Yakima River Basin Integrated Water Resource Management Plan

Technical Memorandum: Wymer Reservoir Pumping Plant Update

U.S. Bureau of Reclamation
Contract No. R08PC10677 ID/IQ

Prepared by

HDR Engineering, Inc.

U.S. Department of the Interior
Bureau of Reclamation
Pacific Northwest Region
Columbia-Cascades Area Office

State of Washington
Department of Ecology
Office of Columbia River

April 2014

MISSION STATEMENTS

U.S. Department of the Interior

Protecting America's Great Outdoors and Powering our Future.

The U.S. Department of the Interior protects America's natural resources and heritage, honors our cultures and tribal communities, and supplies the energy to power our future.

Bureau of Reclamation

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

Washington State Department of Ecology

The Mission of the Washington State Department of Ecology is to protect, preserve and enhance Washington's environment, and promote the wise management of our air, land and water for the benefit of current and future generations.

If you need this document in a format for the visually impaired, call the Office of Columbia River at (509) 575-2490. Persons with hearing loss can call 711 for Washington Relay Service. Persons with a speech disability can call 877-833-6341.

Contents

List of Tables

List of Figures

Appendices

1.0 Introduction and Background

The U.S. Department of the Interior, Bureau of Reclamation (Reclamation) prepared the first design and cost estimate for Wymer Dam and Reservoir in 1985. Reclamation subsequently prepared the Yakima River Basin Storage Study Wymer Dam and Reservoir Appraisal Report (Appraisal Report) in September 2007 (Technical Series No. TS-YSS-16). The Appraisal Report documented an updated appraisal assessment of the costs and features required to construct Wymer Dam and Reservoir as originally studied in 1985.

In March 2011, HDR Engineering, Inc. (HDR) prepared the Yakima River Basin Study, Wymer Dam and Reservoir Summary Technical Memorandum under Contract No. 08CA10677A ID/IQ, Task 4.7. The 2011 technical memorandum summarized the findings of the 2007 Appraisal Report and described the challenges and possible next steps for this potential water storage project. A companion technical memorandum updated the 2007 cost estimate to 2010 values. No new or supplemental technical analysis was performed by HDR for preparation of the March 2011 technical memorandum.

1.1 Purpose

The Wymer Dam and Reservoir is comprised of the following major features:

- Yakima River Intake
- Fish Screen and Bypass
- Pumping Plant
- Pipeline
- Discharge Channel
- Reservoir
- Main Dam
- Saddle Dike
- Spillway
- Outlet Works
- Lmuma Creek Modifications
- I-82 Bridge Protection Measures

The owners of the property upon which the proposed Wymer Dam and Reservoir would be built were concerned with the potential for adverse impacts to their large, irrigated pasture on the left bank of the Yakima River upon which the project's intake, fish screen and bypass, pumping plant, and lower portion of the pipeline would be constructed. For this reason, Reclamation sought to identify an alternative location upon which to site these project features. An undeveloped site approximately 5,000 feet upstream of the original location was identified by Reclamation and visited by Reclamation and HDR personnel.

The purpose of this technical memorandum is to prepare text and an updated set of drawings and cost estimate for a relocated pumping plant. The balance of the Wymer Dam and Reservoir's major project features are not being altered or updated within this technical memorandum. Thus, the focus of this technical memorandum is simply the relocation of the major project features comprising the reservoir pumping plant. To the greatest degree possible, the design of the prior project features has been retained unaltered. This approach allows the current efforts to rely on the prior analysis and cost estimates for those project features that are being relocated in the current technical memorandum. The following specific project features are being relocated within this technical memorandum:

- Yakima River intake
- Fish screen and bypass
- Pumping plant
- Pipeline
- Outlet structure
- Access roads

This technical memorandum also considers the Interconnection, Transmission Line, and Substation features which were not included in prior studies.

1.2 Level of Study

HDR gratefully acknowledges the prior work performed by Reclamation, in both: 1) Reclamation's original study of the Wymer Dam and Reservoir Project (1985), and 2) Reclamation's subsequent Appraisal Report (September 2007). This technical memorandum builds upon the prior work performed by Reclamation both in terms of the body of this technical memorandum's text and in the drawings that are a part of this technical memorandum.

This technical document remains at an appraisal-level engineering evaluation for all features associated with Wymer Dam and Reservoir as defined in Reclamation Policy, Directives, and Standards. The designs are based on available design data from past Reclamation work and limited additional data obtained during the study. Similar to Reclamation, HDR considers the cost estimates provided for this study to be comparable to an Association for the Advancement of Cost Engineering (AACE) Class 4 cost estimate (-20 percent to +30 percent).

1.3 Prior Documents as References

This technical memorandum provides limited new information regarding the major project features of Wymer Dam and Reservoir. The new information contained in this technical memorandum is limited to that necessary for the re-siting of the reservoir pumping plant. For this reason, readers of this technical memorandum who desire more detailed design and cost information for Wymer Dam and Reservoir are directed to the two prior Reclamation studies and reports prepared in 1985 and 2007, and the summary technical memorandum prepared by HDR in 2011.

2.0 Principal Project Features

Principal projects features are shown on Figure 2 and are discussed below.

2.1 Highway Access

Ongoing operation and maintenance activities at fish screens, pumping plant, pipeline appurtenances, and outlet structure require vehicular access for both pickup trucks and semitrailers. State Route (SR)-821 on the north side of the intersection with the proposed access road was constructed by excavating through the rock outcrop. In this appraisal-level design, investigations of the required sight distances for right turn, left turn, and crossover maneuvers were not performed. Sufficient paved surface for performing right turn maneuvers for semitrailers was provided as shown on Figure 5. Depending on the outcome of the sight distances study, implementation of right turn only (no left turn or crossover maneuvers) traffic control may be required.

2.2 Access Roads

Consistent with the previous 2007 Appraisal Report, all roadway sections utilize two 12-foot-wide lanes. See Figures 4 and 5. Considering the anticipated traffic volumes, a shoulder would not be provided. A typical roadway cross section would have a 1-foot-deep ditch on both sides. Six-inch gravel surfacing was assumed for cost estimating purposes. Vehicle guardrail may be required along steep side slope portions of proposed access roads. Horizontal and vertical alignment was set to achieve a maximum road grade of 12 percent. Limited effort to balance earthwork quantities was made during this appraisal-level report. The proposed access road would cross McPherson Canyon Creek approximately 1,400 feet east of SR-821. A concrete box culvert designed for HS20 traffic loads with clear width of 24 feet (two 12-foot lanes) was adopted for this technical memorandum. For the purposes of the cost estimate, we assumed that the box culvert dimensions will be identical to those of SR-821 and McPherson Canyon creek crossing.

2.3 River Intake

The primary components and perpendicular orientation of the intake centerline to the flow of the river are the same as those identified in the 2007 Appraisal Report (See Figure 6). These components include a relocated concrete intake structure, a trashrack, dewatering stop logs, and an intake operating deck with safety railings. The face of the intake has been located immediately upstream and within a narrowing section of the Yakima River where the water velocities are accelerating. It is believed that the narrowing aspect of the river at this location is caused by the presence of a bedrock outcrop on the right bank of the river. The new intake is located on the left bank of the river, as it was in the 2007 Appraisal Report.

Intake features that should be considered during further design development of the intake include a raised intake sill to promote sediment exclusion from entering the face of the intake structure, a submerged intake headwall to promote the passage of floating debris without impingement on or passage through the trashrack, equipment to handle the removal of woody debris that impinges on the face of the trashrack, and provision for the removal of any sediments that enter and deposit within the intake structure. Figures 7 to 9 provide further details of intake and fish screens.

2.4 Fish Screens and Bypass

The relocated fish screens are oriented 90 degrees different from the orientation of the screens in the 2007 Appraisal Report. The fish screens have been reoriented to better fit the area constraints at the new intake site, as the new site is a relatively narrow bench located on a point bar. Other than the different orientation of the screens relative to the intake alignment, there are no other changes proposed to the fish screens. The 2007 Appraisal Report t fish bypass system required the use of a screw pump to lift the bypassed fish a maximum of 14 vertical feet, since a gravity-driven fish bypass system was determined to not be possible due to a lack of sufficient slope in the Yakima River at the downstream location studied in the 2007 Appraisal Report. Since the Yakima River is more steeply sloping at the relocated site for the intake, fish screens, and bypass, a gravity-driven fish bypass system with larger diameter piping has been conceptualized as it is considered more desirable than the fish pump system (see Figures 7 to 9)

2.5 Pumping Plant

To enable comparison with previous studies, the Wymer pumping plant is a 7-unit, 400-cfs facility. The relocation of the fish screens necessitated several adjustments to the pumping station configuration as compared to the 2007 Appraisal Report. The service bay was re-located on the intake side of the pumping plant to enable easy approach from the access road for a semitrailer. The surge tank was located near the pumping station end wall to provide vehicular access around the station and into the switchyard.

Internal layout of the pumping station from the 2007 Appraisal Report was largely retained. No adjustments to the number of pumping units, unit capacity, or air chamber size were considered necessary for this technical memorandum. See Figure 3 for hydraulic profile and Figures 10 to 12 for the pumping plant layout.

2.6 Pipeline

Due to the shift in the fish screen and the pumping station location, a new pipeline alignment was developed to route the discharge pipeline from the pumping station to the south end of the saddle dike (see Figure 14). After leaving the pump station, the pipeline will climb the steep hill between the Yakima River and SR-821, and descend from the high point along the existing access track. The pipeline will cross SR-821 near McPherson Canyon. The pipeline will then follow the right side of the McPherson Canyon before crossing the McPherson Canyon channel, continuing southeast before terminating near the south end of the proposed saddle dike. The length of the pipeline has increased from the original length of 4,700 feet to approximately 7,000 feet. The diameter of the pipeline will be unchanged at 96 inches. The revised pipeline alignment will have one high and one low spot, which will require vacuum/air release valves on the high point and a drain valve at the low point. The proposed crossing of the McPherson Canyon channel will be exposed to scour during flood events and will be protected against erosion with riprap.

2.7 Pipeline Highway Crossing

For the purposes of this technical memorandum, it was assumed that the pipeline crossing of SR-821 shown on Figure 15 will be performed in the following stages:

1. Install casing pipe using traditional cut-and-cover method of construction
2. Install water carrier pipe inside the casing

The two-stage installation (casing and carrier) is expected to shorten the duration of the required construction detour significantly. Casing pipe will be uncoated and unlined and can be installed during the night by using a single lane, alternating traffic diversion. The carrier pipe installation will be performed by welding and coating individual pipe lengths and then pulling them through the previously installed casing. The annular space between the casing and the carrier pipe will be filled with grout. For this memorandum, removal and replacement of approximately 80 linear feet of existing 30-foot-wide roadway with an 8-inch-thick base course and a 4-inch-thick concrete asphalt layer was used in the cost estimate. The cost estimate of construction detours consisted of approximately 200 linear feet of 15-foot-wide roadways with an 8-inch-thick base course and a 4-inch-thick concrete asphalt layer.

2.8 Outlet Structure

The discharge outlet structure and outlet chute concept was largely retained from the 2007 Appraisal Report. The outlet structure for the discharge pipeline consists of a concrete box with an overflow weir and transition to the outlet chute as shown on Figure 16. The overflow weir is set at El. 1750 to avoid providing isolation devices for pipeline maintenance when reservoir is full or surcharged (see Figure 17). The purpose of the overflow weir is to keep the discharge pipeline submerged and to uniformly direct flow into the outlet chute. The outlet structure will convey flow into the outlet chute for the full range of reservoir operating heads. Refer to Figure 17 for a plan view of the outlet structure.

Consistent with 2007 Appraisal Report, an approximately 1,800-foot-long discharge outlet chute is provided to channel the discharges from the outlet structure to the reservoir pool without causing damage from excessive erosion. The outlet chute is 12-feet wide with 6-foot-high walls with bottom slope of 12 percent for the first 1,030 feet and 33 percent for the last 750 feet. The outlet structure and chute were sized to carry a maximum flow of 580 cfs and will be flowing supercritical in the chute. Computed normal depths are provided on Figure 17. The riprap area at the end of the chute is provided for erosion protection during the initial filling of the reservoir. Initial filling of the reservoir can be achieved by low pumped flows and natural flows from Lmuma Creek. Once the initial reservoir pool is created, pumped flows can be increased to full design flow.

2.9 Power Delivery

2.9.1 Introduction

Tapping the existing Clymer-Moxee 115-kilovolt (kV) line to provide service for the proposed 30 megavolt ampere (MVA) Wymer pumping plant is proposed (Figure 18). The tap point would be about midway between Ellensburg and Roza. Investigation of pumping plan operation to maintain Western Electricity Coordinating Council (WECC) voltage and line loading criteria was performed with results presented below.

2.9.2 Transmission Assumptions

Study work was performed upon the 2017 HS1A-approved base case obtained from the Western Electricity Coordinating Council. The Power Technologies PSS/E rev 33 study software was used. The proposed pumping plant was modeled with seven synchronous pump motors assumed at a nominal rating of 3.3 MW each. A number of assumptions have been made for this report that will need to be clarified during feasibility design:

- BPA is likely to require a switching station to tap the Clymer-Moxee 115-kV line
- The proposed pumps are synchronous, and run with a power factor of at least 0.8
- The additional load represented in the change case was obtained from the swing bus. In actual operation, the power supplier would need to demonstrate adequate transmission for the pumping load

2.9.3 Switching Station and Pumping Plant Switchyard

Due to the size of the connected load, BPA will likely require a switching station at the tap point of Clymer-Moxee 115-kV line. Design of power equipment required to tap the line was not considered during previous studies.

No changes to the switchyard design at the pumping plant were made from the 2007 Appraisal Report (see Figure 13). Layout of the yard is based on two transformers (one “main” and one “spare”) with 115-kV bays. Each transformer has three cooling ratings - a lower rating to handle load from half of the plant in normal operation, a middle rating, and a higher rating to handle the full load of the plant if the other transformer is out of service.

Transformer size is based on a 30 MVA anticipated load for full pumping plant operation at a power factor of 0.8, which should be a worst case estimate. The 2007 Appraisal Report recommendation of a rating of 33.33 MVA for the third stage of cooling is reasonable. Similarly, under normal operations with about half of the station load on each transformer, the self-cooled rating of the transformers should be about 20 MVA.

2.9.4 Power Flow Study Results

HDR performed an appraisal-level analysis to see if the Bonneville Power Administration (BPA) Clymer – Moxee 115-kV line (bus numbers 42389-40755) can provide the necessary power to the facility. The BPA was not contacted for this analysis. The tap line would be approximately 6 miles long and the study results show sufficient capacity exists on the existing transmission lines to support the new pumping plant at full pumping load. The additional load does have an impact upon the transmission system in the region, but is within emergency ratings:

- The 230/115-kV transformer at Outlook, upon loss of the transformer at Wine Country: The existing first contingency overload in the base case of 103.9 percent is increased in the change case to 105.5 percent. This is an existing issue that BPA may have already addressed, and the 2 MVA increase may be within the operational parameters under which the transformer is currently operated.

- The Sunnyside-Wine Country 115-kV line overloads upon loss of the Midway-Union gap 230-kV line: The existing first contingency overload in the base case of 105.2 percent is increased in the change case to 106.3 percent. This is an existing issue that BPA may have already addressed, and the 1 MVA increase may be within the operational parameters under which the transmission line is currently operated.

3.0 Real Estate

The majority of the Wymer Dam and Reservoir major project features, including the main dam, saddle dike, outlet works, spillway, and improvements to Lmuma Creek, are located on privately owned land. The relocated intake, fish screen and bypass, pumping plant, and pipeline (from SR-821 to the pumping plant), a small portion of the high voltage electrical transmission line, and the substation and the associated access roads are located on property that is also privately owned. The high voltage electrical system interconnection and transmission line is located on land owned by the Washington Department of Fish and Wildlife and Washington Department of Natural Resources.

4.0 Environmental Considerations

The potential environmental impacts of the Wymer Dam and Reservoir project, including the intake facility, were evaluated in the 2009 Yakima River Basin Water Storage Feasibility Study Final Planning Report/Environmental Impact Statement (Storage Study PR/EIS) (Reclamation, 2009). The impacts associated with the location of the intake were primarily construction related and included clearing of vegetation, temporary increases in erosion, and temporary disturbance of wildlife in the area. Relocating the intake facility to an upstream location would not alter those potential impacts. Construction of the intake facility would require acquisition of private property.

5.0 Opinion of Probable Construction Cost

The appraisal-level cost estimate presented here was conducted with the purpose of assessing the costs associated with the relocation of major project features outlined in Section 2.0. To provide a useful baseline of comparison with the most recent March 2011 technical memorandum appraisal-level cost estimate mentioned in Section 1.0, anticipated project feature costs were estimated in (3rd quarter) 2010 dollars, similar to the March 2011 estimate. A summary of estimated project feature costs for the proposed project scheme with relocated features is presented in Section 5.1, alongside the corresponding estimated costs from the March 2011 technical memorandum estimate for comparison. The difference in estimated costs between the two project schemes is discussed in Section 5.2. Lastly, Section 5.3 provides an estimate of the anticipated project feature costs in 2013 dollars for the proposed Wymer project scheme with relocated project features.

5.1 Summary of Project Feature Costs in 2010 dollars

Table 5-1 below shows the estimated costs in 2010 dollars associated with the proposed project scheme, with relocation of project features, alongside the corresponding costs for the previous project scheme estimated in the March 2011 technical memorandum.

For major project features that were left unaltered in the proposed project scheme, project feature cost estimates were carried over unaltered from the previous March 2011 estimate, with the exception of switchyard and transmission line cost, which has been updated from the previous estimate. For major project features that have been altered or relocated, the revised estimated cost for each project feature along with a cost difference comparison with the previous project scheme feature estimates are shown.

Table 1. Cost Comparison of Major Project Features in 2010 dollars (3rd Quarter)

Project Feature	Proposed Project Scheme with Relocated Project Features Cost Estimate	March 2011 Technical Memorandum Project Scheme Cost Estimate	Cost Difference
Yakima River Intake	$17,910,00	$20,840,000	$(2,930,000)
Pumping Station	$62,100,000	$60,870,000	$1,230,000
Switchyard and Transmission Line	$8,430,000	$6,540,000	$1,890,000
Discharge Line	$25,160,000	$27,720,000	$(2,560,000)
Dam and Dike	$399,920,000	$399,920,000	$0
Spillway and Outlet Works	$63,580,000	$63,580,000	$0
Diversion during Construction	$4,770,000	$4,770,000	$0
Road and Creek Improvements	$9,140,000	$6,610,000	$2,530,000
Subtotal	$591,010,000	$590,850,000	$160,000

As shown in Table 5-1, the overall cost estimate of the proposed project scheme is approximately equal to the March 2011 technical memorandum. The reasons for the cost differences between the two estimates are discussed in Section 5.2. The more detailed cost estimate is provided in Appendix A.

5.2 Discussion of Cost Differences

5.2.1 Yakima River Intake

The revised and relocated Yakima River Intake scheme illustrated in Figure 7 is estimated to be approximately $2.9 million dollars less than the intake scheme estimated in the March 2011 technical memorandum and based on the 2007 Appraisal Report. The cost reduction is largely due to the elimination of the fish pump system and its associated civil, mechanical, and electrical works. The estimated cost reduction due to the elimination of the fish pumps exceeds the additional estimated costs associated with the extended length of both the fish bypass pipe and intake and fish screen structure for the relocated feature. See Appendix A for a more detailed view of the cost differences associated with revised and relocated Yakima River Intake scheme.

5.2.2 Pumping Station

The proposed pumping station relocation cost estimate is approximately $1.2 million more than the previous estimate. The additional expense is largely associated with the anticipated additional excavation into the hillside on the southeast corner of the service yard to bring the site down to finished grade of El.1307.0 (see Figure 4 and Figure 6). This estimate assumed the excavation would be into rock. Estimated costs of excavation can vary substantially depending on subsurface material present; thus, confirmation of site topography and the nature of the subsurface material are recommended to produce a more reliable estimate of anticipated excavation costs.

5.2.3 Switchyard and Transmission Line

As mentioned in Section 2.9.3, the switchyard and transmission line design is more extensive due to the added switching station at the connection to the BPA line. The current estimated cost is $1.9 million more than the cost estimated in March 2011. It should be noted that the costs for power equipment needed to tap the line was not included in previous estimates, as it should have been furnished by BPA. Formal communication with BPA should be initiated during the feasibility design to confirm interconnection equipment requirements.

5.2.4 Discharge Pipeline

The $2.6 million reduction of the estimated cost of the revised and relocated discharge pipeline is primarily due to the following:

- The reinforced concrete access conduit previously proposed to be constructed through Wymer Dam is no longer required with the revised proposed pipe alignment. The proposed relocated discharge pipe alignment now connects to the outlet structure near the southeast end of the saddle dike (Figure 4).
- There will be a reduction in anticipated earthwork associated with the relocation of the outlet chute. The existing topography of the previous outlet chute alignment location required significant cut and fill to obtain the desired design outlet chute slopes. The relocated outlet chute will largely follow the existing grade with reduced cut and fill volumes (see Figure 16). Confirmation of this assumption will require more detailed topography data along with a more detailed alignment analysis.

The reduced estimated costs associated with the eliminated concrete access conduit, and revised outlet chute location exceed the additional costs associated with the extended length of both the proposed discharge pipeline and concrete outlet chute (see Figure 14 and Figure 16 respectively and Appendix A for further cost details). Again, these estimated cost differences are based upon a confirmation of topography assumptions and a more detailed alignment analysis.

5.2.5 Road and Creek Improvements

The net additional cost anticipated for road and creek improvements is approximately $2.5 million for the proposed project scheme per Table 5-1. This additional cost is largely due to the construction of the proposed access roads from SR-821 to the pumping station and switchyard, and to the proposed outlet structure at the southeast end of the proposed saddle dike location, both of which are shown in Figure 4.

The cost assumes that the access road from the access house to the dike listed in the March 2011 technical memorandum cost estimate is not required. Other access roads not shown on the 2007 Appraisal Report figures but listed in the March 2011 Cost Estimate include an access road from SR-821 to the Wymer Dam outlet works, and an access road from SR-821 to other side of

Wymer Dam. These road costs were carried forward to the revised cost estimate although their proposed locations were not shown on the Wymer 2007 figures.

5.3 Project Cost in 2013 Dollars

Table 5-2 below shows the conversion of project feature cost estimates from 3rd quarter 2010 dollars to 4th quarter 2013 dollars along with the estimated total field cost for the project.

Table 2. Project Cost Estimate in 2013 Dollars

Description	Amount (2010 Dollars)	Index Factor	Amount (2013 Dollars)	Rate	Totals (2013 Dollars)
Yakima River Intake	$ 17,910,000	1.092	$ 19,550,000		
Pumping Station	$ 62,100,000	1.092	$ 67,810,000		
Switchyard and Transmission Line	$ 8,430,000	1.085	$ 9,150,000		
Discharge Line	$ 25,160,000	1.078	$ 27,140,000		
Dam and Dike	$ 399,920,000	1.116	$446,290,000		
Spillway and Outlet Works	$ 63,580,000	1.097	$ 69,770,000		
Diversion during Construction	$ 4,770,000	1.093	$ 5,210,000		
Road and Creek Improvements	$ 9,140,000	1.122	$ 10,260,000		
Subtotal					$655,180,000
Contractors Fee			$ 39,310,000	6%	
Contractor's Bonds and Insurance			$ 9,830,000	1.5%	
Subtotal					$704,320,000
Mobilization			$ 21,130,000	3%	
Subtotal w/ Mobilization					$725,450,000
Unlisted Items Minor			$ 29,020,000	4%	
Design and Scope Changes Minor			$ 29,020,000	4%	
Cost Estimate Refinements			$ 14,510,000	2%	
Procurement Strategy Open Competition			$0	0%	
Contract Cost					$798,000,000
Contingencies			$199,500,000	25%	
Field Cost					$997,500,000

The index factors used for the conversion are based on the Reclamation construction cost trends indices. Percentage rates for mobilization, unlisted items, minor design and scope changes, cost estimate refinements, and contingencies are based on the rates used in the March 2011 technical memorandum.

6.0 Recommendations for Feasibility Design

The following recommendations are made regarding subsequent analysis and feasibility design of the Wymer Dam relocated reservoir pumping plant features:

- Conduct a site specific bathymetric survey of the river in the vicinity of the proposed intake.
- Conduct a site specific survey of the point bar on which the intake, fish screen and bypass, pumping plant, and lower segment of the pipeline are to be located.
- Perform a geomorphological study of the movement and deposition of sediment, both upstream and downstream in the vicinity of the intake, for use in design of sediment exclusion and passage.
- Perform hydrologic and hydraulic analyses to determine the range of normal flows, flood flows, and the design flood flow for use in developing operating criteria, a headworks operating deck elevation, and the design of flood protection measures.
- Revisit and refine the alignment of the access road after better survey data and geotechnical input on cut/fill slopes have been obtained.
- Determine box culvert dimensions of the access road crossing of McPherson Canyon creek and dimensions of other culverts based on the drainage area and rainfall intensity.
- Initiate formal communication with BPA to confirm power equipment requirements to tap the line.
- Confirm the required pumping station hydraulic capacity and operating parameters.
- Determine the number and preferred arrangement (vertical vs. horizontal shaft) of the pumps.
- Install the river level gauge to confirm river stage vs. flow relationship at the proposed intake location.
- Complete a pump station/pipeline hydraulic transient analysis to confirm the required air chamber size.
- Determine Reclamation's experience with construction and operation of the Durango pumping plant (model for the proposed Wymer pumping plant) and use this experience to improve the design of the proposed Wymer pumping plant. The Durango pumping plant went online in 2009.
- Confirm pipeline diameter.
- Perform geotechnical investigations to determine cut/fill slopes along the pipeline alignment.
- Investigate options for the surface pipeline after leaving the pumping station.

7.0 Pump Storage Consideration

7.1 Assessment of Power Generation Capabilities

Reclamation's 2007 Appraisal Report provides an assessment of the potential for generating power when releasing from the reservoir. In Reclamation's 2007 Appraisal Report, "it was determined that reservoir operations to meet the primary objectives do not permit operation of Wymer Dam and Reservoir as an efficient pump storage facility to justify the costs of installing and operating power facilities at this site."

8.0 References

Reclamation 2007	Yakima River Basin Storage Study Wymer Dam and Reservoir Appraisal Report, Technical Series No. TS-YSS-16, U.S. Department of Interior, Bureau of Reclamation, September 2007.
Reclamation 2008	Yakima River Basin Water Storage Feasibility Study Final Planning Report and Environmental Impact Statement. December 19, 2008.
Reclamation 2011	Yakima River Basin Study - Wymer Dam and Reservoir Summary, Technical Memorandum Task 4.7, U.S. Department of Interior, Bureau of Reclamation, March 2011.

9.0 List of Preparers

NAME	BACKGROUND	RESPONSIBILITY
HDR ENGINEERING, INC.		
Bob King	Engineering	Task Lead
Edward Weber	Engineering	Electrical Design
Val Kovalishyn	Engineering	Mechanical Design
Jordan Stewart	Engineering	Civil Design, Cost Estimation
Jim Peterson	Engineering	QC Reviewer
Richard Glassen	Cost Estimating	Cost Estimating QC Reviewer
ESA		
Ann Root	Planning	Environmental and Permitting Lead

(This page intentionally left blank)

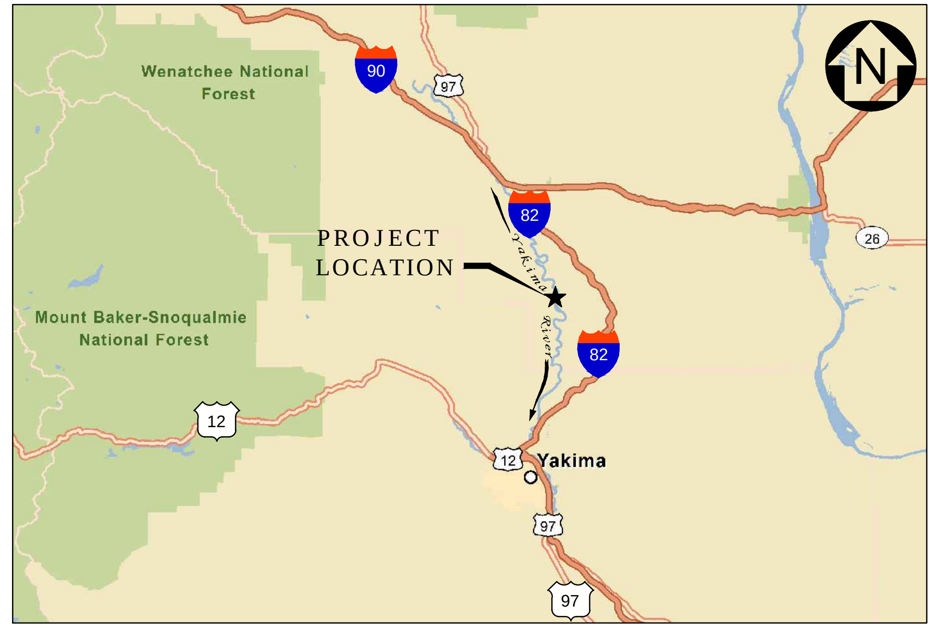
Figures

(This Page Intentionally Left Blank)

RECLAMATION
Managing Water in the West

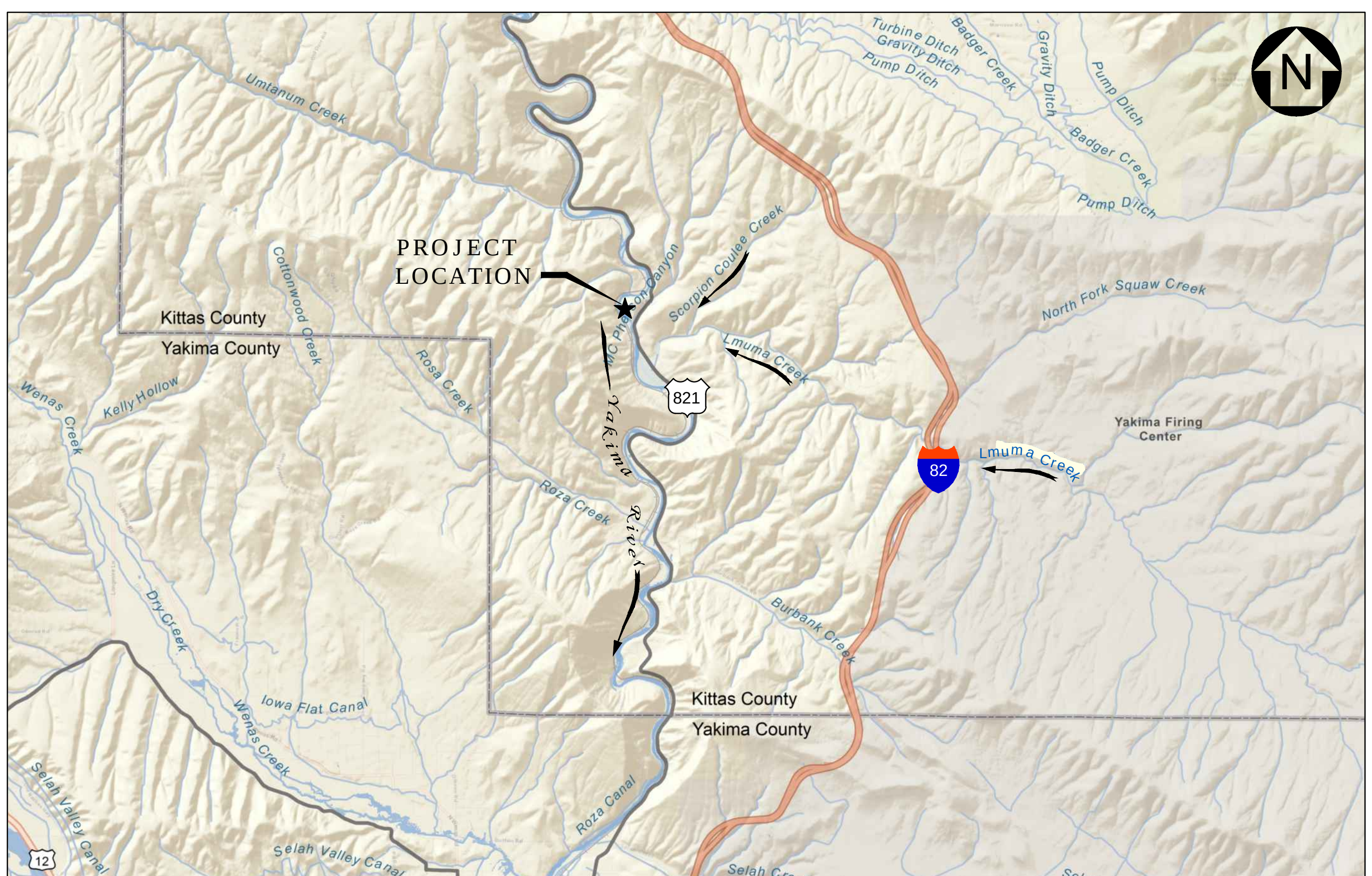
HDR

WASHINGTON STATE
SCALE: NO SCALE



VICINITY MAP
SCALE: NO SCALE

INDEX OF FIGURES



LOCATION MAP
SCALE: NO SCALE

Bureau of Reclamation

Yakima River Basin Study
Wymer Reservoir
Pumping Plant Update

HDR Project No: 203638

THE SOURCE FILES FOR THE MAJORITY OF THE DRAWINGS CONTAINED IN THIS DRAWING SET ARE FROM EITHER: 1) RECLAMATION'S ORIGINAL STUDY OF THE WYMER DAM AND RESERVOIR PROJECT (1985), OR 2) RECLAMATION'S SUBSEQUENT YAKIMA RIVER BASIN STORAGE STUDY, WYMER DAM AND RESERVOIR, APPRAISAL REPORT (SEPTEMBER 2007). FOR THIS PRESENT STUDY, HDR REQUESTED, AND RECLAMATION GRACIOUSLY SUPPLIED, THE SOURCE FILES FOR THE ORIGINAL DRAWINGS FOR HDR'S USE IN THE PRESENT STUDY AND TECHNICAL MEMORANDUM. HDR GRATEFULLY ACKNOWLEDGES THE PRIOR WORK AS HAVING BEEN PREPARED BY RECLAMATION AND SUBSEQUENTLY PROVIDED TO HDR.

PRELIMINARY CONCEPT DRAWING
ELEVATIONS AND DIMENSIONS ARE APPROXIMATE

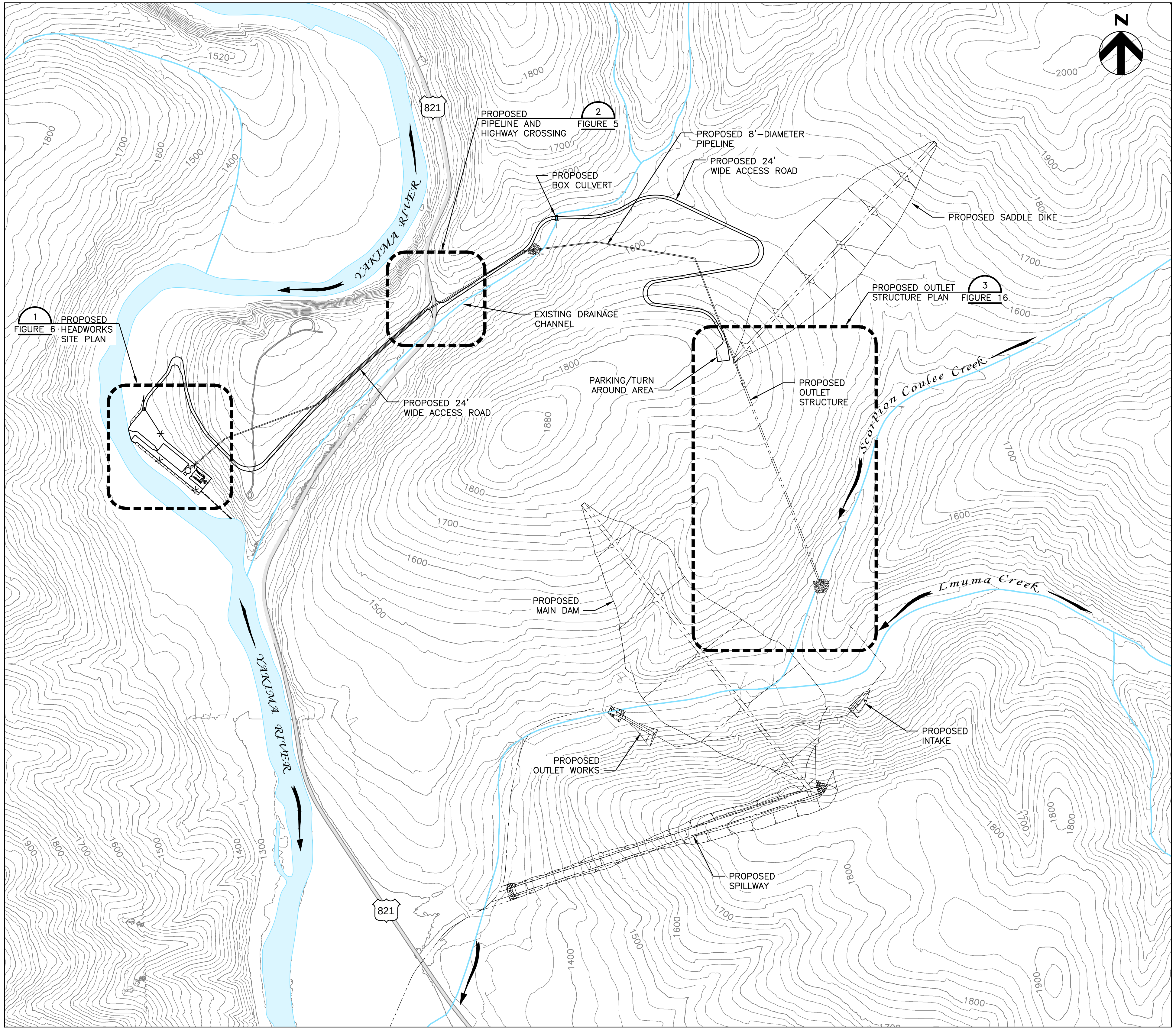
ALWAYS THINK SAFETY

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
YAKIMA RIVER BASIN STUDY
WYMER RESERVOIR PUMPING PLANT UPDATE
COVER PAGE, FIGURE INDEX,
RELOCATION AND LOCATION MAPS

DESIGNED V. KOVALISHYN
DRAWN R. CARPENTER
CHECKED J. PETERSON
TECH. APPR. R. KING
NAME – TITLE
APPROVED A. GRAHAM
ADMINISTRATIVE APPROVAL – NAME – TITLE

FIGURE 1
SHEET 1 OF 18

HDR C:\pwworking\sea\d1040839\F-01.dwg PRINTED: 3/18/2014 6:46:11 AM BY: pwilhelm



OVERALL SITE PLAN

0 250 500 1000
SCALE IN FEET

NOTE:

1. SOURCE OF CONTOURS IS "WYMER DAM AND RESERVOIR APPRAISAL REPORT (TS-YSS-16)" AND IS APPROXIMATE ONLY. A DETAILED SURVEY WILL BE NECESSARY TO MORE ACCURATELY CHARACTERIZE THE TOPOGRAPHY.

THE SOURCE FILES FOR THE MAJORITY OF THE DRAWINGS CONTAINED IN THIS DRAWING SET ARE FROM EITHER: 1) RECLAMATION'S ORIGINAL STUDY OF THE WYMER DAM AND RESERVOIR PROJECT (1985), OR 2) RECLAMATION'S SUBSEQUENT YAKIMA RIVER BASIN STORAGE STUDY, WYMER DAM AND RESERVOIR, APPRAISAL REPORT (SEPTEMBER 2007). FOR THIS PRESENT STUDY, HDR REQUESTED, AND RECLAMATION GRACIOUSLY SUPPLIED, THE SOURCE FILES FOR THE ORIGINAL DRAWINGS FOR HDR'S USE IN THE PRESENT STUDY AND TECHNICAL MEMORANDUM. HDR GRATEFULLY ACKNOWLEDGES THE PRIOR WORK AS HAVING BEEN PREPARED BY RECLAMATION AND SUBSEQUENTLY PROVIDED TO HDR.

PRELIMINARY CONCEPT DRAWING
ELEVATIONS AND DIMENSIONS ARE APPROXIMATE

RECLAMATION
Managing Water in the West

HDR

ALWAYS THINK SAFETY

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
YAKIMA RIVER BASIN STUDY
WYMER RESERVOIR PUMPING PLANT UPDATE
OVERALL SITE PLAN

DESIGNED V. KOVALISHYN
DRAWN R. CARPENTER
CHECKED J. PETERSON
TECH. APPR. R. KING
NAME - TITLE
APPROVED A. GRAHAM
ADMINISTRATIVE APPROVAL - NAME - TITLE

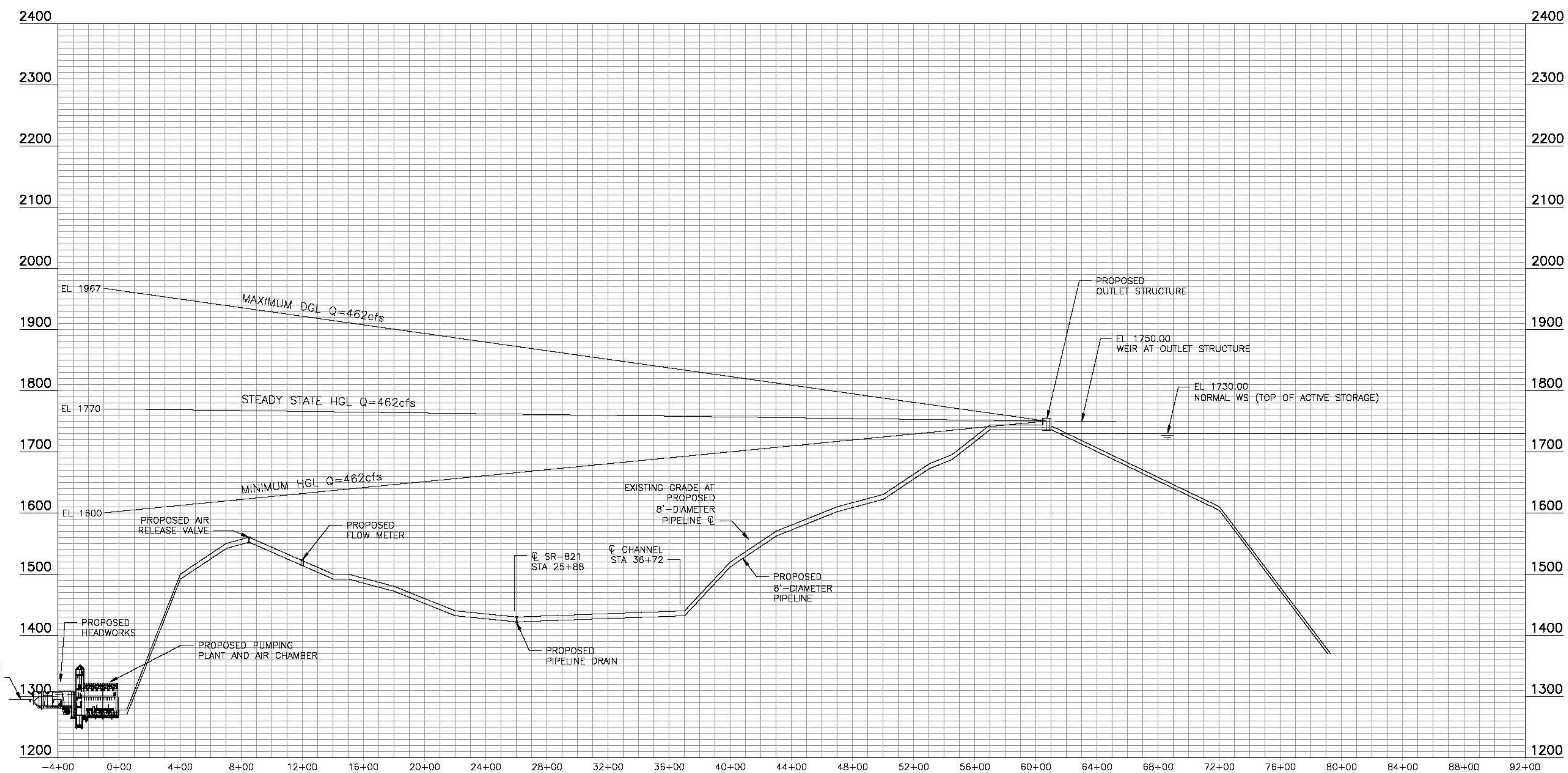
FIGURE 2
SHEET 2 OF 18

HDR C:\pwworking\sea\d1040839\F-02.dwg PRINTED: 3/18/2014 12:36:57 PM BY: pwilhelm

NOTE:

1. SOURCE OF CONTOURS IS "WYMER DAM AND RESERVOIR APPRAISAL REPORT (TS-YSS-16)" AND IS APPROXIMATE ONLY. A DETAILED SURVEY WILL BE NECESSARY TO MORE ACCURATELY CHARACTERIZE THE TOPOGRAPHY.
2. SOURCE OF HYDRAULIC/TRANSIENT DATA IS FIGURE 24 OF "WYMER DAM AND RESERVOIR APPRAISAL REPORT (TS-YSS-1Q)". HGL AND DGL ADJUSTED FOR INCREASED OUTLET STRUCTURE ELEVATION

THE SOURCE FILES FOR THE MAJORITY OF THE DRAWINGS CONTAINED IN THIS DRAWING SET ARE FROM EITHER: 1) RECLAMATION'S ORIGINAL STUDY OF THE WYMER DAM AND RESERVOIR PROJECT (1985), OR 2) RECLAMATION'S SUBSEQUENT YAKIMA RIVER BASIN STORAGE STUDY, WYMER DAM AND RESERVOIR, APPRAISAL REPORT (SEPTEMBER 2007). FOR THIS PRESENT STUDY, HDR REQUESTED, AND RECLAMATION GRACIOUSLY SUPPLIED, THE SOURCE FILES FOR THE ORIGINAL DRAWINGS FOR HDR'S USE IN THE PRESENT STUDY AND TECHNICAL MEMORANDUM. HDR GRATEFULLY ACKNOWLEDGES THE PRIOR WORK AS HAVING BEEN PREPARED BY RECLAMATION AND SUBSEQUENTLY PROVIDED TO HDR.



HYDRAULIC PROFILE

SCALE: HORIZ 1"=400'
VERT 1"=100'

PRELIMINARY CONCEPT DRAWING
ELEVATIONS AND DIMENSIONS ARE APPROXIMATE

RECLAMATION
Managing Water in the West

HDR

ALWAYS THINK SAFETY

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
YAKIMA RIVER BASIN STUDY
WYMER RESERVOIR PUMPING PLANT UPDATE
HYDRAULIC PROFILE

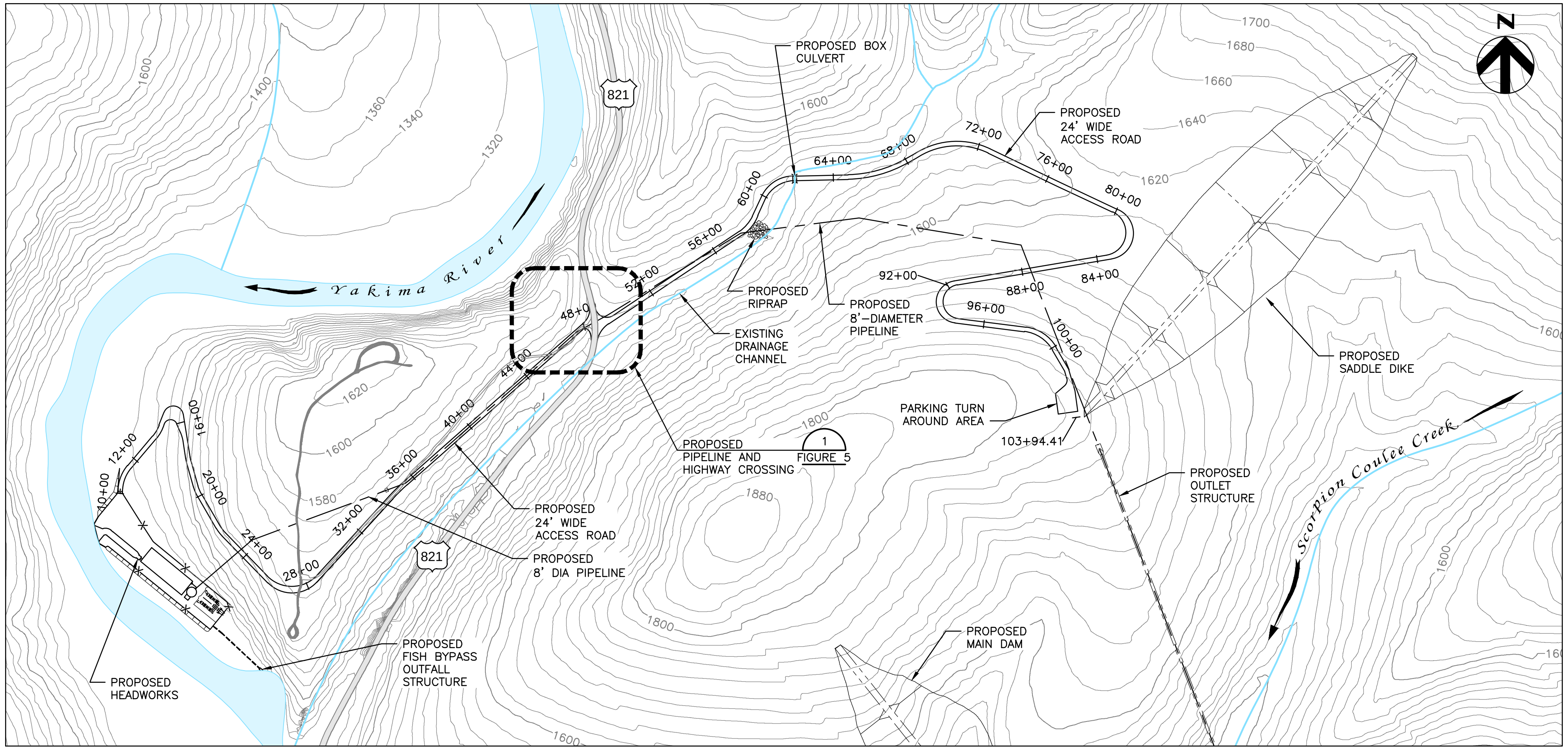
DESIGNED V. KOVALYSHYN
DRAWN R. CARPENTER
CHECKED J. PETERSON
TECH. APPR. R. KING (NAME - TITLE)
APPROVED A. GRAHAM (ADMINISTRATIVE APPROVAL - NAME - TITLE)

FIGURE 3
SHEET 3 OF 18

HDR C:\pwworking\sea\d1040839\F-03-update.dwg PRINTED: 3/18/2014 6:42:36 AM BY: pwilhelm

NOTE:

1. SOURCE OF CONTOURS IS "WYMER DAM AND RESERVOIR APPRAISAL REPORT (TS-YSS-16)"AND IS APPROXIMATE ONLY. A DETAILED SURVEY WILL BE NECESSARY TO MORE ACCURATELY CHARACTERIZE THE TOPOGRAPHY.

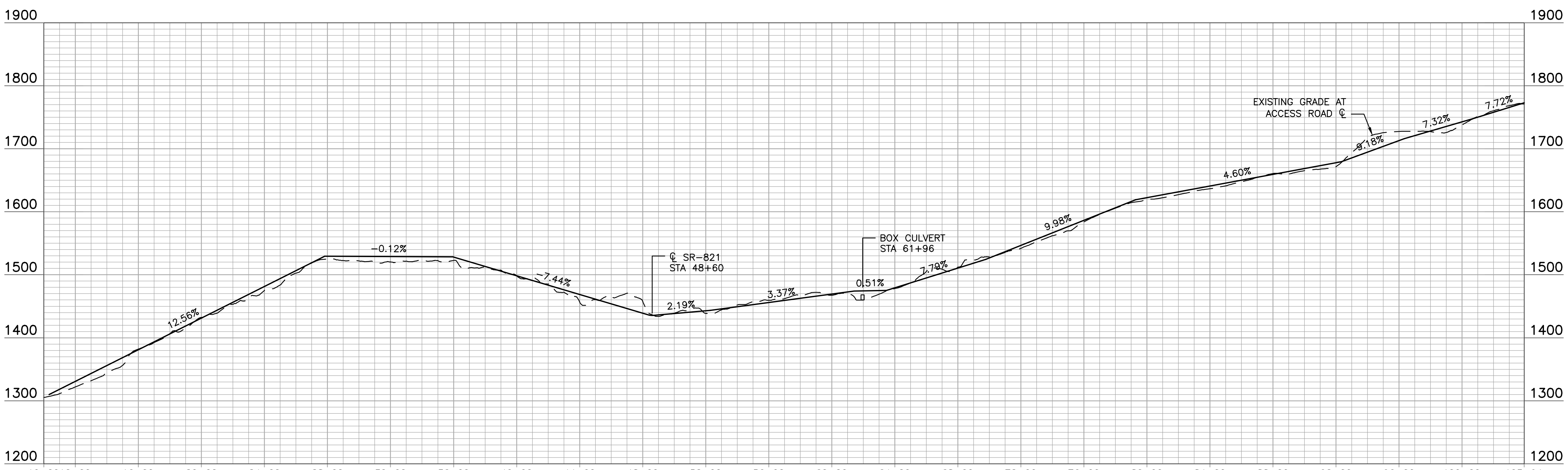


PLAN

0 200 400 800

SCALE IN FEET

THE SOURCE FILES FOR THE MAJORITY OF THE DRAWINGS CONTAINED IN THIS DRAWING SET ARE FROM EITHER: 1) RECLAMATION'S ORIGINAL STUDY OF THE WYMER DAM AND RESERVOIR PROJECT (1985), OR 2) RECLAMATION'S SUBSEQUENT YAKIMA RIVER BASIN STORAGE STUDY, WYMER DAM AND RESERVOIR, APPRAISAL REPORT (SEPTEMBER 2007). FOR THIS PRESENT STUDY, HDR REQUESTED, AND RECLAMATION GRACIOUSLY SUPPLIED, THE SOURCE FILES FOR THE ORIGINAL DRAWINGS FOR HDR'S USE IN THE PRESENT STUDY AND TECHNICAL MEMORANDUM. HDR GRATEFULLY ACKNOWLEDGES THE PRIOR WORK AS HAVING BEEN PREPARED BY RECLAMATION AND SUBSEQUENTLY PROVIDED TO HDR.



PROFILE

SCALE: HORIZ 1"=400'
VERT 1"=100'

PRELIMINARY CONCEPT DRAWING

ELEVATIONS AND DIMENSIONS ARE APPROXIMATE

RECLAMATION
Managing Water in the West

HDR

ALWAYS THINK SAFETY

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
YAKIMA RIVER BASIN STUDY
WYMER RESERVOIR PUMPING PLANT UPDATE
ACCESS ROAD PLAN AND PROFILE

DESIGNED V. KOVALISHYN
DRAWN R. CARPENTER
CHECKED J. PETERSON
TECH. APPR. R. KING
NAME - TITLE
APPROVED A. GRAHAM
ADMINISTRATIVE APPROVAL - NAME - TITLE

FIGURE 4

SHEET 4 OF 18

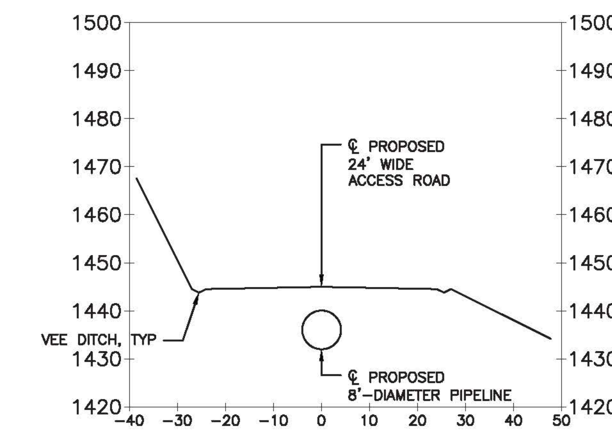
HDR C:\pwworking\sea\d1040839\F-04-update.dwg PRINTED: 3/18/2014 12:39:05 PM BY: pwilhelm

PLAN

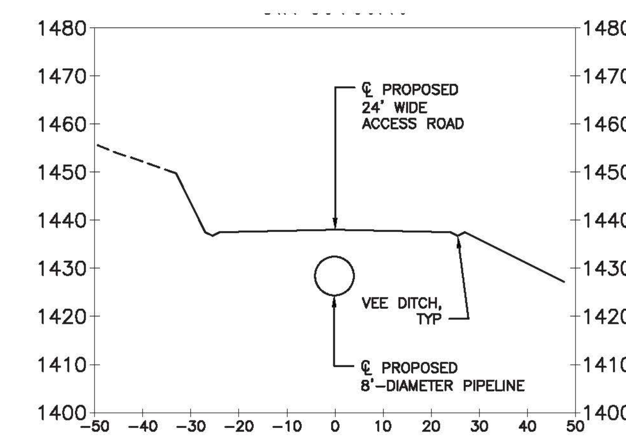
0 10 20 40
SCALE IN FEET

NOTE:

1. SOURCE OF CONTOURS IS "WYMER DAM AND RESERVOIR APPRAISAL REPORT (TS-YSS-16)" AND IS APPROXIMATE ONLY. A DETAILED SURVEY WILL BE NECESSARY TO MORE ACCURATELY CHARACTERIZE THE TOPOGRAPHY.



SECTION A
SCALE: 1/4" = 1'-0"



SECTION B
SCALE: 1/4" = 1'-0"

THE SOURCE FILES FOR THE MAJORITY OF THE DRAWINGS CONTAINED IN THIS DRAWING SET ARE FROM EITHER: 1) RECLAMATION'S ORIGINAL STUDY OF THE WYMER DAM AND RESERVOIR PROJECT (1985), OR 2) RECLAMATION'S SUBSEQUENT YAKIMA RIVER BASIN STORAGE STUDY, WYMER DAM AND RESERVOIR, APPRAISAL REPORT (SEPTEMBER 2007). FOR THIS PRESENT STUDY, HDR REQUESTED, AND RECLAMATION GRACIOUSLY SUPPLIED, THE SOURCE FILES FOR THE ORIGINAL DRAWINGS FOR HDR'S USE IN THE PRESENT STUDY AND TECHNICAL MEMORANDUM. HDR GRATEFULLY ACKNOWLEDGES THE PRIOR WORK AS HAVING BEEN PREPARED BY RECLAMATION AND SUBSEQUENTLY PROVIDED TO HDR.

PRELIMINARY CONCEPT DRAWING
ELEVATIONS AND DIMENSIONS ARE APPROXIMATE

RECLAMATION
Managing Water in the West

HDR

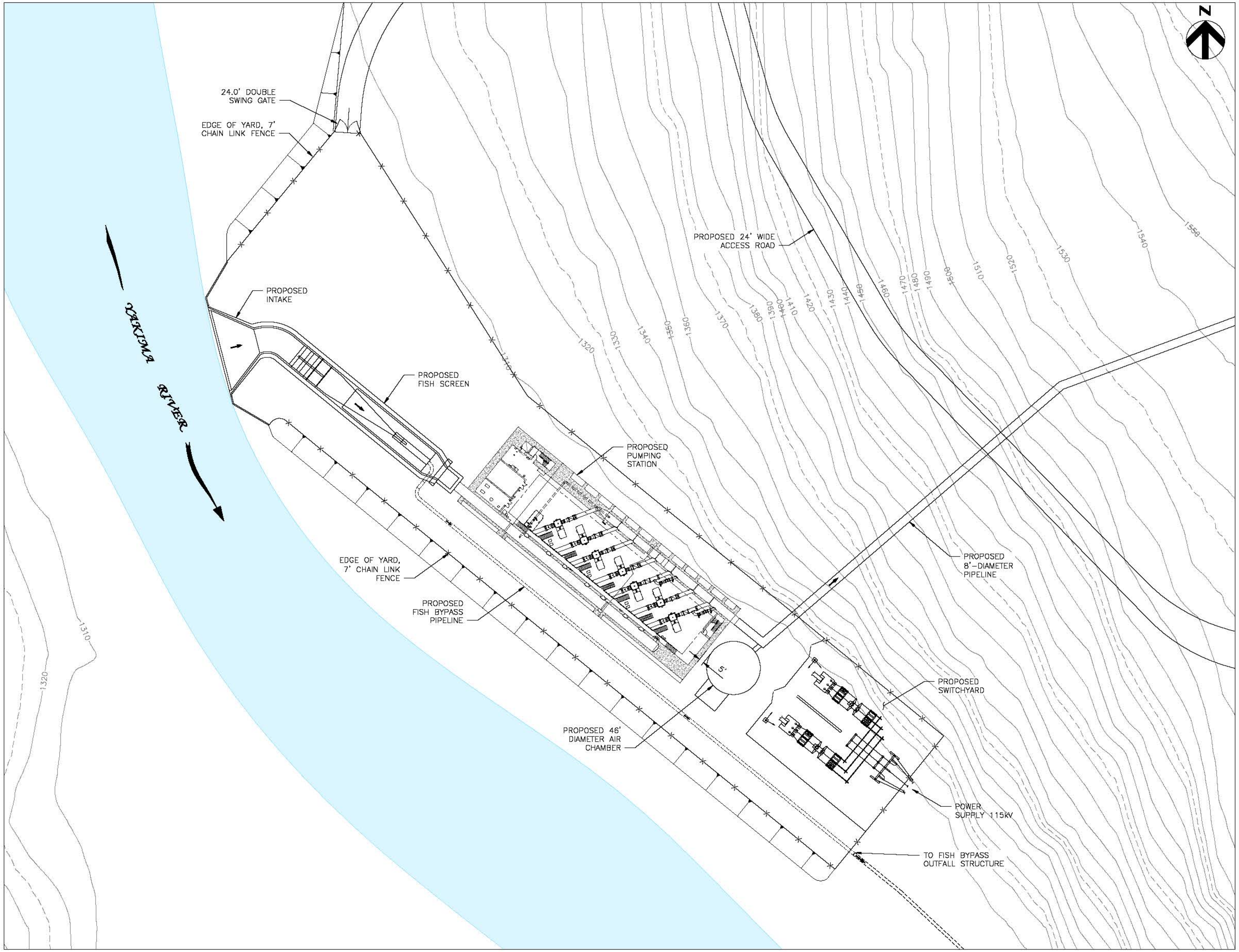
ALWAYS THINK SAFETY

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
YAKIMA RIVER BASIN STUDY
WYMER RESERVOIR PUMPING PLANT UPDATE
HIGHWAY ACCESS PLAN

DESIGNED V. KOVALISHYN
DRAWN R. CARPENTER
CHECKED J. PETERSON
TECH. APPR. R. KING (NAME - TITLE)
APPROVED A. GRAHAM (ADMINISTRATIVE APPROVAL - NAME - TITLE)

FIGURE 5
SHEET 5 OF 18

HDR C:\pwworking\sea\d1040839\F-05-update.dwg PRINTED: 3/18/2014 12:42:07 PM BY: pwilhelm



HEADWORKS SITE PLAN

0 25 50 100
SCALE IN FEET

NOTE:

1. SOURCE OF CONTOURS IS "WYMER DAM AND RESERVOIR APPRAISAL REPORT (TS-YSS-16)" AND IS APPROXIMATE ONLY. A DETAILED SURVEY WILL BE NECESSARY TO MORE ACCURATELY CHARACTERIZE THE TOPOGRAPHY.

THE SOURCE FILES FOR THE MAJORITY OF THE DRAWINGS CONTAINED IN THIS DRAWING SET ARE FROM EITHER: 1) RECLAMATION'S ORIGINAL STUDY OF THE WYMER DAM AND RESERVOIR PROJECT (1985), OR 2) RECLAMATION'S SUBSEQUENT YAKIMA RIVER BASIN STORAGE STUDY, WYMER DAM AND RESERVOIR, APPRAISAL REPORT (SEPTEMBER 2007). FOR THIS PRESENT STUDY, HDR REQUESTED, AND RECLAMATION GRACIOUSLY SUPPLIED, THE SOURCE FILES FOR THE ORIGINAL DRAWINGS FOR HDR'S USE IN THE PRESENT STUDY AND TECHNICAL MEMORANDUM. HDR GRATEFULLY ACKNOWLEDGES THE PRIOR WORK AS HAVING BEEN PREPARED BY RECLAMATION AND SUBSEQUENTLY PROVIDED TO HDR.

PRELIMINARY CONCEPT DRAWING
ELEVATIONS AND DIMENSIONS ARE APPROXIMATE

RECLAMATION
Managing Water in the West

HDR

ALWAYS THINK SAFETY

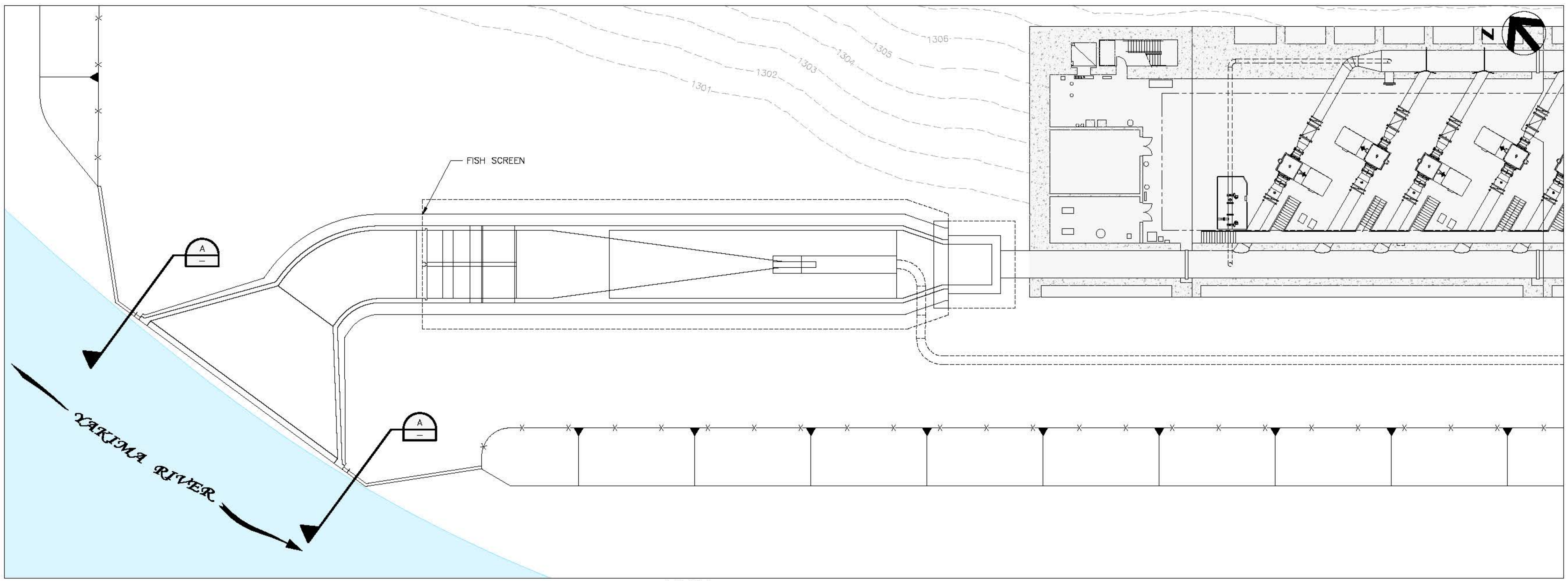
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
YAKIMA RIVER BASIN STUDY
WYMER RESERVOIR PUMPING PLANT UPDATE
HEADWORKS SITE PLAN

DESIGNED V. KOVALISHYN
DRAWN R. CARPENTER
CHECKED J. PETERSON
TECH. APPR. R. KING
NAME – TITLE
APPROVED A. GRAHAM
ADMINISTRATIVE APPROVAL – NAME – TITLE

FIGURE 6

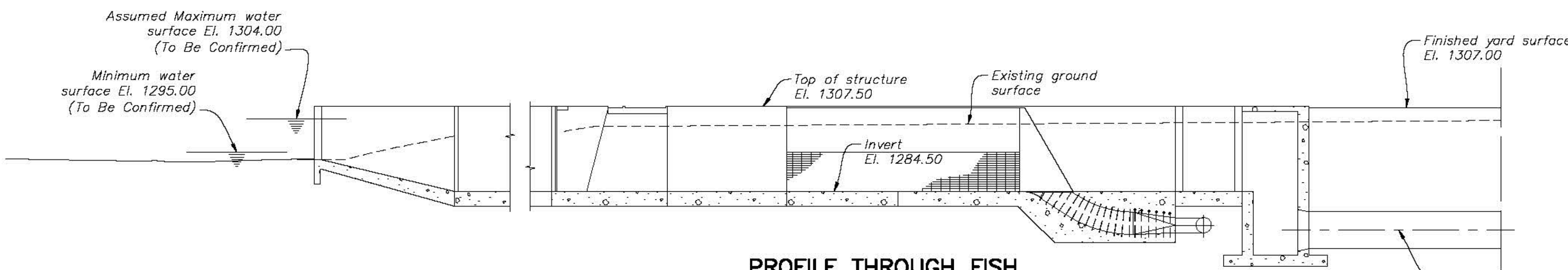
SHEET 6 OF 18

HDR C:\pwworking\sea\d1040839\F-06-update.dwg PRINTED: 3/18/2014 12:43:54 PM BY: pwilhelm



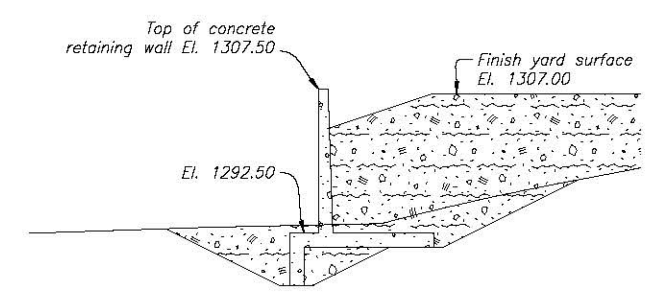
PLAN

0 10 20 40
SCALE IN FEET



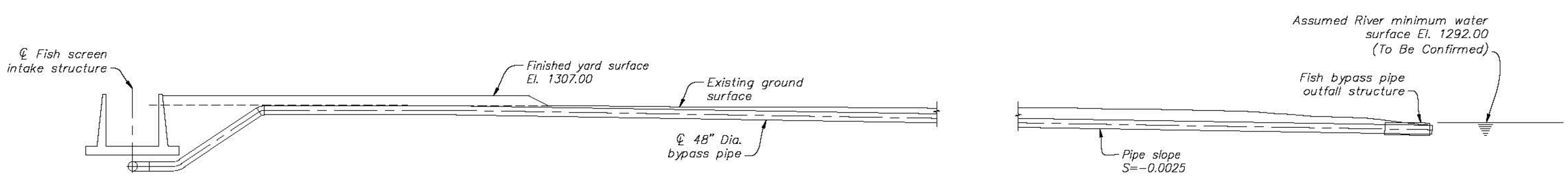
PROFILE THROUGH FISH SCREEN INTAKE STRUCTURE 1

SCALE: 1"=20'



SECTION A

SCALE: 1"=30'



PROFILE ALONG FISH BYPASS SYSTEM 2

SCALE: 1"=30'

THE SOURCE FILES FOR THE MAJORITY OF THE DRAWINGS CONTAINED IN THIS DRAWING SET ARE FROM EITHER: 1) RECLAMATION'S ORIGINAL STUDY OF THE WYMER DAM AND RESERVOIR PROJECT (1985), OR 2) RECLAMATION'S SUBSEQUENT YAKIMA RIVER BASIN STORAGE STUDY, WYMER DAM AND RESERVOIR, APPRAISAL REPORT (SEPTEMBER 2007). FOR THIS PRESENT STUDY, HDR REQUESTED, AND RECLAMATION GRACIOUSLY SUPPLIED, THE SOURCE FILES FOR THE ORIGINAL DRAWINGS FOR HDR'S USE IN THE PRESENT STUDY AND TECHNICAL MEMORANDUM. HDR GRATEFULLY ACKNOWLEDGES THE PRIOR WORK AS HAVING BEEN PREPARED BY RECLAMATION AND SUBSEQUENTLY PROVIDED TO HDR.

PRELIMINARY CONCEPT DRAWING
ELEVATIONS AND DIMENSIONS ARE APPROXIMATE

RECLAMATION
Managing Water in the West

HDR

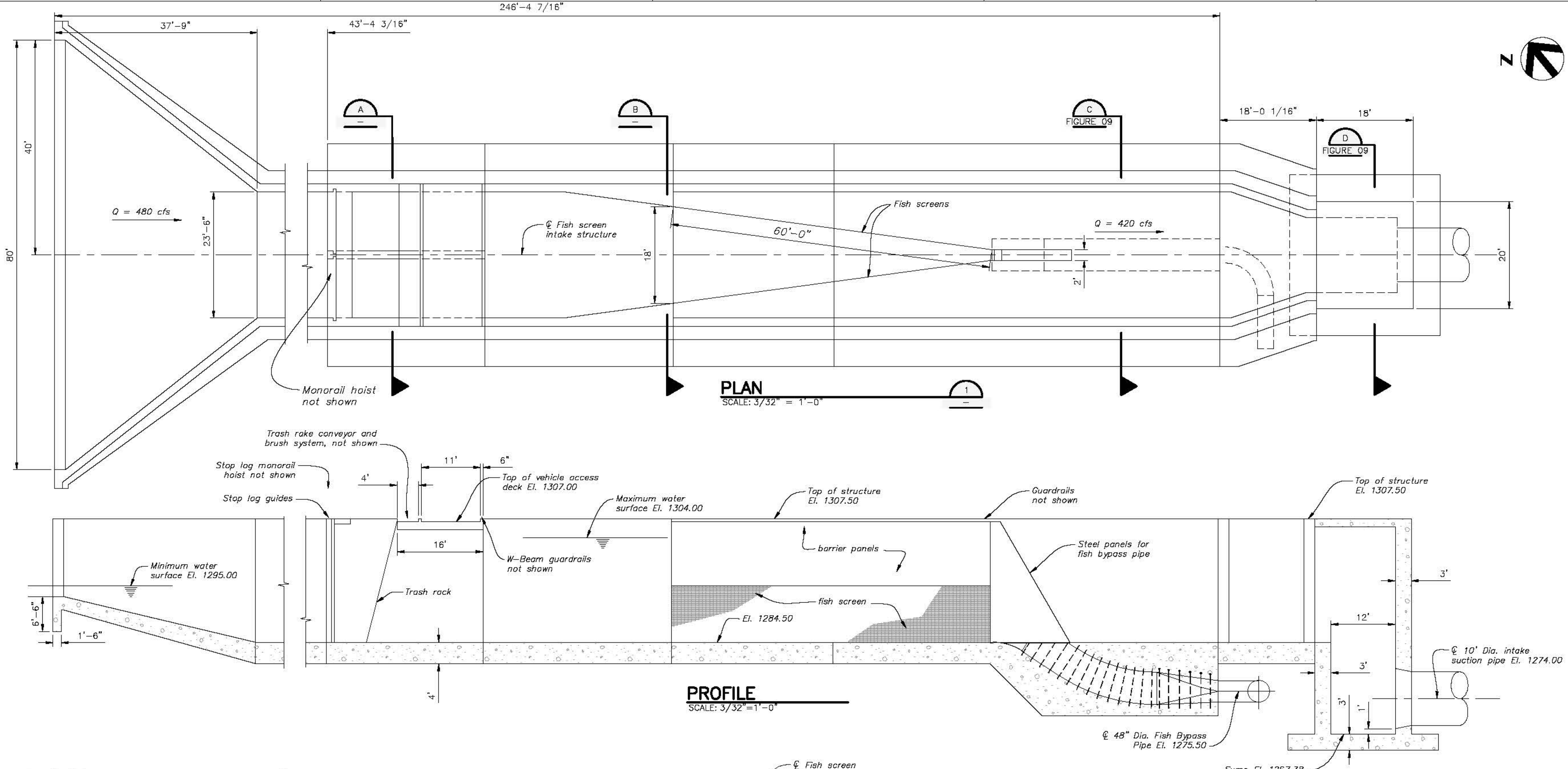
ALWAYS THINK SAFETY

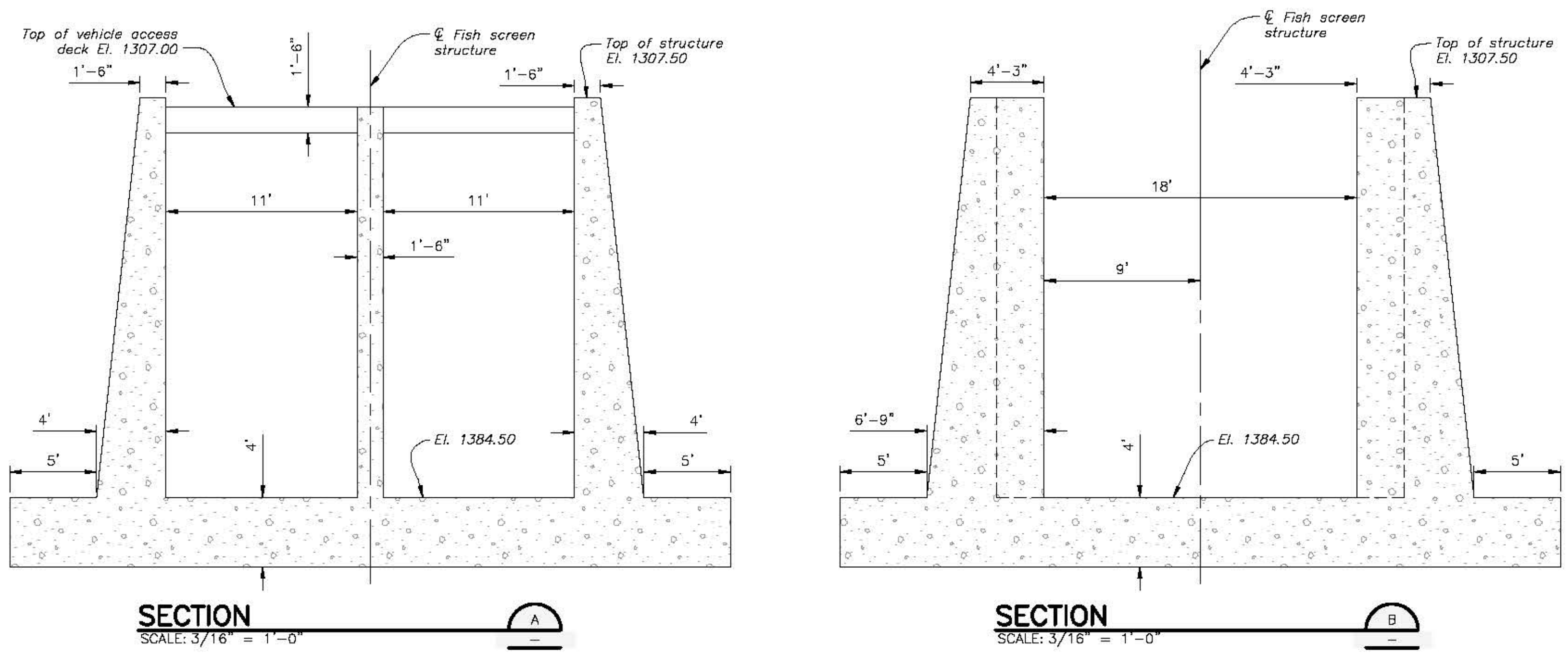
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
YAKIMA RIVER BASIN STUDY
WYMER RESERVOIR PUMPING PLANT UPDATE
INTAKE AND FISH SCREEN
SITE PLAN AND PROFILES

DESIGNED V. KOVALISHYN
DRAWN R. CARPENTER
CHECKED J. PETERSON
TECH. APPR. R. KING (NAME - TITLE)
APPROVED A. GRAHAM (ADMINISTRATIVE APPROVAL - NAME - TITLE)

FIGURE 7
SHEET 7 OF 18

HDR C:\pwworking\sea\d1040839\F-07-update.dwg PRINTED: 3/18/2014 12:45:53 PM BY: pwilhelm





THE SOURCE FILES FOR THE MAJORITY OF THE DRAWINGS CONTAINED IN THIS DRAWING SET ARE FROM EITHER: 1) RECLAMATION'S ORIGINAL STUDY OF THE WYMER DAM AND RESERVOIR PROJECT (1985), OR 2) RECLAMATION'S SUBSEQUENT YAKIMA RIVER BASIN STORAGE STUDY, WYMER DAM AND RESERVOIR, APPRAISAL REPORT (SEPTEMBER 2007). FOR THIS PRESENT STUDY, HDR REQUESTED, AND RECLAMATION GRACIOUSLY SUPPLIED, THE SOURCE FILES FOR THE ORIGINAL DRAWINGS FOR HDR'S USE IN THE PRESENT STUDY AND TECHNICAL MEMORANDUM. HDR GRATEFULLY ACKNOWLEDGES THE PRIOR WORK AS HAVING BEEN PREPARED BY RECLAMATION AND SUBSEQUENTLY PROVIDED TO HDR.

PRELIMINARY CONCEPT DRAWING
ELEVATIONS AND DIMENSIONS ARE APPROXIMATE

RECLAMATION
Managing Water in the West

HDR

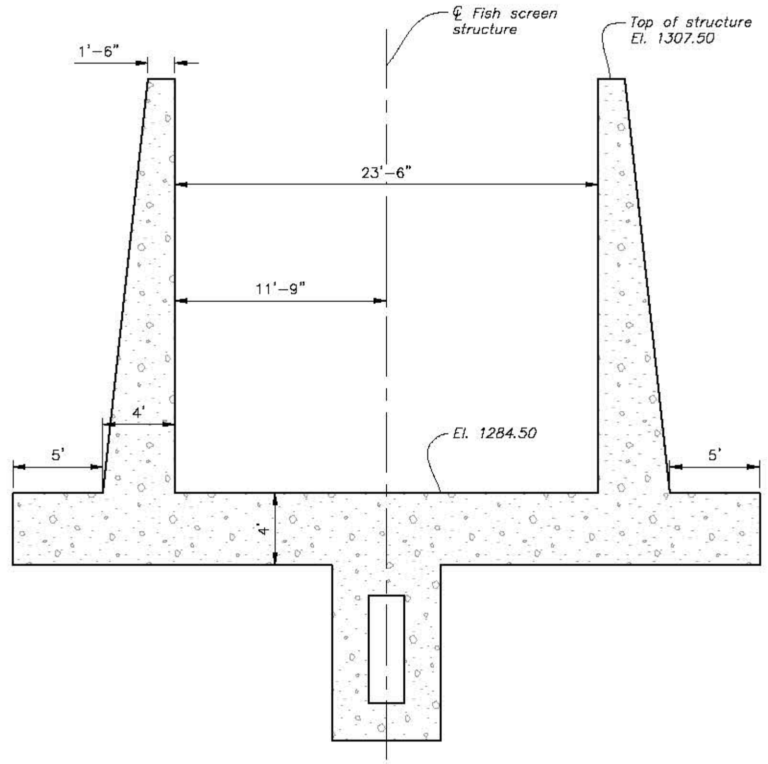
ALWAYS THINK SAFETY

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
YAKIMA RIVER BASIN STUDY
WYMER RESERVOIR PUMPING PLANT UPDATE
INTAKE AND FISH SCREEN
PLAN, PROFILE AND SECTIONS

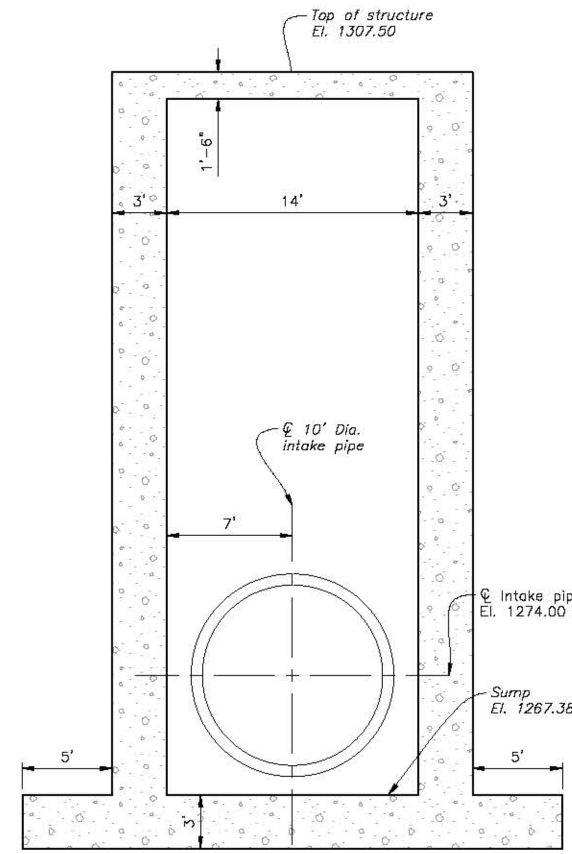
DESIGNED V. KOVALISHYN
DRAWN R. CARPENTER
CHECKED J. PETERSON
TECH. APPR. R. KING NAME – TITLE
APPROVED A. GRAHAM ADMINISTRATIVE APPROVAL – NAME – TITLE

FIGURE 8
SHEET 8 OF 18

HDR C:\pwworking\sea\d1040839\F-08-update.dwg PRINTED: 3/18/2014 7:13:44 AM BY: pwilhelm



SECTION C / FIGURE 8
SCALE: 3/16"=1'-0"



SECTION D / FIGURE 8
SCALE: 3/16"=1'-0"

THE SOURCE FILES FOR THE MAJORITY OF THE DRAWINGS CONTAINED IN THIS DRAWING SET ARE FROM EITHER: 1) RECLAMATION'S ORIGINAL STUDY OF THE WYMER DAM AND RESERVOIR PROJECT (1985), OR 2) RECLAMATION'S SUBSEQUENT YAKIMA RIVER BASIN STORAGE STUDY, WYMER DAM AND RESERVOIR, APPRAISAL REPORT (SEPTEMBER 2007). FOR THIS PRESENT STUDY, HDR REQUESTED, AND RECLAMATION GRACIOUSLY SUPPLIED, THE SOURCE FILES FOR THE ORIGINAL DRAWINGS FOR HDR'S USE IN THE PRESENT STUDY AND TECHNICAL MEMORANDUM. HDR GRATEFULLY ACKNOWLEDGES THE PRIOR WORK AS HAVING BEEN PREPARED BY RECLAMATION AND SUBSEQUENTLY PROVIDED TO HDR.

PRELIMINARY CONCEPT DRAWING
ELEVATIONS AND DIMENSIONS ARE APPROXIMATE

RECLAMATION
Managing Water in the West

HDR

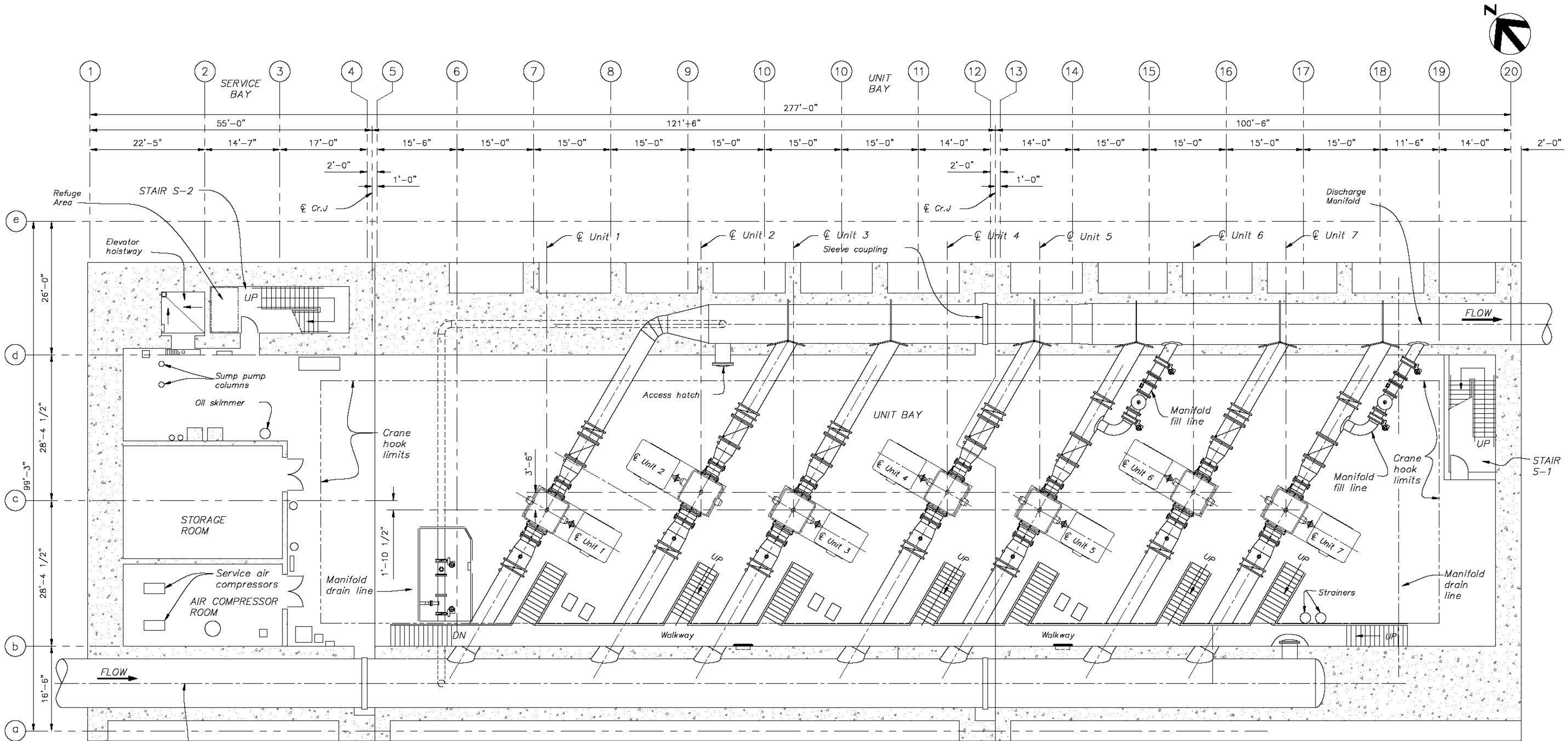
ALWAYS THINK SAFETY

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
YAKIMA RIVER BASIN STUDY
WYMER RESERVOIR PUMPING PLANT UPDATE
FISH SCREEN SECTIONS

DESIGNED V. KOVALISHYN
DRAWN R. CARPENTER
CHECKED J. PETERSON
TECH. APPR. R. KING (NAME – TITLE)
APPROVED A. GRAHAM (ADMINISTRATIVE APPROVAL – NAME – TITLE)

FIGURE 9
SHEET 9 OF 18

HDR C:\pwworking\sea\d1040839\F-09.dwg PRINTED: 3/18/2014 5:38:01 PM BY: pwilhelm



FLOOR – EL. 1270.00

PUMP DATA		
PUMP NUMBER	RATED CAPACITY *(cfs)	RATED HEAD (ft)
1 through 7	60 each	475
TOTAL	420	–

* Includes 5% wear factor

THE SOURCE FILES FOR THE MAJORITY OF THE DRAWINGS CONTAINED IN THIS DRAWING SET ARE FROM EITHER: 1) RECLAMATION'S ORIGINAL STUDY OF THE WYMER DAM AND RESERVOIR PROJECT (1985), OR 2) RECLAMATION'S SUBSEQUENT YAKIMA RIVER BASIN STORAGE STUDY, WYMER DAM AND RESERVOIR, APPRAISAL REPORT (SEPTEMBER 2007). FOR THIS PRESENT STUDY, HDR REQUESTED, AND RECLAMATION GRACIOUSLY SUPPLIED, THE SOURCE FILES FOR THE ORIGINAL DRAWINGS FOR HDR'S USE IN THE PRESENT STUDY AND TECHNICAL MEMORANDUM. HDR GRATEFULLY ACKNOWLEDGES THE PRIOR WORK AS HAVING BEEN PREPARED BY RECLAMATION AND SUBSEQUENTLY PROVIDED TO HDR.

NOTE:
1. VERTICAL DATUM REFERENCED TO NGVD 29.

PRELIMINARY CONCEPT DRAWING
ELEVATIONS AND DIMENSIONS ARE APPROXIMATE

RECLAMATION
Managing Water in the West

HDR

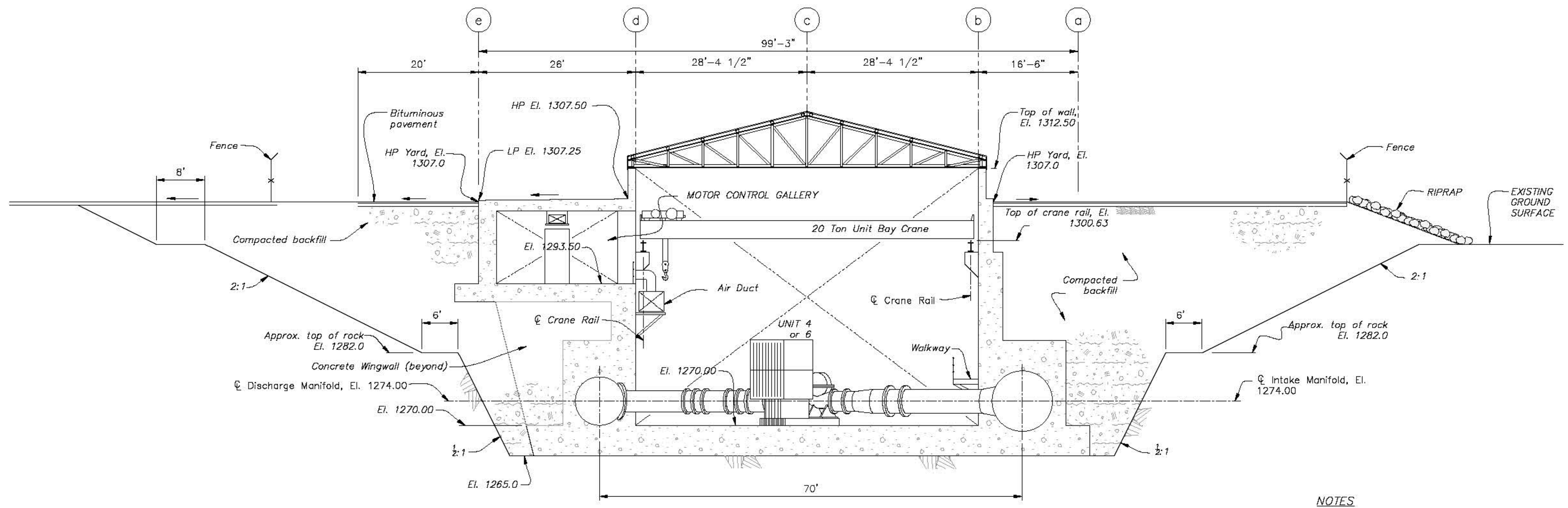
ALWAYS THINK SAFETY

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
YAKIMA RIVER BASIN STUDY
WYMER RESERVOIR PUMPING PLANT UPDATE
PUMPING PLANT GENERAL ARRANGEMENT

DESIGNED V. KOVALISHYN
DRAWN R. CARPENTER
CHECKED J. PETERSON
TECH. APPR. R. KING
NAME – TITLE
APPROVED A. GRAHAM
ADMINISTRATIVE APPROVAL – NAME – TITLE

FIGURE 10
SHEET 10 OF 18

HDR C:\pwworking\sea\d1040839\F–10.dwg PRINTED: 3/18/2014 5:36:30 PM BY: pwilhelm



NOTES

1. Vertical datum referenced to NGVD29.

TRANSVERSE SECTION THRU UNIT BAY

SCALE: 3/32"=1'-0"

THE SOURCE FILES FOR THE MAJORITY OF THE DRAWINGS CONTAINED IN THIS DRAWING SET ARE FROM EITHER: 1) RECLAMATION'S ORIGINAL STUDY OF THE WYMER DAM AND RESERVOIR PROJECT (1985), OR 2) RECLAMATION'S SUBSEQUENT YAKIMA RIVER BASIN STORAGE STUDY, WYMER DAM AND RESERVOIR, APPRAISAL REPORT (SEPTEMBER 2007). FOR THIS PRESENT STUDY, HDR REQUESTED, AND RECLAMATION GRACIOUSLY SUPPLIED, THE SOURCE FILES FOR THE ORIGINAL DRAWINGS FOR HDR'S USE IN THE PRESENT STUDY AND TECHNICAL MEMORANDUM. HDR GRATEFULLY ACKNOWLEDGES THE PRIOR WORK AS HAVING BEEN PREPARED BY RECLAMATION AND SUBSEQUENTLY PROVIDED TO HDR.

PRELIMINARY CONCEPT DRAWING

ELEVATIONS AND DIMENSIONS ARE APPROXIMATE

RECLAMATION
Managing Water in the West

HDR

ALWAYS THINK SAFETY

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
YAKIMA RIVER BASIN STUDY
WYMER RESERVOIR PUMPING PLANT UPDATE

PUMPING PLANT TRANVERSE SECTION

DESIGNED V. KOVALISHYN
DRAWN R. CARPENTER
CHECKED J. PETERSON
TECH. APPR. R. KING (NAME – TITLE)
APPROVED A. GRAHAM (ADMINISTRATIVE APPROVAL – NAME – TITLE)

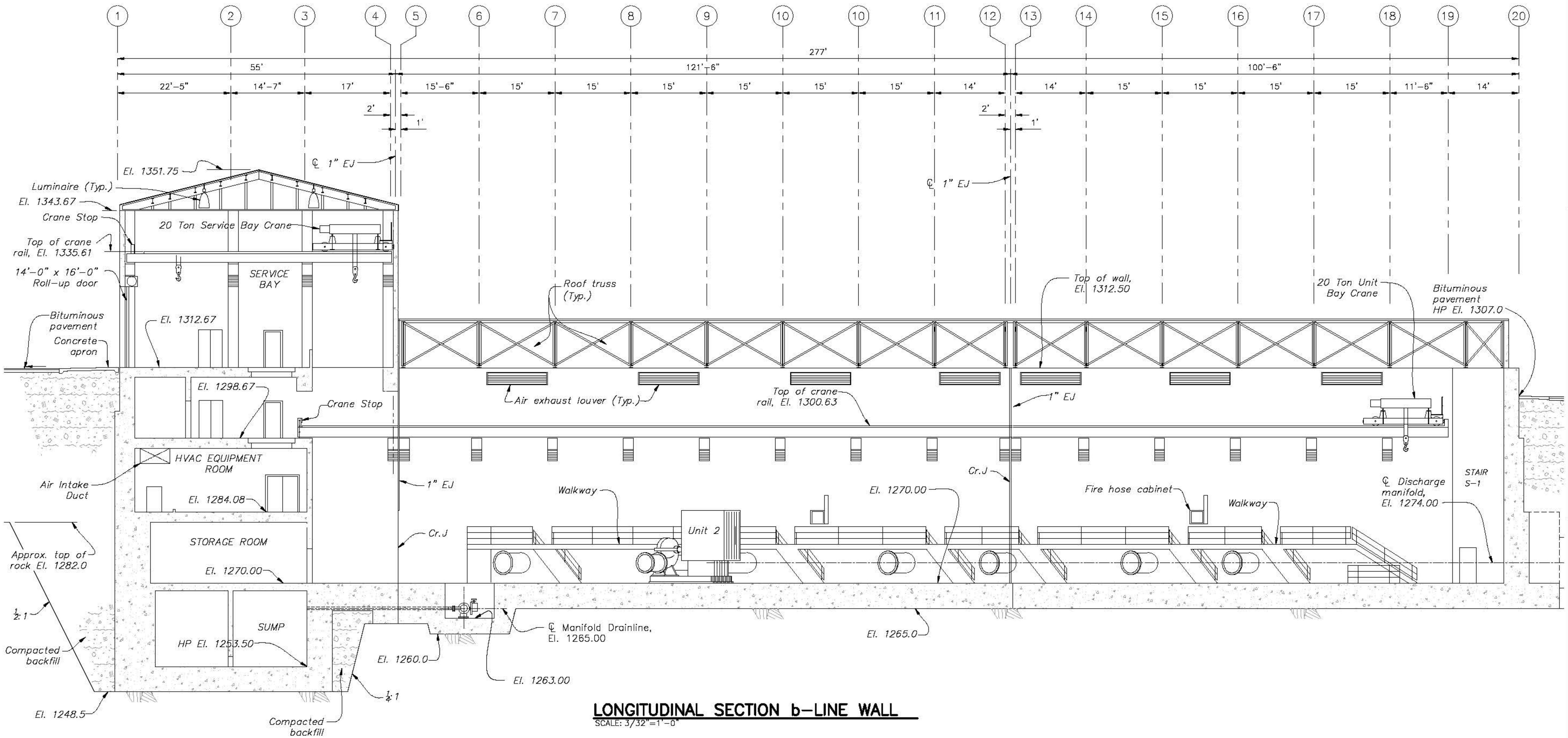
FIGURE 11

SHEET 11 OF 18

HDR C:\pwworking\sea\d1040839\F-11.dwg PRINTED: 3/18/2014 5:40:43 PM BY: pwilhelm

RECLAMATION
Managing Water in the West

HDR



LONGITUDINAL SECTION b-LINE WALL

SCALE: 3/32"=1'-0"

THE SOURCE FILES FOR THE MAJORITY OF THE DRAWINGS CONTAINED IN THIS DRAWING SET ARE FROM EITHER: 1) RECLAMATION'S ORIGINAL STUDY OF THE WYMER DAM AND RESERVOIR PROJECT (1985), OR 2) RECLAMATION'S SUBSEQUENT YAKIMA RIVER BASIN STORAGE STUDY, WYMER DAM AND RESERVOIR, APPRAISAL REPORT (SEPTEMBER 2007). FOR THIS PRESENT STUDY, HDR REQUESTED, AND RECLAMATION GRACIOUSLY SUPPLIED, THE SOURCE FILES FOR THE ORIGINAL DRAWINGS FOR HDR'S USE IN THE PRESENT STUDY AND TECHNICAL MEMORANDUM. HDR GRATEFULLY ACKNOWLEDGES THE PRIOR WORK AS HAVING BEEN PREPARED BY RECLAMATION AND SUBSEQUENTLY PROVIDED TO HDR.

PRELIMINARY CONCEPT DRAWING
ELEVATIONS AND DIMENSIONS ARE APPROXIMATE

ALWAYS THINK SAFETY

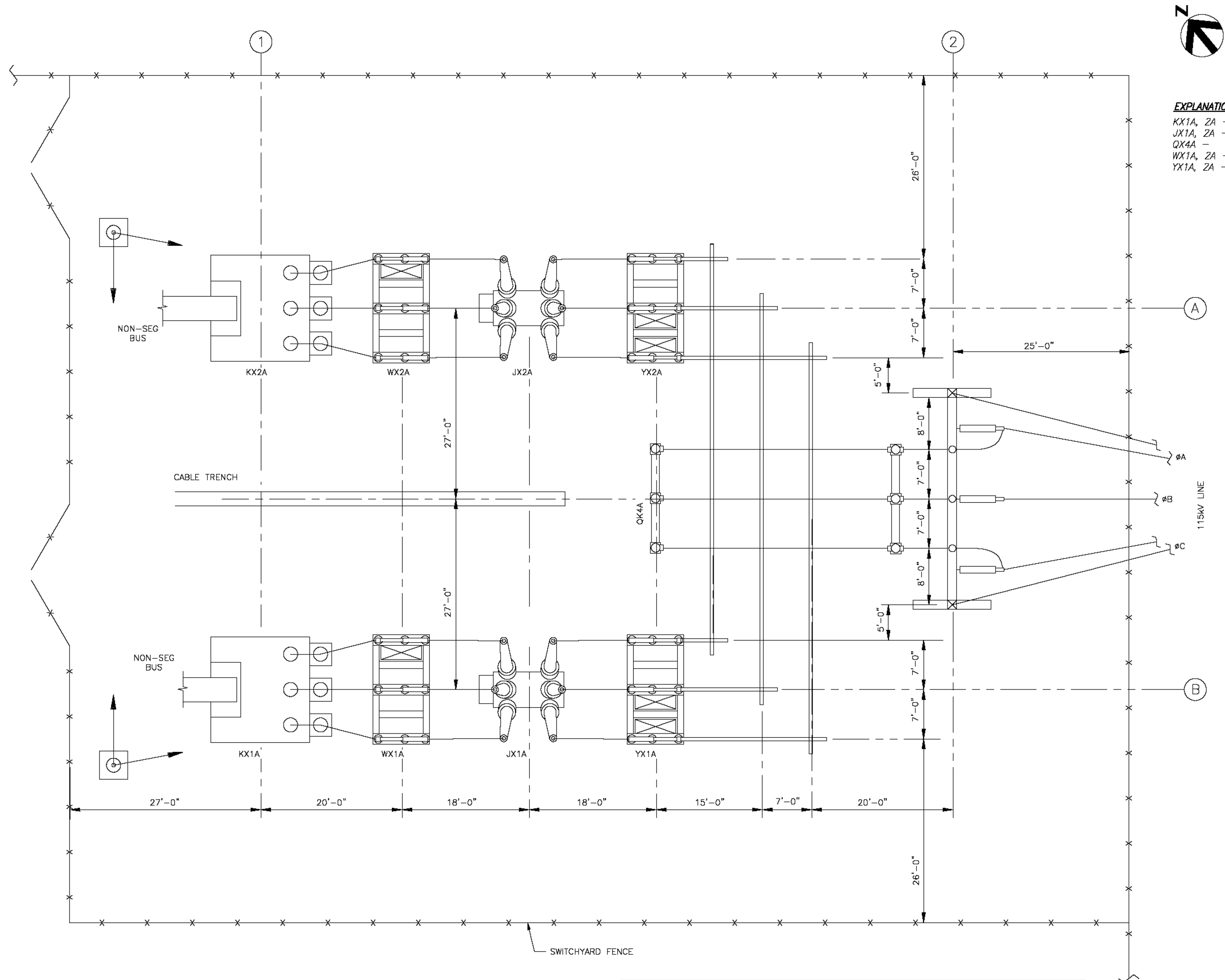
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
YAKIMA RIVER BASIN STUDY
WYMER RESERVOIR PUMPING PLANT UPDATE

PUMPING PLANT LONGITUDINAL SECTION

DESIGNED V. KOVALISHYN
DRAWN R. CARPENTER
CHECKED J. PETERSON
TECH. APPR. R. KING (NAME – TITLE)
APPROVED A. GRAHAM (ADMINISTRATIVE APPROVAL – NAME – TITLE)

FIGURE 12

SHEET 12 OF 18



EXPLANATION

KX1A, 2A – Main Power Transformers
JX1A, 2A – High Voltage Circuit Breakers
QX4A – Current Transformers
WX1A, 2A – Load-Side Disconnect Switches
YX1A, 2A – Line-Side Disconnect Switches

THE SOURCE FILES FOR THE MAJORITY OF THE DRAWINGS CONTAINED IN THIS DRAWING SET ARE FROM EITHER: 1) RECLAMATION'S ORIGINAL STUDY OF THE WYMER DAM AND RESERVOIR PROJECT (1985), OR 2) RECLAMATION'S SUBSEQUENT YAKIMA RIVER BASIN STORAGE STUDY, WYMER DAM AND RESERVOIR, APPRAISAL REPORT (SEPTEMBER 2007). FOR THIS PRESENT STUDY, HDR REQUESTED, AND RECLAMATION GRACIOUSLY SUPPLIED, THE SOURCE FILES FOR THE ORIGINAL DRAWINGS FOR HDR'S USE IN THE PRESENT STUDY AND TECHNICAL MEMORANDUM. HDR GRATEFULLY ACKNOWLEDGES THE PRIOR WORK AS HAVING BEEN PREPARED BY RECLAMATION AND SUBSEQUENTLY PROVIDED TO HDR.

PRELIMINARY CONCEPT DRAWING
ELEVATIONS AND DIMENSIONS ARE APPROXIMATE

RECLAMATION
Managing Water in the West

HDR

ALWAYS THINK SAFETY

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
YAKIMA RIVER BASIN STUDY
WYMER RESERVOIR PUMPING PLANT UPDATE
PUMPING PLANT SWITCHYARD PLAN

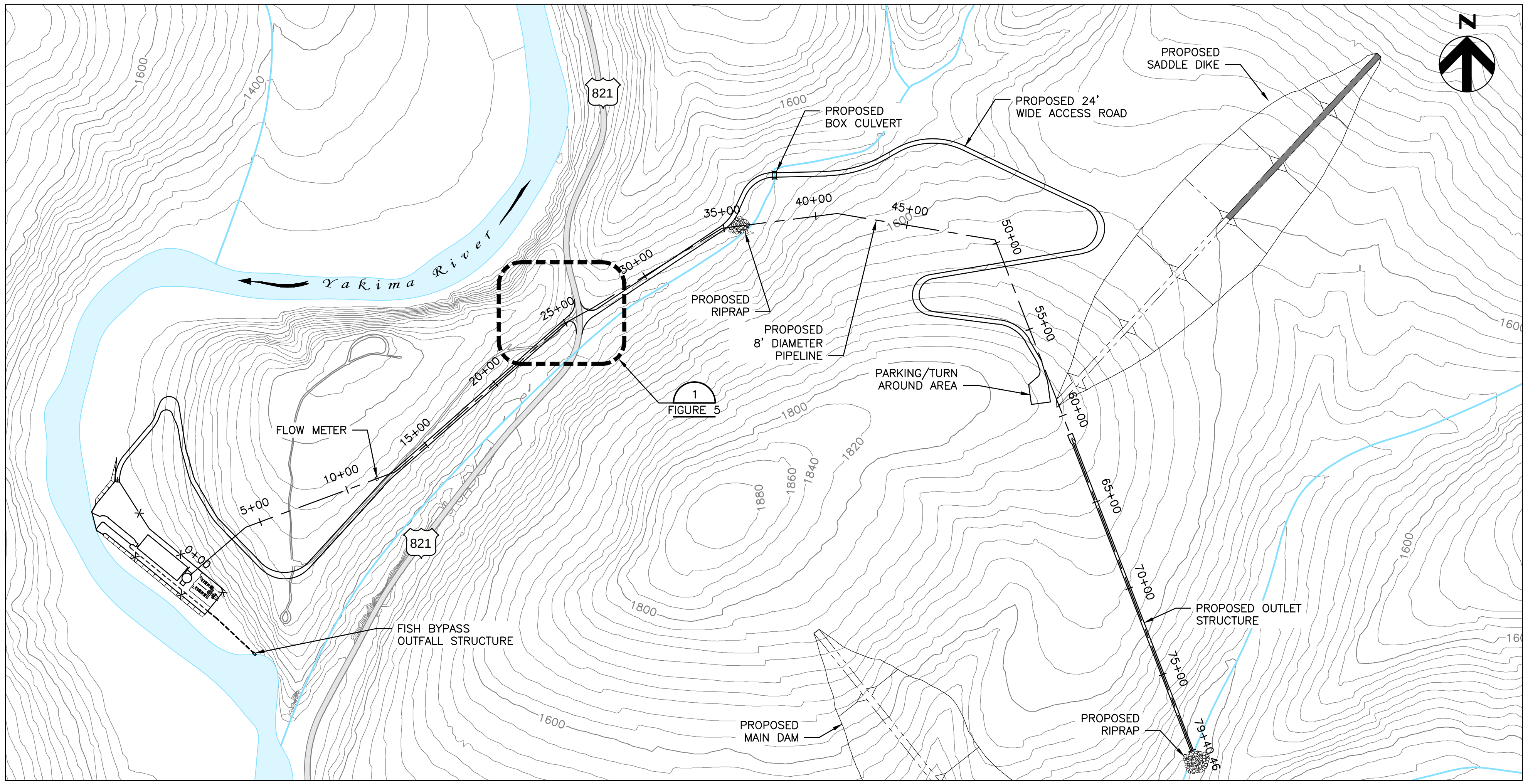
DESIGNED V. KOVALISHYN
DRAWN R. CARPENTER
CHECKED J. PETERSON
TECH. APPR. R. KING
NAME – TITLE
APPROVED A. GRAHAM
ADMINISTRATIVE APPROVAL – NAME – TITLE

FIGURE 13
SHEET 13 OF 18

HDR C:\pwworking\sea\d1040839\F-13.dwg PRINTED: 3/18/2014 5:42:46 PM BY: pwilhelm

NOTE:

1. SOURCE OF CONTOURS IS "WYMER DAM AND RESERVOIR APPRAISAL REPORT (TS-YSS-16)" AND IS APPROXIMATE ONLY. A DETAILED SURVEY WILL BE NECESSARY TO MORE ACCURATELY CHARACTERIZE THE TOPOGRAPHY.

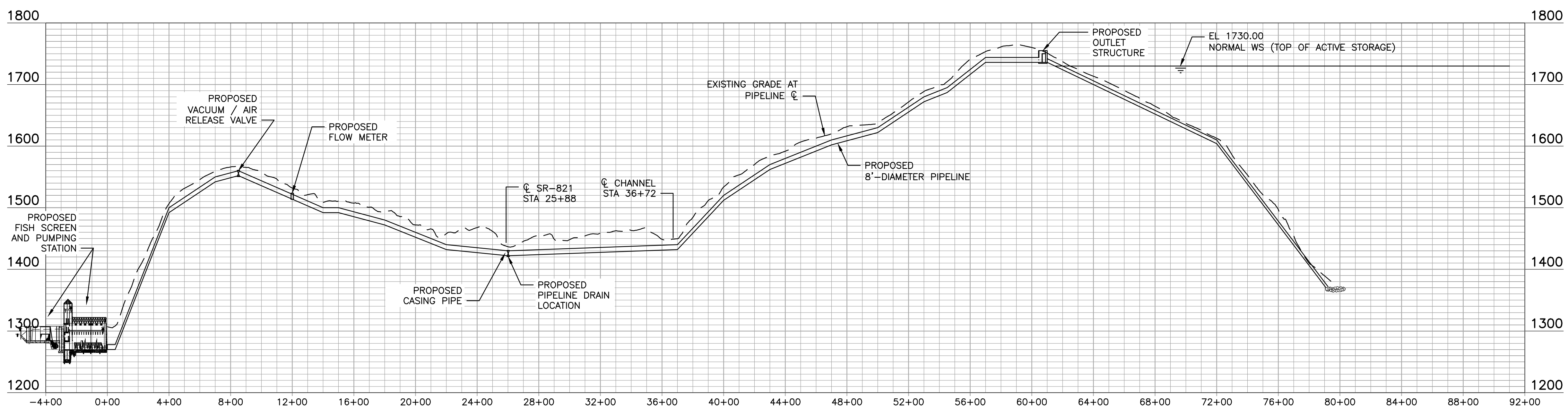


PLAN

0 200 400 800

SCALE IN FEET

THE SOURCE FILES FOR THE MAJORITY OF THE DRAWINGS CONTAINED IN THIS DRAWING SET ARE FROM EITHER: 1) RECLAMATION'S ORIGINAL STUDY OF THE WYMER DAM AND RESERVOIR PROJECT (1985), OR 2) RECLAMATION'S SUBSEQUENT YAKIMA RIVER BASIN STORAGE STUDY, WYMER DAM AND RESERVOIR, APPRAISAL REPORT (SEPTEMBER 2007). FOR THIS PRESENT STUDY, HDR REQUESTED, AND RECLAMATION GRACIOUSLY SUPPLIED, THE SOURCE FILES FOR THE ORIGINAL DRAWINGS FOR HDR'S USE IN THE PRESENT STUDY AND TECHNICAL MEMORANDUM. HDR GRATEFULLY ACKNOWLEDGES THE PRIOR WORK AS HAVING BEEN PREPARED BY RECLAMATION AND SUBSEQUENTLY PROVIDED TO HDR.



PROFILE

SCALE: HORIZ 1"=400'
VERT 1"=400'

PRELIMINARY CONCEPT DRAWING

ELEVATIONS AND DIMENSIONS ARE APPROXIMATE

RECLAMATION
Managing Water in the West

HDR

ALWAYS THINK SAFETY

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
YAKIMA RIVER BASIN STUDY
WYMER RESERVOIR PUMPING PLANT UPDATE
PIPELINE PLAN AND PROFILE

DESIGNED V. KOVALISHYN
DRAWN R. CARPENTER
CHECKED J. PETERSON
TECH. APPR. R. KING NAME – TITLE
APPROVED A. GRAHAM ADMINISTRATIVE APPROVAL – NAME – TITLE

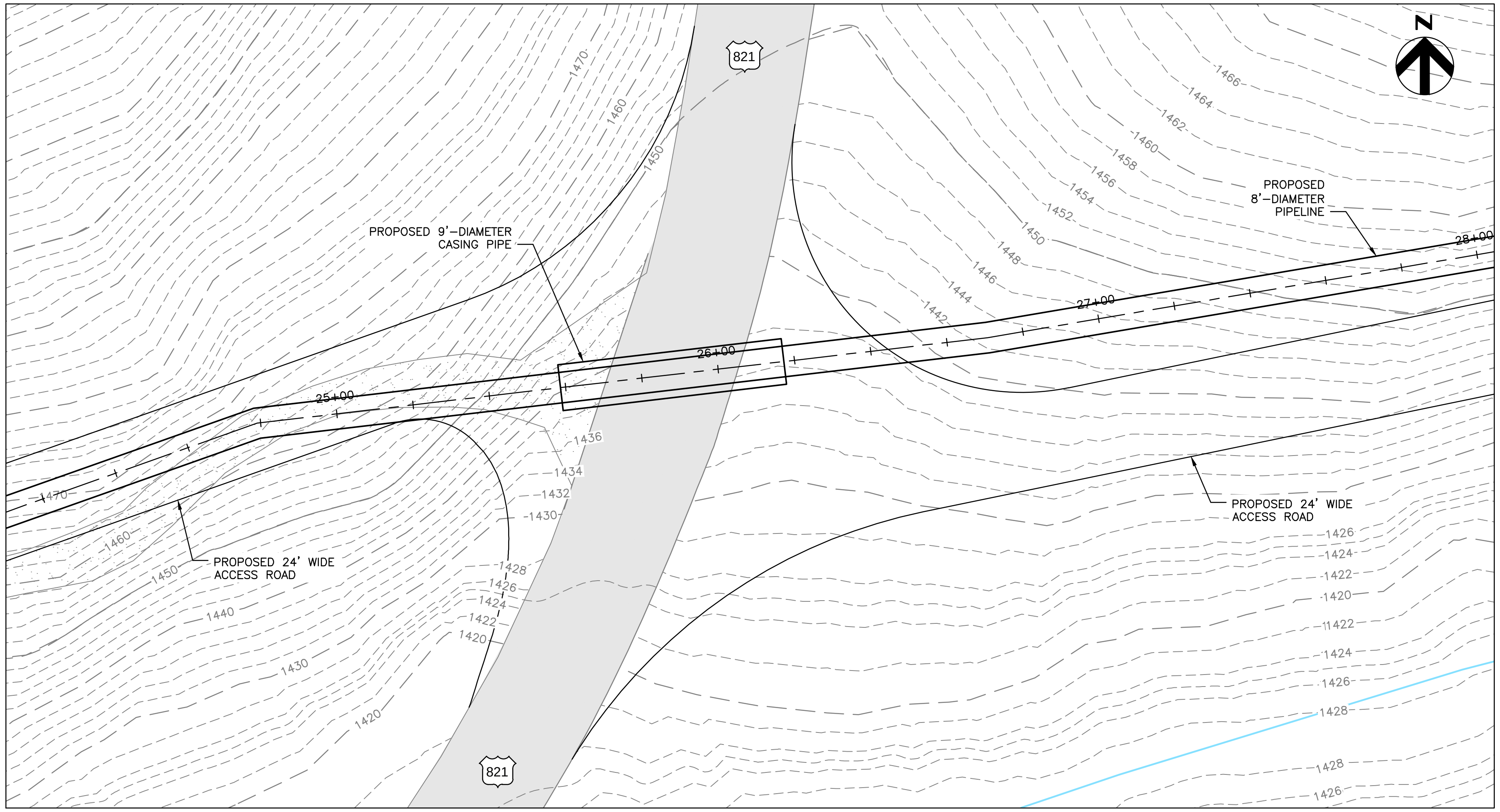
FIGURE 14

SHEET 14 OF 18

HDR C:\pwworking\sea\d1040839\F-14.dwg PRINTED: 3/18/2014 5:44:51 PM BY: pwilhelm

NOTE:

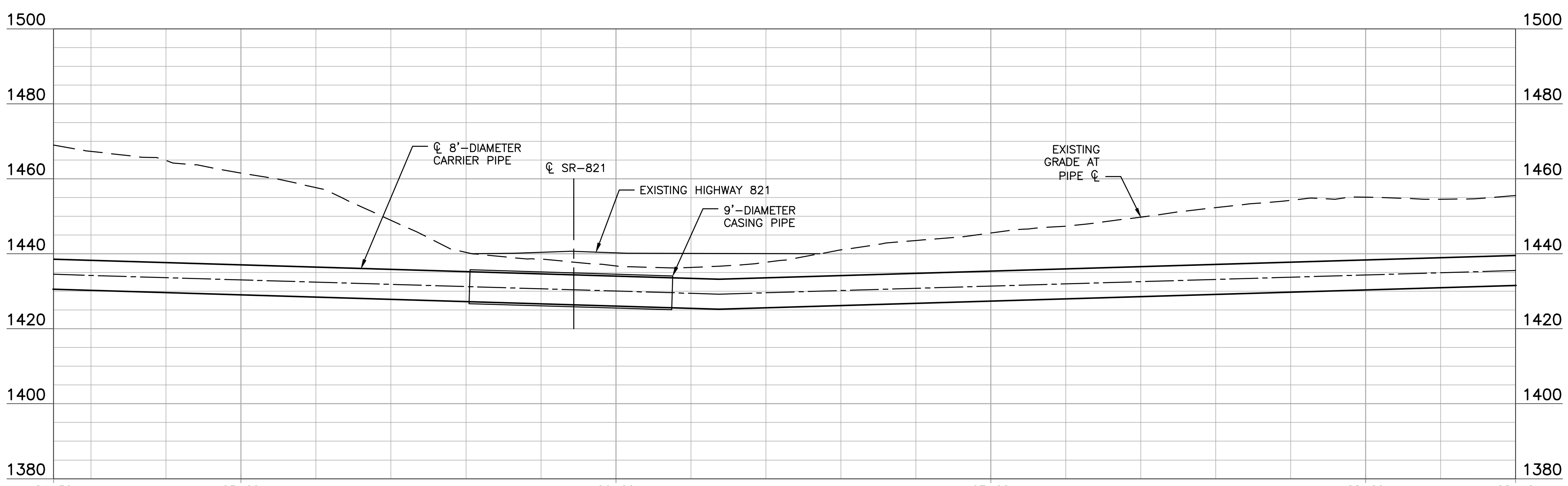
1. SOURCE OF CONTOURS IS "WYMER DAM AND RESERVOIR APPRAISAL REPORT (TS-YSS-16)" AND IS APPROXIMATE ONLY. A DETAILED SURVEY WILL BE NECESSARY TO MORE ACCURATELY CHARACTERIZE THE TOPOGRAPHY.



PLAN

0 10 20 40
SCALE IN FEET

1
FIGURE ??



PROFILE

SCALE: HORIZ 1"=20'
VERT 1"=20'

THE SOURCE FILES FOR THE MAJORITY OF THE DRAWINGS CONTAINED IN THIS DRAWING SET ARE FROM EITHER: 1) RECLAMATION'S ORIGINAL STUDY OF THE WYMER DAM AND RESERVOIR PROJECT (1985), OR 2) RECLAMATION'S SUBSEQUENT YAKIMA RIVER BASIN STORAGE STUDY, WYMER DAM AND RESERVOIR, APPRAISAL REPORT (SEPTEMBER 2007). FOR THIS PRESENT STUDY, HDR REQUESTED, AND RECLAMATION GRACIOUSLY SUPPLIED, THE SOURCE FILES FOR THE ORIGINAL DRAWINGS FOR HDR'S USE IN THE PRESENT STUDY AND TECHNICAL MEMORANDUM. HDR GRATEFULLY ACKNOWLEDGES THE PRIOR WORK AS HAVING BEEN PREPARED BY RECLAMATION AND SUBSEQUENTLY PROVIDED TO HDR.

PRELIMINARY CONCEPT DRAWING
ELEVATIONS AND DIMENSIONS ARE APPROXIMATE

RECLAMATION
Managing Water in the West

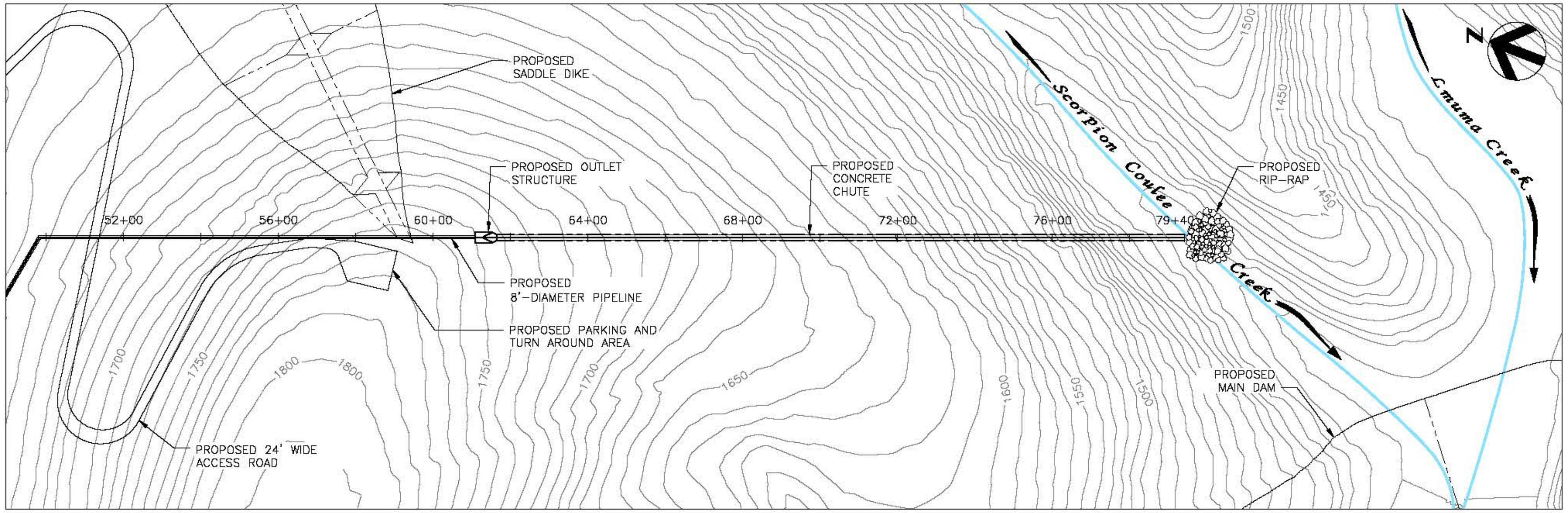
HDR

ALWAYS THINK SAFETY

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
YAKIMA RIVER BASIN STUDY
WYMER RESERVOIR PUMPING PLANT UPDATE
PIPELINE HIGHWAY CROSSING
PLAN AND PROFILE

DESIGNED V. KOVALISHYN
DRAWN R. CARPENTER
CHECKED J. PETERSON
TECH. APPR. R. KING (NAME - TITLE)
APPROVED A. GRAHAM (ADMINISTRATIVE APPROVAL - NAME - TITLE)

FIGURE 15
SHEET 15 OF 18

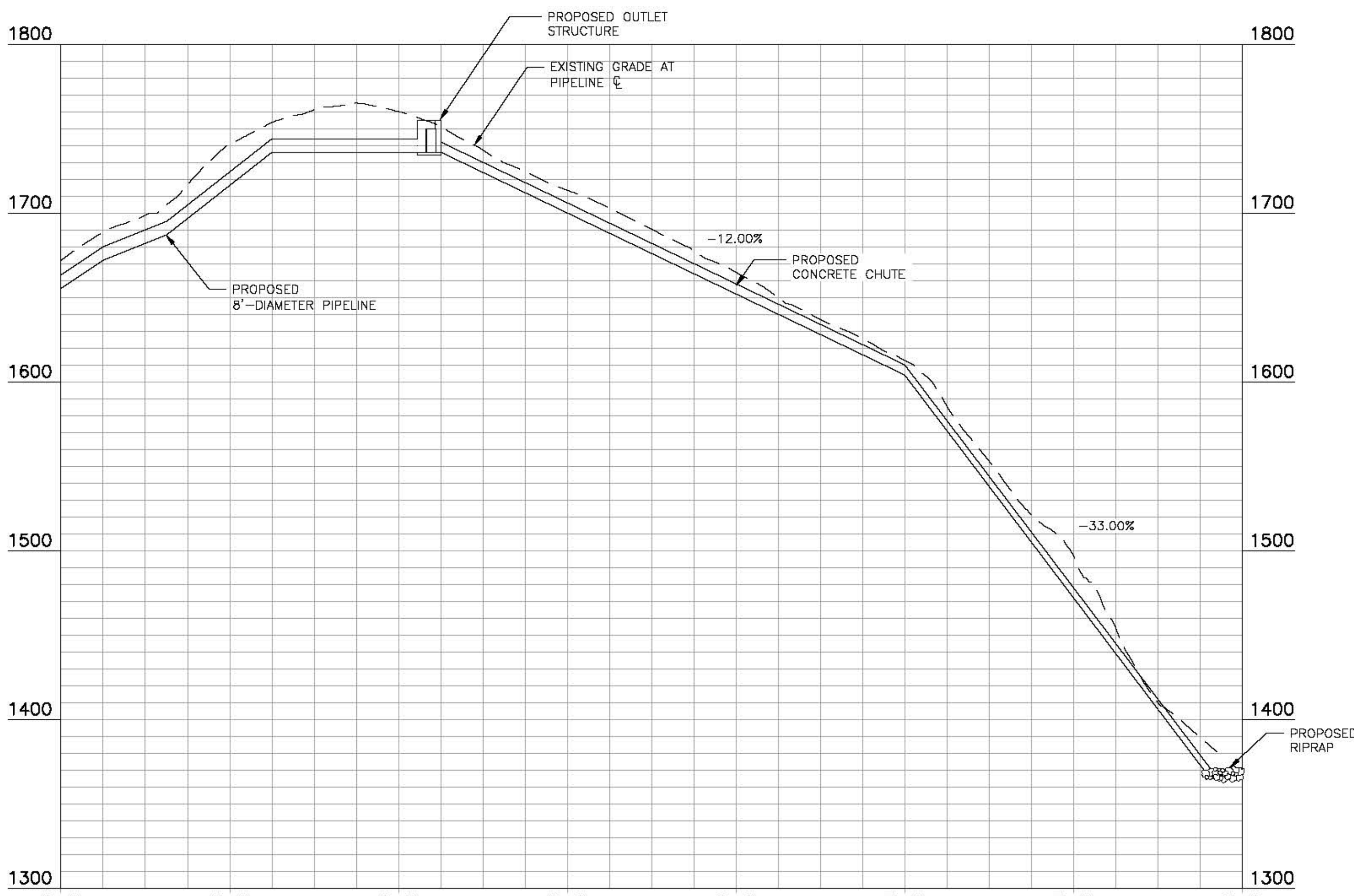


OUTLET SITE PLAN

SCALE: 1" = 200'

3 F-01

0 100 200 400 SCALE IN FEET



PROFILE

SCALE: HORIZ 1"=200'
VERT 1"=50'

NOTE:

1. SOURCE OF CONTOURS IS "WYMER DAM AND RESERVOIR APPRAISAL REPORT (TS-YSS-16)" AND IS APPROXIMATE ONLY. A DETAILED SURVEY WILL BE NECESSARY TO MORE ACCURATELY CHARACTERIZE THE TOPOGRAPHY.

THE SOURCE FILES FOR THE MAJORITY OF THE DRAWINGS CONTAINED IN THIS DRAWING SET ARE FROM EITHER: 1) RECLAMATION'S ORIGINAL STUDY OF THE WYMER DAM AND RESERVOIR PROJECT (1985), OR 2) RECLAMATION'S SUBSEQUENT YAKIMA RIVER BASIN STORAGE STUDY, WYMER DAM AND RESERVOIR, APPRAISAL REPORT (SEPTEMBER 2007). FOR THIS PRESENT STUDY, HDR REQUESTED, AND RECLAMATION GRACIOUSLY SUPPLIED, THE SOURCE FILES FOR THE ORIGINAL DRAWINGS FOR HDR'S USE IN THE PRESENT STUDY AND TECHNICAL MEMORANDUM. HDR GRATEFULLY ACKNOWLEDGES THE PRIOR WORK AS HAVING BEEN PREPARED BY RECLAMATION AND SUBSEQUENTLY PROVIDED TO HDR.

PRELIMINARY CONCEPT DRAWING
ELEVATIONS AND DIMENSIONS ARE APPROXIMATE

RECLAMATION
Managing Water in the West

HDR

ALWAYS THINK SAFETY

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
YAKIMA RIVER BASIN STUDY
WYMER RESERVOIR PUMPING PLANT UPDATE
OUTLET STRUCTURE PLAN AND PROFILE

DESIGNED V. KOVALISHYN
DRAWN R. CARPENTER
CHECKED J. PETERSON
TECH. APPR. R. KING
NAME - TITLE
APPROVED A. GRAHAM
ADMINISTRATIVE APPROVAL - NAME - TITLE

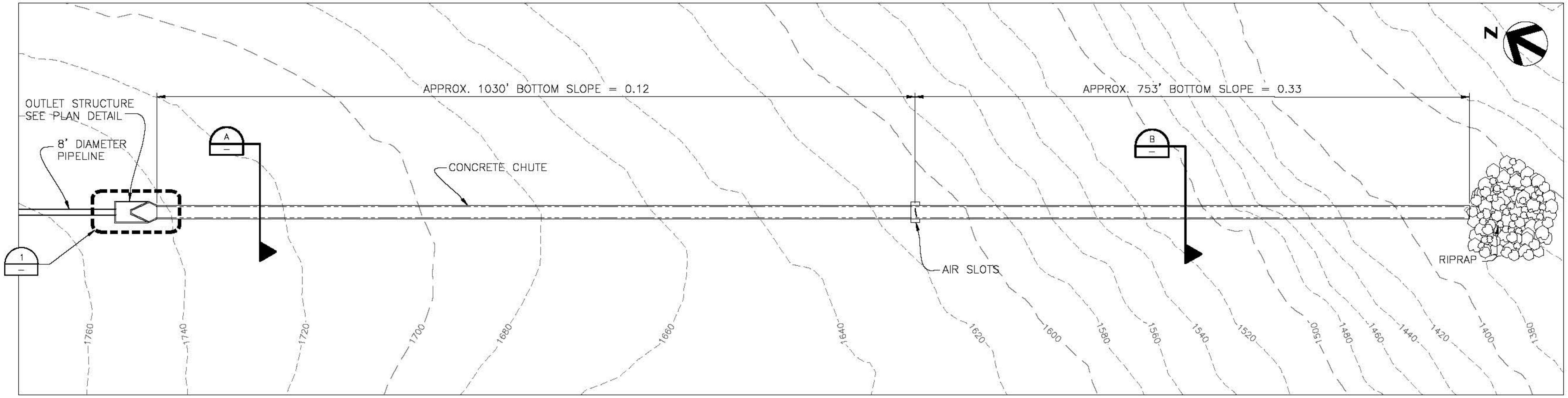
FIGURE 16

SHEET 16 OF 18

HDR C:\pwworking\sea\d1040839\F-16.dwg PRINTED: 3/18/2014 5:48:00 PM BY: pwilhelm

NOTE:

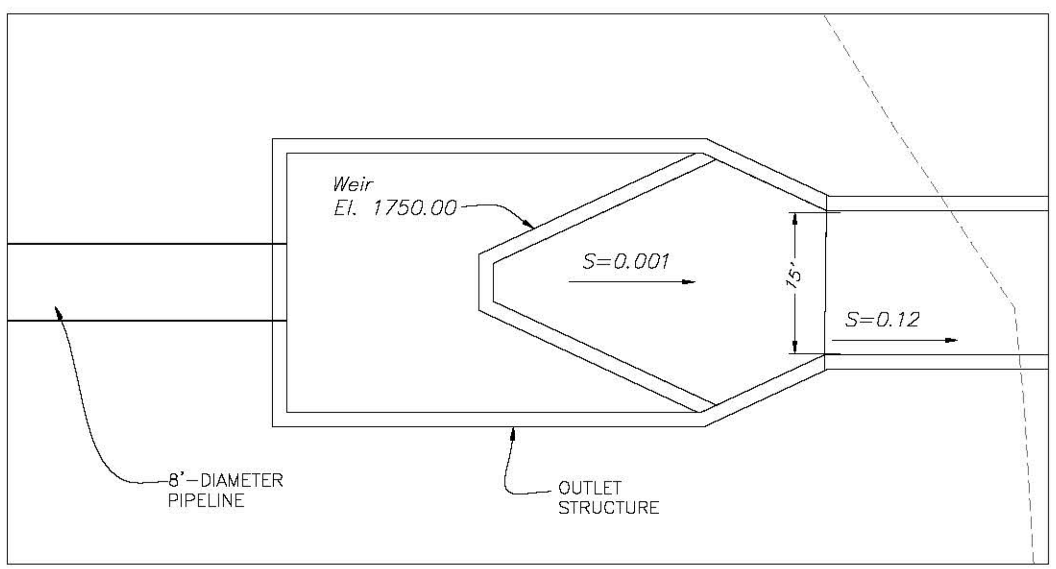
1. SOURCE OF CONTOURS IS "WYMER DAM AND RESERVOIR APPRAISAL REPORT (TS-YSS-16)" AND IS APPROXIMATE ONLY. A DETAILED SURVEY WILL BE NECESSARY TO MORE ACCURATELY CHARACTERIZE THE TOPOGRAPHY.



PLAN

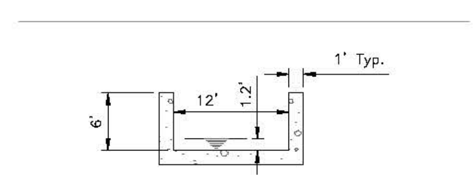
0 40 80 160
SCALE IN FEET

THE SOURCE FILES FOR THE MAJORITY OF THE DRAWINGS CONTAINED IN THIS DRAWING SET ARE FROM EITHER: 1) RECLAMATION'S ORIGINAL STUDY OF THE WYMER DAM AND RESERVOIR PROJECT (1985), OR 2) RECLAMATION'S SUBSEQUENT YAKIMA RIVER BASIN STORAGE STUDY, WYMER DAM AND RESERVOIR, APPRAISAL REPORT (SEPTEMBER 2007). FOR THIS PRESENT STUDY, HDR REQUESTED, AND RECLAMATION GRACIOUSLY SUPPLIED, THE SOURCE FILES FOR THE ORIGINAL DRAWINGS FOR HDR'S USE IN THE PRESENT STUDY AND TECHNICAL MEMORANDUM. HDR GRATEFULLY ACKNOWLEDGES THE PRIOR WORK AS HAVING BEEN PREPARED BY RECLAMATION AND SUBSEQUENTLY PROVIDED TO HDR.



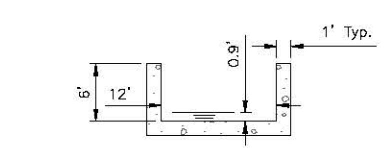
ENLARGED PLAN

SCALE: 1"=10'



SECTION A

SCALE: 1"=10'



SECTION B

SCALE: 1"=10'

HYDRAULIC PROPERTIES

Q	V	n	s	b	d	H
580	7.7	0.013	0.001	12	6.3	8
580	55.0	0.013	0.33	12	0.9	6

NOTES

1. *Hydraulic Properties Table is for normal water depths at design flow 580 cfs.*

PRELIMINARY CONCEPT DRAWING

ELEVATIONS AND DIMENSIONS ARE APPROXIMATE

RECLAMATION *Managing Water in the West*

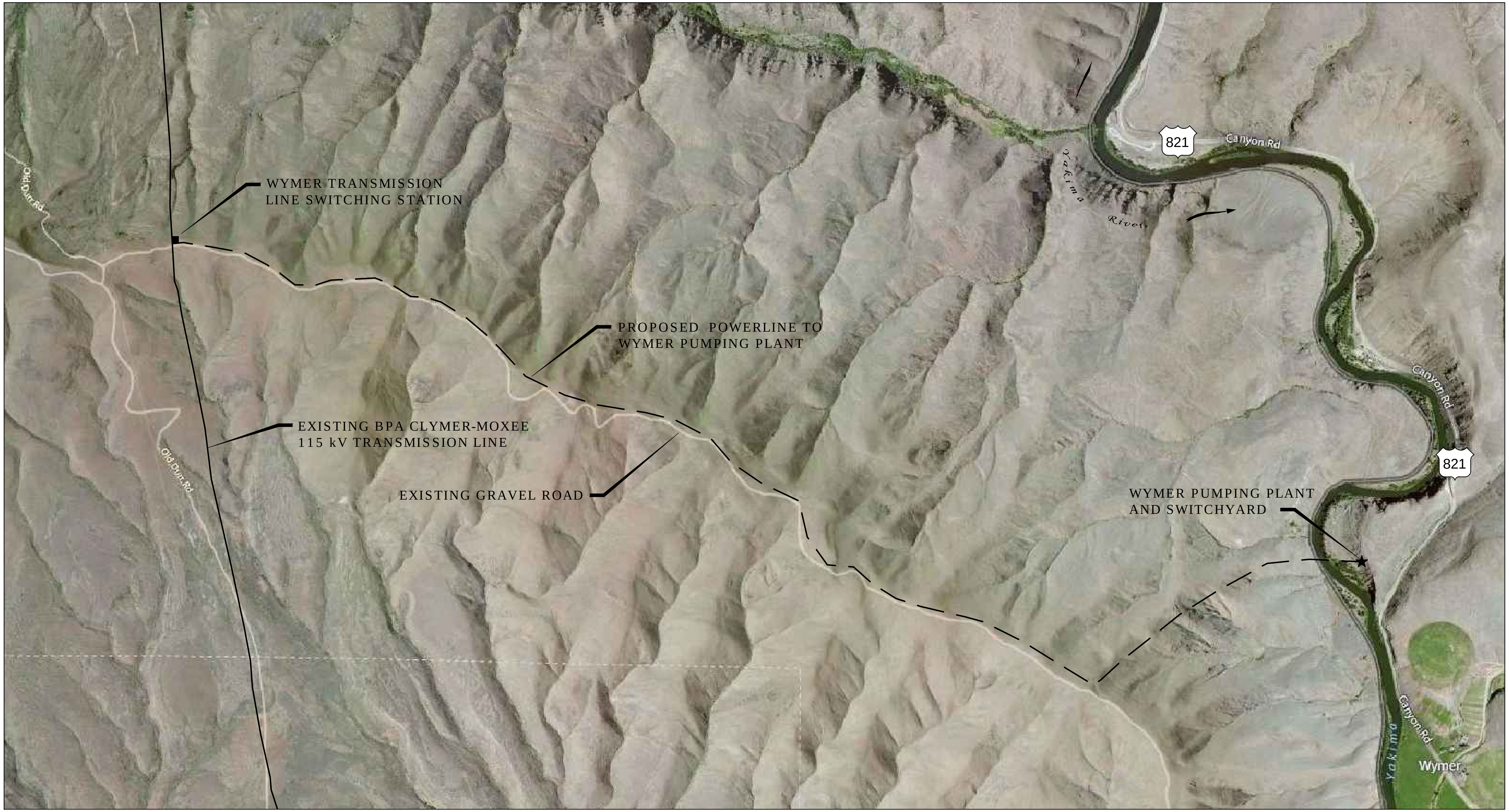
HDR

ALWAYS THINK SAFETY

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
YAKIMA RIVER BASIN STUDY
WYMER RESERVOIR PUMPING PLANT UPDATE
OUTLET STRUCTURE SECTIONS AND DETAILS

DESIGNED V. KOVALISHYN
DRAWN R. CARPENTER
CHECKED J. PETERSON
TECH. APPR. R. KING (NAME - TITLE)
APPROVED A. GRAHAM (ADMINISTRATIVE APPROVAL - NAME - TITLE)

FIGURE 17



LOCATION MAP

SCALE: NO SCALE

THE SOURCE FILES FOR THE MAJORITY OF THE DRAWINGS CONTAINED IN THIS DRAWING SET ARE FROM EITHER: 1) RECLAMATION'S ORIGINAL STUDY OF THE WYMER DAM AND RESERVOIR PROJECT (1985), OR 2) RECLAMATION'S SUBSEQUENT YAKIMA RIVER BASIN STORAGE STUDY, WYMER DAM AND RESERVOIR, APPRAISAL REPORT (SEPTEMBER 2007). FOR THIS PRESENT STUDY, HDR REQUESTED, AND RECLAMATION GRACIOUSLY SUPPLIED, THE SOURCE FILES FOR THE ORIGINAL DRAWINGS FOR HDR'S USE IN THE PRESENT STUDY AND TECHNICAL MEMORANDUM. HDR GRATEFULLY ACKNOWLEDGES THE PRIOR WORK AS HAVING BEEN PREPARED BY RECLAMATION AND SUBSEQUENTLY PROVIDED TO HDR.

PRELIMINARY CONCEPT DRAWING

ELEVATIONS AND DIMENSIONS ARE APPROXIMATE

RECLAMATION
Managing Water in the West

HDR

ALWAYS THINK SAFETY

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
YAKIMA RIVER BASIN STUDY
WYMER RESERVOIR PUMPING PLANT UPDATE

POWERLINE TO WYMER PUMPING PLANT
LOCATION MAP

DESIGNED V. KOVALISHYN
DRAWN P. WILHELM
CHECKED J. PETERSON
TECH. APPR. R. KING (NAME - TITLE)
APPROVED A. GRAHAM (ADMINISTRATIVE APPROVAL - NAME - TITLE)

FIGURE 18

SHEET 18 OF 18

HDR C:\pwworking\sea\d1040839\F-18.dwg PRINTED: 3/18/2014 5:51:34 PM BY: pwilhelm

Appendix A: Opinion of Probable Construction Cost

(This page intentionally left blank)

Project Feature	Code	Line Item Description	Revised Takeoff Quantity	Unit	Unit Price (2010 dollars)	Revised/Additional Amount (2010 dollars)	Revised Project Scheme Total (2010 dollars)	Previous Project Scheme Total (2010 dollars)	Cost Difference Between Project Scheme Features (2010 dollars)
001 YAKIMA RIVER INTAKE									
DIVISION 02		**SITE CONSTRUCTION**							
I-001		*Construct/Remove Cofferdam around Intake*							
		See Note 1							
		I-001 Construct/Remove Cofferdam around Intake					$ 118,284	$ 118,284	$ -
		Note 1: Cost in 3rd quarter 2010 dollars remains unchanged from previous estimate. Refer to Appendix D, March 2011 Task 5.3 Costs of the Integrated Water Resource Management Plan Technical Memorandum for further details.							
I-002		*Construct/Remove Cofferdam around Intake Fish Return Structure*							
		See Note 1							
		I-002 Construct/Remove Cofferdam around Intake Fish Return Structure					$ 43,231	$ 43,231	$ -
I-003		*Dewatering Intake and Pumping Plant*							
		See Note 1							
		I-003 Dewatering Intake and Pumping Plant					$ 6,882,284	$ 6,882,284	$ -
I-004		*Structural Excavation and Backfill*							
	6280	Structural excavation, BCY, sandy clay loam, 3 1/2 cy bucket, machine excavation, hydraulic backhoe	28,680.00	BCY	$ 10.222	$ 293,166.96			
	----	Excavation of rock for structures (drill and shoot)	2,455.00	CY	$ 68.150	$ 167,308.25			
	1600	Backfill, bulk, 6" to 12" lifts, dozer backfilling	16,445.00	ECY	$ 17.040	$ 280,222.80			
	2200	Backfill, trench, 6" to 12" lifts, dozer backfilling, compaction with vibrating roller	16,445.00	ECY	$ 19.310	$ 317,552.95			
		I-004 Structural Excavation and Backfill					$ 1,058,251	$ 888,286	$ 169,965
I-008		*Fish Bypass Pipe - Earthwork*							
	4250	Struct concrete, ready mix, flowable fill, struct, 140 psi, includes ash, cement, aggregate, and, water, delivered, excludes all additives and treatments	1,073.00	CY	$ 215.802	$ 231,555.55			
	1030	Excavating, trench, or continuous footing, common earth, 3CY excavator, 10' to 14' deep, excludes sheeting or dewatering	4,263.00	BCY	$ 19.310	$ 82,318.53			
	2200	Backfill, bulk, 6" to 12" lifts, dozer backfilling	2,765.00	ECY	$ 27.830	$ 76,949.95			
		I-008 Fish Bypass Pipe - Earthwork					$ 390,824	$ 134,944	$ 255,880
		DIVISION 02 SITE CONSTRUCTION					**$ 8,492,874**	**$ 8,067,030**	**$ 425,844**
DIVISION 03		**CONCRETE**							
I-005		*Construct Gated Intake and Fishscreen Structure*							
	----	Cast-in-place concrete in place, 4000psi, includes forms, excludes reinforcing steel, cement costs	3,410.00	CY	$ 1,249.380	$ 4,260,385.80			
	----	Furnish and place concrete reinforcement (120 LB/CY)	409,200.00	LB	$ 1.704	$ 697,276.80			
	----	Furnish and handle cement (.282 TON/CY)	961.62	TONS	$ 170.370	$ 163,831.20			
		I-005 Construct Gated Intake and Fishscreen Structure					$ 5,121,494	$ 4,431,653	$ 689,841
I-006		*Construct Intake Structure Retaining Walls*							
		See Note 1							
		I-006 Construct Intake Structure Retaining Walls					$ 518,532	$ 518,532	$ -
I-007		*Construct Sump for Fish Pumps and Bypass*							
		Sump for Fish Pumps eliminated.							
		Cast-in-place concrete in place, 4000psi, includes forms, excludes reinforcing steel, cement costs	28.00	CY	$ 1,476.540	$ 41,343.12			
		Furnish and place concrete reinforcement (120 LB/CY)	3,360.00	LB	$ 1.760	$ 5,913.60			
		Furnish and handle cement (.282 TON/CY)	7.90	TONS	$ 181.730	$ 1,434.94			
		I-007 Construct Sump for Fish Pumps and Bypass					$ 48,692	$ 1,808,604	$ (1,759,912)

Project Feature	Code	Line Item Description	Revised Takeoff Quantity	Unit	Unit Price (2010 dollars)	Revised/Additional Amount (2010 dollars)	Revised Project Scheme Total (2010 dollars)	Previous Project Scheme Total (2010 dollars)	Cost Difference Between Project Scheme Features (2010 dollars)
I-011		*Control Building*							
		See Note 1							
		I-011 Control Building					$ 26,748	$ 26,748	$ -
		DIVISION 03 CONCRETE					**$ 5,715,465**	**$ 6,785,537**	**$ (1,070,072)**
DIVISION 05		**METALS**							
I-005		*Construct Gated Intake and Fishscreen Structure*					$ 3,635	$ 3,635	$ -
I-009		*Structural Steel*					$ 11,358	$ 11,358	$ -
I-010		*Miscellaneous Metalwork*					$ 90,864	$ 90,864	$ -
I-011		*Control Building - Pre-Engineered Metal Building*					$ 70,420	$ 70,420	$ -
I-012		*Control Building - Trashracks and Guides*					$ 1,425,883	$ 1,425,883	$ -
I-013		*Mechanical Process*					$ 1,181,232	$ 1,181,232	$ -
		DIVISION 05 METALS					**$ 2,783,392**	**$ 2,783,392**	$ -
DIVISION 13		**SPECIAL CONSTRUCTION**							
I-013		*Mechanical Process-Water Level Measuring System*					$ 62,242	$ 62,242	$ -
I-014		*Pumping Unit for the Fish Bypass - Eliminated*					$ -	$ 2,423,797	$ (2,423,797)
		DIVISION 13 SPECIAL CONSTRUCTION					**$ 62,242**	**$ 2,486,039**	**$ (2,423,797)**
DIVISION 14		**CONVEYING SYSTEMS**							
I-012		*Control Building - Material Handling Hoists*					$ 6,815	$ 6,815	$ -
		DIVISION 14 CONVEYING SYSTEMS					**$ 6,815**	**$ 6,815**	**$ -**
DIVISION 15		**MECHANICAL**							
I-012		*Control Building - Ventilating Systems for Fish Pump Electrical Equipment - Eliminated*					$ -	$ 3,407	$ (3,407)
I-015		*Steel Pipe for the Fish Bypass*							
	----	48"ID x 1/4" wall steel pipe 915 LF x 96lbs/LF	915.00	LF	$ 438.550	$ 401,273.24			
	----	8 each - 48" AWWA Class D Flanges	2,858.67	LBS	$ 4.543	$ 12,986.92			
	----	All Welded Steel Plates	35,000.00	LBS	$ 4.543	$ 159,005.00			
		I-015 Steel Pipe for the Fish Bypass					$ 573,265	$ 460,826	$ 112,439
I-016		*Valves for Fish Bypass*							
	----	2 - 48" Knife Gate Valves	6,672.00	LBS	$ 12.494	$ 83,359.97			
		I-016 Valves for Fish Bypass					$ 83,360	$ 62,469	$ 20,891
		DIVISION 15 MECHANICAL					**$ 656,625**	**$ 526,702**	**$ 129,923**
DIVISION 16		**ELECTRICAL**							
I-013		*Mechanical Process*					$ 22,716	$ 22,716	$ -
I-017		*Service Equipment*					$ 21,921	$ 21,921	$ -
I-018		*Combination Motor Starters*					$ 11,358	$ 11,358	$ -
I-019		*Adjustable Speed Drives*					$ 124,938	$ 124,938	$ -
I-020		*Lighting System*					$ 7,951	$ 7,951	$ -
		DIVISION 16 ELECTRICAL					**$ 188,884**	**$ 188,884**	**$ -**
		001 YAKIMA RIVER INTAKE					***$ 17,906,298***	***$ 20,844,399***	***$ (2,938,101)***
002 PUMPING STATION									
DIVISION 2		**SITE CONSTRUCTION**							
PS-001		*Service Yard and Access Road*							
	---	Common excavation to service yard El. 1307	41,330.00	CY	$ 32.930	$ 1,360,996.90			
	---	Place and compact embankment for Service Yard	22,080.00	CY	$ 10.980	$ 242,438.40			
	---	Stripping (Remove and dispose 6" of topsoil	14,140.00	SY	$ 5.490	$ 77,628.60			
	---	Furnish and install 7' x 24' wide access gate	1.00	EA	$ 4,829.440	$ 4,829.44			
	---	Furnish and install 7' chain link fence for service yard	1,730.00	LF	$ 27.440	$ 47,471.20			
	---	Furnish and place bituminous pavement 3" thick	285.00	TONS	$ 104.272	$ 29,717.52			

Project Feature	Code	Line Item Description	Revised Takeoff Quantity	Unit	Unit Price (2010 dollars)	Revised/Additional Amount (2010 dollars)	Revised Project Scheme Total (2010 dollars)	Previous Project Scheme Total (2010 dollars)	Cost Difference Between Project Scheme Features (2010 dollars)
	---	Furnish and place 6" thick gravel surfacing	5,389.00	SY	$ 8.781	$ 47,320.81			
	---	Furnish and place 6" thick base course material	755.00	TONS	$ 32.930	$ 24,862.15			
	0900	Riprap (d50=24") (120lb/cf)	3,400.00	TON	$ 71.860	$ 244,324.00			
	0900	Riprap Bedding (130lb/cf)	1,360.00	TON	$ 51.330	$ 69,808.80			
		PS-001 Service Yard and Access Road					$ 2,149,398	$ 921,391	$ 1,228,007
PS-002		*Dewatering During Construction*							
		See Note 1.							
		PS-002 Dewatering During Construction					$ 3,306,762	$ 3,306,762	$ -
		DIVISION 02 SITE CONSTRUCTION					**$ 5,456,160**	**$ 4,228,153**	**$ 1,228,007**
		DIVISION 03 CONCRETE					**$ 16,740,946**	**$ 16,740,946**	**$ -**
		DIVISION 05 METALS					**$ 3,921,516**	**$ 3,921,516**	**$ -**
		DIVISION 07 THERMAL AND MOISTURE PROTECTION					**$ 220,666**	**$ 220,666**	**$ -**
		DIVISION 08 DOORS & WINDOWS					**$ 47,965**	**$ 47,965**	**$ -**
		DIVISION 11 EQUIPMENT					**$ 10,165,971**	**$ 10,165,971**	**$ -**
		DIVISION 13 SPECIAL CONSTRUCTION					**$ 230,496**	**$ 230,496**	**$ -**
		DIVISION 13 CONVEYING SYSTEMS					**$ 856,128**	**$ 856,128**	**$ -**
		DIVISION 14 MECHANICAL					**$ 18,168,297**	**$ 18,168,297**	**$ -**
		DIVISION 16 ELECTRICAL					**$ 6,289,402**	**$ 6,289,402**	**$ -**
		002 PUMPING STATION					***$ 62,097,549***	***$ 60,869,542***	***$ 1,228,007***
003 SWITCHYARD AND TRANSMISSION LINE									
		Additional - Site preparation at tap	1.00	EA	$ 100,000.000	$ 100,000.00			
		DIVISION 02 SITE CONSTRUCTION					**$ 224,128**	**$ 124,128**	**$ 100,000**
		DIVISION 03 CONCRETE					**$ 209,200**	**$ 209,200**	**$ -**
		DIVISION 05 METALS					**$ 212,298**	**$ 212,298**	**$ -**
		115 kV disconnects (at switching station)	6.00	EA	$ 37,737.000	$ 226,422.00			
		115 kV breaker (at switching station)	3.00	EA	$ 172,512.000	$ 517,536.00			
		Control building and controls at switching station (15.5 X 30)	1.00	EA	$ 240,000.000	$ 240,000.00			
		20/26.6/33.3 MVA-115/6.9 kV delta-grd wye transformer	2.00	EA	$ 1,186,020.000	$ 2,372,040.00			
		115 kV disconnects (at switchayrd)	4.00	EA	$ 37,737.000	$ 150,948.00			
		115 kV breaker (at switchyard)	2.00	EA	$ 172,512.000	$ 345,024.00			
		115 kV Single circuit wood w/OPGW	6.00	mile	$ 593,010.000	$ 3,558,060.00			
		115 kV voltage transformers	3.00	EA	$ 22,642.200	$ 67,926.60			
		115 kV current transfromers	3.00	EA	$ 21,564.000	$ 64,692.00			
		Control building and controls at pumping site (15.5 X 30)	1.00	EA	$ 240,000.000	$ 240,000.00			
		DIVISION 16 ELECTRICAL					**$ 7,782,649**	**$ 5,999,159**	**$ 1,783,490**
		002 SWITCHYARD AND TRANSMISSION LINE					***$ 8,428,274***	***$ 6,544,784***	***$ 1,883,490***
004 DISCHARGE LINE									
DIVISION 1		**GENERAL REQUIREMENTS**							
DL-005		*SH 821 Detour for Open Cut Discharge Line*							
	0900	Concrete Jersey Barriers (SH821)	200.00	LF	$ 114.060	$ 22,812.00			
	0900	Detour Signage (SH821)	1.00	LS	$ 79,842.000	$ 79,842.00			
	0900	Detour Removal (SH821)	1.00	LS	$ 45,624.000	$ 45,624.00			
		DL-005 SH 821 Detour for Open Cut Discharge Line					$ 148,278	$ 148,278	$ -

Project Feature	Code	Line Item Description	Revised Takeoff Quantity	Unit	Unit Price (2010 dollars)	Revised/Additional Amount (2010 dollars)	Revised Project Scheme Total (2010 dollars)	Previous Project Scheme Total (2010 dollars)	Cost Difference Between Project Scheme Features (2010 dollars)
DL-012		*Electrical - Discharge Line*							
		Steel pipe @end of discharge pipe (96"ID x 3/8" wall, 386lb/ft)	470.00	LF	$ 1,106.382	$ 519,999.54			
		DL-012 Electrical Disharge Line					$ 520,000	$ 520,000	$ -
		DIVISION 01 GENERAL REQUIREMENTS					**$ 668,278**	**$ 668,278**	**$ -**
DIVISION 2		**SITE CONSTRUCTION**							
DL-001		*Earthwork - PS Discharge Line to Reservoir*							
	0900	Clearing and grubbing (150' wide along pipeline)	119,200.00	SY	$ 1.141	$ 136,007.20			
	0900	Common excavation for pipe	33,470.00	CY	$ 6.844	$ 229,068.68			
	0900	Rock excavation for pipe (drill and shoot)	95,640.00	CY	$ 26.234	$ 2,509,019.76			
	0900	Backfill for pipe	95,080.00	CY	$ 5.133	$ 488,045.64			
	0900	Rockfill for pipe under dam - Eliminated	0.00	CY	$ 50.190	$ -			
	0900	Soil cement slurry (CLSM)	20,720.00	CY	$ 114.060	$ 2,363,323.20			
		DL-001 Earthwork - PS Discharge Line to Reservoir					$ 5,725,464	$ 8,018,988	$ (2,293,524)
DL-005		*SH 821 Open Cut Discharge Line and Detour*							
	0900	Common excavation for pipe	725.00	CY	$ 6.844	$ 4,961.90			
	0900	Backfill, trench, 6" to 12" lifts, compaction with vibrating roller	650.00	CY	$ 27.830	$ 18,089.50			
	0900	Remove and replace concrete asphalt on SH821	105.00	TON	$ 125.470	$ 13,174.35			
	0900	Concrete asphalt for detour (SH821)	135.00	TON	$ 114.060	$ 15,398.10			
	0900	Remove and replace aggregate base on SH821	190.00	TON	$ 57.030	$ 10,835.70			
	0900	Aggregate base for detour (SH821)	255.00	TON	$ 57.030	$ 14,542.65			
		DL-005 SH 821 Detour for Open Cut Discharge Line					$ 77,002	$ 310,300	$ (233,298)
DL-007		*Outlet Structure - Discharge Line*					$ 187,743	$ 187,743	$ -
DL-008		*Outlet Chute -Discharge Line*							
	0900	Excavation of common materials for structures (2:1)	18,060.00	CY	$ 17.110	$ 309,006.60			
	0900	Backfill for chute (2:1)	9,031.00	CY	$ 25.550	$ 230,742.05			
	0900	Compacted backfill	9,031.00	CY	$ 9.130	$ 82,453.03			
	0900	Riprap (d250=24") (120lb/cf)	650.00	TON	$ 71.860	$ 46,709.00			
	0900	Riprap Bedding (130lb/cf)	260.00	TON	$ 51.330	$ 13,345.80			
		DL-008 Outlet Chute -Discharge Line					$ 682,256	$ 1,797,175	$ (1,114,919)
		DIVISION 02 SITE CONSTRUCTION					**$ 6,672,466**	**$ 10,314,206**	**$ (3,641,740)**
DIVISION 03		**CONCRETE**							
DL-007		*Outlet Structure - Discharge Line*					$ 499,412	$ 499,412	$ -
DL-008		*Outlet Chute -Discharge Line*							
		Furnish, form,and place reinforced concrete	2,400.00	CY	$ 1,270.000	$ 3,048,000.00			
		Furnish and place concrete reinforcement (120lb/CY)	285,000.00	LBS	$ 1.500	$ 427,500.00			
		Furnish and handle cement (.282T/CY)	660.00	TONS	$ 160.000	$ 105,600.00			
		DL-008 Outlet Chute -Discharge Line					$ 3,581,100	$ 2,640,261	$ 940,839
DL-009		*Miscellaneous Reinforced Concrete - Access Conduit for Discharge Line - Eliminated from design*					$ -	$ 4,486,835	$ (4,486,835)
		DIVISION 03 CONCRETE					**$ 4,080,512**	**$ 7,626,508**	**$ (3,545,996)**
		DIVISION 13 SPECIAL CONSTRUCTION					**$ 180,215**	**$ 180,215**	**$ -**
DIVISION 15		**MECHANICAL**							
DL-002		*Pipeline F&I*							
	0900	8' OD, pipe thickness = 0.4375 (456lb/ft steel weight)	5,655.00	LF	$ 1,859.180	$ 10,513,662.90			
	0900	8' OD, pipe thickness = 0.625 (652lb/ft steel weight)	1,400.00		$ 1,300.284	$ 1,820,397.60			
	0900	9' OD Steel Casing Pipe (t=1in)	60.00	LF	$ 3,000.000	$ 180,000.00			
	0900	96x96x36 Tee for buried manhole	5.00	LS	$ 67,295.400	$ 336,477.00			

Project Feature	Code	Line Item Description	Revised Takeoff Quantity	Unit	Unit Price (2010 dollars)	Revised/Additional Amount (2010 dollars)	Revised Project Scheme Total (2010 dollars)	Previous Project Scheme Total (2010 dollars)	Cost Difference Between Project Scheme Features (2010 dollars)
		DI-002 Pipeline F&I					$ 12,850,538	$ 8,223,042	$ 4,627,496
DL-010	0900	*Mechanical - Bulkhead gate, guides, ventilation system, etc.*					$ 387,804	$ 387,804	
DL-011	0900	*Mechanical - Valves - Discharge Isolation Valve*					$ 275,113	$ 275,113	
DL-012	0900	*Electrical - Discharge Line*					$ 2,281	$ 2,281	
DL-013	0900	*Mechanical - Valves - Butterfly Valve for filling line*					$ 13,687	$ 13,687	
		DIVISION 14 MECHANICAL					**$ 13,529,423**	**$ 8,901,927**	**$ 4,627,496**
		DIVISION 16 ELECTRICAL					**$ 32,849**	**$ 32,849**	**$ -**
		004 DISCHARGE LINE					***$ 25,163,742***	***$ 27,723,982***	***$ (2,560,240)***
005 DAM AND DIKE							***$ 399,920,542***	***$ 399,920,542***	***$ -***
006 SPILLWAY AND OUTLET WORKS							***$ 63,578,112***	***$ 63,578,112***	***$ -***
007 DIVERSION DURING CONSTRUCTION							***$ 4,768,930***	***$ 4,768,930***	***$ -***
009 ROAD AND CREEK IMPROVEMENTS									
DIVISION 2		**SITE CONSTRUCTION**							
AR-001		*Road from SH821 to other side of Dam*					$ 1,206,043	$ 1,206,043	$ -
AR-002		*Road from Access House to other side of Dike- Eliminated*					$ -	$ 667,362	$ (667,362)
AR-003		*Road from SH821 to Outlet Works*					$ 194,461	$ 194,461	$ -
AR-004		*Earthwork and other Improvement to Lumuma Creek*					$ 2,850,701	$ 2,850,701	$ -
AR-005		*I-82 Bridges - Embankment Protection*					$ 1,665,969	$ 1,665,969	$ -
AR-006		*I-82 Bridges - Pier Protection*					$ 10,903	$ 10,903	$ -
AR-007		*Access Road from Pumping Station to Saddle Dike*							
	----	Excavation	75,000.00	CY	$ 33.520	$ 2,514,000.00			
	----	Road Compacted Fill	12,000.00	CY	$ 18.135	$ 217,620.00			
	----	Furnish and Place 6-in thick gravel surfacing	6,800.00	TONS	$ 49.451	$ 336,266.80			
	----	Furnish and Place 5.5'X 6' Concrete Box Culvert	35.00	LF	$ 905.000	$ 31,675.00			
	----	24" Corrugated Metal Pipe Culvert (assume 20 X 35' lengths)	700.00	LF	$ 69.934	$ 48,953.80			
	0900	Riprap (d250=24") (120lb/cf)	600.00	TON	$ 71.860	$ 43,116.00			
	0900	Riprap Bedding (130lb/cf)	200.00	TON	$ 51.330	$ 10,266.00			
		AR-007 Access Road from Pumping Station to Saddle Dike					$ 3,201,898	$ -	$ 3,201,898
		DIVISION 02 SITE CONSTRUCTION					**$ 9,129,975**	**$ 6,595,438**	**$ 2,534,536**
		DIVISION 03 CONCRETE					**$ 14,474**	**$ 14,474**	**$ -**
		009 ROAD AND CREEK IMPROVEMENTS					***$ 9,144,449***	***$ 6,609,912***	***$ 2,534,536***

This Page Intentionally Left Blank