PILOT STUDY WORK PLAN

FOR

NEBRASKA GROUNDWATER RECHARGE FEASIBILITY STUDY

PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM

Prepared by:

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Table of Contents

APPENDICES

1. Introduction

This Work Plan has been prepared by EA Engineering, Science & Technology, Inc. (EA) and Daniel B. Stephens & Associates, Inc. (DBS&A) for work related to construction observation and operation of a pilot scale recharge basin project (basin project) and evaluation of operation of the Phelps Canal for the Nebraska Groundwater Recharge Feasibility Study. The Pilot Project collectively refers to the pilot scale operation of the Phelps Canal and the basin project. The work will be completed at the Phelps Recharge Site 8.7 (Phelps Site) located south of Overton, Nebraska.

1.1. Background and Purpose

The purpose of this project is to analyze the feasibility of groundwater recharge in the central Platte River for the Platte River Recovery Implementation Program (Program). This purpose of this Work Plan is to implement Phase II activities which include construction, operation, and evaluation of the pilot project and recommendations for full scale projects.

The Program decided to proceed with design of the pilot project at both the 7.7 and 8.7 sites during the review of the Design Memo. However, a lease agreement could not be obtained for the 7.7 Site. Therefore, only the 8.7 site is included in the Phase II activities.

1.2. Scope of Phase II Activities

The pilot project includes the following primary components:

- Construction of the earthen recharge basin
- Construction of the water delivery system
- Installation of instrumentation
- Construction phase engineering services and operational support
- Operation and maintenance of the basin project
- Collection of instrumentation data during the basin project
- Evaluation and reporting of the results

1.3. Study Schedule

The target date for beginning construction of the pilot project is 31 August 2011. The target operational period is from 7 October 2011 through 1 March 2012, while weather permits. Restoration of the site will be completed by 1 April 2012. A more detailed schedule is included in Appendix A.

2. Construction of the Earthen Recharge Basin

Construction of the earthen recharge basin includes earthwork activities such as stripping and salvaging topsoil, excavating and stockpiling subsoil, and final grading. The Program is contracting earthwork activities separate from other work on the basin project. Work to be completed by the earthwork contractor is described in Appendix B and an estimate of cost is included in Appendix D.

Construction activities also include the restoration of the site upon completion of the basin project to pre-construction conditions, including backfill of subsoil, replacement of topsoil and final grading.

3. Construction of the Water Delivery System

Construction of the water delivery system includes installation of above ground piping from the canal to the recharge basin, buried piping at the recharge basin and the stilling well, pump, connection of electrical service to the pump, valves, and flow meter. The Program is contracting with the Central Nebraska Public Power and Irrigation District (CNPPID) to install the temporary infrastructure needed to deliver water to the recharge basin. Work to be completed by CNPPID is described in Appendix C and an estimate of cost is included in Appendix D.

Upon completion of the basin project, the water delivery system will be removed by CNPPID and the site restored to preconstruction conditions. These activities include removal of above ground piping, pumps, valves, and flow meter. These activities also include removal of buried piping and stilling well, backfill piping trenches and final grading of these areas.

4. Installation of Instrumentation

EA and DBS&A will be installing additional instrumentation directly related to the basin project. Specific activities to be performed by EA and DBS&A include:

- One piezometer will be installed adjacent to the recharge basin to monitor mounding of the water table beneath the basin using similar techniques as previous monitoring wells (excluding laboratory analysis). The piezometer will only be screened in the alluvial sand and gravel formation. A continuous water level recorder will be installed in the piezometer. The casing elevation of the piezometer will be surveyed to determine the measuring point elevation. The piezometer will be installed in accordance with EA SOP No. 19 – Monitoring Well Installation, attached in Appendix F.
- Prepare a geologic log from information obtained during installation of the piezometer.
- One soil moisture array will be installed adjacent to the piezometer to monitor vertical movement of water through the vadose zone to the water table. A borehole will be drilled to install the soil moisture sensors. Starting above the water table, the soil moisture sensors will be placed on 5 foot intervals with the wires extending to the surface through the bore hole. Each sensor will be enveloped in a 2 foot layer of sand as shown in Appendix G. Between each sensor and sand envelope, the borehole will be sealed with bentonite chips and hydrated. Each of the sensor leads will be connected to a data logger.
- One rain gauge will be installed at the site to provide continuous measurement of rainfall, and will be connected to a data logger.
- One continuous water lever recorder will be installed in the stilling well to record water levels in the basin.

Upon completion of the basin project, EA will remove the instrumentation to return the site to pre-existing conditions. Removal activities include the following:

- The rain gauge and water level recorders from the piezometer and stilling well will be removed and salvaged.
- The piezometer will be abandoned meeting regulatory requirements for well abandonment.
- The water level sensors from the soil moisture array will be difficult to remove since they will be directly buried. Where possible, the sensors will be pulled out and salvaged. If they sensor cannot be pulled out, the wire leads will be cut off at an approximate depth of 4 feet below final grade and abandoned in place.

5. Construction Phase Engineering Services and Operational Support

EA and DBS&A will be providing construction phase engineering services during construction of the earthen recharge basins and water delivery system. These activities include:

- Pre-construction survey including detailed topographic survey to determine quantities, construction staking, and establishment of on-site horizontal and vertical control.
- Post-construction survey to determine as-built quantities for unit price payment of earthwork contractor and measure as-built infiltration area.
- Post-restoration survey to verify that the site has been returned to pre-construction grades, if the EDO deems necessary.
- Review of submittals and contractor invoices.
- Determination of quantities for contractor payment.
- Address and resolve questions from the earthwork contractor and from CNPPID during construction activities.
- On-site observation during construction. Three site visits were assumed.
- Final site walk through with the contractor, CNPPID, and the Program at substantial completion.

EA and DBS&A will also be providing engineering support to the Program and CNPPID during operation of the basin project to answer questions and assist in resolving any operational issues that may arise.

6. Operation and Maintenance of the Pilot Project

The Program is contracting with the CNPPID operate the temporary infrastructure needed to deliver water to the recharge basin. These activities include:

- Daily site visits to observe the operation of the water delivery system and the recharge basin.
- Daily manual adjustment of flow rate using the flow control valve to maintain the water level in the basin close to the target water level and make sure that the water level does not exceed the maximum water level or fall below the minimum water level.

- Respond to any emergency conditions.
- Conduct necessary maintenance and repairs to keep the recharge project operating.
- Decide when the system should be shut down for the winter due to persistent freezing conditions and restarted in the spring.
- Shut down the system if water is not available in the canal at the 8.7 Site.
- Document operation and maintenance activities.
- Collect data for recharge from the canal.

7. Collection of Instrumentation Data during Pilot Project

The Program is contracting with EA and DBS&A to conduct monitoring and data collection from the instrumentation for the basin project and surrounding area. Specific activities to be performed by EA include:

- Download data on two week intervals for the following:
  - Instrumentation at the recharge site: piezometer, rain gauge, soil moisture sensor array, basin water levels, and flow meter
  - Water levels recorders in the six Program installed monitoring wells
  - Water levels in the four drains (prior to freezing conditions)
- Additional data will be collected from the following sources:
  - Water level recorders in Tri-Basin wells
  - Phelps canal operational data from CNPPID
  - Manual water level readings from staff gauges in drains from the Program.

The water level data will be collected following EA SOP No. 10 – Water Level and Well Depth Measurements, attached in Appendix E.

8. Evaluation and Reporting

The Program is contracting with EA and DBS&A to provide evaluation of data collected from the instrumentation during the pilot project and preparation of a summary report. Specific activities to be performed include:

- Document the construction of the basin project.
- Document the pilot project operational information.
- Summarize the instrumentation data collected during the pilot project.
- Evaluate the recharge results of the basin project.
- Evaluate the recharge results of extended operation of the Phelps Canal.
- Provide recommendations on future recharge activities.

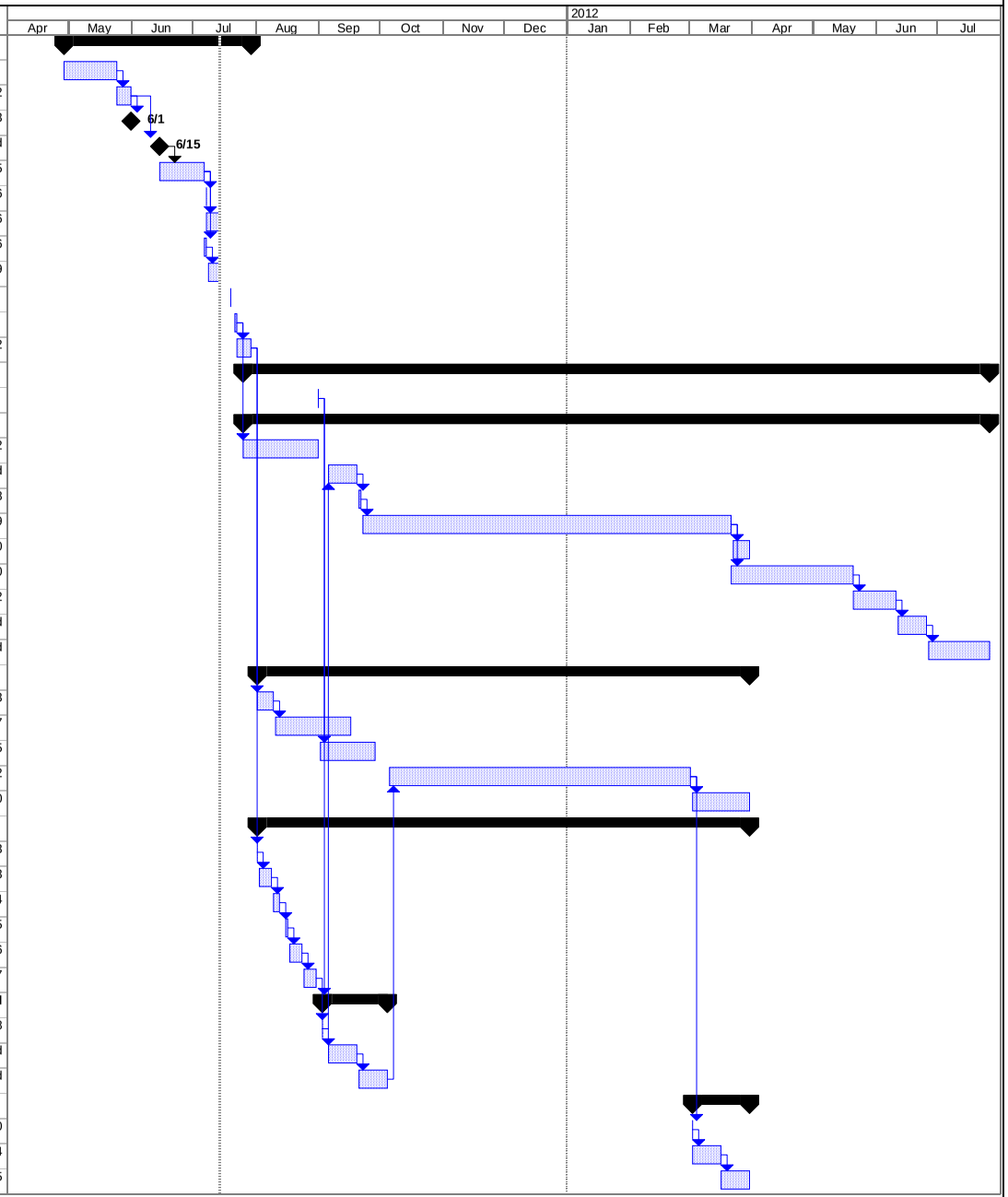
A Draft Report will be prepared for review and comment by the ED Office. Report comments will be addressed and incorporated into the Final Report

APPENDIX A

PILOT PROJECT SCHEDULE

PILOT PROJECT SCHEDULE
PRRIP - Nebraska Ground Water Recharge Project

ID	Task Name	Duration	Start	Finish	Predecessors
1	**Pilot-Scale Recharge Design**	**66d**	**Fri 4/29/11**	**Fri 7/29/11**	
2	30% Design Memorandum	26ed	Fri 4/29/11	Wed 5/25/11	
3	ED Office Review	7ed	Wed 5/25/11	Wed 6/1/11	2
4	WG Meeting	0d	Wed 6/1/11	Wed 6/1/11	3
5	50% Progress Meeting	0ed	Wed 6/15/11	Wed 6/15/11	3FS+14ed
6	90% Design	22ed	Wed 6/15/11	Thu 7/7/11	5
7	DNR Appropriation Approval	1d	Thu 7/7/11	Thu 7/7/11	6
8	Obtain Signed Lease for Pilot Project Site	6d	Thu 7/7/11	Thu 7/14/11	6
9	ED Office Review	1ed	Thu 7/7/11	Fri 7/8/11	6
10	Revised 90% Design	5d	Fri 7/8/11	Thu 7/14/11	9
11	WAC Meeting	1d	Tue 7/19/11	Tue 7/19/11	
12	Finance Committee Approval of Phase II	2d	Thu 7/21/11	Fri 7/22/11	
13	Final Design & Bid Package	7ed	Fri 7/22/11	Fri 7/29/11	12
14	**Pilot-Scale Recharge Operation**	**264d**	**Mon 7/25/11**	**Thu 7/26/12**	
15	Tenant Chops Corn	1d	Wed 8/31/11	Wed 8/31/11	
16	**EA Engineering**	**264d**	**Mon 7/25/11**	**Thu 7/26/12**	
17	Procurement	28d	Mon 7/25/11	Wed 8/31/11	12
18	Mobilization	14ed	Mon 9/5/11	Mon 9/19/11	40FS+1d
19	Install Instrumentation	2d	Tue 9/20/11	Wed 9/21/11	18
20	Data Collection	130d	Thu 9/22/11	Wed 3/21/12	19
21	Restoration	7d	Thu 3/22/12	Fri 3/30/12	20
22	Reporting and Recommendations Draft	60ed	Wed 3/21/12	Sun 5/20/12	20
23	EDO Review and Submit Revised Draft	21ed	Sun 5/20/12	Sun 6/10/12	22
24	Work Group Review	14ed	Mon 6/11/12	Mon 6/25/12	23FS+1d
25	Reporting and Recommendations Final	30ed	Tue 6/26/12	Thu 7/26/12	24FS+1d
26	**CNPPID**	**175d**	**Mon 8/1/11**	**Fri 3/30/12**	
27	Final Letter of Understanding	7d	Mon 8/1/11	Tue 8/9/11	13
28	Procurement	28d	Wed 8/10/11	Fri 9/16/11	27
29	Installation	20d	Thu 9/1/11	Wed 9/28/11	15
30	Run Pilot Project	107d	Wed 10/5/11	Thu 3/1/12	42
31	Restoration	21d	Fri 3/2/12	Fri 3/30/12	30
32	**Earthwork Contractor**	**175d**	**Mon 8/1/11**	**Fri 3/30/12**	
33	Advertise Bids	1d	Mon 8/1/11	Mon 8/1/11	13
34	Pre-Bid Meeting	5d	Tue 8/2/11	Mon 8/8/11	33
35	Bids Due	4d	Tue 8/9/11	Fri 8/12/11	34
36	Notice of Award	2d	Mon 8/15/11	Tue 8/16/11	35
37	Contractor Signs Agreement	5d	Wed 8/17/11	Tue 8/23/11	36
38	Owner Signs Agreement	5d	Wed 8/24/11	Tue 8/30/11	37
39	**Construct Basins**	**23d**	**Fri 9/2/11**	**Tue 10/4/11**	**15FS+1d**
40	Notice to Proceed	1d	Fri 9/2/11	Fri 9/2/11	38
41	Substantial Completion	14ed	Mon 9/5/11	Mon 9/19/11	40FS+1d
42	Final Completion	14ed	Tue 9/20/11	Tue 10/4/11	41FS+1d
43	**Site Restoration**	**21d**	**Fri 3/2/12**	**Fri 3/30/12**	
44	Notice to Proceed	1d	Fri 3/2/12	Fri 3/2/12	30
45	Substantial Completion	14ed	Fri 3/2/12	Fri 3/16/12	44
46	Final Completion	14ed	Fri 3/16/12	Fri 3/30/12	45



Task
Progress
Milestone
Summary
Rolled Up Task
Rolled Up Milestone
Rolled Up Progress
Split
External Tasks
Project Summary
Group By Summary
Deadline

APPENDIX D

ENGINEER'S ESTIMATE OF COST – CNPPID AND EARTHWORK CONTRACTORS

Pilot-Scale Recharge Project
Nebraska Groundwater Recharge Feasibility Study
90% Design - Engineer's Estimate of Cost
Water Delivery System - CNPPID

Bid Item	COMPONENT DESCRIPTION	UNIT	ESTIMATED IN-PLACE QUANTITY	UNIT PRICE	SUBTOTAL	TOTAL	Recommended Bidding Unit	Comment
1	**Mobilization/Demobilization**					**$1,843.20**	LS	
	Backhoe	LS	2	$780.00	$1,560.00			1 Backhoe, 25 miles one way
	Orange Construction Fence	SF	240	$1.18	$283.20			
2	**Canal Water Supply Piping & Stilling Well**					**$14,593.76**	LS	
	Procurement of Supplies	hr	16	$50.00	$800.00			Engineer Estimate
	Installation - Supervisor	hr	10	$75.00	$750.00			Engineer Estimate
	Installation - Technicians	hr	80	$50.00	$4,000.00			2 technicians for 1 week
	Backhoe	day	1	$247.50	$247.50			
	4" PVC Above Ground Piping	LF	2900	$1.05	$3,043.26			Excludes any salvage cost savings
	Control Valve	ea	1	$825.00	$825.00			spears schedule 40 globe valve
	Data Logger for Flow Meter	ea	1	$2,002.00	$2,002.00			
	Isolation Valves	ea	2	$693.00	$1,386.00			spears schedule 40 ball valve
	Restraints	LS	1	$550.00	$550.00			
	Fittings	ea	10	$16.50	$165.00			
	Shipping	LS	1	$550.00	$550.00			
	Stilling Well	LS	1	$275.00	$275.00			
3	**Canal Water Supply Pump & Electrical**					**$3,400.00**	LS	
	Pump	LS	2	$700.00	$1,400.00			Rental for 2 pumps
	Electrical	LS	2	$1,000.00	$2,000.00			Install and Remove
4	**Water Delivery System Operation**					**$16,187.29**	LS	
	Main Technician	hr	150	$50.00	$7,500.00			1 hr/day for up to 5 months
	Maintenance/Repair	hr	80	$50.00	$4,000.00			2 technicians, 8 hrs/month for up to 5 months
	Supervisor	hr	10	$75.00	$750.00			2 hrs/month for up to 5 months
	Miscellaneous Supplies	LS	1	$500.00	$500.00			Engineer Estimate
	Electrical Usage	Kw hr	5,371	$0.087	$467.29			2 hp, 1 pump continuous for up to 5 months
	Vehicle Usage	miles	10,800	$0.28	$2,970.00			assumes 1/2 IRS rate due to dual purpose trip from Holdrege
5	**Water Delivery System Restoration**					**$2,797.50**	LS	
	Restoration - Supervisor	hr	2	$75.00	$150.00			
	Restoration - Technician	hr	48	$50.00	$2,400.00			2 technicians for 3 days
	Backhoe	day	1	$247.50	$247.50			
	Contingency	%	20			**$7,764.35**		
	Total					**$46,586.11**		

LS = Lump Sum, SF = Square Foot, hr = hour, LF = Linear Feet, ea = Each

Pilot-Scale Recharge Project
Nebraska Groundwater Recharge Feasibility Study
90% Design - Engineer's Estimate of Cost
EARTHWORK CONTRACTOR

Bid Item	COMPONENT DESCRIPTION	UNIT	ESTIMATED IN-PLACE QUANTITY	UNIT PRICE	SUBTOTAL	TOTAL	Recommended Bidding Unit	Comment
1	**Mobilization/Demobilization**					**$2,238.50**	LS	
	Equipment Mobilization/Demobilization	EA	2	$858.00	$1,716.00			1 Dozer 30 miles 1 way
	Silt Fence	LF	550	$0.95	$522.50			
2	**Recharge Basin Excavation**					**$12,122.00**	BCY	
	Topsoil Excavation & Stockpile	BCY	1100	$3.19	$3,509.00			200 HP Dozer, 150 ft haul average, sand and loam
	Subsoil Excavation & Stockpile	BCY	2700	$3.19	$8,613.00			200 HP Dozer, 150 ft haul average, sand and loam
3	**Restoration**					**$9,015.60**	BCY	
	Topsoil Excavation & Stockpile	BCY	1100	$2.16	$2,371.60			200 HP Dozer, 150 ft haul average, sand and loam
	Subsoil Excavation & Stockpile	BCY	2700	$2.16	$5,821.20			200 HP Dozer, 150 ft haul average, sand and loam
	Finish Grading	SY	4840	$0.17	$822.80			Approximately 1 acre
	Contingency	%	5			**$1,168.81**		
	Total					**$24,544.91**		

BCY = Bank Cubic Yards, SY = Square Yards, LF = Linear Feet, EA = Each