WOOD RODGERS

TECHNICAL MEMORANDUM 99% Draft

TO: Ms. Regina Espinoza
Yolo County Planning and Public Works

FROM: Larry Ernst, PG, CEG, CHG
Jeffrey Lodge, P.E. # C 55828

DATE: March 5, 2012

SUBJECT: **North Davis Meadows CSA Well Replacement –**
Revised Technical Memorandum/Engineers Report

This technical memorandum details Wood Rodgers recommendations for the North Davis Meadows County Service Area (NDMCSA) water supply system improvements. The objective of this project is to develop new wells with acceptable water quality and to increase the source water capacity and water storage to meet the CDPH and local Fire Department water demand requirements. This memo includes project background information, a project summary, a description of the existing water facilities, our recommended project approach, and cost summaries to complete this project. Over the past two years, the North Davis Meadows Water Advisory Committee has worked closely with Yolo County, CDPH, the City of Davis, the local Fire Departments, and Wood Rodgers to come up with the collaborative solutions discuss in this memo.

Background

NDMCSA Wells 1 and 2 have concentrations of nitrate that exceed the California Department of Public Health (CDPH) primary (health based) maximum contaminant level (MCL). Both wells have also exceeded the CDPH secondary (aesthetic) MCL for specific conductance and the CDPH notification level for boron. The Yolo County, Health Department, Environmental - Health Division issued Compliance Order No: 12-09 on December 1, 2009, which stated that this water system must be brought into compliance by December 1, 2010. Previous attempts to improve water quality have not achieved the desired level of success with regard to water quality improvements.

CDPH has determined that the required maximum day demand (MDD) for the NDMWSA water system is 411 gpm. CDPH also requires 100 percent redundancy for this capacity. In addition, the City of Davis Fire Department has determined that North Davis Meadows requires 875 gpm at 20 psi for a 2-hour duration at any of the fire hydrants in the distribution system, of as per the 2010 California Fire Code[1]. In summary, the NDMCSA water system must be able to produce the fire flow requirements (875 gpm) and the MDD (411 gpm), which is: 1,286 gpm for 2-hours from water in storage in conjunction with well capacity, with the largest source of water supply (the highest capacity well) out of service.

[1] Per January 6, 2011 email correspondence from Tim Annis, Acting Fire Marshal, City of Davis Fire Department.

Project Summary

Wood Rodgers recommends constructing new deep aquifer wells (approximallty 900-foot) at each of the existing well sites. Both new wells would be located near the existing wells. Figures 1 and 2 illustrate the areas near these existing well locations that appear to meet CDPH setback requirements. Exploration of the deep aquifer will be conducted by constructing a monitoring well at each of the two wells sites into the 900-foot aquifer. If the water quality is favorable, the location of the new wells would be determined based on the final site layout configurations. CDPH would then review the proposed new well designs and well location maps, followed by a site visit, so they can provide preliminary approval for NDMCSA to move forward with new well construction.

The modified Site 1 will also include additional water storage, a high capacity fire pump with increased capacity, and additional generator capacity to support increased electrical capacity requirements. The modified Site 2 will include a new well, but will not require the addition of storage, booster pumps, or backup power generation. The Well 2 replacement project will utilize as much of the existing site infrastructure as possible to help keep the overall project costs down.

Existing Facilities

The existing facilities at the Site 1 include a domestic well (Well 1) with a capacity of about 360 gpm, a 30-foot diameter tank with about 29,000 gallons of useable storage capacity, three booster pumps rated at 100 gpm each, a single fire pump rated at 180 gpm, a 1,600 gallon hydropneumatic tank with a drawdown volume of about 800 gallons, and an 100 kW emergency stand-by natural gas generator for booster and fire pump operation. The system operational set points for pressure are 55 psi, minimum and 65 psi, maximum. The maximum combined pumping capacity with all booster pumps and the fire pump in operation has not been measured since there is no flow meter downstream of the pumps, but it has been determined to be inadequate for fire flow protection requirements of 875 gpm.

Under the current operating strategy, water is pumped from Well 1 into the storage tank. The well pump operates based on level set points within the storage tank. The storage tank has an emergency overflow to prevent overfilling. A flow meter is located on the well discharge line between the well and the storage tank. The storage tank is connected to the suction side of three booster pumps and a fire flow pump via a header pipe. The three booster pumps are activated based on pressure settings measured by pressure switches located at the discharge side of each pump. The booster pumps operate on a lead-lag basis; the lead and lag pumps can be manually adjusted at the operator panel. The fire pump is activated when the system pressure drops below the low-low set point. To prevent running the pumps dry, the booster pumps and the fire flow pump will not operate when the low-low level in the storage tank is reached. The discharge sides of the pumps are connected to the distribution system with a branch connection to a hydropneumatic tank. The hydropneumatic tank provides water to the meet water demands from the distribution system between the lead booster pump shut down pressure and the pump turn on

pressure. Additionally, the hydropneumatic tank provides a cushion to maintain necessary pressure in the distribution system to prevent the lead booster pump from short-cycling.

Beyond water quality concerns, the existing system is hydraulically limited in that it cannot produce the needed fire flow and max day demand even when all pumps are operating. Additionally, there is no storage redundancy so the existing storage tank cannot be taken off-line without shutting down the whole Well 1 facility.

Currently, Well 1 is not used due to elevated nitrate concentrations. Well 2 has been temporarily modified with a packer on the pump column to shut off water contribution from the upper aquifer which has reduced the nitrate concentration to under the CDPH maximum contaminant level (MCL). Well 2 has provided all of the water supply for the NDMCSA water system for the past several months. Well 2 operates with a VFD and feeds the NDMCSA water system directly. Water produced from Well 2 does not replenish the storage tank. Well 2 is currently able to produce approximately 450 gpm.

Proposed Facility Improvements

The Well Site No. 1 proposed facility improvements are presented schematically Figure 3. These improvements include the addition of a new replacement domestic water well, a new water tank to increase water storage capacity, a new higher capacity booster pump for fireflow requirements, a new emergency generator, and a system discharge flow meter. Under the proposed system, the new well would normally pump to the new storage tank, which would be hydraulically connected to the inlet piping to the existing storage tank. The proposed hydraulic connection would ensure flow-through for each storage tank to prevent water stagnation. The site pumping system would still be able to operate with either of the tanks temporarily removed from service for maintenance. Scheduled tank maintenance could be planned during months with low water demands.

Additional major improvements include upsizing the booster pump capacity to meet the design condition of MDD and fire flow (411 gpm + 875 gpm ~ 1,300 gpm[rounded]) and adding a flow meter on the system discharge line to provide NDMCSA with the ability to measure flow entering the distribution system. The increase in pumping capacity includes an increase in the electrical loads for the site and requires associated electrical equipment upgrade. In order to support the increase in pumping capacity during a power disruption, an upgrade to the existing capacity is needed. A second natural gas emergency generator will be installed and constructed to utilize the existing generator in series to provide power for the site. A minor but important improvement is to add an additional backflow prevention device to the existing hose connection piping branching from the discharge header of the booster pumps to prevent a potential cross-connection hazard.

The addition of the new well and equipment requires expansion of the existing Well Site No. 1 footprint. This expansion will require additional fencing, site work, grading landscape irrigation and landscaping.

Well Site No. 2 improvements are shown in Figure 4. This conversion will require disconnection of the existing Well 2 from distribution piping. The station piping for the new well will connect to existing distribution piping. Power for the new well will be routed from the existing electrical components to reduce overall project costs. The new well site will require the addition of fencing, an access road, and minor site grading to complete the improvements.

COST ESTIMATE

An engineer's opinion of probable cost estimate for the proposed facility improvements at each well site is enclosed. The estimate includes a 20% estimating contingency to reflect project uncertainty. This contingency can be reduced once more detailed site-specific information is gathered.

FIGURE 1
NORTH DAVIS MEADOWS CSA
CDPH OFFSET MAP
YOLO COUNTY, CA

NOTES

NORTH

0 50 100
FEET

WOOD RODGERS
DEVELOPING INNOVATIVE DESIGN SOLUTIONS
3301 C Street, Bldg. 100-B Tel: 916.341.7760
Sacramento, CA 95816 Fax: 916.341.7767

\\Sacfile01\Jobs\Jobs\8359_Davis, City of\8359.008 NDM CSA Well Replacement\Well\GIS\Tasks\Figure 1_Well 2A_New Well Site_CDPH_Offsets_20120302 V1.mxd 3/2/2012 7:04:26 PM sspaeth

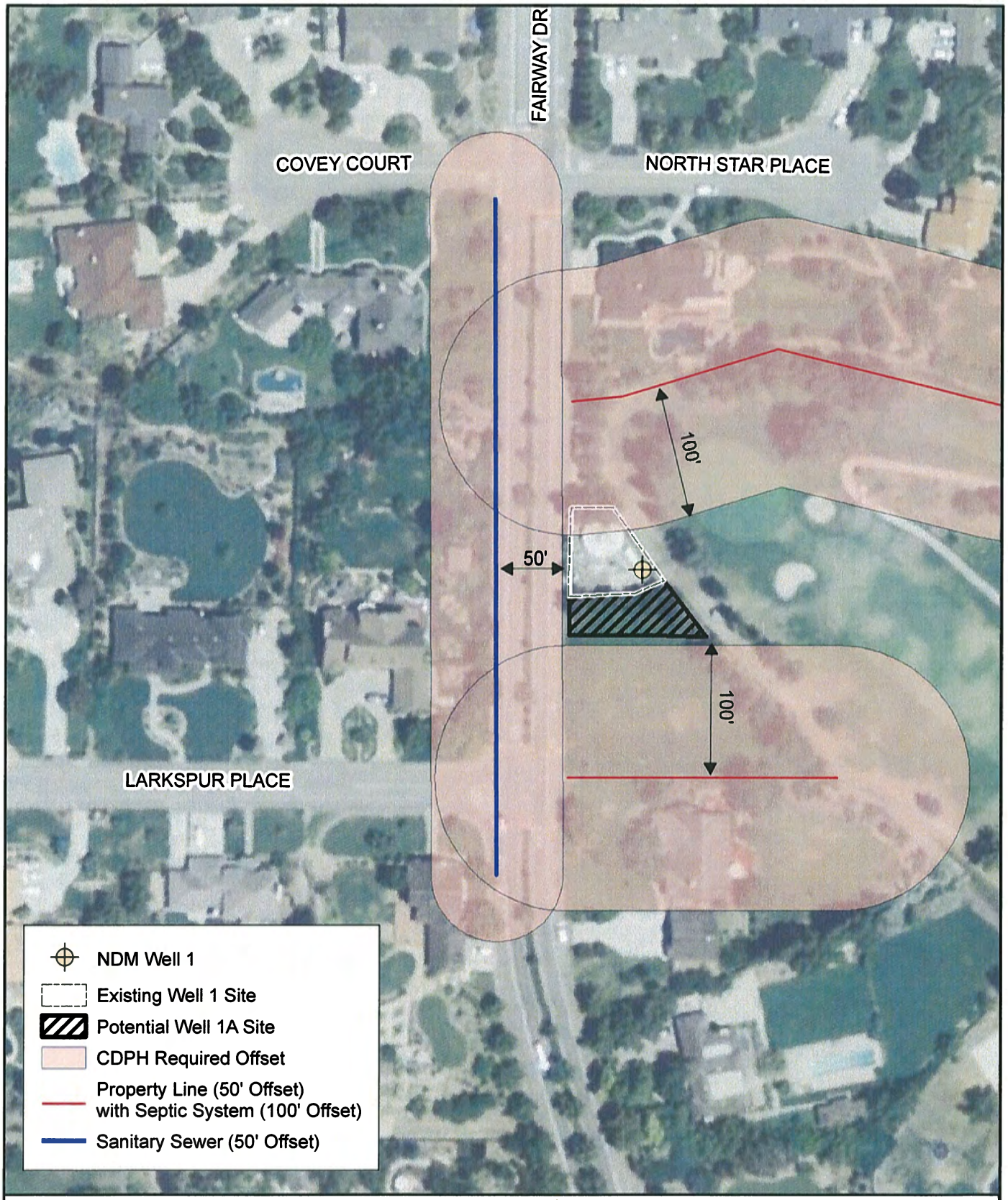

FIGURE 2
NORTH DAVIS MEADOWS CSA
CDPH OFFSET MAP
YOLO COUNTY, CA

NOTES

NORTH

0 50 100
FEET

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\\Sacfile01\Jobs\Jobs\8359_Davis, City of\8359.008 NDM CSA Well Replacement\Well\GIS\Tasks\Figure 2_Well 1A_New Well Site_CDPH_Offsets_20120302 V1 .mxd 3/2/2012 7:07:03 PM sspaeth

OPERATING STRATEGY

PUMP	PRESSURE (PSI)		COMMENTS
	ON	OFF	
Well Pump (Lead) Well Pump (Lag)	–	--	Rotating Duty. Fills Storage Tanks based on level. Lag pump activated based on low-level set point.
Booster 1	45	60	Rotating duty by manual operator selection
Booster 2	40	55	
Booster 3	35	50	
Fire Pump	30	60	Fire pump activation based on low-pressure set point

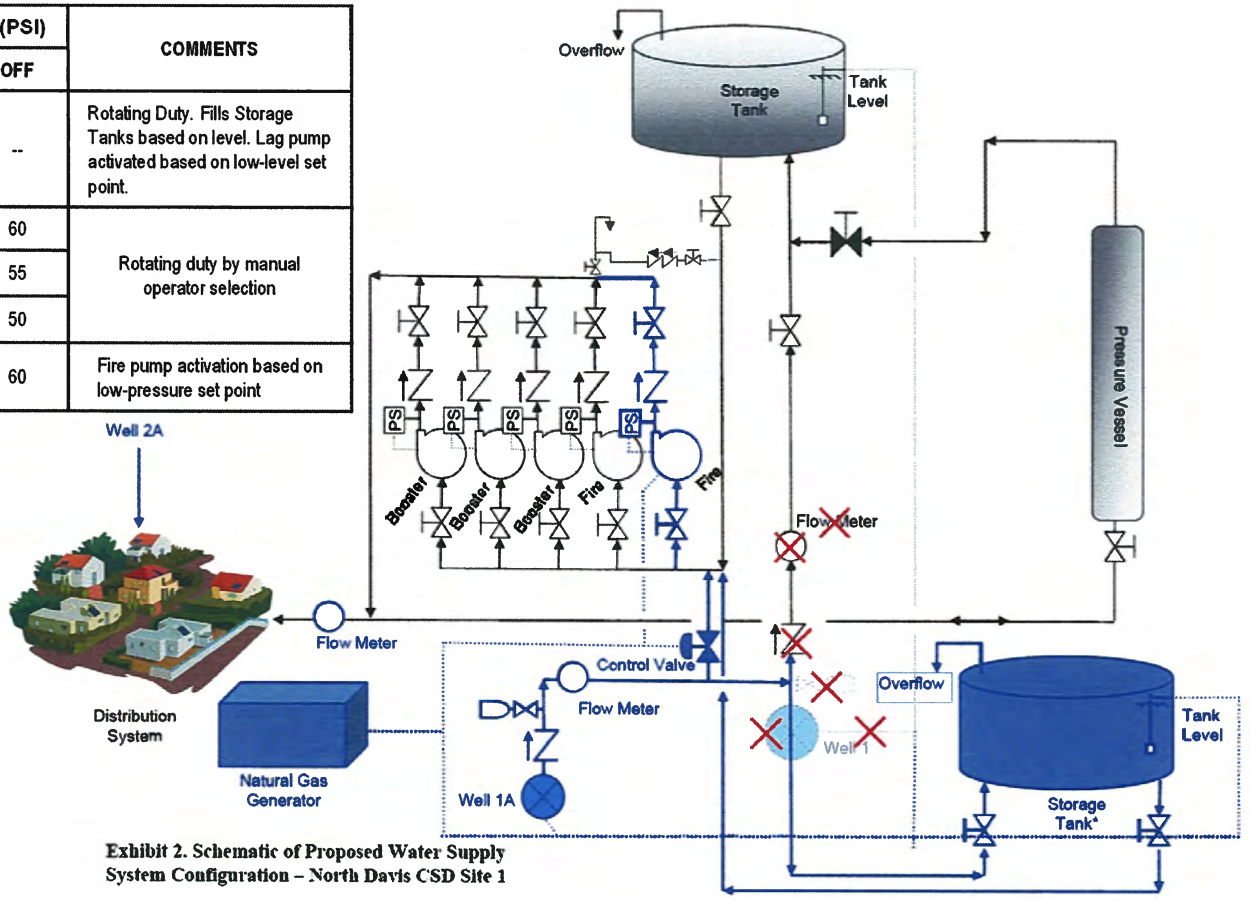

Exhibit 2. Schematic of Proposed Water Supply System Configuration – North Davis CSD Site 1

*Size to be determined based on new Well 1A yield

LEGEND

- EXISTING
- PROPOSED
- ABANDON
- ELECTRIC SIGNAL

FIGURE 3 – WELL SITE NO. 1
WELL PUMPING AND STORAGE SYSTEM SCHEMATIC
NORTH DAVIS MEADOWS CSA
YOLO COUNTY PLANNING AND PUBLIC WORKS
YOLO COUNTY CALIFORNIA
March 2012

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OPERATING STRATEGY

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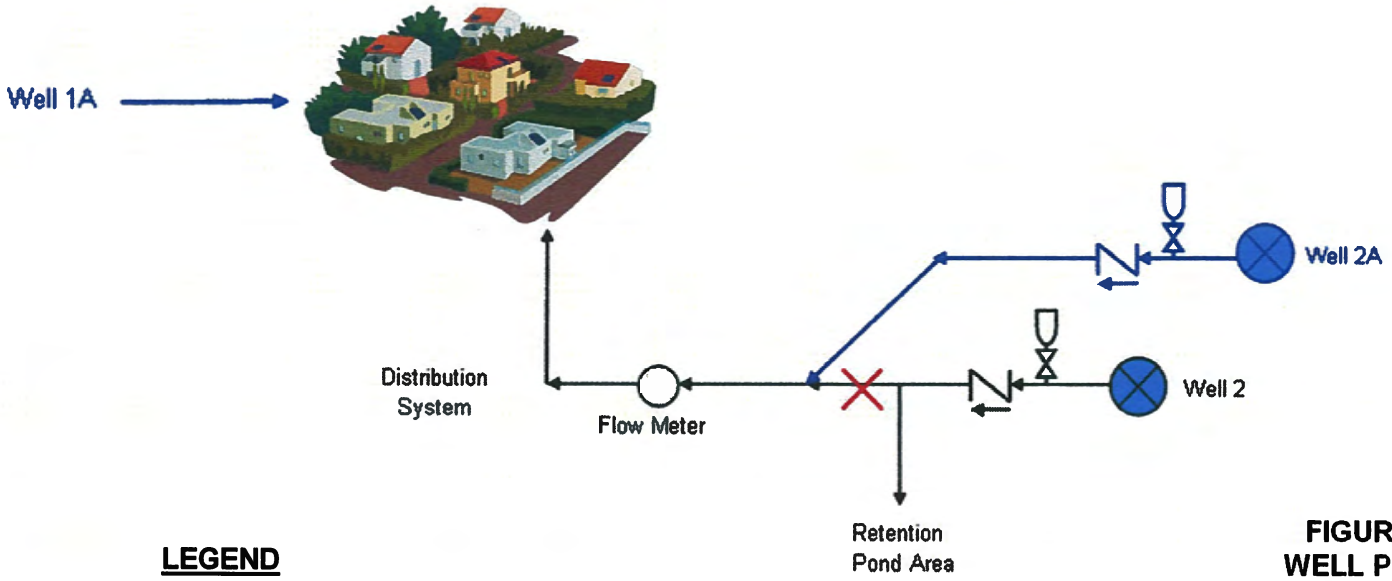
Fire Pump	30	60	Fire pump activation based on low-pressure set point



LEGEND

- EXISTING
- PROPOSED
- ABANDON
- ELECTRIC SIGNAL

FIGURE 4 – WELL SITE NO. 2
WELL PUMPING AND STORAGE SYSTEM SCHEMATIC
NORTH DAVIS MEADOWS CSA
YOLO COUNTY PLANNING AND PUBLIC WORKS
YOLO COUNTY CALIFORNIA
March 2012

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WOOD RODGERS

North Davis Meadows CSA Well Replacement - Site 1 Updated: 2012-March-23
Engineer's Estimate of Construction Costs - Separate Sites
Project No. 8359.008 Prepared By: JAL/LHE

ITEM NO	DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL
	A. General				
1	Mob/Demob/Bonds/Ins/Contract Admin/Incidentals (10%)	1	LS	$50,000	$50,000
2	Engineering - Bridging for pump station design build	1	LS	$75,000	$75,000
	General Subtotal				**$125,000**
	B. Well Construction and Development				
3	Mob for Drilling Contractor	1	EA	$15,000	$15,000
4	30-inch O.D. Conductor Casing and Sanitary Seal	50	LF	$450	$22,500
5	Geophysical (E-Log)	1	EA	$2,500	$2,500
6	28-inch Borehole Drilling	850	LF	$75	$63,750
7	16-inch O.D. Steel Well Casing	800	LF	$100	$80,000
8	16-inch O.D. Well Screen	100	LF	$300	$30,000
9	2-inch Dia. Sound Tube Pipe, Sch 40 BSP	700	LF	$10	$7,000
10	3-inch Dia. Gravel Fill Pipe, Sch 40 BSP	620	LF	$14	$8,680
11	Gravel Envelope	300	LF	$40	$12,000
12	Annular Seal	600	LF	$45	$27,000
13	Test Pump Installation	1	LS	$10,000	$10,000
14	Well Development	1	EA	$20,000	$20,000
15	Well and Aquifer Testing (Test Pumping)	24	HR	$250	$6,000
16	Plumbness & Alignment Test	1	EA	$3,000	$3,000
17	Video Camera Survey	1	LS	$2,500	$2,500
18	Site Cleanup and Records	1	LS	$3,000	$3,000
19	Well Disinfection	1	EA	$1,000	$1,000
20	Standby Time	10	HR	$250	$2,500
21	Monitoring well	1	LS	$80,000	$80,000
22	Existing Well Destruction	1	LS	$10,000	$10,000
	Well Construction and Development Subtotal				**$406,430**
	C. Civil Site Work and Underground				
23	Site Grading	1	LS	$3,000	$3,000
24	Paving and Aggregate Base Surfacing	1,500	SF	$5	$7,500
25	6' CL Fence w/ slats and bw	325	LF	$35	$11,375
26	Access Gate	1	LS	$4,000	$4,000
27	Tank Base	1	LS	$20,000	$20,000
28	Steel Tank - 70,000 gal	1	LS	$105,000	$105,000
29	18" AWWA C900 PVC Drain Pipe	65	LF	$200	$13,000
30	48" Drainage Manhole	1	EA	$6,000	$6,000
31	Sheeting, Shoring, and Bracing	1	LS	$5,000	$5,000
32	Landscaping	1	LS	$7,500	$7,500
33	Security	1	LS	$0	$0
34	SWPPP Implementation and Maintenance	1	LS	$3,000	$3,000
	Sitework and Underground Subtotal				**$185,375**
	D. Well Pumps, Fire Pump, Appurenances				
35	50hp Well Pumps, Prem Efficiency Motors	1	EA	$20,000	$20,000
36	100hp Fire Pump, Prem Efficiency Motor	1	EA	$25,000	$25,000
37	Flow meter	1	EA	$8,000	$8,000
38	Piping, Valving, and Appurtenances	1	LS	$25,000	$25,000
	Well Pumps, Fire Pump, Appurenances Subtotal				**$78,000**
	E. Electrical				
39	100 kW Natural Gas Generator	1	LS	$70,000	$70,000
40	Generator Paralleling Connection Box	1	LS	$20,000	$20,000
41	400 Amp Automatic Transfer Switch	1	LS	$45,000	$45,000
42	200 Amp to 400 Amp Electrical Service Upgrade	1	LS	$60,000	$60,000
43	Well Pump and Booster Pump Control Panel	1	LS	$45,000	$45,000
44	PLC and Radio Telemetry Upgrades	1	LS	$65,000	$65,000
45	Electrical Installation, Start up and Testing	1	LS	$90,000	$90,000
46	Electrical Engineering and Design	1	LS	$35,000	$35,000
	Electrical Subtotal				**$430,000**
				Subtotal (rounded):	**$1,225,000**
				Contingency (20%) :	**$245,000**
				Total Estimated Construction Cost :	**$1,470,000**

Note: The Probable Construction Cost above is based on the assumptions outlined in the attached Technical Memorandum. Neither Wood Rodgers nor the Client has any control over the cost of labor, materials, equipment, the Contractors' methods of determining

WOOD RODGERS

North Davis Meadows CSA Well Replacement - Site 2
Engineer's Estimate of Construction Costs - Separate Sites
Project No. 8359.008

Updated: 2012-March-23
Prepared By: JAL/LHE

ITEM NO	DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL
	A. General				
1	Mob/Demob/Bonds/Ins/Contract Admin/Incidentals (10%)	1	LS	$0	$0
2	Engineering - Bridging for pump station design build	1	LS	$10,000	$10,000
	General Subtotal				**$10,000**
	B. Well Construction and Development				
3	Mob for Drilling Contractor	1	EA	$15,000	$15,000
4	30-inch O.D. Conductor Casing and Sanitary Seal	50	LF	$450	$22,500
5	Geophysical (E-Log)	1	EA	$2,500	$2,500
6	28-inch Borehole Drilling	850	LF	$75	$63,750
7	16-inch O.D. Steel Well Casing	800	LF	$100	$80,000
8	16-inch O.D. Well Screen	100	LF	$300	$30,000
9	2-inch Dia. Sound Tube Pipe, Sch 40 BSP	700	LF	$10	$7,000
10	3-inch Dia. Gravel Fill Pipe, Sch 40 BSP	620	LF	$14	$8,680
11	Gravel Envelope	300	LF	$40	$12,000
12	Annular Seal	600	LF	$45	$27,000
13	Test Pump Installation	1	LS	$10,000	$10,000
14	Well Development	1	EA	$20,000	$20,000
15	Well and Aquifer Testing (Test Pumping)	24	HR	$250	$6,000
16	Plumbness & Alignment Test	1	EA	$3,000	$3,000
17	Video Camera Survey	1	LS	$2,500	$2,500
18	Site Cleanup and Records	1	LS	$3,000	$3,000
19	Well Disinfection	1	EA	$1,000	$1,000
20	Standby Time	10	HR	$250	$2,500
21	Monitoring well	1	LS	$80,000	$80,000
	Well Construction and Development Subtotal				**$396,430**
	C. Civil Site Work and Underground				
22	Site Grading	1	LS	$1,000	$1,000
23	Paving and Aggregate Base Surfacing	300	SF	$5	$1,500
24	6' CL Fence w/ slats and bw	100	LF	$35	$3,500
25	Access Gate	1	LS	$2,000	$2,000
26	18" AWWA C900 PVC Drain Pipe	65	LF	$200	$13,000
27	Landscaping	1	LS	$1,000	$1,000
28	Security	1	LS	$0	$0
29	SWPPP Implementation and Maintenance	1	LS	$2,000	$2,000
	Sitework and Underground Subtotal				**$24,000**
	D. Well Pumps, Fire Pump, Appurenances				
30	50hp Well Pumps, Prem.Efficiency Motors	1	EA	$20,000	$20,000
31	Piping, Valving, and Appurtenances	1	LS	$15,000	$15,000
	Well Pumps, Fire Pump, Appurenances Subtotal				**$35,000**
	E. Electrical				
32	Relocating Well #2 Starter Panel	1	LS	$10,000	$10,000
32	Controls Upgrade at Well #1	1	LS	$10,000	$10,000
33	Electrical Installation, Start up and Testing	1	LS	$25,000	$25,000
34	Electrical Engineering and Design	1	LS	$5,000	$5,000
	Electrical Subtotal				**$50,000**
			Subtotal (rounded):		**$516,000**
			Contingency (20%) :		**$103,000**
			Total Estimated Construction Cost :		**$619,000**

Note: The Probable Construction Cost above is based on the assumptions outlined in the attached Technical Memorandum. Neither Wood Rodgers nor the Client has any control over the cost of labor, materials, equipment, the Contractors' methods of determining

WOOD RODGERS

North Davis Meadows CSA Well Replacement **Updated: 2012-March-23**
Engineer's Estimate of Construction Costs - Same Site
Project No. 8359.008 **Prepared By: JL/LE**

ITEM NO	DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL
	A. General				
1	Mob/Demob/Bonds/Ins/Contract Admin/Incidentals (10%)	1	LS	$50,000	$50,000
2	Engineering - Bridging for pump station design build	1	LS	$85,000	$85,000
	General Subtotal				**$135,000**
	B. Well Construction and Development				
3	Mob for Drilling Contractor	1	EA	$30,000	$30,000
4	30-Inch O D Conductor Casing and Sanitary Seal	100	LF	$450	$45,000
5	Geophysical (E-Log)	2	EA	$2,500	$5,000
6	28-Inch Borehole Drilling	1,700	LF	$65	$110,500
7	16-Inch O D Steel Well Casing	1,566	LF	$100	$156,600
8	16-Inch O D Well Screen	220	LF	$300	$66,000
9	2-Inch Dia Sound Tube Pipe, Sch 40 BSP	1,400	LF	$10	$14,000
10	3-Inch Dia Gravel Fill Pipe, Sch 40 BSP	1,240	LF	$14	$17,360
11	Gravel Envelope	600	LF	$40	$24,000
12	Annular Seal	1,200	LF	$45	$54,000
13	Test Pump Installation	2	LS	$10,000	$20,000
14	Well Development	2	EA	$20,000	$40,000
15	Well and Aquifer Testing (Test Pumping)	48	HR	$250	$12,000
16	Plumbness & Alignment Test	2	EA	$3,000	$6,000
17	Video Camera Survey	2	LS	$2,500	$5,000
18	Site Cleanup and Records	2	LS	$3,000	$6,000
19	Well Disinfection	2	EA	$1,000	$2,000
20	Standby Time	20	HR	$250	$5,000
21	Monitoring well	1	LS	$80,000	$80,000
22	Existing Well Destruction	2	LS	$10,000	$20,000
	Well Construction and Development Subtotal				**$718,460**
	C. Civil Site Work and Underground				
23	Site Grading	1	LS	$3,000	$3,000
24	Paving and Aggregate Base Surfacing	800	SF	$5	$4,000
25	Tank Base	1	LS	$20,000	$20,000
26	Steel Tank - 70,000 gal	1	LS	$105,000	$105,000
27	18" AWWA C900 PVC Drain Pipe	65	LF	$200	$13,000
28	48" Drainage Manhole	1	EA	$6,000	$6,000
29	Sheeting, Shoring, and Bracing	1	LS	$5,000	$5,000
30	SWPPP Implementation and Maintenance	1	LS	$5,000	$5,000
	Sitework and Underground Subtotal				**$161,000**
	D. Well Pumps, Fire Pump, Appurenances				
31	50hp Well Pumps, Prem Efficiency Motors	2	EA	$16,000	$32,000
32	100hp Fire Pump, Prem Efficiency Motor	1	EA	$18,000	$18,000
33	Flow meter	1	EA	$8,000	$8,000
34	Piping, Valving, and Appurtenances	1	LS	$35,000	$35,000
	Well Pumps, Fire Pump, Appurenances Subtotal				**$93,000**
	E. Electrical				
35	100 kW Natural Gas Generator (Site 1)	1	LS	$70,000	$70,000
36	Generator Paralleling Connection Box (Site 1)	1	LS	$20,000	$20,000
37	400 Amp Automatic Transfer Switch (Site 1)	1	LS	$45,000	$45,000
38	200 Amp to 400 Amp Electrical Service Upgrade (Site 1)	1	LS	$60,000	$60,000
39	Well Pump and Booster Pump Control Panel (Site 1)	1	LS	$45,000	$45,000
40	PLC and Radio Telemetry Upgrades (Site 1)	1	LS	$65,000	$65,000
41	Electrical Installation, Start up and Testing (Site 1)	1	LS	$90,000	$90,000
42	Relocating Starter Panel (From Site 2)	1	LS	$10,000	$10,000
43	Controls Upgrade (Site 1)	1	LS	$10,000	$10,000
44	Electrical Engineering and Design	1	LS	$40,000	$40,000
	Electrical Subtotal				**$480,000**
				Subtotal (rounded):	**$1,588,000**
				Contingency (20%) :	**$318,000**
				Total Estimated Construction Cost :	**$1,906,000**

Note: The Probable Construction Cost above is based on the assumptions outlined in the attached Technical Memorandum. Neither Wood Rodgers nor the Client has any control over the cost of labor, materials, equipment, the Contractors' methods of determining bid prices, or other competitive bidding markets. Prices may vary from engineer's estimate due to bidding climate, competition, and materials escalation at time of receiving bids. The above cost estimate represents preliminary amounts that are subject to change