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NWP NACIMIENTO WATER PROJECT
San Luis Obispo County Flood Control & Water Conservation District

**San Luis Obispo County FC&WCD**
John R. Hollenbeck, P.E.
Nacimiento Project Manager

**Commissioners**
Frank Mecham, SLO County FC&WCD
John Hamon, City of Paso Robles
Judy Dietch, Templeton CSD
Grigger Jones, Atascadero MWC
Andrew Carter, City of San Luis Obispo

June 1, 2011

Honors and Awards Program Office
American Society of Civil Engineers
1801 Alexander Bell Drive
Reston, VA 20191-4400

SUBJECT: Introduction of the Nacimiento Water Project Associated with the ASCE Outstanding Civil Engineering Achievement Award Entry

To whom it may concern:

The San Luis Obispo County Flood Control and Water Conservation District (District), and the District's design engineer Black & Veatch Corporation (B&V), proudly submit this entry for the Nacimiento Water Project's (Project's) consideration to be the ASCE Outstanding Civil Engineering Achievement Award recipient. This $176.1-million Project is the single largest public works project ever managed, funded, and constructed by the San Luis Obispo County government (by a factor of six!) and serves as an icon of the collaborative strength that was built between local water agencies during the Project's planning, design, financing, construction, and initial operation.

B&V developed and constantly applied the following mission statement during the Project's design phase:

> *"To seek opportunities for efficiently designed facilities that focus on capital cost savings and appeal to the construction industry."*

The District applauds B&V's, and its major subconsultant Boyle Engineering Corporation's (now AECOM), endeavor to fulfill this mission. Our entry form will describe paths taken to overcome challenges and to achieve the intent of this mission statement.

Our Project, over time, developed a certain vernacular to aid in communication of the Project's elements, and to assist the reader in the evaluation of our entry we provide the following list of acronyms and abbreviations:

AF – acre feet
AFY – acre feet per year
cfs – cubic feet per second

District – San Luis Obispo County Flood Control and Water Conservation District
FEIR – Final Environmental Impact Report
gpm – gallons per minute
HDD – horizontal directional drill
Participants – The water agencies participating in the Project include:

- City of Paso Robles
- Templeton Community Services District
- Atascadero Mutual Water Company
- City of San Luis Obispo
- County Service Area 10, Benefit Zone A

Project – Nacimiento Water Project
SCADA - supervisory control and data acquisition
WDEC – Water Delivery Entitlement Contract

We have organized our entry submittal to conform to the ASCE Outstanding Civil Engineering Achievement Award Program instructions. A summary of this addendum to our entry submittal is presented below:

- Introduction: Includes this introductory letter, a one-page Project Description, and a one-page Project Fact Sheet.

- Resourcefulness in Planning and Solving Design Challenges (see **Section 2**): The Project incorporated various creative measures to resourcefully manage planning, budgeting, design, and bidding challenges. Many "smart design" strategies were developed which reduced capital costs and allowed Participants to remain committed to the Project.

- Originality and Innovation (see **Section 3**): The Project utilized inventive configuration of the lake intake, pipe construction methods on Camp Roberts, and electrical power savings investment. New technology was also incorporated to monitor for damaging hydraulic transients in the pipeline.

- Sustainability Considerations (see **Section 4**): The Project strived to minimize environmental, cultural, and archeological impacts through construction methods and monitoring. The Project also constructed architecturally pleasing facilities and entered into a Savings by Design program with the power utility company.

- Project Planning and Delivery (see **Section 5**): The Project is completely self-funded by the Participants through a 30-year debt service to repay revenue bonds. The execution of the Project is on-time and under-budget.

- Contribution to the Well-Being of People and Communities (see **Section 6**): Water can divide or unite communities, and both have occurred over a five decade period on this Project. Fortunately, this capital project has now strengthened the relationships of the agencies that have been involved in

implementing this regional water supply project. Through public outreach and community partnership, the quality of life in San Luis Obispo County will be greater for generations to come.

- Appendices: Four appendices provide additional information including letters of support, technical papers and presentations, newspaper/journal articles, and photographs.

We trust that our entry complies with the information you requested; however, if you have questions please call either the undersigned at (805) 781-5252, or Mr. Steve Foellmi with B&V at (949) 753-0500. Thank you for your consideration of the Nacimiento Water Project for the ASCE Outstanding Civil Engineering Achievement Award.

Sincerely,

JOHN R. HOLLENBECK, P.E, M. ASCE
Nacimiento Project Manager

Intake Facility at Lake Nacimiento

Intake Pump Station

Santa Ysabel Pump Station

Rocky Canyon Tank and Pump Station

45 miles of welded steel and ductile iron pipe

**ENTRY FOR ASCE OUTSTANDING CIVIL ENGINEERING ACHIEVEMENT AWARD**

JUNE 1, 2011

# Nacimiento Water Project Description

**Cost:** $176.1-million

**Completion Date:** January 2011

**Owner:** San Luis Obispo County Flood Control and Water Conservation District

**Engineer:** Black & Veatch Corporation

**Project:** 45-mile raw water distribution system to convey 15,750 acre-feet per year from Lake Nacimiento to various participating agencies.

The Nacimiento Water Project (Project) consists of a multi-port sloping intake facility at Lake Nacimiento with a pump station, two intermediate pump stations, three storage tanks, a control system, and approximately 45 miles of transmission pipeline ranging from 36- to 12-inches in diameter, with the ability to deliver 15,750 acre-feet of raw water each year to communities within San Luis Obispo County.

The $176.1-million Project is owned, managed and operated by the San Luis Obispo County Flood Control and Water Conservation District (District). It is the District's largest project ever constructed by a factor of six, and serves as an icon of collaboration between communities within San Luis Obispo County. The Participants in the Project are the City of Paso Robles, Templeton Community Services District, Atascadero Mutual Water Company, the City of San Luis Obispo, and County Service Area 10, Benefit Zone A.

NWP NACIMIENTO WATER PROJECT

San Luis Obispo County Flood Control & Water Conservation District

*Presenting the Nacimiento Water Project's Entry for the American Society of Civil Engineers' Outstanding Civil Engineering Achievement Award…*

# FACT SHEET FOR THE NACIMIENTO WATER PROJECT

| Item | Description of Civil Engineering Facts |
|---|---|
| **Project** | 15,750 acre-feet per year (AFY) Raw Water Conveyance<br>Source of Water: Lake Nacimiento, San Luis Obispo County, California. Lake full capacity is 377,900 AF, and dead pool capacity is 10,300 AF.<br>Water Rights: Via October 19, 1959 Agreement for use of 17,500 AFY |
| **Pipeline** | Length: 45-miles<br>Diameter: Ranges from 36- to 12-inch<br>Materials: First 22 miles are welded steel. Last 23 miles is ductile iron.<br>Corrosion Protection: Welded steel is cement mortar coated and lined. Ductile iron is cement mortar lined and coated with asphaltic coating with polyethylene plastic encasement. Pipe fully bonded with corrosion monitoring stations throughout.<br>Hydraulic Capacity: Maximum 32.79 cubic feet per second (cfs), minimum 8.40 cfs. |
| **Intake at Lake Nacimiento** | Lake Intake Structure<br>➢ Type: 7-port sloping intake pipe, 48-inch diameter, A316L Stainless Steel<br>➢ Ports: Six 24-inch diameter, one 48-inch diameter. Each port protected with debris screens and controlled by hydraulically-actuated butterfly valves<br>➢ Design Capacity: 32.79 cfs<br>Intake-to-Shaft Tunnel<br>➢ Type: 52-inch diameter steel lined tunnel<br>➢ Shaft Isolation Valve: Hydraulically-actuated 48-inch diameter butterfly valve<br>Pump Station Wet-Well Shaft<br>➢ Type: Cast-in-Place Concrete-Lined Vertical Shaft<br>➢ Dimensions: 20-foot diameter by 180-foot deep |

| **Pump Stations** | **Intake** | **Santa Ysabel** | **Rocky Canyon** |
|---|---|---|---|
| No. Pumps: | 5 | 4 | 3 |
| Type: | Vertical Turbine | Vertical Turbine | Vertical Turbine |
| Unit Operation: | 8.24 cfs @ 370 ft head | 6.68 cfs @ 528 ft head | 4.46 cfs @ 606 ft head |
| Drives: | 450 hp, 4160V Electric Mtr | 500 hp, 460V Electric Mtr | 400 hp, 460V Electric Mtr |
| VFD's*: | All Five Units | Two Units | None |
| No. Stages: | 4 | 4 | 6 |
| Discharge Size: | 14-inch diameter | 12-inch diameter | 12-inch diameter |
| Other: | Submerged in wet-well | Submerged in pump barrel | Submerged in pump barrel |

| **Tanks** | **Camp Roberts** | **Rocky Canyon** | **Cuesta** |
|---|---|---|---|
| Capacity: | 850,000 gallons | 850,000 gallons | 300,000 gallons |
| Diameter: | 70 feet | 70 feet | 52 feet |

| **Turnouts** | **Paso Robles** | **Templeton CSD** | **Atascadero MWC** | **San Luis Obispo** |
|---|---|---|---|---|
| Size: | 24-inch diameter | 8-inch diameter | 18-inch diameter | 12-inch diameter |
| Control Valve: | 16-inch globe valve | 4-inch globe valve | 10-inch globe valve | 8-inch sleeve |
| Design Flow: | 12.90 cfs | 1.27 cfs | 10.22 cfs | 8.40 cfs |

* VFD stands for Variable Frequency Drive.

| Date | Milestone Event |
|---|---|
| Jan 6, 2004 | District's Board Approves Final Environmental Impact Report |
| Aug 17, 2004 | District's Board Executes Water Delivery Entitlement Agreements (WDEC) with City of Paso Robles, Templeton Community Services District, Atascadero Mutual Water Company, and City of San Luis Obispo |
| Jul 15, 2005 | District's Board Approves Engineering Agreement with Black & Veatch Corporation |
| Oct 24, 2006 | District's Board Executes WDEC with County Service Area 10, Benefit Zone A |
| May 22, 2007 | District's Board Approves Project's Plans and Designs and Authorizes Bidding |
| Jul - Aug 2007 | Five Construction Contract Bids Opened |
| Aug 24, 2007 | WDEC Opt-Out Period ends with all Participants continuing with Project |
| Aug 28, 2007 | District's Board Awards Intake and Pipeline Construction Contracts |
| Sep 10, 2007 | San Luis Obispo County Financing Authority issues both taxable and nontaxable bonds, representing the single largest bond sale in San Luis Obispo County. The bond sale generates the $176.1-million in funds for design and construction costs. |
| Sep 11, 2007 | District's Board Awards Construction Contract for the Facilities |
| Oct 2007 | Notice to Proceed Issued to Construction Contractors |
| Dec 6, 2011 | District's Operators take over operations and delivery of water |
| Jan 7, 2011 | Successful Completion of the Startup, Testing and Commissioning of the Project |

# 2. Resourcefulness in Planning And Solving Design Challenges

"Each of the purveyors had the opportunity to opt out of the project… If Paso Robles or San Luis Obispo opted out of the project, this project would not have happened. And so with participation and cooperation, for the first time in San Luis County history, you had communities that came together who said we are all in this together and we have got to find a way to build it and we are willing to pay the price."
Nacimiento Commissioner and 1st District Supervisor Frank Mecham

## 2.1 BRIEF PROJECT DESCRIPTION

The Nacimiento Water Project (Project), illustrated in **Figure 2-1**, is a new 15,750 acre-feet pear year (AFY) raw water conveyance consisting of a lake intake at Lake Nacimiento, three pump stations with supporting structural and architectural elements, three welded steel storage tanks, four turnouts for delivering water to the participating agencies, 45 miles of transmission piping, associated electrical-mechanical works, and instrumentation and controls features. The pipeline traverses different terrains including hills, rivers, a military base, state highways, railroads, and many public and private properties.

The Project was launched with the Final Environmental Impact Report (FEIR) adoption on January 6, 2004, by the Board of Supervisors (Board) for the San Luis Obispo County Flood Control and Water Conservation (District). The District owns the Project and took over daily operation in early December 2010 to conduct a 30-day commissioning test that was successfully completed on January 7, 2011 – almost seven years to the day after the District's Board directed staff to manage, design, fund, and construct the Project.

The District engaged several consulting firms, affectionately known as "the Army of Consultants" to perform the design engineering, right-of-way procurement, environmental permitting, revenue bond development, and preliminary construction management review of the Project during the Design Phase that spanned from 2004 through spring 2007. The Bidding Phase occurred from May to August 2007. The final budget of $176.1-million was established in late August 2007, and revenue bonds, both taxable and non-taxable, were sold on September 10, 2007, providing full-funding of the Project through the end of construction. Construction began on October 3, 2007. The final construction milestone, the completion of the startup and testing activities, occurred on January 7, 2011. The Project's overall organization chart is presented in **Figure 2-2**.


"The Army of Consultants"

The B&V design team's subconsultants each performed specialized tasks. B&V's leadership during the Design Phase included preliminary design development, recommendation for alignment alterations, management of the geotechnical exploration studies, and coordination with the District's right-of-way consultant and environmental permitting consultant to develop the bidding documents for the District's Board to approve and advertise for construction. B&V remained active on the Project during the Construction Phase to review technical shop drawing submittals and perform design modifications when necessary.

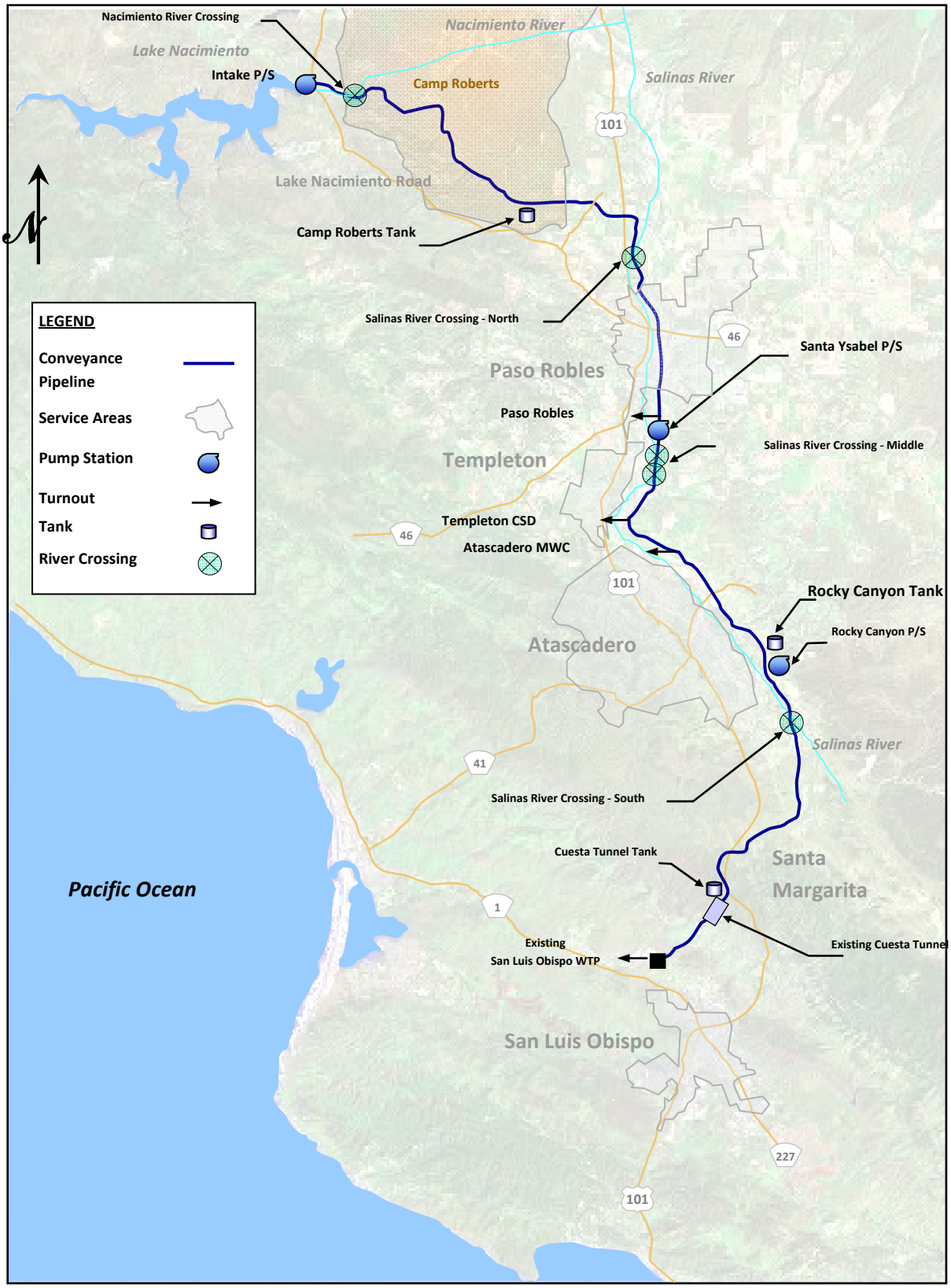



Figure 2-1. Nacimiento Water Project Map

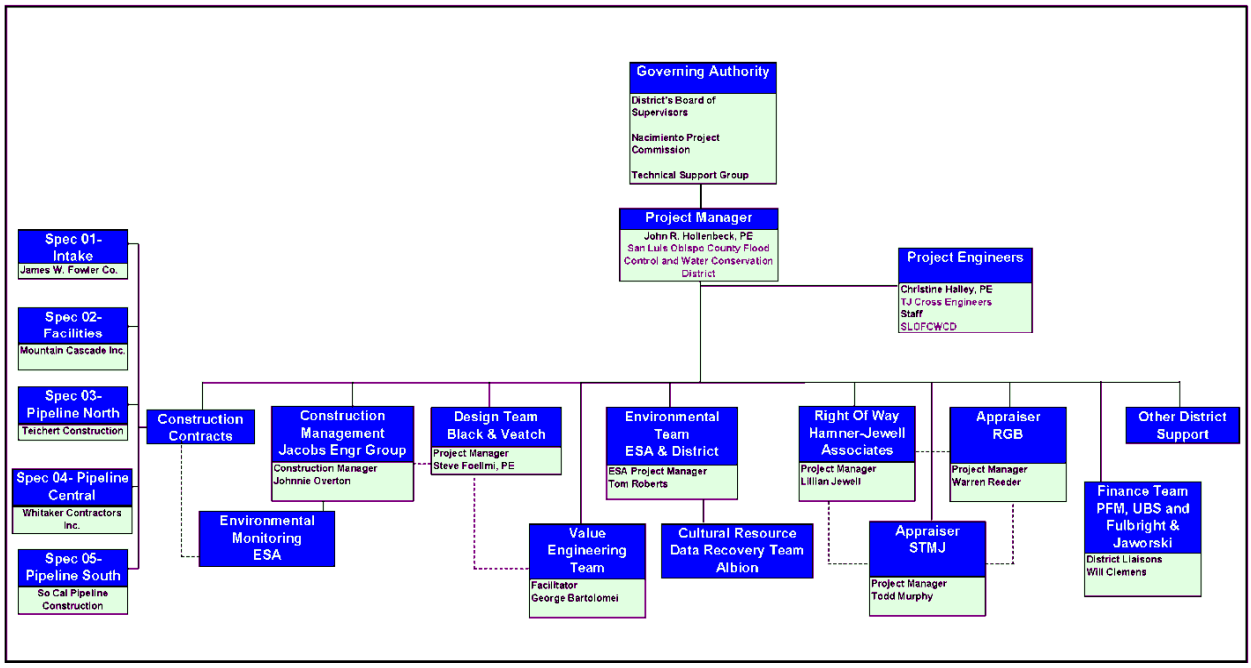



Figure 2-2. Nacimiento Water Project Organizational Chart

Most civil engineering projects have their complexities, their few critical design factors, and their uniqueness that makes them stand out over other projects, and the same is true for this Project. It is not a simple "bury the pipe in the ground" project, but required a concerted effort to develop design strategies that produce an efficient design while managing the capital cost. B&V developed the following as its mission statement and shared this concept with all members of the Project's team:

**"To seek opportunities for efficiently designed facilities that focus on capital cost savings and appeal to the construction industry."**

The driver behind the development of this mission statement was a contractual provision between the District and the participating agencies, namely that the Project's initial budget, established in February 2004, was $150-million, and if that value were exceeded any of the participating agencies could back out of the Project at the conclusion of the Bidding Phase. The District continued to stress "smart design" with the B&V engineers and with the rest of the Army of Consultants. The following section describes the challenges faced by the District and B&V, and the resourcefulness of the team to overcome these challenges.

## 2.2 THE CHALLENGE – MANAGEMENT OF THE "OPT-OUT" PROVISION

Participants did not want an open checkbook.

The Water Delivery Entitlement Contract (WDEC) was developed by the District in early 2004 after the District's Board of Supervisors adopted the FEIR. The purpose of the WDEC is to establish the delivery entitlements with each participating water agency (Participant) and the terms and conditions placed upon the Participants by which the District will make those deliveries. The Participants asked and received a provision within the WDEC to limit their financial exposure during the construction phase in the event the Project because too expensive for them to financially afford. This provision became known as the "Opt-Out" provision. The initial four Participants[1] obligated themselves when executing the WDEC to pay for the Project's Design Phase, budgeted at $18.9-million (a non-reimbursable investment by the Participants), and included the District's management, design, rights-of-way, utility investigation, environmental permitting, initial construction management, and bond financing. The Opt-Out provision is based on the following:

- The District is obligated to open construction bids that equal at least 30-percent of the total Project cost; and
- If the total Project cost is estimated to be greater than $150-million, then the Participants have 30 days to opt-out of the construction phase of the Project (all design and bidding phase expenses are not reimbursable, sunk funds to the Participant); and
- To stay in the Project, a Participant's governing authority did not need to take any action. The only action required occurred if an agency wished to opt-out of the Project's Construction Phase.

The opt-out provision was very important to the Participants prior to them entering into an agreement with the District. Construction costs in 2004 had seen an escalation that was uncommon compared with the prior ten years. Based on the *Engineering News Record* indices, the Material Index grew by nearly 20-percent in 2004 over the prior year, whereas the growth rate in the prior 10 years was nearly flat. Acknowledging that `the construction

1 The Initial Participants are the City of Paso Robles with 4,000 AFY, the Templeton Community Services District with 250 AFY, the Atascadero Mutual Water Company with 2,000 AFY, and the City of San Luis Obispo with 3,380 AFY.

industry's price behavior was in major flux, the District accepted an opt-out policy as fair treatment of the Participants.

## 2.3 RESOURCEFULNESS – SMART DESIGN TO MANAGE CHALLENGES

The District and B&V developed several strategies tailored to reduce the capital cost of construction in an attempt to limit the Project's cost as close to the $150-million budget established in the WDEC. The District generally sensed the Participants' budget-tolerance for the overall Design and Construction Phase costs as having a ceiling of $200-million—below this cost, the Participants would likely remain committed to the Project. This concept was termed "Threshold of Financial Pain" and is illustrated in **Figure 2-3**.

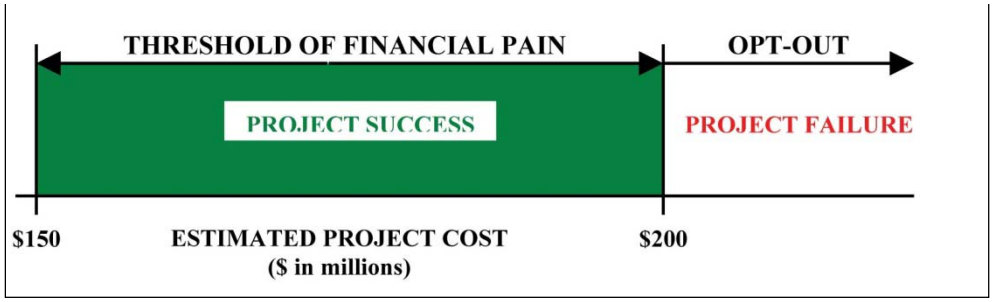



Figure 2-3. Threshold of Financial Pain

The smart design strategies developed to manage the construction costs and incorporated into the Project are discussed in the following subsections:

### 2.3.1 Smart Design - Hydraulic Downsizing of the Pipeline.

Soon after hiring B&V to design the Project, they prepared a baseline opinion of probable construction cost based on the design described within the FEIR. That opinion resulted in a total Project Design and Construction Phase cost estimate of about $195-million.

The Project's hydraulic capacity described in the FEIR was to convey all of the reserve capacity (unsubscribed water) of nearly 6,100 AFY to the farthest downstream location since the Project is a regional supplemental water supply project for use anywhere within the boundaries of San Luis Obispo County. The Nacimiento Project Commission and the District's Board of Supervisors both realized that full utilization of the 6,100 AFY in the south county was unlikely, but instead a large majority of the reserve water would likely be used in the future within the North County. Thus, the Project incorporated a policy to downsize the pipeline's hydraulic capacity based on a distribution of the reserve water per the Participants' pro rata share of their existing delivery entitlement—approved by the governing bodies and resulting in a nominal savings of $8- to 9-million in construction costs. **Table 2-1** presents the results of the downsizing.

Table 2-1. Hydraulic Downsizing of the Pipeline

| PIPELINE REACH | HYDRAULICS | |
|---|---|---|
| | Capacity (AFY) | Discharge (cfs) |
| Intake to Paso Robles Turnout | 15,750 | 32.79 |
| Paso Robles to Templeton Turnout | 9,208 | 19.89 |
| Templeton to Atascadero Turnout | 8,799 | 18.62 |
| Atascadero to San Luis Obispo Turnout | 5,528 | 8.40 |

### 2.3.2 Smart Design – Physical Hydraulic Model of Intake Wet-Well.

The intake pump station wet-well is a 180-foot deep shaft constructed adjacent to the lake. The District and B&V desired to have hydraulic performance of the wet-well, including the arrangement of the five vertical turbine pumps, confirmed by having a hydraulic laboratory build and test a model. A 1:3 scale physical model was built to evaluate the possible presence of adverse hydraulic conditions such as flow pre-swirl entering the pumps, vortex formation, and flow velocity imbalance approaching the pump impellers. The hydraulic laboratory could investigate mitigation measures to incorporate into the design should adverse conditions exist. The model testing did reveal adverse hydraulic conditions near the pump suction bell. The mitigation measures include raising all pumps to provide a minimum clearance off the wet-well floor, and the installation of an anti-vortex basket attached to the pump's suction bell (see **Figure 2-4**).

Figure 2-4. Pump Suction Bell and Assembly of Anti-Vortex Baffle

### 2.3.3 Smart Design – Value Engineering.

The District assembled a value engineering team to evaluate the Project's design with the purpose of identifying design changes that could reduce the Project's construction cost. The individual team members were hand-selected by the District and consisted of a value engineering facilitator; engineers with experiences in pipelines, tunnels, trenchless technologies, and electro-mechanical systems; and a cost estimator from a construction contractor. The team was assembled to evaluate the Project at the 30-percent design stage. At this point in the design the Preliminary Engineering

Report had been prepared[2]. B&V participated in the value engineering process to instruct the team about the Project, and then later to further evaluate those proposals that were judged as possibly favorable to the Project. The three-day value engineering session resulted in fifty-two individual proposals, of which, four were implemented into the final design producing an estimated capital savings between $10- and $15-million. The four proposals implemented included downsizing the water storage tank volume from an aggregate of 7-million gallons to 2-million gallons, moving the middle pump station from Camp Roberts to south of the city of Paso Robles, installing a sloping intake founded on the side of the lake with a single tunnel connecting to the pump station wet-well shaft (see **Section 3.2** for a more detailed discussion of hot tapping Lake Nacimiento), and placing pipeline along side West Perimeter Road on Camp Roberts (not in the asphalt paved roadway).

Of the 52 Value Engineering proposals, four were selected and implemented resulting in an estimated $10- to $15-million in cost savings.

### 2.3.4 Smart Design – Pipeline Optimization

B&V utilized a pipeline optimization analysis to assess the selection of the most cost effective pipe diameter size. The analysis considers the capital cost of the pipe and the life-cycle operation cost of the pumped water to find the minimum overall combination of capital and operation cost versus pipe diameter. **Figure 2-5** illustrates a sample graph of the results of this analysis.

[2] "Draft Preliminary Engineering Report", Black & Veatch Corporation, February 22, 2006.

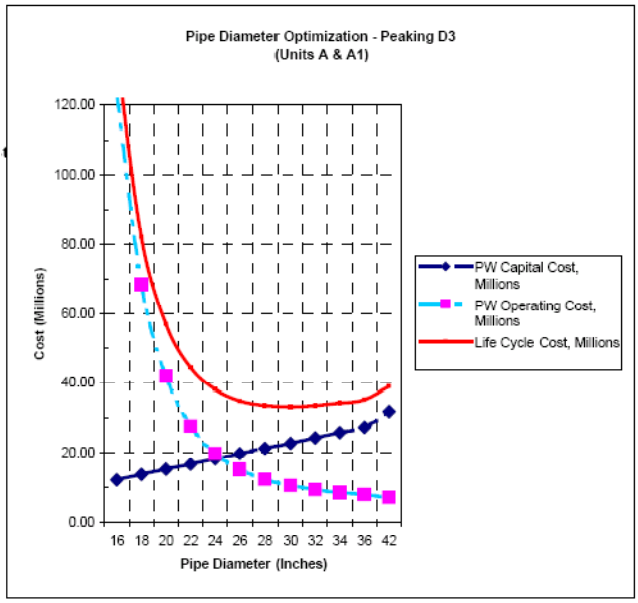



Figure 2-5. Pipeline Diameter Optimization Results

### 2.3.5 Smart Design – Alternative Pipe Materials.

B&V organized the design and bid documents to allow bids for alternative pipe materials over the 45 miles of pipeline. The documents allowed either welded steel pipe or ductile iron pipe as pipe material alternatives. The material specifications for both pipe types were set-up and carefully reviewed to achieve parity between pipeline installation requirements for the two pipe material options. The results rewarded the effort of bidding alternative pipe materials because the pipeline bids came in much lower than estimated, in large part attributed to the price competition between the two pipe material suppliers.

### 2.3.6 Smart Design – SCADA Communication System.

A good communication system for the SCADA system is essential for robust and reliable operation of the controls of the Project. Different alternatives available for SCADA communication are:

- Dedicated telephone line
- Radio Telemetry
- Dedicated Fiber Optic System

The first two options are feasible, but telephone communication would be controlled by external agencies and radio telemetry has reliability concerns; whereas, a dedicated fiber optic line would provide the District with the exceptional speed of fiber optics and would give the District complete control over the system. Fiber optic poses an increased capital cost, but savings are realized over time because there is no payment to a utility company, and the reliability is superior to radio telemetry.

The District worked with the County's Information Technology Department who wanted to participate in the fiber optic line on an incremental basis for expanded County needs at public facilities like fiber stations, schools, courts, police, and libraries.

### 2.3.7 Smart Design – Contractor Pre-Qualification.

The District recognized that the intake construction and the horizontal directional drilling (HDD) construction needed to be performed by contractors experienced in that aspect of the work. To ensure this, the District chose to pre-qualify construction companies specialized in that work, and only allow those qualified to submit bids. The intake construction had three major elements of work, and the pre-qualification sought to identify a general contractor who specialized in one of those three: shaft construction, microtunneling, or marine operations. The HDD work is a sub-element of the pipeline construction for the Pipeline North and Central contracts, and thus pre-qualified subconsultants were determined and listed in the bidding documents. The District pre-qualified seven companies to bid the intake construction, and six companies to submit subcontractor bids to general pipeline construction contractors.

### 2.3.8 Smart Design – Contractor Workshops.

The bidding atmosphere leading up to the May 2007 Project bid announcement was that construction contractors had a very strong backlog of work, and thus, could simply pick and chose what work they wanted to pursue. This created a problem for the District, especially if a limited number of bidders were interested in the Project. The District charged B&V to "market" the project to the construction industry. Telephone contacts were made with several contractors. Information about the Project was posted on the Project's web site. And three workshops, conducted in San Luis Obispo but simulcast over the internet, were conducted. The results of the workshops were phenomenal, with contractors as far away as the Midwest attending, and this outreach proved effective.

### 2.3.9 Smart Design – Bidding Strategies.

The District and B&V developed a theory based on four principals to achieve the most favorable bids, including:

1. Increases in the number of bidders results in increases in competition among bidders.
2. Increases in completion among bidders results in decreases in bid prices.
3. Quality contractors make few costly construction mistakes, resulting in low overall construction costs.
4. Contractual documents with clear conditions and shared risk reduce bid contingencies, resulting in low bid prices.

The organization of the Project into bidding packages is an important step to attract a large quantity of bidders. The District evaluated a number of options ranging from a single bid package up to eight bid packages. A single package was estimated to be valued at nearly $140-million, and there are only a handful of large construction companies that can perform at that value; thus, a single package would possibly limit the quantity of bidders. Eight packages was judged too many because several of the pipeline contract sizes would be near-equal in value. The final choice of five packages was made based on the following:

- **Contract 1** would be a specialty contractor to construct the intake shaft, tunnel, and marine operations to install the multi-port sloping intake pipe.
- **Contract 2** would be a facilities contractor to install all pump stations, water storage tanks, and the SCADA system.
- **Contract 3** would be a semi-large valued pipeline contract, with estimated value near $50-million for 22 miles of pipe construction.
- **Contract 4** would be a moderate valued pipeline contract, with estimated value near $25-million for 11 miles of pipe construction.
- **Contract 5** would be a smaller valued pipeline contract, with estimated value near $18-million for 12 miles of pipe construction.

The timing of the bidding for Contracts 1, 3, 4 and 5 was also important. The District decided to stagger the bid openings of these contracts by as much as a week. Staggering the bidding allowed contractors to bid as many of the packages as possible, and the District did receive bids from the same contractors on several of the contracts. The overall timing of the bidding was also important to allow staff enough time to create an Opt-Out Summary Report of Project Costs used by the Participants in their assessment of the opt-out provision of the WDEC. **Table 2-2** presents the outcome of the bidding for the five construction contracts.

Table 2-2. Summary of Project Bidding

| CONTRACT | BID OPENING DATE | NUMBER OF BIDDERS | OPINION OF PROBABLE COST | LOW BID COST | HIGH BID COST | SUCCESSFUL BIDDER |
|---|---|---|---|---|---|---|
| 1 – Intake | 7/16/07 | 3 | $13.1M | $20.8M | $29.4M | JW Fowler Company |
| 2 – Facilities | 8/16/07 | 4 | $30.8M | $25.6M | $32.3M | Mountain Cascade |
| 3 – Pipeline North | 7/19/07 | 9 | $49.8M | $38.4M | $51.3M | Teichert Construction |
| 4 – Pipeline Central | 7/26/07 | 9 | $27.1M | $22.7M | $29.3M | Whitaker Contractors |
| 5 – Pipeline South | 8/2/07 | 7 | $18.2M | $16.3M | $24.0M | Southern California Pipeline Co. |

The bidding strategy developed to support the opt-out provision of the WDEC created an interesting result in the bidding and completion of the construction work. The opt-out provision required sufficient information obtained from contractor bids to finalize an estimate of the Project's costs, and give the participating agencies time to assess if they would continue or opt-out of the Project. The outcome was that all five construction contractors would start work essentially at the same time, but would complete their work at staggered intervals. **Figure 2-6** illustrates this concept for the Project and also relative to that of a "normal" multi-contract project which relies on the contracts being completed all about the same time. The only issue with the Project's bid and construction timing is that warranty items of early-completed contracts might run out prior to full-scale Project operation at the conclusion of the last-completed contract.

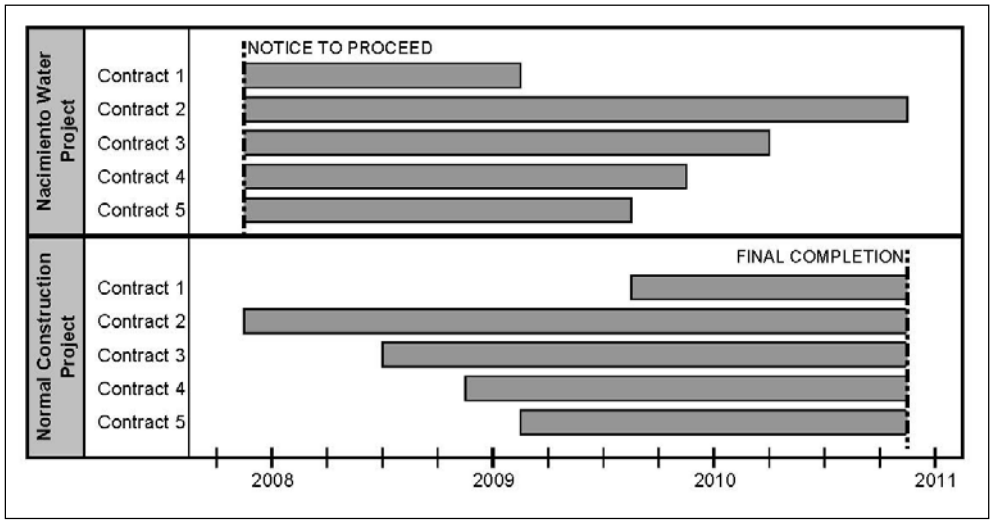



Figure 2-6. Bid Scheduling–Projects vs. Normal

The District expended a significant effort to reduce unnecessary bid contingencies placed within the contractor's bid by thoroughly reviewing the front-end documents (Section 0 and 1 using the Construction Specification Institute format) within the contract documents. The District obtained the front-end documents from several water agencies throughout the state and compared each with the District's documents, and selected the best and most fair and equitable terms and conditions. The District also worked on the details of the front-end documents to make them read as if they were prepared by a single author, ensure clear terms and conditions, and structure a document flow for ease-of-use. A goal of this effort was to share risk with the contractor as opposed to assigning all risk to the contractor. An example is the District took ownership of the risk of differing site conditions, offered a value engineering incentive to share the savings of contractor cost-reduction proposals, and provided allowances for utility conflicts and hazardous materials. The District also involved the Project's construction management team in the review process to make sure the front-end specifications had clear and practical procedures and requirements, including change order procedures, contractor obligations, and payment procedures.

## 2.4 THE FINAL RESULT

The District and B&V realize the application submittal should present technical information in lay terms; however, civil engineers simply struggle to write about a pipeline project without showing a hydraulic profile. **Figure 2-7** presents the design hydraulic profile—a graphical representation of the hydraulic pressures (expressed in terms of elevation) inside the pipeline as it conveys the water from Lake Nacimiento to the terminus point at San Luis Obispo's water treatment plant. Each pump station adds more energy (pressure) to the water in the pipeline. The downward sloping lines represent the reduction in pressure as the water flows downstream. This loss in pressure is predominately due to the friction of the water as it rubs along the inside walls of the pipeline. Also presented are the topography along with the locations for water tanks and pump stations, and the design flow conditions. The Project was designed for the Phase I flows, which equals the maximum flow deliveries to the Initial Participants. The Project is also designed for the Ultimate Flows which assumes a flow distribution presented in **Table 2-1**. Photographs of the Project's features both under construction and in their final form are presented within **Appendix D**.

The District and B&V are extremely proud of the accomplishments made during this Project, and with preventative care of the electro-mechanical equipment, regular corrosion monitoring and active corrosion mitigation of the pipeline, and regular maintenance of this new asset, this Project's technical-life of 100-years should easily be achieved.

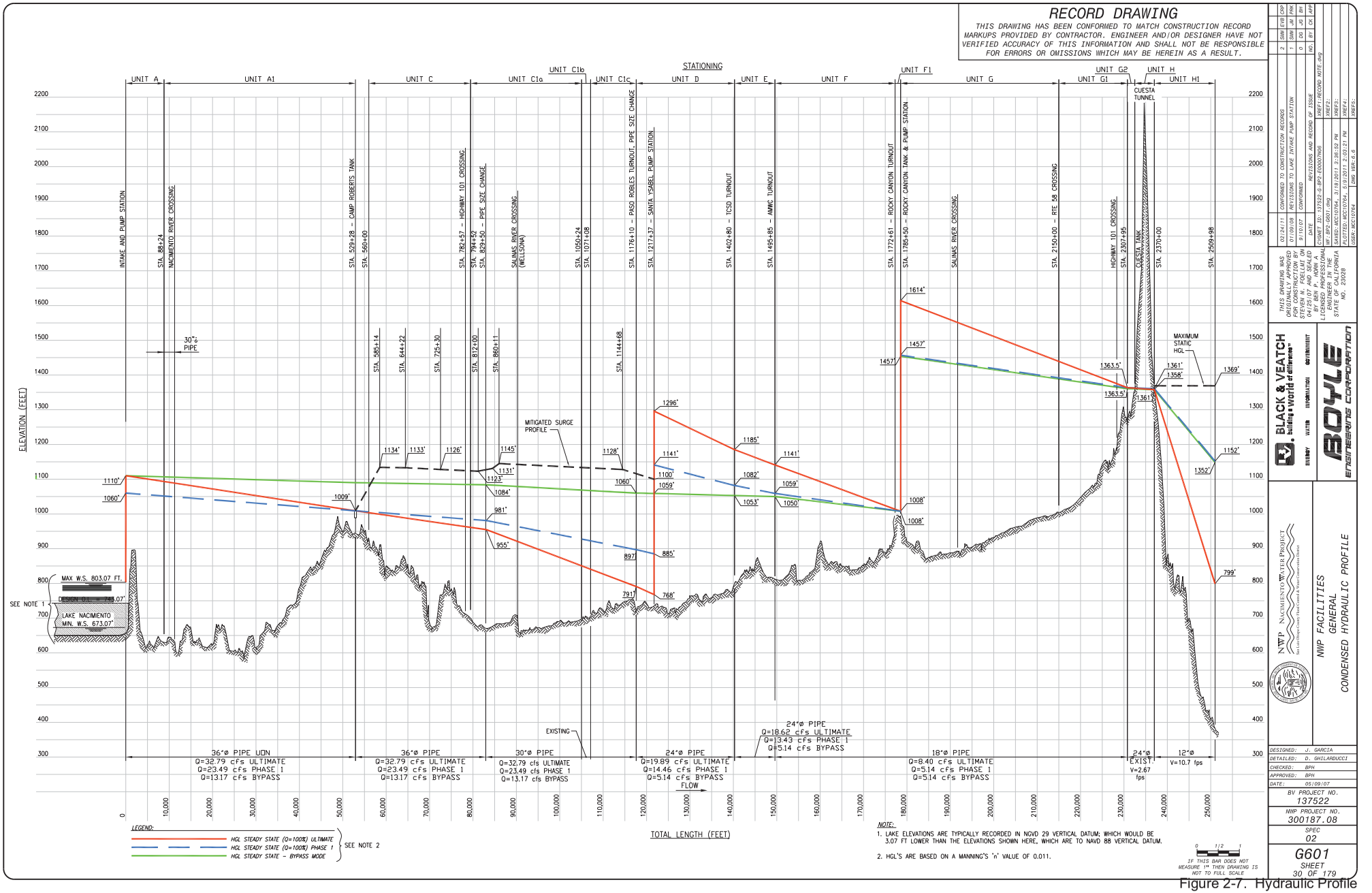



Figure 2-7. Hydraulic Profile

# 3. Originality and Innovation

The title of this section is "Originality and Innovation", and the obvious expected question that most engineers would ask is "What can be original and innovative about the construction of a pipeline project?" That is a fair question and one that will be answered as the focus of the Project turns away from the basic construction methods of burying a pipe in a trench and instead turns the focus on how to cross a military reservation without being blown-up, how to tap into a lake bottom without first draining it (i.e., hot tapping the lake), how to comply with the multitude of environmental compliance issues specified within the permits, how spending (investing) more money during the construction can save on operating costs in the future, how installation of new monitoring technology can help mitigate hydraulic transient problems, how to actively implement an asset management plan to get full technical life out of the Project, and how to increase operational flexibility.

## 3.1 UNEXPLODED ORDNANCE DETECTION

Practice Mine Discovered During UXO Sweep on Camp Roberts

Camp Roberts is a military installation situated on 42,784 acres about 1.7 miles east of Nacimiento Dam. The post was authorized by the U.S. Congress in 1940 as a U.S. Army training center and was named for Corporal Harold W. Roberts who lost his life in World War I while saving a fellow soldier. Corporal Roberts received the Medal of Honor posthumously for his selfless act, and the post remains the only active military facility named for an enlisted serviceman. Camp Roberts was officially closed by the Army in 1970, and in 1971 the California Army National Guard took over the facility under a license with the Army to establish a Reserve Component Training Center.

The Project's pipeline traverses nearly 9 miles of Camp Roberts, winding through oak woodlands, tank crossings, and rivers, until it meets the Project's 850,000 gallon water storage tank located near the post's eastern boundary.

The National Guard alerted the District that while the Project's facilities are located a far distance from the current training area and artillery ranges, danger still existed because of the excavations on a military post. The National Guard made it clear that because the post is over six-decades old, there is a possibility that unexploded ordnances (UXO) might exist within the construction route, and that the military would not be liable for any damages or losses that could be caused by the detonation of an UXO during construction. The ordnances likely to be encountered were specified as 60mm, 81mm, and 105mm projectiles. The National Guard recommended a UXO detection sweep prior to construction. The construction documents specified a surface clearance and a geophysical subsurface detection to locate any UXO.

The contractor performed a surface sweep using a metal detector device attached to an all terrain vehicle. This exploration found several historic artifacts including beverage containers, hardware, personal items, and

ammunition. The most significant finds were several earth-screw rods described for use in un-tracking a tank's tracks, and practice mines.

The geophysical subsurface detection process was complicated because the equipment's maximum depth range is four feet, whereas the bottom of the trench is nearly twice that depth. The maximum depth of ordnance penetration used on Camp Roberts was predicted to be no-greater than eight feet. The specifications called for the geophysical sweep, trench excavation to a depth of four-feet, and completion of a second sweep allowing for additional verification that UXOs do not exist within Project limits.

The contractor developed an alternative approach. They first performed a first-pass geophysical subsurface sweep over the entire length of the pipeline. This provided clearance of the top four feet of ground. Second, they excavated to a depth of four feet with the use of a 6-inch trencher (except in cultural resource sites), and then performed a second geophysical subsurface sweep performed at the trench bottom. Fortunately, no ordnances were discovered. At cultural resource sites the contractor used a backhoe to trench four-feet deep to avoid the pulverizing of resources that would likely occur with a trencher.

## 3.2 HOT TAP CONSTRUCTION OF LAKE NACIMIENTO

The most challenging design and construction activities involved the Project's connection to Lake Nacimiento via a new intake facility. There are only a few lake hot taps constructed using microtunneling technology, and the hot tapping of Lake Nacimiento now joins that list. This section will describe the configuration of the intake facility, the design, and finally the construction employed by the contractor.

### 3.2.1 Configuration of the Intake.

The FEIR recommended the Project's intake include a vertical shaft, drilled or excavated into the ground from the shoreline to a depth of about 160 to 170 feet, to serve as a wet well for vertical turbine pumps. The shaft would connect to the lake via three horizontal tunnels approximately 36- to 72-inches in diameter, bored at elevations 670, 720 and 770 feet. **Figure 3-1** illustrates this configuration. The purpose of the multi-level intake is to select the best quality water for use by the Participant agencies in their water treatment processes.

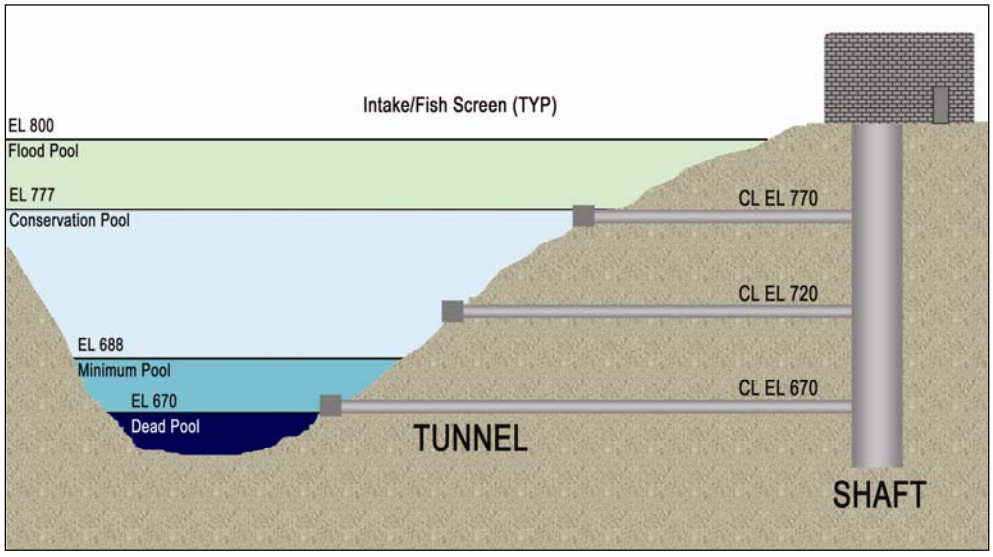



Figure 3-1. Intake Configuration Presented in FEIR

The Project's design underwent a value engineering assessment at the 30-percent design stage in the spring of 2006. A proposal was developed to eliminate the upper two tunnels and along with them the associated tunneling risks, and instead build a multi-port sloping intake pipe founded on the sides of the reservoir that connects to the lower tunnel. **Figure 3-2** illustrates this concept. The District accepted this proposal and B&V implemented the concept into the design.

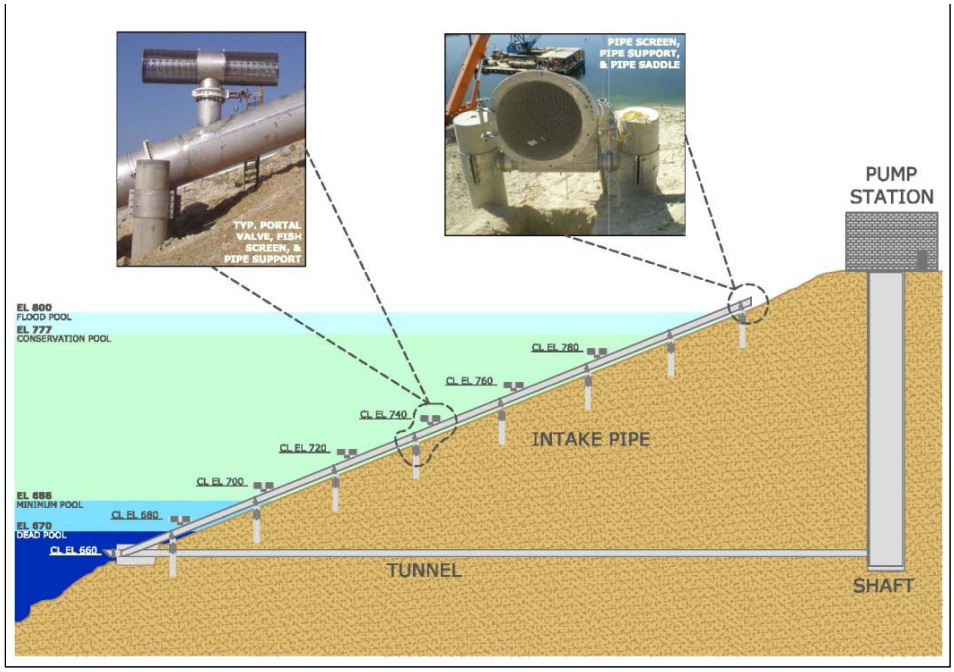



Figure 3-2. Final Design Configuration of Intake Shaft Tunnel and Intake Pipe

### 3.2.2 Intake Design.

The final design configuration was a constant diameter shaft with an inside diameter between 16- and 20-feet (contractor to select size) lined with concrete (cast-in-place or pre-cast), 180-feet deep with a 500-feet long steel-lined horizontal tunnel with minimum diameter of 48-inches. The tunnel connects to a 48-inch diameter stainless steel multi-port intake pipe, with each port controlled by a hydraulic actuated butterfly valve. Each port is also protected with a debris screen. The maximum hydraulic capacity of the intake is 32.79 cubic feet per second (cfs).

The site geology is the central California Coast Ranges Geomorphic Province. The intake shaft and tunnel construction occurred in the Vaqueros Formation, which consists of sandstone. The formation is predominantly quartz with minor constituents that include feldspar and clay minerals. The Rock Quality Designation (RQD) in this vicinity ranged from poor to average, values of 25- to 50-percent. Groundwater inflow estimates were 500 gallons per minute (gpm) with flush flows as high as 2,000 gpm. B&V prepared a Geotechnical Baseline Report to assist the contractor in preparing the shaft and tunnel construction plans.

The construction documents presented four designs for the shaft, including:

- Conventional excavation with steel liner plate for initial support
- Slurry wall panels constructed with hydrofraise excavations
- Secant piles
- Blind shaft boring with a casing support

The tunnel design was to jack a coated and lined steel pipe following a microtunnel boring machine (MTBM), with the pipe serving as the initial support and the final liner. The steel-lined tunnel connected to a 48-inch diameter fabricated fitting placed underwater in the lake, which connected to the sloping intake pipe. The specified minimum diameter of the tunnel was 48-inches. The joints of the tunnel pipe were specified as fully welded or Permalock© pipe with Type 7 gasketed joints.

The sloping intake pipe design featured a seven-port arrangement fabricated from ASTM A312 stainless steel. The portals are spaced about every 20 feet vertically, which was based on an analysis of over a decade of District-collected water quality data taken near the dam in anticipation of one day constructing the Project. The lower port is 48-inches in diameter and controlled with a stainless steel butterfly valve. The rest of the ports are controlled with 24-inch diameter butterfly valves, the lower two are fabricated from stainless steel since these valves will most likely always be submerged, and the remaining four are fabricated from ductile iron and will be exposed more frequently for easy maintenance access. The entire tunnel and intake pipe can be isolated from the bottom of the shaft via a 48-inch diameter stainless steel butterfly valve connected to the terminus of the tunnel.

### 3.2.3 Intake Construction.


Shaft Excavation

The contractor built the shaft and multi-port intake pipe at the same time, with construction of the tunnel following the conclusion of the shaft construction.

The contractor used a small excavator placed into the shaft to dig out the sandstone, with excavated materials placed in a skip-box to be hauled to the surface and stockpiled for later disposal off-site. About 70 vertical feet of the material was excavated using drill and shoot methods prior to excavating with the small excavator. The rough diameter was 23-feet, with initial support provided by liner plate and steel ribs. As the excavation advanced, the contractor would halt excavation about every 13 feet to install the reinforcing steel per the design drawings. Next, a two-piece circular form was lowered into the shaft and secured to allow the finished concrete liner to be cast-in-place, thus, the contractor installed the finished lining in a top-down fashion, opposite what the designers had envisioned. This construction method worked very well. Prior to placing the final wall pour, the MTBM's launch seal was secured and cast into the pour of the wall. The predicted jacking forces of the 504-foot long microtunnel did not require an augmented reaction block or any intermediate jacking system.

The MTBM hot tap (connection) to Lake Nacimiento posed significant challenges. The designed process of having the MTBM engage a large body of water without jeopardizing the safety of the workers, injuring the newly-driven tunnel, or damaging the MTBM required many iterations of meetings and discussions in partnership with the District, construction manager, design engineer, contractor, and specialty subcontractor. The work required the installation of two individual bulkheads, within the tunnel and within the transition of the MTBM tapping the lake. Each bulkhead could be described as a welded intrados ring to the Permalock© pipe, which later incorporated a specialized gasket/bolted door section. Both bulkheads had porting which allowed the MTBM's utilities to pass through, providing continuous MTBM operations. Once the MTBM was stopped and fully exposed within the lake, the area between the two bulkheads was flooded with water from the shaft side of the tunnel to a pressure equal to the lake pressure, allowing divers to safely cut the MTBM and the first bulkhead section away from the tunnel. Afterwards, the tunnel pipe was pushed to the final allowable stop point and the shaft and tunnel were flooded. Divers proceeded to cut the second bulkhead from the tunnel and connected the fabricated fitting between the tunnel and sloping intake pipe. The contractor successfully completed the 504-foot long microtunneling operation using a 54-inch diameter Soltau RVS 600 MTBM and 10-foot long sections of Permalok© steel pipe.

The multi-port sloping intake pipe is a fabricated 48-inch diameter stainless steel pipe connected with stainless steel pipe supports, each supported by two drilled piles. The lake level was very low during the intake pipe construction,

allowing the contractor to perform much more work out of the water than anticipated. Marine activities required drilling piles, clam shell excavation, and installation of the intake pipe. The marine operation was also used to place two very large anchor blocks in the center of the lake to connect to the newly installed floating log boom placed further from the dam and replacing an old wooden boom.

## 3.3 MASTER COMPLIANCE TABLE

A project of this magnitude is permitted by several environmental agencies, and the coordination of these regulatory requirements is a daunting task. Every permit obtained by the District was made a part of the Contract Documents. The technical specifications and environmental plans consisting of aerial images adjacent to the plan-profile drawings both convey the environmental compliance requirements mandated during construction.

Contractor displaying his copy of the Master Compliance Table

Through the construction management firm, the subconsultant responsible for environmental compliance monitoring developed an exceptional tool to assist all field personnel (construction contractor, inspectors, etc.) to understand and track the interrelationship between the various permitting agencies for biological, cultural, and paleontological resources. This tool was called the Master Compliance Table (MCT). This table, sorted by Project station location, identified the regulatory agency permit, associated drawing numbers, site name, resource being regulated, and instructions to the field personnel on what mitigation measures are required. The MCT was produced on 11-inch by 17-inch sheets of paper and was made easily transportable. The environmental compliance monitoring team ensured that every worker for the contractor had a copy and was trained to read and understand the importance of protecting all resources. The environmental compliance monitoring team also trained each and ever worker on the Project, and all management staff for the contractors and District, on the environmental permits and the compliances mandated within those permits.

## 3.4 PG&E "SAVINGS BY DESIGN" PROGRAM

B&V, through their major subconsultant Boyle Engineering Corporation (now part of AECOM) helped the District coordinate with the local electrical utility company, Pacific Gas and Electric Company (PG&E), to apply for their Savings by Design (SBD) Program. The SBD Program offers monetary incentives to electrical customers who elect to invest in design changes that will lower their project's electrical consumption. The Project boundaries were divided into eight SBD projects, including each pump station as a stand-alone SBD project, and the pipeline segmented into five SBD projects. The District opted to invest in the use of variable frequency drives at the Intake Pump Station, and half of the units at the Santa Ysabel Pump Station. Premium efficiency motors and high efficiency pumps were also specified. The SBD pipeline projects involved increasing the pipe diameter by six-inches throughout the length of the Project; however, that decision could not be made prior to bidding as the

expected capital cost for such an investment was judged to take the Project outside the bounds of the "threshold of financial pain" that the participating agencies could endure. B&V devised a method to seek alternative construction bids for the enlarged pipe and identified within the bidding documents that the District's evaluation of those alternative bids would be done after award of the construction contract. Ultimately, the District judged upsizing of one reach of the pipe, the first nine-miles of 30-inch diameter welded steel pipe, to be economically feasible. The District issued a change order to the contractor to install 36-inch pipe within this reach, thereby, meeting the SBD requirements. This resulted in the motor size for the Intake Pump Station pumps to be reduced from 700-hp to 450-hp. The District's total investment in the SBD program was $2,300,000, with PG&E's incentive to the District at $387,962. The District judges a return on this investment of between 10 and 15 years created by the reduction in electrical energy costs.

## 3.5 NEW TRANSIENT PRESSURE MONITORING TECHNOLOGY

The Project's designers gave careful attention to the control and mitigation of hydraulic transients. A commonly used lay term for hydraulic transient is water hammer, and most people experience this phenomenon inside their homes when they rapidly shut the faucet valve to a sink or bathtub and hear a banging sound within their plumbing. On a small scale like in a home, hydraulic transients are generally an inconvenience and pose no large risk of rupturing the water pipes. On a large scale like this Project, the increased pressure within the pipeline caused by suddenly changing the flow of water can be extremely damaging both to the pipeline and to the surrounding area after a pipe rupture.

Rupture of Unknown Water Pipe from Excessive Hydraulic Transient Pressure

B&V mitigated for the hydraulic transients with surge chambers (a large tank that contains air and water and are used to dampen the transients) at each of the three pump stations. The term "surge" is another part of civil engineer vernacular that refers to non-normal pressures. At the Santa Ysabel Pump Station, the upstream side of the station also employs surge relief valves, which automatically open and relieve large internal pipeline pressures caused by a sudden shutdown of the pump station.

Around 2007, District staff learned of a new pressure monitoring technology that is specifically designed to monitor and record abnormal pressure events on the pipeline. This system is named by the manufacturer as TP-1. The best way to avoid transients is to incorporate mitigation into the design just as B&V has done; however, with computers and now the new TP-1 technology, an even more robust approach was available to the District. The District, through a change order to the construction contract, had nine TP-1 monitoring stations installed on the Project. These devices constantly record the pressure within the pipeline and are programmed to switch into "hyper-record mode" if it senses a hydraulic transient event and begins to digitally

record the pressure reading from a small pressure transducer at a rate of 100-readings per second. This hyper-recording of the event is necessary in order to capture (record) the maximum pressure rise (or fall) in the pipeline as the transient occurs. The SCADA system logs each transient event as an alarm, and the District's operators review the recorded transient events and provide a simple report to the District's engineers on a monthly basis. The goal of the transient monitoring program is to always be aware of events that occur on the pipeline, and to correlate those events to operation activities (e.g., starting or stopping pumps), and more importantly to further investigate when an event cannot be correlated to an operation activity. The best management of an asset against damages from hydraulic transients is to know and understand when they occur and be proactive to modify operations to prevent them in the future, and the new TP-1 technology monitoring devices support that strategy.

## 3.6 ASSET MANAGEMENT FEATURES

The Project technical life is predicted to be 100 years with good operation and maintenance of the assets such as, regular inspection, replacement of worn parts, and monitoring of equipment and system performance.

### 3.6.1 Corrosion Monitoring.

Corrosion Monitoring Testing Station on the Ductile Iron Pipeline

The single largest capital investment of the Project is the 45 miles of pipeline. The cumulative bid cost of the three pipeline construction contracts is about $77-million, and essentially this entire asset is buried underground. Corrosion poses the chief threat to the pipeline. Even though the pipeline, whether steel or ductile iron, has been coated or lined to protect the metal, corrosion can occur. The District invested in a corrosion monitoring system, and B&V designed the system with monitoring stations spaced throughout the entire pipeline. A baseline survey of the pipeline was prepared by each pipeline contractor, and through regular inspections in the future years, the pipeline performance can be compared to the baseline data, allowing mitigation action to be taken if corrosion in an area is suspected.

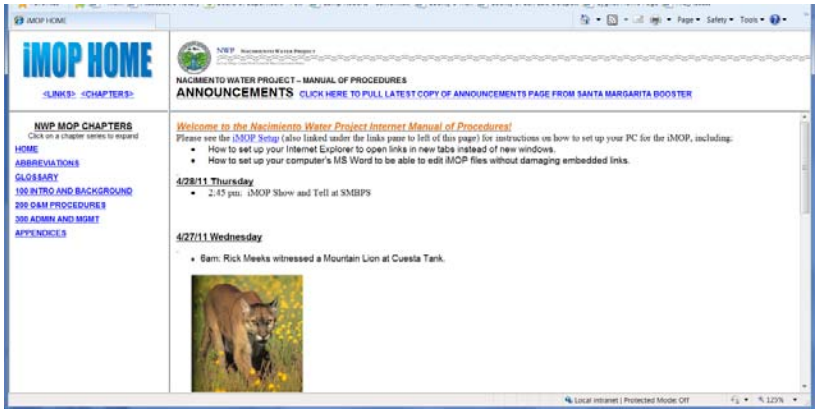
### 3.6.2 Assets and the District's Accounting System.

The District has also conducted a detailed accounting of the parts associated with the Project's pump station and tank facilities. These individual parts are then entered into the District's SAP accounting system, along with maintenance and replacement work orders for each part based on the manufacturer's operation and maintenance manuals. These work orders will be automatically reported to the District's operation staff as they conduct their maintenance efforts of the facility assets.

### 3.6.3 Manual of Procedures and GIS.

To often at the conclusion of construction when the care of a project is handed over to the operations staff, engineers do not leave enough time to adequately "pass the torch" of the project, and many important design aspects are historically lost. This Project is different because the concerns of the operators were captured early in the design phase, and budget was secured to provide excellent documentation of both design and constructed related features into documents that are useful to the operators. Two distinct documents were created: a Manual of Procedures and a GIS database of the assets.

The Manual of Procedures, or MOP for short, was developed in both hardcopy and computer assessable softcopy (called the iMOP – see inset screen shot of the iMOP home page). The purpose of the MOP is to provide historical tracks to the current and future engineers, operators, and administrators of the Project. B&V provided the leadership in the development of the MOP with the District providing secondary leadership on subchapters dealing with administrative tasks. The MOP is structures into the following three primary sections:




- Introduction and Background
- Operation and Maintenance Procedures
- Administration and Management

The introduction and background provide historical documentation of the design features of the Project – information that predominately is within the Preliminary Design Report (PDR) which was finalized in July 2006, but which could be lost over the next several decades. The PDR is a seven-volume set, and the utmost of information from the PDR was prepared within the introduction and background section of the MOP, and includes historic background information, description of the hydraulics and operation modes, and description of the Project's assets.

The operation and maintenance procedures are a compilation of the many recommendations by the various suppliers of equipment. This data is reported within the shop drawings and operation and maintenance manuals provided by the manufactures, and having a summary of this data presented in an easy-to-find location will benefit the overall care for the assets since the operators now have an easy place to retrieve the information.

The administration and management section provide guidelines to the office staff (current and future) on how to process the several administrative tasks

associated with running a raw water conveyance system. For example, as-needed consulting agreements (e.g., corrosion monitoring), review and approval of electric bills and assigning of costs to the Participants, safety protocols, capital replacement plan, etc.

The most useful feature of the iMOP is the interlinks created with the location of digital data like shop drawings, operation and maintenance manuals, design as-built drawings, photographs, etc. A GIS database was created by B&V during the design and expanded upon by the construction management firm, and this database is hot-linked from the iMOP, providing even greater management capabilities. The investment of funds to create the MOP and its corresponding iMOP are greatly appreciated by the operations staff.

## 3.7 OPERATIONAL FLEXIBILITY

### 3.7.1 Bypass Operation of the System

The Project will be operating at varying flow rates from day-to-day. The predicted demands by the five Participants, on a monthly basis, are presented in Table 3-1.

Table 3-1. Initial System Flow Rates of Nacimiento Water Project

| PARTICIPANT | MONTHLY MAXIMUM DEMAND, CFS | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| City of Paso Robles | 2.06 | 2.58 | 3.09 | 4.64 | 9.03 | 9.03 | 9.03 | 9.03 | 9.03 | 4.38 | 3.09 | 2.06 |
| Templeton CSD | 0 | 0 | 0 | 0 | 0 | 1.03 | 1.03 | 1.03 | 1.03 | 0 | 0 | 0 |
| Atascadero MWC | 0 | 0 | 0 | 0 | 0 | 0 | 8.29 | 8.29 | 8.29 | 8.29 | 0 | 0 |
| City of San Luis Obispo and CSA 10A | 5.14 | 5.14 | 5.14 | 5.14 | 5.14 | 5.14 | 5.14 | 5.14 | 5.14 | 5.14 | 5.14 | 5.14 |
| Reserve Capacity (Future) | 9.30 | 9.30 | 9.30 | 9.30 | 9.30 | 9.30 | 9.30 | 9.30 | 9.30 | 9.30 | 9.30 | 9.30 |

The flow to the City of Paso Robles is fully delivered by the Intake Pump Station. The Santa Ysabel Pump Station will deliver the flow to the remaining turnouts. During months 1, 2, 3, 4, 11 and 12, of the initial operational years, the total flow to deliver water to the initial Participants is significantly lower than the remaining months. B&V incorporated in the design the ability to operate the Project in "bypass mode" during these low-flow periods. The Intake Pump Station is capable of directly pumping this low-flow amount to the turnouts and to Rocky Canyon Tank, while bypassing the Camp Roberts Tank and the Santa Ysabel Pump Station. Operating the Santa Ysabel Pumps at low-flow rates would be an inefficient use of electricity. The advantages of the bypass mode are:

- Less wear and tear on Santa Ysabel pumps due to less hours of operation.
- More efficient operation of the system as the Intake pumps will be operating close to their design operating point.

### 3.7.2 Backfeed Operation from Storage Tanks

Another pioneering design feature of the Project is the incorporation of the "backfeed mode of operation". The storage volume within Rocky Canyon and Cuesta Tunnel Tanks can flow backward in the pipe and "backfeed" the upstream turnouts, namely Atascadero and Templeton, during a power failure or similar shutdown of the pumps. This provides a short term supply of water giving the District's operation staff time to restart the pumps and resume normal flow operations.

# 4. Sustainability Considerations

## 4.1 IMPACT ON THE ENVIRONMENT

Environmental permitting a 45-mile long project faces challenges of the Project's footprint spanning across a wide variety of environmental resources. The District and the environmental permitting consultant developed environmental mitigation strategies to position the Project to receive favorable issuance of the permits. Thirteen permits were needed from both federal and state agencies to accommodate listed and protected species, sensitive stream crossings, and rich cultural resources. The District, working with the environmental permitting consultant, developed a team approach to either eliminate or minimize impacts. Lastly, the District's environmental consultant also created an archaeological treatment plan to manage any cultural resources discovered while excavating for the Project. Each of these mitigation measures are briefly discussed below.

### 4.1.1 Elimination of Environmental Impacts

The design and environmental consultants worked together during the design phase to incorporate certain construction methods into the design that would not impact sensitive environmental resources. The use of trenchless technology to cross sensitive streams was one method extensively used on this Project. The horizontal directional drilling (HDD) method was used to cross the Nacimiento River at one location and the Salinas River at five locations. The aggregate length of HDD crossings is 10,000-feet. Bore-and-jack technology was used to make three stream crossings. And five times a pipe bridge was used to cross over a sensitive stream. One of the pipe bridge crossings was unexpected during the design as the stream was expected to be dry during the summer season, but instead the tiny tributary to the Santa Margarita Creek had a small amount of water flowing and supported a small water pool that contained federally listed Steelhead trout. This pipe bridge crossing was designed and constructed via change order during construction.

Pullback at Salinas River HDD Crossing near Atascadero, CA

Pipe Bridge Crossing at Steelhead Trout Habitat

### 4.1.2 Minimizing Environmental Impact

One of the most abundant resources in San Luis Obispo County is the cultural resources contained within the ground from the prehistoric inhabitants of the area. Past research studies were consulted to identify where resources existed along the pipeline route and where possible the pipeline was routed away from those sites; however, a re-routing solution was not always available. Mitigation measures provided in the design include a narrowing of the construction corridor to 30-feet to minimize the impact. Typical construction corridor was 60-feet wide. Data recovery was also conducted prior to the construction proceeding through the area. An environmental monitor was on-site continuously as the construction progressed through these areas.

Local residents are very proud and protective of the County's oak woodlands. The designers worked to minimize damage to or removal of these trees. Tree removal was nonetheless unavoidable in certain areas of the Project. The District committed to tree replacement at three-to-one ratio, and 241 trees were removed during construction. The District collected hundreds of acorns from the species of trees impacted and grew seedlings at the County's nursery. Those seedlings were then planted at various locations, including Camp Roberts. As of the spring 2011, 197 trees have been planted, and more plantings are underway.

### 4.1.3 Archaeological Treatment Plan

The District knew that with a long linear project, there is a very good chance that the Project's construction would unearth archaeological resources; therefore, a plan developed prior to the beginning of construction was important to limit the amount of downtime associated with recovery and mitigation of found resources. The District's environmental consultant obtained the services of a firm specialized in development of such a plan which was prepared and approved by the State Office of Historic Preservation. The plan is called the Archaeological Research Design and Treatment Plan (ARD/TP)[3]. The ARD/TP was used for data recovery mitigation at existing sites prior to construction and at new sites discovered during the construction work.

Prehistoric human remains were discovered with just ¼-mile of pipeline construction remaining on the whole 45-mile project. The utilization of the ARD/TP in the management of the discovery greatly reduced the amount of downtime experienced by the contractor. Downtime delay was in aggregate approximately a week and was predicted to be several months had the Project not had the approved ARD/TP.

## 4.2 OTHER BENEFICIAL EFFECTS

The following is a summary of other beneficial effects associated with the Project.

[3] "Archaeological Research Design and Treatment Plan for Data Recovery at the Nacimiento Water Project", Albion Environmental, Inc. for Environmental Sciences Associates, November 2007.

- **Supplemental Water Supply** – The communities north of the Cuesta Grade and along the Salinas River Valley receive their water by pumping from the Paso Robles Groundwater Basin. The basin, in recent years, has shown signs of nearing the safe yield (i.e., inflow the basin is near equal to outflow from the basin). Users of the basin include municipalities, rural residential, and agriculture (predominately wine grapes). The local imported supply from Lake Nacimiento will benefit the basin by offsetting part of the groundwater pumping from the communities of Paso Robles, Templeton, and Atascadero. An important aspect of the Project is that the supply from Lake Nacimiento is "local", and the use of the word "imported" simply means conveying the water from the lake to the local communities. Other water projects within California rely on imported supplies from non-local sources (e.g., the State Water Project). Those non-local supplies have challenges associated with outside influences of political or social-economic issues, whereas this Project has wide-spread support and is judged a highly reliable supply of supplemental water.

- **Architecture of Buildings** – An FEIR mitigation measure required architecture of buildings to appear consistent with agricultural structures in the surrounding area. The Intake Pump Station's exterior architecture utilized a stone façade to match that of the hydroelectric power plant building located at the base of the dam. The Santa Ysabel and Rocky Canyon Pump Stations were designed to look like barns to reflect the rural setting where they are located. The architecture color scheme and shape of barns located on the Happy Valley Ranch near Atascadero were photographed and used by B&V to develop the adopted design for the pump stations. Three-rail vinyl fencing was placed around the site to further the appearance of an agricultural facility.

Santa Ysabel Pump Station

- **Mosaic Artwork** – The Nacimiento Project Manager began his assignment to create a Project Logo. A search of old District letterhead did not yield a logo, but did discover the font used which served as a starting point. The key for the logo came from the embossing stamp used by the County Clerk-Recorder's office when they record official documents executed by the District's Board of Supervisors. The embossing stamp, housed within an ornate cast-iron manual stamping mechanism, contained the engraved image of what has now been digitally reproduced and colored. This logo serves as the mosaic artwork at each pump station, and is surrounded by the name of the Project, the name of the facility, and the year built.


Five-foot Diameter Mosaic Artwork Logo

- **History Book** – The District has embarked on the preparation of a history book of the Project. The book will capture the Project's rich history in political wranglings, engineering, construction, and the people. It is expected to be completed by the end of 2011.

- **Minimize Site Runoff** – The sites around the pump stations were covered with gravel surfacing to the maximum extent possible to provide a pervious surface for the infiltration of precipitation, thus reducing the amount of site runoff.
- **Savings by Design Program** – The District's investment of about $2.3-million in electro-mechanical equipment and enlarged pipeline, all to reduce the amount of electricity needed to pump the water, will benefit the public both economically and environmentally in the future. The investment results in less usage of electricity, which saves on the electric bill that ultimately is charged to the public through their water rates. And less electrical utilization means less production of electricity from fossil-fuel power plants which improves the environment. Additional discussion on this program can be found in **Section 3.6** of this entry.
- **Economics During Construction** – The short-term economic benefit to the local economy was studied in 2003 , and estimates of new jobs created during the Design and Construction Phases ranged from 605 to 773, and the sales taxes generated were estimated to range from $2.3- to $2.9-million over the construction period.
- **Stronger Agency Collaboration** – This Project has strengthened the collaboration and partnering relationships of the north and south County communities of Paso Robles and San Luis Obispo, and the intermediate communities of Templeton and Atascadero. As is the case in several areas of the United States, the subject of "water" had in past decades been a dividing force within these communities; however, this Project has fostered strong professional relationships between the water agencies.
- **Technology Transfer Within County Government** – This Project is the single largest public works type project ever managed, designed and constructed by this County government – by a factor of six! The benefit to the County is the experience gained over several governmental areas, including the legal department, public works department (engineering, administration, and accounting), the auditor-controller's office, and the clerk-recorder's office. All of these entities had not experienced the execution of a mega-project prior to this Project. The successes achieved on this Project will serve as a significant benefit to the public in the future as the public works department takes on a nearly $170-million sewer collection system and treatment plant for the community of Los Osos in western San Luis Obispo County beginning in late 2011.

# 5. Project Planning and Delivery

## 5.1 FINANCING

The Project is completely self-funded by the Participants (the local community water agencies) by their debt service obligation under the Water Delivery Entitlement Contract (WDEC), which is the agreement between the Participants and the District. The District has pledged property tax revenue of approximately $1-million annually to help pay for the unsubscribed share (about 6,100 AFY out of the 15,750 AFY) of the Project until such time as the Project is fully subscribed. The financing was accomplished by structuring the sale of both non-taxable and taxable bonds. The bond sale and issuance was by the San Luis Obispo County Financing Authority (Authority), and was the single largest bond sale in the history of San Luis Obispo County. The Authority is a California joint exercise of powers authority, organized and existing under a Joint Powers Agreement by and between San Luis Obispo County and the District[4].

The governmental agency Participants (City of Paso Robles, Templeton Community Services District, City of San Luis Obispo, and County Service Area 10, Benefit A) receive funding through the non-taxable bond sale, whereas the taxable bonds are associated with the private water company (Atascadero Mutual Water Company). The District procured the services of bond counsel, financial advisor, and bond underwriting company. A trustee is retained to hold and distribute the bond proceeds.

The District received credit ratings from Standard & Poor's (S&P) and Fitch Ratings (Fitch). S&P assigned an underlying rating of "A", and Fitch assigned a rating of "A+" based on due diligence evaluation of the Participants, District, and the Authority. The District secured an insurance policy for this debt, and with this coverage both S&P and Fitch assigned ratings of "AAA" to the revenue bonds.

[4] The County and District are governed by the same Board of Supervisors. Their governing authority is dependent on the type of project brought before them. The Nacimiento Water Project is governed by the District.

The bonds were sold on September 10, 2007. The Project did receive favorable interest on the sale of the bonds, with the non-taxable bond interest at 4.7-percent, and the taxable bond interest at 5.7-percent.

The bond sale closed and the Project was funded on September 26, 2007. The Project's design and construction fund budget was net-funded with the bond proceeds of $158.8-million of the $176.1-million budget – the difference being funded through interest during construction. The non-taxable and taxable bond proceeds generated from the bond sale was $126.5-million and $32.3-million, respectively.

The Project solicited proposals from financial institutions to provide a Guaranteed Investment Contract (GIC) on the construction funds during construction. A GIC bearing interest of 4.806-percent on the non-taxable funds and $4.701-percent on the taxable money was locked in for a three-year term to coincide with the three-year construction schedule.

## 5.2 BUDGET

The Public Works Department's Accounting Division is responsible for the management of the funds and payments of all vendors invoicing associated with the Project. The Nacimiento Project Manager reviews and approves all invoicing and submits to the Accounting Division for processing. The overall design and construction phase budget is the ultimate responsibility of the Nacimiento Project Manager, and he regularly reports the status of the budget to the Participants through the Nacimiento Project Commission, a body of elected officials established by the WDEC to oversee Project development and implementation, with the charge of budget oversight. Table 5-1 is the latest budget summary report for the Project which was presented to the Commission at their May 26, 2011, meeting. The financial books for the Project's design and construction phase have not yet closed as there are a few outstanding issues remaining including the final closeout of three of the five construction contracts; however, the current trending of the Project's budget indicates a final cost of $174.1-million, or about $2-million under budget.

## 5.3 SCHEDULE

Figure 5-1 presents the Project's schedule. The District stressed "scope, schedule, and budget" throughout the various phases of the implementation of the Project. Maintaining schedule is judged an essential success factor in any public works endeavor, and the District drove the "Army of Consultants" to maintain their commitments to schedule. As-such, the Project's bidding documents were prepared on time and advertised by the District's Board on schedule. The Construction Phase schedule is more challenging for the District to control because of the large influence that a general contractor's equipment supplier has on schedule performance. This proved to be the case when the pump supplier delivered the Intake Pump Station pumps later than anticipated. Prior to this situation and based on the better-than-anticipated

performance of the five construction contractors, the District's manager had predicted the Project would be operational by the summer of 2010 (approximately six months early) but with the pump equipment delay the Project essentially was completed exactly on-time as originally scheduled back in 2004. The District took over beneficial use of the Project on December 6, 2010, to begin a 30-day commissioning test of the entire facility. On January 7, 2011, the District announced successful completion of the commission testing and made raw water available to the Participants as part of the Operation and Maintenance Phase of the Project. Technically, the Project came in one-week late – but who's counting! The District and Participants are all very pleased that the execution of the Project is on-time and under-budget.

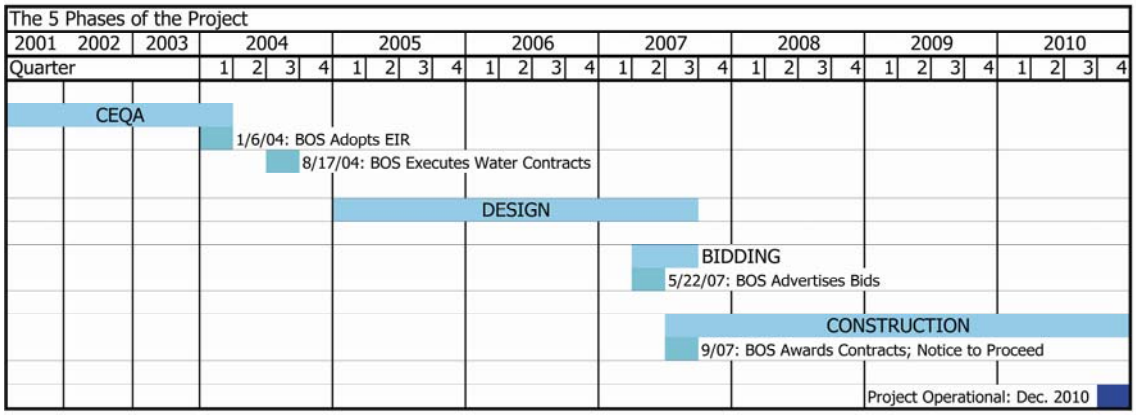



Figure 5-1. Nacimiento Water Project Schedule

# TABLE 5-1. Budget Summary Report for Nacimiento Water Project

## Nacimiento Water Project
## Project Budget Reporting
## Report Ending Period: 4/30/2011

| | Revised Budget: MARCH 2010 | Cost to Date thru 4/30/11 | Remaining Budget | Projected Total Cost as of 4/30/2011 | Projected Variance (Budget Vs. Projected Cost) | Comments |
|---|---|---|---|---|---|---|
| **Design Phase Costs** | | | | | | |
| Project Management | $2,450,000 | $2,298,745 | $151,255 | $2,419,494 | $30,506 | Includes County Project Manager, VE, support staff, TJCross support, finance team, legal fees, and County overhead allocation during Design Phase. Revised 2/2010- Adjusted to better align with actual costs to date. |
| AD-15 Process (Preparation for Bidding) | $113,057 | $ 113,057.01 | $0 | $113,057 | $0 | Reproduction and mailing of Contract Docs, addenda, and other bid phase correspondence, utilizing ASAP Reprographics. |
| Environmental | $2,346,867 | $ 2,339,517.98 | $7,349 | $2,346,867 | $0 | ESA-Includes design assistance, permit applications, agency coordination. Amendments authorized for EIR Addendum and extended cultural resource efforts. |
| PG&E Service Extension | $300,000 | $ 211,660.45 | $88,340 | $300,000 | $0 | Estimate to extend power to proposed facilities at $100,0000. Add $200,000 for low energy usage in first year (2/10) |
| Right of Way Consulting Services | $1,562,000 | $1,485,828 | $76,172 | $1,562,000 | $0 | Hamner-Jewell contract plus allowance for appraisal, title reports by others, and Special Counsel. Includes court hearings for orders of possession. |
| Property Acquisition | $1,700,000 | $ 1,623,986.48 | $76,014 | $1,700,000 | $0 | 2/10-Revised acquisition budget. |
| Construction Mgt/Constructability Review | $669,173 | $ 669,109.19 | $64 | $669,173 | $0 | Amendment revised Design Phase Value to $669,173. |
| Engineering Design (Includes geotechnical, survey & Design CM) | $9,088,800 | $ 9,419,153.76 | ($330,354) | $9,088,800 | $0 | Black and Veatch Corporation 11/06-Revised projected total. 8/07-revised back up to original budget pending Design Amendment |
| Finance | $0 | $ - | $0 | $0 | $0 | PFM, UBS, and Fulbright & Jaworski support services coded to Project Management line item above. |
| New Participant Contribution | ($50,000) | ($49,040) | ($961) | ($50,000) | $0 | 11/06-CSA 10A buy-in fee per Article 29 of the WDEC. |
| | | | | | | |
| Design Phase Budget Reserve (NOTE 1) | $720,103 | | $720,103 | $0 | $720,103 | |
| SUMMARY - DESIGN PHASE | $18,900,000 | $18,112,018 | $787,982 | $18,149,391 | $750,609 | |

# Nacimiento Water Project
# Project Budget Reporting
# Report Ending Period: 4/30/2011

| | Revised Budget: MARCH 2010 | Cost to Date thru 4/30/11 | Remaining Budget | Projected Total Cost as of 4/30/2011 | Projected Variance (Budget Vs. Projected Cost) | Comments |
|---|---|---|---|---|---|---|
| **Construction Phase Costs** | | | | | | |
| Project Management | $4,858,563 | $ 5,285,030.30 | ($426,467) | $6,425,838 | ($1,567,275) | Includes District staff, County Counsel, intern support, TJCross support, and operator support during construction. Also includes premium for District-provided Builder's Risk Insurance and County overhead allocation. Updated 2/2010: Added $170,000 from Prof Serv Contingency |
| Environmental Mitigation | $1,862,757 | $ 66,878.58 | $1,795,878 | $ 227,813 | $1,634,944 | For pipeline realignments, special const tech and other costs incurred due to unforeseen enviro issues. Also used for mitigation of habitat (oak trees, SJ Kit Fox, etc). Revised 2/2010 ($364,779 to Const Cont, $955,000 to Prof Services Cont., and $1,317,464 reduction to correct overall budget to Aug 2007 level) |
| Construction Management, includes Environmental Monitoring, Materials Testing & Surveying | $10,190,827 | $ 9,620,658.04 | $570,169 | $10,190,827 | $0 | Based on Jacobs construction management services fees and ESA's Environmental Monitoring Fees through Amendment No. 8 |
| Post-Design Services by Designer | $3,200,000 | $ 3,329,641.87 | ($129,642) | $3,920,000 | ($720,000) | Black & Veatch's construction phase services. Added $720,000 for Amendment #23 (longer period + MOP) |
| Construction Contracts | $130,265,722 | $ 129,995,758.80 | $269,963 | $ 131,967,411.70 | ($1,701,690) | BASED ON CONSTRUCTION BIDDING + CHANGE ORDERS |
| District Controlled Contingency Construction Phase Contingency and Reserve (NOTE 1) | $5,235,826 | | $5,235,826 | $1,580,995 | $3,654,831 | Recommended contingency for construction change orders, prof service changes, and other Project reserve. Excludes the carryover of unused Design Phase reserves. |
| | | | | | | |
| SUMMARY - CONST. PHASE | $155,613,695 | $148,297,968 | $7,315,727 | $154,312,885 | $1,300,810 | |
| **Prior Expenses** | | | | | | |
| Advance Expenditures | $513,000 | $513,000 | $0 | $513,000 | $0 | |
| Cuesta Tunnel | $1,031,000 | $1,031,000 | $0 | $1,031,000 | $0 | Includes construction of Nacimiento Water Project pipeline section through Cuesta Tunnel and cost for 2003 EIR. |
| | | | | | | |
| TOTAL PROJECT | $176,057,695 | $167,953,985 | $8,103,709 | $174,006,276 | $2,051,419 | |

Positive Projected Variance indicates costs are under the revised line item budget.
Recent Update: May 23, 2011

# 6. Contribution to the Well-Being of People and Communities

Every community understands the significant affect water supply can play on its ability to thrive and even sustain existing populations—arguably Californians understand this better than most. The state is overflowing with challenges related to supplying water to areas that lack the needed water resources to meet community demand, and San Luis Obispo County is no exception.

## 6.1 NACIMIENTO RESERVOIR ENTITLEMENT

The Nacimiento Water Project (Project) relies on delivery of water entitlement from Nacimiento Reservoir located within San Luis Obispo County, California. The 377,900 acre-feet (AF) reservoir was built in 1958 by Monterey County Flood Control and Water Conservation District (now Monterey County Water Resources Agency) in order to provide flood control and water conservation for the Salinas River Valley.

On October 19, 1959, the District executed an agreement that secured 17,500 acre-feet of water per year from the Nacimiento Reservoir. Ten-percent of the entitlement remains for lakeside uses, and the remaining 15,750 AF is exported by the Project. The infrastructure to move the water from the lake to various communities would wait five decades until the need for its use materialized.

## 6.2 HISTORICAL WATER DEMAND AND SUPPLY

San Luis Obispo County covers approximately 3,300 square miles with a current population of about 273,000. The County's municipal users have historically depended on groundwater to meet nearly 80-percent of its water demand, while the remaining water demand is met through surface water supplies, including Whale Rock Reservoir, Lopez Lake, Santa Margarita Lake, and the State Water Project. During the 1960's, '70's, and '80's several feasibility studies were conducted, considering the need for and use of the Nacimiento Reservoir entitlement, but each time existing water sources were deemed the best water source to meet communities' demands.

## 6.3 NACIMIENTO WATER PROJECT— THE NEED, THE CONFLICT, THE RESOLUTION

"Whiskey is for drinking and water is for fighting over." Mark Twain

In the last two decades, several things occurred, which shaped the need for supplement water: a change in the local agricultural industry and a severe drought.

San Luis Obispo County's culture and success thrive heavily on its agricultural industry and community. In recent decades, the local North County industry moved its focus from hay, cattle grazing, grains, and nut trees to wine grapes

replacing grains and nuts. While this shift certainly rippled positive effects for local economies and tourism, it added to the withdrawal from the north County groundwater basin. The proactive communities began looking for a supplemental water source to complement their groundwater usage.

Local reservoir during drought period

One of the most severe droughts in the region's history occurred from 1987 to 1991. This drought stressed existing water sources, and pushed local agencies into emergency action to seek supplemental water supply to meet their communities' water demand. Particularly, the City of San Luis Obispo found that its surface water storage was insufficient during long-period droughts and they began searching for additional water supplies. Local agencies began to see the District's Nacimiento Reservoir entitlement as a leading source for reliable, efficient solution to the region's need for additional water sources; however, political turmoil between local communities posed a serious challenge.

"What was going to be a battle, basically, the fighting for water, actually led to the design of the Nacimiento Water Project." Nacimiento Commissioner and 1st District Supervisor Harry Ovitt (retired)

Historically, San Luis Obispo County teemed with political conflicts between north and south County communities. Individual agencies addressed their own water supply challenges, without much consideration for the surrounding communities, and often did not seek regional solutions. However, conveyance of the water entitlement from such a remote reservoir would require significant infrastructure that agencies could not provide individually. A partnership grew between the District and several local agencies.

## 6.4 A REGION UNITED

And so a region that once waged wars over water, found a common goal to bring supplemental water supply to San Luis Obispo County communities.

The District Board of Supervisors approved the Final Environmental Impact Report (FEIR) in 2004, and directed staff to move forward with the Project's planning and design. Also in 2004, the Board executed Water Delivery Entitlement Contracts (WDEC) with the four initial Participants of the City of Paso Robles, Templeton Community Services District, Atascadero Mutual Water Company, and the City of San Luis Obispo. The District Board of Supervisors executed a similar agreement with County Services Area 10 Benefit Zone A (Cayucos) in 2006.

District staff worked closely with Participants to design Project facilities capable of annually moving 15,750 AF of raw water from the Nacimiento Reservoir to the Participants.

## 6.5 A ROUTE CONSIDERED

A water conveyance system is largely housed underground (out of sight and out of mind) but the disturbance caused by construction can be upsetting to a

community. Initially, the pipeline was slated to traverse through the City of Paso Robles' Vine Street area, and was met with opposition by that neighborhood and City Council. In order to lessen the public impact, the pipeline path was re-routed to pass through Camp Roberts and rural public right-of-way.

## 6.6 COMMUNITY OUTREACH

This Project instigated a wide array of public communication from the very beginning. District staff willingly made presentations at a wide array of public forums. Staff, from 2005 to the present, has made 54 presentations locally to technical engineering groups, real estate organizations, and community service groups. District and consultant staffs also developed, presented, and published 14 technical papers and presentations on the Project's successes and challenges, and innovative methods and strategies employed to complete the Project (see **Appendix B**). The Project team spent ample time responding to the public and the related industries to gain a positive public perception of the Project, and civil engineering infrastructure in general.

## 6.7 ICON OF REGIONAL COLLABORATION

The Project and its design and construction phases certainly possess many areas of contribution to the well being of the region in the way the Project was managed and implemented, but even more, it served to prove that the region's communities can successfully align their efforts to meet regional objectives. The 45-mile pipeline acts as a thread, stitching together previously unconnected agencies of San Luis Obispo County, and the support letters presented in **Appendix A** for this Outstanding Civil Engineering Achievement Award echo each agency's understanding and appreciation of the collaborative efforts that all agencies now enjoy with one another.