Appendix A

Project Specific Cost Estimates and Technology and Design Considerations

Project Specific Cost Estimates and Technology and Design Considerations

A1.1 El Dorado Main 2 PRS 1

PRIORITY:
Recommended for immediate implementation

PURVEYOR LEAD: EID

Project Category: Feed-In Tariff

Design Head (ft): 222

Design Flow (cfs): 24

Nameplate capacity (kW): 360

Estimated Annual MWh/year: 1,739

Photo 1 – El Dorado Main 2 Pressure Reducing Station No. 1 at Reservoir 3

Capital Cost to Construct (Estimated): $1,556,000

Annual Income: $205,976 (assumes 20-year FIT agreement with PG&E; annual revenues cannot be reasonably projected beyond the 20-year analysis period)

EXISTING FEATURES:

Avg. annual flow (cfs)	Distance to 3-phase Power (ft)	Pipeline (in.)	Access Road	Downstream Storage	Land Ownership
21	**500**	**30**	**Y**	**Y**	**EID/USFS**

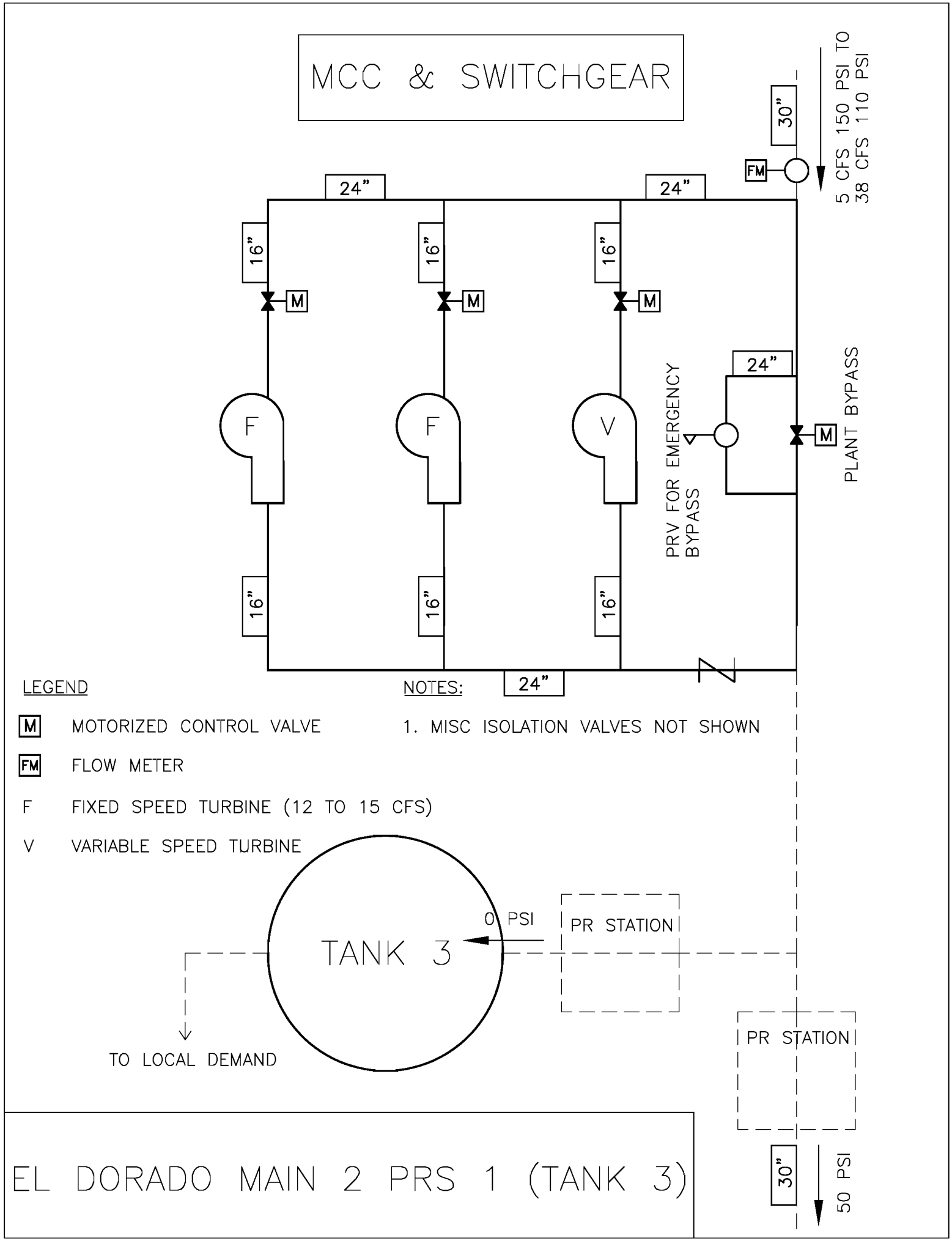
PROJECT DESCRIPTION:

This project is at an existing PRS on El Dorado Main 2 at the inlet to Reservoir 3, located adjacent to the U.S. Forest Service (USFS), Institute of Forest Genetics property, on Carson Road. The energy production is somewhat higher when compared to the other PR sites (approx. 1,700 MWh). The PRS structure is located adjacent to the Reservoir 3 property. Area within the Reservoir 3 property is available with few structures other than the existing tank. Placement on the adjacent USFS property would be an option. 3-phase power is nearby. Placing the hydro site on the Reservoir 3 property would require additional piping from the existing 30-inch pipeline, adding cost to the project. The hydro station would consist of three PATs, with one turbine operating at variable speed with a regenerative power converter. The facilities would be housed in a masonry building approximately 400 square feet in area. The flows vary more than some sites but are higher and there is available storage at Reservoir 3 to assist in flow regulation. This is a FIT project.

El Dorado Main 2 PRS 1 (Tank 3)
Engineer's Preliminary Estimate of Probable Costs

Element Description	Estimated Quantity	Units	Unit Price (installed)	Estimated Amount
Mobilization & Site work				
Mobilization, Bonds, Insurance	1	LS	$ 30,000	$ 30,000
Traffic Control	1	LS	$ 1,500	$ 1,500
Site Grading & Paving & Access	1	LS	$ 25,000	$ 25,000
Fencing	1	LS	$ 10,000	$ 10,000
			Subtotal =	**$ 66,500**
Pipe, Valves and Fittings				
Intake and Return Tie into existing 30" line (Including de-water of pipe)	1	LS	$ 30,000	$ 30,000
24" In -Line Bypass Valve, piping & vault	1	LS	$ 32,000	$ 32,000
24" pipe to and from plant	60	LF	$ 200	$ 12,000
Intake and Return Manifolds	1	LS	$ 20,000	$ 20,000
16" turbine pipe runs	50	lf	$ 185	$ 9,250
12" motorized control valve	3	EA	$ 9,500	$ 28,500
12" pressure reducing valve	1	EA	$ 8,500	$ 8,500
24" check valve	1	EA	$ 11,000	$ 11,000
isolation valves, reducers, misc fittings	1	LS	$ 22,000	$ 22,000
24" flow meter	1	EA	$ 16,000	$ 16,000
			Subtotal =	**$ 189,250**
Turbine/Generator Units				
120 KW Pump as Turbine/Generator Units Installed	3	EA	$ 125,000	$ 375,000
			Subtotal =	**$ 375,000**
Electrical Equipment & Tie-in to Grid				
Electrical Controls/Switchgear for turbine/generator units	1	LS	$ 120,000	$ 120,000
Electrical utility /transformer , misc site electrical	1	LS	$ 95,000	$ 95,000
Hook-up to Grid (power lines, transformers, switches)	1	LS	$ 45,000	$ 45,000
			Subtotal =	**$ 260,000**
Building and Misc Structural				
Masonry building	400	SF	$ 150	$ 60,000
Foundation structure (concrete)	8	CY	$ 550	$ 4,400
Roofing & Misc supports	1	LS	$ 40,000	$ 30,000
			Subtotal =	**$ 94,400**
			Materials/Installation Subtotal =	**$ 985,150**
			15% Construction Contingency Costs=	$ 147,773
			TOTAL CONSTRUCTION COST:	**$ 1,133,000**
Non -Construction Costs				
Admin/Planning/Design/Environmental Docs (% of construction costs)	15%	LS		$ 169,950
Environmental Mitigation (% of construction costs)	8%	LS		$ 90,640
Right of Way Costs	0.5	AC	$ 30,000	$ 15,000
Construction Administration (% of construction costs)	8%	LS		$ 90,640
				$ 56,650
			Subtotal =	**$ 423,000**
			TOTAL ESTIMATED COST =	**$ 1,556,000**

Annual Costs				
Administration and Insurance ($0.0033/kWh)	1700000	$0.0033	$	5,610
Operation & Maintenance (Labor)			$	7,058
Repair and Replacement (Parts and Material), (0.3% of total construction cost)		0.30%	$	3,399
Subtotal			$	16,067
Contingency (20%)		20%	$	3,213
Total O&M			$	19,280


MCC & SWITCHGEAR
30"
FM
5 CFS 150 PSI TO
38 CFS 110 PSI
24"
24"
16"
16"
16"
M
M
M
F
F
V
24"
M
PRV FOR EMERGENCY
BYPASS
PLANT BYPASS
16"
16"
16"
24"
LEGEND
M MOTORIZED CONTROL VALVE
FM FLOW METER
F FIXED SPEED TURBINE (12 TO 15 CFS)
V VARIABLE SPEED TURBINE
NOTES:
1. MISC ISOLATION VALVES NOT SHOWN
TANK 3
0 PSI
PR STATION
PR STATION
TO LOCAL DEMAND
30"
50 PSI
EL DORADO MAIN 2 PRS 1 (TANK 3)

A1.2 El Dorado Main 2 PRS 3

Photo 2 – El Dorado Main 2 Pressure Reducing Station No. 3 west of Reservoir 3

PRIORITY:
Recommended for reoperation study

PURVEYOR LEAD: EID

Project Category: Feed-In Tariff

Design Head (ft): 152

Design Flow (cfs): 24

Nameplate capacity (kW): 195

Estimated Annual MWh/year: 892

Capital Cost to Construct (Estimated): $1,409,000

Annual Income: $109,667 (assumes 20-year FIT agreement with PG&E; annual revenues cannot be reasonably projected beyond the 20-year analysis period)

EXISTING FEATURES:

Avg. annual flow (cfs)	Distance to 3-phase Power (ft)	Pipeline (in.)	Access Road	Downstream Storage	Land Ownership
14	**1,000**	**24**	**Y**	**Y**	**EID**

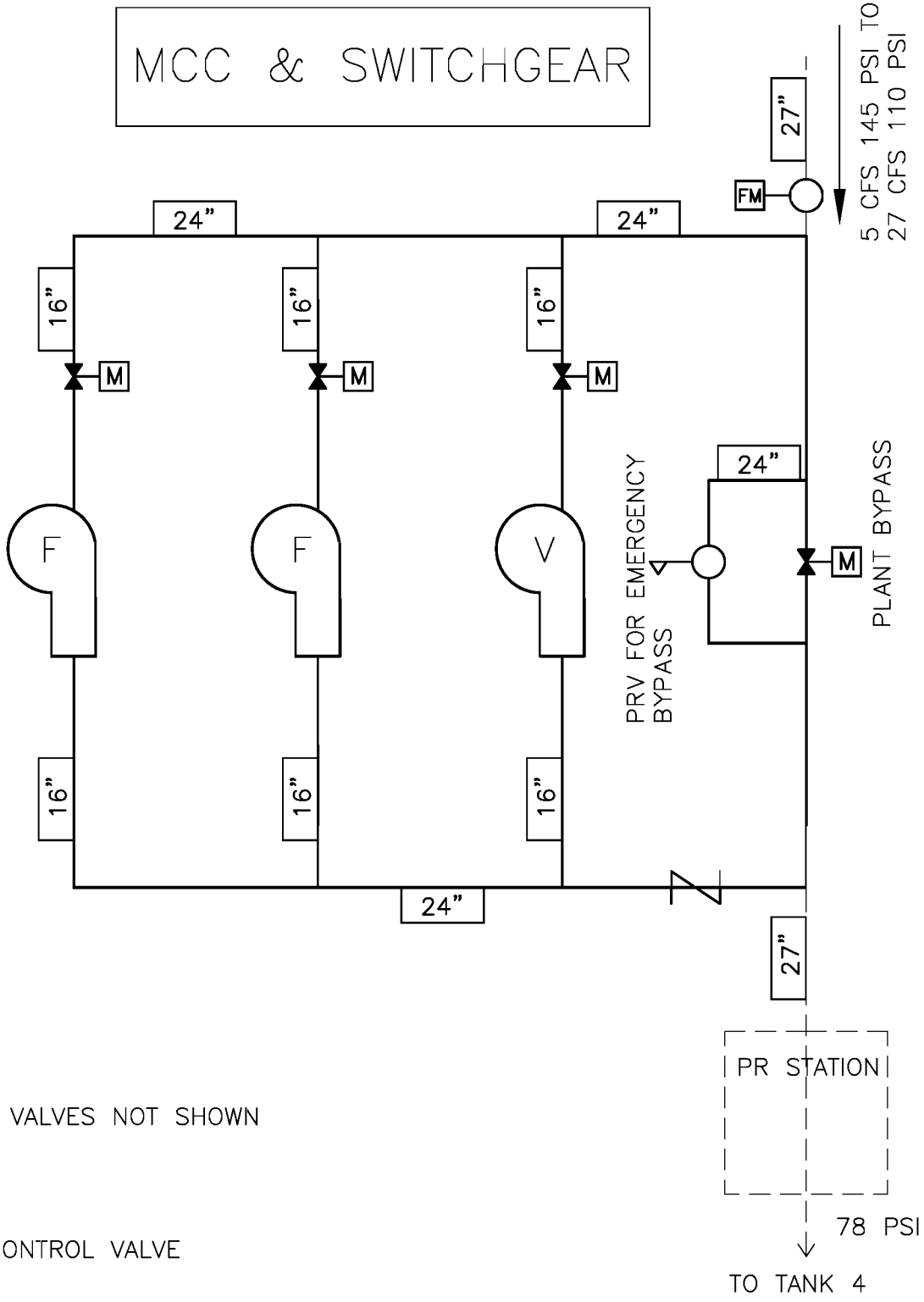
PROJECT DESCRIPTION:

This project is at an existing PRS on EID's El Dorado Main 2 system, located 4,500 feet downstream from Reservoir 3 on Whispering Wind Drive. The site, situated at 2,270 feet elevation, is relatively flat and has good construction access and 3-phase power nearby. The hydro station would consist of three PATs with one turbine operating at variable speed with a regenerative power converter. The proposed facilities will be housed in a masonry building approximately 400 square feet in area. As with many of the PRS sites there is no system storage and flows vary widely, requiring flow regulation through multiple units and valve controls. This is a FIT project with relatively low construction costs.

El Dorado Main 2 PRS 3
Engineer's Preliminary Estimate of Probable Costs

Element Description	Estimated Quantity	Units	Unit Price (installed)	Estimated Amount
Mobilization & Site work				
Mobilization, Bonds, Insurance	1	LS	$ 25,000	$ 25,000
Traffic Control	1	LS	$ 2,500	$ 2,500
Site Grading & Paving & Access	1	LS	$ 30,000	$ 30,000
Fencing	1	LS	$ 10,000	$ 10,000
			Subtotal =	**$ 67,500**
Pipe, Valves and Fittings				
Intake and Return Tie into existing 24" line (Including de-water of pipe)	1	LS	$ 25,000	$ 25,000
24" In -Line Bypass Valve, piping & vault	1	LS	$ 32,000	$ 32,000
24" pipe to and from plant	60	LF	$ 200	$ 12,000
Intake and Return Manifolds	1	LS	$ 20,000	$ 20,000
16" turbine pipe runs	50	lf	$ 185	$ 9,250
12" motorized control valve	3	EA	$ 9,500	$ 28,500
12" pressure reducing valve	1	EA	$ 8,500	$ 8,500
24" check valve	1	EA	$ 11,000	$ 11,000
isolation valves, reducers, misc fittings	1	LS	$ 22,000	$ 22,000
24" flow meter	1	EA	$ 16,000	$ 16,000
			Subtotal =	**$ 184,250**
Turbine/Generator Units				
65 KW Pump as Turbine/Generator Units Installed	3	EA	$ 90,000	$ 270,000
			Subtotal =	**$ 270,000**
Electrical Equipment & Tie-in to Grid				
Electrical Controls/Switchgear for turbine/generator units	1	LS	$ 110,000	$ 110,000
Electrical utility /transformer , misc site electrical	1	LS	$ 95,000	$ 95,000
Hook-up to Grid (power lines, transformers, switches)	1	LS	$ 60,000	$ 60,000
			Subtotal =	**$ 265,000**
Building and Misc Structural				
Masonry building	400	SF	$ 150	$ 60,000
Foundation structure (concrete)	8	CY	$ 550	$ 4,400
Roofing & Misc supports	1	LS	$ 40,000	$ 40,000
			Subtotal =	**$ 104,400**
			Materials/Installation Subtotal =	**$ 891,150**
			15% Construction Contingency Costs=	$ 133,673
			TOTAL CONSTRUCTION COST:	**$ 1,025,000**
Non -Construction Costs				
Admin/Planning/Design/Environmental Docs (% of construction costs)	15%	LS		$ 153,750
Environmental Mitigation (% of construction costs)	8%	LS		$ 82,000
Right of Way Costs	0.5	AC	$ 30,000	$ 15,000
Construction Administration (% of construction costs)	8%	LS		$ 82,000
Financing Cost				$ 51,250
			Subtotal =	**$ 384,000**
			TOTAL ESTIMATED COST =	**$ 1,409,000**

Annual Costs			
Administration and Insurance ($0.0033/kWh)	890000	$0.0033	$ 2,937
Operation & Maintenance (Labor)			$ 7,058
Repair and Replacement (Parts and Material), (0.3% of total construction cost)		0.30%	$ 3,075
Subtotal			$ 13,070
Contingency (20%)		20%	$ 2,614
Total O&M			$ 15,684



NOTES:

1. MISC ISOLATION VALVES NOT SHOWN

LEGEND

M	MOTORIZED CONTROL VALVE
FM	FLOW METER
F	FIXED SPEED TURBINE (7 TO 12 CFS)
V	VARIABLE SPEED TURBINE

EL DORADO MAIN 2 PRS 3

A1.3 Oak Ridge Tanks to Bass Lake Tanks Pumped Storage

Photo 3 – One of Bass Lake Tanks

PRIORITY:
Recommended for reoperation study

PURVEYOR LEAD: EID

Project Category: Feed-In Tariff

Design Head (ft): 400

Design Flow (cfs): 10

Nameplate capacity (kW): 280

Estimated Gross/Net Annual MWh/year: 874/(30)

Capital Cost to Construct (Estimated): $774,000

Gross Annual Income: $117,388 (assumes 20-year FIT agreement with PG&E; annual revenues cannot be reasonably projected beyond the 20-year analysis period)

EXISTING FEATURES:

Avg. annual flow (cfs)	Distance to 3-phase Power (ft)	Pipeline (in.)	Access Road	Downstream Storage	Land Ownership
5	**300**	**18**	**Y**	**Y**	**EID**

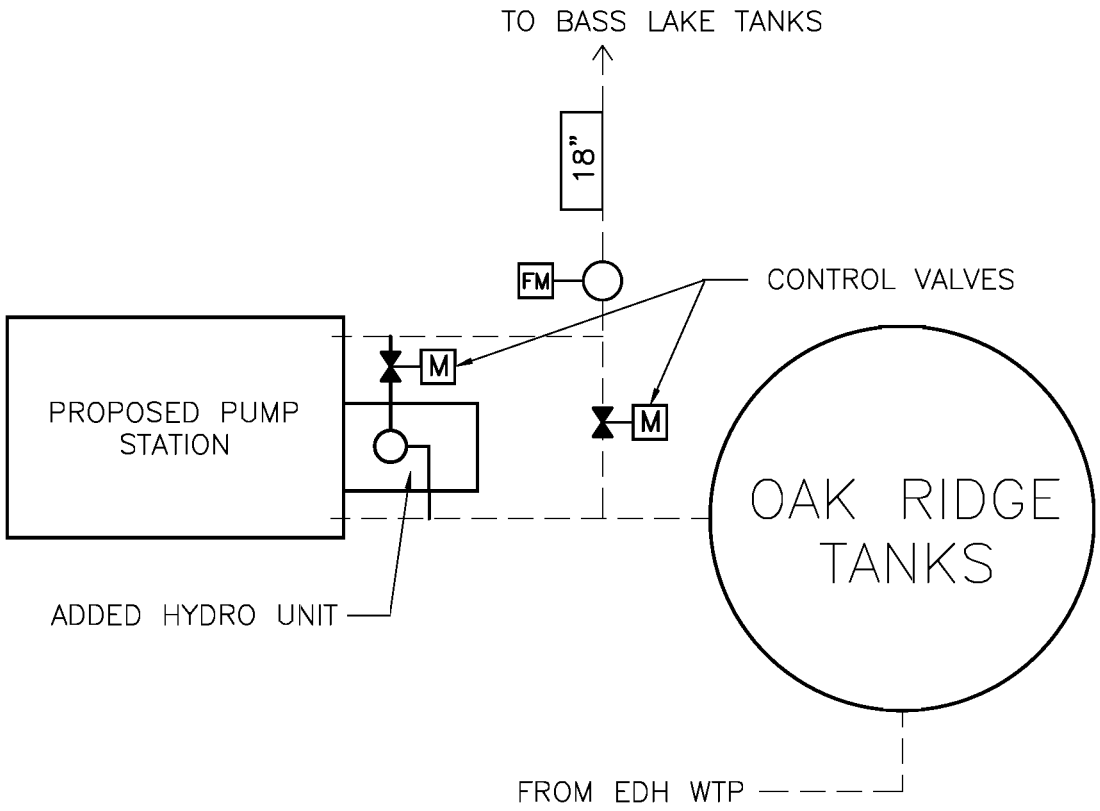
PROJECT DESCRIPTION:

This project is at a pumping station currently under design at the Oak Ridge storage facilities in the community of El Dorado Hills. The project would be a pumped storage project, pumping flow from the Oak Ridge storage tanks to Bass Lake storage tanks during off-peak hours, then generating power at the Oak Ridge tanks site during peak energy demand periods. The hydro station will consist of one PAT with variable speed and a regenerative power converter. The facilities will be housed in a masonry building approximately 400 square feet in area. Access and distance to power grid are good. This is a FIT project with relatively low overall construction costs. Whether or not the existing storage is sufficient for feasible operations will be an important component to the future review of this hydro option.

Oak Ridge Tanks to Bass Lake Tanks Pump
Engineer's Preliminary Estimate of Probable Costs

Element Description	Estimated Quantity	Units	Unit Price (installed)	Estimated Amount
Mobilization & Site work				
Mobilization, Bonds, Insurance	0	LS	$ 20,000	$ -
Traffic Control	0	LS	$ 1,000	$ -
Site Grading & Paving & Access	1	LS	$ 5,000	$ 5,000
Fencing	0	LS	$ 10,000	$ -
			Subtotal =	**$ 5,000**
Pipe, Valves and Fittings				
Turbine Intake and Return Tie into new pump station & tank lines	1	LS	$ 25,000	$ 25,000
12" In -Line Bypass Valve, piping & vault	1	LS	$ 18,000	$ 18,000
12" pipe to and turbine	40	LF	$ 150	$ 6,000
10" turbine pipe runs	25	lf	$ 135	$ 3,375
10" motorized control valve	1	EA	$ 8,500	$ 8,500
12" check valve	1	EA	$ 7,500	$ 7,500
isolation valves, reducers, misc fittings	1	LS	$ 16,000	$ 16,000
			Subtotal =	**$ 84,375**
Turbine/Generator Units & pump sta modifications				
280 KW Pump as Turbine/Generator Units Installed	1	EA	$ 180,000	$ 180,000
Additional Pumping Capacity at new PS	1	EA	$ 50,000	$ 50,000
Valve Modifications at Bass Lake Tanks	1	EA	$ 15,000	$ 15,000
			Subtotal =	**$ 245,000**
Electrical Equipment & Tie-in to Grid				
Electrical Controls/Switchgear for turbine/generator units	1	LS	$ 70,000	$ 70,000
Electrical utility /transformer , misc site electrical	1	LS	$ 35,000	$ 35,000
Hook-up to Grid (power lines, transformers, switches)	1	LS	$ 18,000	$ 18,000
			Subtotal =	**$ 123,000**
Building and Misc Structural				
Masonry building	150	SF	$ 150	$ 22,500
Foundation structure (concrete)	4	CY	$ 550	$ 2,200
Roofing & Misc supports	1	LS	$ 10,000	$ 10,000
			Subtotal =	**$ 34,700**
			Materials/Installation Subtotal =	**$ 492,075**
			15% Construction Contingency Costs=	$ 73,811
			TOTAL CONSTRUCTION COST:	**$ 566,000**
Non -Construction Costs				
Admin/Planning/Design/Environmental Docs (% of construction costs)	18%	LS		$ 101,880
Environmental Mitigation (% of construction costs)	0%	LS		$ -
Right of Way Costs	0	AC	$ 30,000	$ -
Construction Administration (% of construction costs)	15%	LS		$ 84,900
Financing costs				$ 21,225
			Subtotal =	**$ 208,000**
			TOTAL ESTIMATED COST =	**$ 774,000**

Annual Costs				
Administration and Insurance ($0.0033/kWh)	380000	$0.0033	$	1,254
Operation & Maintenance (Labor)			$	5,183
Repair and Replacement (Parts and Material), (0.3% of total construction cost)		0.30%	$	1,698
Subtotal			$	8,135
Contingency (20%)		20%	$	1,627
Total O&M			$	9,762



NOTES:

1. MISC ISOLATION VALVES NOT SHOWN

LEGEND

M MOTORIZED CONTROL VALVE

FM FLOW METER

OAK RIDGE TANKS TO BASS LAKE TANKS PUMPED STORAGE

A1.4 Sandtrap Siphon

Photo 4 – Aerial of Walton Reservoir at the Outlet of Sandtrap Siphon

PRIORITY:
Recommended for immediate implementation

PURVEYOR LEAD: GDPUD

Project Category: Feed-In Tariff

Design Head (ft): 137

Design Flow (cfs): 24

Nameplate capacity (kW): 230

Estimated Annual MWh/year: 1,130

Capital Cost to Construct (Estimated): $1,456,000

Annual Income: $140,752 (assumes 20-year FIT agreement with PG&E; annual revenues cannot be reasonably projected beyond the 20-year analysis period)

EXISTING FEATURES:

Avg. annual flow (cfs)	Distance to 3-phase Power (ft)	Pipeline (in.)	Access Road	Downstream Storage	Land Ownership
17	**500**	**36**	**Y**	**Y**	**GDPUD**

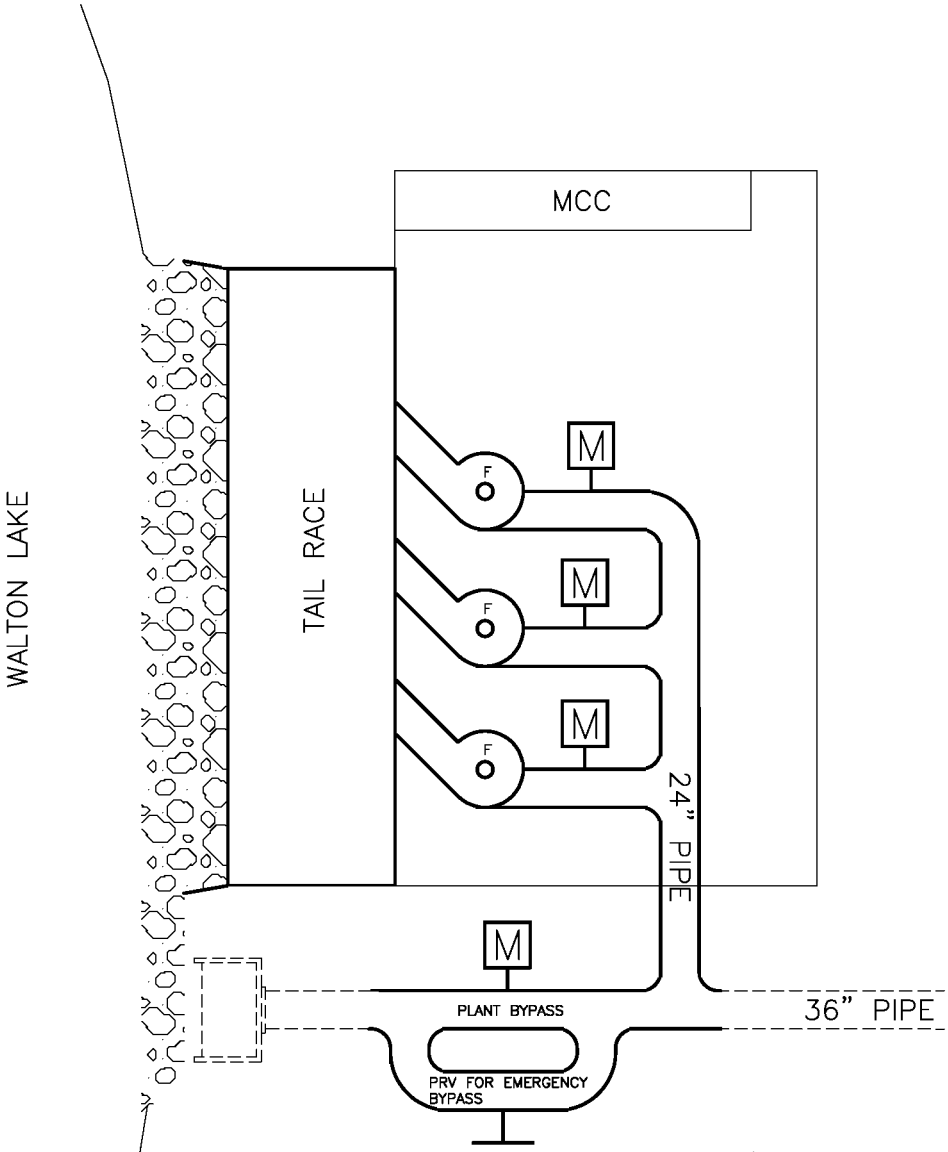
PROJECT DESCRIPTION:

As part of the Stumpy Meadows Project, the GDPUD diverts water at the Pilot Creek Diversion Dam and conveys it in the Georgetown Ditch. The Georgetown Ditch conveyance system includes the inverted Sandtrap Siphon located east of the town of Georgetown. The site is located adjacent to Walton Lake and the Walton Lake Water Treatment Plant, and is within land zoned as commercial. Access to the project is very good. The elevation at the site is approximately 3,100 feet. The project would likely occur within the existing GDPUD easement area, but may require adjacent landowner right-of-way. The Sandtrap hydro option would be located where the Sandtrap Siphon pipeline enters Walton Lake and would include a new 230 kW hydroelectric generating facility, consisting of three units – two fixed and one variable pumps operated as turbines that would collectively have a design flow of 24 cfs. A small powerhouse would be constructed near the Walton Lake shoreline to house the generating equipment. The average annual generation would be approximately 1,130 MWh.

Sandtrap Siphon
Engineer's Preliminary Estimate of Probable Costs

Element Description	Estimated Quantity	Units	Unit Price (installed)	Estimated Amount
Mobilization & Site work				
Mobilization, Bonds, Insurance	1	LS	$ 20,000	$ 20,000
Traffic Control	1	LS	$ 2,500	$ 2,500
Site Grading & Paving & Access	1	LS	$ 40,000	$ 40,000
Fencing	1	LS	$ 10,000	$ 10,000
			Subtotal =	**$ 72,500**
Pipe, Valves and Fittings				
Intake Tie into existing 36" line	1	LS	$ 15,000	$ 15,000
18" In -Line Bypass Valve, piping & vault	1	LS	$ 25,000	$ 25,000
30" pipe to plant	30	LF	$ 245	$ 7,350
Intake Manifold	1	LS	$ 12,000	$ 12,000
16" turbine pipe runs	50	lf	$ 185	$ 9,250
12" motorized control valve	3	EA	$ 9,500	$ 28,500
12" pressure reducing valve	1	EA	$ 8,500	$ 8,500
isolation valves, reducers, misc fittings	1	LS	$ 15,000	$ 15,000
24" flow meter	1	EA	$ 16,000	$ 16,000
			Subtotal =	**$ 136,600**
Turbine/Generator Units				
60 KW Pump as Turbine/Generator Units Installed	3	EA	$ 95,000	$ 285,000
			Subtotal =	**$ 285,000**
Electrical Equipment & Tie-in to Grid				
Electrical Controls/Switchgear for turbine/generator units	1	LS	$ 90,000	$ 90,000
Electrical utility /transformer , misc site electrical	1	LS	$ 70,000	$ 70,000
Hook-up to Grid (power lines, transformers, switches)	1	LS	$ 120,000	$ 120,000
			Subtotal =	**$ 280,000**
Building and Misc Structural				
Masonry building	400	SF	$ 150	$ 60,000
Foundation & Tailrace structure (concrete)	60	CY	$ 550	$ 33,000
Roofing & Misc supports	1	LS	$ 40,000	$ 40,000
			Subtotal =	**$ 133,000**
			Materials/Installation Subtotal =	**$ 907,100**
			15% Construction Contingency Costs=	$ 136,065
			TOTAL CONSTRUCTION COST:	**$ 1,043,000**
Non -Construction Costs				
Admin/Planning/Design/Environmental Docs (% of construction costs)	15%	LS		$ 156,450
Environmental Mitigation (% of construction costs)	10%	LS		$ 104,300
Right of Way Costs	1	AC	$ 30,000	$ 30,000
Construction Administration (% of construction costs)	8%	LS		$ 83,440
Financing Costs				$ 39,113
			Subtotal =	**$ 413,000**
			TOTAL ESTIMATED COST =	**$ 1,456,000**

Annual Costs				
Administration and Insurance ($0.0033/kWh)	970000	$0.0033	$	3,201
Operation & Maintenance (Labor)			$	7,058
Repair and Replacement (Parts and Material), (0.3% of total construction cost)		0.30%	$	3,129
Subtotal			$	13,388
Contingency (20%)		20%	$	2,678
Total O&M			$	16,065



h_s = 140ft
TDH = 120ft
Q_{summer} = 30cfs
Q_{winter} = 3–10cfs

NOTES:

1. MISC ISOLATION VALVES NOT SHOWN

LEGEND

M MOTORIZED CONTROL VALVE

F FIXED SPEED TURBINE (10 CFS)

SANDTRAP SIPHON

A1.5 Buffalo Hill Siphon

PRIORITY:
Recommended for reoperation study

PURVEYOR LEAD: GDPUD

Project Category: Feed-In Tariff

Design Head (ft): 141

Design Flow (cfs): 20

Nameplate capacity (kW): 170

Estimated Annual MWh/year: 860

Capital Cost to Construct (Estimated): $1,284,000

Photo 5 – Outlet Structure at Buffalo Hill Siphon

Annual Income: $106,777 (assumes 20-year FIT agreement with PG&E; annual revenues cannot be reasonably projected beyond the 20-year analysis period)

EXISTING FEATURES:

Avg. annual flow (cfs)	Distance to 3-phase Power (ft)	Pipeline (in.)	Access Road	Downstream Storage	Land Ownership
15	**300**	**24**	**Y**	**N**	**GDPUD**

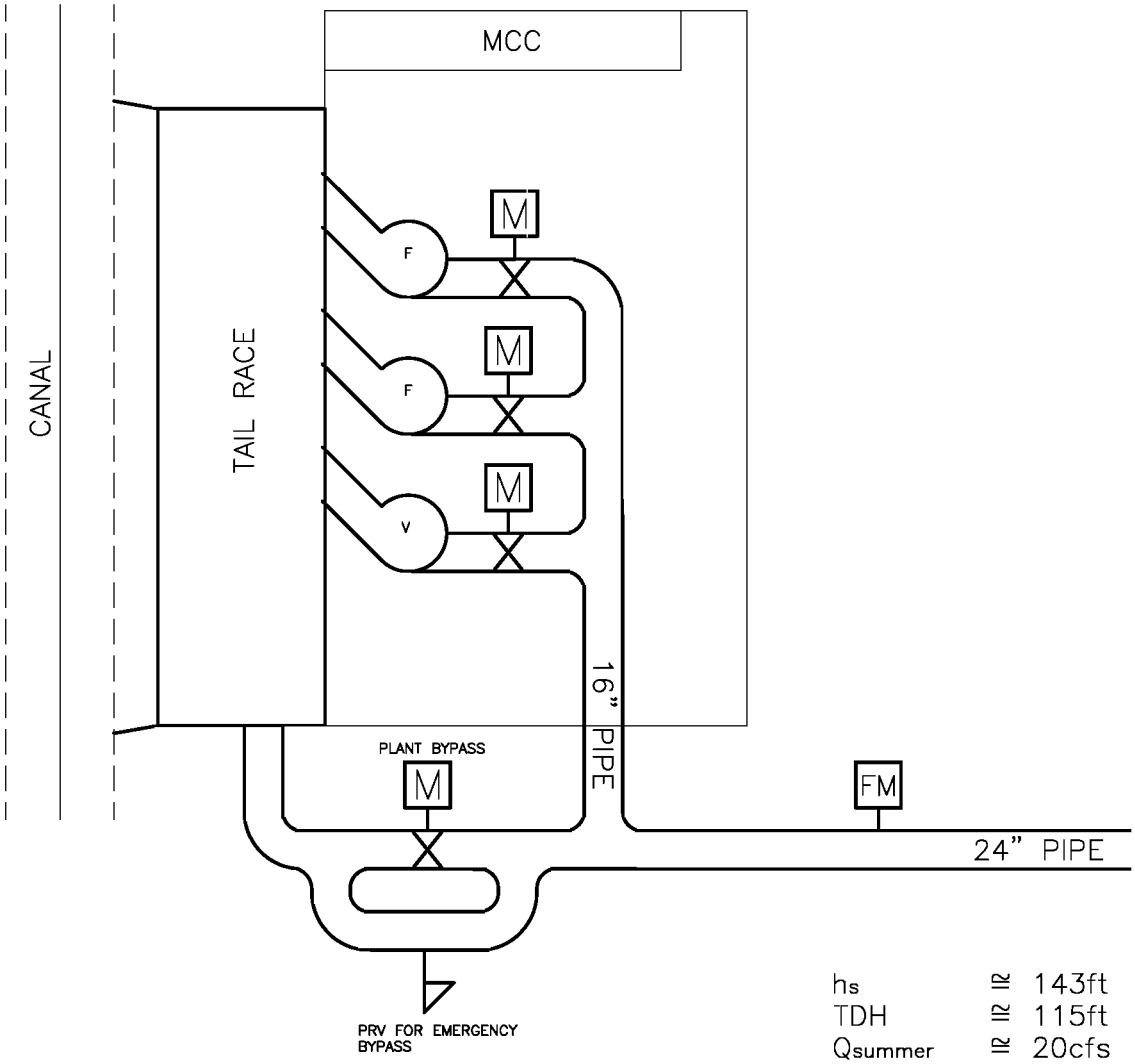
PROJECT DESCRIPTION:

The Buffalo Hill inverted siphon is located on the Georgetown Ditch conveyance system just north of the town of Georgetown, near Highway 193. The Buffalo Hill Siphon hydro option would capture the energy available at the existing 24-inch Buffalo Hill Siphon with a 170 kW hydroelectric generating facility located near the energy dissipating structure at the terminus of the siphon. The project would be sized for a maximum flow of 20 cfs, which approximates the peak flows between May and October. Annual flows are expected to average 12 cfs due to lower demand in the winter. The operating head would be variable, depending on flow rate, but is expected to average about 115 feet (141 feet max.). The project would operate using existing and future water supplies required by the GDPUD distribution system. No reoperation of the Stumpy Meadows Project or the Georgetown Ditch is expected. The average annual generation expected from the Buffalo Hill Siphon option is about 860 MWh.

Buffalo Hill Siphon
Engineer's Preliminary Estimate of Probable Costs

Element Description	Estimated Quantity	Units	Unit Price (installed)	Estimated Amount
Mobilization & Site work				
Mobilization, Bonds, Insurance	1	LS	$ 20,000	$ 20,000
Traffic Control	1	LS	$ 2,500	$ 2,500
Site Grading & Paving & Access	1	LS	$ 20,000	$ 20,000
Fencing	1	LS	$ 10,000	$ 10,000
			Subtotal =	**$ 52,500**
Pipe, Valves and Fittings				
Intake Tie into existing 24" line	1	LS	$ 12,500	$ 12,500
18" In -Line Bypass Valve, piping & vault	1	LS	$ 25,000	$ 25,000
24" pipe to plant	30	LF	$ 200	$ 6,000
Intake Manifold	1	LS	$ 12,000	$ 12,000
16" turbine pipe runs	50	lf	$ 185	$ 9,250
12" motorized control valve	3	EA	$ 9,500	$ 28,500
12" pressure reducing valve	1	EA	$ 8,500	$ 8,500
isolation valves, reducers, misc fittings	1	LS	$ 15,000	$ 15,000
24" flow meter	1	EA	$ 16,000	$ 16,000
			Subtotal =	**$ 132,750**
Turbine/Generator Units				
60 KW Pump as Turbine/Generator Units Installed	3	EA	$ 95,000	$ 285,000
			Subtotal =	**$ 285,000**
Electrical Equipment & Tie-in to Grid				
Electrical Controls/Switchgear for turbine/generator units	1	LS	$ 90,000	$ 90,000
Electrical utility /transformer , misc site electrical	1	LS	$ 70,000	$ 70,000
Hook-up to Grid (power lines, transformers, switches)	1	LS	$ 60,000	$ 60,000
			Subtotal =	**$ 220,000**
Building and Misc Structural				
Masonry building	400	SF	$ 150	$ 60,000
Foundation & Tailrace structure (concrete)	60	CY	$ 550	$ 33,000
Roofing & Misc supports	1	LS	$ 40,000	$ 40,000
			Subtotal =	**$ 133,000**
			Materials/Installation Subtotal =	**$ 823,250**
			15% Construction Contingency Costs=	$ 123,488
			TOTAL CONSTRUCTION COST:	**$ 947,000**
Non -Construction Costs				
Admin/Planning/Design/Environmental Docs (% of construction costs)	15%	LS		$ 142,050
Environmental Mitigation (% of construction costs)	8%	LS		$ 75,760
Right of Way Costs	0.25	AC	$ 30,000	$ 7,500
Construction Administration (% of construction costs)	8%	LS		$ 75,760
Financing Costs				$ 35,513
			Subtotal =	**$ 337,000**
			TOTAL ESTIMATED COST =	**$ 1,284,000**

Annual Costs				
Administration and Insurance ($0.0033/kWh)	760000	$0.0033	$	2,508
Operation & Maintenance (Labor)			$	7,058
Repair and Replacement (Parts and Material), (0.3% of total construction cost)		0.30%	$	2,841
Subtotal			$	12,407
Contingency (20%)		20%	$	2,481
Total O&M			$	14,888



hs	≅	143ft
TDH	≅	115ft
Qsummer	≅	20cfs
Qwinter	≅	3–10cfs

NOTES:

1. MISC ISOLATION VALVES NOT SHOWN

LEGEND

M	MOTORIZED CONTROL VALVE
FM	FLOW METER
F	FIXED SPEED TURBINE (6 TO 10 CFS)
V	VARIABLE SPEED TURBINE

BUFFALO HILL SIPHON

A1.6 Kaiser Siphon

PRIORITY:
Recommended for immediate implementation

PURVEYOR LEAD: GDPUD

Project Category: FIT (to be confirmed)

Design Head (ft): 668

Design Flow (cfs): 15

Nameplate capacity (kW): 580

Estimated Annual MWh/year: 3,638

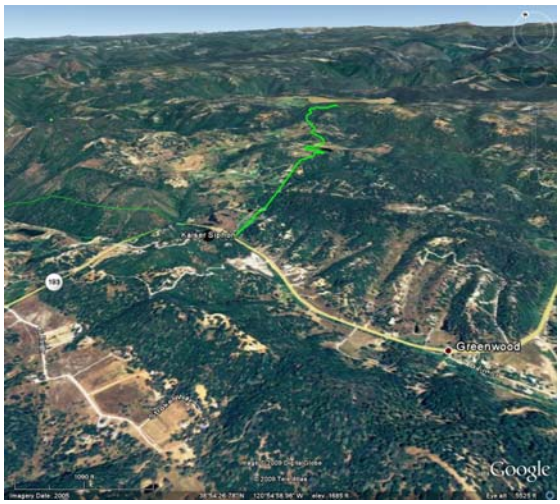


Photo 6 – Aerial of Approximate Pipeline Alignment (shown in green)

Capital Cost to Construct (Estimated): $5,172,000 (includes Oblique Aerial of Kaiser Siphon Area 8,000-foot pipeline)

Annual Income: $448,331 (assumes 20-year FIT agreement with PG&E; annual revenues cannot be reasonably projected beyond the 20-year analysis period)

EXISTING FEATURES:

Avg. annual flow (cfs)	Distance to 3-phase Power (ft)	Pipeline (in.)	Access Road	Downstream Storage	Land Ownership
10	**1,200**	**24**	**Y**	**N**	**GDPUD/Priv.**

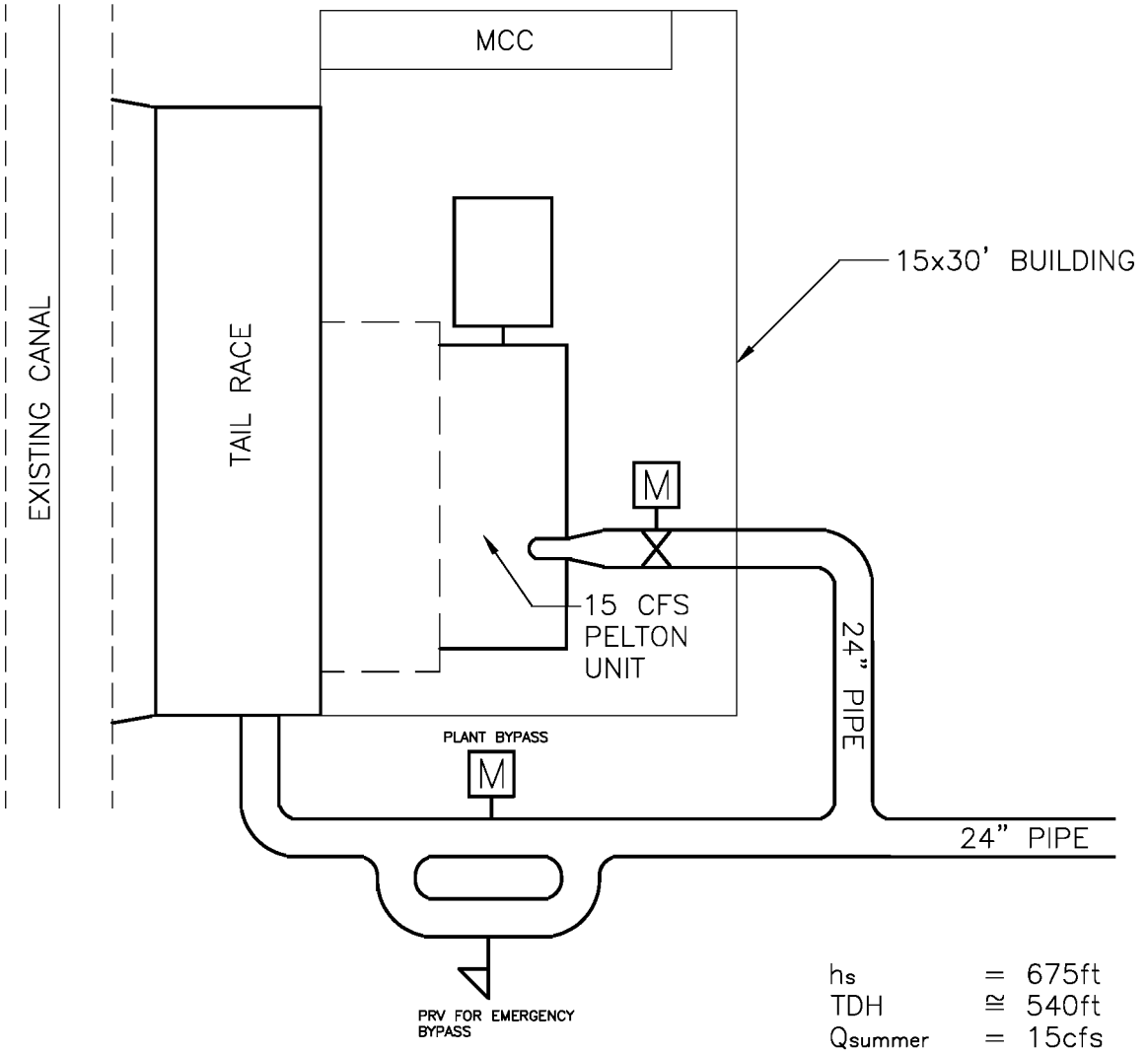
PROJECT DESCRIPTION:

The Kaiser inverted siphon is located on the Georgetown Ditch conveyance system near Highway 193 just north of Greenwood, near the Auburn Lake Trails Water Treatment Plant. The existing siphon is a 24-inch diameter buried pipeline that flows to an energy dissipater at its terminus. This project option includes replacing an existing reinforced plastic mortar (Techite) pipe and an open channel section upstream of the siphon with new, 24-inch diameter pipe, for a total distance of 8,000 feet. The extended pipe provides for a significant increase in available head and resulting project benefit. The proposed 580 kW generating facility would be located immediately adjacent to and downstream from the existing energy dissipating structure. The project is sized for an estimated maximum flow of 15 cfs, which would occur between May and October. Annual flows are expected to average 10 cfs due to lower demand in the winter. The operating head would be variable, depending on flow rate, but is expected to average about 540 feet. The proposed project would operate using existing and future water supplies required by the GDPUD distribution system. No reoperation of the Stumpy Meadows Project or the Georgetown Ditch is expected. The average annual generation expected from the Kaiser Siphon hydroelectric project is about 3,600 MWh.

Kaiser Siphon
Engineer's Preliminary Estimate of Probable Costs

Element Description	Estimated Quantity	Units	Unit Price (installed)	Estimated Amount
Mobilization & Site work				
Mobilization, Bonds, Insurance	1	LS	$ 25,000	$ 25,000
Traffic Control	1	LS	$ 2,000	$ 2,000
Site Grading & Paving & Access	1	LS	$ 20,000	$ 20,000
Fencing	1	LS	$ 10,000	$ 10,000
			Subtotal =	**$ 57,000**
Pipe, Valves and Fittings				
New 24" pipeline in existing ditch	8,000	LF	$ 200	$ 1,600,000
Temporary Service Pipeline	8,300	LF	$ 50	$ 415,000
Replace techite section	300	LF	$ 230	$ 69,000
Tie into new 24" line	1	LS	$ 12,000	$ 12,000
24" In -Line Bypass Valve, piping & vault	1	LS	$ 32,000	$ 32,000
24" pipe to plant	40	LF	$ 200	$ 8,000
Intake Manifold	1	LS	$ 9,000	$ 9,000
18" motorized control valve	1	EA	$ 25,000	$ 25,000
isolation valves, reducers, misc fittings	1	LS	$ 15,000	$ 15,000
			Subtotal =	**$ 2,185,000**
Turbine/Generator Units				
580 KW Pelton Turbine/Gen Installed	1	EA	$ 580,000	$ 580,000
			Subtotal =	**$ 580,000**
Electrical Equipment & Tie-in to Grid				
Electrical Controls/Switchgear for turbine/generator units	1	LS	$ 95,000	$ 95,000
Electrical utility /transformer , misc site electrical	1	LS	$ 80,000	$ 80,000
Hook-up to Grid (power lines, transformers, switches)	1	LS	$ 120,000	$ 120,000
			Subtotal =	**$ 295,000**
Building and Misc Structural				
Masonry building	600	SF	$ 150	$ 90,000
Foundation & tailrace structure (concrete)	120	CY	$ 550	$ 66,000
Roofing & Misc supports	1	LS	$ 40,000	$ 40,000
			Subtotal =	**$ 196,000**
			Materials/Installation Subtotal =	**$ 3,313,000**
	15% Construction Contingency Costs=			$ 496,950
			TOTAL CONSTRUCTION COST:	**$ 3,810,000**
Non -Construction Costs				
Admin/Planning/Design/Environmental Docs (% of construction costs)	15%	LS		$ 571,500
Environmental Mitigation (% of construction costs)	10%	LS		$ 381,000
Right of Way Costs	3.5	AC	$ 30,000	$ 105,000
Construction Administration (% of construction costs)	8%	LS		$ 304,800
Financing Costs				$ 238,125
			Subtotal =	**$ 1,362,000**
			TOTAL ESTIMATED COST =	**$ 5,172,000**

Annual Costs				
Administration and Insurance ($0.0033/kWh)	3600000	$0.0033	$	11,880
Operation & Maintenance (Labor)			$	6,558
Repair and Replacement (Parts and Material), (0.3% of total construction cost)		0.30%	$	6,630
Subtotal			$	25,068
Contingency (20%)		20%	$	5,014
Total O&M			$	30,081



NOTES:

1. MISC ISOLATION VALVES NOT SHOWN

LEGEND

[M] MOTORIZED CONTROL VALVE

KAISER SIPHON

A1.7 Sly Park Dam

PRIORITY:
Recommended for immediate implementation

PURVEYOR LEAD: EID

Project Category: Feed-In Tariff

Design Head (ft): 95

Design Flow (cfs): 55

Nameplate capacity (kW): 400

Estimated Annual MWh/year: 1,833

Photo 7 – Sly Park Dam, Hydroelectric Project at Dam Section on Right

Capital Cost to Construct (Estimated): $2,571,000

Annual Income: $227,978 (assumes 20-year FIT agreement with PG&E; annual revenues cannot be reasonably projected beyond the 20-year analysis period)

EXISTING FEATURES:

Avg. annual flow (cfs)	Distance to 3-phase Power (ft)	Pipeline (in.)	Access Road	Downstream Storage	Land Ownership
75	**1,000**	**48**	**Y**	**N**	**EID**

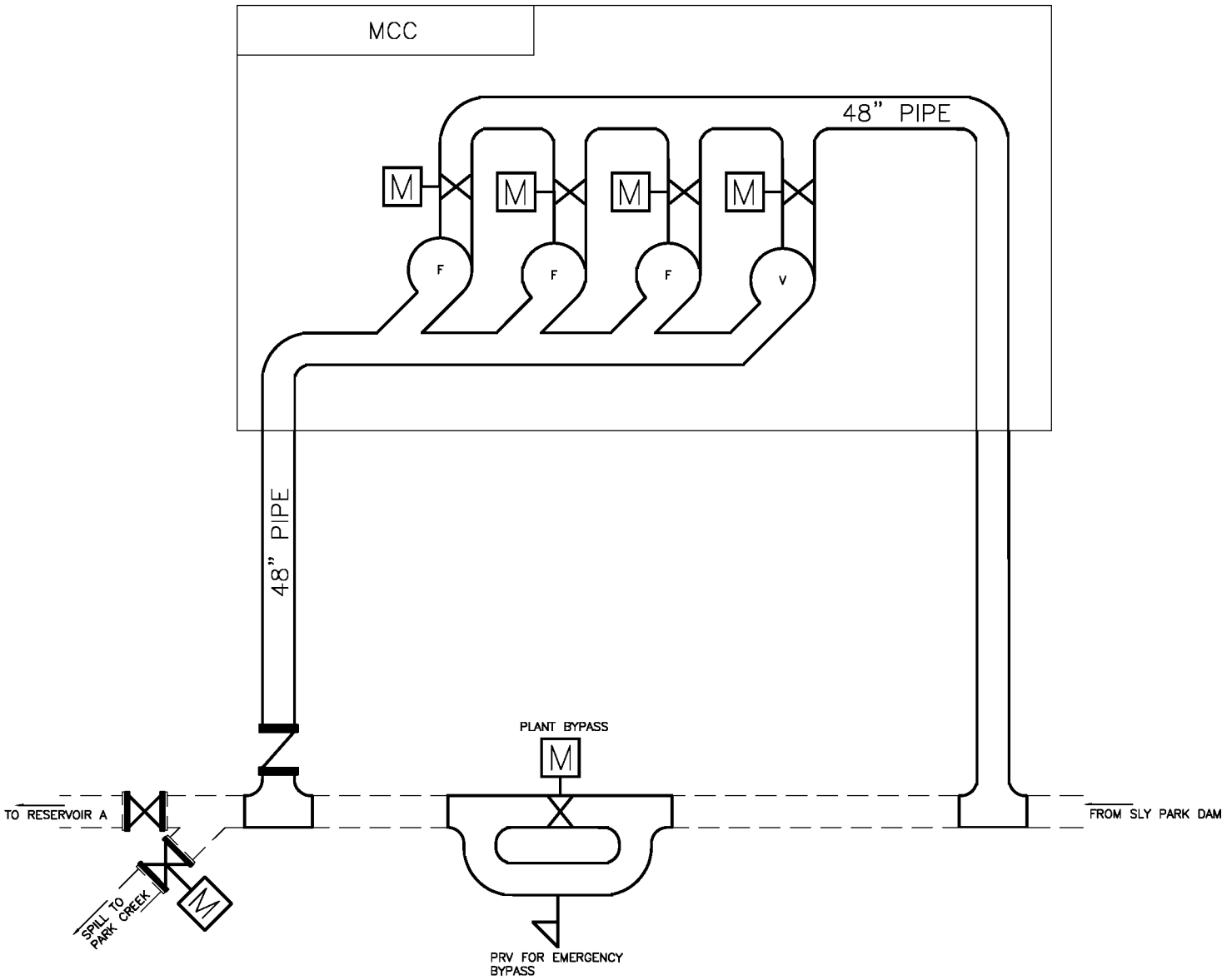
PROJECT DESCRIPTION:

The Sly Park Dam hydro option would replace a pressure reducing valve (PRV) on the dam outlet works with a hydroelectric facility that has at least two operational sub-options. Sly Park Dam impounds Jenkinson Lake just to the southeast of Pollock Pines. The main dam is approximately 176 feet high with a crest length of 760 feet and elevation 3,482 feet. The first option would generate power from the Camino Conduit flows. The second option would add Jenkinson spillway flows. This is a FIT project with good road access and relatively close proximity to existing transmission lines. Power generation from the first option is expected to be approximately 1,800 MWh per year using four vertical turbine PATs.

Sly Park Dam
Engineer's Preliminary Estimate of Probable Costs

Element Description	Estimated Quantity	Units	Unit Price (installed)	Estimated Amount
Mobilization & Site work				
Mobilization, Bonds, Insurance	1	LS	$ 20,000	$ 20,000
Traffic Control	0	LS	$ 2,500	$ -
Site Grading & Paving & Access	1	LS	$ 75,000	$ 75,000
Fencing	1	LS	$ 15,000	$ 15,000
			Subtotal =	**$ 110,000**
Pipe, Valves and Fittings				
Tie into Existing 48" pipe (station inlet and outlet)	1	LS	$ 45,000	$ 45,000
48" Bypass Valve & Piping	1	LS	$ 45,000	$ 45,000
48" Plant pipe	40	LF	$ 320	$ 12,800
18" turbine pipe runs	45	LF	$ 265	$ 11,925
18" motorized control valve	3	EA	$ 15,000	$ 45,000
36" turbine pipe run	20	LF	$ 285	$ 5,700
36" motorized control valve	1	EA	$ 32,000	$ 32,000
isolation valves, reducers, misc fittings	1	LS	$ 45,000	$ 45,000
Spill outfall pipe and valve	1	LS	$ 50,000	$ 50,000
48" flow meter	1	EA	$ 36,000	$ 36,000
			Subtotal =	**$ 328,425**
Turbine/Generator Units				
100 KW Pump as Turbine/Generator Units Installed	4	EA	$ 118,000	$ 472,000
			Subtotal=	**$ 472,000**
Electrical Equipment & Tie-in to Grid				
Electrical Controls/Switchgear for turbine/generator units	1	LS	$ 250,000	$ 250,000
Electrical utility /transformer , misc site electrical	1	LS	$ 145,000	$ 145,000
Hook-up to Grid (power lines, transformers, switches)	1	LS	$ 60,000	$ 60,000
			Subtotal =	**$ 455,000**
Building and Misc Structural				
Masonry building (30'x40')	1,200	SF	$ 150	$ 180,000
Foundation	25	CY	$ 550	$ 13,750
Roofing & Misc supports	1	LS	$ 50,000	$ 50,000
Outfall erosion control	1	LS	$ 30,000	$ 30,000
			Subtotal =	**$ 273,750**
			Materials/Installation Subtotal =	**$ 1,639,175**
			15% Construction Contingency Costs=	$ 245,876
			TOTAL CONSTRUCTION COST:	**$ 1,885,000**
Non -Construction Costs				
Admin/Planning/Design/Environmental Docs (% of construction costs)	15%	LS		$ 282,750
Environmental Mitigation (% of construction costs)	8%	LS		$ 150,800
Right of Way Costs	0.25	AC	$ 30,000	$ 7,500
Construction Administration (% of construction costs)	8%	LS		$ 150,800
Financing costs				$ 94,250
			Subtotal =	**$ 686,000**
			TOTAL ESTIMATED COST =	**$ 2,571,000**

Annual Costs				
Administration and Insurance ($0.0033/kWh)	1800000	$0.0033	$	5,940
Operation & Maintenance (Labor)			$	7,411
Repair and Replacement (Parts and Material), (0.3% of total construction cost)		0.30%	$	5,655
Subtotal			$	19,006
Contingency (20%)		20%	$	3,801
Total O&M			$	22,807



NOTES:

1. MISC ISOLATION VALVES NOT SHOWN

LEGEND

M	MOTORIZED CONTROL VALVE
F	FIXED SPEED TURBINE (15 CFS)
V	VARIABLE SPEED TURBINE

SLY PARK DAM

A1.8 Pleasant Oak Main (Reservoir B)

PRIORITY:
Recommended for immediate implementation

PURVEYOR LEAD: EID

Project Category: Feed-In Tariff (2-plants)

Design Heads (ft): 139/199

Design Flow (cfs): 24

Nameplate capacities (kW): 180/ 270

Estimated Annual MWh/year: 2,657

Photo 8 – Existing Pressure Reducing Station at Reservoir B

Capital Cost to Construct (Estimated): $3,591,000

Annual Income: $326,980 (assumes 20-year FIT agreement with PG&E; annual revenues cannot be reasonably projected beyond the 20-year analysis period)

EXISTING FEATURES:

Avg. annual flow (cfs)	Distance to 3-phase Power (ft)	Pipeline (in.)	Access Road	Downstream Storage	Land Ownership
16	**10,000**	**36**	**Y**	**Y**	**EID**

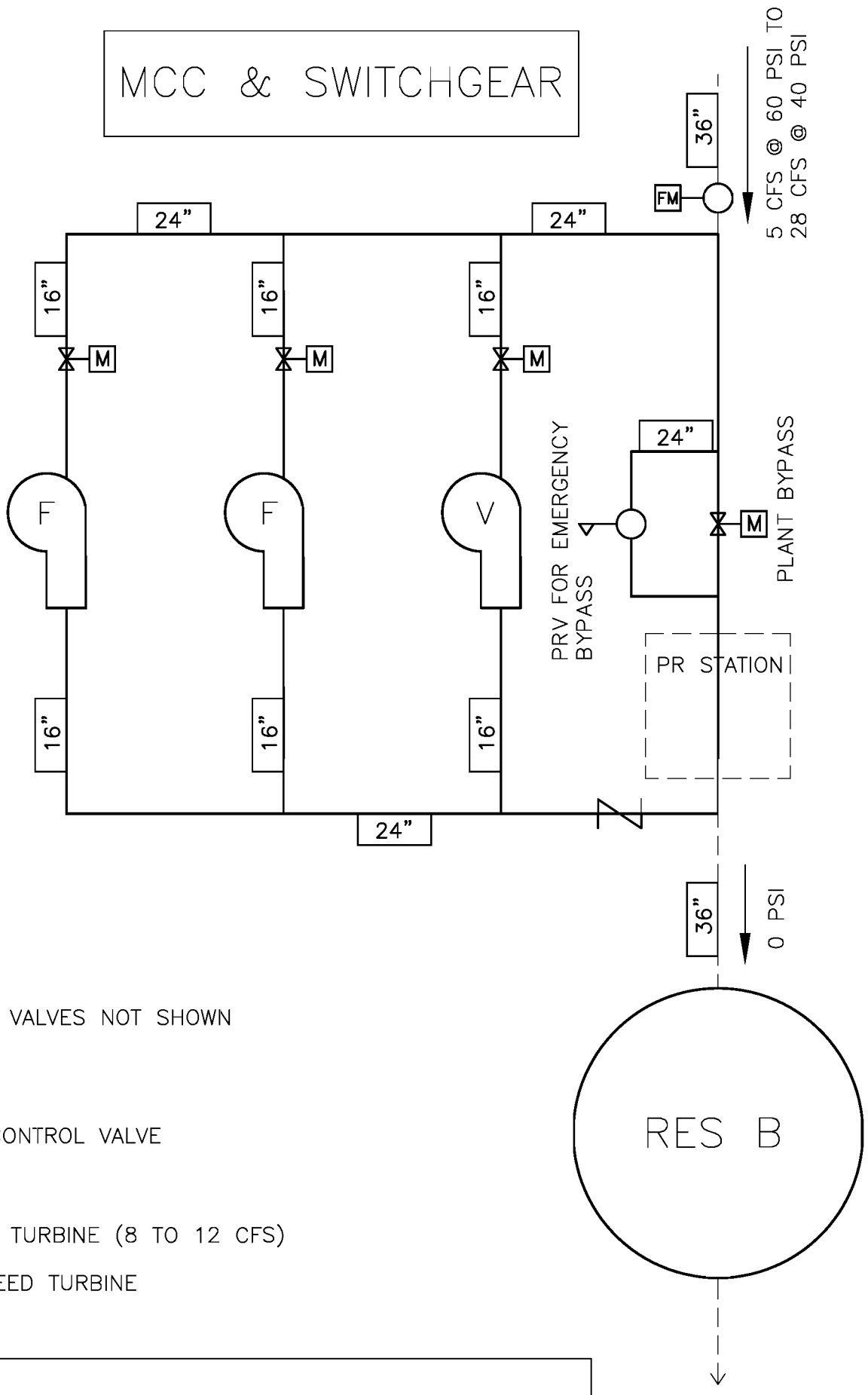
PROJECT DESCRIPTION:

The Pleasant Oak Main (POM) at Reservoir B hydro option is a dual station project, located off of Pleasant Valley Road. One unit would be upstream at the Reservoir B site and one unit downstream (west) of Reservoir B along the District access road. The two stations would share transmission line facilities and the same flow rates through the POM pipeline. The two sites are relatively flat and have good construction access. There is sufficient area on the Reservoir B site for the proposed project. The second site may require a small amount of new right-of-way adjacent to the District's access road to Reservoir B. 3-phase transmission lines are approximately 10,000 feet from the furthest unit. The two hydro stations would be located on the existing 36-inch pipeline. Each hydro station will have three PATs with one turbine operating at variable speed with a regenerative power converter. Each hydro station will be housed in a masonry building approximately 400 square feet in area. The combined power generating capacity of the two hydro stations is projected to be about 2,600 MWh per year.

Pleasant Oak Main (Reservoir B)
Engineer's Preliminary Estimate of Probable Costs

Element Description	Estimated Quantity	Units	Unit Price (installed)	Estimated Amount
Mobilization & Site work (combined)				
Mobilization, Bonds, Insurance	1	LS	$ 40,000	$ 40,000
Traffic Control	1	LS	$ 2,000	$ 2,000
Site Grading & Paving & Access	1	LS	$ 55,000	$ 55,000
Fencing	1	LS	$ 15,000	$ 15,000
			Subtotal =	**$ 112,000**
Pipe, Valves and Fittings (plant 1)				
Intake and Return Tie into existing 36" line (Including de-water of pipe)	1	LS	$ 33,000	$ 33,000
24" In -Line Bypass Valve, piping & vault	1	LS	$ 32,000	$ 32,000
24" pipe to and from plant	60	LF	$ 200	$ 12,000
Intake and Return Manifolds	1	LS	$ 20,000	$ 20,000
16" turbine pipe runs	50	lf	$ 185	$ 9,250
12" motorized control valve	3	EA	$ 9,500	$ 28,500
12" pressure reducing valve	1	EA	$ 8,500	$ 8,500
24" check valve	1	EA	$ 11,000	$ 11,000
isolation valves, reducers, misc fittings	1	LS	$ 22,000	$ 22,000
24" flow meter	1	EA	$ 16,000	$ 16,000
Pipe, Valves and Fittings (plant 2)	**1**	**LS**	**$ 192,250**	**$ 192,250**
			Subtotal =	**$ 384,500**
Turbine/Generator Units (combined)				
90 KW Pump as Turbine/Generator Units Installed	3	EA	$ 115,000	$ 345,000
60 KW Pump as Turbine/Generator Units Installed	3	EA	$ 90,000	$ 270,000
			Subtotal =	**$ 615,000**
Electrical Equipment & Tie-in to Grid(combined)				
Electrical Controls/Switchgear for turbine/generator units	1	LS	$ 220,000	$ 220,000
Electrical utility /transformer , misc site electrical	1	LS	$ 180,000	$ 180,000
Hook-up to Grid (power lines, transformers, switches)	1	LS	$ 550,000	$ 550,000
			Subtotal =	**$ 950,000**
Building and Misc Structural (combined)				
Masonry building	800	SF	$ 150	$ 120,000
Foundation structure (concrete)	16	CY	$ 550	$ 8,800
Roofing & Misc supports	1	LS	$ 80,000	$ 80,000
			Subtotal =	**$ 208,800**
			Materials/Installation Subtotal =	**$ 2,270,300**
			15% Construction Contingency Costs=	$ 340,545
			TOTAL CONSTRUCTION COST:	**$ 2,611,000**
Non -Construction Costs				
Admin/Planning/Design/Environmental Docs (% of construction costs)	15%	LS		$ 391,650
Environmental Mitigation (% of construction costs)	8%	LS		$ 208,880
Right of Way Costs	0.25	AC	$ 30,000	$ 7,500
Construction Administration (% of construction costs)	8%	LS		$ 208,880
Financing Cost				$ 163,188
			Subtotal =	**$ 980,000**
			TOTAL ESTIMATED COST =	**$ 3,591,000**

Annual Costs				
Administration and Insurance ($0.0033/kWh)	2600000	$0.0033	$	8,580
Operation & Maintenance (Labor)			$	7,058
Repair and Replacement (Parts and Material), (0.3% of total construction cost)		0.30%	$	7,833
Subtotal			$	23,471
Contingency (20%)		20%	$	4,694
Total O&M			$	28,165



NOTES:

1. MISC ISOLATION VALVES NOT SHOWN

LEGEND

M	MOTORIZED CONTROL VALVE
FM	FLOW METER
F	FIXED SPEED TURBINE (8 TO 12 CFS)
V	VARIABLE SPEED TURBINE

PLEASANT OAK MAIN (RESERVOIR B)

A1.9 Pleasant Oak Main PRS 5 (Reservoir 7)

PRIORITY:
Recommended for immediate implementation

PURVEYOR LEAD: EID

Project Category: Feed-In Tariff

Design Head (ft): 340

Design Flow (cfs): 24

Nameplate capacity (kW): 510

Estimated Annual MWh/year: 2,321

Photo 9 – Tanks and Pressure Reducing Station at Reservoir 7

Capital Cost to Construct (Estimated): $1,523,000

Annual Income: $287,082 (assumes 20-year FIT agreement with PG&E; annual revenues cannot be reasonably projected beyond the 20-year analysis period)

EXISTING FEATURES:

Avg. annual flow (cfs)	Distance to 3-phase Power (ft)	Pipeline (in.)	Access Road	Downstream Storage	Land Ownership
14	**40**	**24**	**Y**	**Y**	**EID**

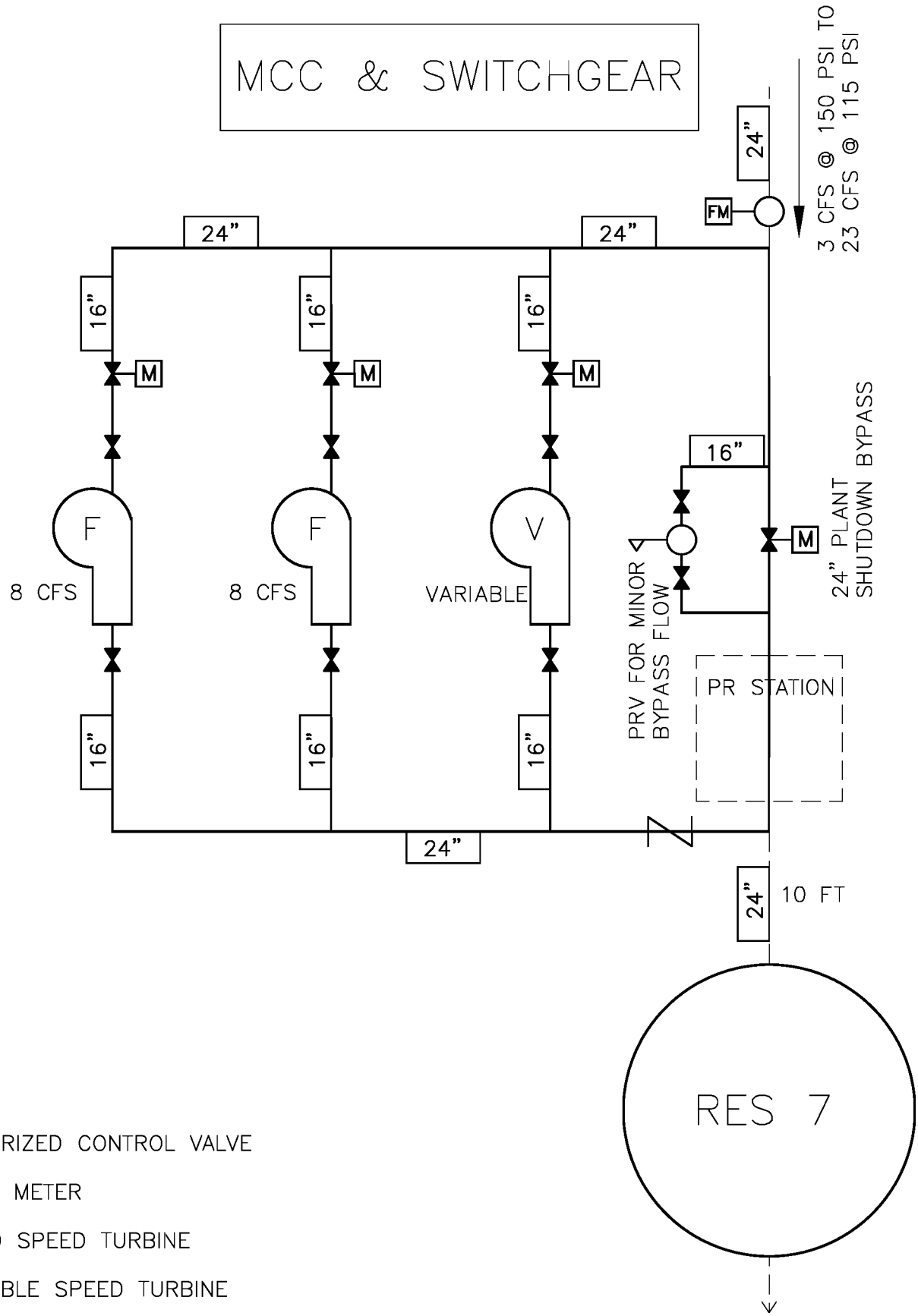
PROJECT DESCRIPTION:

The POM Pressure Reducing Station 5 (PRS 5) hydro option would be located on the northeast side of the Reservoir 7 tank site, off of Pleasant Valley Road. There is sufficient area on the existing site for the proposed project. The site is situated at approximately 2,230 feet elevation, is relatively flat, and has good construction access. The surrounding land use is low density residential and open space. The hydro station will consist of three PATs with one turbine operating at variable speed with a regenerative power converter. The facilities will be housed in a masonry building approximately 400 square feet in area. Minor changes in operations for delivery of flow to Reservoir 7 can smooth out the variability of the flow which can result in less complicated control, greater generation, and less potential wear on the hydro station components. Annual power generation is expected to be approximately 2,300 MWh.

Pleasant Oak Main PRS5 (Reservoir 7)
Engineer's Preliminary Estimate of Probable Costs

Element Description	Estimated Quantity	Units	Unit Price (installed)	Estimated Amount
Mobilization & Site work				
Mobilization, Bonds, Insurance	1	LS	$ 20,000	$ 20,000
Traffic Control	1	LS	$ 3,000	$ 3,000
Site Grading & Paving & Access	1	LS	$ 18,000	$ 18,000
Fencing	0	LS	$ 10,000	$ -
			Subtotal =	**$ 41,000**
Pipe, Valves and Fittings				
Intake and Return Tie into existing 30" line (Including de-water of pipe)	1	LS	$ 30,000	$ 30,000
24" In -Line Bypass Valve, piping & vault	1	LS	$ 32,000	$ 32,000
24" pipe to and from plant	60	LF	$ 200	$ 12,000
Intake and Return Manifolds	1	LS	$ 20,000	$ 20,000
16" turbine pipe runs	50	lf	$ 185	$ 9,250
12" motorized control valve	3	EA	$ 9,500	$ 28,500
12" pressure reducing valve	1	EA	$ 8,500	$ 8,500
24" check valve	1	EA	$ 11,000	$ 11,000
isolation valves, reducers, misc fittings	1	LS	$ 22,000	$ 22,000
24" flow meter	1	EA	$ 16,000	$ 16,000
			Subtotal =	**$ 189,250**
Turbine/Generator Units				
170 KW Pump as Turbine/Generator Units Installed	3	EA	$ 140,000	$ 420,000
			Subtotal =	**$ 420,000**
Electrical Equipment & Tie-in to Grid				
Electrical Controls/Switchgear for turbine/generator units	1	LS	$ 120,000	$ 120,000
Electrical utility /transformer , misc site electrical	1	LS	$ 95,000	$ 95,000
Hook-up to Grid (power lines, transformers, switches)	1	LS	$ 4,000	$ 4,000
			Subtotal =	**$ 219,000**
Building and Misc Structural				
Masonry building	400	SF	$ 150	$ 60,000
Foundation structure (concrete)	8	CY	$ 550	$ 4,400
Roofing & Misc supports	1	LS	$ 40,000	$ 40,000
			Subtotal =	**$ 104,400**
			Materials/Installation Subtotal =	**$ 973,650**
			15% Construction Contingency Costs=	$ 146,048
			TOTAL CONSTRUCTION COST:	**$ 1,120,000**
Non -Construction Costs				
Admin/Planning/Design/Environmental Docs (% of construction costs)	15%	LS		$ 168,000
Environmental Mitigation (% of construction costs)	8%	LS		$ 89,600
Right of Way Costs		AC	$ 30,000	$ -
Construction Administration (% of construction costs)	8%	LS		$ 89,600
Financing costs				$ 56,000
			Subtotal =	**$ 403,000**
			TOTAL ESTIMATED COST =	**$ 1,523,000**

Annual Costs				
Administration and Insurance ($0.0033/kWh)	2300000	$0.0033	$	7,590
Operation & Maintenance (Labor)			$	7,058
Repair and Replacement (Parts and Material), (0.3% of total construction cost)		0.30%	$	3,360
Subtotal			$	18,008
Contingency (20%)		20%	$	3,602
Total O&M			$	21,609



LEGEND

M	MOTORIZED CONTROL VALVE
FM	FLOW METER
F	FIXED SPEED TURBINE
V	VARIABLE SPEED TURBINE

PLEASANT OAK MAIN PRS 5 (RESERVOIR 7)

A1.10 Diamond Springs Main PRS 1 (Reservoir 8)

PRIORITY:
Recommended for reoperation study

PURVEYOR LEAD: EID

Project Category: Feed-In Tariff

Design Head (ft): 136

Design Flow (cfs): 17

Nameplate capacity (kW): 140

Estimated Annual MWh/year: 690

Capital Cost to Construct (Estimated): $1,082,000

Photo 10 – DSM Pressure Reducing Station No.1

Annual Income: $82,196 (assumes 20-year FIT agreement with PG&E; annual revenues cannot be reasonably projected beyond the 20-year analysis period)

EXISTING FEATURES:

Avg. annual flow (cfs)	Distance to 3-phase Power (ft)	Pipeline (in.)	Access Road	Downstream Storage	Land Ownership
11	**40**	**24**	**Y**	**N**	**EID**

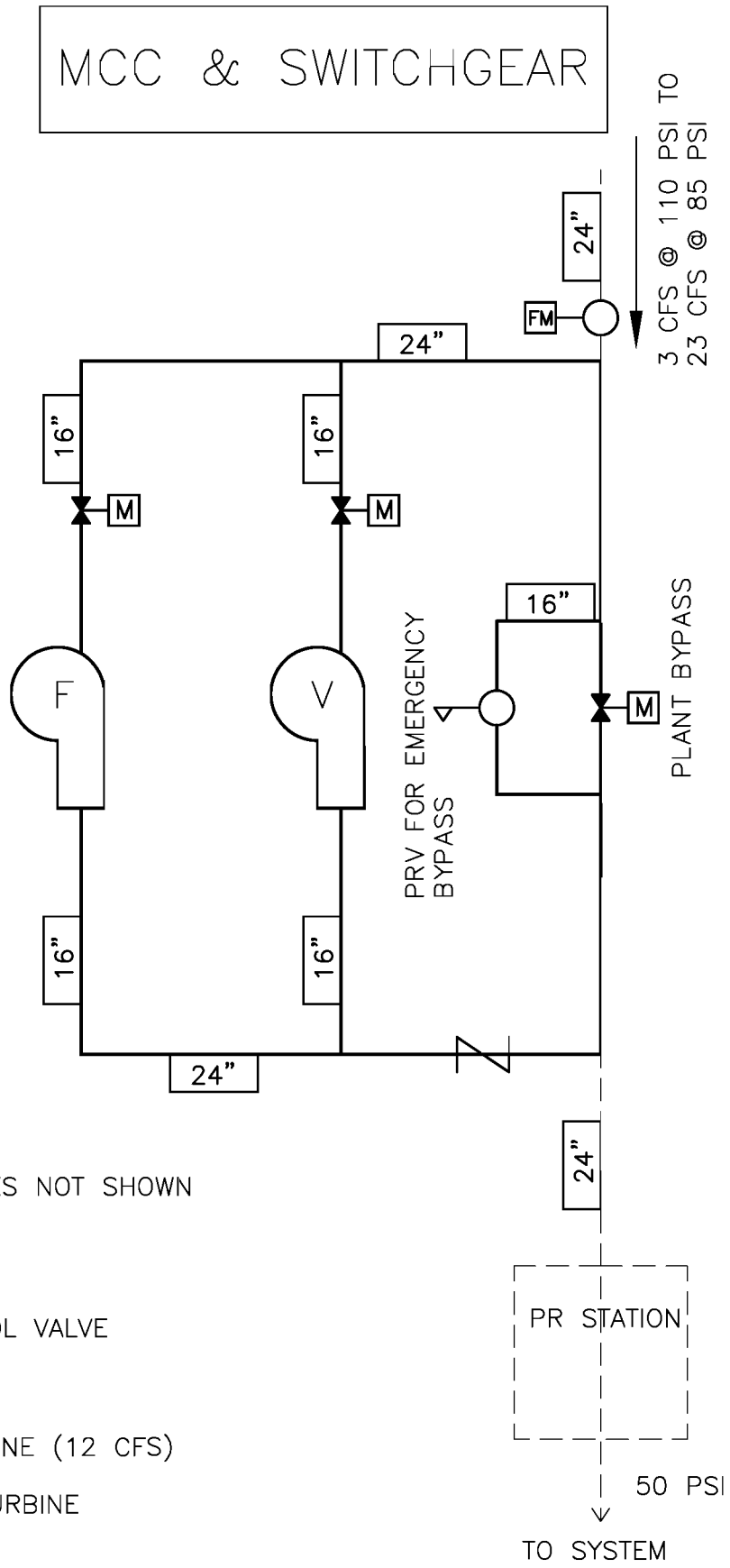
PROJECT DESCRIPTION:

This project is at an existing pressure reducing (PR) station on EID's Diamond Springs Main at the old Reservoir 8 Site. The site, at an elevation of 2,080 feet, is relatively flat and has good construction access. The surrounding land use is low and medium density residential and open space. The hydro station will consist of two PATs with one turbine operating at variable speed with a regenerative power converter. The energy production is moderate (690 MWh) when compared to some of the other more favorable sites due to less head and flow. As with many of the PR sites, onsite storage is not available to regulate flows, requiring flow regulation through multiple units and valve controls. However, access and distance to power grid are reasonable. The proposed facilities would be housed in a masonry building approximately 230 square feet in area.

Diamond Springs Main PRS 1 (Reservoir 8)
Engineer's Preliminary Estimate of Probable Costs

Element Description	Estimated Quantity	Units	Unit Price (installed)	Estimated Amount
Mobilization & Site work				
Mobilization, Bonds, Insurance	1	LS	$ 25,000	$ 25,000
Traffic Control	1	LS	$ 3,000	$ 3,000
Site Grading & Paving & Access	1	LS	$ 25,000	$ 25,000
Fencing	1	LS	$ 10,000	$ 10,000
			Subtotal =	**$ 63,000**
Pipe, Valves and Fittings				
Intake and Return Tie into existing 24" line (Including de-water of pipe)	1	LS	$ 25,000	$ 25,000
24" In -Line Bypass Valve, piping & vault	1	LS	$ 32,000	$ 32,000
24" pipe to and from plant	45	LF	$ 200	$ 9,000
Intake and Return Manifolds	1	LS	$ 20,000	$ 20,000
12" turbine pipe runs	30	lf	$ 155	$ 4,650
12" motorized control valve	2	EA	$ 9,500	$ 19,000
12" pressure reducing valve	1	EA	$ 8,500	$ 8,500
24" check valve	1	EA	$ 11,000	$ 11,000
isolation valves, reducers, misc fittings	1	LS	$ 22,000	$ 22,000
18" flow meter	1	EA	$ 12,000	$ 12,000
			Subtotal =	**$ 163,150**
Turbine/Generator Units				
70 KW Pump as Turbine/Generator Units Installed	2	EA	$ 95,000	$ 190,000
			Subtotal =	**$ 190,000**
Electrical Equipment & Tie-in to Grid				
Electrical Controls/Switchgear for turbine/generator units	1	LS	$ 100,000	$ 100,000
Electrical utility /transformer , misc site electrical	1	LS	$ 90,000	$ 90,000
Hook-up to Grid (power lines, transformers, switches)	1	LS	$ 4,000	$ 4,000
			Subtotal =	**$ 194,000**
Building and Misc Structural				
Masonry building	230	SF	$ 150	$ 34,500
Foundation structure (concrete)	8	CY	$ 550	$ 4,400
Roofing & Misc supports	1	LS	$ 40,000	$ 40,000
			Subtotal =	**$ 78,900**
			Materials/Installation Subtotal =	**$ 689,050**
			15% Construction Contingency Costs=	$ 103,358
			TOTAL CONSTRUCTION COST:	**$ 792,000**
Non -Construction Costs				
Admin/Planning/Design/Environmental Docs (% of construction costs)	15%	LS		$ 118,800
Environmental Mitigation (% of construction costs)	8%	LS		$ 63,360
Right of Way Costs	0.5	AC	$ 30,000	$ 15,000
Construction Administration (% of construction costs)	8%	LS		$ 63,360
Financing Cost				$ 29,700
			Subtotal =	**$ 290,000**
			TOTAL ESTIMATED COST =	**$ 1,082,000**

Annual Costs				
Administration and Insurance ($0.0033/kWh)	690000	$0.0033	$	2,277
Operation & Maintenance (Labor)			$	7,058
Repair and Replacement (Parts and Material), (0.3% of total construction cost)		0.30%	$	2,376
Subtotal			$	11,711
Contingency (20%)		20%	$	2,342
Total O&M			$	14,053



NOTES:

1. MISC ISOLATION VALVES NOT SHOWN

LEGEND

M	MOTORIZED CONTROL VALVE
FM	FLOW METER
F	FIXED SPEED TURBINE (12 CFS)
V	VARIABLE SPEED TURBINE

DIAMOND SPRINGS MAIN PRS 1 (RESERVOIR 8)

HYDROELECTRIC DEVELOPMENT OPTIONS REPORT
HYDRO STATION EQUIPMENT AND TECHNOLOGIES

Typical Project Components

For project construction cost estimating in the screening analysis and more detailed feasibility analyses, typical hydroelectric station layouts were developed for the various types of installations. The types of installations encountered included:

1. larger long term hydro development project (Alder Reservoir),
2. short term "feed in tariff"(FIT) projects at pressure reducing stations,
3. short term "feed in tariff" projects at existing dams,
4. short term "feed in tariff" small pump storage project between storage tanks (Oak Ridge Tanks to Bass Lake Tanks)
5. short and mid term "feed in tariff" projects at the end of raw water supply pipelines,
6. low head canal demonstration project.

For the more detailed feasibility analyses, project facilities were broken down into adequate detail to identify most components required for installations with contingency added for minor variations. The following table shows the basic components included for each of the project types:

Project Type Components

Project Type	Design Parameters	Project Components
Large Long Term (Alder Reservoir)	High Head (over 400ft) Pumped Storage	a. dam & reservoir b. pump station from American River (El. Dorado Canal) to Reservoir c. large diameter penstock (for pumped flow and hydro generation flow) d. high head (Pelton Wheel turbine) hydro-electric station. e. long transmission lines
FIT at Existing Pressure Reducing Stations	Medium head (150 to 350 ft head) Variable flows	a. Tie into existing piping b. discharge to lower pressure pipeline c. Pumps as turbines (PATs) as most economical solution with Francis turbines as an option in complex hydraulic (flow & head variation) applications d. short distance to existing transmission lines

1107 Investment Boulevard, Suite 145 El Dorado Hills, CA 95762 [916] 933-1997 [916] 933-4778 Fax

FIT at Existing Dams	Low to Medium head (75 to 100 ft head) Variable flows	a. Tie into existing piping b. discharge to atmosphere c. Pumps as turbines (PATs) or Cross-flow turbine as most economical solution with Francis turbines as an option. d. short distance to existing transmission lines
FIT pumped storage at Existing Tanks (Oak Ridge Tanks to Bass Lake Tanks)	Constant medium head and constant flow	a. Tie into existing piping b. Separate pumps to storage and single pump as turbines as most economical solution c. Separate pump as turbine is most economical d. short distance to existing transmission lines
FITs at the end of pipelines	Medium to high head (150 to over 600 ft head) Variable flows	a. Tie into existing piping at discharge location b. discharge to canal or reservoir c. Pumps as turbines or Cross-flow turbine as most economical solution for medium head. Pelton Wheel for highest heads d. moderate to long transmission lines
Low head canal demonstration project.	In-canal low head variable flow	a. Specialized technology packaged equipment

Turbine Selection Criteria

For the purpose of the hydroelectric options study, selection of turbines was based primarily on hydraulic head characteristics and to a lesser degree on design flow variability. Other than the Alder Reservoir project all of the projects brought forward for detailed study are relatively low flow (30cfs and under) projects. Once the turbine options were identified, cost of the installation was the final criteria. The following guidelines were used for the selection of turbine units.

Turbine Selection Guidelines

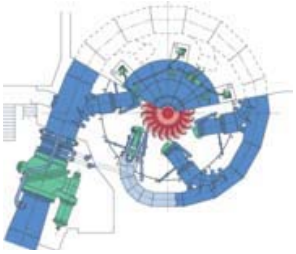
Design Head	**Discharge to atmosphere**	**Discharge to pressurized pipeline**	**Pumped storage**
70 to 350 ft	, Pump as Turbine, Francis, Crossflow	Pump as Turbine or Francis	Pump as Turbine or Francis
Over 350 ft	Pelton Wheel	NA- for these projects	NA-for these projects

As seen in the above table, there is more than one turbine option available for most projects. Final selection of the turbines for use in the study analyses also considered the capital costs and the generating efficiencies of these units.

1107 Investment Boulevard, Suite 145 El Dorado Hills, CA 95762 [916] 933-1997 [916] 933-4778 Fax

***High Head Applications*:**

Pelton Wheel (or Turgo) turbines were selected for the Alder Reservoir and the Kaiser Siphon projects as both of these projects have over 500 feet of operating head. A single Pelton unit can handle a wide range of flow at relatively high efficiency through velocity control at the nozzle with a needle valve, and or by the use of multiple nozzles. Even at flow as low as 20% of the design rate, the Pelton will perform to near 80% efficiency. These unit can handle heads well beyond the limits of any of the projects analyzed in this study, but are not recommended for heads much below 200ft. Another advantage of these types of units is that bypass can be achieved at the turbine by way of deflectors that can automatically divert the nozzle jet flow away from the wheel.



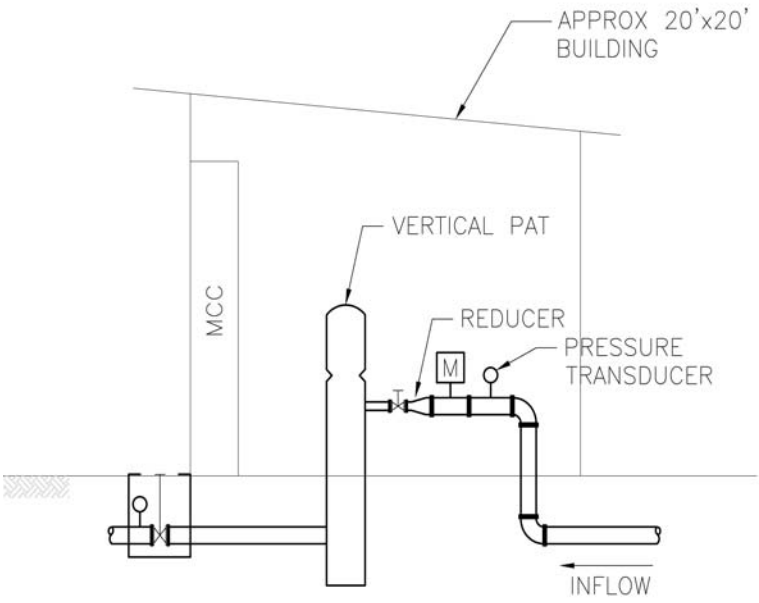
Multi- nozzle Pelton Wheel Turbine

Pressure Reducing Station (PRS) Sites:

For all of the projects at existing EID pressure reducing stations, pump as turbines (PATs) or reverse pumps were used for the basis of the cost analysis. These units are significantly less expensive than a Francis turbine (which is basically a modified reverse pump) and a Cross-flow turbine which in addition must discharge to atmosphere similar to the Pelton Wheel. The PATs are effective for the mid- head range projects in this study from 70ft to 350ft. Options for PATs become somewhat limited at higher heads.

The disadvantage of the PATs is the need for multiple units when generating over a wide range of flows. PATs are different from a Francis turbine in that they do not have adjustable guide vanes (wicket gates) to regulate flow changes across the impeller (or runner), which allows a single Francis unit to run at highly efficient rate over a wide range of flow. However, even with multiple units, the relatively low cost and availability of the PATs and replacement parts make it an attractive option for these applications. Sizing of the individual units in a multiple unit system must be done carefully, especially if (as in most in-line cases) the head also varies with flow change for the system. For the purpose of this study, multiple PAT applications were sized splitting the system flow up evenly.

1107 Investment Boulevard, Suite 145 El Dorado Hills, CA 95762 [916] 933-1997 [916] 933-4778 Fax



Typical Pump as Turbine (Elevation) NTS

Francis Turbine adjustable wicket gates

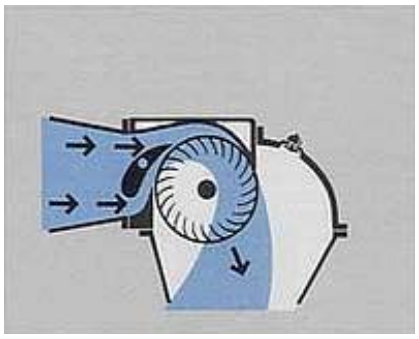
Minimum flow

Maximum flow

In addition to the lower cost of PATs, recent application of variable speed regenerative drive technology has increased the capacity to capture variable flow generation using the PATs, where in the past gaps in generation between fix speed units limited the use of PATs under these conditions. The regenerative drive concept is basically providing a variable speed drive (VFD) for a pump application, set in reverse. The regenerative drive unit takes the power generated by the variable flow (speed) reverse pump and converts the power to the proper frequency to interface with the electrical grid. For the purposes of cost estimating and comparison between projects, generation quantities in the hydro options analyses assumed the use of this technology for all PRS sites. During the design phase of selected projects, these advancements using PATs will be compared further against the use of a single Francis unit.

1107 Investment Boulevard, Suite 145 El Dorado Hills, CA 95762 [916] 933-1997 [916] 933-4778 Fax

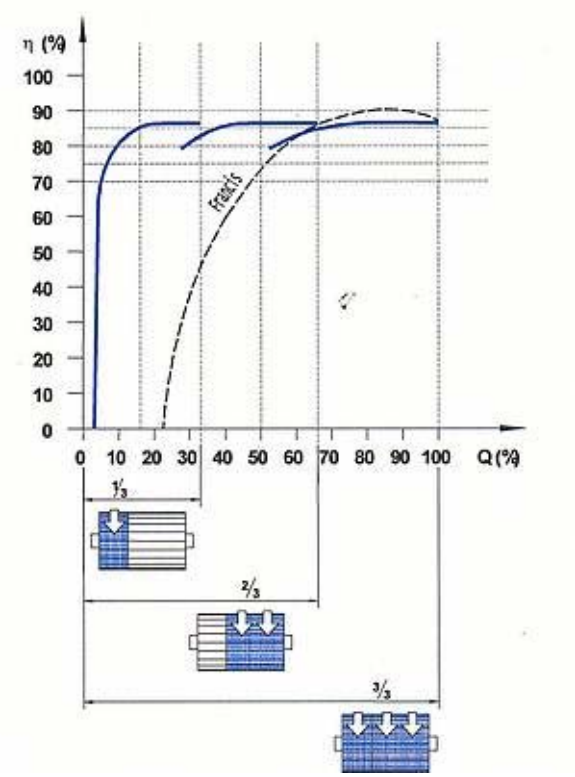
Existing Dam Sites:



Cross-flow Turbine Section

For the three potential projects located at existing dams (Sly Park Reservoir, Stumpy Meadows Reservoir and Caples Lake), the same PAT turbine arrangement and technology was applied as for the PRS sites for comparison. Given the project parameters for head, flow and discharge conditions (to atmosphere), Cross-flow (Ossberger) type turbine were also considered for these sites. This type of turbine is an impulse turbine like the Pelton Wheel, but it is not applicable for higher heads. The above projects have relatively low heads between 70ft to 100ft. The Cross-flow does not have nozzled jets directed at a wheel like the Pelton, rather it contains a cylinder drum-like rotor configuration where variable flow is sectioned off in separate cells over portions of the drum to provide high efficiency over a wide range of flows. This turbine is a possible alternative to the PATs, when comparing its higher costs to efficiency. A single Cross-flow unit may also compare well against the costs and efficiency of a Francis unit for these existing dam projects. However, concern for documented mechanical failure at mid to high head applications due to cycle fatigue is a significant draw-back for this turbine selection.

1107 Investment Boulevard, Suite 145 El Dorado Hills, CA 95762 [916] 933-1997 [916] 933-4778 Fax



Multi Stage Cross-flow Unit showing efficiency vs Francis unit

Pump Storage Project (Oak Ridge Tanks to Bass Lake Tanks):

For the Oak Ridge Tanks to Bass Lake Tanks project, a single fixed speed PAT generating unit at the Oak Ridge site will be the least expensive and most practical selection. This unit will be separate from the pump station, although with a Francis type turbine, a single unit could both pump the flow to Bass Lake and generate energy in the opposite direction. However, the added cost of the Francis unit does not make this a viable option. The PAT alone cannot provide both functions due to the operating head variation from the pumping mode to the generating mode.

End of Pipeline Applications:

There are three Georgetown Divide PUD projects that are all raw water supply projects at the termination of existing pipeline (or siphons) to either an open canal or reservoir. The Kaiser Siphon (with added pipeline) is a high head application (over 600ft) ideal for a Pelton Wheel turbine. The other two projects (Sandtrap and Buffalo Hill) are mid-head range projects and have been analyzed using the PAT application described previously. As indicated for the dam applications, with mid range head, varied flow and discharge to atmosphere, the Cross-flow turbine should also be considered as an alternative during the design phase of either of these two projects.

1107 Investment Boulevard, Suite 145 El Dorado Hills, CA 95762 [916] 933-1997 [916] 933-4778 Fax

Other Design Considerations

The turbine selection is an important component of the hydro station design. However, there are many other design considerations included in the feasibility analyses. Major project components that were included in the project layouts and cost estimate as listed below:

Design Components

Pipe, Valves & Fittings

- Intake and Return Tie into existing Pipe
- In -Line Bypass Valve, piping & vault
- Intake and Return Manifolds
- turbine pipe runs
- motorized control valves
- pressure reducing valve
- check valves
- isolation valves, reducers, misc fittings
- flow meter

Turbine/Generator Units

- Single or Multiple units

Electrical Equipment & Tie-in to Grid

- Electrical Controls/Switchgear for turbine/generator units
- Electrical utility /transformer , misc site electrical
- Hook-up to Grid (power lines, transformers, switches)

Building and Misc Structural

- Masonry building
- Foundation structure (concrete)
- Roofing & Misc supports

Other Misc Items

- Grading, Paving, Drainage and Fencing
- Environmental Mitigation

1107 Investment Boulevard, Suite 145 El Dorado Hills, CA 95762 [916] 933-1997 [916] 933-4778 Fax