NORTHERN ARIZONA UNIVERSITY

Bread and Butter Engineering Inc.
(B&B Inc.)

April 30, 2013

MEMORANDUM

To : Dr. Wilbert Odem

CC : Justin Ramsey, Sr. Manager

: Dr. Paul Trotta

From : Patrick Belsheim

: William Tavares

: Tim Mahon

: Ali Alrayyes

Subject : On-Site Water Demonstration Facility Project Proposal

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1.0 Project Understanding

The project is the design of a lift station and transmission line to deliver residential wastewater effluent from family housing, located on the south campus of Northern Arizona University (NAU), to an existing lift station of the On-Site Water Demonstration Project (OWDP), for use on selected test plots for research purposes.

1.1 Background

The OWDP site was funded through a Clean Water Act 319H grant overseen by the Arizona Department of Environmental Quality (ADEQ). The facility was designed and constructed in 2000/2001. The original purpose of the project was:

1. To test on-site water treatment systems.
2. To deliver training to local professionals.
3. To familiarize ADEQ employees with new residential wastewater treatment systems and techniques.

There has been a renewed interest in the facility by ADEQ and a regional professional organization, Arizona Onsite Wastewater Recycling Association (AzOWRA), to commission the facility after the project was shut down due to budget constraints. ADEQ, through regulatory requirements, is mandated to maintain a list of Arizona approved on-Site wastewater treatment systems. ADEQ is defining "on-site" as a wastewater treatment system capable of treating no more than 24,000 gpd (gallons per day). ADEQ and AzOWRA have approached NAU requesting the OWDP be modified into a test facility for potential on-site wastewater treatment systems. Although several changes to the existing OWDP will be required, the project focus is

on improving the volume of wastewater effluent available to the site through a lift station and force main.

1.2 Stakeholders

The key stakeholders in this project are NAU, ADEQ and AzOWRA. Dr. Trotta and Mr. Ramsey developed the original concept for this facility and will act as technical advisors.

1.3 Constraints

- The lift station must be capable of diverting wastewater to the OWDP when needed and by pass the effluent through the existing gravity system when effluent is unneeded.
- The lift station must be automatically bypassed, keeping wastewater in the existing gravity sewer main, in cases of emergencies (i.e. power failure, problems at facility, and overflow from family housing).
- The system must not retain residential effluent for more than the required ADEQ timespan for keeping residential effluent at one site. The system must meet this requirement by delivering the effluent back into the municipal system if the maximum retention time has been exceeded.
- The trench for the force main must be adequately sized in order to allow a second line to pump effluent from the existing lift station back into the existing sewer system.
- The survey data for the planned locations must be gathered before unfavorable weather prevents access to the site and reduces operational safety of equipment and personnel.

1.4 Key Factors for Success

- To maintain regular bi-weekly contact with the client and technical adviser, to better facilitate the inception of the proposed force main and lift station.
- To understand the technical challenges and regulations involved in the lift station and force main.
- To gain an intimate understanding of the residential wastewater production and pipe system currently at the family housing residential complex.
- To manage time in order to meet project deadlines, complete tasks, and maintain project integrity.

1.5 Approach

The team will provide three design alternatives, as seen in Figure 1, including the final alternative for the lift station and force main.

Design Alternative 1:

Design Alternative 1 will utilize gravity differentials to properly deliver the wastewater to the OWDP site. The design will use the gradual slopes of the hill to the east of the family housing complex as a constant slope to place the piping to deliver the wastewater. The team will evaluate and provide a hydraulic model based on the gravity transmission design to the OWDP site.

Design Alternative 2:

Design Alternative 2 will utilize a path for the piping delivering the wastewater that passes through the residential housing parking lot to the north east of the complex. The route would pass under the family housing complex parking lot. The pipe would then descend a

hill to the east of the family housing complex down to the OWDP site. This design may require pressure reduction valves due to the rapid change in elevation between the starting and ending destinations.

Design Alternative 3:

Design Alternative 3 would deliver the wastewater under the family housing complex. This would be the most direct route to the OWDP site. It would cut under the housing complex and down the hill to the east. It is expected this design would require pressure reduction valves to slow down the effluent due to the change in elevation between the start and end destinations.

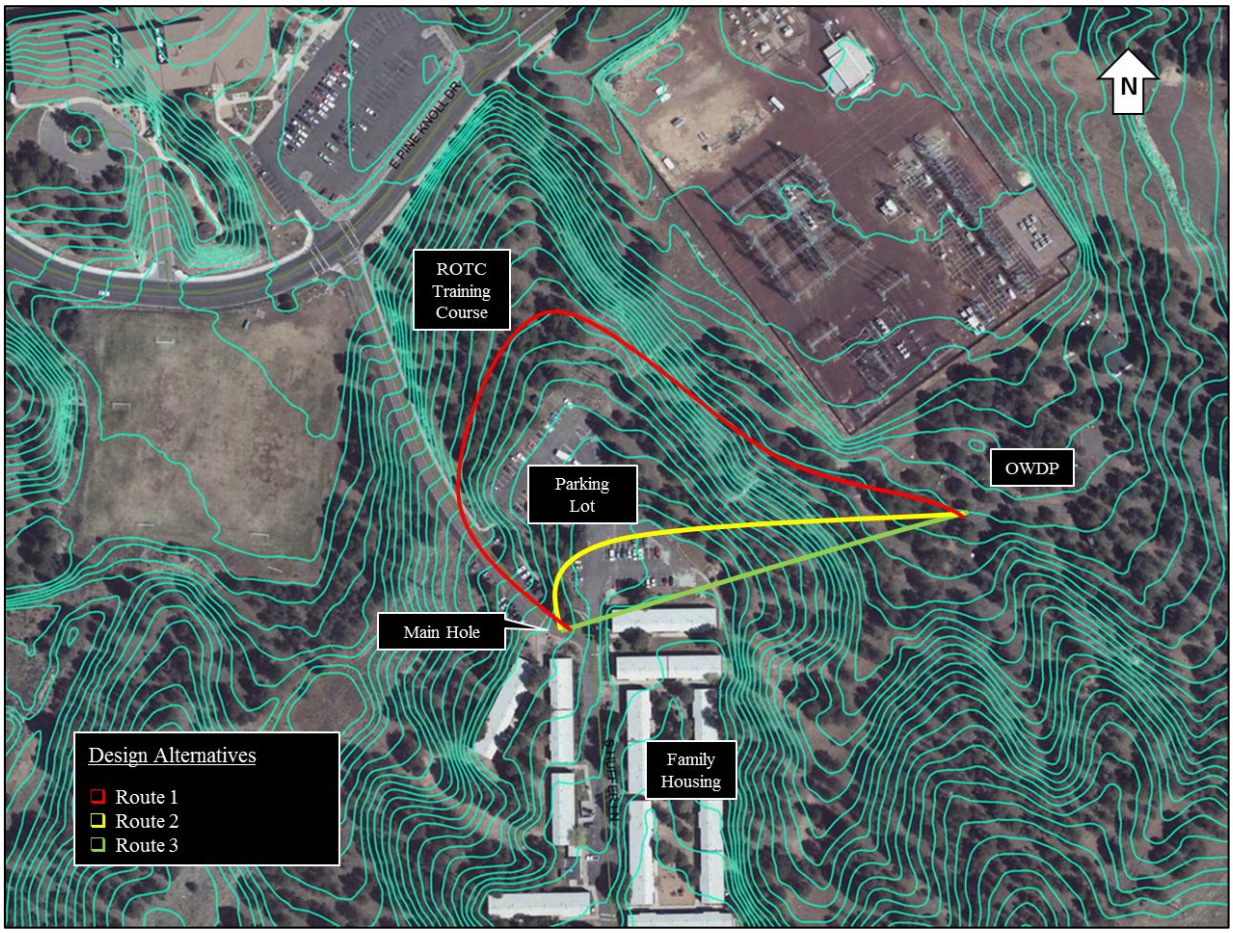

Figure 1. Force main routes

2.0 Scope of Services

The team will perform the tasks mentioned below for the client in regards to the On-Site Water Demonstration Facility located north of the I-40, West of Lone Tree, and South of Pine Knoll Rd. behind the APS electrical grid facility on the Northern Arizona University campus in Flagstaff, Arizona.

Task 1 - Project Management

Task 2 - Site Characterization

Task 3 - Tabulation of Relevant Regulatory, Physical, and University Constraints

Task 4 - Force Main Route Determination

Task 5 - Hydraulic Model

Task 6 - Control Panel Selection

Task 7 - Public Awareness

Task 8 - Final Design

Task 1 - Project Management

The following tasks will be completed to organize the project:

- **Task 1.1 Project Meetings**

  Project meetings will be held bi-weekly with the technical advisors to discuss project progress. Meetings will be held with the client after alternatives are assessed and a preferred alternative is chosen.

  Deliverable: Documentation of meetings between client and technical advisor

- **Task 1.2 Team Meetings**

  Team meetings will be held once a week and they will serve as time to review and resolve project issues.

  Deliverable: Documentation of meetings between team

Task 2 - Site Characterization

To characterize the site, the following activities will be completed:

- **Task 2.1 Visit Family Housing Complex**

  The team will visit the family housing complex to determine possible lift station locations and force main routes.

  Deliverable: Photographs of family housing complex

- **Task 2.2 Meet with facility managers**

  The team will meet with family housing facility managers to identify possible additional constraints.

  Deliverable: Document of relevant facility constraints

- **Task 2.3 Contact Capital Assets**

  Capital Assets will be contacted to determine the location of the pre-existing pipe system configuration at family housing.

  Deliverable: Site photographs and pipe specifications

- **Task 2.4 Acquire Topographic Data**

  The team will obtain topographic information to determine possible lift station locations and force main routes.

  Deliverable: Topographic maps of site

- **Task 2.5 Confirmation of topographic data by survey**

  The team will survey the site to identify possible lift station locations and force main routes and to confirm the accuracy of the topographic maps.

  Deliverable: Survey data and map of site

- **Task 2.6 Obtain As-Built Plans**

  The team will obtain as-built plans from Dr. Trotta, Mr. Ramsey and Capital Assets.

  Deliverable: As-built plans of site

- **Task 2.7 Locate Structures On-Site**

  The team will verify the accuracy of the as-built plans.

  Deliverable: Layout and photographs of pre-existing structures on site and their purpose

- **Task 2.8 Explore Sub-Surface Conditions**

  The team will perform a sieve analyses at the OWDP site, at various locations to assess the soil conditions along the proposed force main routes. The soil will be classified using the USCS soil classification system.

  Deliverable: Soil Report

- **Task 2.9 Tabulate Physical Constraints**

  The team will tabulate all relevant physical constraints pertaining to the project.

  Deliverable: Document presenting relevant physical constraints

Task 3 - Tabulation of Regulatory and University Constraints

The team will review and tabulate all relevant regulatory constraints, pertaining to the proposed force main and lift station.

- **Task 3.1 Tabulation of Relevant Regulatory Constraints**

  Relevant federal, ADEQ and City of Flagstaff regulatory constraints will be identified and tabulated.

  Deliverable: Document of tabulated federal, state and city constraints

- **Task 3.2 Tabulation of NAU Constraints**

  University constraints relating to the project will be identified and tabulated.

  Deliverable: Document tabulating relevant constraints

Task 4 - Force Main Route Determination

To optimize the cost and efficiency of the proposed force main and lift station, the team will evaluate several force main routes from the proposed lift station.

- **Task 4.1 Evaluate the Three Alternate Force Main Routes**

  The team will identify and analyze three possible force main routes.

  Deliverable: Document identifying possible routes

- **Task 4.2 Provide Design Matrixes for The Alternate Routes**

  The team will create design matrixes with criteria for the proposed alternate force main routes.

  Deliverable: Design matrixes

- **Task 4.3 Create Graphical Representations of Alternative Force Main Routes**

  The team will create graphical representations of the alternate force main routes using AutoCAD Civil 3D software and attained survey data.

Deliverable: Graphical representations of possible pipe routes

Task 5 - Hydraulic Model

The team will develop a hydraulic model of the preferred alternative using WaterCAD or SewerCAD.

Deliverables:

1. *Model of lift station and force main*
2. *Selected pipe modeling equipment*

Task 6 - Control Panel Selection

The team will provide criteria for selection of control panel.

- List needed control panel functions and constraints for lift station
- Specify flow monitoring instrumentation
- Provide multiple vendor choices to the client

Deliverables:

1. *Control panel selections*
2. *List of vendors*

Task 7 - Public Awareness

The team will create flyers to notify the public in proximity of the project to the details of the project.

Deliverable: Project description flyers

Task 8 - Final Design

The team will prepare the final report, presentation and website of the project.

- **Task 8.1 Design Report**

  Once the preliminary engineering tasks have been completed, the team will prepare a design report with final recommendations on the placement and design for the proposed force main and lift station.

  Deliverable: Design report

- **Task 8.2 Presentation**

  With the design report completed, the team will present their final report to the undergraduate board for final grading.

  Deliverable: PowerPoint presentation and poster board

- **Task 8.3 Website**

  To generate interest in the OWDP, the team will design a website which will describe the purpose and function of the facility to any interested persons. The website will also outline our team's project as per the NAU Civil/Environmental Engineering department chair's instructions.

  Deliverable: Project website

3.0 Staffing Plan and Budget

The team has established a staffing plan for the project tasks. Table 1 shows the staffing plan for the OWDP project:

Table 1. Staffing plan for the OWDP project

Tasks	Staff	Classification	Rate ($/hr)	Hours	Cost Estimate
1.1 - Project Meetings	Tim Mahon Ali Alrayyes William Tavares Patrick Belsheim	Engineering	75	64	$4,800.00
1.2 - Team Meetings	Tim Mahon Ali Alrayyes William Tavares Patrick Belsheim	Engineering	75	96	$7,200.00
2.1 - Visit Family Housing Complex	Tim Mahon Ali Alrayyes William Tavares Patrick Belsheim	Engineering	75	8	$600.00
2.2 - Meet with Facility Managers	William Tavares	Engineering	75	2	$150.00
2.3 - Contact Capital Assets	Patrick Belsheim	Engineering	75	2	$150.00
2.4 - Acquire Topographic Data	Ali Alrayyes	Technician	45	4	$180.00
2.5 - Confirmation of Topographic Data by Survey	Tim Mahon Ali Alrayyes William Tavares Patrick Belsheim	Technician	45	100	$4,500.00
2.6 - Obtain As-Built Plans	Tim Mahon Ali Alrayyes William Tavares Patrick Belsheim	Engineering	75	8	$600.00
2.7 - Locate Structures On-Site	Tim Mahon Ali Alrayyes William Tavares Patrick Belsheim	Technician	45	8	$360.00
2.8 - Explore Sub-Surface Conditions	William Tavares Tim Mahon	Technician	45	32	$2,400.00

Tasks	Staff	Classification	Rate ($/hr)	Hours	Cost Estimate
2.9 - Tabulate Physical Constraints	Ali Alrayyes	Engineering	75	6	$450.00
3.1 - Tabulate Relevant Regulatory Constraints	Patrick Belsheim Ali Alrayyes	Engineering	75	8	$600.00
3.2 - Tabulate NAU Constraints	Patrick Belsheim Ali Alrayyes	Engineering	75	8	$600.00
4.1 - Evaluate Alternative Force Main Routes	Tim Mahon Ali Alrayyes William Tavares Patrick Belsheim	Engineering	75	32	$2,400.00
4.2 - Provide Design Matrixes for Alternate Routes	Tim Mahon Ali Alrayyes William Tavares Patrick Belsheim	Engineering	75	32	$2,400.00
4.3 - Create Graphics of Alternate Force Main Routes	Tim Mahon	Engineering	75	24	$1,800.00
5.0 - Hydraulic Model	Tim Mahon William Tavares	Engineering	75	32	$2,400.00
6.0 - Control Panel Selection	Ali Alrayyes Patrick Belsheim	Engineering	75	16	$1,200.00
7.0 - Public Awareness	Tim Mahon	Engineering	75	4	$300.00
8.0 - Final Design	Tim Mahon Ali Alrayyes William Tavares Patrick Belsheim	Engineering	75	96	$7,200.00
TOTAL				**582**	**$40,290.00**

4.0 Schedule

The team has constructed a Gantt Chart in respect to the provided Staffing Plan. The Gantt Chart for the OWDP Project Proposal is seen in Figure 2:

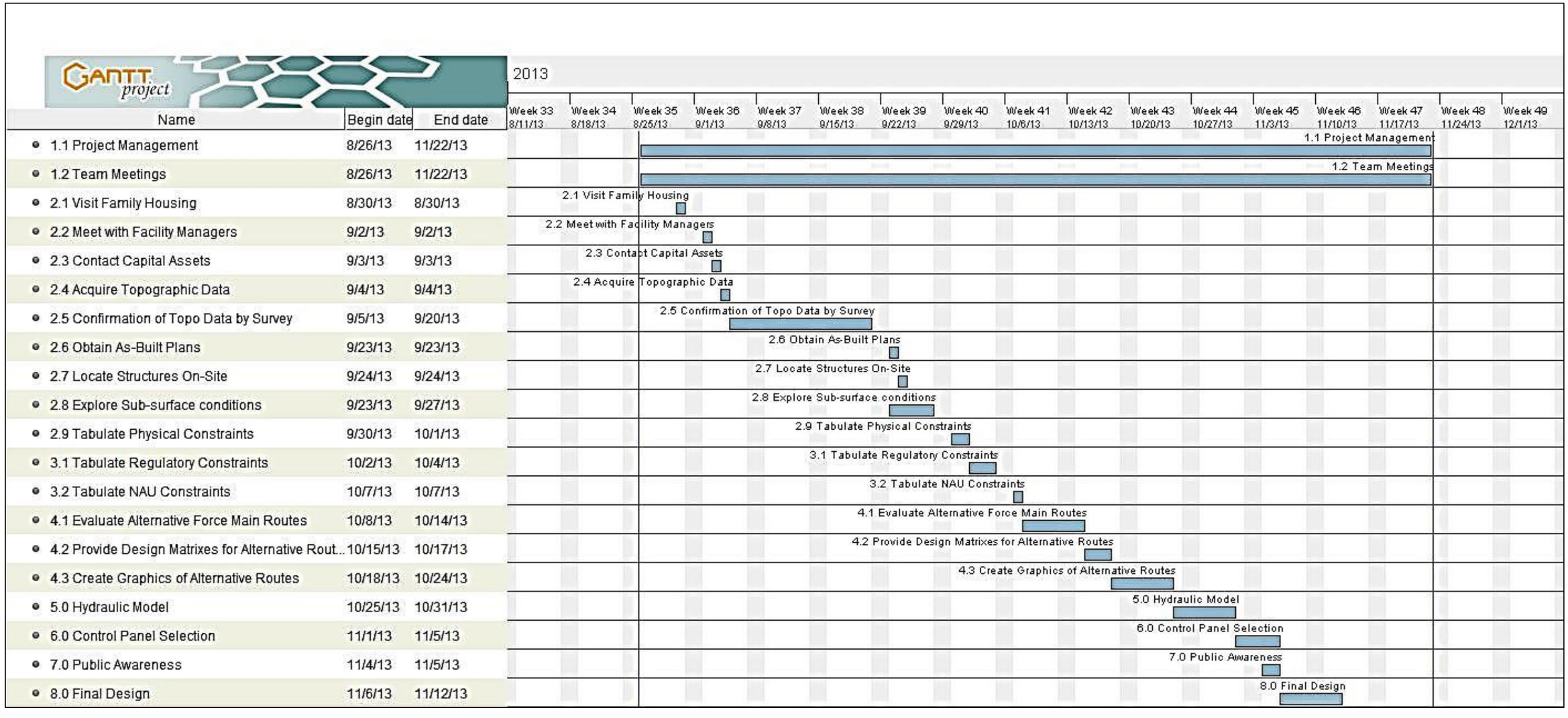

Figure 2. OWDP Gantt Chart

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