# Executive Summary

Energy markets and regulations are changing rapidly. Today's focus is on renewable energy, including hydropower, which is gaining prominence similar to that seen during the oil crisis of the 1970s and early 1980s. Widespread public support seems greater than ever for renewable energy.

There are tremendous demands for new non-carbon, dependable electrical energy generation, and that trend is expected to grow given the state and national policy climates. El Dorado County's (County) purveyors are in a unique position to capitalize on incentives associated with small hydro [1.5 megawatt (MW) or less] and energy efficiency/load shifting within existing water systems. The County's purveyors have a further opportunity to develop and finance water supply/pumped storage reservoir systems utilizing the revenues from the small hydro incentives. As with all legislative or regulatory incentives and mandates, they can be discontinued. When incentives such as these arise, the window of opportunity should be seized before the window closes.

Advances in renewable energy generation, energy storage, energy transmission, and energy efficiency are seen by policymakers as a key to America's independence from foreign oil, economic recovery, air basins seeking improved air quality, and goals to reduce greenhouse gas emissions. Current policies emphasize interagency planning and cross-sector (e.g., energy, transportation, water, manufacturing, and agriculture) actions to achieve energy independence at local, regional, statewide and national levels.

The El Dorado County Water Agency's (EDCWA) Water Resources Development and Management Plan (WRD&MP 2007) identifies hydroelectric development as important to the County's future water supplies and operations. Hydropower projects produce revenues and reduce the costs of operating water facilities. Examples include Project 184, the Central Valley Project, and the State Water Project. Hydroelectric power is a proven technology typically with reliable operations over a 40- to 50-year project life, and (in the case of pumped storage) is considered by the California Independent System Operator as a critical source of dependable energy storage (CAISO 2009) that will provide a reliable balance to renewable energy sources that are not dependable, such as solar and wind.

*Scope of Hydroelectric Development Options Study*

This study was sponsored by the EDCWA and the El Dorado Irrigation District (EID), and included the participation of the Georgetown Divide Public Utility District (GDPUD). With guidance from the EDCWA, County water purveyors, and a Hydro Advisory Panel (HAP) with extensive local knowledge, EN2 Resources, Inc. and a supporting team of consultants (Consultant Team) identified, evaluated, narrowed, and recommend the most promising options for either: 1) immediate implementation, 2) detailed feasibility evaluation, or 3) future re-evaluation as the energy industry, market, and regulations continue to evolve.

Approximately 100 hydroelectric development options were initially identified throughout the County. Of the 100 options evaluated, detailed economic and financial analyses were performed on the "top 10" hydro options.

*Hydro Options Recommended for Immediate Implementation*

Based on this study, seven hydro options are recommended for immediate implementation. The two with the strongest economic characteristics (Table ES-1A) are Pleasant Oak Main PRS 5 at Reservoir 7 and El Dorado Main 2 PRS 1 at Tank 3. The other five projects recommended for immediate implementation (Table ES-1B) are: Kaiser Siphon, Pleasant Oak Main at Reservoir B, Sandtrap Siphon, Sly Park Dam, and a technology (hydrokinetic) demonstration project on the El Dorado Canal immediately downstream of the El Dorado Diversion Dam.

The seven recommended projects qualify for "must take" power purchase contracts (up to 20-year terms) with Pacific Gas and Electric Company (PG&E), except possibly for Kaiser Siphon (major pipeline option). All are economically superior to other projects evaluated and should proceed without delay to permitting, design, and construction to take advantage of this year's unprecedented rate incentives under the California Public Utilities Commission's (CPUC) Feed-In Tariff (FIT) program. The scope of the Kaiser Siphon option requires some site-specific investigations to confirm that it meets Renewable Portfolio Standard (RPS) eligibility criteria for the FIT program.

Detailed economic and financial analyses were used to identify the economically viable projects, which are recommended for implementation as described above. Because the projects recommended for immediate implementation all rely on the FIT program for viability, a critical path condition is that the projects be online within 18 months of FIT contract execution. Assuming that FIT contracts are executed not later than November 2009 (December 2009 is when the FIT program likely will be revised), then the recommended projects will need to be online by May 2011 to receive the energy price assumed in this report's economic analyses. Otherwise, PG&E has the discretion to re-queue the project and apply a new FIT contract and rates that are in effect following the expiration of the 18-month period.

The FIT program is evolving toward a 'cost-plus' margin rate structure. Because the price of oil has declined dramatically thus far in 2009, future terms likely will be less attractive for small hydro. Lower rates, increased administrative hurdles to assess 'cost-plus' margins, and increased competition for establishing a PG&E contract may make the recommended projects infeasible. Furthermore, PG&E is obligated only to accept FIT contracts totaling about 105 MW for all eligible public energy projects (e.g., hydro, solar, wind, biodiesel, and biomass) associated with water and wastewater systems. Recent and projected reductions in world petroleum prices caused by the worldwide economic downturn are likely to at least temporarily weaken future rates for renewable energy in general.

*Table ES-1A: Hydro Options with Strong Economic Characteristics (with 20-Year Feed-In Tariff Contract)*

| Project Name | Plant Size (kW) | Avg. Annual Generation (MWh) | Annual Revenues | Initial Year of Operation | Capital Cost | Cost/ Years of Debt | IRR (%) | NPV | Payback Period (years) |
|---|---|---|---|---|---|---|---|---|---|
| Pleasant Oak Main PRS 5 (Reservoir 7) | 510 | 2,321 | $ 287,082 | 2011 | $ 1,523,000 | 6.00% / 30 | 19.82 | $ 1,702,726 | 7 |
| El Dorado Main 2 PRS 1 (Tank 3) | 360 | 1,739 | $ 205,976 | 2011 | $ 1,556,000 | 6.00% / 30 | 11.46 | $ 777,089 | 14 |
| *Total* | *870* | *4,060* | *$ 493,058* | - | *$ 3,079,000* | - | - | *$ 2,479,815* | - |

*Table ES-1B: Additional Hydro Options with Viable Economic Characteristics (with 20-Year Feed-In Tariff Contract)*

| Project Name | Plant Size (kW) | Avg. Annual Generation (MWh) | Annual Revenues | Initial Year of Operation | Capital Cost | Cost/ Years of Debt | IRR (%) | NPV | Payback Period (years) |
|---|---|---|---|---|---|---|---|---|---|
| Kaiser Siphon* | 580 | 3,638 | $ 448,331 | 2011 | $ 5,172,000 | 6.00% / 30 | 5.34 | $ 347,616 | 20-30 |
| Pleasant Oak Main (Reservoir B) | 450 | 2,657 | $ 326,980 | 2011 | $ 3,591,000 | 6.00% / 30 | 5.66 | $ 319,690 | 20-30 |
| Sandtrap Siphon | 232 | 1,130 | $ 140,752 | 2011 | $ 1,456,000 | 6.00% / 30 | 5.96 | $ 158,462 | 20-30 |
| Sly Park Dam | 400 | 1,833 | $ 227,978 | 2011 | $ 2,571,000 | 6.00% / 30 | 5.04 | $ 121,711 | 20-30 |
| *Total* | *1,662* | *9,258* | *$ 1,144,041* | - | *$12,790,000* | - | - | *$ 947,479* | - |
| El Dorado Canal - Technology Demonstration** | 40 | 70 | TBD | TBD | TBD | TBD | TBD | TBD | TBD |

*Further investigation is required to confirm that Kaiser Siphon qualifies for the Feed-In Tariff program, which is a critical assumption for this economic analysis.

**Verdant Power proposes to design and construct this project at no cost to El Dorado Irrigation District, and is prepared to submit a proposal upon EID's execution of a confidentiality agreement.

**Annual Revenues –** assumes 20-year FIT agreement with PG&E. Annual revenues cannot be reasonably projected beyond the 20-year analysis period.
**IRR – Internal Rate of Return –** the interest rate received for an investment consisting of payments and income that occur at regular periods. A project is a good investment proposition if its IRR is greater than the rate of return that could be earned by alternate investments of equal risk (the hurdle rate). In a fully debt-funded project, the hurdle rate is generally the cost of the debt.
**NPV – Net Present Value –** the total present value (PV) of a time series of cash flows. It is a standard method for using the time value of money to appraise long-term projects. The NPV is based on a 20-year analysis. The project life is 40 to 50 years.
**Payback Period –** the number of years it would take to pay off the capital cost of a project if annual cash flows were used to pay down the principal component of the debt incurred to finance the project. If energy values remain the same after expiration of the PG&E contract, the payback period would be as follows: Pleasant Oak Main PRS 5 (Reservoir 7) – 7 years; El Dorado Main 2 PRS 1 (Tank 3) – 14 years; Kaiser Siphon – 26 years; Pleasant Oak Main (Reservoir B) – 26 years; Sandtrap Siphon – 25 years; Sly Park Dam – 27 years.

The Project Team (comprised of County water purveyors, HAP members, and the Consultant Team) recommends further project evaluations that will be performed (EID 2009) as part of a grant received from the CEC under its Renewable-based Energy Secure Communities (RESCO) Public Interest Energy Research (PIER) program. This evaluation will identify the extent to which water system re-operation could further benefit the economics of the recommended hydro options, and possibly make additional hydro options economically viable. System reoperation could include changing the TOD or flow-frequency of an existing water system, thereby taking advantage of peak energy pricing and shoulder peak energy pricing periods. Reoperation could further include the installation of additional storage tanks that could establish system-wide changes in the timing of flows through multiple in-conduit generators of the same system.

*Economic Highlights of the Recommended Hydro Options*

The economic analyses for the recommended projects were based on accepted financing assumptions for public water agencies and are summarized in Tables ES-1A and ES-1B. Because the technology demonstration project would be paid for and installed by Verdant Power, the limited cost and the public benefits of the hydrokinetic demonstration project support its recommendation for immediate development.

The recommended projects are viable primarily because of the applicable FIT contracts with guaranteed rates for up to 20 years, which are more than double current energy market values. FIT rates increased by more than 15 percent from 2008 to 2009, but similar increases are not expected in future years as the CPUC seeks to reduce cost impacts of the FIT and RPS programs to utility customers.

The economics of the projects are expected to improve as designs (e.g., turbine generator efficiencies) are optimized for the flows and other operating conditions at each site. The hydro option cost estimates are comprehensive and include design, permitting, construction, operation, maintenance, and equipment replacement. For Sly Park Dam, there will be new regulatory compliance costs to meet Federal Energy Regulatory Commission (FERC) dam safety requirements, which will include dam inspections, FERC fees, and possible periodic studies (e.g., emergency action plans). The costs for the new FERC dam safety requirements were not included in the Sly Park Dam project cost estimate, and do not apply to any of the other hydro options recommended for immediate implementation.

Increases in system demands over time are expected to increase total generation, substantially strengthening the projects' economic viability. For this study, energy generation and revenues for EID hydro options were projected using a conservative 0.5 percent average annual increase over the 20-year analysis period. Actual energy generation and revenues are expected to be greater under the County-adopted 2004 General Plan. Through 2025 and through hypothetical build-out, the 2004 General Plan estimates total population growth increases for the County's west slope of 65 percent and 170 percent, respectively. Because the Georgetown Ditch system is at or near capacity, no increases in flows or generation were projected for GDPUD hydro options.

*Approaches for Alternative Financing for Recommended Hydro Options*

One near-term option for financing some or all of the "top 10" hydro projects is the American Recovery and Reinvestment Act of 2009 (ARRA), which authorizes $1.6 billion of new Clean Renewable Energy Bonds (New CREBs) and $2.4 billion of new Qualified Energy Conservation Bonds (QECBs). Under the ARRA, New CREBs and QECBs are being made available for financing renewable energy and greenhouse gas emission reduction initiatives. New CREBS most directly apply to the hydro options. The application deadline for New CREBs is August 4, 2009. QECBs have no projected closing date, other than award of total available bonds.

With New CREBs (those authorized via the 2009 ARRA), the bond holder receives a tax credit that is equal to 70 percent of the IRS-approved bond market rate for New CREBs. The effective interest rate of the New CREBs for the bond issuer (e.g., EID or GDPUD) should be close to the difference between the current tax-exempt bond rate in the market and the tax credit to the bond holder, but may be somewhat more or less than this. Assuming effective interest rates on a New CREBs bond issuance and a standard tax-exempt bond issuance are 1.8 percent and 6 percent, respectively, Table ES-2 compares the overall effect of 15-year New CREBs (1.8 percent) to typical 30-year bond (6 percent) financing. Table ES-3 displays the sensitivity of the "top 10" hydro options to this same CREBs scenario for a 20-year financing analysis period.

Table ES-2: Comparison of 30-Year Bonds to Example New CREBS Financing for the "Top 10" Hydro Options

| Financing | Capital Cost (Top 10 Options) | Net Present Value (20-Year Analysis Period) | Capacity (kW)/ Annual kWh |
|---|---|---|---|
| 30-Year Bonds | $ 20,418,000 | $ 2,962,136 | 3,315/16,632,000 |
| CREBs/QECBs | $ 20,418,000 | $ 5,194,196 | 3,315/16,632,000 |

Combining or 'batching' hydro projects by water system (e.g., Pleasant Oak Main and Georgetown Ditch) is a possible approach for financing and it also offers opportunities for multiple project economies of scale where proximity and system similarities can reduce design, permitting, financing, construction, and other development and operation costs. Estimating such cost savings would require that specific combinations of projects be identified. Table ES-3 displays how hydro options could be grouped by water system.

*Table ES-3: "Top 10" Hydro Options Sensitivity to Example Clean Renewable Energy Bonds (with 20-Year Feed-In Tariff Contract)*

| Project Name | Plant Size (kW) | Avg. Annual Generation (MWh) | Initial Year of Operation | Capital Cost | Cost/ Years of Debt | IRR (%) | NPV | Payback Period (years) |
|---|---|---|---|---|---|---|---|---|
| **El Dorado Main System*** | | | | | | | | |
| El Dorado Main 2 PRS 1 (Tank 3) | 360 | 1,739 | 2011 | $ 1,556,000 | 1.80% / 15 | 11.46 | $ 947,188 | 8 |
| El Dorado Main 2 PRS 3 | 195 | 892 | 2011 | $ 1,409,000 | 1.80% / 15 | 2.57 | $ 1,047 | >15 |
| **El Dorado Hills System*** | | | | | | | | |
| Oak Ridge Tanks to Bass Lake Tanks Pumped Storage | 280 | 874 | 2011 | $ 774,000 | 1.80% / 15 | 2.39 | $ 10,446 | >15 |
| **Georgetown Ditch System*** | | | | | | | | |
| Sandtrap Siphon | 232 | 1,130 | 2011 | $ 1,456,000 | 1.80% / 15 | 5.96 | $ 317,629 | 13 |
| Buffalo Hill Siphon | 168 | 860 | 2011 | $ 1,284,000 | 1.80% / 15 | 3.46 | $ 71,073 | >15 |
| Kaiser Siphon | 580 | 3,638 | 2011 | $ 5,172,000 | 1.80% / 15 | 5.34 | $ 913,010 | 13 |
| **Pleasant Oak Main System*** | | | | | | | | |
| Sly Park Dam | 400 | 1,833 | 2011 | $ 2,571,000 | 1.80% / 15 | 5.04 | $ 402,768 | 14 |
| Pleasant Oak Main (Reservoir B) | 450 | 2,657 | 2011 | $ 3,591,000 | 1.80% / 15 | 5.66 | $ 712,252 | 13 |
| Pleasant Oak Main PRS 5 (Reservoir 7) | 510 | 2,321 | 2011 | $ 1,523,000 | 1.80% / 15 | 19.82 | $ 1,869,218 | 5 |
| Diamond Springs Main PRS 1 (Reservoir 8) | 140 | 688 | 2011 | $ 1,082,000 | 1.80% / 15 | 1.76 | $ (50,435) | >15 |
| *Total* | *3,315* | *16,632* | - | *$20,418,000* | - | - | *$ 5,194,196* | - |

*Examples of potential hydro option groupings that could be used to apply for CREBs or Qualified Energy Conservation Bonds, or to pursue economies of scale in hydro option development.

**Note: The New CREBs interest rate on July 1, 2009 was 7.05%. Assuming issuer and holder agree to this bond rate, then financing would have an effective rate of 2.11%.**

**IRR – Internal Rate of Return –** the interest rate received for an investment consisting of payments and income that occur at regular periods. A project is a good investment proposition if its IRR is greater than the rate of return that could be earned by alternate investments of equal risk (the hurdle rate). In a fully debt-funded project, the hurdle rate is generally the cost of the debt.

**NPV – Net Present Value –** the total present value (PV) of a time series of cash flows. It is a standard method for using the time value of money to appraise long-term projects.

**Payback Period –** the number of years it would take to pay off the capital cost of a project if annual cash flows were used to pay down the principal component of the debt incurred to finance the project.

*Hydro Options Recommended for Detailed Feasibility Evaluation*

A grant was recently awarded to EID et al. (2009) by the California Energy Commission (CEC) to evaluate reoperation of selected water systems. The reoperation evaluation will seek to maximize water system (e.g., El Dorado Main and Georgetown Ditch) hydro generation during peak energy value periods, improve system energy efficiencies, and shift water system energy loads to off-peak periods. A key aspect of this grant will be to assess the feasibility of reoperation by incorporating intermittent energy storage systems, primarily water storage tanks, which would allow turbine-generator efficiency optimization and peaking re-regulation of flows to maximize hydroelectric revenues. Basically, the water systems would be re-operated to uncouple customer demand from daily operations.

The four projects shown in Table ES-4 (Diamond Springs Main PRS 1, El Dorado Main 2 PRS 3, Oak Ridge Tanks to Bass Lake Tanks Pumped Storage, and Buffalo Hill Siphon) do not appear economically viable based solely on analyses of existing water system operations. The reoperation evaluation grant may demonstrate that these and other system options would be economically viable with flow re-regulation (made possible with increased storage at key locations), energy efficiency cost savings, and load management to take advantage of energy prices at different times of the day. The intermittent storage systems would also boost overall water system reliability. Indeed, EID and GDPUD may have other facility improvement and operation considerations that could make these hydro options attractive for reasons other than economics.

Additional hydro options, other than the four projects identified for reoperation, warrant detailed feasibility studies to better assess their merits. The most promising are identified in Table ES-5. Included are hydro options within the South Tahoe Public Utility District (STPUD) and Heavenly Ski Resort water systems. Studies by Heavenly Ski Resort and STPUD's update to its 2001 evaluation of the "C-Line" treated wastewater pipeline are expected to identify some viable options.

Of the projects listed in Table ES-5, the greatest potential for hydroelectric generation would be from the Alder Reservoir hydro options. Previous studies of Alder Reservoir focused on either a very large alternative to support then-proposed South Fork American River (SOFAR) Project, or a smaller, stand-alone alternative that was limited to storing Alder Creek flows. This study identified Alder Reservoir concept alternatives that include water projects shared and jointly studied with other County purveyors or downstream purveyors (e.g., members of the American River Basin Regional Water Authority) that may be seeking drought, conjunctive use, or other water rights.

*Table ES-4: Hydro Options that May Become Viable with System Reoperation (with 20-Year Feed-In Tariff Contract)*

| Project Name | Plant Size (kW) | Avg. Annual Generation (MWh) | Annual Revenues | Initial Year of Operation | Capital Cost | Cost/ Years of Debt | IRR (%) | NPV | Payback Period (years) |
|---|---|---|---|---|---|---|---|---|---|
| Diamond Springs Main PRS 1 | 140 | 688 | $ 82,196 | 2011 | $ 1,082,000 | 6.00% / 30 | 1.76 | $ (168,717) | >30 |
| El Dorado Main 2 PRS 3 | 195 | 892 | $ 109,667 | 2011 | $ 1,409,000 | 6.00% / 30 | 2.57 | $ (152,982) | >30 |
| Oak Ridge Tanks to Bass Lake Tanks Pumped Storage | 280 | 874 | $ 117,388 | 2011 | $ 774,000 | 6.00% / 30 | 2.39 | $ (74,167) | >30 |
| Buffalo Hill Siphon | 168 | 860 | $ 106,777 | 2011 | $ 1,284,000 | 6.00% / 30 | 3.46 | $ (69,292) | >30 |
| *Total* | *783* | *3,314* | *$ 416,028* | - | *$ 4,549,000* | - | - | *$ (465,158)* | - |

Annual Revenues – assumes 20-year FIT agreement with PG&E. Annual revenues cannot be reasonably projected beyond the 20-year analysis period.

**IRR – Internal Rate of Return –** the interest rate received for an investment consisting of payments and income that occur at regular periods. A project is a good investment proposition if its IRR is greater than the rate of return that could be earned by alternate investments of equal risk (the hurdle rate). In a fully debt-funded project, the hurdle rate is generally the cost of the debt.

**NPV – Net Present Value –** the total present value (PV) of a time series of cash flows. It is a standard method for using the time value of money to appraise long-term projects.

**Payback Period –** the number of years it would take to pay off the capital cost of a project if annual cash flows were used to pay down the principal component of the debt incurred to finance the project.

*Table ES-5: Hydro Options Recommended for Detailed Feasibility Study*

| Project Name | Description | Estimated Plant Size | Estimated Generation | Additional Comments |
|---|---|---|---|---|
| **Alder Reservoir Hydroelectric Options** | *Generation from a new 50,000 to 100,000 acre-foot reservoir to function as seasonal pumped storage and to supplement generation at the El Dorado Powerhouse* | about 15 MW at Alder Powerhouse; no change to El Dorado Powerhouse | Net increase of roughly 50,000,000 kWh annually for Alder and El Dorado Powerhouse generation combined | This option could support water rights storage and delivery to EID and possibly other El Dorado County purveyors through purveyor pipeline interties and operating agreements. Reservoir sizing could incorporate drought period and other water rights dedicated to downstream purveyors that partially finance the reservoir and hydropower facilities. |
| **Caples Dam** | *This option could interconnect with Mountain Utilities to supply Kirkwood Resort; analyses of this option indicate that the conduit through Caples Dam downstream of the slide gate would need to be modified; an option to the 280 kW project could be a smaller capacity unit (e.g., 40 kW) that is sized for the Caples Dam Outlet works, Caples Resort, Caples Lake boat launch facility, Hwy 88 rest area at the auxiliary dam, and Caltrans maintenance station* | About 280 kW | About 1,000,000 kWh annually | Caples Resort has expressed interest in exploring the possibility of participating with EID in a downsized project if Kirkwood area interests do not wish to develop a larger project. |
| **El Dorado Hydroelectric (FERC) Project 184 Minimum Instream Flows** | *Since the Federal Energy Regulatory Commission (FERC) 2006 relicensing of Project 184, the El Dorado Powerhouse has generated substantially less energy due in part to the increased minimum instream flow requirements for the South Fork American River and feeder streams along the El Dorado Canal; this project would revisit instream flows of the El Dorado Relicensing Settlement Agreement to evaluate options to recover unexpected losses in El Dorado Powerhouse generation* | No change to El Dorado Powerhouse | Recovery of generation lost with the 2006 relicensing of the El Dorado Powerhouse | The new FERC License instream flow conditions for Project 184 were based on a generalized hydrologic model. The power generation model was based on monthly water supply averages over a historical period. The power generation analyses and relicensing condition decisions may have overestimated the power generation. EID could more accurately model power generation, consult with the Settlement Agreement Parties and FERC, and propose modifications to minimum instream flows that would allow EID to recoup unintended losses in renewable energy. |

| | | | | |
|---|---|---|---|---|
| **El Dorado Powerhouse Low-High Flow Optimization** | *El Dorado Canal flows vary based on water year conditions. This option would evaluate minimum and maximum generation capability at the El Dorado Powerhouse.* | Incremental 0.5 to 1.0 MW | Net annual increase dependent on canal flows and operations | An incremental generation option (up to 1 MW) would qualify for FIT rates, which are more than double the rates that EID currently receives for El Dorado PH generation; an optimization study should also consider low flow operations of less than 3 MW. |
| **Heavenly Ski Resort California Base Pump Station** | *Heavenly Ski Resort currently receives treated water from STPUD through a Heavenly Ski Resort re-regulating tank and pressurized pipeline. Water is then pumped about halfway up the Resort's ski area to its California Dam Reservoir; this project simply replaces a pressure reduction valve at the Resort's pump station with an in-conduit generator* | about 60 kW | about 150,000 kWh annually | Generation would generally be limited to the October through January period when the Resort is making snow (flows are continuous during this period); an in-conduit generator would operate at a high capacity and efficiency for the entire period, and could be used to help pay for or offset pumping, snowmaking, and other Resort peak season energy loads. |
| **South Tahoe Public Utility District "C-Line" Treated Wastewater Outfall** | *Replacement of the existing 42-year-old gravity flow pipeline with a high-pressure pipeline to allow installation of one or more in-conduit turbine generators* | about 1,000 kW with a new pressurized pipeline | about 7,500,000 kWh annually | The existing pipeline has an uncertain number of years of remaining useful life; analyses of alternatives involving low pressure hydro installations now, and incorporation of higher capacity generation with the replacement pipeline later, should be considered. |
| **Stumpy Meadows Dam** | *GDPUD has analyzed this project intermittently since the early 1980s, and it represents an example of a non-powered, viable hydro option; this project has not been developed to date because the nearest point of interconnection is a 2-phase power line about 3 miles distant that would need to be upgraded to 3-phase and extended to the dam outlet* | about 485 kW | about 2,000,000 kWh annually | Existing public and/or Sierra Pacific Industries' access roads could be used for extending the power line. Past coordination efforts with PG&E have been unsuccessful due to planning and construction costs; GDPUD could request that the CA Public Utilities Commission support power line financing provisions for Feed-In Tariff projects, or ask PG&E directly for assistance with financing the power line extension to the project site. |

A new Alder Reservoir and seasonal pumped storage concept identified by this study consists of a medium-sized (50,000 to 100,000 acre-foot) reservoir that would support an approximately 15 MW Alder powerhouse, augment water supplies for the 21 MW El Dorado Hydroelectric Project, store existing and supplemental County purveyor water rights, and possibly augment flows for instream and other downstream beneficial uses. Water would come from two sources: 1) Alder Creek flows that include existing EID hydroelectric water rights and 2) existing and possibly supplemental water rights diverted from the South Fork American River during high flow runoff periods when instream resources would not be adversely affected by increased diversions. More specifically, increased diversions in the El Dorado Canal between the Kyburz diversion and Alder Siphon would be used to convey high runoff period flows to a pump station, at the Alder Siphon, that would lift water to the Alder Reservoir. This winter/spring runoff from the South Fork American River, together with Alder Creek basin water, would be released for hydroelectric generation at a new Alder Powerhouse and the existing El Dorado Powerhouse during peak generation revenue periods in the summer and fall. Besides providing new storage and power generation facilities, this option capitalizes on excess capacity in the existing canal and increases power generation at an existing powerhouse by prolonging power generation into late summer and fall, which is currently not possible due to release restrictions.

Of all previous reservoir concepts considered, the newly identified Alder Reservoir seasonal pumped storage hydroelectric option offers substantial promise for an energy revenue-supported, long-term water supply project for El Dorado County purveyors. Based on preliminary estimates, a 50,000 acre-foot Alder Reservoir and 15 MW Powerhouse would yield a net increase of about 50,000,000 kWh (50,000 MWh) and roughly $5 million/year in net energy revenues for Alder and El Dorado Powerhouse generation combined. Additional storage would allow electric generation for both hydro projects (Project 184 and Alder) during the highest demand/price periods as water released from Alder could flow to Forebay reservoir and the El Dorado Powerhouse to help meet seasonal, daily peak, and ‘on-call’ demands for electricity.

*Hydro Options in Changing Regulatory and Climatic Environments*

Public proceedings on current energy programs, evaluations of foreign energy programs, new state and federal legislation, and industry-sponsored initiatives for California’s renewable energy future are re-shaping the regulatory and economic framework for hydro development. However, history indicates that today’s renewable energy boom could periodically experience a sudden decline as occurred following the 1980s drop in international oil prices. Oil prices have decreased substantially to date in 2009. In contrast, the forces of public policy or the energy market could continue to drive up the value of renewable energy to levels not previously thought possible. Consequently, County purveyors should continue to closely track and participate in the policy and regulatory proceedings affecting the value and scope of hydro options that could measurably support existing and future water and wastewater system operations in the County. This is especially important because of increasing indications that energy management could become a regulated aspect of water system operations in the future.

The Alder project offers extraordinary potential for premium price energy production as well as additional water supply. The water stored here has substantial potential to be a synergistic addition with variable options to strengthen the late season supply or storage at existing reservoirs (Sly Park) or possible new sites (Texas Hill), or to feed the El Dorado Power Plant for power generation during peak demand/price time periods. It would offer far greater value as an integrated part of the EID Project 184 system than it would as a stand-alone reservoir and power plant. This would also be a key site for capturing water into storage as climatic fluxes raise and lower the snow/rain elevation interface. During periods with a rising snow line, it will be important to have the capability to change the timing for capturing rainfall into storage.

*Other Potential Benefits of Hydro Options*

Non-economic and indirect economic benefits of the identified hydro options were not quantified by this study, but can be important when considering project viability and system operations:

- Long-term economic value (40- to 50-year project life) of energy sales beyond the 20-year economic analysis period;
- Progress toward a Hydro Advisory Panel-proposed policy of energy independence for the customers served by the water systems;
- Renewable energy credits (for non-FIT and post-FIT projects) that could be either applied toward future purveyor requirements, sold in a developing cap and trade greenhouse gas emissions reductions market, or used to meet future purveyor greenhouse gas emission reduction requirements;
- Public policy benefits of developing renewable energy to help displace fossil fuel-fired electricity consumed by water system operations;
- Jobs creation and multiplier benefits to the local, water sector, and renewable energy economies from project development; and,
- Enhanced monitoring and control systems at the hydro project sites that would improve water service reliability and system equipment longevity.

Customers will also benefit economically from the hydro options. The NPV represents net revenues for reducing total costs to purveyor customers for the first 20 years of operation. Because the projects typically have 40- to 50-year project lives, substantial net revenues also are expected beyond the initial 20-year period.

*Conclusions*

The hydro options identified in Tables ES-1A and ES-1B warrant proceeding to design and permitting without delay to take advantage of the 20-year FIT rates with PG&E's "must take" standard contracts. The FIT rates and conditions are under review and likely will change in December 2009. Therefore, lengthy FERC license exemption and other regulatory processes must be initiated immediately to help ensure that PG&E FIT contract 18-month deadlines are met for commercial operation. The hydro options

identified in Tables ES-4 and ES-5 are recommended for detailed feasibility evaluations, with initial emphasis on: 1) reoperation of the existing water systems, and 2) defining the scope and potential framework for the Alder Reservoir hydro options. Figure ES-1 shows the locations of these recommended hydro options.

*Recommended Next Steps*

The next steps are to:

1) authorize the design, FERC review, permitting, and CEC RPS renewable energy pre-certification of the hydro options in Table ES-1A and Table ES-1B,
2) assign purveyor staff workgroups responsible for overseeing development of the selected projects,
3) consider whether to adopt a Hydro Advisory Panel-recommended policy of energy independence for water system operators and/or County agencies,
4) complete the water system reoperation study, funded by the CEC, and evaluate reoperation changes to the economics of the hydro options in Table ES-4,
5) consider applying for CREBs or QECB low-interest bonds for some or all of the "top 10" projects (Table ES-3),
6) sign and submit the PG&E "must-take" FIT agreements for the selected projects by November 2009,
7) initiate detailed feasibility studies on the projects identified in Table ES-5, and
8) initiate dialogue with PG&E, SMUD, and/or others regarding partnering or financing all, or elements of, the projects recommended for further feasibility study (e.g., GDPUD Stumpy Meadows).

The PG&E "must-take" FIT agreements for the recommended projects will require that the projects be operational within 18 months of signing, otherwise, PG&E may void the FIT contracts or re-queue the projects under a new and less favorable tariff in effect at that time. Therefore, to help ensure successful development of the economically viable projects, this study strongly recommends an immediate start for FERC review, permitting and design, and diligence through construction. Assuming that FIT agreements are signed and submitted in November 2009, the selected projects would need to be on-line by May 2011.

# Figure ES-1. Locations of Recommended Hydro Options


PLACER COUNTY

LAKE TAHOE

NEVADA

Middle Fork American River

Buffalo Hill Siphon

Sandtrap Siphon

Kaiser Siphon

Georgetown

Stumpy Meadows Dam

Stumpy Meadows Reservoir

Pilot Creek

Rubicon River

Loon Lake

South Fork Rubicon River

General Creek

Little Silver Creek

Union Valley Reservoir

Fallen Leaf Lake

Heavenly Ski Resort Base Pump Station

Lake Aloha

Angora Creek

Upper Truckee River

Echo Lakes

Cold Creek

Trout Creek

Saxton Creek

Silver Creek

Ice House Reservoir

South Fork Silver Creek

South Fork American River

El Dorado Hydroelectric (FERC) Project 184

El Dorado Canal Technology Demonstration

STPUD - Treated Wastewater Outfall

El Dorado Main 2 PRS 1 (Tank 3)

El Dorado Main 2 PRS 3

Placerville

Pollock Pines

Alder Reservoir Options

Jenkinson Lake

Sly Park Dam

Caples Dam

Caples Lake

Kirkwood

Silver Fork American River

Weber Res.

Weber Creek

Pleasant Oak Main (Reservoir B)

Oak Ridge Tanks to Bass Lake Tanks Pumped Storage

Diamond Springs Main PRS1 (Reservoir 8)

Pleasant Oak Main PRS 5 (Reservoir 7)

North Fork Cosumnes River

Silver Lake

ALPINE COUNTY

Folsom Lake

Folsom

New York Creek

El Dorado Hills

Cameron Park

Shingle Springs

Deer Creek

Big Canyon Creek

Martinez Creek

Grizzly Flat

Middle Fork Cosumnes River

Cosumnes River

South Fork Cosumnes River

SACRAMENTO COUNTY

AMADOR COUNTY

AMADOR COUNTY

80 49 193 50 89 88

0 1 2 4 6 8 Miles

NAD 83; California State Plane Zone II (ft)

## Map Features

### Hydroelectric Project Recommendations

- Immediate Implementation
- Reoperation Feasibility Study
- Technology Demonstration
- Detailed Feasibility Study

**Water District Sphere of Influence**

- El Dorado Irrigation District (EID)
- Georgetown Divide Public Utility District (GDPUD)
- South Tahoe Public Utility District (STPUD)

**Administrative Boundaries**

- County
- Community Region
- Rural Center

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Map Prepared By: Ethan Koenigs 07/13/09