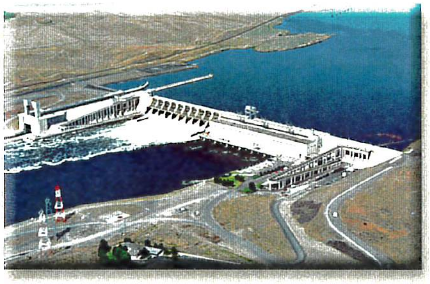
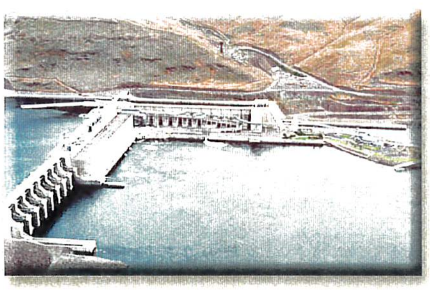
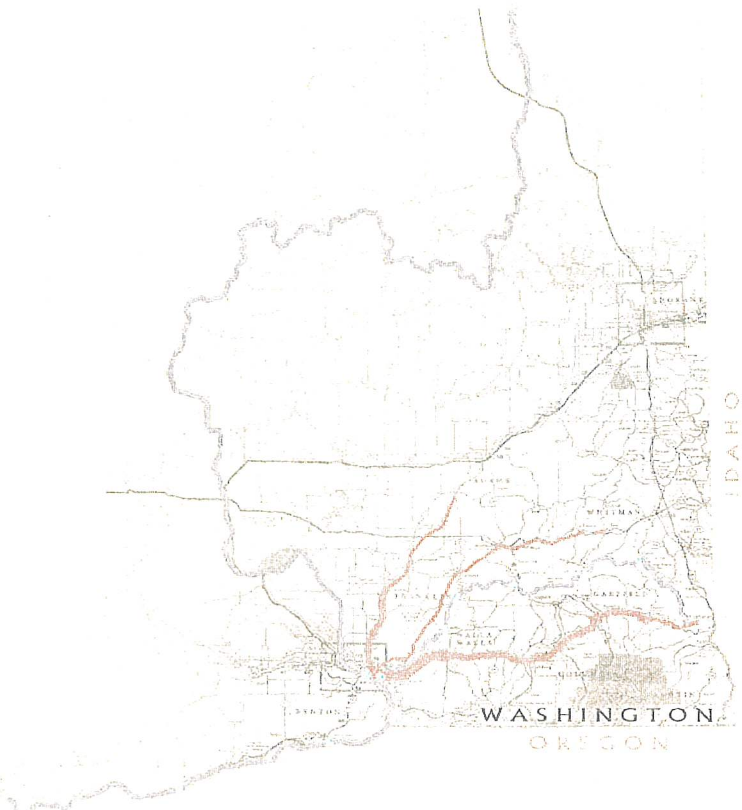
Lower Snake River Drawdown Study - Phase 2







Final Technical Memorandum No. 8

Summary of Local (City and County) Roadway System Impacts and Costs

Prepared for
the Washington State Legislative Transportation Committee
by HDR Engineering, Inc.
July 2000

HDR
Technical Memorandum

Lower Snake River Drawdown Study

Technical Memorandum No. 8

Summary of Local (City and County) Roadway System Impacts and Costs

This technical memorandum summarizes the estimated impacts and costs to Eastern Washington's local (city and county) roadway systems if a drawdown were to occur on the Snake River prohibiting all river barge traffic. Specifically, these costs and impacts are related to the additional demand placed on local roadways as a result of the diversion of commodities from barges to railroads and trucks. If this shift were to occur, modifications to the infrastructure of the local roadways would need to be made in the form of new system connections as well as mitigation of accelerated roadway pavement damage. In addition to pavement costs, this analysis includes considerations for other potential impacts of a drawdown including required capacity improvements, congestion mitigation, safety concerns, and increased maintenance costs. This study does not address costs and impacts to upgrade facilities at the new destination ports, to study and address resulting environmental impacts, or to relocate recreational facilities needing access to the lowered Snake River water elevation.

This technical memorandum is being completed as Phase II of the Lower Snake River Drawdown Study, commissioned by the Legislative Transportation Committee in 1998. Phase I of the "Drawdown Study", completed in February 1999, was intended to document the impacts to a sample of the transportation systems and the general economy of Washington State if a drawdown of the Lower Snake River were to occur. While Phase I dealt with impacts to several important highway and rail corridors, costs for damage and impacts to local roads were identified at the time as a potential future (Phase II) study.

Technical memoranda produced for the Lower Snake River Drawdown Study (Phase I) include:

TM#	Topic
1.	Annotated Bibliography of Existing EWITS and Eastern Washington Freight Mobility Study Data Sources
2.	Annotated Bibliography of Newly Acquired Data Sources
3.	Description of EWITS Model and Features
4.	Summary of Geotechnical Implications of Drawdown on Parallel Transportation Facilities
5.	Summary of Assumptions and Affected Corridors
6.	Summary of Corridor Impacts and Costs
7.	Summary of Commodity Shifts Out of Eastern Washington as a Result of a Drawdown of the Lower Snake River Reservoirs

Introduction

The proposed removal of four dams on the Lower Snake River would have significant cost impacts on the transportation infrastructure of Eastern Washington. Eastern Washington's economy is driven in large part by the production of agricultural commodities that are shipped to ports on the Lower Columbia River for export. Producers use barge, truck, and rail modes to ship their commodities to these export facilities. In Phase I of this study, the analysis of shipping rates for different modes showed that in many parts of the eastern Washington study area, the rates charged for shipment of commodities by rail and by truck/barge are quite competitive with one another—with barge currently enjoying a small advantage. Breaching the four Lower Snake River dams would end commercial navigation between Lewiston, Idaho and Pasco, Washington. While barging would continue from Pasco down to the Lower Columbia River export facilities, an important mode for many Eastern Washington shippers would be lost.

Although the analysis completed in Phase I showed that most of the commodities produced in Eastern Washington would continue to be shipped by barge, rail and truck modes would almost certainly play a larger role. The extent of the shift from truck/barge to rail would be based in part on strategic decisions made by barge and rail operators related to the rates that they would charge customers after drawdown. In Phase I of the study the consultant team established two scenarios for analysis representing likely responses to a drawdown. As discussed in *Technical Memorandum No. 6 – Summary of Corridor Impacts and Costs*, Scenario 1 assumed that transportation rates for truck/barge and for rail would remain constant relative to one another and that current rail car shortages would continue. Under this scenario, the truck/barge mode would continue to carry the majority of the commodities, and impacts to infrastructure would be focused on the highway system. A second scenario developed in Phase I of this study modeled a significant movement of commodities by rail. Scenario 2 identified a need for investment in railroad infrastructure. Because the intent of this memorandum is to identify impacts to local roadway infrastructure, this memorandum only addresses the impacts suggested by Scenario 1.

This memorandum, which builds on the Phase I work done for *Technical Memorandum No. 6 – Summary of Corridor Impacts and Costs*, discusses the impacts to the local (city and county) roadway systems based on the results of a least-cost transportation model, and describes in detail the methods used to calculate these impacts. The consultant team used the model developed in Phase I without modifying the base assumptions, network of roads, or final run output. Model results were analyzed more closely to identify changes in freight movement on local roads and three additional state highway corridors (SR 17, SR 26, US 195) that provide transportation systems connectivity.

The technical memoranda presented in Appendix B of the *Lower Snake River Drawdown Study* (Phase I) addressed the data and methods used to develop the least-cost transportation model for the LTC Snake River Drawdown study. Appendix B also includes a detailed discussion of the methods used to estimate costs and impacts on state highway and mainline rail facilities in Phase I, many of which have been carried forward into this analysis.

Existing Conditions

Table 1 illustrates the commodities included in the least-cost transportation model as well as their 1996/97 volumes on the Snake River. In order to best capture the quantities of goods affected by a drawdown of the Lower Snake River, volumes of commodities shipped are presented for barge traffic at Ice Harbor Dam, the furthest downstream of the four dams under consideration for removal in the EIS being prepared by the Army Corps of Engineers.

Table 1, Barge Commodity Movement, Existing Condition

Commodity	Volume at Ice Harbor, Tons	Direction
Wheat & Barley	3,240,618	Downstream
Petroleum	114,980	Upstream
Wood Products	590,000	Downstream
Fertilizers	33,123	Upstream
Containers	457,887	Downstream

Figure 1 presents the results of a model run showing the currently existing conditions for commodity movements within the study area. This model run was completed during Phase I of this analysis, at which time the results were compared with actual shipping data as indicated in the Phase I *Technical Memorandum No. 5 - Summary of Assumptions and Affected Corridors*. Commodity movements predicted by the model demonstrated a close correlation with actual reported commodity movements. In general, the patterns indicated in the model run closely resembled existing patterns of freight movement up and down the Columbia/Snake River system, the tributary highways, and the railroad systems. This base run also serves as the basis for comparison for this Phase II analysis.

Transportation Movements Analysis with Implementation of the Drawdown

In order to simulate the Eastern Washington transportation system after drawdown, the model was run again without any of the barge routes to and from the Snake River ports. The consultant team compared the results of this run with the existing conditions run. As a result of the restrictions on Snake River ports, the model showed a strong shift away from roads leading to the Snake River, and a greatly increased load on roads leading to the grain loading facilities in the Tri-Cities area. This movement pattern would increase traffic on three primary highway corridors, US 395, SR 124/US 12, and the Pasco-Kahlotus/SR 26 system. In essence, highways in these three corridors replace the Snake River as the primary route to the Tri-Cities ports for trans-shipment to barges for delivery to the Portland area. As indicated in *Technical Memorandum No. 6 – Summary of Corridor Impacts and Costs*, little change was seen in the mode or route choices of commodity shipments downstream of the Tri-Cities.

A comparison of the existing conditions and drawdown scenarios revealed that transportation patterns along local roads would also be affected by a drawdown. Similar to the shift in transportation patterns identified above for the highways, grain movements using the local roads will be re-focused towards the Tri-Cities area and away from the current generally north-south routes, which provide access to the Snake River ports.

Figure 2 shows this information, graphically displaying the change in highway truck volumes flowing from Eastern Washington to the Tri-Cities. The following sections provide a more detailed look at the costs associated with these increased volumes both to highway corridors not examined in detail in the Phase I analysis, and to local roads.

Impacts to Additional Highways

While the Phase I technical memoranda indicated traffic would increase on three primary highway corridors, US 395, SR 124/US 12, and the Pasco-Kahlotus/SR 26 system, there are other significant highway corridors which are extensively utilized in the movements of goods in the vicinity of the Lower Snake River. In Phase II of the drawdown study, these other highways, particularly SR 17, SR 26, and US 195, were analyzed in greater detail to determine if there are transportation impacts resulting from the Snake River drawdown which were not included in Phase I of the study.

Of these other highways, the model indicates SR 17 and SR 26 would experience the largest increase in truck traffic as a result of the lowering of the Snake River. SR 17 is shown by the analysis to be utilized for the transportation of an additional 144,000 tons of grain (11,160 additional truck trips) per year just south of I 90, and an additional 257,000 tons (19,920 additional truck trips) per year at the south end of SR 17 (at the intersection with US 395). Impacts to the section of SR 26 between Washtucna and Dusty are included in the Phase I study. The SR 26 section between Dusty and Colfax is shown in the analysis to carry 376,000 additional tons of grain (29,150 additional truck trips) annually at Dusty to 228,000 (17,670 additional truck trips) at Colfax. These highways are both designated with a functional classification of Principal Arterial, and are constructed to accommodate these additional trucks without exceeding the threshold where significant impacts to the roadway surfacing are expected. Of more concern is the number of trucks added to the "wye" intersection in Colfax where SR 26 and US 195 meet. This intersection would see an increase of approximately 15 trucks per hour along SR 26 during the harvest month. This intersection would likely require reconstruction to accommodate the additional trucks along SR 26, and to improve safety. Several narrow structures adjacent to the intersection will require renovation. Costs to reconstruct this intersection are estimated in the range of $6.5 million to $7.8 million.

The movement of grain on US 195, the main transportation corridor serving the areas between Spokane and the Snake River ports near Clarkston, is shown to decrease as a result of the Snake River drawdown. Since this corridor is oriented generally north-south, commodities currently transported using this corridor will shift to generally east-west corridors that provide access to the Tri-Cities area ports.

Impacts to Local Roadways

Impacts to local (city and county) roads would result from the increase in the movement of grain (wheat and barley) products towards barge facilities in the Tri-Cities area. Impacts to local roads are a concern primarily in southeastern Washington—south of I-90 and east of the Tri-Cities. The counties where the most impact is expected are Asotin, Garfield, Columbia, Walla Walla, Whitman, Adams, Franklin, and portions of Grant, Spokane and Lincoln.

In order reasonably to accommodate these increased truck movements, infrastructure improvements will be necessary to maintain adequate highway performance and minimal travel delay. Table 2 summarizes the impacted roadways, which are shown to experience an increase in tonnage hauled as a result of the Snake River drawdown. Figures 3 through 12 graphically indicate the road impacts for each of the impacted counties.

Table 2: Length (in Centerline Miles) of Local Road Impacted

County	Increase in Annual Tonnage						Total Length
	0 to 39,000	39,000 to 98,000	98,000 to 196,000	196,000 to 600,000	600,000 to 1,200,000	1,200,000 to 2,930,000	
Adams	162.0	11.2	37.9	16.0	13.9	0.0	241.0
Asotin	13.6	0.0	0.0	0.6	0.0	0.0	14.2
Columbia	54.3	23.2	8.7	0.0	0.0	6.4	92.6
Franklin	63.2	0.0	5.4	11.9	1.6	40.7	122.8
Garfield	88.2	4.8	0.0	0.0	0.0	0.0	93.0
Grant	195.0	44.1	35.0	0.0	0.0	0.0	274.1
Lincoln	194.9	16.0	0.0	0.0	0.0	0.0	210.9
Spokane	0.3	0.0	0.0	0.0	0.0	0.0	0.3
Walla Walla	83.3	9.2	23.4	0.0	0.0	3.3	119.2
Whitman	311.7	78.0	25.8	19.9	16.8	0.0	452.2
Total	1,166.5	186.5	136.2	48.4	32.3	50.4	1620.3

With the shift in the movement of commodities, away from the Snake River ports and towards the Tri-Cities area, many local roadways, which currently only occasionally experience truck traffic, will need to accommodate trucks year around. A substantial number of these roadways have pavement deficiencies, including inadequate base and/or pavement, which prevents the use of these roads to carry trucks all year long. Table 3 summarizes the impacted local roadways, which are adequate to carry trucks all year long (all-weather) and those which are inadequate (not all-weather). This table is divided into "slightly impacted" and "significantly impacted" roadways. "Slightly impacted" are roadways that will carry additional trucks as a result of the drawdown, but the number of trucks added is below the threshold where damage to the roadway pavement is expected when used only during "dry" periods. "Significant impacts" are roadways that will carry additional trucks as a result of the drawdown, but the number of trucks added is at or above that threshold.

Table 3: Length (in Centerline Miles) of Local All-Weather Roads Impacted

County	Slightly Impacted Roadways			Significantly Impacted Roadways			Total Length
	All-Weather	Not All-Weather	Total Length	All-Weather	Not All-Weather	Total Length	
Adams	116.0	70.9	186.9	26.1	28.0	54.1	241.0
Asotin	11.2	2.4	13.6	0.6	0.0	0.6	14.2
Columbia	29.6	45.4	75.0	12.6	5.0	17.6	92.6
Franklin	28.2	49.4	77.6	2.6	42.6	45.2	122.8
Garfield	70.3	19.4	89.7	0.0	3.3	3.3	93.0
Grant	146.0	100.8	246.8	2.1	25.2	27.3	274.1
Lincoln	159.8	51.1	210.9	0.0	0.0	0.0	210.9
Spokane	0.3	0.0	0.3	0.0	0.0	0.0	0.3
Walla Walla	21.9	70.7	92.6	12.4	14.2	26.6	119.2
Whitman	276.8	101.9	378.7	62.7	10.8	73.5	452.2
Total	860.1	512.0	1372.1	119.1	129.1	248.2	1620.3

Several improvements are identified to mitigate the impacts from the increased trucks resulting from the Snake River drawdown:

- Adding roadway capacity, particularly with intersection and climbing lane improvements, would minimize congestion.
- Rehabilitating pavements and more frequent maintenance to offset the increased wear on the pavement, which results from the additional truck traffic.
- Reconstructing roadways to provide adequate base, pavement, and/or width (lane and shoulder) needed to carry the truck traffic all year long.
- Upgrading bridge structures to correct or reduce deficiencies, including weight, width and clearance restrictions, which limit truck use.

The estimated costs of this increased freight movement over local roadways are summarized in the below tables. Table 4 summarizes the one-time costs needed to upgrade the local roadways to accommodate the increased or redirected truck traffic. These costs are divided into two categories, "significantly" impacted and "slightly" impacted roadways. The "slightly" impacted costs are estimates for converting non-All Weather roadways, that are projected to experience only a low increase in truck traffic volumes with the drawdown of the Snake River, into All Weather roadways. As summarized in Table 3, there are over 1,370 miles of local roadways that fall into this category. Instead of converting all of these to All Weather roadways, Counties may instead choose to develop other roadways to serve as strategic All Weather east-west corridors, to replace the north-south corridor which currently serve the Snake River ports. (With the drawdown of the Snake River, these north-south corridors will be used to a lessor degree as movement of commodities by barges on the Snake River is eliminated.) Development of these new strategic east-west corridors may be more costly than the costs shown in Table 4 for improving the "slightly" impacted roadways.

Additional information obtained during the Phase II study, indicates that approximately one-third of the Pasco-Kahlotus roadway will need re-alignment to straighten existing curves and to reduce other hazardous conditions. In the Phase I study, the Pasco-Kahlotus Road was identified as one of the three main corridors, which would receive the majority of the additional truck trips generated by the loss of barges if the Snake River drawdown were to occur. Included in the Phase I study was an estimated cost of $18.9 million to $22.7 million for pavement improvements needed to mitigate the increased deterioration of the pavement structure resulting from increased truck traffic. In addition to the costs included in Phase I, a cost in the range of $23.8 million to $28.6 million is estimated to re-align the Pasco-Kahlotus Road so additional truck traffic can be safely accommodated.

The costs presented in Table 4 do not include evaluation of environmental studies or meeting Endangered Species Act requirements. Depending on the location and the extent of work proposed, addressing these issues can add 10% to 30% to the indicated one-time cost impacts.

Table 4: One-Time Cost Impacts for Local Roadways and Noted Highways (Costs in Million of Year 2000 Dollars)

Counties	Significantly Impacted Roadways					Slightly Impacted Roadways				Total One-Time Costs for All Roadways
	Length of Roadway Improved (Miles)	Capacity Improvements	Pavement Improvements	Bridge Upgrades	Total One-Time Costs	Length of Roadway Improved (Miles)	Pavement Improvements	Bridge Upgrades	Total One-Time Costs	
Adams	54.1	$0.6 to $0.7	$59.2 to $71.0	$0.4 to $1.7	$60.2 to $73.4	70.9	$19.1 to $23.0	$0.3 to $1.3	$19.4 to $24.3	$79.6. to $97.7
Asotin	0.6	$0.0 to $0.0	$0.1 to $0.1	$0.0 to $0.0	$0.1 to $0.1	2.4	$0.6 to $1.0	$0.0 to $0.0	$0.6 to $1.0	$0.7 to $1.1
Columbia	17.6	$0.0 to $0.0	$3.8 to $4.6	$0.0 to $0.0	$3.8 to $4.6	45.4	$12.3 to $15.0	$0.1 to $0.2	$12.4 to $15.2	$16.2 to $19.8
Franklin	45.2	$0.2 to $0.2	$7.4 to $8.9	$0.0 to $0.0	$7.6 to $9.1	49.4	$13.3 to $16.0	$0.1 to $0.2	$13.4 to $16.2	$21.0 to $25.3
Garfield	3.3	$0.0 to $0.0	$0.6 to $0.7	$0.0 to $0.0	$0.6 to $0.7	19.4	$5.2 to $6.0	$0.0 to $0.0	$5.2 to $6.0	$5.8 to $6.7
Grant	27.3	$0.0 to $0.0	$6.8 to $8.2	$0.1 to $0.1	$6.9 to $8.3	100.8	$27.2 to $33.0	$0.1 to $0.1	$27.3 to $33.1	$34.2 to $41.4
Lincoln	0.0	$0.0 to $0.0	$0.0 to $0.0	$0.0 to $0.0	$0.0 to $0.0	51.1	$13.8 to $17.0	$0.2 to $0.9	$14.0 to $17.9	$14.0 to $17.9
Spokane	0.0	$0.0 to $0.0	$0.0 to $0.0	$0.0 to $0.0	$0.0 to $0.0	0.0	$0.0 to $0.0	$0.0 to $0.0	$0.0 to $0.0	$0.0 to $0.0
Walla Walla	26.6	$0.0 to $0.0	$5.2 to $6.2	$0.2 to $0.4	$5.4 to $6.6	70.7	$19.1 to $23.0	$0.0 to $0.0	$19.1 to $23.0	$24.5 to $29.6
Whitman	73.5	$5.0 to $6.0	$5.3 to $6.4	$0.1 to $0.4	$10.4 to $12.8	101.9	$27.5 to $33.0	$1.7 to $2.0	$29.2 to $35.0	$39.6 to $47.8
Phase II Subtotal	248.2	$5.8 to $6.9	$88.4 to $106.1	$0.8 to $2.6	$95.0 to $115.6	512.0	$138.1 to $167.0	$2.5 to $4.7	$140.6 to $171.7	$235.6 to $287.3
Franklin	Re-alignment of the Pasco-Kahlotus Road to reduce roadway hazards									$23.8 to $28.6
Phase II TOTAL										$259.4 to $315.9
	Phase I TOTAL (See Technical Memorandum No. 6, *Summary of Corridor Impacts and Costs,*									$84.1 to $100.7
Phase I & II TOTAL										$343.5 to $416.6

Table 5 summarizes the increase in annual costs, which result from the additional trucks. A detailed discussion of the methodology used for calculating the highway infrastructure, maintenance, and accident costs is found in Appendix A.

Table 5: Annual Cost Impacts for Significantly Impacted Local Roadways and Noted Highways

County	Length of Roadway Improved (Miles)	Costs in Year 2000 Dollars		
		Accidents	Maintenance	Total Annual Costs
Adams	54.1	$89,000	$150,000	$239,000
Asotin	0.6	$1,000	$0	$1,000
Columbia	17.6	$61,000	$57,000	$118,000
Franklin	45.2	$264,000	$103,000	$367,000
Garfield	3.3	$1,000	$7,000	$8,000
Grant	27.3	$20,000	$62,000	$82,000
Lincoln	0.0	$0	$0	$0
Spokane	0.0	$0	$0	$0
Walla Walla	26.6	$40,000	$68,000	$108,000
Whitman	73.5	$152,000	$226,000	$378,000
Total	248.2	$628,000	$673,000	$1,301,000

A summary of the combined transportation impact costs from both the Phase 1 and the Phase 2 studies are included in Table 6.

Table 6: Summary of Transportation Impact Costs—Phases I and II

Lower Snake River Drawdown Study Phase	Costs in Million of Year 2000 Dollars				
	One-Time Cost Impacts		Annual Costs Impacts (for a 20 year period)	Total Cost Impacts (One-Time and Annual Combined)	
	High	Low	---	High	Low
Phase 1	$108	$129	$48	$156	$177
Phase 2	$236	$287	$26	$262	$313
TOTAL	$344	$416	$74	$418	$490

The costs presented in this study only address increased impacts to eastern Washington roadways from trucks hauling commodities—assuming barges are no longer available on the Snake River because of the proposed drawdown. There are other significant costs associated with the potential drawdown, including loss of access to recreation and irrigation facilities resulting from a lowered water level on the Lower Snake River. These issues are not within the scope of this report, and will require study by experts knowledgeable in the appropriate field of interest.

Appendix A: Cost Determination for Local Roadway Infrastructure Impacts

Technical Memoranda 1 through 7, prepared for Phase I of this study, include a detailed description of the methods employed by the consultant team to estimate the volumes of grain and other commodities traveling over Eastern Washington's transportation network. For this Phase II analysis of impacts to local roads (*Technical Memorandum 8*), the consultant team used two model runs developed for the analyses completed in Phase I. Using the output of these two model runs, the consultant team examined the increase in commodities diverted to highways and local roads and estimated the increase in truck trips needed to haul these commodities. With the increase in truck trips established, the project team estimated the following impacts and costs to Eastern Washington's local roadways.

- Capacity improvements and costs needed to accommodate the projected increased truck traffic;
- Pavement improvement and costs needed to accommodate the increased truck traffic;
- Bridge deficiencies and costs needed to upgrade these structures to accommodate the projected increased truck traffic;
- Annual increase in accidents and costs resulting from the projected increased truck traffic; and
- Annual increase in maintenance costs resulting from the projected increased truck traffic.

These analyses, performed for local roads, are consistent with the analyses completed for the three most significantly affected highway corridors in Phase I of this study.

<u>Increase in Number of Trucks</u>
The consultant team estimated the increase in the number of truck trips based on the increase in annual tonnage for all commodities diverted from river barges to trucks. This information was collected by roadway segment for local roads, which were shown by the model to experience increases in tonnage. By dividing the annual tonnage from the model by an assumed average payload per truck of 51,600 pounds, the consultant calculated the increase in the number of one-way trucks on each segment. Currently, when trucks are used to haul grain in Eastern Washington, they are primarily used in a feeder role to deliver grain "at harvest time to an elevator within a relatively short distance of the field or to the farmer's own storage".[1] These short distance hauls are performed typically utilizing 80,000 pound or less gross vehicle weight (GVW) trucks. Because of the increased haul distances and quantities of grain diverted to trucks in this region if shipment by barge on the Snake River is prohibited, it was assumed that a significant number of 105,500 pound GVW trucks, the largest truck-size legally allowed on Washington highways, would be used to haul grain products.

Increase in trucks hauling grain products (assuming a combination of 105,500 pound and 80,000 pound GVW trucks):

Payload (105,500 pound GVW truck) = 61,400 pounds = 30.70 tons
Payload (80,000 pound GVW truck) = 50,680 pounds = 25.34 tons

Payload (assuming a 45% / 55% split) = 55,500 pounds = 27.75 tons

[1] "*Transportation Characteristics of Wheat and Barley Shipments on Haul Roads to and from Elevators in Eastern Washington*", EWITS Report #5, 1995, page 5.

Average load = 93% of payload[2] times 27.75 tons = 25.80 tons (or 51,600 pounds)

$$\text{Annual increase in grain trucks (one-way)} = \frac{\text{Annual increase in grain tonnage}}{\text{(25.80 tons/ truck)}}$$

Total increase in trucks (hauling commodities diverted from river barges) per roadway segment:

Total annual increase in trucks = Total annual increase in trucks (grain only trucks) x (2 trips / round trip)

Intersection Capacity Improvements and Costs

Based on the estimates of increased truck traffic derived from the analysis described above, the study team examined intersections along eastern Washington roadway corridors in order to identify potential capacity constraints. Where significant restrictions were identified, the study team assessed the need for and extent of intersection improvements to alleviate these restrictions. The study team then prepared cost estimates for implementing these identified improvements.

In analyzing intersections to identify whether improvements were required, the total annual increase in trucks was converted to increase in trucks during peak hours. This value was determined using the following assumptions:

1. *The heaviest truck traffic on local roadways in eastern Washington occurs during the July and August harvest season[3]. 40% of the deliveries to local elevators are transported during the peak month.[4]*
2. *The grain is transported seven days a week. (There are 31 days during the peak month.)*
3. *The majority of the grain transported is hauled during a 16-hour period.*
4. *The increase in number of truck trips during peak hours is calculated as follows:*

$$\text{Total increase per hour} = \frac{\text{Annual increase in trucks x 40\% in peak month}}{\text{31 days/ month x 16 hours/ day}} \quad \text{or} \quad \frac{\text{Annual increase in trucks}}{1240}$$

Pavement Improvements and Costs

To determine the extent of the pavement improvements that would be required under a drawdown scenario, the study team completed a conceptual analysis of the pavement to determine the percent reduction in pavement life which could be expected if truck traffic were to increase to the levels projected by the model. Utilizing a simplification of the basic concepts for pavement rehabilitation, described in the WSDOT Pavement Guide, general design traffic values[5] for four basic roadway classifications (major arterial, minor arterial, collector, and other county roads) were developed. These design traffic values are indications of the number of trucks the "average" highway is expected to withstand during the design period for each of the roadway classifications.

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[2] U.S. DOT Comprehensive Truck Size and Weight Study, Volume II—Issues and Background, June 1997 DRAFT, page III-12 states "Under the current 80,000 pound Federal GVW limit...Five-axle tractor-semitrailer combinations with specialized body type (dump, tank, grain) use about 93 percent of available GVW."

[3] EWITS Report #5, page 19, "deliveries to upcoming elevators are more heavily concentrated during the July and August harvest season".

[4] EWITS Report #5, page 17, Figure 2.1 and 2.2, and Tables 2.1 and 2.2, 72.2 % of the wheat and 66.5% of the barley is received at the elevators was delivered during July and August.

[5] Using ESALs (or Equivalent 18,000-lb Single Axle Loads), a design value used in evaluating pavement systems.

In addition, a traffic value was determined for each of the roadway sections, based on the estimated annual increase in truck trips resulting from a loss of river barge traffic on the Snake River. This projected increase in truck traffic was estimated based on the increase in annual tonnage for commodities diverted from river barges to trucks, as discussed in an earlier section of this Appendix A. This value was then converted to ESALs using 2.63 ESALs per round trip (2.57 ESALs for loaded truck plus 0.06 ESAL for the unloaded truck return trip). The percent reduction in pavement life was then estimated as the ratio of the traffic values for the roadway section divided by the design for the designated roadway classification of the section being analyzed. Based on this percentage, the study team identified an increased tonnage level where pavement life is "significantly impacted" for the roadway functional class. These levels are noted in Table A.1.

Table A.1 Values for Determination of "Significant" Impact

Roadway Classification	Assumed Design ESAL for Roadway Classification	Annual Increase to Significantly Impact Pavement Life		
		Increase in Tonnage	Truck Roundtrips (25.8 Tons/Truck)	Increased ESAL (2.63 per Truck)
Prin. Arterial	3,000,000	588,000	22,790	59,940
Minor Arterial	1,000,000	196,000	7,600	19,990
Collector	500,000	98,000	3,800	9,990
Minor Collector	200,000	39,000	1,510	3,970

In order to determine whether or not pavement improvements would be required, the study team evaluated each of the roadway sections that were identified as receiving an increase in tonnage as a result of the Snake River drawdown. Paved roadways were evaluated using the criteria indicated in Table A.2. Unpaved roadways were evaluated based on the criteria presented in Table A.3. This methodology is similar to the process identified in the January 1993 *Cost Responsibility Study – Phase I*, prepared for the State of Washington Legislative Transportation Committee by Cambridge Systematics, Inc. with Evergreen Policy Group.

Table A.2 Paved Roadways

	All-Weather Roadway (Adequate Base)	Not an All-Weather Roadway (Inadequate Base)
Slightly Impacted Local Roadway	Roadways: • No roadway improvements Structures: • No structure widening • Strengthen structures if "posted" or restricted	Roadways: • Reconstruct roadway (rebuild pavement and base) • Widen roadway and shoulders to "standard" widths Structures: • No structure widening • Strengthen structures if "posted" or restricted
Significantly Impacted Local Roadway	Roadways: • Rehabilitate roadway (structural overlay) • Widen roadway and shoulders to "standard" widths Structures: • Widen structures • Strengthen structures if "posted" or restricted	Roadways: • Reconstruct roadway (rebuild pavement and base) • Widen roadway and shoulders to "standard" widths Structures: • Widen structures • Strengthen structures if "posted" or restricted

The study team estimated the costs for improving the pavement and correcting structural deficiencies using values presented in the Cost Responsibility Study. These costs were converted to year 2000 dollars using Washington State Department of Transportation escalation factors.

Table A.3 Unpaved Roadways

ADT	All-Weather Roadway (Adequate Base)	Not an All-Weather Roadway (Inadequate Base)
Less than 250	Roadways: • No Action	Roadways: • Upgrade roadway base • Widen to "standard" roadway width
250 or Greater	Roadways: • Pave Roadway • Widen to "standard" roadway width	Roadways: • Pave Roadway • Widen to "standard" roadway width

<u>Annual Increase in Accidents and Costs</u>

An increase in accidents, which could result from an increase in the number of truck trips, was calculated based on average rates of accident occurrence per truck-mile.[6] The cost per occurrence was based on WSDOT cost factors for use in performing safety-related analysis.[7] The rates and costs used are as follows:

Table A.4

Accident Type	Roadway Classification	Occurrence Rate (per 100 million combination truck miles)	Cost per Occurrence
Fatality	Rural Highway Rural Other Road	7.12 5.37	$800,000
Injury	Rural Highway Rural Other Road	41.12 31.04	$62,000
Property Damage	Rural Highway Rural Other Road	107.55 81.18	$5,800

[6] Transportation Research Board (TRB) Special Report 246: Paying Our Way: Estimating Marginal Social Costs of Freight Transportation National Academy Press, 1996

[7] These cost factors are not actual costs but instead are values used to identify deficiencies (based on past collision history) and to calculate future benefits of proposed improvements.

From these calculations the study team estimated annual increases in accident costs. A cost per segment was obtained by multiplying the projected increase in truck trips, divided by 100 million, times the length of the roadway section (in miles), and then multiplying by the occurrence rate for the roadway segment classification:

$$\text{Cost/Segment} = \frac{\text{Truck trips}}{100{,}000{,}000} \times \text{Length of segment} \times \text{Occurrence}$$

Annual Increase in Maintenance Costs

An increase in maintenance, which could result from an increase in the number of truck trips, was calculated based on values established in the Cost Responsibility Study. Maintenance costs were dependent on the pavement type, roadway functional classification, and average daily traffic (ADT) range. These costs were converted to 2000 dollars using Washington State Department of Transportation escalation factors.