Lake Powell Pipeline Project
FERC Additional Information Request Schedule B – Item 16

Exhibit E

16. In your response to our comment 28 on the PLP, you say that additional information about estimated dewatering flow rates where groundwater is expected during open-cut channel crossings would be addressed in final design. In order to complete our analysis of potential effects on groundwater and surface water resources, please provide your best estimate of the dewatering flow rates.

UBWR Response:

Estimated dewatering flow rates for drainage channel crossings by LPP project alignment alternatives are shown in Table 2-1. The estimated depth to groundwater is based on soil survey data obtained from the Natural Resources Conservation Service (NRCS), field reconnaissance of each alignment alternative crossing, and assumptions based on observed site conditions. Field reconnaissance information used to estimate the depth to groundwater included surrounding geological features visible at the ground surface, soils observed, and presence/absence of riparian vegetation within the drainage channels and associated floodplains. The hydraulic conductivity of each soil type in Table 2-1 is estimated by the NRCS. The saturated thickness of an aquifer is assumed based on estimated effective saturation of an upper aquifer. The saturated thickness at the trench when dewatered assumes the dewatering draws down an aquifer to two feet below the excavated trench bottom. The distance from maximum drawdown to zero drawdown is assumed with a conservative number. The estimated dewatering rate is calculated by equation 22.7 in *Groundwater and Wells* (Driscoll 1995).

The Paria River is the only drainage along the LPP project alignments with stream flow recorded by a USGS gage. The USGS stream flow gage is located on the downstream end of the Highway 89 bridge, downstream from the proposed Water Conveyance System pipeline crossing. Two open cuts of the sandy soils comprising the Paria River substrates are anticipated as part of the pipeline construction at this crossing. The estimated dewatering rate at the Paria River crossing would range from 95 to 120 gallons per minute (gpm).

The Proposed Action (South) alignment would cross Kanab Creek south of the Kaibab-Paiute Indian Reservation immediately upstream of the Jacob Canyon confluence with Kanab Creek. Depth to groundwater is not applicable at this crossing site because Kanab Creek is an ephemeral drainage at this site and the channel occurs over bedrock that exhibits no discharging aquifer. Kanab Creek canyon at this crossing site is a headcut into layers of surrounding bedrock, extending downstream to the Grand Canyon. Therefore, no groundwater would be encountered during excavation for the penstock at this crossing site and negligible or no dewatering is anticipated.

The Hydro System Existing Highway Alternative alignment would cross Kanab Creek near Fredonia, Arizona approximately 1.5 miles upstream (north) of the Highway 389 bridge. Kanab Creek flows across a broad alluvial floodplain at this crossing site. Depth to groundwater at this alignment alternative crossing site is estimated at approximately 10 feet. Estimated dewatering

rates for the Existing Highway Alternative alignment penstock trench crossing Kanab Creek range from 2 to 9 gpm.

The Cane Beds area along the Hydro System alignment between Yellowstone Road and Colorado City, AZ consists of a broad alluvial valley with wells showing groundwater depth is normally deeper than the LPP project penstock trench depth. The estimated depth to groundwater ranges from 20 to 40 feet below the ground surface. Therefore, no groundwater would be encountered during excavation for the penstock at this crossing site and negligible or no dewatering is anticipated.

The Hydro System would cross Short Creek in Colorado City, AZ immediately upstream of the Highway 389 bridge and also downstream in Canaan Gap between Lost Spring Mountain (Arizona) and Little Creek Mountain (Utah). Short Creek is an ephemeral drainage The estimated depth to groundwater at the Short Creek crossing in Colorado City is 12 feet. The estimated dewatering rate for the Hydro System penstock construction at this drainage crossing site is 10 gpm.

All other drainage crossing sites along the LPP project alignments are ephemeral drainages that only have active surface flow resulting from intense precipitation events. The drainage channels that would be crossed by the LPP project alignment alternatives are developed in desert soil conditions, many with bedrock at or near the surface, and have no riparian vegetation growing in the channel except where surface runoff has been impounded for livestock watering. Depths to groundwater at all of these drainage crossings is estimated to be far deeper than the trench excavation depth averaging 12 feet. Therefore, no dewatering is expected to be necessary at any of the other drainage crossing sites along the LPP project alignments.

Table 2-1
Estimated Dewatering Flowrates at Drainage Crossings Where Groundwater Could be Encountered

System: Alignment Alternative	Drainage Crossing Location	Trench Length, x (ft)	Trench Length Rationale	Soil Type(s)[1]	Depth of Soil[1] (ft)	Depth to Groundwater[1,2] (ft)	Hydraulic Conductivity, Ksat[1] (gal/day/ft^2)	Saturated Thickness of Aquifer, H[3] (ft)	Saturated Thickness at Trench When Dewatered, h[4] (ft)	Distance from Maximum Drawdown to Zero Drawdown, L_0[5] (ft)	Estimated Dewatering Rate, Q[6] (gpm)	Comments
Water Conveyance System: (All Alternatives)	Paria River	300	½ of floodplain	Radnik/Swanee Complex; Mido-Yarts Complex	>6.6	10	158; 195	20	16	50	95 - 120	Range of flow for each soil type.
Hydro System: South, Southeast Corner	Kanab Creek	50	floodplain	Rock Outcrop	0	Not Applicable	Not Applicable	0	0	Not Applicable	0	Bedrock; likely negligible flow.
Hydro System: Highway	Kanab Creek	50	floodplain	Glenyon silty clay loam; Jocity loamy fine sand	>6.6	10	88; 19	20	16	50	2 - 9	Range of flow for each soil type. May be negligible flow.
Hydro System: (All Alternatives)	Cane Beds	500	max. day	Barx fine sandy loam	>6.6	20-40	Not Applicable	Not Applicable	Not Applicable	Not Applicable	0	Well logs in general area show groundwater depth normally deeper than trench depth.
Hydro System: (All Alternatives)	Short Creek	50	floodplain	Mido fine sand/fine loamy sand	>6.6	12	195	20	18	50	10	Stream only flows during storm events and runoff.

Notes:
1) NRCS, 2016. Web Soil Survey. http://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx
2) Assumed depths to groundwater based on site conditions because in all cases groundwater is deeper than NRCS estimated maximum value of 6.6 feet.
3) Assumed based on estimated effective saturation of upper aquifer; no data available.
4) Assumed; no data available. Assumes drawdown dewaters aquifer to 2 feet below bottom of trench.
5) Assumed (conservative).
6) Driscoll, F.G. 1995. *Groundwater and Wells.* Johnson Screens, St. Paul, MN., 1089 pp. Equation 22.7: $Q = [2x(Ksat)(H^2 - h^2)]/[(2880)(L_0)]$, flow from both sides of trench.