Preliminary Design Report

Del Rio Replacement Well 271

Prepared for

City of Modesto

November 2017

WEST YOST ASSOCIATES
Consulting Engineers

418-12-17-48

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WEST YOST ASSOCIATES
consulting engineers

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Preliminary Design Report
Del Rio Replacement Well 271

Prepared for

City of Modesto

Project No. 415-12-17-48

James P Connell — November 2, 2017

Project Manager: James P. Connell, PE — Date

K. Whatley — November 2, 2017

QA/QC Review: Kristen Whatley, PE — Date

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1.0 INTRODUCTION

The purpose of this Preliminary Design Report is to describe the proposed improvements, document design assumptions and criteria, provide planning level cost estimates, present preliminary site and piping plans and electrical and instrumentation plans, and recommend a location of the replacement well for the City of Modesto's (City) Del Rio Replacement Well 271 Project (Project). The original Well 271 was drilled in 1956 and is located along Country Club Drive. The 2010 Engineer's report, prepared by West Yost Associates, identified that the existing Well 271 was only producing 50 percent of its initial production capacity of 395 gpm; likely a result of well age -related matters (e.g., well screen incrustation, well casing integrity, *etc.*). This Project will construct a replacement well north of the intersection of Stewart Road and McHenry Avenue.

This report is intended to lay the groundwork for the detailed design of the Project and to provide the necessary information to City staff for an assessment of the preferred system design and to obtain City approval of the concept design prior to beginning final detailed design. A preliminary set of design drawings and cost estimate, at an approximate 35 percent design level of completion, are included in the appendices of this Preliminary Design Report.

2.0 ENVIRONMENTAL CONFORMANCE

The following document was prepared by the City regarding environmental compliance:

- Del Rio Tank and Wells Project Final Environmental Impact Report, certified by City Council September 5, 2017.

The following is a summary of the mitigation measures that will be implemented with this project by inclusion in the contract documents, in accordance with the environmental report listed above:

- Implement and employ design solutions and noise-reducing practices and methods during construction and during facility operations;
- Conduct preconstruction surveys and compensate for the loss of Swainson's Hawk foraging habitat;
- Conduct preconstruction surveys for nesting birds; avoid and minimize impacts on nesting raptors and other migratory birds; and protect bat colonies;
- Implement a graffiti overlay coat (or similar material) to reduce the potential for and impact of vandalism on the site wall;
- Avoid areas of sensitive biological habitat, specifically the area within the dripline of the live oak tree south of the proposed project site, for consideration of construction staging areas; and
- Conduct a project specific geotechnical investigation prior to construction.

3.0 BASIS OF DESIGN

3.1 Project Overview

The proposed Well 271 replacement site is located immediately north of the intersection of Stewart Road and McHenry Avenue, and will be accessed via a paved driveway from McHenry Avenue. The Project, when completed, will provide the City with a fully functional municipal production well with an anticipated capacity of up to 1,000 gallons per minute (gpm). The Project includes the following elements:

1. Construction of a municipal water supply production well with a 16-inch diameter, steel, well casing and screen;
2. Installation of all down-hole equipment, including vertical turbine well pump and water level sensor;
3. Construction of a masonry block well building to house the well, mechanical equipment, chlorination chemical feed system, and electrical and instrumentation equipment;
4. Construction of a 12-foot tall masonry block wall for security purposes and appearance;
5. Connection of the well facility to the existing City water distribution and storm drain systems;
6. Installation of a standby electrical generator with sub-base fuel tank;
7. Installation of electrical and instrumentation equipment; and
8. Construction of associated civil, mechanical, and structural improvements.

In general, the Project will provide similar equipment and design approaches as previously used at other City well sites constructed within the last five years. The Project is proposed to closely resemble the Grogan Park Well facility (Well 67) currently under construction, with the addition of a proposed well building, which will be similar to the well building proposed for Replacement Well 229. The Project assumes that source water quality will meet regulatory requirements and wellhead water treatment facilities will not be required.

3.2 Site Design

The Project is immediately north of the intersection of Stewart Road and McHenry Avenue. Preliminary, 35 percent design level plans are provided in Appendix A. Site layout plans include proposed well location, site access, connection to existing water and storm drain systems, concrete paving, and associated improvements.

For security purposes and appearance, the proposed facility will be constructed behind a 12-foot tall masonry block wall. Project facilities, within the secure area, will include well head and discharge piping, electrical and control equipment, chemical feed system, and a standby, diesel-driven, electrical generator. The proposed well, associated piping, chlorine storage and feed equipment, and electrical and control equipment will be housed in a masonry pump building

with a standing seam metal roof. The chlorine storage and feed facilities will be located in a separately vented room to prevent chlorine gasses from damaging the electrical and control equipment.

The portion of the site inside the wall will be paved with concrete to match the current City standard. Therefore, no landscaping will be proposed within the walled portion of the Project site; however, landscaping will be considered for the area outside the walled area to improve site aesthetics.

A proposed air gap structure on the well flush line will be located near the corner of Stewart Road and Grove Pointe Way. The air gap structure will discharge to the Del Rio storm drain system which outlets to an approximately 1.6-acre-foot storm drainage basin near Hartley Drive on the southwest side of the Del Rio development.

3.2.1 Geotechnical

A geotechnical investigation will be prepared for the proposed site once the site has been acquired by the City. Foundation design and construction will follow the recommendations of the geotechnical report.

3.3 Production Well

Well equipping includes pump selection, control valves, piping, and associated facilities. The proposed well equipping design was developed in coordination with the City's operations staff. Preliminary design criteria are summarized in Table 1 and will be refined once the well drilling and pump testing are completed and the results of the pump test are analyzed.

The proposed pump column pipe will be constructed of uncoated, Schedule 40 threaded steel pipe. The discharge head will be constructed of 3-piece fabricated steel. Pump bowls will be factory porcelain-lined. Pump to waste discharge piping will include an air gap to protect the well from siphon potential. Pump pre-lubrication will be provided with solenoid control. Lubrication water will be initiated from process control prior to pump start. Pre-lubrication duration will be adjustable from 0 to 15 minutes. Pump lubrication water will turn off after the pump is started. A small (approximately 55-gallon) lubrication water storage tank will be installed because potable water may not be available at the proposed well site. The pre-lubrication storage tank will empty during pump startup and will refill once the well pump is running.

The proposed well pump column and flow meter were sized at 8-inches in diameter, which results in a velocity of 6.4 feet per second, to provide sufficient velocity for sand removal and accurate flow measurement. The proposed pipeline from the well facility to the existing distribution system was sized at 10-inches in diameter, to minimize head loss without oversizing the pipe.

Table 1. Preliminary Design Criteria[a]	
Parameter	
Well Pump Discharge Pressure, psi	65
Well Pump Capacity, gpm (maximum)	1,000
Type of Pump	Vertical Turbine
Rated Head, feet	234[b]
Column diameter, inches	8
Line Shaft Diameter, inches	1.5
Pump Setting, feet below discharge head	100 (approximately)
Pump Lubrication	Open Line Shaft Product Lubricated
Motor Horsepower	100
Motor Speed, rpm	1,800
Motor Type	Hollow Vertical Shaft TEFC
Motor Starter Type	VFD

(a) Criteria to be updated once well is constructed and pump tests results are analyzed.
(b) Based on an assumed static water level of 50 feet below ground, a specific capacity of 50 gpm/ft, column and pipeline losses, and a discharge pressure of 65 psi.

In addition to the construction of the above-grade facilities, the City will also install a nested monitoring well within 50 feet of the production well. The monitoring well will be completed at a similar depth as the production well, and will be used to monitor ground water levels. This monitoring well is not included in the proposed design of this well construction and equipping project.

3.4 General Design Elements

The following list of design elements is intended to improve facility operation and maintenance:

- Utility source water for the chlorination system and pump pre-lubrication tank will be provided from the proposed pump discharge piping;
- Ground wires will not be connected to small water lines;
- Pressure gauges will be rated for 100 psi;
- Chlorine tap will be located downstream of the well check valve; provide tubing for chlorine feed in place of hard piping; and,
- The chemical feed/analyzer room will be sized to provide sufficient clearance to access equipment.

3.5 Off-Site Utilities

The well facility will be connected to the following utilities, which are shown on the drawings in Appendix A.

- **Existing Water Distribution Piping in Stewart Road**. There is an existing 10-inch diameter PVC pipeline in Stewart Road west of Grove Pointe Way and an 8-inch diameter PVC pipeline in Grove Pointe Way. The proposed 10-inch diameter PVC well discharge pipeline will connect to both the existing 10- and 8-inch pipelines in Stewart Road and Grove Pointe Way, respectively by replacing an existing 10-inch by 8-inch diameter reducing elbow with a new 10-inch diameter tee that has a 10-inch by 8-inch diameter reducer on one run. To connect to the existing pipelines, the 10-inch diameter well discharge pipeline will need to cross an existing 18-inch diameter asbestos cement storm drain. Survey information indicates that there will not be sufficient vertical clearance to allow for sufficient bury depth if the potable water pipeline is constructed over the existing storm drain. Thus, the 10-inch diameter well discharge pipeline will be constructed underneath the existing storm drain and subsequently raised back up to the elevation of the existing water mains for connection.
- **Storm Drain in Grove Pointe Way**. The well pump-to-waste operation requires an air gap prior to discharge into the storm drain system. An air gap structure will be constructed on the south side of Stewart Road near the corner of Grove Pointe Way. The proposed air gap structure will include a painted steel gooseneck return with a minimum air gap of 12-inches. The flush water will discharge into a nominal 18-inch diameter, precast concrete storm drain pipe. The flush to waste system will be manually operated by sequentially opening and closing valves in Stewart Road. A new storm drain manhole will be constructed in Stewart Road to receive flow from the air-gap structure and convey it to the existing storm drain manhole near the corner of Stewart Road and Grove Pointe Way.
- **Site Drainage**. The existing site currently does not connect to the County's storm water system in McHenry Avenue and is mostly covered with existing vegetation. The site within the walled area will be concrete, with openings in the proposed masonry wall to allow drainage to flow out of the walled area to the north, where it will infiltrate into the ground.

3.6 Chemical Feed System

Currently, the Del Rio water system is not chlorinated. However, per California Waterworks Standards (Chapter 16 of Title 22 CCR) for non-chlorinated systems, design and construction must allow a chlorination system to be readily installed in case it is needed (e.g., control biological growth). To meet this requirement, a chlorination system and chlorine residual analyzer will be installed and ready for use. Chlorination will be accomplished through the dissolving of solid chlorine tablets in a tablet chlorinator. The chlorination system will be located in a separate room within the well building from the well and electrical and equipment controls. The tablet chlorinator will be oriented to allow easy replacement of the chlorinator system pump. The proposed chemical room will be sized to accommodate the chlorine residual analyzer and a future nitrate analyzer, as well as to meet National Electric Code (NEC) working space requirements.

The Accu-Tab PowerPro 3075 MD tablet chlorinator is proposed for this project and will be purchased by the City directly for installation by the contractor.

Since source water will not be available to the site when the well is out of service, a portable eye wash kit will be provided, in addition to the eye wash and shower that will be connected to the well discharge pipe.

3.7 Security

Security measures are proposed to protect the water facilities from vandalism or other threats to the City water supply. As indicated above, the entire site will be surrounded by a 12-foot tall masonry wall. In addition, the critical elements (e.g., the well, electrical power, and controls) will be housed in a locked masonry block building that will provide an added layer of security and reduce external noise.

As was provided for Well 67 at Grogan Park, proposed conduits will be included for a future closed-circuit television system to be provided by others. Configuration and integration of the closed-circuit television system will be the responsibility of the installing manufacturer. Future video cameras are recommended with 24-hour recorded storage.

Additional security system elements are proposed consistent with the City's requirements including: secure locks, access control, intrusion alarms, site surveillance, and motion-activated lighting. Motion-activated lighting is proposed at the site access gate, outside the well building, and on the generator. All interior and exterior lighting will be LED.

Exterior lights will be cut-off style that direct light downwards to comply with local dark sky requirements. The quantity of light will be such that a minimum of 0.25 foot candles are available at all points on the ground. This quantity will enable the future video monitoring equipment to perform satisfactorily at night.

All exterior lights and one interior gate light will utilize built-in photocell and motion detectors. At night, these lights will turn on at a low brightness level; when the motion sensor is activated, the light fixtures will go to full brightness for an adjustable period of time. A light switch next to the 3-foot swing gate will control the remaining interior gate lighting, on and off.

The outdoor generator enclosure door, and well building doors will be provided with intrusion switches wired in series. Similar to other City sites, a keyed selector switch will be provided to disable the door intrusion input to the City's HSQ Technology Inc. (HSQ) system. Green and red indicating lights will also be provided to indicate status of intrusion disable.

4.0 ELECTRICAL AND INSTRUMENTATION

4.1 Electrical Needs and Components

A new utility electrical service is required since there is no existing electrical service at the site. The electrical equipment will be located in the proposed well building. Climate control will be provided to keep the electrical equipment and controls within their recommended operable temperature range. The proposed electrical system design will limit employee arc flash incident energy exposure to less than 8 cal/cm^2.

Proposed major electrical components include main service metering and disconnect, motor control center including well pump starter, variable frequency drive, and facility panelboard. The proposed electrical equipment layout, lighting and receptacle layout, and major conduit runs will be provided as part of final design. Project design will comply with Modesto Irrigation District electrical requirements for installation of substructures including a transformer pad and service conduits. Provisions for a future activated carbon filter and nitrate analyzer will also be provided; however, available space on the site for these future amenities is very limited, as shown on the Drawings.

4.2 Instrumentation Needs

Instrumentation and test point locations will be provided including: discharge pressure, well water level, discharge flow, tablet chlorinator, eye wash flow, and water quality monitoring. Pressure monitoring is required on the well side of the check valve for pump pressure and deadhead monitoring. The electrical pre-design report is included as Appendix B.

4.3 Supervisory Control and Data Acquisition (SCADA)

Process control requirements include a City standard HSQ RTU local control panel for each well site that links to the City's operations center.

As part of final design, requirements to update Human Machine Interface (HMI) screens and reporting requirements in proposed SCADA systems will be defined. A radio-based telemetry link will be established to provide a communication link to the existing City telemetry network. Programming of the HSQ system will be by HSQ. SCADA modifications will be by the City.

4.4 Process Control

The purpose of the new well is to provide controlled water pressure to the City's Del Rio water distribution system. In general, operating modes will consist of well pumping and manual waste pumping. The overall control system strategy is described below.

- The pump station will be placed in production mode manually by the operator. Initial start-up will be a manual operation to flush the well and the 10-inch diameter transmission main prior to discharging into the distribution system. Once the flushing has been completed, the pump will be put into Production mode.

- Once the manual flush operation is completed, the well will be placed in "Auto" mode. Normal operation will be fully automatic with system start and stop. In "Auto", the operators will select on/off parameters and pressure setpoints based on desired Local Pressure or SCADA input. The pump will be called to start on either low system pressure (Local Pressure) or via start call from the SCADA system, with well water level enabled. A pump stop call will be initiated by high system pressure or low flow (Local Pressure), or by SCADA.
- From SCADA, the City may "Initiate" the pump into production mode, which would override normal "Auto" operation. If the pump is not running since it hasn't dropped to a start pressure (Local Pressure), the Initiate would call the pump to run. The operator should be on site to manually open the pump-to-waste valve before using the "Initiate" button.
- The pump would stop based on its typical production mode programming.

4.5 Standby Power

A 125 kW generator with sound attenuating enclosure and sub-base fuel tank is proposed to provide site power during a power outage. Consistent with City standards, a UL2085 subbase fuel tank will be provided. The UL2085 subbase fuel tank is double-walled and has lightweight concrete between the walls of the inner and outer steel tanks. The generator will be turned on and off and the automatic transfer switch (ATS) will be activated and deactivated upon utility power failure and restoration, respectively.

5.0 IMPLEMENTATION

This section summarizes the estimated construction cost and provides the construction schedule.

5.1 Construction Cost Estimates

The construction cost estimate is based on the preliminary design concepts described in this report and includes all aspects of the Project construction including earthwork, site piping, paving, and electrical and instrumentation. Manufacturers, material and equipment suppliers, and local contractors were sources for this preliminary cost estimate information. In addition, previous experience on similar projects was used to develop these preliminary cost estimates. In considering the preliminary construction cost estimates, it is important to realize that these preliminary estimates will be refined throughout the detailed design stages of the Project, and any changes during the final design will also alter these cost estimates. A breakdown of the estimated construction costs for the major elements of this Project is provided in Table 2. As shown in Table 2, the total estimated preliminary construction cost for this Project is approximately $2.90 million. A detailed preliminary estimate is included in Appendix C.

Table 2. Preliminary Construction Cost Estimate[(a)]	
Items	Cost, dollars
General Requirements (5%)	94,800
Mobilization/Demobilization (2%)	37,900
Site Work	601,400
Concrete	29,400
Masonry	112,000
Metals	5,000
Finishes	50,000
Equipment	105,000
Mechanical	20,000
Electrical and Instrumentation	974,000
Subtotal	2,029,500
Estimating Contingency (30%)	608,900
Subtotal	2,638,400
Construction Contingency (10%)	263,900
Total Estimated Construction Cost	2,902,300
(a) Costs are tied to the Engineering News Record 20 Cities Construction Cost Index for September 2017 of 10,822.	

5.1.1 General Requirements

General requirements include other costs directly associated with the construction project such as supervision, field offices, administration, engineering and legal service costs. A five percent add-on was included in the construction cost estimate to account for these costs.

5.1.2 Mobilization/Demobilization

A two percent add-on was included in the construction cost estimate to account for mobilization/ demobilization costs.

5.1.3 Estimating Contingency

A 30 percent estimating contingency factor was applied to all construction costs to include elements not specifically itemized in recognition of the uncertainties that are unavoidable with the preliminary design. The contingency factor covers items such as unexpected conditions that may necessitate special construction methods. This contingency percentage will be reduced as the detailed design progresses.

5.1.4 Construction Contingency

A 10 percent construction contingency factor was applied to all construction costs to provide an allowance for the likelihood that additional construction work may be needed after the design has been completed and construction is underway. Additional construction work typically is a result of unforeseen conditions, such as geotechnical conditions or discovery of unknown utilities; and/or owner requested changes.

5.2 Schedule

Construction of the above grade facilities is scheduled to commence in mid-2018 and be completed in late 2018, after well drilling and testing is complete.

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APPENDIX A

Preliminary Site Plans and Preliminary Electrical and Instrumentation Plans

Bound separately.

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APPENDIX B

Electrical Pre-Design Report

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October 2, 2017

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West Yost & Associates
7041 Koll Center Parkway, Suite 110
Pleasanton, CA, 94566
E-mail: jconnell@westyost.com

Location: City of Modesto
Project: Del Rio Well 271
Subject: Electrical Pre-Design Report – REVISED

The following paragraphs are for the Electrical Pre-Design for replacing the existing well Well 271.

ELECTRICAL RECOMMENDATIONS

ELECTRICAL SERVICE

The Del Rio Well 271 will require a new 400A Utility main service along with a new pad mounted MID transformer for the 100HP well pump (VFD motor control) and building. The transformer pad would be sized per MID. Clear space of 8' in front of the transformer and 3' on the back and sides is typical. MID will provide the transformer and primary conductors and terminate the conductors. Secondary conductors will be provided by the Contractor and terminated by MID.

POWER DISTIBUTION

A NEMA 1 gasketed rated Metering / Main Switchboard (MMS) will be located in an enclosure housing the MID meter, main circuit breaker, Automatic Transfer Switch (ATS). It will be located within the building. The surge protective device, power monitor and power fail relay will be mounted in the ATS section

A Motor Control Center (MCC) will be required to house the well pump variable frequency drive (VFD) motor controls, lighting controls and panelboard distribution. The RTU system will be designed to be integrated with the existing SCADA system. The proposed five-section MCC-1 (21"D x 100"W x 90"H) will house the following in a single lineup:

1. VFD Motor controls for 1-100HP (200A each) pump will occupy a 20" wide MCC section. The pilot devices will be mounted in a separate MCC cubicle separate from the motor controls.

2. A 30KVA lighting panelboard transformer and panelboard will be housed in a 24" wide MCC section.

3. Well pump and light controls will be housed in a 20" wide MCC section.

4. The SCADA system RTU would be mounted inside a 36" wide section with HSQ controls. The flow transmitter will be mounted on the backpan.

The building will be provided with a thermostat controlled HVAC.

A 125KW, 156KVA, 188A @ 480V standby diesel generator will provide backup power to the station in the event of a power failure. This generator is sized at 40% load to provide power to operate the 100HP well pump from the generator source. The standby generator will be located outside the control building and be provided with both the standard manufacturer's sound attenuating housing and UL2085 subbase fuel tank.

When the generator is not running to 50% capacity, not all of the diesel fuel could be burned and can cause a problem called "wet stacking". To correct for this, generators are "exercised" with load banks, at 50% of the generator's rating, periodically. An exhaust mounted load bank rated for 100KW will be provided for this generator.

There will be various analog instruments to provide monitoring and control of the well station:

1. Well drawdown level
2. Discharge pressure transmitter
3. Discharge flow
4. Chlorine residual analyzer
5. Tablet chlorinator
6. Gate and door intrusion switches
7. Eyewash station flow switch monitoring

Conduits will be provided for future surveillance system.

Several features proposed for the well station control system are:

1. High and low alarms will be generated by the PLC off of the analog instruments.
2. Building door switches will trigger an intrusion alarm.
3. When the well pump starts the lube water solenoid valve will be called to open.
4. Pump will ramp down at low well water level.

Please call if you have any questions or require additional information.

Regards,

Sharon M. Kimizuka, P.E.
A T.E.E.M. Electrical Engineering

APPENDIX C

Detailed Cost Estimate

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PROJECT: Del Rio Replacement Well 271 Equipping
OWNER: City of Modesto
LOCATION: Modesto, CA
WEST YOST PROJECT #: 418-12-17-48
TITLE: Preliminary Design (35%) Construction Cost Estimate

Description		Quantity	Unit	Unit Cost, $	Cost, $
General Conditions					
DIV 1					
	General Requirements (% of DIV 2 through 16)	5.0%			94,800
	Mobilization (% of DIV 2 through 16)	2.0%			37,900
	Subtotal				**132,700**
Sitework					
DIV 2					
	Clearing and Grubbing	1	LS	5,000	5,000
	Stormwater Pollution Control	1	LS	15,000	15,000
	Concrete Flatwork	100	CY	200	20,000
	24-ft Sliding Gate	1	EA	15,000	15,000
	3-ft Door	1	EA	1,500	1,500
	Well Building with foundation (32'-8" x 20')	653	SF	400	261,200
	Commercial Driveway	1	LS	7,500	7,500
	Landscaping	1	LS	50,000	50,000
	Buried Pipelines:				
	8-inch W (DI)	60	LF	150	9,000
	10-inch W (DI)	880	LF	190	167,200
	15-inch Storm Drain	90	LF	300	27,000
	New SD MH	1	LS	10,000	10,000
	Tie-in to Water System	1	LS	10,000	10,000
	Air Gap Structure	1	LS	1,500	1,500
	Tie-in to Existing SD MH	1	LS	1,500	1,500
	Subtotal				**601,400**
Concrete					
DIV 3					
	Well Head	2	CY	1,200	2,400
	Generator Slab	25	CY	1,000	25,000
	Transformer Pad	2	CY	1,000	2,000
	Subtotal				**29,400**
Masonry					
DIV 4					
	Masonry Wall (12 ft tall)	280	LF	400	112,000
	Subtotal				**112,000**
Metals					
DIV 5					
	Miscellaneous	1	LS	5,000	5,000
	Subtotal				**5,000**
Finishes					
DIV 9					
	Coating & Painting	1	LS	50,000	50,000
	Subtotal				**50,000**
Equipment					
DIV 11					
	Well Pump	1	LS	85,000	85,000
	Chlorine Feed System	1	LS	20,000	20,000
	Subtotal				**105,000**
Mechanical					
DIV 15					
	Pump Station piping, valves, and fittings	1	LS	20,000	20,000
	Subtotal				**20,000**
Electrical and Instrumentation					
DIV 16					
	Main SWBD, Motor Control Center, Control Panel	1	LS	485,000	485,000
	Field Instruments	1	LS	73,000	73,000
	Generator	1	LS	170,000	170,000
	Site Electrical	1	LS	130,000	130,000
	Building Electrical	1	LS	116,000	116,000
	Subtotal				**974,000**
				Subtotal	**2,029,500**
				Estimating Contingency 30.0%	608,900
				Subtotal	**2,638,400**
				Construction Contingency 10.0%	263,900
				Total Estimated Construction Cost	**2,902,300**