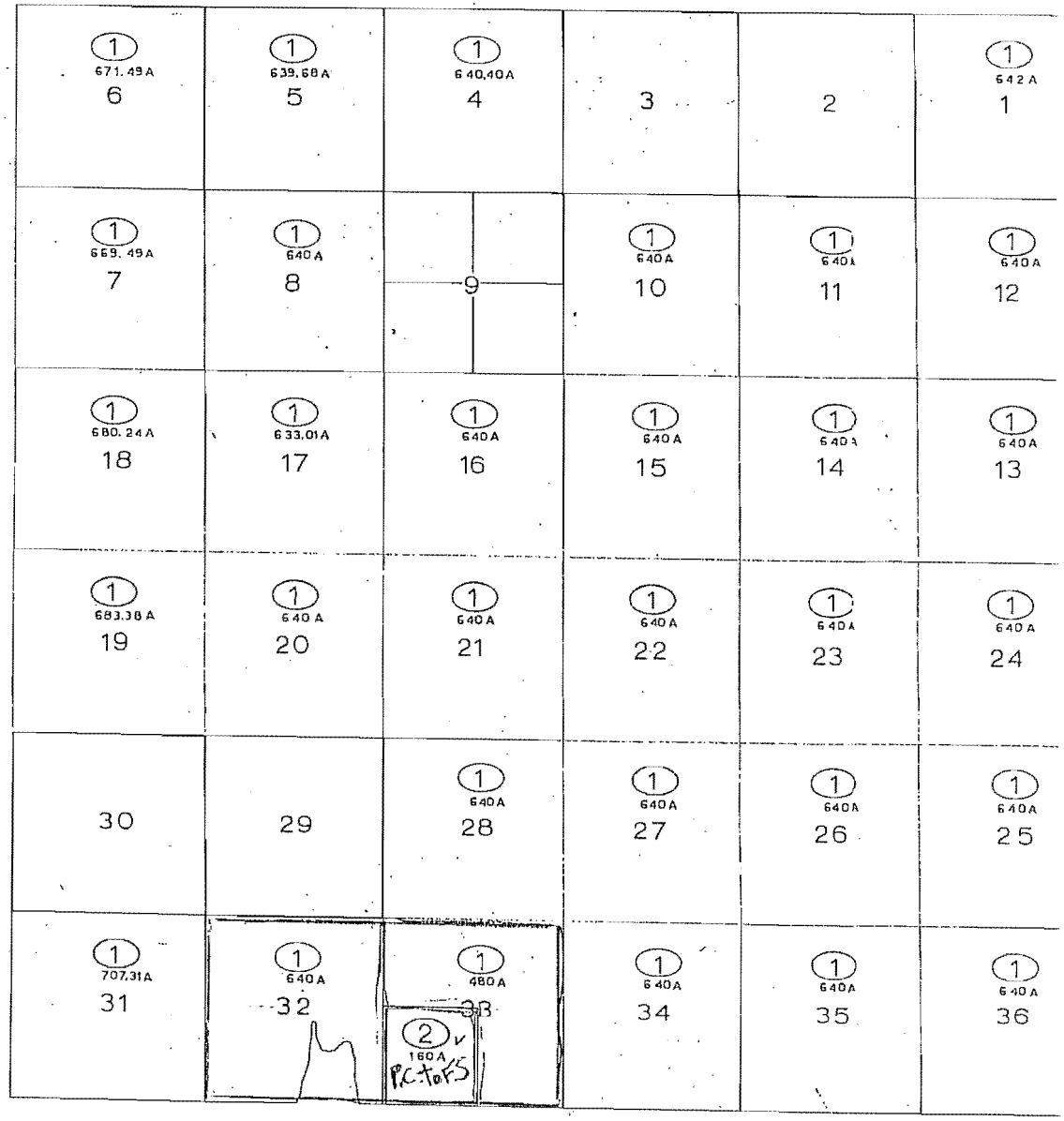


OFFICIAL MAP

T. 22 N., R. 14 E.

REPRODUCED WITHOUT WRITTEN CONSENT OF COUNTY ASSESSOR

SCALE: 1 INC



UCA-1205

United States Department of the Interior

JAN 12 2000

BUREAU OF RECLAMATION
Pacific Northwest Region
1150 North Curtis Road, Suite 100
Boise, Idaho 83706-1234

IN REPLY
REFER TO:
PN-3905
LND- 3.00

JAN 06 2000

MEMORANDUM

To: Area Manager, Upper Columbia Area Office, Yakima, Washington
Attention: UCA-1200 (Esget), UCA-1205 (Isley)

See 1/14/2000 update

From: Kenneth B. Todd, Regional Appraiser

Subject: Supplemental Land Acquisition Cost Estimate with Consolidated Summary of Proposed Land Acquisitions as of January 6, 2000, for Cle Elum Improvements Project (CLIP)(3-foot Dam Raise Project), Yakima River Basin Water Enhancement, Upper Columbia Area Office, Yakima, Washington.

Additional lands were identified in late 1999 for acquisition for the proposed CLIP Project for raising the Cle Elum Dam by 3 feet. These lands are in the SE Quarter of Section 4, Township 20 North, Range 14 East, W. M., Kittitas County, Washington. These lands are 300 feet from the Cle Elum Lake shoreline. Four land ownerships are being affected by the acquisitions with 4.12 acres proposed for acquisition from Lot 1, 5.93 acres from Lot 2, 0.23 acres from Lot 3, and 5.12 acres from Lot 4, for a total of 15.4 additional proposed acres to add to the estimate.

Supplemental Value:

Estimated Acquisition Cost	-	$ 60,000.
Plus 33%-Contingencies	-	$ 19,800
Contract Appraisal & Appraisal Review & Cleanup Costs	-	$ 20,200
Total Supplemental Value	-	$ 100,000

Consolidated Summary:

Total Estimated Costs as of September 20, 1999	-	$ 3,900,000
Additional Estimated Costs as of October 14, 1999		
House Demolition & Clean Up Costs	-	$ 75,000
Contract Appraisal & Appraisal Review Costs	-	$ 75,000
Supplemental Value (above)	-	$ 100,000
Total Consolidated Land Acquisition Costs	-	$ 4,150,000

w/copy of encl.

LND-3.00

CLTPCST2.EST.wpd

An additional cost estimate will need to be made if additional land ownerships are identified to be affected and take lines developed by The CLIP Core Team for these acquisitions.

The undersigned has no present or contemplated interest in the properties proposed to be acquired

Please refer and review the basis of the cost estimates outlined in the partial cost estimate dated September 20, 1999.

Attached is plat showing the proposed acquisition areas in Section 4 referred to in this memorandum.

Kenneth B Todd

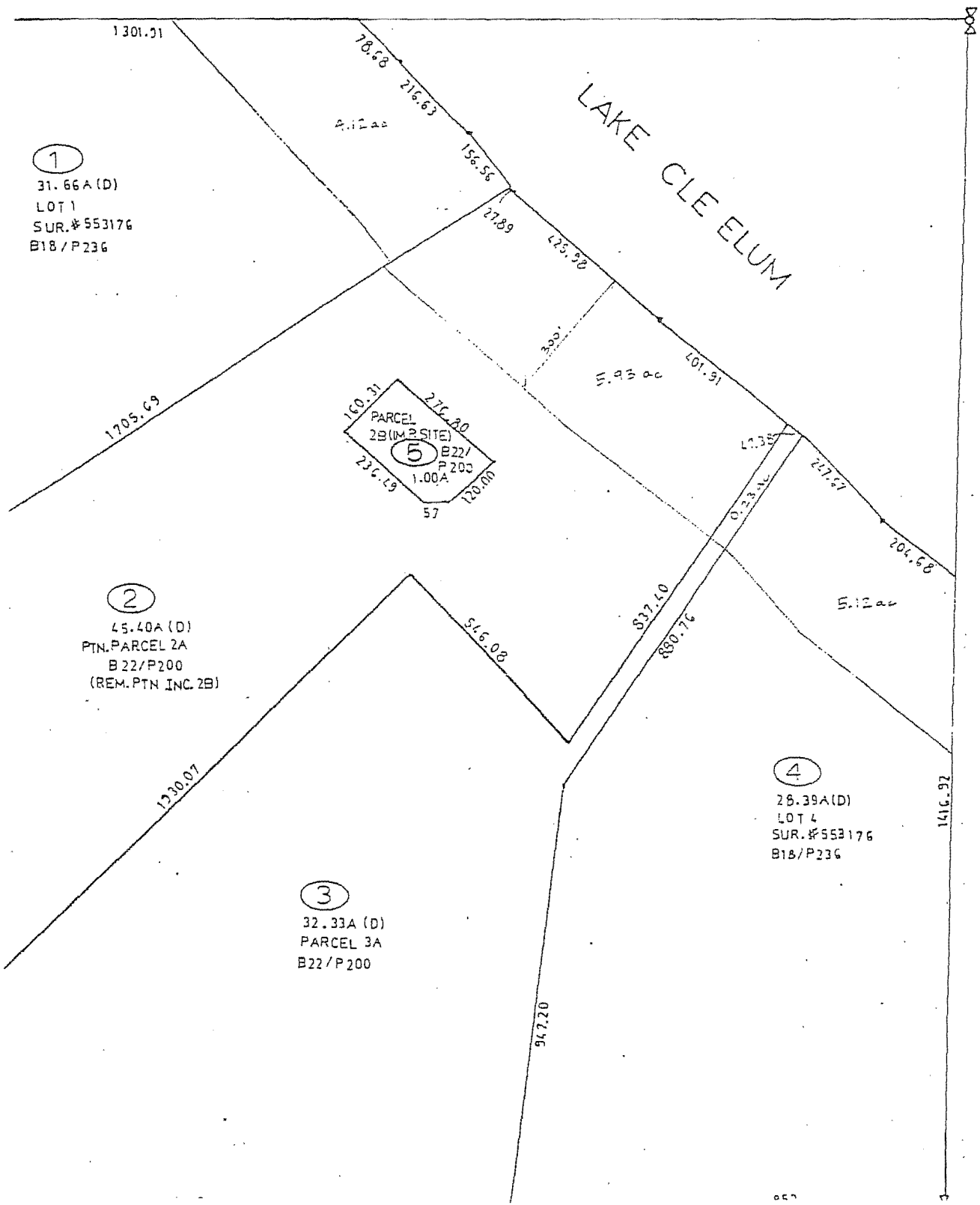
Attachment

COUNTY ASSESSOR
SPECIAL MAP

SE 4
4 · 20 · 14

EN CONSENT OF COUNTY ASSESSOR

SCALE: 1 INCH = 200 FEE



PN-3905
LND- 3.00

September 20, 1999

To: Area Manager, Upper Columbia Area Office, Yakima, Washington
Attention: UCA-1200 (Esget), UCA-1205 (Isley)

From: Kenneth B. Todd, Regional Appraiser

Subject: Cost Estimate of Proposed Land Acquisitions as of September 20, 1999, for Cle Elum Improvements Project (CLIP)(3-foot Dam Raise Project), Yakima River Basin Water Enhancement, Upper Columbia Area Office, Yakima, Washington.

This partial cost estimate of the proposed land acquisition costs including value of affected improvements on the land, is for part of the overall total estimated costs being assembled for the Cle Elum Improvement Project (CLIP). The estimated land acquisition costs is part of the costs for raising the Cle Elum Dam by three feet.

Investigations of land and improvement values, primarily lake shore properties in the areas of Cle Elum Lake and Kachess Lake were conducted in August and September, 1999.

The estimated land acquisition costs covers only those lands as proposed for acquisition on the two drawings received in the Pacific Northwest Regional Office on September 2, 1999. The drawings covers only those proposed lands within:

1st Drawing - NW1/4 of Section 2, Township 20 North, Range 14 East, W.M.
2nd Drawing - SE1/4 of Section 34, Township 21 North, Range 14 East, W.M.

Nineteen ownerships were identified to date by CLIP Core Team members as being affected by the proposed project. Six affected ownerships are in Section 2, and 13 affected ownerships are in Section 34. A blue line was provided on the drawings to show the proposed acquisition line and a yellow line was provided on the drawings to show the United States Forest Service boundary line. The blue line indicates:

4 ownerships as being full complete takes/acquisitions.
5 ownerships as being partial takes/acquisitions with non-economic remainders estimated to result in complete acquisitions.
10 ownerships as being partial takes/acquisitions with estimated economic remainders.
19

CLIPCOST.EST

The estimate was made by intensive review of Kittitas County records, visual inspection of the subject ownerships from different sides of the properties, survey evidence which were believed found and verbal discussions with Eduardo Lopez-Owsley who prepared the drawings. No owners were contacted as instructed. This estimate assumes the proposed take lines were located and identified by red surveyor's tape tied to solid uprights or on trees and bushes.

Estimated land acquisition costs as of September 20, 1999, are:

Section 2	-	$ 1,150,000 (6 ownerships)
Section 34	-	$ 1,550,000 (13 ownerships)
Estimated Acquisition Cost	-	$ 2,700,000
Plus 33% Contingencies*	-	$ 900,000
Estimated Land Acquisition	-	$ 3,600,000
Plus Relocation Costs**	-	$ 300,000
Total Estimated Costs	-	$ 3,900,000

*Because of the strong active real estate market of the area and the high prices being paid for water enhanced lake shore properties, the contingency factor for unforeseen items was increased from 25% to 33%.

** 11 residences are estimated to be acquired and will require relocation assistance, varying from modest housing relocation benefits plus moving to more substantial housing relocation benefits plus moving. The current maximum relocation benefit is $22,500 but may vary depending on numerous circumstances including available housing (appears currently adequate). Moving costs are additional to the housing benefit.

Pictures of the affected areas in Section 2 and Section 34 are attached along with copies of the two drawings. *

An additional cost estimate will need to be made if additional land ownerships are identified to be affected and take lines developed by The CLIP Core Team for these acquisitions.

The undersigned has no present or contemplated interest in the properties proposed to be acquired.

Kenneth L Todd

* Attachment maps, etc. retained in CLIP Lands file - SI

From: James Blanchard
To: Isley, Stan
Date: 9/20/99 8:20AM
Subject: Real estate costs

Stan,

I talked briefly with Ken Todd last week and he will be sending you an estimate on the subdivision lands at Cle Elum. Sound to me, without looking at his estimate that a figure around 5 million will be needed when you add in the relocation costs etc.

On personnel time to do that work and the other realty work associated with the acquistion of pit sites, timber land etc, I disagree with the estimate that Ron sent. After checking with others we believe that a timeframe of 5.5 man-years is too much. I believe that 1 man year should cover the work and adding in other costs such as my time, your time and appriaisls etc I think that 125,000 should cover the entire thing. If you think that you would need to have someone from some where else do the work then add another 25,000 for travel.

Realty is a big game of hurry up and wait. You tend to do one little piece, send it away and then wait for it to come back. While waiting other little pieces can be done to other work. One does not need to do nothing while waiting or to only work on a single job at one time. Our realty people here and at Umatilla work on 50-100 item at any one time. Most of them are in the waiting mode at any given time.

Hope that this helps you, if you have questions please call

c:\My Files\Cle Elum\Realest#.wpd

Estimate Prepared: August 20, 1999
by Ron Cochran, Realty Specialist, Yakima Field Office, Yakima, WA.

CLIP ACQUISITION TIME FRAMES & POTENTIAL COSTS

(Estimates assume about 45 easements or fee title land only acquisitions and 5 fee title homes acquired). Estimates were derived by my experience, some actual times on CLIP and Phase I fish passage acquisitions, and sometimes educated guesses. See the end for tabulations.

(Another assumption is that the word "owner" below implies one parcel and a relatively small number of owners – 1 or 2 people. Obviously there are some ownerships with multiple parcels and multiple numbers of owners and these are hard to estimate.)

---- Meetings (Reclamation staff only, supervisor direction): 1.25 hours/owner.

---- Obtain Assessors Maps, Plat book records, Reclamation Ownership: 2.0 hours/owner.

---- Order Title Reports: 1.5 hours/ owner.

---- Review and Mail Title Reports: 5.5 hours/owner.

---- Review take lines – 2.0 hours/owner.

---- Review acquisition deeds (originals) for new take lines – 4.0 hours/owner

---- Receive tract maps – (For A&B) 8.0 hours/owner.

A) Review legals:

B) Check ownership names

---- Appraisal Request Forms – 8.0 hours/owner.

---- Review appraisals upon completion –

A) Review with appraiser. – 1 hour/owner
B) Study other recent sales. – 2 hours/owner

---- Prepare offer letters and contracts –

A) Fee title - land purchase contracts and deeds. – 24 hours/owner

B) Easement areas - easement necessities defined and contracts. – 16 hours/owner

---- Meetings with Landowners - Offers, Negotiations

A) Discuss acquisition with landowner (preliminary) and or tenant. – 8 hours/owner. (Assumes more than one meeting.)

B) Discuss specific problems and/or find answers (Title problems, Loan releases, Signatures, Taxes, Affidavits, etc.) – 4 hours/owner.

C) Non-resident owners – Contacts. – 4 hours/owner.

D) Relocation Assistance, Agreements, and Offers. — 24 hours/owner.

E) Review signed agreements –All signatures obtained based on title evidence. – 3 hours/owner.

F) Obtain any additional signatures. 2 hours/owner.

G) Negotiation reports. – 4 hours/owner

---- CONTRACTS NOT EXECUTED:

A) Final offer letter. – 4 hours/owner.
B) Condemnation Appraisal Request. – 8 hours/owner.
C) Request updated Title evidences. – 2 hours/owner.
D) Memos and papers to Region on Condemnation. – 16 hours/owner.

---- Review Title:

A) Current within 6 months, may need new title commitment updates. – 2 hours/owner
B) Special exceptions studied and deleted if possible. Paperwork for this. – 2 hours/own.
C) Updates to include only land to be acquired. – 2 hour/owner.

---- Prevalidate funds: 2 hours/owner.

----- Determine approval authority, Contracts signed and letters. – 4 hours/owner.

----- Request Mortgage Releases and Other Instruments: 8 hours/owner.

---- Obtain Disclaimers, ACH Forms, etc.: – 4 hours/owner.

---- Prepare Vouchers and Request Payment: – 8 hours/owner.

---- Prepare and obtain signatures on Closing Documents: – 8 hours/owner.
A) Mechanic liens.
B) Certificate of Possession.

---- Check Courthouse Records, Record Contracts, Releases, etc.: – 16 hours/owner.
A) Taxes
B) Mortgages, etc. at Clerks office
C) Court judgements.
D)State and Federal Tax Liens

---- Request Preliminary Opinion: – 24 hours/owner.

----Record conveyance documents: – 8 hours/owner.

---- Request Final Title Policy: – 4 hours/owner.

---- Request Final Title Opinion – 16 hours/owner.

---- Receive Final Title Opinion. – 4 hours/owner.

---- Deliver Payment : – 4 hours/owner.

TABULATIONS:

(Fee Title)	(Easement)
Base Hours -- Land or House Plus Land	Base Hours – Land
196.25 hours/owner	188.25 hours/owner

Add the following additional hours to the base amount for condemnations, non resident work, and relocation assistance:

Condemnations --------- 30.0 hours/owner
Non resident work ------- 4.0 hours/owner
Relocation assistance ---- 24.0 hours/owner

In processing acquisitions you could have various scenarios in which land with or without a home is to be acquired using the variables mentioned above requiring more work hours for these elements like condemnation, non resident work (someone not living as primary residence at Cle Elum Reservoir area), or relocation assistance. Using these elements under land with a house on site there could be 8 purchase scenarios. Acquiring land with no homes either by fee title or easement there are at least 4 scenarios each for either a fee purchase or an easement purchase. No attempt has been made to contemplate works hours necessary to incorporate purchase of improvements other than homes on the land. These improvements may have to be included in the acquisition agreements and will include some time. The appraiser will consider the value of improvements if necessary for a Federal acquisition.

The following scenarios are those most likely to occur at Cle Elum Reservoir in terms of our land acquisition time estimates:

Land Purchase: (Hours Per Purchase – Either Fee or Easement) (Assume purchase of 45 Parcels)	Land Plus Home Purchase: (Hours Per Purchase – Fee, Condemnation) (Assume purchase of 5 Parcels)
Base Hrs. — 196.25 hours, Used fee figure.	Base Hrs. — 196.25 hours.
Assume No Condem. +0.0	Condemn. + 30.00
Assume Resident +0.0	Non. Resid. + 4.00
	Reloc. Assist. + 24.00
Totals 196.25 hours/owner	254.25 hours/owner
196.25 X 45 = 8,831.25 hours	254.25 X 5 = 1,271.25 hours
8,831.25 divided by 8 = 1,103.9 days	1,271.25 divided by 8 = 158.9 days
OR	OR
160 hours per man month, so	160 hours per man month, so
8,831.25 divided by 160 = 55.2 man/months	1,271.25 divided by 160 = 7.95 man/mo.
55.2 divided by 12 = 4.60 years or FTE	7.95 divided by 12 = 0.66 years or FTE

GRAND TOTAL ESTIMATE 5.26 years or FTEs

COSTS: 5.26 FTEs X $50,000 year = $263,000.00.

Qualifier: Due to the variables involved in a large acquisition project such as CLIP it is my belief that the cost estimate presented here is plus or minus 20% of what can be expected for this size of an acquisition.

TITLE:	YAKIMA RIVER BASIN WATER ENHANCEMENT PROJECT	STATE:	WASHINGTON
		BUREAU:	RECLAMATION

ISSUE:

- Reclamation has recently made a decision to delay its Chandler Electrification Project (authorized in Section 1208 of the 1994 Yakima River Basin Water Enhancement Project Act, Title XII of Public Law 103-434) pending the study of a pump exchange project, and therefore to move immediately into preparations for Lake Cle Elum Improvements (authorized in Section 1206 of Public Law 103-434).

BACKGROUND:

- Lake Cle Elum Improvements Project was scheduled for initiation in FY 2000, with Safety of Dams (SOD) review, design and specification work in FY 2001 and out years. Monies from the delay of the Chandler Electrification Project will be moved into Lake Cle Elum Improvements to allow an acceleration of that Project. Public Law 103-434 authorized $2,934,000 (allowing for additional indexing) for this work. Early indications are that the Cle Elum Dam structural modifications may very possibly have associated SOD corrections which will come into play with respect to the provision of 14,600 acre-feet of additional storage capacity with the Lake Cle Elum Improvement Project. Additional issues include accelerated shore erosion issues requiring significant riprap work or buyout of residential properties, spotted owl - old growth timber issues, and possible provision of fish passage at the dam (as specified in Public Law 103-434).

GENERAL FUTURE DIRECTION:

- Coordination and kickoff meetings are being scheduled with Area Office, Boise Design and SOD, and Denver SOD staff to lay out schedules, coordinate SOD risk assessment work, and to mesh SOD and design cost estimating. Although we do not currently have a schedule indicating when reliable cost estimates for the Project will be available, we have provided clear direction that very reliable estimates will be needed as soon as possible to allow the budget to be pursued for any increases over the authorized amount, or to stop work if deemed appropriate. Very likely areas of cost exceedance would include the structural modifications, lands purchases, fish passage modifications, and old growth habitat mitigation. Fish passage was not factored into previous cost estimates, and it was assumed that no SOD problems existed at the Dam. Only limited riprap and land purchase work was included.

PROGRAM CONTACT:

Jim Esget, Program Manager
(509) 575-5848 (ext 267)
Or:
Stan Isley, Project Coordinator
(509) 575-5848 (ext 281)

UPDATED: February 13, 1998

Cle Elum (CLIP) Fish Passage Cost Estimate
($10,000,000 to $35,000,000)
April 11, 2000

Background

Section 1206 of the 1994 Yakima River Basin Water Enhancement Project Act (YRBWEP) authorizes the appropriation of $2,934,000, cost indexed to September 1990 prices, to: (A) modify the radial gates at the Cle Elum Dam spillway to raise the reservoir pool in Cle Elum Reservoir 3 feet, thus storing an additional 14,600 feet of water. This additional storage water is dedicated exclusively to instream flows for fish and wildlife; (B) provide for shoreline protection of Lake Cle Elum; and (C) construct juvenile fish passage facilities at Cle Elum Dam. Section 1206 further authorizes the appropriation of "such additional amounts as may be necessary which may be required for environmental mitigation." Section 1206 also authorizes the appropriation of "such sums as may be necessary for that portion of the operation and maintenance of Cle Elum Dam determined by the Secretary to be a Federal responsibility."

The August 1, 1994 Committee Report (U.S. House of Representatives, Committee on Natural Resources) accompanying the 1994 YRBWEP Act notes that: "as a part of the Northwest Power Planning Council's Fish and Wildlife Program, the Bonneville Power Administration is studying the possibility of reintroducing sockeye salmon into Cle Elum lake. If this is determined to be feasible, fish passage facilities to provide for the outmigration of juvenile smolts from the lake would be required."

Indeed, the Bonneville Power Administration funded a study, conducted by the National Marine Fisheries Service (NMFS) from 1987 through 1992. The study included releasing sockeye salmon fry (from Lake Wenatchee broodstock) into Cle Elum Lake over these several years and monitoring the success of their outmigration as smolts and their return as adults. The study was never formally completed. Study results were somewhat inconclusive, but preliminary results seemed to show that the potential habitat available in Cle Elum Lake and upstream in the Cle Elum River could sustain a viable population of sockeye salmon. NMFS' study leader for the Cle Elum Lake sockeye study, Tom Flagg, had not completed the final report for the study as of the start of this year. Mr. Flagg has completed the final report now, in April 2000.

Reclamation, to date, has not received any formal determination from the Bonneville Power Administration as to the feasibility of reintroducing sockeye salmon into Cle Elum Lake. Reclamation must review the final report from NMFS on the results of the 1987-1992 study and seek additional input from local and regional biologists regarding the feasibility of salmon reintroduction into Cle Elum Lake. Then Reclamation must determine whether the benefits of salmon reintroduction justify the costs of constructing fish migration facilities at Cle Elum Dam.

Fish Passage Facility Cost Analysis

Reclamation contracted with Harza Engineering in July 1999 to provide a report on potential downstream and upstream fish passage concepts at Cle Elum Dam with an "order of magnitude" estimate of costs associated with each of the concepts. Harza submitted a draft fish passage concepts report in September 1999 and a final report in December 1999, presenting three general design concepts for downstream passage and two upstream passage concepts. Downstream juvenile salmon passage options analyzed are: 1) outlet conduit, 2) surface attraction to a trap and haul facility, and 3) surface outlet to an open channel bypass. Upstream adult passage options analyzed are: 1) fish ladder to a trap and haul facility, and 2) fish ladder with a slide to the lake.

The fish passage concept costs are given as rough estimates like "$5 to $10 M," (five to ten million dollars). The downstream passage concept costs range from the least expensive at $5 - $10 M, to the most expensive at $15 - $20 M. The upstream passage concept costs range from the least expensive at $5 - 10 M, to the most expensive at $10 - $15 M. The list of options analyzed in the Harza fish passage report is by no means an exhaustive list, but it provides a good indication of the ballpark costs for whatever fish passage systems might be implemented at Cle Elum Dam.

Even the least expensive pairing of downstream and upstream fish passage facilities at Cle Elum Dam is estimated to cost between $10,000,000 and $20,000,000. The most expensive pairing of downstream and upstream fish passage facilities at Cle Elum Dam is estimated to cost between $25,000,000 and $35,000,000.

These costs are very high, but installation of such fish passage facilities at Cle Elum Dam would provide several benefits to the public. Providing anadromous fish passage into Cle Elum Lake and upstream river segments would potentially restore the extirpated sockeye salmon to the Yakima River basin, would potentially restore fish access to the historic spawning grounds once used by ESA-threatened steelhead and candidate spring chinook salmon, would potentially provide spawning habitat to coho salmon (a species which also historically utilized this habitat), and may also benefit resident populations of ESA-threatened bull trout.

A new open channel bypass conduit constructed in the right abutment of Cle Elum Dam to provide for fish passage could also double as a second outlet conduit for releasing irrigation water from Cle Elum Lake, if repairs were required on the main reservoir outlet tunnel. Currently only the one main outlet tunnel allows for the release of water from the reservoir when the reservoir pool is below the bottom of the spillway, at elevation 2223 feet. Thus, the possibility exists that Reclamation currently would not be able to release water from Cle Elum Lake to satisfy its contract water users for a period of time if emergency repairs were needed on the main outlet tunnel during the irrigation season.

Total Estimated CLIP Fish Passage Costs ..... $10,000,000 to $35,000,000

(See attached December 1999 Harza Fish Passage Concepts report for details)

US Bureau of Reclamation

Cle Elum Dam

Preliminary Analysis of Fish Passage Concepts

Harza

December ~~September~~ 1999

ENGINEERING COMPANY
Bellevue, WA 98005

TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 Scope

The US Bureau of Reclamation (USBR) has requested Harza's assistance in a preliminary analysis of potential fish passage at Cle Elum Dam, which is owned and operated by the USBR. It is our understanding that the proposal to raise the water surface elevation in Cle Elum Lake by 3 feet (USBR 1998) has caused concerns that fish passage issues should be addressed at the dam. Recent studies by the National Marine Fisheries Service (NMFS) have shown that favorable rearing and spawning habitat for Sockeye salmon potentially exists upstream of the lake. Also issues such as the Endangered Species Act (ESA) listings of Bull Trout, and discussion of reintroductions of Steelhead and Spring Chinook in the Yakima Basin may dictate fish passage consideration in the future. This report will help the USBR to take an informed and proactive approach regarding fish passage considerations at Cle Elum Dam.

The primary goal of this letter report is to provide a general overview of potential downstream and upstream passage concepts for consideration at the Cle Elum Dam. Included in the overview is:

- A brief summary of the technologies for fish passage applicable to this particular situation.
- The potential biological effectiveness of applying those technologies.
- Possible concepts that apply the technology described.
- Order of magnitude estimate of the cost that could be expected with the concepts.

The report will concentrate more on downstream passage due to the issue complexity, although upstream passage concepts will also be presented.

Operation of Cle Elum Lake relative to the fluctuating water surface elevation is the most difficult issue to overcome for fish passage around the dam. This report presents three general design concepts for downstream passage, and two concepts for upstream passage for addressing the fish passage issue. The concepts presented should be considered as initial ideas, and will require more in depth analysis to determine whether they are truly feasible. It is reasonable to assume that other general design concepts may result as the process proceeds.

Section 1 of the report provides general background information about Cle Elum Dam fish passage issues. Section 2 provides a brief discussion of design considerations, mainly objectives and criteria for design concepts. Section 3 lists the overall project physical characteristics. Section 4 and 5 describe various potential concepts for downstream and upstream passage respectively, Section 6 has USBR review comments to the draft report, and Section 7 lists references. Concept drawings are included in Appendix A. The reader should keep in mind that these are preliminary ideas intended for study purposes.

1.2 Background

During 1989 through 1992 the National Marine Fisheries Service (NMFS) conducted studies to investigate the feasibility of the introduction of Sockeye salmon into the Cle Elum basin above the dam. The studies were not formally completed, but preliminary results indicated that the potential habitat available in Lake Cle Elum and upstream in the Cle Elum River could sustain a viable sockeye salmon population (NMFS 1992). Fish passage was not thoroughly addressed at that time, although preliminary studies were conducted to determine whether

fish could find an emigration route out of the Cle Elum reservoir. Findings from Washington Department of Fish and Wildlife (WDFW) studies at Osoyoos Lake (Okanogan County Washington) indicated that sockeye would not pass under radial gates of Oroville Dam (NMFS 1991), leading the NMFS to believe that a similar problem may exist at Cle Elum Dam. The NMFS in cooperation with the US Bureau of Reclamation (USBR) tested surface attraction at Cle Elum Dam by cutting an opening in one of the radial gates at the surface and installing an inclined-plane trap. Surface attraction was tested by release of 75 CFS through the opening during the spring migration period. The results of this study were inconclusive regarding surface attraction.

2.0 FISH PASSAGE DESIGN CONSIDERATIONS

Providing an efficient and safe method of passage for fish downstream and upstream around a dam or obstruction in a waterway is the ultimate goal of any fish passage analysis. Criteria for fish passage generally consist of specific physical or engineering criteria, and more general biological criteria.

- Downstream Passage Goals and Criteria:
  - Minimize delay of migration out of a reservoir or impoundment.
  - Create effective fish attraction flow for a smooth transition from the impoundment into the riverine area downstream of the reservoir.
  - Create a biologically effective and injury free attraction to the bypass.
  - Provide expedient and injury free passage through the bypass.
  - Create the proper hydraulic conditions for the exit from the bypass conduit to the tailrace.
- Upstream Passage Goals and Criteria:
  - Minimize delay of adults in finding and entering a fishway entrance through use of proper hydraulic conditions.
  - Maintain the proper hydraulic conditions for expedient passage through the ladder.
  - Locate and design the ladder exit to expedite exit into the forebay and to prevent fallback over the dam through the spillways or turbines. The exit design would be applicable to trap and haul operation.
  - Design a trap and haul system to minimize handling and stress to the fish.

Criteria for fish passage design can vary with site conditions for passage facilities (upstream and downstream). The agencies (NMFS, WDFW) have criteria published for specific types of passage facilities.

3.0 PROJECT CHARACTERISTICS

3.1 General Data (USBR 1999)

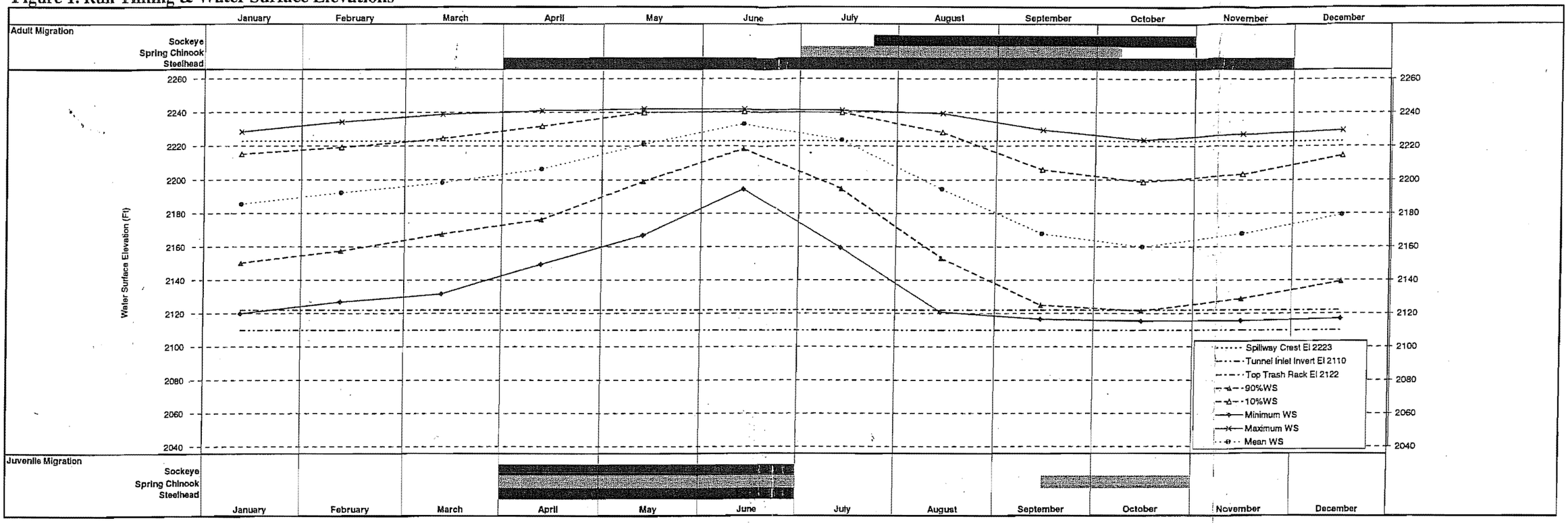
Region	Pacific Northwest
State	Washington
County	Kittitas
Project	Yakima
Dam Type	Earthfill
Location	8mi NW of Cle Elum
Watercourse	Cle Elum River
Reservoir:	Cle Elum
Construction Date	1931-1933
Latitude	47 25' 00"N
Longitude	127 25' 00"W
Crest Elevation of Dam	2250.0 ft
Structural Height of Dam	165.0 ft
Crest Length	1801.0 ft
Top of Active Conservation	2240.0 ft
Spillway Crest	2223.0 ft
Top of Dead Storage	~~2210~~.0 ft 2110.0
Streambed at Dam Axis	2116.4 ft

3.2 Flow Data

The following charts (Figures 1, 2, & 3) show various representations of water surface, inflow, and outflow superimposed with run times for adult and juvenile migrants for the species of interest. Run times are shown for Sockeye, Spring Chinook, and Steelhead (Bell 1990, NMFS 1989). Flow data in the charts are derived from mean daily flow, period of record 1939-1999 (USBR 1999).

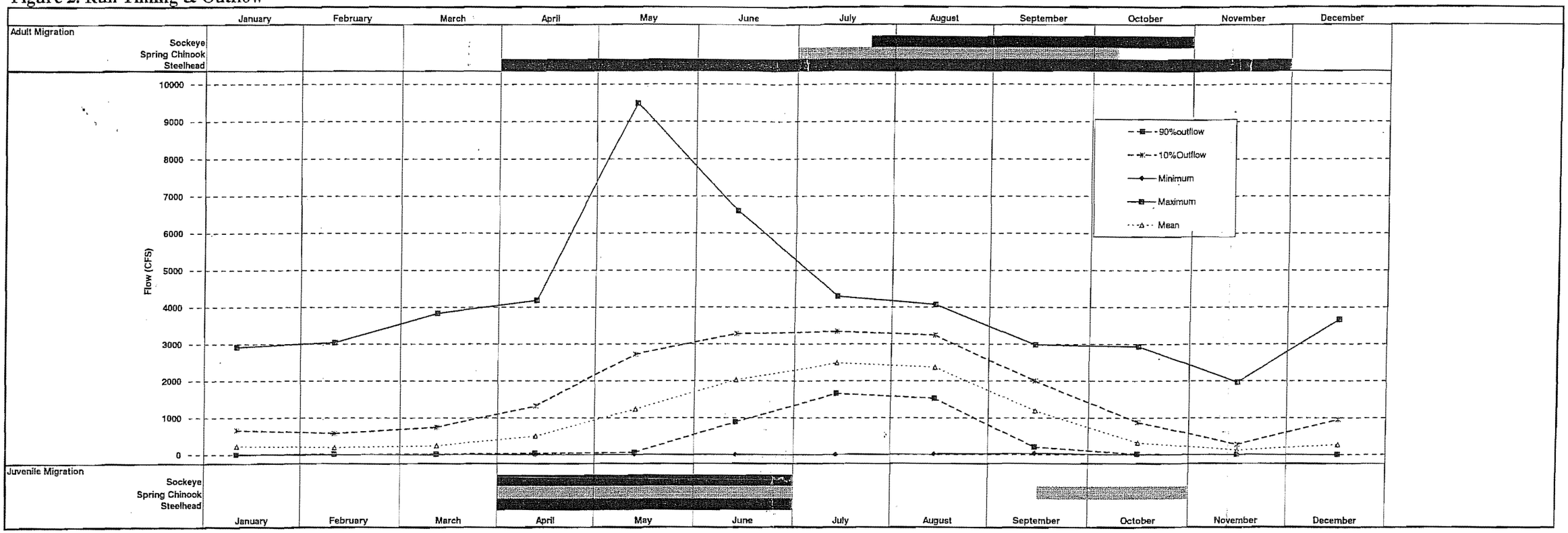
USBR Lake Cle Elum Fish Passage

Figure 1. Run Timing & Water Surface Elevations



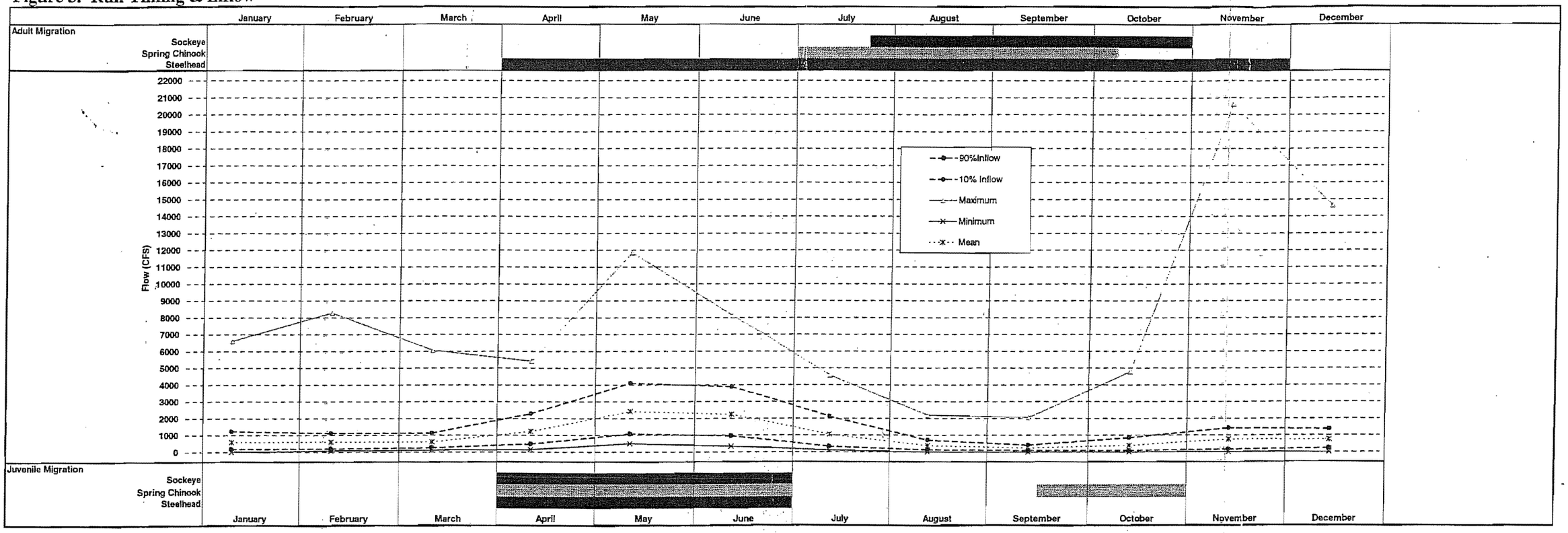
USBR Lake Cle Elum Fish Passage

Figure 2. Run Timing & Outflow



USBR Lake Cle Elum Fish Passage

Figure 3. Run Timing & Inflow



4.0 DOWNSTREAM FISH PASSAGE CONCEPTS

The description of downstream passage concepts has been divided into four sections. Section 4.1 gives a brief summary of the primary components of downstream passage facilities. Section 4.2 describes the general categories of downstream passage technologies. In Section 4.3, three possible concepts are described using existing and innovative technology introduced in the preceding sections. Order of magnitude costs for the concepts are listed in Section 4.4.

4.1 System Components

The primary components that are critical for the design of downstream fish passage facilities are listed and described as:

- **Entrance and Attraction.** Entraining fish into the fish passage system is the most important design issue, but also carries the most uncertainty. This is due to fish behavioral characteristics associated with environmental conditions (i.e., temperature, velocity gradient). Fish passage is generally very site specific, depending on variables such as geometry of the dam, topography, flow characteristics, fish behavior, system hydraulics, and other intangible characteristics.

- **Bypass.** The transition from the bypass entrance to the conduit should be smooth, with velocities in the conduit evenly distributed. The bypass conduit (pipeline or open flume) is normally smooth walled. Design issues to be addressed are flow conditions, injury prevention, trapping/transport flows.

- **Sorting/Monitoring Facility.** Designing the ability to analyze, acquire, discriminate, and enumerate fish migrating through the bypass is important to the overall facility design. In an era of ESA listings, this component becomes an important design issue.

- **Exit.** The proper location of the bypass is important to survival of fish that pass through the system. The exit is normally placed as close to the dam tailrace as possible. Minimizing the time out of the river, plunge of the flow jet, and velocity of receiving water are all important design issues in the protection of fish from predation and injury.

4.2 Existing Downstream Passage Technology

The existing technology for downstream passage can be classified into the following general categories; exclusionary screening, surface attraction systems, high velocity/noncriteria screens (i.e.: those technologies that do not meet agency criteria but have worked in some applications), spill, and behavioral/experimental technology. The costs associated with the examples of downstream technology are capital costs for construction, and have been adjusted for inflation. Estimated costs are noted.

4.2.1 Exclusionary Screening

Exclusionary screens are designed to exclude 100 percent of the target species. Agencies such as NMFS have established criteria for these systems, which vary relative to the size of the species. Criteria for salmonid fry is velocity less than or equal to 0.4 fps, for smolts velocity should be less than or equal to 0.8 fps (NMFS 1995). Sweeping velocity should be equal to or greater than 2.5 times the approach velocity. The screen slot opening criteria is 3/32 in. The guidance efficiency can be as high as 100% for this type of system, but mortality due to impingement could result in significant losses. Examples of effective exclusionary screens in the northwest are:

- Vertical Panel Screens - Naches Diversion (est. $3.0M)
- Drum Screens - Sunnyside and Roza Intakes ($2.8M and $14M, respectively)

Feasibility for application of exclusionary screening technology is probably impractical due to large fluctuations in reservoir water surface elevations. It could be possible to screen the existing intake, but operation and maintenance of the screen structure would be difficult. The normal application of exclusionary screen systems is for hydropower or irrigation diversions.

4.2.2 Surface Attraction Systems

Surface attraction has been utilized under conditions where surface water velocities are low, such as hydroelectric projects with deep intakes. During the spring, downstream migrants normally travel close to the surface of a deep reservoir. The principle behind surface attraction is to use a false attraction at the water surface to draw fish into a bypass. Criteria for this application are not as specific as those for exclusionary screens, and is often evaluated in terms of Fish Guidance Efficiency (Fish Guidance Efficiency refers to the measure of success (into a passage facility). The effectiveness of prototype collectors is often tested before full-scale implementation. At Cle Elum Dam, NMFS has already conducted prototype testing with the radial gate modifications in 1991. Examples of surface collection facilities are:

- Wells Dam on the Columbia River in central Washington. ($1.4 M)
- Cowlitz Falls on the Cowlitz River in western Washington. ($16M)
- Bonneville Prototype Collector at Bonneville Dam on the lower Columbia River. ($5M)
- Gulper system at the Baker Lake Project in Western Washington. (est. $10M - $15M)

Surface attraction principles would be a feasible application to be considered for the Cle Elum project. The design would be governed by site specifics, and the attributes of one or a combination of existing systems could be applied. Fish guidance effectiveness is difficult to quantify in surface collection applications.

4.2.3 High Velocity / Noncriteria Screens

High velocity screens are considered as noncriteria and experimental systems by the resource agencies due to the high velocities normal to the screen face. However, some high velocity screens have been installed with favorable results. These systems are operated under pressure; utilizing horizontal inclined screens to divert fish to a bypass. The screens are inclined from 10 to 15 degrees and feature a center pivot for backwash cleaning. Well known types of high velocity screens are:

- Eicher Screens - Elwha prototype ($1.4M), Willamette Falls Project ($4.7M), Puntledge Hydroelectric Project ($5.4M). Screens are oval shaped, developed for use in penstocks.
- Modular Inclined Screens (MIS) - Prototypes are in use at Green Island (N.Y.) Hydroelectric Project ($1200-3700/cfs, EPRI 1997). This is a recent variation of the Eicher screen concept that is a rectangular shaped screen within a modular housed unit.

High velocity screens are a feasible application for the Cle Elum project. It may be necessary to combine this technology with other technological variations in this situation.

4.2.4 Spill

Spill of fish over dam crests is used with variable success at many of the Columbia River hydroelectric projects. High guidance efficiencies have been observed at many of these projects. Spill was tried at the Cle Elum project by NMFS as an attraction possibility with limited success (NMFS 1990). Spill could be considered as a feasible method of passage at the Cle Elum project in combination with other technological variations.

4.2.5 Behavioral / Experimental Technology

Behavioral methods of diverting fish away from intakes include sound, light, and electric barriers. These methods have proven to be essentially enhancement measures to other passage technology.

4.3 Concepts

Based on the conversations with USBR biologists, we have chosen a more general approach to describing fish passage concepts. Our understanding of the status of fish passage issues at Cle Elum dam is that potential solutions have been discussed, but an organized process has not been established. Harza has found from our past experience in similar processes, that initiating a general process to concept design combined with technical workgroup sessions with key agency personnel, can be an efficient pathway to a final solution, acceptable to all parties.

The following three concepts describe feasible approaches for passage of downstream migrants at Cle Elum dam. Each concept description includes various options that can be considered. These options are not necessarily exclusive to the particular concept, and can sometimes be applied to other concepts. New options may be derived for a concept, and may apply to others as the analysis proceeds in subsequent stages. The most attractive general concepts for downstream passage are:

(1) Surface attraction with a pressurized bypass (Concept #1)

(2) Floating surface attraction with trap and haul (Concept #2)

(3) Surface attraction with non-pressurized bypass (Concept #3)

These concepts would most likely require a facility or system for monitoring and evaluation (M&E) of the success of the passage system. An M&E facility has not been detailed in this report. Also, all the concepts described below could be implemented with a surface attraction system using the radial spill gates. A surface attraction system would be used for higher water surface elevations, probably limited to the upper 10 or 15 feet of the reservoir.

4.3.1 Concept #1 - Total Surface Attraction and Pressurized Bypass

This concept is based on constructing a new intake tower over the existing outlet tunnel. The general approach for the concept is to use surface attraction in combination with a pressurized bypass to pass fish around the dam. In Option A all or the majority of the flow through the dam would be used for surface attraction of the migrants. Option B would utilize a portion of the flow. In both concepts, variations of the same pressurized

bypass are used. In both options the opening to the intake would adjust to the fluctuating water surface with a single gate or series of multiple gates.

Option A: An intake tower would be constructed over the existing outlet tunnel bypass pipeline (Drawing 1). Operation of the existing intake would remain, giving the flexibility to balance flow for downstream temperature control requirements. The surface attraction intake flow would be controlled by operation of a telescoping gate, which would adjust to the lake level. Flow through the tunnel would continue to be controlled by the existing gate. An extension would be attached to the downstream end of the outlet tunnel. The tunnel extension would manifold into two or three separate penstocks, each with an "Eicher" type-high velocity screen. The inclined Eicher screen would pass fish from the primary outflow to the bypass pipeline located at the top of the penstock. From this point the bypass pipeline would still be under pressure head from the water surface in Lake Cle Elum. The bypass pipelines would cross over to the south side of the river downstream of the spillway.

Generally, open channel, non-pressurized flow conditions are required in bypass pipelines. The alignment of the bypass pipeline shown on Drawing 1 is an example of a transition from pressurized flow to open channel flow, utilizing the topography of the site. The pressurized pipeline travels uphill to a high point equivalent to the maximum water surface in the lake. At this point the bypass pipeline transitions to a shallow sloped alignment, which traverses the dam slope to the river exit. Automated knife gates control the bypass transition at lower water surface elevations, in this concept at 10-foot intervals. At each interval, the gate passes fish through a wye fitting off the primary bypass conduit through a smooth transition to the open channel conduit. The open channel bypass exits to the river downstream of the main outlet flow.

Option B: A new intake tower would be constructed over the outlet tunnel, with a single pressurized exit bypass pipeline. This option would be designed to take a portion of the total flow, screening the bypass flow in the new surface intake structure. The horizontal inclined screen would adjust vertically with the weir gates and the lake water surface. Attraction flow would be returned to the outlet tunnel through the intake structure. The bypass pipeline would be aligned to pass to the south side of the spillway to undisturbed natural earth. Bypass flow and fish would be transported through the new bypass pipeline. The bypass would be depressurized in a similar manner to that described in Option A, but without the need for an Eicher screen.

Order of Magnitude Estimate of Cost:

Option A - Total Surface Attraction with Pressurized Bypass: $10M - $15M

Option B - Partial Surface Attraction with Pressurized Bypass: $5M - $10M

4.3.2 Concept # 2 - Floating Surface Attraction Facility

This concept would implement a floating surface attraction facility, similar to the "gulper" type collector used on the Puget Sound Energy Baker Lake project in western Washington. The facilities would be based on a surface collector housed on a floating barge, which would continuously adjust to the water surface. Attraction flows would be in the range of 10 to 20 percent of the total flow through the dam. The attraction flows would be created by either pumps or gravity flow. Both options would implement truck haul of fish as the bypass option.

Option A - Flexible Alignment Surface Collector: A concrete trapping facility would be constructed to work with the floating collector. Gravity flow would be driven by the water flow from the trap facility to the existing

outlet tunnel. Flow would be supplied in a similar manner to that described in Concept#1, Option B. In this case, flow would enter the floating collector near the surface of the lake, and pass through a flexible pipeline to the trapping facility. Guide nets would extend from the end of the collection barge to assist in guiding fish into the system. The trapping facility would be a concrete intake constructed over the existing outlet tunnel, with bypass flow separated by an adjustable height horizontal inclined screen. The floating collector, bypass pipeline, and screen would adjust together as one unit with the changing water surface fluctuations. This option would permit the floating collector to be moved to the most efficient collection location, with the flexible transport conduit adjusted accordingly. Once in the trapping and collection facility, most of the flow would continue to the outlet tunnel, with only a portion of the flow screened to a separate compartment for fish trapping and collection. Fish trapped in the compartment would be transferred to trucks by use of a trap/hoist mechanism. A bridge would be constructed from the shoreline south of the spillway to the trapping and collection facility for access, and truck transport to release point(s) downstream.

Option B - Fixed Alignment Surface Collector: The surface collection barge would travel a fixed horizontal alignment, moving back and forth with changes in lake water surface elevations. Collector alignment would be maintained by fixed guide rails or barge mounted winches. Flow to the collector would be generated using pumps mounted on the barge. Fish would be separated by passing the flow over an inclined screen on the barge, which would then direct fish to a holding tank on the barge. A concrete access ramp similar to a boat ramp would be constructed for the haul truck along the base of the lake aligned with the travel path of the barge. This would provide access for truck loading from the holding tank. A water to water transfer would be designed between the holding tank and the truck.

In either option, guide nets attached to the barge entrance would probably be required to maintain a reasonable level of effectiveness with this system. The guide nets would be designed to adjust to the fluctuations in the water surface of the reservoir.

Order of Magnitude Estimate of Cost:

Option A - Flexible Alignment Surface Collector: $10M - $15M

Option B - Fixed Alignment Surface Collector: $5M - $10M

4.3.3 Concept # 3 - Surface Attraction with Open Channel Bypass

In this concept, surface attraction would be utilized using multiple intakes leading to separate open channel bypass conduits. A percentage of the total outflow would be used to create the attraction. Once captured by the bypass velocities, fish would be transported downstream of the spillway back to the river. Option A is a gravity flow attraction, and Option B is a pumped flow option.

Option A - Multi-level Gravity Intake with Open Channel Bypass Conduit: In this option, a new intake structure would be constructed on the shoreline south of the spillway. An intake channel would be excavated from an area adjacent to the existing intake to the new intake structure. A multiple level intake would adjust to separate bypass channels. Surface flow would pass over a telescopic weir gate into each respective bypass channel. Variable water surface would be necessary downstream of the intake gates within each channel. A series of hinged weirs would create steps to spill flow without injury to fish, while adjusting to the change in water surface elevation. The multiple transport conduits would be either box culverts or pipelines sized for open channel flow, exiting either directly to the river downstream of the spillway or indirectly to the river via a

monitoring and evaluation facility.

Option B - Multi-level Pumped Intake with Open Channel Bypass Conduit: Multi level open screw pumps would transports water and fish up over dam (100 cfs max per pump, 20 ft maximum rise) in this option. An intake structure housing each of the pumps would be constructed to the south side of the existing intake and spillway. Gates would control the flow to each intake depending on the water surface elevation in the lake. As the water in the lake rises, the screw pump would become submerged until it reaches a level for transition to the next higher pump. At this point, gates would isolate the lower pump chamber, and the intake gate to the new chamber opened. A short transport channel would connect the high point of the lower screw pump with the low point of the adjacent higher screw pump. Fish are passed to a bypass channel at the crest of the dam, which traverses the downstream dam face. The serpentine alignment allows for open channel flow conditions in the bypass conduit back to the river downstream of the spillway.

Order of Magnitude Estimate of Cost:

Option A - Multi-level Gravity Intake with Open Channel Bypass Conduit: $15M - $20M

Option B - Multi-level Pumped Intake with Open Channel Bypass Conduit: $15M - $20M

5.0 UPSTREAM FISH PASSAGE CONCEPTS

Upstream passage concepts at Cle Elum dam are more limited than those for downstream passage. A fish ladder will be the corner stone of the concepts described in this section. As in the downstream passage descriptions, components of an upstream passage system will be described, then existing technology, followed by potential concepts.

5.1 System Components

The focus of the description of system components for upstream passage will be on ladders, with elements of trap and haul technology included. The following list describes the components:

- **Fishway Entrance.** Design of the fishway entrance is the most important element of any adult passage system. Placing the entrance in the proper location relative to the specific site topography and hydraulic conditions is essential to the success of the facility. Important design elements include orientation of the entrance, the proper amount of attraction flow, water temperature of the attraction and fishway flow, the proper distribution of attraction flow, and access for operation and maintenance.

- **Fishway.** The term fishway refers to the internal elements of the adult passage system. Many different configurations exist that can be considered for adult passage. The type chosen depends on swimming characteristics of the target species, related hydraulic conditions necessary for passage, and operation and maintenance considerations.

- **Fishway Exit.** Design element considerations of the fishway exit depend on the site conditions to which the exit leads. For example, the exit considerations for a trap and haul system would be different than for an exit to a stream or lake. The descriptions of the concepts in Section 5.3 will give more insight into this design consideration. Proper exit location and orientation, location and screening of the attraction water intake, proper hydraulic design, and ease of maintenance are all necessary for a successful and efficient fishway design.

- **Trap and Haul.** Due to the large fluctuations in water surface elevations of Cle Elum Lake (approximately 100 ft), trap and haul becomes a logical choice for this situation. Water to water transfer of adults from the ladder to the truck is generally preferred by the agencies for a trap and haul system. The idea behind the water to water transfer is to minimize the handling and stress on adults. An added advantage of trapping at Lake Cle Elum is the short haul and the flexibility of using different release sites.

5.2 Existing Upstream Passage Technology

For adult upstream passage, existing technology is not as extensive as for downstream passage technology. The technology is very dependent on site specific conditions, target species, and flow characteristics. There are several different types of ladder configurations, generally involving pool size and step characteristics. The common types can be categorized as pool and weirs, vertical slot, and denil. Several specific variations fall under each of these general categories. Considerations of the specific type of ladder to be used would be more appropriate at the next phase of the design process. Costs of ladders are also site specific, and dependant on the height of the passage and the level of design complexity.

The general principles of ladders described in the previous section apply to trap and haul as well, and are

specific to site characteristics. Depending on the complexity of the operation and goals desired, construction costs of trap and haul facilities vary accordingly. Operation and maintenance consideration will be an important component in design of the upstream passage facility.

5.3 Concepts

Two concepts are described in the following section. Upstream passage concepts include (1) trap and haul (Concept #4), and (2) volitional passage (Concept #5). Options for the trap and haul use a truck for hauling fish around the dam, or use a tramway for lifting fish over the dam. The second concept is a fish ladder to the crest of the dam with a slide back to the lake.

5.3.1 Concept #4 - Fish Ladder with Trap and Haul

Concept #1 would consist of a ladder leading to a trap and haul facility. The ladder entrance would most likely be located on the north side, close to both the end of the spillway and to the outlet tunnel exit. Fish ladder supply and attraction water supply would most likely be gravity supply originating from a pipeline tap into the outlet tunnel. The ladder would climb to the trap and haul facility, which would be located on fairly level terrain above the 100-year flood elevation.

Option A: Existing access roads would be improved to accommodate the truck route from the trapping facility to the dam crest. The design of release sites will depend on future fish management discussions and decisions. This option is probably the most feasible with the most flexibility, but with high operation and maintenance. There will be stress to adults in handling, but it can be minimized with the water to water transfer, and designing for the ability of the fish to recover and volitionally migrate out of a stress relief system.

Option B: The ladder entrance location, attraction flow, and exit to the trapping facility will be identical to Option A. The difference will be that a tramway would be designed to transition fish directly into the lake. The ladder exit and tram interface would require more design beyond the scope of this report. Also, the design of the exit facility (stress relief and M&E) would also need further consideration to work out the details of adjusting to the fluctuating water surface in the lake.

Order of Magnitude Estimate of Cost:

Option A and B: $5M - $10M

5.3.2 Concept #5 - Fish Ladder with Slide

In this concept the ladder entrance would be located downstream of the spillway and existing tunnel outlet. An entrance channel would provide passage across the river to the ladder. The south bank of the river provides a location for construction that minimizes impact to the dam. The end of the spillway would need to be modified to pass flow over the transport channel. At the high point of the ladder, the last pool would contain a false weir. Fish would jump at the water flow from the false weir, and pass into a slide located upstream from the false weir which would slope to the lake. The slide would probably be a closed conduit extending from the ladder to the high water elevation, then open channel from the high water surface to the low water surface elevation. The open top flume would allow fish exit at the lake water surface elevation. Water for the slide facility or a stress relief facility would be supplied to the high point in the ladder with multiple pumps or a single variable speed pump to over come fluctuating water surface elevation. This option would be straightforward to operate, but would have power maintenance costs associated with the pumped water supply system.

Order of Magnitude Estimate of Cost:

$10M - $15M

6.0 REVIEW COMMENTS

USBR staff of the Upper Columbia Area Office (Yakima) and the Regional Office (Boise) reviewed the draft report for this study, and provided their comments. These comments are not addressed in this study since they are pertinent to design and operational issues that are not within the scope of work for this study. A central theme of these comments is that a technical work group should be created as an advisory forum in future considerations of fish passage facilities at Cle Elum Dam. Specific comments are in Appendix B.

7.0 REFERENCES

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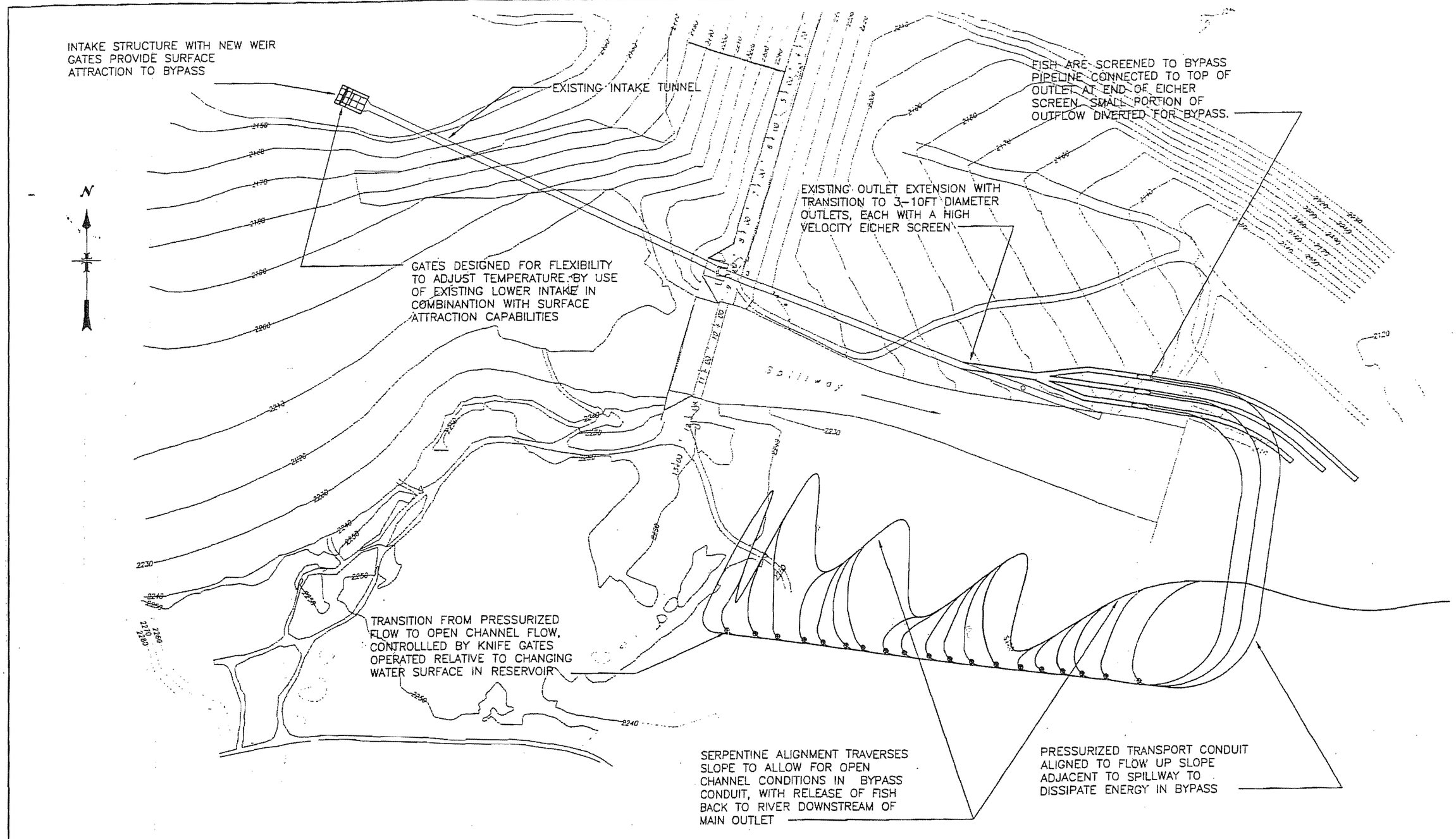
Appendix A

Drawings



CONCEPT #1
OPTION A – TOTAL SURFACE ATTRACTION
AND PRESSURIZED BYPASS

U.S.BUREAU OF RECLAMATION

CLE ELUM DAM
FISH PASSAGE STUDY

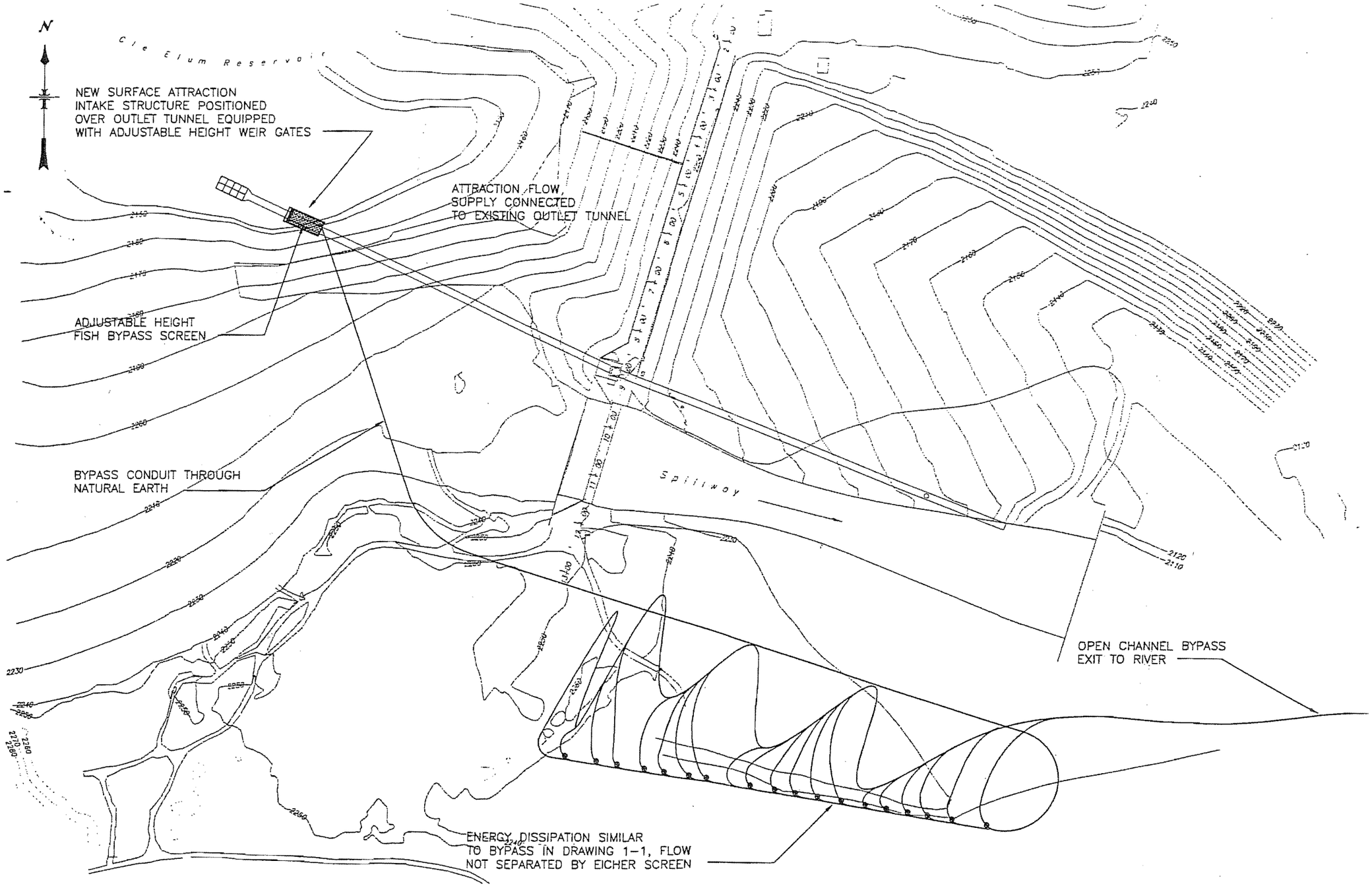
DOWNSTREAM PASSAGE
CONCEPT #1

Scale: 1" = 200'
Date: SEPTEMBER, 1999
File:

Drawing 1

HARZA Engineering Co.

BELLEVUE, WASHINGTON
(425) 602-4000



CONCEPT #1
OPTION B – PARTIAL SURFACE ATTRACTION
WITH PRESSURIZED BYPASS

U.S.BUREAU OF RECLAMATION

CLE ELUM DAM
FISH PASSAGE STUDY

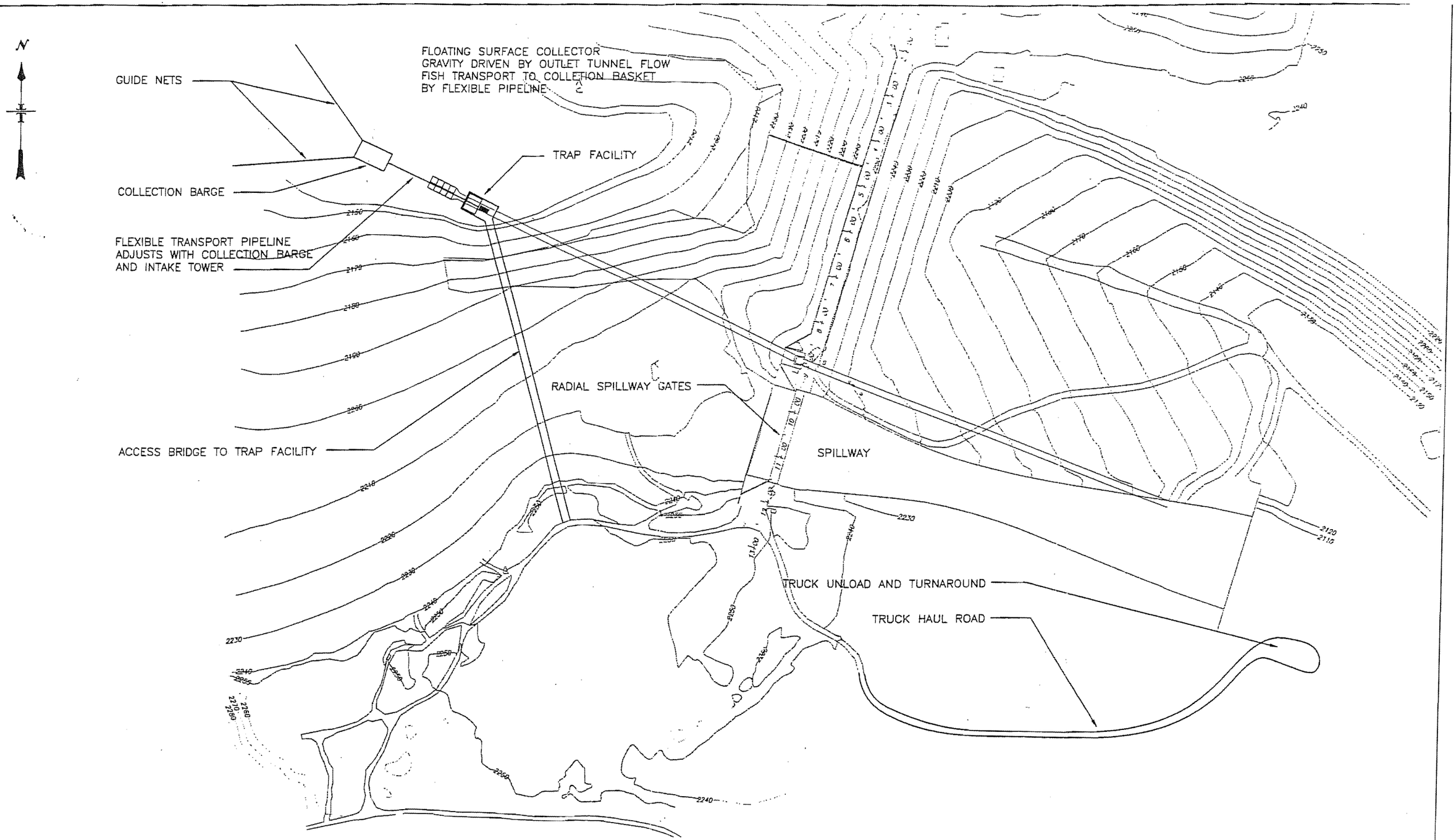
DOWNSTREAM PASSAGE
CONCEPT #1

Scale: 1" = 200'
Date: SEPTEMBER, 1999
File:

Drawing 2

HARZA Engineering Co.

BELLEVUE, WASHINGTON
(425) 602-4000



CONCEPT #2 – FLOATING SURFACE ATTRACTION FACILITY
OPTION A – FLEXIBLE ALIGNMENT SURFACE COLLECTOR

U.S.BUREAU OF RECLAMATION

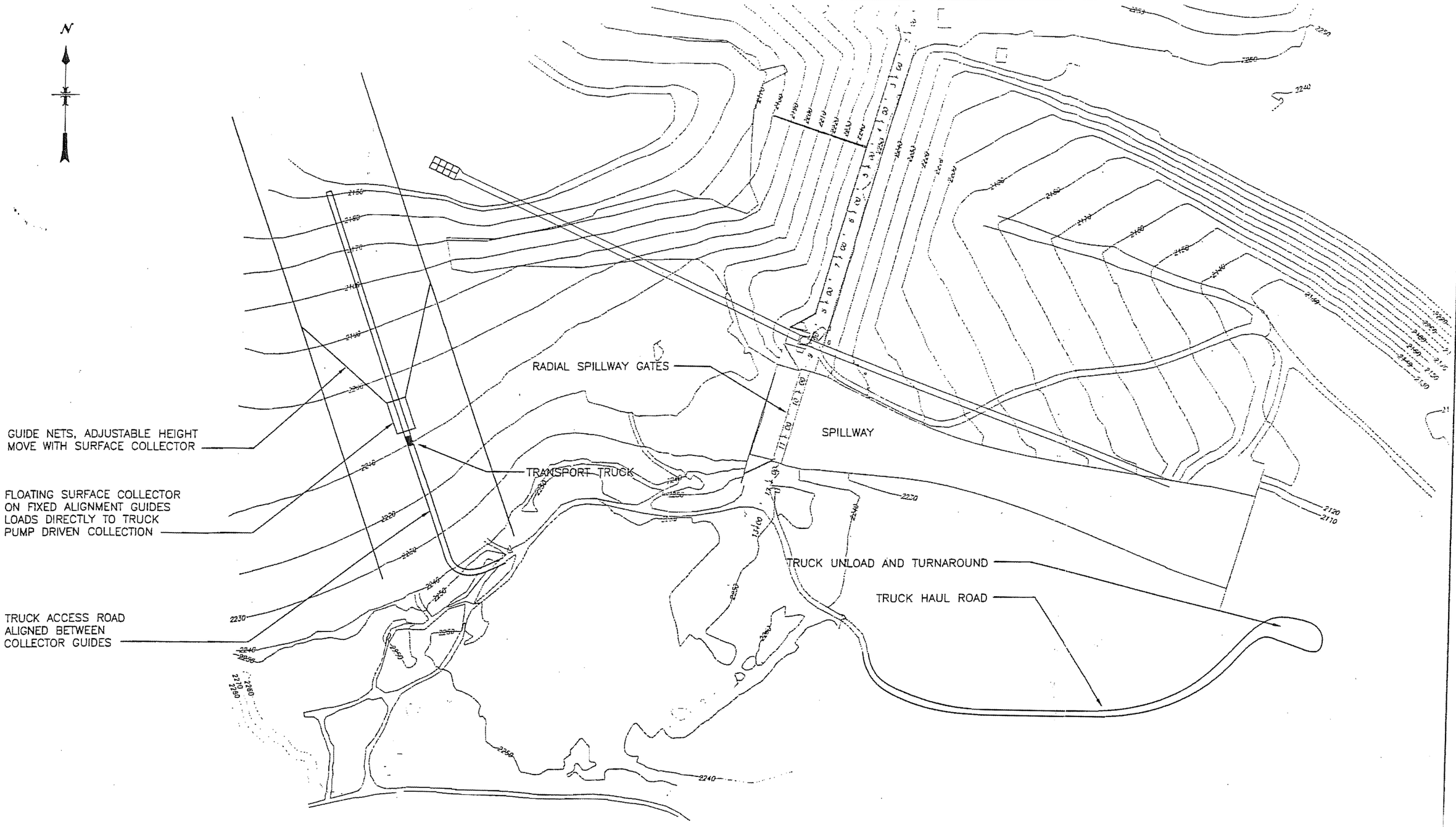
CLE ELUM DAM
FISH PASSAGE STUDY

DOWNSTREAM PASSAGE CONCEPT #2

Scale: 1" = 200'
Date: SEPTEMBER, 1999
File:

Drawing 3

HARZA Engineering Co.
BELLEVUE, WASHINGTON
(425) 602-4000



CONCEPT #2 – FLOATING SURFACE ATTRACTION FACILITY
OPTION B – FIXED ALIGNMENT SURFACE COLLECTOR

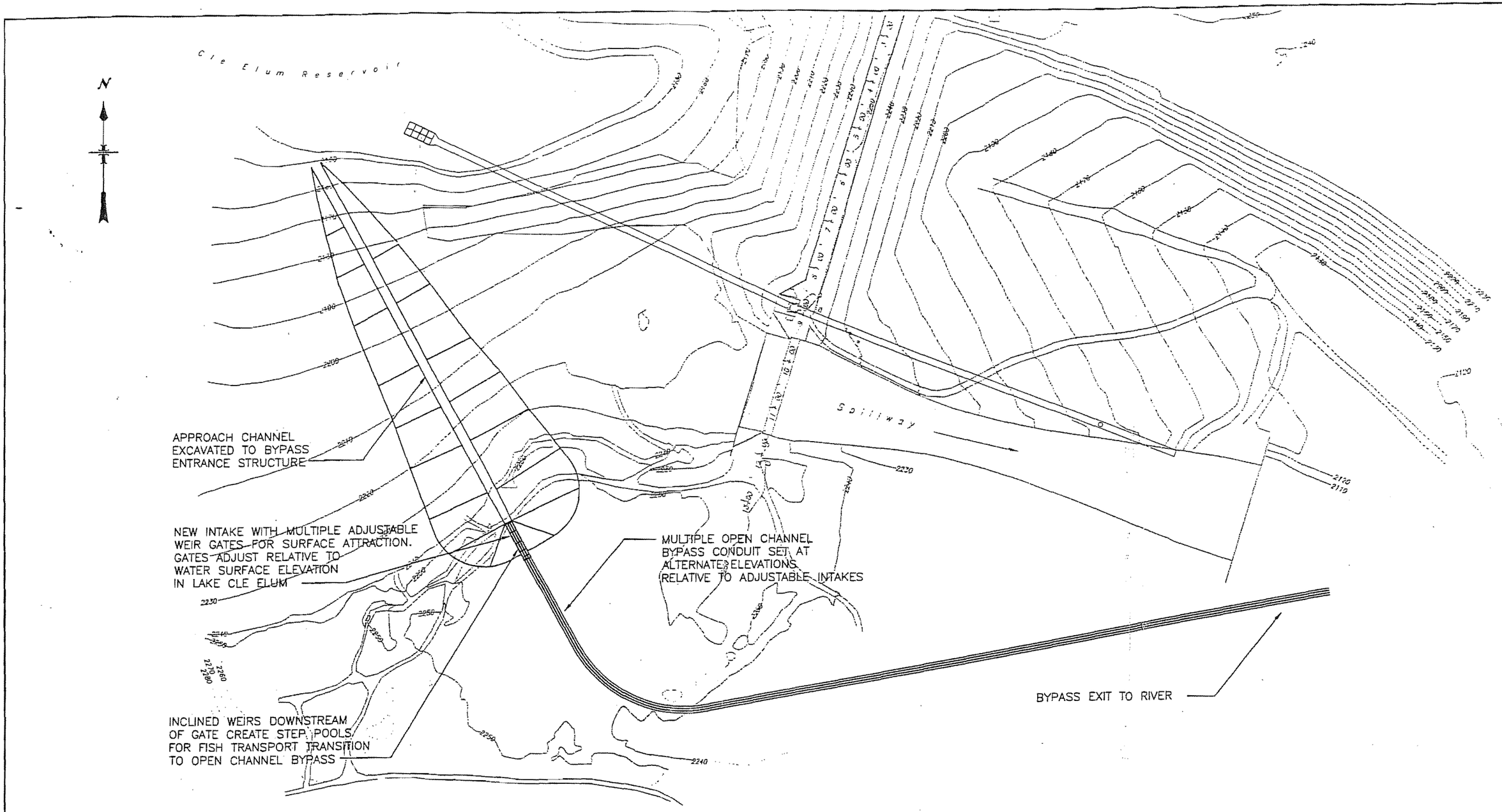
U.S.BUREAU OF RECLAMATION
CLE ELUM DAM
FISH PASSAGE STUDY

DOWNSTREAM PASSAGE CONCEPT #2

Scale: 1" = 200'
Date: SEPTEMBER, 1999
File:

Drawing 4

HARZA Engineering Co.
BELLEVUE, WASHINGTON
(425) 602-4000



CONCEPT #3 SURFACE ATTRACTION WITH OPEN CHANNEL BYPASS
OPTION A – MULTIPLE GRAVITY INTAKES

U.S.BUREAU OF RECLAMATION

CLE ELUM DAM
FISH PASSAGE STUDY

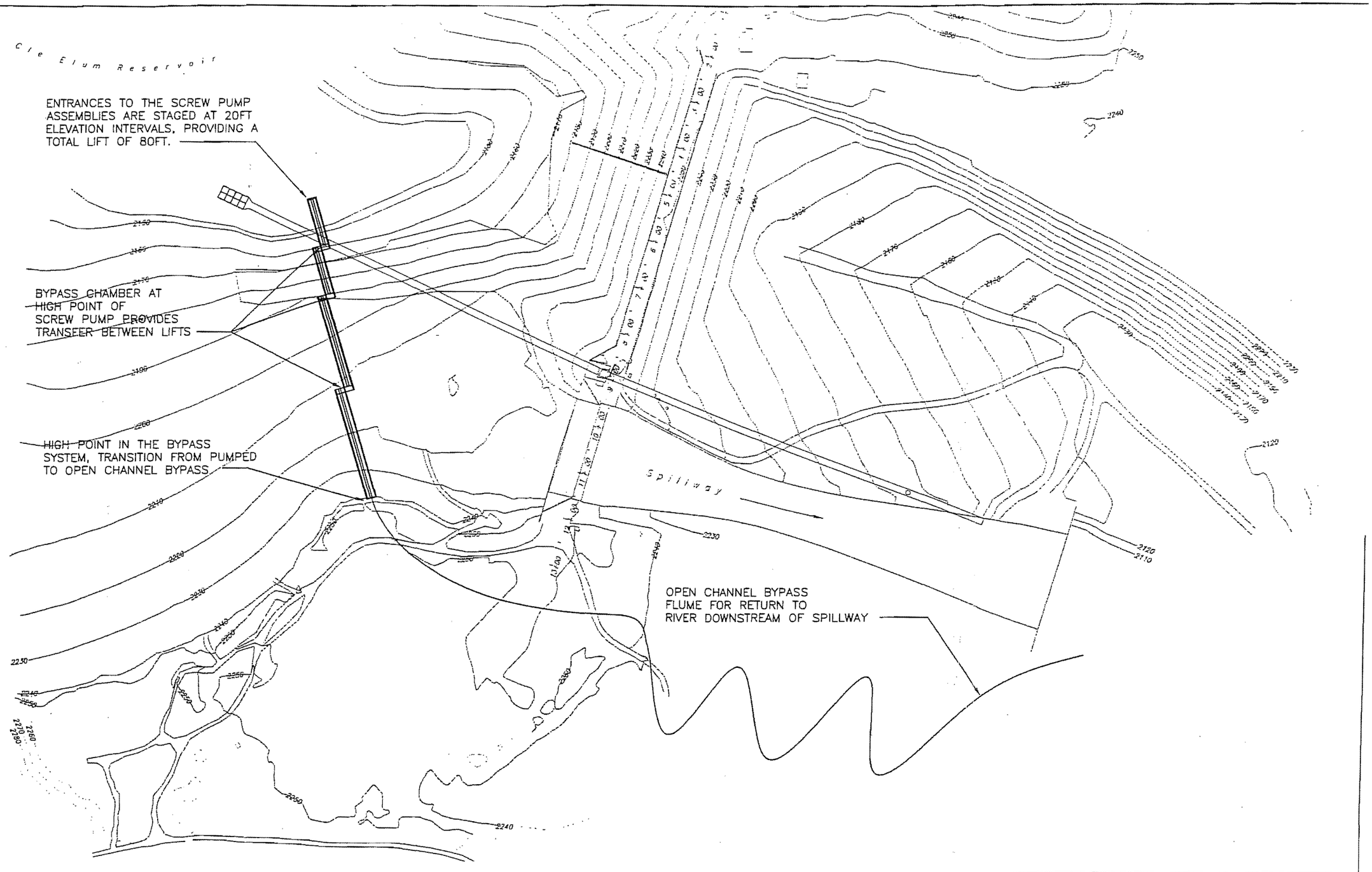
DOWNSTREAM PASSAGE
CONCEPT #3

Scale: 1" = 200'
Date: SEPTEMBER, 1999
File:

Drawing 5

HARZA Engineering Co.

BELLEVUE, WASHINGTON
(425) 602-4000



CONCEPT #3 – SURFACE ATTRACTION WITH OPEN CHANNEL BYPASS
OPTION B – MULTI-LEVEL PUMPED INTAKE WITH OPEN CHANNEL BYPASS CONDUIT

U.S.BUREAU OF RECLAMATION

CLE ELUM DAM
FISH PASSAGE STUDY

DOWNSTREAM PASSAGE CONCEPT #3

Scale: 1" = 200'
Date: SEPTEMBER, 1999
File:

Drawing 6

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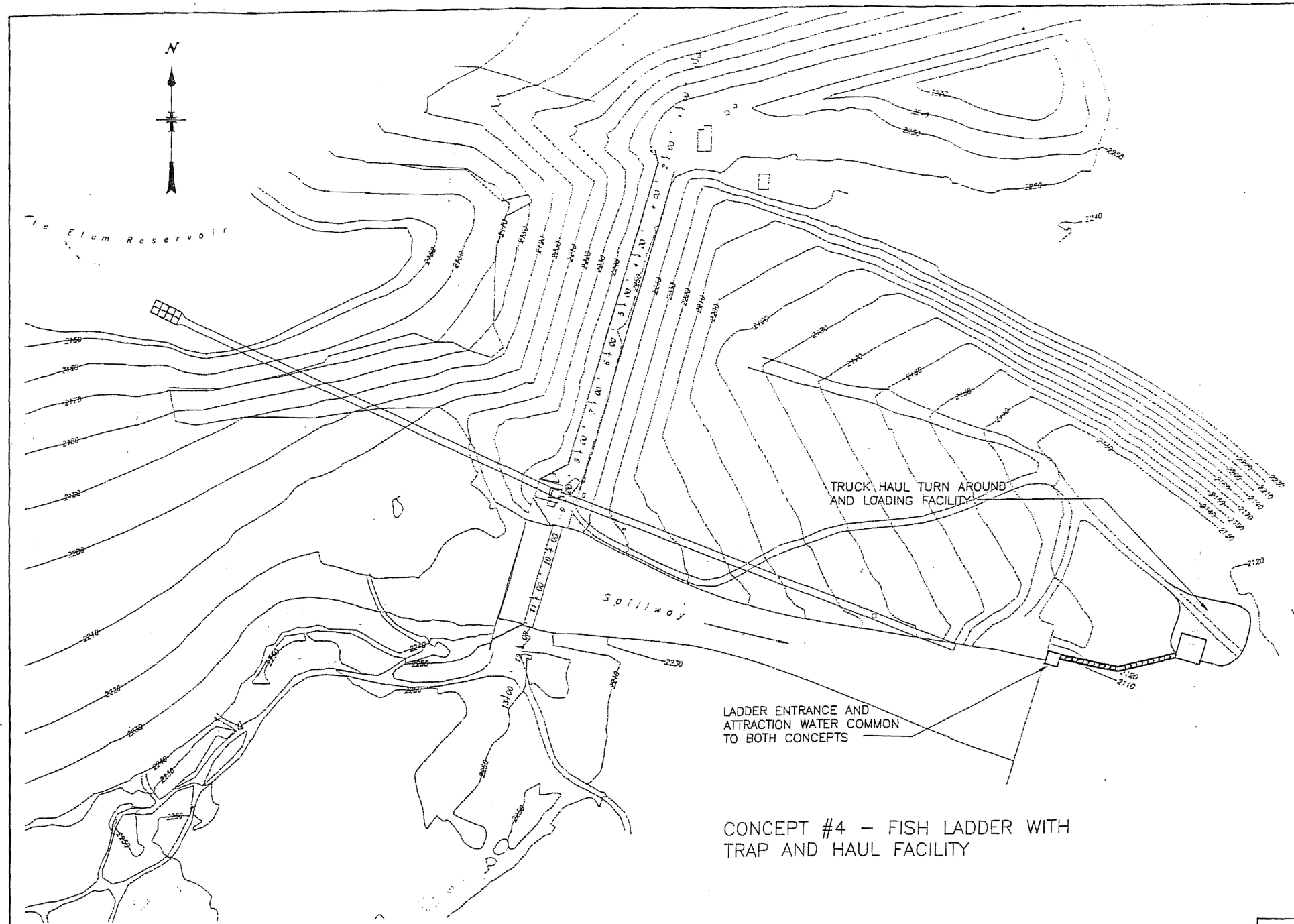

CONCEPT #4 – FISH LADDER WITH
TRAP AND HAUL FACILITY

U.S.BUREAU OF RECLAMATION

CLE ELUM DAM
FISH PASSAGE STUDY

UPSTREAM PASSAGE
CONCEPT #4

Scale: 1" = 200'
Date: SEPTEMBER, 1999
File:

Drawing 7

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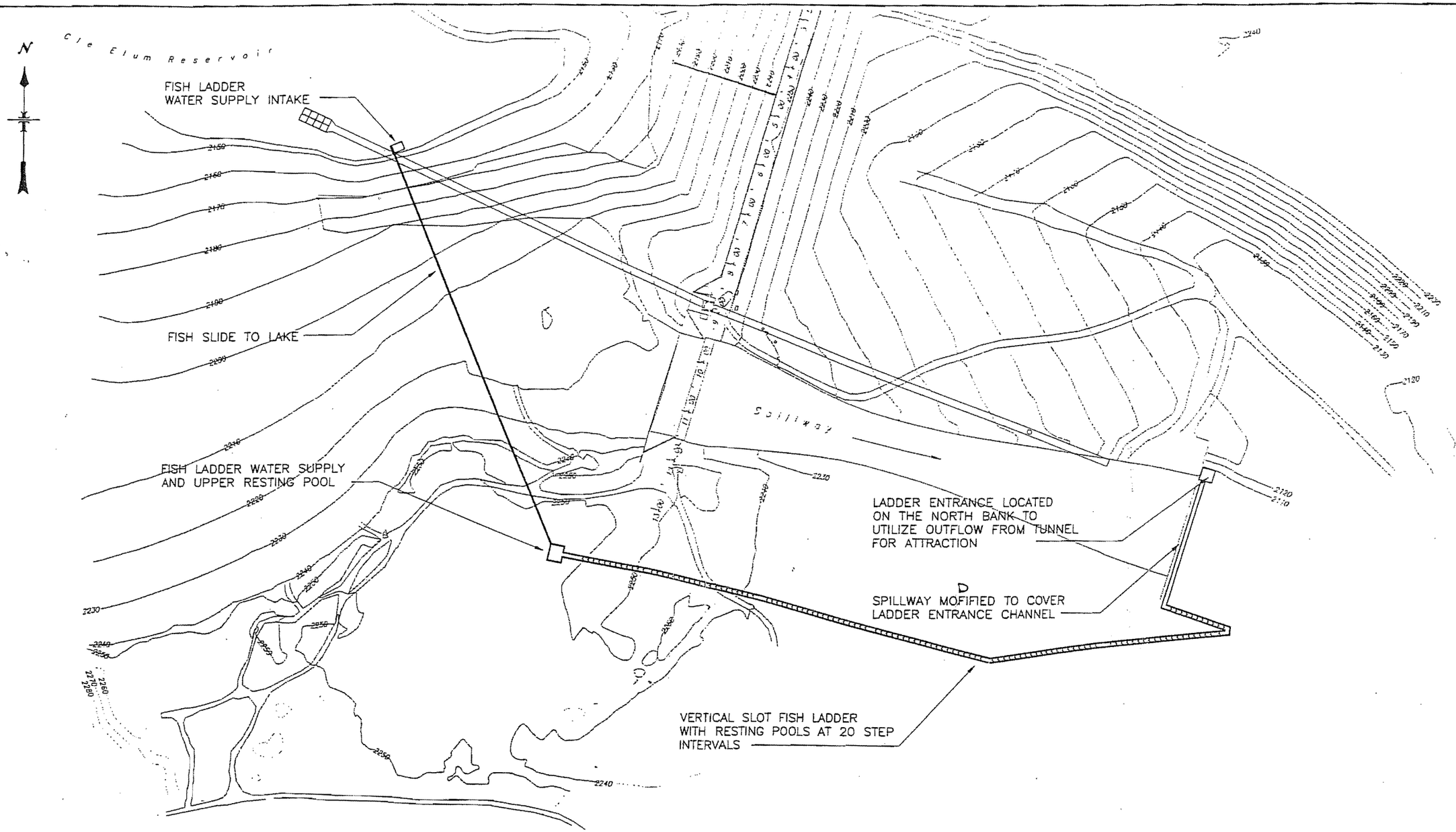

CONCEPT #5
FISH LADDER WITH
SLIDE TO LAKE

U.S.BUREAU OF RECLAMATION — CLE ELUM DAM
FISH PASSAGE STUDY

~~DOWN~~UP STREAM PASSAGE
CONCEPT #5

Scale: 1" = 200'
Date: SEPTEMBER, 1999
File: Drawing 8

HARZA Engineering Co. — BELLEVUE, WASHINGTON (425) 502-4000

Appendix B

USBR Report Comments

To: Bob Hamilton

From: Walter Larrick

Subject: Cle Elum Fish Passage Concept, Harza Report, Sept. 1999

Comments,

The fish passage facilities should consider all species that could potentially use the area above the Cle Elum Dam, such as, coho, steelhead, bull trout, chinook, and all other native resident fishes.

Temperature of the water should be a design consideration in both juvenile and adult passage.

Operation and maintenance issues with each option could be ranked as to some sort of scale related to cost and difficulty.

Good work, just what we needed at this stage of the project.

a:\cleelum.harza\ 10/17/99 JFM

To: Walt Larrick

From: John Manfredi

Subject: Cle Elum Fish Passage Concepts, Harza Report, Sept 1999

Comments,

Report item 4.3 explains concepts are meant to initiate a general process using a technical workgroup. This is an important qualification as each of the options present questions only a diverse workgroup will be able to address. Following comments are based on my limited interpretation of the report and limited knowledge of Cle Elum structure and engineering issues. These comments by no means cover all engineering and construction bases. I haven't commented on costs, but those involving major outlet works modifications and abutment excavations seem too low. If you want I can send over our bid abstracts for Bumping and Kachees outlet modifications and tunnel lining jobs. These are much smaller jobs than Cle Elum work would be but may be useful comparisons for whoever is doing the estimates..

Concept 1, Option A Surface Intake w/ Pressure Bypass:

1. The existing outlet tunnel has no entrance control. Entrance control will be needed to balance surface and bottom draw. This will mean new large submerged gates, and operators, at the entrance. The outlet tunnel may need to be lined to withstand a reservoir to tunnel head differential that will develop across the tunnel entrances.

2. Existing regulating gates, for the outlet tunnel, are located in the gateshaft at approximate dam centerline. Under present conditions most of the reservoir head is dissipated through these gates, and the tunnel downstream of the gates is not pressurized. Fish entering the upstream outlet tunnel will have to pass through these gates and experience high orifice velocity, through the gates, and instant depressurization. Alternatively to maintain reservoir head through the entire length of the existing outlet tunnel, a new set of gates would need to be constructed at the outlet end on the tunnel, downstream of the trifurcation. Also the existing tunnel downstream of the existing control gates would probably have to be lined for reservoir pressure flow in it's reach through the dam embankment.

3. The intake structure will be very expensive and difficult to construct, requiring low reservoir drawdown and cofferdam/bypass for construction.

4. The new intake structure will need power and control for actuators, convenient operator access; additionally winter ice will be a problem for the multi level gates.

5. Fish entering at the surface will be pulled down the intake shaft to the tunnel level (pressurized), through the tunnel and then back to surface (depressured) at the outlet end. How will fish handle this pressurization/ depressurization cycle?

6. At the bypass trifurcation structure and Eicher screen, access and dewatering for cleaning,

inspection and maintenance pose difficult design questions.

7. Outlet piping, across the spillway channel, and up to the serpentine flume, with multiple knife gates is not well described. Also, outlet pipe and serpentine flume design flows are not stated. Knife gates will need to be reservoir head rated (expensive), and 10' head increments between gates will require throttling or accepting a large variation in flow.

Comments, Concept 1, Option B Surface Intake w/ Pressure Bypass:

1. Repeat Comments 1., 3., 4., 5., 7. above.

2. The new bypass conduit will require an excavation through the right dam abutment as deep as 100' for pressure flow at low reservoir level. This will pose dam safety geologic and engineering issues.

Concept 2, Option A Surface Intake w/truck haul:

1. 1. The existing outlet tunnel has no entrance control. Entrance control will be needed to create hydraulic draw into the surface collector. This will mean new large submerged gates, and operators, at the entrance. The outlet tunnel may need to be lined to withstand a reservoir to tunnel head differential that will develop across the tunnel entrance.

2. Would the bridge shown for transport trucks be above high water level, or floating? If above high water level how would the trapped fish be raised to the bridge level?

3. Winterization (or storage) of the intake and barge is not addressed.

Concept 2, Option B Surface Intake w/truck haul:

1. Much simpler engineering than above options.

Concept 3, Option A Surface Attraction with Open Channel Bypass:

1. Open channel excavation and open channel bypass conduit could pose safety of dams and slope stability questions, depending on how deep the open channel bypass needs to be (ie what is the minimum reservoir level for passing fish).

2. What is the vertical travel range of the telescoping weir gate(s)?

Concept 3, Option B Screw Pumps:

1. Numerous mechanical, operation, maintenance and winterization issues.

Comments on Preliminary Analysis of Fish Passage Concepts

Date:

Mon, 18 Oct 1999 10:49:26 -0600

From:

"Larry Soderlind" <LSODERLIND@pn.usbr.gov>

To:

"Walter Larrick" <wlarrick.1yak1100.ibr1dm20@pn.usbr.gov>

CC:

"Robert J Hamilton" <RHAMILTON@pn.usbr.gov>

Several downstream passage concepts use channels that are separate from the upstream passage channels. The upstream and downstream

passage channels are combined into a single channel in a concept that Gene Humbles is developing for another facility. The downstream fish

go down the same fishladder that the upstream fish use. Perhaps combining the channels could save money.

Upstream concept #5 shows a long fish slide, it might be a bit stressful on the fish. Would the fish hit a sheet of ice? Rather than

making the fish swim to the crest of an empty dam then slide back down, perhaps another idea would be a tunnel through the dam. At the

upstream end of the tunnel could be a fish exit gate for when the dam is empty, then a second gate leading to an enclosed ladder when the

dam is partially or completely full. The enclosed ladder could be at the upstream face of the dam with fish exit gate openings at various

elevations. The gate closest to the reservoir opening is opened to let the fish out. Then the ladder wouldn't need to be as large since it

wouldn't need to extend to the crest of the dam.

Cle Elum Improvements Project
Final Cost Estimate
April 2000