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1 SUMMARY:

ECO:LOGIC performed a location analysis and investigated the required design parameters for installation of a new diversion weir to provide the Glendale Water Treatment Plant with a water supply capacity of 28 million gallons per day. The location analysis recommendation is to replace the existing diversion weir with a new structure in the original location. ECO:LOGIC is recommending the new diversion weir design be capable of diverting 37.5 MGD (58cfs) to match the plant production capabilities, and should be constructed of concrete with a crest elevation 4434.6, and include trash racks, sediment transport away from the intake, screening facilities to exclude juvenile fish and fry from the intake channel, fish passage designed to accommodate the as yet to be determined governing species for design, safe boat and recreational access, and capable of capturing one hundred percent of privately owned storage water during drought releases. ECO:LOGIC is also recommending the design be numerically modeled using the HEC RAS program to ensure adequate design evaluation, and a physical model be constructed and tested at a hydraulic facility to ensure adequacy of design refinements.

2 PURPOSE:

The Truckee Meadows Water Authority has requested ECO:LOGIC to provide an analysis of two alternative weir locations and required design parameters for providing 28 MGD (43 cfs) of firm capacity to the Glendale Water Treatment Plant.

3 LOCATION

Two locations were initially identified for site investigations, the Pioneer Diversion site, and the Glendale Diversion site. The Pioneer Diversion site has been eliminated for a variety of reasons via ongoing discussions with TMWA, and the focus has been on the design requirements of the existing location.

4 DESIGN REQUIREMENTS

A new Glendale weir in the existing location would be approximately 300 feet in width, depending on the exact site location, and should entail removal of existing debris as part of the project. There are several options available for design of a new diversion weir that would be applicable for any weir footprint chosen.

4.1 TYPE OF DIVERSION

There are several options available for constructing a new diversion weir that has proven design parameters and functionality. Inflatable dams are becoming increasingly more common, as well as the traditional weir types of concrete, grouted riprap, and drum gates.

The current trend in the construction of low head diversions is to mimic the appearance of naturally occurring river structures as much as possible to provide a more aesthetically pleasing diversion structure that blends with the natural environment. It can be expected that the Reno/Sparks community, given a choice, will express their desire for a similar, more natural appearing structure.

Other issues to be considered when choosing the weir type are safety, maintenance, and longevity. With either the drum gate or the inflatable dam, it will be more difficult to design a structure that has sufficient energy dissipation downstream of the structure, or a lack of "keeper holes" created by the overflow without incorporating a sloped apron. In the Northwest Hydraulic Consultants report (Attachment 9.1), they point to the possibility of the inflatable dam being punctured and "the consequences of rapid deflation due to damage must be considered."[1] The drum gate, being mechanically actuated, and steel, would initially appear to inherently require more maintenance than any of the other options listed, and does not account for hydraulic energy dissipation on the downstream slope.

4.2 Design Flow

The chart below compares the mean flow for the Truckee River for the period of record, which is approximately 78 years, and 1994, in which he least amount of recorded flow in recent years. The importance of designing a new diversion for efficient capture of POSW releases becomes clear when comparing the numbers on the chart. This emphasizes the requirement of ensuring a new design incorporates features for blocking all discretionary flow past the diversion, including fish ladder / boat passage flow and sediment transport flow. The probability of migrating fish in the river with total river flow of 14 cfs is low to none. As can be seen, during the periods of extreme low flow, natural stream flow past the diversion would be nonexistent unless POSW other than TMWA's were being release from upstream storage reservoirs.

[1] Northwest hydraulic consultants: Glendale Diversion Weir & Intake Modification Design

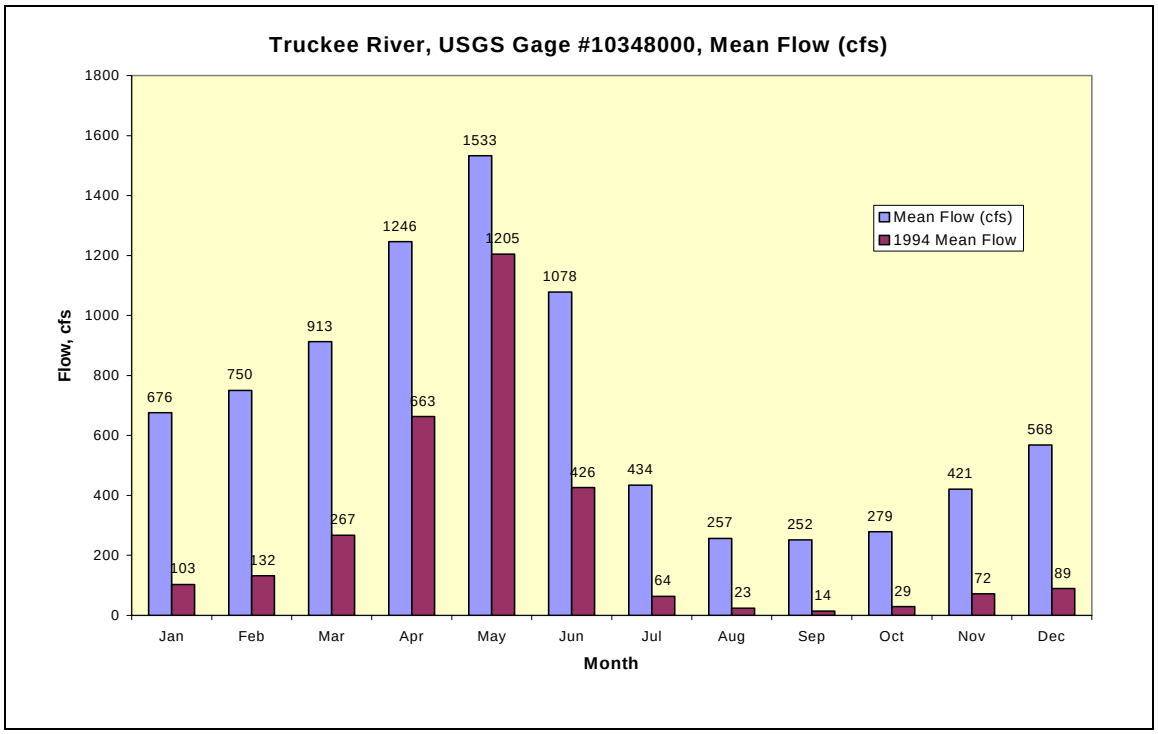

Table 4.1 Truckee River Flows

4.3 Sediment Transport

A sediment transport channel to funnel sediment and debris away from the screens must be an integral part of the new design. NHC[2] reports medium and coarse sediment loading rates in this reach of the Truckee River at "approximately 51,000 tons/year," and suspended sediment loading at "approximately 250,000 tons/year." This a significant amount of bed loading that will require managing near the screens. Sediment transport should be an integral portion of the hydraulic modeling required for a new diversion.

4.4 Trash Racks

If new on channel fish screens are incorporated into the design for a new diversion, new trash racks should protect them. NHC[2] has recommended design parameters that should be included in the new trash rack design:

- Maximum size of woody debris to be a log 12 inches in diameter and 15 feet long.
- Maximum velocity of woody debris at impact 12 fps.
- Woody debris wetted unit weight 55 lbs per cubic foot.
- Trash rack minimum spacing 12 inches.

[2] Northwest hydraulic consultants: Glendale Diversion Weir & Intake Modification Design

- Trash rack cleaning to be automatic and continuous.

If off-channel fish screens are decided upon, it may not be necessary to install new trash racks unless the existing trash racks are not performing satisfactorily.

4.5 River Recreational Uses

An important aspect of an improved weir design will be provision for recreational users and or boat-ways over the diversion. NHC's report details the required boat passage design criteria, which is also listed below:[3]

- Minimum width of a drop: 15 ft to prevent pinning of boats on rocks
- Minimum width of a pool: 30 ft to allow for eddy formation
- Minimum pool depth: 3 ft to provide ample head room for overturned kayakers
- Minimum pool length: 40 ft to provide enough room for one or more kayak roll attempts
- Rock and boulder construction, concrete drops have uniform edges that encourage formation of keeper holes that trap boaters and debris
- Difficulty of rapids formed by drops should be consistent with the difficulty of the rest of the river reach so as to not present short, more difficult reaches to less experience rowers
- Hydraulic jump formation at drops should be undulating and standing waves; plunging jets and submerged rollers of water off of drops should be avoided.

Issues to be resolved with design of boat passageways are placement and volume of water required during low flow periods. If the boat and fish ladder are combined, then restricting water for recreation to ensure an adequate diversion rate during low flow periods may potentially impact fish passage. If the boat passage and fish ladder are separated, the required volume of water to keep both flowing will increase, and may not be available during the summer months. Modeling of the diversion with actual design alternatives may be the best avenue for solution of these issues.

4.6 Fisheries

4.6.1 Fish Passage

Chinook Engineering of Coupeville, Washington, performed the technical analysis and development of the fisheries design criteria for this report (Attachment 9.2). The United States Fish and Wildlife Service (USFWS) have indicated that the species of concern for the fish passage and screens are the

[3] Northwest hydraulic consultants: Glendale Diversion Weir & Intake Modification Design

Lahontan Cutthroat Trout (LCT) or the Cui Ui. The Cui Ui may be the governing design specie, as they have less vigorous swimming characteristics that would need to be accounted for in the design. The fish passage guidelines for the Cui Ui were established by the Bureau of Reclamation's work at the Derby Dam, and published in the "Environmental Assessment Derby Dam Fish Passage Facility," May 2001. The Cui Ui and Lahontan Cutthroat Trout fish passage design criteria shown are excerpted from the Chinook report and displayed in the table below:[4]

Design Criteria Summary River flow basis, Reno Gage		
	Lahontan cutthroat trout Juveniles and Adults	Cui Ui
Criteria	Value	Value
Maximum Vertical Step of pathway at structures	0.5 ft.	0.4 ft.
Maximum Percent Slope	5.5% With interstitial pathways	1.5 - 2%
Anticipated Percent Slope	<5%	<2%
Minimum Flow depth	1 ft.	4 ft.
Fish Passage High Flow Rate	Q_{High} = 6000 cfs	Q_{High} = TBD cfs
Fish Passage Low Flow Rate, 2-Year, 7-Day Low Flow	Q_{Low} = 150 cfs	Q_{Low} = 5??? cfs
Fish Passage Efficiency	1,000 fish/day	100,000 fish/day
Maximum Average-Depth Velocity at 0.6' depth	V = 4 fps	V = 4 fps
Burst swimming velocity	V = 4 fps, Juveniles	
Prolonged swimming velocity	V = 2 fps, Juveniles	
Fish Screen Criteria	$V_{through\ screen}$ = 0.33 fps	
Fish Screen Criteria	$V_{sweeping\ screen}$ > 0.33 fps	

Table 4.2 Fish Passage Design Criteria

[4] Chinook Engineering, Glendale Diversion Fisheries Engineering Investigation, Alternative Study

4.6.2 Fish Screens

The guidelines for the fish screening requirements are governed by the National Marine Fisheries Service (NMFS). The guidelines are published in the "Fish Screening Criteria for Anadromous Salmonids," January 1997 (Attachment 9.4), and express a preference for on-channel screening with screens parallel to the river flow and aligned with the bank to prevent eddies in the current near the screens. This requirement will necessitate extension of the existing intake area to the edge of the open area in front of the screens so that screen placement can be parallel to the channel flow. The intent of this type of design is to leave the juvenile fish in the river. Another type of screen that may be acceptable under certain circumstances is off-river screening with return flow. This would require the screens to be constructed in the intake channel with return flow to the river.

Screening issues to be resolved include the NMFS requirement for the fish screen sweeping velocity to be greater than the approach velocity. TMWA is in the unique position of anticipating the diversion of 100% of the POSW release in the river during extreme drought conditions. This does not accommodate the NMFS requirements for sweeping flow at the fish screens if juvenile fish are present. Water supply for the juvenile fish, if present, or the return flow requirement for off channel screening, will need to be resolved as part of the next phase of design whether on-channel or off-channel screening is chosen.

4.7 Hydraulic Efficiency

Flow calculations for the three 54" CMP's for water conveyance to the intake channel indicate a minimum elevation requirement of three feet to deliver 58 cfs, or 37.5 MGD to the water plant, and when added to the existing intake pipe invert elevation of 4431.6, provides an estimated weir crest elevation of 4434.6 for a new diversion structure.

4.8 Modeling Requirements

A new diversion structure will impact both normal flow and flood control issues on the Truckee River. HEC-RAS modeling of the design should be performed in conjunction with hydraulic modeling of a scaled model of the proposed design to ensure there will be no adverse impacts on the environment by the proposed weir, and also to model efficiency of the diversion process when coupled with the other physical requirements of the weir.

5 Environmental Issues

Replacement of the Glendale diversion weir, and construction of the fish bypass will require destruction and revegetation of riparian habitat on both sides of the

river. Western Botanical Services, Inc. has prepared a Revegetation Analysis (Attachment 9.3). The revegetation analysis contains a description of the species of plants and trees found at the Glendale diversion site, and includes recommendations for preservation of existing vegetation, salvaging of vegetation during construction, construction sequencing, post construction vegetative maintenance requirements, and noxious weed control. There are specific strategies identified for different parts of the project area, as well as sample specifications and unit cost estimates.

5.1 Permit Requirements for Replacement of the Existing Glendale Diversion and Intake Structure

Permitting requirements were discussed under the previous Phase I analysis, and are reiterated here for the purposes of keeping relevant project information together. Permitting / government coordination requirements for replacement of the Glendale diversion weir and construction of the fish bypass include:

5.1.1 Rolling Stock Permit

Contact: Icyl Mulligan, Water Pollution Control, NDEP

5.1.2 401 Water Quality Permit

Contact: Glen Gentry, Water Quality Planning, NDEP

5.1.3 Nationwide 404 Permit No. 7, if applicable(See Attachment 9.5 for copy of permit)

Nationwide 404 Permit No. 7 was re-issued in January 15, 2002, and expires in 2007. ECO:LOGIC recommends that TMWA seek to have the replacement of the Glendale diversion and intake structure authorized under this nationwide permit. If the US Army Corps of Engineers do not feel that this is permit is applicable, then TMWA would need to pursue an Individual 404 permit through the Sacramento District.

Contact: Richard Gephardt, USACE Reno office

5.1.4 Individual 404 Permit, if applicable:

The Carson-Truckee Water Conservancy District has jurisdiction from the California/Nevada State Line to the Glendale Avenue Bridge. Applications are reviewed by the Conservancy Board, and then forwarded to the Flood Control branch of USACE for review and approval. If it is determined that an Individual 404 Permit is required for the project, then the first step would be to set up a pre-application meeting with the Corps of Engineers.

Contact: Gwyn Estrella (Conservancy District)

Kennedy/Jenks, Conservancy District Engineer
Richard Gephardt (USACE Reno),
Andy Rosneau (USACE Sacramento)

5.1.5 Easement to work on State Lands, or exemption from easement

Contact: Dave Wilson, Nevada Department of Conservation and Natural Resources, State Lands Division

5.1.6 City of Sparks: Notification of the intended maintenance activities, and required permission to trespass for access to the river, is normally asked for and granted by The City of Sparks.

Contact: Shawn Gooch, City of Sparks

5.1.7 Carson-Truckee Water Conservancy District: All work being performed in the river upstream of the Glendale bridge requires approval.

Contact: Gwyn Estrella, Conservancy District
Kennedy/Jenks, Conservancy District Engineer

5.2 Possible Funding Assistance

Truckee River Flood Management Project: ECO:LOGIC met with Paul Urban (see Attachment 9.6 for meeting notes), project manager for the Truckee River Flood Management Project, in July 2002 to discuss possibilities for funding of certain elements of the Diversion project. The Truckee River Flood Project Community Coalition has noted the Glendale diversion as a structure of concern, not so much from a flood control perspective, but from the perspective that it is a hazard for recreational use of this stretch of the river by boaters.
According to Paul, recreation elements of the project would not be eligible for funding. There is, however, the possibility to partially fund up to 75% of the habitat restoration elements of the diversion project. It would be important to discuss this possibility further with Paul Urban when construction plans and specifications are being developed to ensure that there is adequate separation of costs, perhaps even a separate contract for restoration elements, so that restoration costs can be accurately tracked and reimbursed. Additionally, in order to respond to the numerous requests for funding of projects under the Truckee River Flood Management Project, Paul will be working to develop criteria for prioritization of project funding.

U.S. Army Corps of Engineers: There may be additional funding opportunities available to TMWA through Corps of Engineers programs

geared towards wetlands / river restoration and endangered species preservation.

6 CONSTRUCTION SCHEDULE

A projected construction schedule is included that reflects approximately a ninety-week Design, Modeling, and Permitting timeframe, with construction in the summer of 2005.
(NOTE: Anticipated construction dates revised in 2004 to reflect a 2007 construction period).

Table 6.1 2005 Construction Schedule

7 HILTON POND

Discussions surrounding the use of the Hilton Pond have centered on use of the pond for emergency supply, with further negotiations between The Hilton and TMWA being required. The Hilton has expressed concern over the influx of river water that may be warmer than the pond water, but initial investigations show that if Hilton Pond water were replenished at night, that there might be minimal impact. Water temperatures for the 2002 Glendale influent and the Hilton Pond data from the 1993 UNR Energy Assessment Study are depicted in table 7.1.

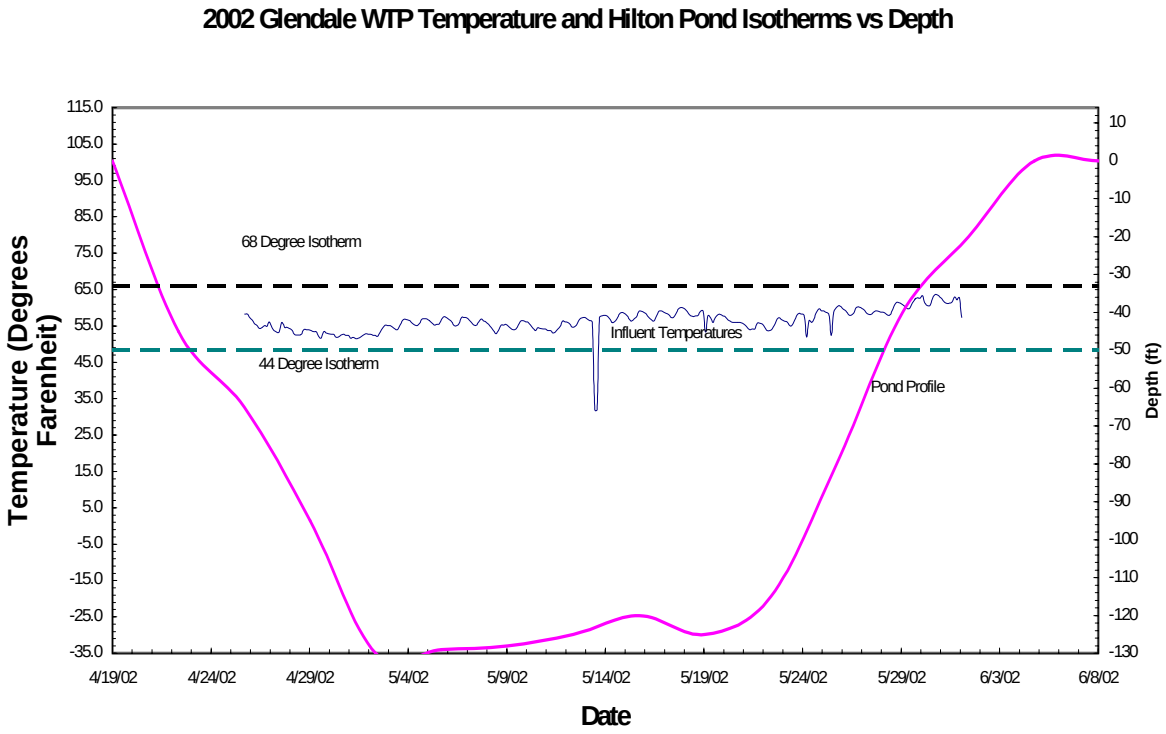

Table 7.1 Glendale Influent vs. Hilton Pond Temp.

The University of Nevada has expressed interest in providing support to TMWA with ongoing negotiations with The Hilton. They have submitted a proposal (Attachment 9.7) for $31,500 to construct a computer model of the pond and its current usage, and then run simulations using their TRNSYS program to:

- Using Pond water as temporary supply to Glendale facility with no makeup water to the Pond.
- Using Pond water as temporary supply to Glendale facility with river makeup water to the Pond.

- Using Pond water as constant supply to Glendale facility with river makeup water to the Pond.

UNR will provide support for TMWA's negotiations with the Hilton based on the model simulation data.

The benefit to TMWA from use of the Hilton Pond would be primarily as an source of supply for emergency use when the river Truckee would be contaminated or otherwise unavailable for use. Based on TMWA findings presented in a memo at a January 2001 NDOT meeting (Attachment 9.8), the Glendale water plant was off line due to turbidity events for 64 hours in the three previous treatment seasons (years), which would not justify the cost of pipeline and pump station improvements. Water quality analysis was performed on the Hilton Pond by TMWA staff, and met current drinking water standards. Supply to and from the Hilton Pond may be provided through a future connection to the Glendale raw water pipelines via installation of a tee with a blind flange until the connection is required.

8 CONCLUSION:

ECO:LOGIC is recommending design and installation of a new Glendale weir in approximately the same location to ensure efficient capture of POSW water during drought conditions, so that water storage in upstream reservoirs can be utilized to their maximum efficiency for the community's long term benefit.

The recommended weir design should incorporate the smallest footprint possible that provides the necessary design requirements:

1. 58 cfs (37.5 MGD) diversion capacity during minimal river flow periods
2. 100 percent POSW capture during drought conditions
3. Sediment transport away from the screening structure
4. Fish Screens
5. Fish passage as required for identified fish species
6. Boating and recreational passage and safety
7. No impact on flood water passage

The recommended weir material is concrete on the upstream face for low maintenance and stability, with either a smooth face, grouted riprap, or concrete supported cobbles downstream for a natural appearance. The design should be both numerically and physically modeled before construction to ensure design parameters meet predictions and requirements.

9 ATTACHMENTS

9.1 northwest hydraulic consultants. Glendale Diversion Weir & Intake Design, November 2002

9.2 Chinook Engineering. Glendale Diversion Fisheries Engineering Investigation, Alternative Study, January 2003

9.3 Western Botanical Services. Draft Vegetation Analysis, October 2002

9.4 National Marine Fisheries Service Southwest Region. Fish Screening Criteria for Anadromous Salmonids, January 1997

9.5 U.S. Army Corps of Engineers Sacramento District. Nationwide Permit Summary 33CFR Part 330; Issuance of Nationwide Permits, February 2002

9.6 Glendale Diversion Meeting Minutes with Mike Wilkin, Lisa Haldane, Paul Urban. Joint Funding Issues, July 2002

9.7 University of Nevada Energy Assessment Center. Feasibility Analysis Proposal for Potential Use of the Hilton Pond, January 2003

9.8 Truckee Meadows Water Authority. NDOT Meeting Summary of Findings, January 2001