FINAL REPORT
for:

DAYTON WATER SUPPLY PROJECT
Level II Study

Prepared for:
Wyoming Water Development Commission

Submitted by:
EnTech, Inc.
Consulting Engineers
Sheridan, Wyoming
In association with
Environmental Design Engineering

November, 2001
FINAL REPORT
for:

DAYTON WATER SUPPLY PROJECT
Level II Study

Prepared for:
Wyoming Water Development Commission

Submitted by:
EnTech, Inc.
Consulting Engineers
Sheridan, Wyoming

In association with
Environmental Design Engineering

November, 2001
TABLE OF CONTENTS

1. INTRODUCTION & PROJECT DESCRIPTION .............................................................. 1-1
2. DIVERSION FACILITY ALTERNATIVES ............................................................... 2-1
   2.1 Existing Diversion Facilities ............................................................................ 2-1
   2.2 Proposed Diversion Facilities ......................................................................... 2-1
      2.2.1 WTP Alternative A: Replace/reconstruct the Infiltration Gallery .......... 2-2
      2.2.2 WTP Alternative B: Construct Pre-sedimentation Basin ..................... 2-8
      2.2.3 WTP Alternative C: Membrane Filtration System .................................. 2-13
3. SCADA SYSTEM ANALYSIS .............................................................................. 3-1
4. COST ESTIMATES ............................................................................................... 4-1
   4.1 WTP Alternative A: Replace/reconstruct the Infiltration Gallery ................ 4-1
   4.2 WTP Alternative B: Construct Pre-sedimentation Basin .............................. 4-4
   4.3 WTP Alternative C: Membrane Filtration System ........................................ 4-7
   4.4 SCADA System Costs .................................................................................... 4-7
5. RECOMMENDED ALTERNATIVE ........................................................................ 5-1
6. ABILITY-TO-PAY ANALYSIS AND FINANCING PLAN ..................................... 6-1
   6.1 Potential Funding Sources .............................................................................. 6-1
      6.1.1 WWDC ................................................................................................. 6-1
      6.1.2 RUS .................................................................................................... 6-1
      6.1.3 State Land and Investment Board (SLIB) ............................................. 6-2
      6.1.4 WDEQ State Revolving Loan Fund .................................................... 6-2
      6.1.5 Wyoming Business Council (Comm. Dev. Block Grant) .................... 6-2
      6.1.6 Capital Facilities Tax ............................................................................ 6-3
   6.2 Possible Funding Scenarios ............................................................................ 6-3
   6.3 Determination of Equivalent Dwelling Units ............................................... 6-4
   6.4 Annual Revenues, and Operations and Maintenance Expenses .................... 6-5
   6.5 Current Fees and Charges ............................................................................ 6-6
   6.6 Proposed Rate Schedule .............................................................................. 6-7
   6.7 Comparison with Similar Communities ....................................................... 6-8
7. ENVIRONMENTAL REPORT ............................................................................. 7-1
8. SUMMARY AND PATH FORWARD .................................................................... 8-1

LIST OF TABLES

<table>
<thead>
<tr>
<th>TABLE NO.</th>
<th>TITLE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>DAYTON WTP TURBIDITY DATA</td>
<td>2-10</td>
</tr>
<tr>
<td>4.1</td>
<td>COST ESTIMATE – VFD’S AND RELATED COMPONENTS</td>
<td>4-1</td>
</tr>
<tr>
<td>4.2</td>
<td>COST ESTIMATE – SCHEDULE A-1</td>
<td>4-2</td>
</tr>
<tr>
<td>4.3</td>
<td>COST ESTIMATE – SCHEDULE A-2</td>
<td>4-3</td>
</tr>
<tr>
<td>4.4</td>
<td>COST ESTIMATE – SCHEDULE B-1</td>
<td>4-5</td>
</tr>
<tr>
<td>4.5</td>
<td>COST ESTIMATE – SCHEDULE B-2</td>
<td>4-6</td>
</tr>
</tbody>
</table>
4.6 COST ESTIMATE – MEMBRANE FILTRATION UNIT 4-7
4.7 COST ESTIMATE – SCADA SYSTEM (WTP & COMPONENTS) 4-8
5.1 RECOMMENDED ALTERNATIVES 5-3
6.1 PHASE 1 IMPROVEMENTS 6-4
6.2 PHASE 2 IMPROVEMENTS 6-4
6.3 EQUIVALENT DWELLING UNITS 6-5
6.4 WATER FUND ESTIMATED OPERATING BUDGET – YR. 2003 6-6
6.5 DAYTON WATER RATE SCHEDULE – EXISTING 6-7
6.6 DAYTON PLANT INVESTMENT AND TAPPING FEES 6-7
6.7 DAYTON WATER RATE SCHEDULE – PROPOSED 6-8
6.8 WATER RATES OF SURROUNDING COMMUNITIES 6-8
6.9 TYPICAL BILL COMPARISON BETWEEN COMMUNITIES 6-9
8.1 PHASE 1 IMPROVEMENTS 8-2
8.2 PHASE 2 IMPROVEMENTS 8-2

LIST OF FIGURES

FIGURE NO. TITLE
2-1 LOCATION MAP
2-2 TEST HOLE LOG, TEST PIT #1
2-3 TEST HOLE LOG, TEST PIT #2
2-4 EXISTING DAYTON WTP SITE LAYOUT
2-5 CROSS SECTION OF INFILTRATION GALLERY AND FILTER PACK
2-6 PLAN VIEW OF INFILTRATION GALLERY AND PIPING
2-7 WET WELL PIPING AND INFILTRATION GALLERY CONNECTIONS
2-8 DETAIL OF INFILTRATION GALLERY BYPASS INLET TO WET WELL
2-9 ALTERNATIVE B PROPOSED INTAKE AND PRESEDIMENTATION BASIN MODIFICATION CONCEPT
2-10 PRESEDIMENTATION BASIN TYPICAL CROSS SECTIONS
2-11 WTP EFFLUENT TURBIDITY

APPENDICIES

APPENDIX A: INFILTRATION GALLERY DESIGN CONSIDERATIONS
APPENDIX B: GRADATION ANALYSIS OF SEDIMENT IN RAW WATER WET WELL
APPENDIX C: TOTAL SUSPENDED SOLIDS ANALYSIS ON WATER SAMPLES
APPENDIX D: A&E SCADA REPORT AND PRELIMINARY DRAWINGS
APPENDIX E: ENVIRONMENTAL REPORT
1. INTRODUCTION AND PROJECT DESCRIPTION

EnTech, Inc. Consulting Engineers of Sheridan, Wyoming (EnTech), in association with Environmental Design Engineering, also of Sheridan, performed a study for the Wyoming Water Development Commission (WWDC) dated November 2000 entitled Dayton Level I Master Plan Study. This Level I study developed a master plan for the Town of Dayton, Wyoming's (Dayton) public water system. As part of this Level I study, a review of Dayton’s current water treatment plant (WTP) was performed. This review presented the following two recommendations relative to the WTP.

1. Further investigate problems associated with raw water turbidity, and evaluate two diversion facility alternatives for alleviating the problems associated with this turbidity. Data portrayed in the Level I study revealed problems in being able to successfully treat raw water due to periodic elevated turbidity levels in the Tongue River, which is the source of water for the Dayton WTP. Two diversion facility alternatives to alleviate this raw water turbidity problem were proposed:
   - WTP Alternative A – reconstruct the existing infiltration gallery and install variable frequency drives on influent raw water pumps; and
   - WTP Alternative B – relocate the existing infiltration gallery and construct an upstream pre-sedimentation basin.

2. Conduct a more thorough evaluation of Dayton’s exact needs for a SCADA system. The Level I study performed a brief review of the need for and cost associated with a Supervisory Control and Data Acquisition (SCADA) system to monitor and control Dayton’s water facilities. The study estimated that a SCADA system for Dayton would cost $324,473; however, it also recognized that a more thorough review of such a system was necessary to better define Dayton’s needs and provide for a more accurate cost estimate. As a result, the Level I study recommended that Dayton should pursue a Level II study to more accurately determine the efficacy of, and cost associated with, a SCADA system.

As a result of these two recommendations, Dayton requested that the WWDC recommend funding a Level II study to the 2001 Wyoming State Legislature. The Legislature ultimately authorized an expenditure of $50,000 for this purpose. In June 2001, a contract was signed between the WWDC and EnTech to perform the Level II study, for completion in November 2001.

Subsequent to the selection of EnTech to perform this study, Dayton expressed a desire to the WWDC to include membrane filtration as a third alternative (WTP Alternative C) to address the raw water turbidity problem. As a result of this addition, and in conjunction with the original scope of the study as defined by the WWDC, this Level II study will perform the following:
1. evaluate WTP Alternatives A, B, and C to address the raw water turbidity problem;
2. prepare preliminary designs and cost estimates for each of the three alternatives;
3. evaluate the need for, efficacy of, and cost estimate for a SCADA system to serve Dayton;
4. provide a recommendation on the diversion facility alternatives and SCADA system;
5. contact various agencies that potentially have jurisdiction over the construction of any proposed improvements through the National Environmental Protection Act (NEPA);
6. prepare an environmental report compiling agency responses to the proposed improvement project along with any associated costs to mitigate these agencies' NEPA concerns; and
7. perform an ability-to-pay analysis to assist the WWDC in determining financing for any proposed project improvements and prospective financing plan.

The results of the study could conceivably be used to determine the path forward necessary for Dayton to eventually construct the recommended improvements identified in the study.
2. DIVERSION FACILITY ALTERNATIVES

2.1 Existing Diversion Facilities

The Dayton WTP is located approximately 10,000 feet southwest of the Dayton town limits. (See Figure 2-1). Raw water is currently delivered to the Dayton WTP via gravity from an infiltration gallery located directly adjacent to the WTP. This existing infiltration gallery consists of a perforated 24” corrugated metal pipe (CMP) buried in a rock gabion in the bed/bank of the Tongue River. It is reported to have been constructed in 1980.

Water collected within the infiltration gallery flows to a wet well within the WTP building. The wet well is equipped with two line shaft turbine pumps, sized at 600 gallons per minute (gpm) and 400 gpm respectively, for a total influent pumping capability of 1,000 gpm. The raw water pumps deliver water to a bank of four integrated multi-media gravity filters, and previously to two older, additional filters which have been decommissioned since the construction of the treated water storage tank.

Interviews with Dayton’s WTP operators indicate that the 24” CMP infiltration gallery piping is likely in poor condition. The perforations are apparently rusted out, and the washout of gravels has provided a pathway for relatively large debris to enter the raw water wet well. The condition of the infiltration gallery results in significant sediment deposition within the influent piping and the raw water wet well. The deposition becomes severe enough at times to compromise raw water pumping capacity.

The sole source of water to the Dayton WTP is the Tongue River. Although the intake is a buried perforated infiltration gallery, it is still considered to be surface water. In general, the raw water quality to the WTP from the river is excellent. However, raw water turbidities during spring runoff and high river flow conditions can increase significantly. During these times, substantial quantities of suspended solids arrive in the raw water well and in the filters. Turbidities during spring runoff can range from 50 to 200 NTU, and these levels can cause plugging difficulties within the filters.

Additionally, during low flow periods the infiltration gallery is unable to deliver sufficient water to the wet well to supply the WTP. During such times, the operator manually opens a slide gate that bypasses the infiltration gallery and delivers surface water directly into the wet well essentially unscreened. During these times, no turbidity reduction or debris filtration of influent waters occurs.

2.2 Proposed Diversion Facilities

A replacement infiltration gallery or new pre-sedimentation basin must be constructed to allow influent water to pass through it year round, provide effective reduction of raw water turbidity for treatment operations, and provide ample influent flow to operate the plant at current maximum day demand of 0.6 million gallons per day (MGD). It must also have the ability to operate at an increased future peak-day system demand of at least 0.82 MGD, which was identified in the Level I Study as being Dayton’s future Year 2020 water needs.
Currently under peak demand times, the WTP is operated at a peak production rate of 600 gpm. The ratio of the future peak use to the current use is 1.4 (0.82 MGD/0.60 MGD). A conservative estimate of the required future peak use output from an infiltration gallery gives 840 gpm when this ratio is applied to the current 600 gpm peak use. To insure that 840 gpm of water is deliverable to WTP operations, the diversion alternatives considered should be designed with a reasonable factor of safety. Applying a factor of safety of 1.25 to the 840 gpm requirement gives 1,050 gpm as a required diversion design water production rate.

As stated in Section 1 (Introduction and Project Description), this study is to consider three alternatives. The first alternative is to include the addition of variable frequency drive (VFD) units on the WTP’s influent raw water pumps. This addition would address several problems with current WTP operations by allowing enhanced control of WTP throughput rates. Currently there is a limitation in running the WTP only at the capacities of the two single-speed pumps. During periods of relatively low water demand, the WTP must be operated at the full output capability of one of the two raw water pumps (either 400 or 600 gpm).

During periods of high turbidity, the water demand is typically low, and the WTP need not be operated at 400 gpm continuously to meet the demand. For example, if the WTP was operated at a continuous but lesser flow rate, then the time between backwashes could be extended considerably, and the continual presence of operations personnel at the WTP during spring runoff could be greatly reduced. The current single rate raw water pumps are operated at full capacity to treat the water and replenish the WTP’s finished water clearwell. The pumps must be then shut off and treatment halted until water demand depletes the clearwell’s storage, after which more treated water is then produced. If the pumps could be operated at lower, more continual rates that correspond to the treated water use demands upon the clearwell, then the need to constantly start-and-stop the WTP would be precluded, greatly reducing the need for an operator’s presence at the WTP site.

The operational benefits to the WTP from the installation of VFD units on the raw water pumps would exist regardless of the diversion facility alternative selected. Therefore, all alternatives evaluated will include the installation of VFD units.

Each diversion facility alternative is discussed in more detail below.

2.2.1 **WTP Alternative A: Replace/reconstruct the Infiltration Gallery**

2.2.1.1 **Location**

Possible locations for the proposed new infiltration gallery were researched via site visits, surveying, and backhoe trenching at the WTP. The options considered for placement were:

1) within the alluvium underlying the river channel of Tongue River perpendicular to the river flow; and

2) within the river bank alluvium placed parallel to the river.

Use of a perpendicular or parallel orientation of the screen in the two location options is selected to minimize head loss along the length of the infiltration screen in relation to flow direction. Flow direction in the river channel is parallel to the river (i.e., “downstream”), while flow direction in the river bank alluvium is perpendicular to the river, or flowing from the river to the screen. Both screen placement orientations, therefore, result in water flows perpendicular to the
screen length, and no head loss occurs in either of these orientations along the length of the screen.

Test pits were excavated in August, 2001 by a rubber-tired backhoe at two sites adjacent to the WTP, one northeast of the filter building (Test Pit #1) and one southeast of Clearwell #1 (Test Pit #2). The geology logs from these two test pits are shown on Figures 2-2 and 2-3, and the location of these test pits is shown on Figure 2-4. Freely flowing water was encountered in both test pits at approximately the same elevation (Test Pit #1 water elevation = 4039.65 feet and Test Pit #2 water elevation = 4039.25 feet). These elevations appeared approximately 2.85 feet below the Tongue River water elevation of 4042.3 feet at the time of the excavations.

Groundwater infiltration rates into the test pits were measured immediately subsequent to the excavations being completed. The infiltration rate was greater in Test Pit #1 (25-50 gpm) than at Test Pit #2 (10-25 gpm). The infiltration rate was roughly estimated by bailing the test pit dry with the backhoe and then placing the backhoe bucket (of known volume) into the pit and recording the time necessary to fill the bucket.

The general composition of the soils within the test pits, as seen in Figures 2-2 and 2-3, is coarse sands and cobbles. The inflows to the test pits appear lower than expected for soils of this composition. Estimation of the pit inflows is conservative based upon the method used because continual caving of the pit walls and saturated soil conditions make pit inflow determination difficult. The inflow rates arrived at should therefore be considered conservative, and, as such, are useful in developing conservative design estimates for an infiltration gallery.

Based on these groundwater infiltration rates, an open trench length of 8 feet, and a raw water requirement of 1,050 gpm, an estimate of the length of the infiltration gallery necessary at each location was made to determine if such installation galleries could be constructed and obviate the need for a WTP to treat surface water. At Test Pit #1, the infiltration gallery would need to be approximately 336 feet long. At Test Pit #2, the infiltration gallery would need to be approximately 840 feet long. Either of these lengths would necessitate construction of an infiltration gallery well beyond the leased boundaries of the WTP as shown by the property boundary on Figure 2-4.

It is important to note that these estimates provide no guarantee that groundwater inflows into the infiltration galleries along these lengths would be the same as those in the area of the test pits, or that the flow rate would not subside over time as the storage capacity of the alluvium was diminished by initiation of infiltration gallery pumping. Using the information collected from these test pits, it was concluded that insufficient water inflow from the alluvium exists at either of these sites to warrant construction of an off-channel infiltration gallery. Locating the gallery underlying the Tongue River leaves little doubt as to the location and quantity of water available to supply the infiltration gallery. Therefore, the placement of a new infiltration gallery is recommended to be beneath the river itself.

The orientation of the new infiltration gallery is recommended to be perpendicular to the river, as opposed to the parallel orientation of the current infiltration gallery, to minimize head loss along the screen as discussed above. The location of the proposed infiltration gallery is recommended to be within the channel as opposed to the edge of the channel, in order to allow for the least restriction of inflow to the screens and the least obstruction during backwash of the screens. Placement at the edge of the channel leaves only that half of the screen facing the river in direct contact with river inflow. This geometry creates a barrier at the side of the screen away from the
During construction in this location, intake flow to the WTP will need to be diverted from upstream of construction activities via a temporary pipeline and/or pump system throughout that part of construction where in-channel sediment disturbance will be an issue.
Figure 2-2-Test Hole Log

I.D. = TEST PIT#1, DAYTON WTP

STARTED: 8/2/01, 8:30
FINISHED: 8/2/01, 10:15
GROUND ELEV: 4049.65
COORDINATES: 1915046, 1321235
SURFACE COORDINATES BASED ON WYOMING STATE PLANE (EAST CENTRAL ZONE) NAD 83(1993)
ELEVATION DATUM NAVD 88

<table>
<thead>
<tr>
<th>Elevation (AMSL)</th>
<th>Depth (ftBLS)</th>
<th>Section</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4049.65</td>
<td>0</td>
<td></td>
<td>FINE GRAINED, OXIDIZED SAND AND SILT, MOD. ROOT MATERIAL, NOTE TRANSITION HIGHLY VARIABLE</td>
</tr>
<tr>
<td>4048.65</td>
<td>1</td>
<td></td>
<td>ABUNDANT GRAVEL, COBBLES AND BOULDERS WITH MODERATE FINE TO COARSE GRAINED SAND (SAMPLED)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>NOTE: MATERIAL FROM 6' TO 10' DAMP (SAMPLED)</td>
</tr>
<tr>
<td>4044.65</td>
<td>5</td>
<td>OLD MAIN WATERLINE</td>
<td></td>
</tr>
<tr>
<td>4043.65</td>
<td>6</td>
<td></td>
<td>SIGNIFICANT GROUNDWATER INFLOWS AT 10' - EST. 25-50GPM</td>
</tr>
<tr>
<td>4042.65</td>
<td>7</td>
<td></td>
<td>WATER QUALITY FIELD VALUES: pH = 8.3s.u, COND = 3000uS</td>
</tr>
<tr>
<td>4041.65</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4040.65</td>
<td>9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4039.65</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4038.65</td>
<td>11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4037.65</td>
<td>12</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Figure 2-3 Test Hole Log

I.D. = TEST PIT#2, DAYTON WTP

STARTED: 8/2/01, 10:30  FINISHED: 8/2/01, 2:00
GROUND ELEV: 4051.25
COORDINATES: 1914896, 1321228
SURFACE COORDINATES BASED ON WYOMING STATE PLANE (EAST CENTRAL ZONE) NAD 83(1993)
ELEVATION DATUM NAVD 88

<table>
<thead>
<tr>
<th>Elevation (AMSL)</th>
<th>Depth (ftBLS)</th>
<th>Section</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4051.25</td>
<td>0</td>
<td></td>
<td>SILT AND FINE SANDY TOPSOIL DARK BROWN AND BLACK</td>
</tr>
<tr>
<td>4050.25</td>
<td>1</td>
<td></td>
<td>SILT, FINE GR TO COARSE GRAINED SAND AS MATRIX MATERIAL</td>
</tr>
<tr>
<td>4049.25</td>
<td>2</td>
<td></td>
<td>INTERBEDDED SILT AND FINE TO COARSE GRAINED SAND, TRACE GRAVELS</td>
</tr>
<tr>
<td>4048.25</td>
<td>3</td>
<td></td>
<td>UNCONSOLIDATED GRAVELS, COBBLES &amp; BOULDERS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MODERATE SILT AND SAND (SAMPLED)</td>
<td></td>
</tr>
<tr>
<td>4047.25</td>
<td>4</td>
<td></td>
<td>MODERATE GROUNDWATER INFLOWS OBSERVED AT 12’</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EST. 10-25GPM</td>
<td></td>
</tr>
<tr>
<td>4046.25</td>
<td>5</td>
<td></td>
<td>WATER QUALITY FIELD VALUES:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>pH = 7.9s.u.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>COND = 3000uS</td>
</tr>
</tbody>
</table>
NOTE: OLD WTP INTAKE IS APPROXIMATELY 2,300 FT UPSTREAM OF CURRENT WTP INTAKE, OLD INLET ELEVATION = 4,087 FT AMSL.

Backwash Pond (approximate outline)

Backwash Settling Basin

Office

Filter Building

Clearwell #1

Clearwell #2

Parking Area

WTP Fence

WTP Fence

WTP Fence

2' CONTOUR LINE
TEST PIT
WTP FENCE & LEASE AREA
GABION

APPROXIMATE RIVER LOCATION
INфиRATiON PIPING LOCATION

FIGURE 2–4
EXISTING DAYTON WTP SITE LAYOUT
SURVEY DATE = 8/2/01
BY PRESFIELD SURVETING
SCALE: 1" = 20'

SURVEY DATE = 8/2/01
BY PRESFIELD SURVETING
SCALE: 1" = 20'
2.2.1.3 Preliminary Design

In order to develop a preliminary design, accepted stream-placed infiltration gallery engineering practices were followed. Detailed preliminary design considerations and information for the infiltration gallery is presented in Appendix A.

2.2.1.3.1 Filter Pack Evaluation

To aid in design, a sample of the sediments was collected from the WTP raw water wet well. A gradation analysis was performed by Inter-Mountain Laboratories (IML) in Sheridan. The results of the analysis are presented in Appendix B. This sample is representative of the larger particles within the raw water (capable of settling within the wet well). A larger percentage of the silt and clay particles within the raw water is carried beyond the wet well to the filters. Because of this, the filter-pack media size was based extensively upon the ability to filter that range of particle sizes associated with the finest particles in the sample, or about a 200/270 sieve size. The filter pack selected should provide adequate removal capability of the percentage of the silt/clay portion of the sample that occurs within the water currently reaching the WTP filters. For the maximum turbidity levels expected at Dayton (200 NTU) and the associated particle sizes, a fine filter pack of 10-20 graded silica sand is appropriate.

2.2.1.3.2 Infiltration Screen and Bedding Material Design

Figure 2-5 shows a typical cross-sectional view of the infiltration gallery and filter pack. The proposed preliminary design for the infiltration gallery utilizes four 6” diameter, 15’ long stainless steel well screens (30 slot) placed 10 feet apart from each other and oriented perpendicular to the river channel in the center of the river flow line. The screens are plugged on one end, and each is connected to the wet well via separate solid 6” stainless steel pipe on the other. The screens are embedded in filter pack within an area 40 feet long (parallel to the river) and 25 feet wide, allowing for five feet of filter pack beyond each end of the screen and five feet of filter pack upstream and downstream of the screens. Material sizes that make up the filter pack and related material are depicted in Figure 2-5.

The riprap sizing was computed according to the U. S. Army Corps of Engineers (USCOE) Practical Riprap Design method. U. S. Geological Survey (USGS) stream gauging flow records from the station 0.4 miles upstream of the WTP indicate a peak flow of 3,500 cfs over the last 80 years. A flow of 3,500 cfs and a safety factor of 2 were therefore used to size the riprap. Construction of the screen bed will require a cofferdam to route water around the bedding area. Because of this, the ideal construction time would be the seasonal low flow period of the river which is typically late fall.

2.2.1.3.3 Backwashing Considerations

Each screen gravity flows from the filter pack to the wet well and is capable of producing approximately 263 gpm, or a combined total of 1,050 gpm, to the wet well when the raw water pump is drawing water through the screens. The existing raw water pumps and configuration can be used to pump water from the screens to treatment. Figure 2-6 shows a plan view of the infiltration gallery.

Infiltration screens oftentimes have a tendency to plug up over time due to deposition of fine silts on the screen and within the filter pack. To remove the deposition on the screens and restore
screen efficiency, occasional backwashing of the screen is necessary. Because each screen in this design is piped individually to the wet well, each screen can be independently backwashed while drawing water from the three remaining screens. This precludes the need for any backwash water storage or to use treated water to backwash. Backwash pump rates through infiltration gallery screen are typically twice the infiltration gallery influent rate for effective backwashing (derived from empirical data from existing infiltration gallery applications). For the Dayton design, this would require about 525 gpm, which can be accomplished by using the existing larger raw water pump.

Figures 2-6 and 2-7 show the proposed infiltration gallery piping and valve layout. Ideally the screens are backwashed in series from upstream to downstream. The existing raw water pump can be valved to provide the pumping for backwash, and the process can be automated based on water level (a reflection of head loss within the infiltration gallery) within the wet well, or on a timed basis. This automation can be coordinated with the proposed SCADA system. Final design for an infiltration gallery should include a configuration that can be integrated into the proposed SCADA upgrade of the WTP.

2.2.1.3.4 Air Backwash

Backwashing effectiveness can be augmented in the infiltration gallery design via the addition of compressed air lines that provide a scour within the filter-pack above the screens at the time of backwash. This air scour, like the water backwash, helps to mobilize fine particles that have been deposited in the filter pack, reducing the influent water volume produced from the screen. In combination with the water backwash, the air backwash is generally more effective than a water-only backwash. To accomplish air backwash, 2” perforated compressed air lines are laid horizontally over, and parallel to, each 15 foot screen, extending 2.5 feet past each end of the screen, for a total length of 20 foot of perforated line.

Elevational placement of the air lines is depicted in Figure 2-5. These perforated air lines are connected via 2” Schedule 40 PVC to a manifold within the WTP that can be fed from an air compressor system. Each pressure line is valved to be backwashed with air separately (at the time of water backwash to the individual screens). The plan layout of the air piping is identical to the screen and water piping shown in Figure 2-6, except where the water pipes connect to the wet well, at which point the air lines would connect individually to a manifold within the filter building. From this manifold, compressed air could be applied to the system via a permanent or mobile air compressor. The amount of air for backwash through one of the 20’ lengths of perforated air lines is recommended at 200-400 cubic feet per minute (cfm), based upon typical air backwash infiltration gallery design practices of 1-2 cfm/ft\(^2\) of bed and 6 pounds per square inch (psi) of pressure. Pressure is calculated as the pressure required to overcome the pressure head induced by the water above the screens. Assuming a worst case flow depth of 9 feet (flow depth associated with the 3,500 cfs peak flow used in the riprap sizing) and 3.5 feet depth of screen, the head is calculated to be 12.5 feet of water or 5.5 (or approximately 6) psi.

As an alternative to the foregoing compressed air line configuration, the air lines could be installed so that two separate 10’ perforated pipes were laid over each screen. This would result in eight air lines going from the gallery to the manifold. By flushing these lines one at a time, one-half of the screen length would be scoured at a time. This would reduce the amount of required air to 100-200 cfm at 6 psi.
TONGUE RIVER WATER SURFACE, ELEVATION VARIES SEASONALLY

FLOW

12/ AIR SCOUR DISTRIBUTION LINE

RIVER ROCK RIP RAP
$D_{15} = 0.25', D_{50} = 0.59', D_{85} = 1.01'$

RIP RAP FILTER BLANKET $D_{15} = 0.025', D_{50} = 0.10', D_{85} = 0.30$

SCREEN FILTER PACK 10-20 SILICA SAND

2" AIR SCOUR DISTRIBUTION LINE

6" 304SS 15' LONG, 30 SLOT

RIVER CHANNEL BOTTOM
SLOPE ~ 0.006FT/FT

CROSS SECTION OF INFILTRATION GALLERY AND FILTER PACK
SCALE: NONE

FIGURE 2-5
RIVER FLOW

CONCRETE WALL

GABION

6" STANDPIPE IN T CONNECTION TO BACKWASH MANIFOLD (SEE FIGURE 2-7)

RAW WATER PUMPS

NEW 2' DIA. CMP REPLACING OLD INFILTRATION GALLERY CMP, INVERT OF NEW CMP AT INVERT OF OLD CMP AT WET WELL CONNECTION

TRASH RACK/SCREEN

2' CMP BEVELED END TO CONFORM WITH SLOPE & CONCRETED IN PLACE

FILTER PACK

15' 304SS SCREEN 30 SLOT

MANUAL SLIDE GATE

6" STEEL PIPE CONNECTED TO WET WELL WITH INVERT OF 6" PIPE AT INVERT OF OLD 2' CMP ELEVATION

72" DIA CONCRETE

VALVE TO OPEN OR CLOSE SCREEN INLET TO WET WELL

EXISTING WET WELL

FIGURE 2-6

PLAN VIEW OF INFILTRATION GALLERY AND PIPING
SCALE: 1" = 80'
NOTE: INVERT OF SCREEN INLETS AND DIRECT INLET TO WET WELL ARE 4" ABOVE WET WELL BOTTOM.
NOTE: EACH SCREEN INLET TO WET WELL IS VALVED FOR OPEN OR CLOSED CONDITION JUST INSIDE WET WELL (VALVES NOT SHOWN FOR DRAWING CLARITY; SEE FIGURE 2.6).

FIGURE 2-7
WET WELL PIPING AND INFILTRATION GALLERY CONNECTIONS
NO SCALE: DIMENSIONS AS SHOWN
Air volumes and pressures required for air scour under either alternative require a compressor larger than anything currently at the WTP. The compressors required for either alternative are a substantial investment (approximately $21,000 for 200cfm of capacity or approximately $24,000 for 400cfm). An alternative to purchasing such a compressor at this time would be to rent one at the time that a thorough backwashing of the system is required. In this manner, the system could be backwashed solely with water; however, when flow efficiencies were seen to be reduced over time, a compressor could be utilized and allow the gallery system to be more thoroughly backwashed with both water and air. Differing infiltration gallery configurations subjected to different raw water qualities make determination of actual practical air backwash rates for a given system difficult prior to actual application and backwash experimentation. Air rates of 400 cfm (based on the 2 cfm/ft²) are more closely associated with sand filter WTP filter packs having much greater thickness than the filter pack proposed above these infiltration gallery screens. It is most likely that air rates necessary for backwash associated with the type of infiltration gallery recommended here would be closer to 200 cfm at 1 cfm/ft² of bed.

Two choices exist for the type of piping to be used for the 20’ perforated sections of air lines: slotted Schedule 40 PVC, or a specialty pipe such as Schumosoil (trademark Johnson Screens). The Schedule 40 slotted PVC can be used; however, due to the nature of the material within which the pipes would be bedded, air would likely not distribute evenly along their length; i.e., air discharge would be greatest at the air line entrance and diminish along its length. The Schumosoil is a specially-designed polyethylene product that allows for even dispersion of the air flow along the line’s length for applications such as this. Schumosoil is estimated to be considerably more expensive than PVC slot, costing about $18/feet vs. $1.24/feet, respectively. However, the even dispersion of a Schumosoil type material would likely pay for itself over time by extending the life of the gallery due to better backwashing abilities. A Schumosoil-type air line material is recommended and thus included in the cost estimates for this design.

2.2.1.4 Direct Intake Design

In conjunction with the proposed new infiltration gallery, an upgraded gallery bypass for direct raw water intake into the WTP is required. Figure 2-6 shows the location of the direct intake in plan view, and Figure 2-8 portrays the direct intake in profile view. The direct intake is proposed to replace the existing 24” CMP intake, which leads from the slide gate adjacent to the river to the wet well, with a new 24” CMP and slide gate in approximately the same orientation. This intake could be used as a sole raw water intake in case of infiltration gallery malfunction or failure, or during conditions when the infiltration gallery is not needed for delivery of low turbidity water. Under normal conditions, this intake would remain closed, allowing no unscreened raw water to enter the wet well, thereby maintaining reduced raw water turbidities. To prevent inflow of debris and trash, the direct intake would have a trash rack/screen with ½ “openings between bars (removable for cleaning) at the intake opening. The direct intake should be beveled to match the channel side slope grade and secured in place with a concrete footer and protective concrete wing walls.

2.2.1.5 Infiltration Gallery Design Comparison

An infiltration gallery of the type presented in this preliminary design should greatly reduce influent raw water turbidity. For purposes of this evaluation, two infiltration gallery systems within Wyoming were reviewed: one at Mills and the other at Rock River. The Mills WTP staff reports that their infiltration gallery system gives a 10:1 reduction in river turbidity to infiltration...
screen effluent turbidity. Mills uses six 80' long, 10" diameter slot screens that produce approximately 400 gpm. The screens at Mills are embedded 4.5 feet deep in 2 feet of ¼ - 2" washed rock, overlaid by 1' of ¼ - ¾" washed gravel and 2.5' of pit run gravel. The backwash system at Mills uses 30,000 gallons over 12 minutes, with 2 minutes of backwash for each screen. After backwash, a settling time is needed to allow suspended sediment resulting from the backwash to flow downstream prior to WTP restart. According to Mills’ staff, their gallery works satisfactorily, being used mainly as a supplemental raw water source to raw water wells.

The Rock River WTP infiltration gallery provides reduction from stream turbidities of 10-20 NTU to infiltration screen effluent turbidity of 1-2 NTU (or 10:1 as well). Rock River uses 4, 20' long, 16" diameter 130 slot screens in order to deliver 600 gpm. The screens at Rock River were placed on 1' of ¼" clean rock and overlaid by 1' of ¾" clean rock. Backwash at Rock River uses 1,200 gpm. Rock River’s gallery provides adequate filtering of raw water turbidities to consistently supply its membrane filtration WTP with water requiring no further filtration.

Based on these discussions with these two towns and the design computations, it is anticipated that the Tongue River peak water turbidities of 200 NTU can be reduced to 20-40 NTU through the infiltration gallery.

2.2.2 WTP Alternative B – Construct Pre-sedimentation Basin

2.2.2.1 Background

A second alternative recommended for evaluation in the Dayton Level I Study is WTP Alternative B, which is the construction of a pre-sedimentation basin at a place somewhere upstream of the WTP. This basin would allow for settlement of some of the suspended solids from the raw water, thus reducing the higher river turbidities – particularly during spring runoff and after rainfall events. The pre-sedimentation basin would be expected to be utilized only during the one-two month period of the months of May and June when high river turbidities usually occur. It could be bypassed directly to the WTP raw water wet well once turbidities drop to lower levels, which is the case during the majority of the year. The existing filters would be used to remove the remaining suspended solids associated with the nominal raw water turbidities (<3 NTU).

A typical pre-sedimentation basin essentially is a large sump with influent distribution using a broad-crested or notched weir. Effluent flows over the outfall weir on the downstream end of the basin. As the water passes through the basin, the flow velocity is sufficiently low to allow for suspended particles to settle and collect as solid material on the bottom of the basin.

As settled solids accumulate on the basin bottom, the basin will require periodic cleaning. The proposed basin is designed to allow the use of a front-end loader to remove sludge periodically. The sludge removed from the basin during cleaning must be disposed of, requiring a residuals management plan for the WTP. Due to the limited use (i.e., during the spring runoff period) and probable low amounts of sludge accumulated in an average year, the pre-sedimentation basin could be taken out of service each summer and cleaned when not in use.
Air volumes and pressures required for air scour under either alternative require a compressor larger than anything currently at the WTP. The compressors required for either alternative are a substantial investment (approximately $21,000 for 200cfm of capacity or approximately $24,000 for 400cfm). An alternative to purchasing such a compressor at this time would be to rent one at the time that a thorough backwashing of the system is required. In this manner, the system could be backwashed solely with water; however, when flow efficiencies were seen to be reduced over time, a compressor could be utilized and allow the gallery system to be more thoroughly backwashed with both water and air. Differing infiltration gallery configurations subjected to different raw water qualities make determination of actual practical air backwash rates for a given system difficult prior to actual application and backwash experimentation. Air rates of 400 cfm (based on the 2 cfm/ft²) are more closely associated with sand filter WTP filter packs having much greater thickness than the filter pack proposed above these infiltration gallery screens. It is most likely that air rates necessary for backwash associated with the type of infiltration gallery recommended here would be closer to 200 cfm at 1 cfm/ft² of bed.

Two choices exist for the type of piping to be used for the 20' perforated sections of air lines: slotted Schedule 40 PVC, or a specialty pipe such as Schumosoil (trademark Johnson Screens). The Schedule 40 slotted PVC can be used; however, due to the nature of the material within which the pipes would be bedded, air would likely not distribute evenly along their length; i.e., air discharge would be greatest at the air line entrance and diminish along its length. The Schumosoil is a specially-designed polyethylene product that allows for even dispersion of the air flow along the line's length for applications such as this. Schumosoil is estimated to be considerably more expensive than PVC slot, costing about $18/feet vs. $1.24/feet, respectively. However, the even dispersion of a Schumosoil type material would likely pay for itself over time by extending the life of the gallery due to better backwashing abilities. A Schumosoil-type air line material is recommended and thus included in the cost estimates for this design.

### 2.2.1.4 Direct Intake Design

In conjunction with the proposed new infiltration gallery, an upgraded gallery bypass for direct raw water intake into the WTP is required. Figure 2-6 shows the location of the direct intake in plan view, and Figure 2-8 portrays the direct intake in profile view. The direct intake is proposed to replace the existing 24" CMP intake, which leads from the slide gate adjacent to the river to the wet well, with a new 24" CMP and slide gate in approximately the same orientation. This intake could be used as a sole raw water intake in case of infiltration gallery malfunction or failure, or during conditions when the infiltration gallery is not needed for delivery of low turbidity water. Under normal conditions, this intake would remain closed, allowing no unscreened raw water to enter the wet well, thereby maintaining reduced raw water turbidities. To prevent inflow of debris and trash, the direct intake would have a trash rack/screen with ½" openings between bars (removable for cleaning) at the intake opening. The direct intake should be beveled to match the channel side slope grade and secured in place with a concrete footer and protective concrete wing walls.

### 2.2.1.5 Infiltration Gallery Design Comparison

An infiltration gallery of the type presented in this preliminary design should greatly reduce influent raw water turbidity. For purposes of this evaluation, two infiltration gallery systems within Wyoming were reviewed: one at Mills and the other at Rock River. The Mills WTP staff reports that their infiltration gallery system gives a 10:1 reduction in river turbidity to infiltration.
FIGURE 2-8
DETAIL OF INFILTRATION GALLERY BYPASS INLET TO WET WELL — DIRECT INTAKE PROFILE
NO SCALE
2.2.2.2 Pre-Sedimentation Basin Design Considerations

2.2.2.2.1 General

Because of the limited amount of room available for construction at the WTP for a pre-sedimentation basin (see Figure 2-9), and the necessity of its use during only a small portion of the year (1-2 months), a basin of the size and type proposed in the Level 1 study is appropriate. Such a pre-sedimentation basin would consist of an open-air rectangular concrete basin with a sloped bottom capable of entry with a small loader for sludge removal. A removable weir (to allow for loader access when out of service) would distribute influent water, and a collection weir at the end of the basin would collect effluent water. Effluent water would be directed to piping which would gravity flow to the current raw water wet well in the WTP. From there it would be pumped to the filters for treatment.

Figures 2-9 and 2-10 show the conceptual layout and cross sections of such a basin. The basin must be long enough to allow settling of the particles in suspension associated with the high turbidities.

2.2.2.2.2 Required Basin Parameters

A pre-sedimentation basin must be capable of both reducing the turbidity of the raw water as well as reducing the suspended matter that is being conveyed by the raw water. In order to evaluate the condition of the existing raw water, raw water samples were collected at the WTP during the highest turbidity flows in May 2001. Appendix C contains a total suspended solids analysis for four water samples performed by IML. Settleable solids data was taken onsite simultaneously with the samples taken to IML. Table 2.1 shows the sample data. From this table, it can be seen that river turbidity and wet well turbidity are very similar. In fact, wet well turbidity appears slightly higher than river turbidity at times, demonstrating the ineffectiveness of the current infiltration gallery in reducing turbidity.

Samples for settleable solids determination conducted at the plant in 2001 using Imhoff cones (Table 2.1) show approximately 2 ml/L of settleable solids can be expected to accumulate in a pre-sedimentation basin during high turbidity flows (60 NTUs). Past data as presented in the Level 1 study found higher turbidity levels of around 100-120 NTU in Years 1995 and 1996, with turbidity levels as high as 200 NTU in Year 1997. During the Level I and Level II study years (2000 and 2001), raw water turbidity levels seen at the WTP during spring runoff have been around 50 to 60 NTU. These lower turbidity levels over the last two years could be due to the fact that both 2000 and 2001 had well-below normal snowpacks, perhaps leading to reduced spring runoff turbidity levels.

Using the data in Table 2.1, as well as previously reported Year 2000 concentrations of settleable solids and turbidity in the Level 1 study, a projection of a settleable solids volume corresponding to a turbidity of 200 NTU is approximately 3-4 ml/L, and for 120 NTU it is approximately 3 ml/L. These correlations should be recognized as being approximate at best.
Assuming an average plant influent flow rate in April-May of 150 gpm (approximate WTP average flow rate: see Appendix D2, Level I study), and using the worst case estimated settleable solids volume of 4 ml/L as calculated above, approximately 130 cubic yards of settleable solids material could be expected over a one-month period (at 3 ml/L, 96 cubic yards of material would accumulate). A basin of the size depicted in Figure 2-10 would require approximately 20’ x 70’ x 5’ of solids storage capacity in the bottom, or approximately 260 cubic yards. This would effectively require cleaning once every 2 months for 200 NTU water and, assuming two months of high turbidity, would fill to the full 260 cubic yard capacity with solids once a year.

A small loader capable of periodically handling, removing and disposing of these solids from the pre-sedimentation basin would be necessary. To allow easy entry by the loader, the access slope into the basin would have to be no steeper than 4:1.

The recommended pre-sedimentation basin as presented in Figures 2-9 and 2-10 is 90’ x 20’ x 10’ deep. A basin of this type would require approximately 110’ x 40’ of area, allowing for a 10’ nominal open space around the basin for construction, fencing, and operational/access concerns.

From Figure 2-9, it can be seen that there is minimal space to place a pre-sedimentation basin of this size within the current area leased by Dayton from the IXL Ranch for its WTP. The best location for the basin within the current leased area would be just southeast of the backwash settling basin (old sedimentation basin) location. This location would require some leveling of the current topography and rerouting of two existing water mains that originate at Dayton’s previous raw water intake at the mouth of the Tongue River canyon. Such rerouting would be required if Dayton chooses to one day implement its plan to convey untreated irrigation water to Dayton using the 10” asbestos cement transmission main proposed for replacement in 2002.

Backhoe Test Pit #2 (see Figure 2-4) is assumed to be representative of the subsoil conditions to be found within the WTP area. The soil conditions found in Test Pit #2 were suitable for the installation of the pre-sedimentation basin. The bottom of the basin excavation would be at about 4042 feet, which is 2.75 feet above the water table encountered in test pit #2 and 0.3 feet below the August 2, 2001 water elevation in the Tongue River. However, assuming a higher water table in the alluvium during higher flow periods in Tongue River, groundwater and related seepage issues could possibly be a concern during both construction and operations. Additionally, due to the proposed location being directly adjacent to the existing backwash pond (which has a high water elevation of 4055.25 feet, or approximately 13 feet higher than the

<table>
<thead>
<tr>
<th>Sample date</th>
<th>River Turbidity (NTU)</th>
<th>Wet Well Turbidity (NTU)</th>
<th>Settlesble Solids (ml/L) Imhoff cones @ WTP</th>
<th>Total Suspended Solids (mg/L) IML</th>
</tr>
</thead>
<tbody>
<tr>
<td>5/13/01</td>
<td>45</td>
<td>45.5</td>
<td>1</td>
<td>128</td>
</tr>
<tr>
<td>5/14/01</td>
<td>65</td>
<td>60</td>
<td>2</td>
<td>280</td>
</tr>
<tr>
<td>5/15/01</td>
<td>52</td>
<td>62</td>
<td>2</td>
<td>480</td>
</tr>
<tr>
<td>5/16/01</td>
<td>18</td>
<td>24</td>
<td>2</td>
<td>28</td>
</tr>
</tbody>
</table>
NOTE: OLD WTP INTAKE IS APPROXIMATELY 2,300 FT UPSTREAM OF CURRENT WTP INTAKE. OLD INLET ELEVATION = 4,067 FT AMSL.
bottom of the basin excavation), seepage could also occur from this unlined pond. Such seepage would not only have to be accounted for during construction (for dewatering and to offset buoyancy effects), but jointing and eventual cracks in the basin could allow for future infiltration into the basin, inhibiting solids drying and removal.

2.2.2.2.3 Options for Supplying Raw Water to Pre-sedimentation Basin

Raw water influent to the basin would ideally be gravity fed to avoid having to rely on pumps to fill the basin, which would increase construction and operational costs. If the pre-sedimentation basin were constructed so that the majority of the basin was underground (for easy loader cleanout access), the top basin elevation would be at approximately 4052 feet, and the bottom elevation would be at approximately 4042 feet.

Based upon river channel slope survey information along the WTP’s northerly boundary, locating an infiltration gallery far enough upstream to provide for gravity feed to the proposed pre-sedimentation basin would require installation of approximately 1,100 feet of 15” diameter pipe through existing dense vegetation. Such an installation would require the intake elevation to be at approximately 4053 feet. The pre-sedimentation basin could then be placed at the ground surface within the WTP property.

The 1,100 feet pipeline distance could be reduced to around 400 feet if a true hydraulic grade line were followed from the river water level through the pre-sedimentation basin and into the WTP’s raw water wet well. The base water level of this condition would be 4043 feet, allowing for one foot of head over the raw water pumps’ “cavitation elevation” in the wet well, and allowing for nine feet of freeboard in the wet well (elev. 4052 feet) for high water conditions. This orientation, however, would present the following problems.

- It would necessitate placing the pre-sedimentation basin deeply into the ground; i.e., the outflow weir elevation from the pre-sedimentation basin would be about nine feet below existing ground surface.
- The bottom of the basin would be approximately 19 feet below existing ground surface.
- Constructing a basin in this orientation would require a large size to accommodate initial construction and an access ramp for a loader for solids cleanout.
- The loader cleaning out the basin would be working in a very confined space 19 feet below the ground surface.
- The basin would be placed well within the alluvial water table, creating additional potential for groundwater seepage into the basin that may inhibit solids drying and handling as addressed above.

Due to these problems, it is recommended that the shorter 400’ distance option not be considered further.

An infiltration gallery 1,100 feet upstream of the WTP requires that an independent pump station be installed at or near the new intake location, if infiltration gallery backwash is to be implemented. The infiltration gallery required for Alternative B’s intake at this location would allow for a less stringent turbidity/sediment removal requirement, as the pre-sedimentation basin would fulfill much of the purpose of the infiltration gallery. A submerged screen surrounded by gravel pack would afford minimal initial sediment reduction and collect little large debris and sediment, due to the ability of the river to carry material beyond the screen placement. As such, the backwash pump system would not require the same level of backwashing capability.
Both an infiltration gallery screen, with associated gravel placement, and a direct intake, with an associated diversion dam, would require construction within the Tongue River. A diversion with a direct intake from the river would be more susceptible than an infiltration gallery to plugging by debris and accumulating sediments around the inlet pipe, due to the changing of direction and velocity of flow in the vicinity of the diversion dam.

The infiltration gallery required as part of this Alternative B would have essentially the same configuration as the one described in Alternative A: i.e., four (4) 15’ long x 6” inch screens surrounded by a filter pack and manifolded together to allow for independent backwash. However, the screen slot size can be increased (to 100), and the filter pack would be washed ½ - 1” gravel (vs. silica sand), overlaid by 1-2” washed gravel. The washed gravel would be overlaid with riprap of size $D_{50} = 7$ inches. A pump station would also still be required to backwash the screens.

Additional problems to be resolved before implementing Alternative B, including the pre-sedimentation basin and related new intake and infiltration gallery, include the following.

- There is a considerable amount of right-of-way that would have to be acquired from the adjacent IXL Ranch in order to construct, operate and maintain the facilities. Currently, Dayton has a lease from the IXL Ranch only for the land within the fenced area of the current WTP.
- Extensive removal of brush and trees along this right-of-way would be necessary to prepare for the pipeline and intake installation.
- Matching inflow rates from the pipeline to the pre-sedimentation basin to the raw water wet well would require a flow control valve at the inlet to the basin, as well as additional SCADA instrumentation.

For the above reasons, establishment of a new infiltration gallery far enough upstream of the proposed pre-sedimentation basin location to achieve gravity flow is not considered a preferred option. Alternatively, the influent water to the pre-sedimentation basin could be pumped directly from the Tongue River, allowing the necessary intake and infiltration gallery to be located adjacent to the WTP’s existing location. For this option, the area at the southwest corner of the WTP site provides the most direct piping route to the proposed pre-sedimentation basin location. This would require installation of a permanent raw water pumping station with a primary and a backup pump to feed water to the pre-sedimentation basin. The new pumping station will require a power feed and a new wet well to link to the new infiltration gallery that would be located beneath the Tongue River. As with the previous options including a pre-sedimentation basin, water would require being pumped from the intake to the pre-sedimentation basin only during that portion of the year when turbidities are too high to flow directly to the filters without pre-treatment. When turbidities were low, the water could gravity flow directly to the existing WTP raw water wet well.

Raw water pumps required to lift the water from the infiltration gallery beneath the Tongue River into the pre-sedimentation basin would also need to be equipped with VFD’s (i.e., in addition to those VFD’s already required for the WTP’s raw water pumps), in order to control the rate of water flowing through the pre-sedimentation basin into the WTP wet well. These pump flow rates would have to be coordinated, necessitating linkage to the proposed SCADA system. Additionally, it would be desirable to install polymer feed equipment within the pump...
station to allow the use of coagulants to aid in settling within the pre-sedimentation basin, if needed.

2.2.3 **WTP Alternative C - Membrane Filtration System**

Recent contact has been made by Dayton town officials with similarly sized communities that have recently employed a relatively new water treatment technology called membrane filtration. At the request of these town officials, membrane filtration was included in the amended scope of the study as a possible third alternative to address Dayton’s raw water turbidity problems. It is now being considered as Alternative C within this Level II study.

2.2.3.1 **General Benefits of Membrane Filtration**

Membrane filtration is used to treat water by passing it through a semi-permeable membrane, which filters out all particles within the influent water that have a greater size than the pore size of the membrane material. As such, it is referred to as an absolute filter. Because the membrane pore size is fixed, no excursions of effluent particulates greater than the membrane pore size can occur. In other words, no matter what the influent water turbidity is, a membrane filtration system will consistently produce effluent water having 0.05 NTU or less. It is important to note, however, that the greater the amount of turbidity and suspended matter in the raw water, the more frequently periodic backwashes of the filter membrane are required, leading to reduced efficiencies. As such, membrane filtration systems work most effectively when the water being placed upon the filters has already undergone some level of pre-treatment, or that it is already of relatively low turbidity.

Membrane filtration also produces substantial filtration of bacteria and cysts, with the finished water having no detectable levels of the organisms known as *Giardia* and *Cryptosporidium*. Membrane filtration systems can be purchased from several suppliers (ones used in regional installations include Pall and U.S. Filter) and are built and installed in complete packaged systems. The membrane filtration systems typically come with fully automated controls and an integral SCADA system with software tailored to the individual plant situation. Some systems have membrane materials that can tolerate chlorine, allowing for backwash with treated water and subsequent removal of bacteria that may build up on the filters.

One particular benefit to membrane filtration is the ability to install a system that is fully functional but can be easily upgraded to handle an increase in water demand. This is done by adding additional filter units (columns) to the existing manifold of filter units originally purchased. This means, for instance, that a community like Dayton could initially purchase a membrane filtration system to meet its existing demands, and the same system could be expanded simply by adding additional membrane filter units. No other system component or size would necessarily have to change.

Several installations of membrane filtration technology have recently been installed in small Wyoming communities with water demands similar to those of Dayton. Two installations have been evaluated.

- The Town of Meeteetse has installed a Pall system to service a population of approximately 360 people at a peak rate of 150 gpm. The Pall system has completely replaced the conventional filter treatment system previously in use in Meeteetse. Meeteetse’s water source is an intake at the bottom of a large public reservoir.
The Town of Rock River recently installed a U. S. Filter membrane filtration system that services a population of 230 people at a peak rate of 150 gpm. Again, the U.S. Filter system has completely replaced a conventional water treatment facility. Rock River’s water source is an infiltration gallery placed under the surface flow of Rock Creek.

According to the operators of these two systems, the membrane filtration units are working extremely well, and have greatly simplified their operations while simultaneously producing very high quality finished water.

Where influent water quality allows, membrane filtration systems can entirely negate the need for pre-treatment of water and addition of chemical coagulants to settle suspended matter. This can result in a substantial cost savings on chemicals used. In Dayton’s case, the high turbidities seen during brief runoff periods, rarely exceeding 45 days, are likely too high to be directed straight to membrane filtration. Most likely, raw water at such a high turbidity would have to undergo some level of pretreatment before flowing to the membrane system.

If a membrane filtration system were installed at Dayton, the existing filters could theoretically be used to “pre-filter” the high turbidity water during spring runoff times down to levels of 10-20 NTUs, a turbidity much more easily obtained than the current 0.5 NTU turbidity level required as part of the Safe Drinking Water Act requirements. During most months of the year, however, no pre-filtering of influent water would be required prior to it flowing directly to the membrane filtration system.

If a new infiltration gallery is built for Dayton, it is conceivable that the raw water turbidity produced from the gallery may well be low enough to cost-effectively run directly to a membrane filtration system with no need for pre-filtration.

If membrane filtration is chosen as a path Dayton wishes to pursue, further evaluation of various benefits provided by the various vendors and systems, as well as system costs, should be undertaken. If membrane filtration is to be implemented by Dayton, it would be desirable to install the system in conjunction with other proposed WTP improvements, in order to reduce construction costs. However, depending upon the cost to purchase a membrane filtration system, this may not be financially possible for Dayton.

2.2.3.2 Specific Benefits to Dayton

Membrane filtration would provide benefit to the Dayton WTP operations directly in several ways. These benefits are itemized as follows.

- As mentioned previously, no pre-settling of particulates is necessary with membrane filtration, which negates the need for chemical coagulants to aid in sedimentation of suspended matter. A membrane filtration can thus reduce chemical costs.

- The recently-enacted Enhanced Surface Water Treatment Rule as part of the Safe Drinking Water Act (discussed in the Level I Study) has mandated a finished water turbidity standard of 0.3 NTU, applicable to Dayton effective in 2003. The current turbidity standard is 0.5 NTU, with finished water not exceeding this concentration in 95% of samples taken. Examination of Dayton’s daily operations log sheet shows
that the finished water turbidity has exceeded 0.5 NTU on nine (9) occasions since 1995.

It is reasonable to assume that, if Dayton currently has difficulty meeting the 0.5 NTU standard, it will be even more difficult to meet the 0.3 NTU standard. Figure 2-11 shows finished water turbidity measurements taken from January 1995 to May 2000. As can be seen, exceedances of 0.3 NTU have occurred in the past, although recently the finished average turbidity in NTU has on all occasions been at or below 0.3. Membrane filtration could conceivably provide finished water turbidity of 0.05 or less and alleviate this potential problem of meeting the more stringent turbidity standard.

- The capability of membrane filtration to remove *Giardia* and *Cryptosporidium* to $> 6$ log and MS-2 virus to $0.5-3$ log (as required by the Safe Drinking Water Act) prepares Dayton to be capable of meeting more stringent standards as they are enforced on public water systems.

For these reasons, Dayton would like to tailor any upgrades or modifications to the current WTP to, if at all possible, include the installation of a membrane filtration system as funding becomes available.

### 2.2.3.3 Siting

A significant cost of a membrane filtration system can oftentimes be construction of a building to house the equipment. Similarly, piping modifications can oftentimes make a retrofit that includes a membrane filtration system expensive. In the case of the Dayton WTP, however, Filters 5 and 6 are no longer in use, and these filters could be removed and their space utilized for the membrane filtration unit. Additionally, system piping already in place requires minimal modifications to accommodate such a system.

### 2.2.3.4 Pre-treatment Requirements

It was previously mentioned that the efficiency and related operational costs of membrane filtration depends to a great degree upon the quality of the water placed upon the membrane filter; the higher quality of the water to be filtered, the greater the membrane filter’s efficiency and the lesser the operational costs. As such, it is reasoned that this alternative will necessarily have to incorporate either Alternative A or Alternative B, in order to allow for the raw water to be of sufficient quality to allow for efficient treatment by the membrane filter. Thus Alternative C is not a stand-alone to Alternative A or B.

Discussions with Dayton WTP personnel have also suggested that the existing WTP Filters 1-4 remain in service if a membrane filtration system is installed. These filters could aid in producing water during spring runoff periods that would be of sufficient quality to allow final filtration by the membrane filtration system, although not necessarily water of a quality to meet the 0.5 or 0.3 NTU Safe Drinking Water Act standards.
Figure 2-11
WTP Effluent Turbidity
3. **SCADA SYSTEM ANALYSIS**

Task 3 of the contract between EnTech and the WWDC requires EnTech to study the WTP control system and determine Dayton’s needs for a Supervisory Control and Data Acquisition (SCADA) system. In order to provide such an analysis, EnTech employed the services of Automation Electronics (A&E) of Casper. A&E provides both design and construction capabilities in the SCADA field, and is very familiar with such installations, having installed them both for the recently completed Sheridan area regional water project and the Central Wyoming regional water system.

A&E’s report is included in its entirety in Appendix D. It includes the submittal of conceptual drawings of the SCADA system components required. Their report includes recommendations on not only providing a SCADA system for the WTP, but also on linking the existing water storage tank (located on the southeast side of Dayton), the proposed new pump station (to be located adjacent to the Tongue River High School), and the Dayton town shop to a SCADA system as well.

Some important points in A&E’s report include the following.

- Some of the WTP’s existing telemetry, relay equipment and control cabinet can be utilized in conjunction with a new SCADA system.
- The VFD’s discussed and recommended for installation in the various diversion facility alternatives are itemized, and their installation costs can be segregated for use in evaluating costs in the event that Dayton chooses to not implement the entire SCADA system at this time.
- It is recommended that the SCADA linkage of the WTP to the proposed pump station, storage tank, and town shop be performed by installing fiber optic cable in conjunction with the pipeline project to take place in 2002. This cable could be installed at minimal cost at the same time and in the same trench that the pipelines are being installed.

A&E’s report also includes budgetary cost estimates, which are depicted in Section 4.
4. COST ESTIMATES

Sections 2 and 3 discussed:
- two alternatives (A – infiltration gallery and B – pre-sedimentation basin) for diversion facilities;
- an alternative (C) that provided for the installation of a membrane filtration system in conjunction with either Alternative A or B; and
- an analysis of a SCADA system for Dayton.

Conceptual designs for these proposed system components were included in these two sections. Preliminary cost estimates for these components are now portrayed in this section of the report.

It is important to note, and as discussed previously, the cost for the installation of VFD’s on the two existing raw water pumps is required for both Alternatives A and B. In order for the VFD’s to synchronize with the existing equipment, the costs depicted in Table 4.1 must be included with these two alternatives’ estimated costs. These costs would allow for the VFD system to work regardless of whether or not a SCADA system would be installed for the WTP.

Table 4.1

<table>
<thead>
<tr>
<th>VFD’s and Related Components</th>
<th>Item</th>
<th>Quantity</th>
<th>Unit Cost</th>
<th>Estimated Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>VFD’s</td>
<td>2</td>
<td>$5,000</td>
<td>$10,000</td>
</tr>
<tr>
<td></td>
<td>Raw Water Level Transmitter</td>
<td>1</td>
<td>$1,200</td>
<td>$1,200</td>
</tr>
<tr>
<td></td>
<td>Clearwell Level Transmitter</td>
<td>1</td>
<td>$1,200</td>
<td>$1,200</td>
</tr>
<tr>
<td></td>
<td>Control Panel Improvements</td>
<td>1</td>
<td>$15,000</td>
<td>$15,000</td>
</tr>
<tr>
<td></td>
<td>Installation of above eqpt.</td>
<td>1</td>
<td>$15,000</td>
<td>$15,000</td>
</tr>
<tr>
<td></td>
<td>(inc. conduit &amp; wiring)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>TOTAL PROJECT COST</td>
<td></td>
<td></td>
<td>$42,400</td>
</tr>
</tbody>
</table>

4.1 WTP Alternative A: Replace/reconstruct the Infiltration Gallery

From the design described in Section 3, two cost estimates for a new infiltration gallery installation are presented in Tables 4.2 and 4.3. Table 4.2 (depicted also as Schedule A-1) shows the costs for the infiltration gallery without the addition of air backwash capabilities. Table 4.3 (depicted also as Schedule A-2) shows the costs for the infiltration gallery including air backwash capabilities. In order to reduce costs, it is proposed that the air compressor required for such an air backwash system (200 cfm @ 6 psi) be rented vs. purchased and installed at the WTP. Air compressors of this size can be rented locally at a cost of approximately $100/day and are trailer-mounted. Fittings would be installed with the proposed improvements to allow easy connection of the rented air compressor to the air backwash system. In discussions with Dayton WTP personnel concerning this proposal, they agreed that renting the air compressor would make better financial sense.
### Table 4.2
Cost Estimate – Schedule A-1
Infiltration Gallery w/o Air Backwash Capabilities

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>Qty.</th>
<th>Unit Cost</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preparation of Final Designs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Permitting and Mitigation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Legal Fees</td>
<td></td>
<td></td>
<td></td>
<td>$2,500</td>
</tr>
<tr>
<td>Acquisition of Access &amp; ROW</td>
<td></td>
<td></td>
<td></td>
<td>$0</td>
</tr>
<tr>
<td>304SS Screen, 30 Slot, 15 feet</td>
<td>EA</td>
<td>4</td>
<td>$1,100</td>
<td>$4,400</td>
</tr>
<tr>
<td>10-20 silica sand, 102 C.Y.</td>
<td>SACKS</td>
<td>92</td>
<td>$224</td>
<td>$20,608</td>
</tr>
<tr>
<td>Washed gravel</td>
<td>TN</td>
<td>68</td>
<td>$10</td>
<td>$680</td>
</tr>
<tr>
<td>6&quot; steel line valves</td>
<td>EA</td>
<td>10</td>
<td>$2,000</td>
<td>$20,000</td>
</tr>
<tr>
<td>6&quot; steel elbows, 90°</td>
<td>EA</td>
<td>8</td>
<td>$30</td>
<td>$240</td>
</tr>
<tr>
<td>6&quot; stainless steel pipe</td>
<td>FT</td>
<td>350</td>
<td>$32</td>
<td>$11,200</td>
</tr>
<tr>
<td>Misc. piping costs</td>
<td>LS</td>
<td>1</td>
<td>$5,000</td>
<td>$5,000</td>
</tr>
<tr>
<td>30’ 24” CMP &amp; gated structure</td>
<td>LS</td>
<td>1</td>
<td>$2,000</td>
<td>$2,000</td>
</tr>
<tr>
<td>Installation of Infiltration Gallery Components</td>
<td>LS</td>
<td>1</td>
<td>$20,000</td>
<td>$20,000</td>
</tr>
<tr>
<td>VFD’s and related components (Table 4.1)</td>
<td>LS</td>
<td>1</td>
<td>$42,400</td>
<td>$42,400</td>
</tr>
<tr>
<td>Additional SCADA Connections (N/I Table 4.1)</td>
<td>LS</td>
<td>1</td>
<td>$5,000</td>
<td>$5,000</td>
</tr>
<tr>
<td>Construction Cost Subtotal</td>
<td></td>
<td></td>
<td></td>
<td>$131,528</td>
</tr>
<tr>
<td>Engineering Costs @ 10%</td>
<td></td>
<td></td>
<td></td>
<td>$13,153</td>
</tr>
<tr>
<td>Subtotal</td>
<td></td>
<td></td>
<td></td>
<td>$144,681</td>
</tr>
<tr>
<td>Contingency @ 15%</td>
<td></td>
<td></td>
<td></td>
<td>$21,702</td>
</tr>
<tr>
<td>Construction Costs Total</td>
<td></td>
<td></td>
<td></td>
<td>$166,383</td>
</tr>
<tr>
<td>Project Total Cost</td>
<td></td>
<td></td>
<td></td>
<td>$187,036</td>
</tr>
</tbody>
</table>

Dayton Water Supply Project - Level II Study

Cost Estimates
Table 4.3  
Cost Estimate – Schedule A-2  
Infiltration Gallery w/ Air Backwash Capabilities \(^{(1)}\)

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>Qty</th>
<th>Unit Cost</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preparation of Final Designs</td>
<td></td>
<td></td>
<td></td>
<td>$14,064</td>
</tr>
<tr>
<td>Permitting and Mitigation</td>
<td></td>
<td></td>
<td></td>
<td>$5,000</td>
</tr>
<tr>
<td>Legal Fees</td>
<td></td>
<td></td>
<td></td>
<td>$2,500</td>
</tr>
<tr>
<td>Acquisition of Access &amp; ROW</td>
<td></td>
<td></td>
<td></td>
<td>$0</td>
</tr>
<tr>
<td>30&quot; SS Screen, 30 Slot, 15 feet</td>
<td>EA</td>
<td>4</td>
<td>$1,100</td>
<td>$4,400</td>
</tr>
<tr>
<td>10-20 silica sand, 102 CY</td>
<td>SACKS</td>
<td>92</td>
<td>$224</td>
<td>$20,608</td>
</tr>
<tr>
<td>Washed gravel</td>
<td>TN</td>
<td>68</td>
<td>$10</td>
<td>$680</td>
</tr>
<tr>
<td>6&quot; steel line valves</td>
<td>EA</td>
<td>10</td>
<td>$2,000</td>
<td>$20,000</td>
</tr>
<tr>
<td>6&quot; steel elbows, 90°</td>
<td>EA</td>
<td>8</td>
<td>$30</td>
<td>$240</td>
</tr>
<tr>
<td>6&quot; stainless steel pipe</td>
<td>FT</td>
<td>350</td>
<td>$32</td>
<td>$11,200</td>
</tr>
<tr>
<td>Misc. piping costs</td>
<td>LS</td>
<td>1</td>
<td>$5,000</td>
<td>$5,000</td>
</tr>
<tr>
<td>30’’ 24” CMP &amp; gated structure</td>
<td>LS</td>
<td>1</td>
<td>$2,000</td>
<td>$2,000</td>
</tr>
<tr>
<td>Installation of Infiltration Gallery Components</td>
<td>LS</td>
<td>1</td>
<td>$20,000</td>
<td>$20,000</td>
</tr>
<tr>
<td>VFD’s and related components (Table 4.1)</td>
<td>LS</td>
<td>1</td>
<td>$42,400</td>
<td>$42,400</td>
</tr>
<tr>
<td>Additional SCADA Connections (N/I Table 4.1)</td>
<td>LS</td>
<td>1</td>
<td>$5,000</td>
<td>$5,000</td>
</tr>
<tr>
<td>2” PVC Air Lines</td>
<td>FT</td>
<td>350</td>
<td>$0.50</td>
<td>$175</td>
</tr>
<tr>
<td>2” Schumosoi, 10’ sections</td>
<td>EA</td>
<td>8</td>
<td>$180</td>
<td>$1,440</td>
</tr>
<tr>
<td>2” Air Valve</td>
<td>EA</td>
<td>4</td>
<td>$1,000</td>
<td>$4,000</td>
</tr>
<tr>
<td>Miscellaneous Air Connections</td>
<td>LS</td>
<td>1</td>
<td>$1,500</td>
<td>$1,500</td>
</tr>
<tr>
<td>Installation of Air Backwash Components</td>
<td>LS</td>
<td>1</td>
<td>$2,000</td>
<td>$2,000</td>
</tr>
<tr>
<td>Construction Cost Subtotal</td>
<td></td>
<td></td>
<td></td>
<td>$140,643</td>
</tr>
<tr>
<td>Engineering Costs @ 10%</td>
<td></td>
<td></td>
<td></td>
<td>$14,064</td>
</tr>
<tr>
<td>Subtotal</td>
<td></td>
<td></td>
<td></td>
<td>$154,707</td>
</tr>
<tr>
<td>Contingency @ 15%</td>
<td></td>
<td></td>
<td></td>
<td>$23,206</td>
</tr>
<tr>
<td>Construction Costs Total</td>
<td></td>
<td></td>
<td></td>
<td>$177,913</td>
</tr>
<tr>
<td>Project Total Cost</td>
<td></td>
<td></td>
<td></td>
<td>$199,477</td>
</tr>
</tbody>
</table>

\(^{(1)}\) assumes air backwash piping and related connections installed, but air compressor rented as needed vs. purchased.
Backwash frequencies and effectiveness are unknown until system implementation. However, it is assumed that backwash of the infiltration gallery will be more frequent during the high turbidity periods at the WTP and much less frequent during the remainder of the year, at a time when river turbidities are very low. Because of the unknown nature of the required site-specific backwash frequency and effectiveness, it is recommended that the air backwash lines be installed, so that if backwash becomes difficult, it is possible to rent a compressor and enhance the backwash efficiency of the system.

4.2 **WTP Alternative B – Construct Pre-sedimentation Basin**

From the conceptual design described in Section 2, a cost estimate for a pre-sedimentation basin installation (Alternative B) is presented in Tables 4.4 and 4.5. Table 4.4 shows the costs for the pre-sedimentation basin with gravity flow as Schedule B-1. Table 4.5 shows the costs for the pre-sedimentation basin with pumped raw water as Schedule B-2.

Consideration should be given to the fact that, beyond the initial installation cost of Schedule B-2, a plant operational cost increase will occur from running the new raw water pumping station and VFD during high turbidity to supply the existing raw water wet well through the pre-sedimentation basin.
<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>Qty</th>
<th>Unit Cost</th>
<th>Costs</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preparation of Final Designs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$20,898</td>
</tr>
<tr>
<td>Permitting and Mitigation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$5,000</td>
</tr>
<tr>
<td>Legal Fees</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$2,500</td>
</tr>
<tr>
<td>Acquisition of Access &amp; ROW</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$5,000</td>
</tr>
<tr>
<td>304SS Screen, 30 Slot, 15 feet</td>
<td>EA</td>
<td>4</td>
<td>$1,100</td>
<td>$4,400</td>
<td></td>
</tr>
<tr>
<td>Washed gravel</td>
<td>TN</td>
<td>200</td>
<td>$10</td>
<td>$2,000</td>
<td></td>
</tr>
<tr>
<td>6” steel line valves</td>
<td>EA</td>
<td>6</td>
<td>$2,000</td>
<td>$12,000</td>
<td></td>
</tr>
<tr>
<td>6” steel elbows, 90°</td>
<td>EA</td>
<td>4</td>
<td>$30</td>
<td>$120</td>
<td></td>
</tr>
<tr>
<td>6” stainless steel pipe</td>
<td>FT</td>
<td>80</td>
<td>$32</td>
<td>$2,560</td>
<td></td>
</tr>
<tr>
<td>Misc. piping costs</td>
<td>LS</td>
<td>1</td>
<td>$3,000</td>
<td>$3,000</td>
<td></td>
</tr>
<tr>
<td>Infiltration Gallery construction</td>
<td>LS</td>
<td>1</td>
<td>$10,000</td>
<td>$10,000</td>
<td></td>
</tr>
<tr>
<td>Backwash Pump</td>
<td>LS</td>
<td>1</td>
<td>$15,000</td>
<td>$15,000</td>
<td></td>
</tr>
<tr>
<td>15” dia. PVC pipe</td>
<td>FT</td>
<td>1,100</td>
<td>$30</td>
<td>$33,000</td>
<td></td>
</tr>
<tr>
<td>Pipeline path clearing</td>
<td>LS</td>
<td>1</td>
<td>$2,000</td>
<td>$2,000</td>
<td></td>
</tr>
<tr>
<td>Flow control valve</td>
<td>LS</td>
<td>1</td>
<td>$8,000</td>
<td>$8,000</td>
<td></td>
</tr>
<tr>
<td>SCADA control of flow control valve</td>
<td>LS</td>
<td>1</td>
<td>$5,000</td>
<td>$5,000</td>
<td></td>
</tr>
<tr>
<td>Basin excavation and earthwork</td>
<td>CY</td>
<td>350</td>
<td>$10</td>
<td>$3,500</td>
<td></td>
</tr>
<tr>
<td>18” yard piping and connections</td>
<td>FT</td>
<td>200</td>
<td>$40</td>
<td>$8,000</td>
<td></td>
</tr>
<tr>
<td>Weir (inlet &amp; outlet)</td>
<td>EA</td>
<td>1</td>
<td>$2,000</td>
<td>$2,000</td>
<td></td>
</tr>
<tr>
<td>Polymer addition building</td>
<td>LS</td>
<td>1</td>
<td>$10,000</td>
<td>$10,000</td>
<td></td>
</tr>
<tr>
<td>Polymer mixer and pump system</td>
<td>LS</td>
<td>1</td>
<td>$5,000</td>
<td>$5,000</td>
<td></td>
</tr>
<tr>
<td>Concrete in Basin</td>
<td>CY</td>
<td>100</td>
<td>$300</td>
<td>$30,000</td>
<td></td>
</tr>
<tr>
<td>15” poly pipe gravity bypass line</td>
<td>FT</td>
<td>200</td>
<td>$30</td>
<td>$6,000</td>
<td></td>
</tr>
<tr>
<td>VFD’s and related components (Table 4.1)</td>
<td>LS</td>
<td>1</td>
<td>$42,400</td>
<td>$42,400</td>
<td></td>
</tr>
<tr>
<td>Additional SCADA Connections (N/I Table 4.1)</td>
<td>LS</td>
<td>1</td>
<td>$5,000</td>
<td>$5,000</td>
<td></td>
</tr>
<tr>
<td>Construction Cost subtotal</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$208,980</td>
</tr>
<tr>
<td>Engineering Costs @ 10%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$20,898</td>
</tr>
<tr>
<td>Subtotal</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$229,878</td>
</tr>
<tr>
<td>Contingency @ 15%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$34,482</td>
</tr>
<tr>
<td><strong>Construction Costs Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>$264,360</strong></td>
</tr>
<tr>
<td>Project Total Cost</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>$297,758</strong></td>
</tr>
</tbody>
</table>
## Table 4.5
Cost Estimate – Schedule B-2
Pre-Sedimentation Basin with Additional Pump Station

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>Quantity</th>
<th>Unit Cost</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preparation of Final Designs</td>
<td></td>
<td></td>
<td></td>
<td>$18,848</td>
</tr>
<tr>
<td>Permitting and Mitigation</td>
<td></td>
<td></td>
<td></td>
<td>$5,000</td>
</tr>
<tr>
<td>Legal Fees</td>
<td></td>
<td></td>
<td></td>
<td>$2,500</td>
</tr>
<tr>
<td>Acquisition of Access &amp; ROW</td>
<td></td>
<td></td>
<td></td>
<td>$0</td>
</tr>
<tr>
<td>304SS Screen, 30 Slot, 15 feet</td>
<td>EA</td>
<td>4</td>
<td>$1,100</td>
<td>$4,400</td>
</tr>
<tr>
<td>Washed gravel</td>
<td>TN</td>
<td>200</td>
<td>$10</td>
<td>$2,000</td>
</tr>
<tr>
<td>6” steel line valves</td>
<td>EA</td>
<td>6</td>
<td>$2,000</td>
<td>$12,000</td>
</tr>
<tr>
<td>6” steel elbows, 90°</td>
<td>EA</td>
<td>4</td>
<td>$30</td>
<td>$120</td>
</tr>
<tr>
<td>6” stainless steel pipe</td>
<td>FT</td>
<td>80</td>
<td>$32</td>
<td>$2,560</td>
</tr>
<tr>
<td>Misc. piping costs</td>
<td>LS</td>
<td>1</td>
<td>$3,000</td>
<td>$3,000</td>
</tr>
<tr>
<td>Infiltration gallery construction</td>
<td>LS</td>
<td>1</td>
<td>$10,000</td>
<td>$10,000</td>
</tr>
<tr>
<td>Raw water pump</td>
<td>EA</td>
<td>2</td>
<td>$10,000</td>
<td>$20,000</td>
</tr>
<tr>
<td>15” diameter PVC pipe</td>
<td>FT</td>
<td>250</td>
<td>$30</td>
<td>$7,500</td>
</tr>
<tr>
<td>Basin excavation and earthwork</td>
<td>CY</td>
<td>350</td>
<td>$10</td>
<td>$3,500</td>
</tr>
<tr>
<td>18” yard piping and connections</td>
<td>FT</td>
<td>200</td>
<td>$40</td>
<td>$8,000</td>
</tr>
<tr>
<td>Weir (inlet &amp; outlet)</td>
<td>EA</td>
<td>1</td>
<td>$2,000</td>
<td>$2,000</td>
</tr>
<tr>
<td>Polymer addition building</td>
<td>LS</td>
<td>1</td>
<td>$10,000</td>
<td>$10,000</td>
</tr>
<tr>
<td>Polymer mixer and pump system</td>
<td>LS</td>
<td>1</td>
<td>$5,000</td>
<td>$5,000</td>
</tr>
<tr>
<td>Concrete in Basin</td>
<td>CY</td>
<td>100</td>
<td>$300</td>
<td>$30,000</td>
</tr>
<tr>
<td>Wet well and pump house</td>
<td>LS</td>
<td>1</td>
<td>$15,000</td>
<td>$15,000</td>
</tr>
<tr>
<td>15” poly pipe gravity bypass line</td>
<td>FT</td>
<td>200</td>
<td>$30</td>
<td>$6,000</td>
</tr>
<tr>
<td>VFD and related components (Table 4.1)</td>
<td>LS</td>
<td>1</td>
<td>$4,240</td>
<td>$4,240</td>
</tr>
<tr>
<td>Additional SCADA Connections (N/I Table 4.1)</td>
<td>LS</td>
<td>1</td>
<td>$5,000</td>
<td>$5,000</td>
</tr>
<tr>
<td>Construction Cost subtotal</td>
<td></td>
<td></td>
<td></td>
<td>$188,480</td>
</tr>
<tr>
<td>Engineering Costs @ 10%</td>
<td></td>
<td></td>
<td></td>
<td>$18,848</td>
</tr>
<tr>
<td>Subtotal</td>
<td></td>
<td></td>
<td></td>
<td>$207,328</td>
</tr>
<tr>
<td>Contingency @ 15%</td>
<td></td>
<td></td>
<td></td>
<td>$31,099</td>
</tr>
<tr>
<td>Construction Costs Total</td>
<td></td>
<td></td>
<td></td>
<td>$238,427</td>
</tr>
<tr>
<td>Project Total Cost</td>
<td></td>
<td></td>
<td></td>
<td>$264,775</td>
</tr>
</tbody>
</table>
4.3 WTP Alternative C: Membrane Filtration System

A cost estimate for a membrane filtration system is presented in Table 4.6. As mentioned previously, Alternative C requires a level of pre-treatment for raw water, thus either Alternative A or B must accompany this alternative. Once the water is delivered to the existing raw water well by either alternative, the raw water can be pumped directly to the membrane filtration system with the existing raw water pumps located in the WTP. If raw water turbidity is too high, the water can first be pumped into the existing WTP filters prior to entering the proposed new membrane filtration unit.

The costs for Alternative C portrayed in Table 4.6 do not include the cost associated with either Alternative A or B. However, it must be recognized that the cost for one of these two alternatives must be included when determining costs associated with Alternative C.

### Table 4.6 Cost Estimate Membrane Filtration Unit

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>Qty.</th>
<th>Unit Cost</th>
<th>Component Costs</th>
<th>Cost Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preparation of Final Designs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Permitting and Mitigation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Legal Fees</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acquisition of Access &amp; ROW</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Membrane Filtration Unit</td>
<td>LS</td>
<td>1</td>
<td>$900,000</td>
<td>$900,000</td>
<td></td>
</tr>
<tr>
<td>WTP Building Modifications</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Additional SCADA Modifications for MF Unit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compressor and pump installation (for MF unit)</td>
<td>LS</td>
<td>1</td>
<td>$20,000</td>
<td>$20,000</td>
<td></td>
</tr>
<tr>
<td>Miscellaneous piping, components</td>
<td>LS</td>
<td>1</td>
<td>$75,000</td>
<td>$75,000</td>
<td></td>
</tr>
<tr>
<td>Construction Cost Subtotal</td>
<td></td>
<td></td>
<td></td>
<td>$1,095,000</td>
<td></td>
</tr>
<tr>
<td>Engineering Costs @ 10%</td>
<td></td>
<td></td>
<td></td>
<td>$109,500</td>
<td></td>
</tr>
<tr>
<td>Subtotal</td>
<td></td>
<td></td>
<td></td>
<td>$1,204,500</td>
<td></td>
</tr>
<tr>
<td>Contingency @ 15%</td>
<td></td>
<td></td>
<td></td>
<td>$180,675</td>
<td></td>
</tr>
<tr>
<td>Construction Cost Total</td>
<td></td>
<td></td>
<td></td>
<td>$1,385,175</td>
<td>$1,385,175</td>
</tr>
<tr>
<td>Total Project Cost</td>
<td></td>
<td></td>
<td></td>
<td>$1,502,175</td>
<td></td>
</tr>
</tbody>
</table>

4.4 SCADA System Costs

Cost estimates for the SCADA system discussed in Section 3 are portrayed in Table 4.7. These costs do not include the costs necessary to install VFD’s and related equipment, which were previously shown in Table 4.1.

Also in Table 4.7, the following related SCADA components are segregated.

- The costs to install the necessary components to allow for automatic operation of the proposed new pump station in conjunction with the water level in the existing storage tank. Should Dayton choose not to proceed forward with the SCADA system for the WTP automation at this time, these installation costs would still be necessary to allow the pump station to energize when the water within the tank is at a low level. The costs
include installation of fiber optic cable at the same time that the pipeline is being installed from the pump station to the storage tank.

- The costs to install fiber optic cable from the WTP to the proposed pump station to be located directly adjacent to Tongue River High School. This work would be performed at the time that the 10" asbestos cement transmission main is replaced. The cable would be installed within the same trench as the replacement pipe.
- The costs to install fiber optic cable from the pump station to the Dayton town shop, thus allowing for SCADA access at this important location of Dayton's public works operations.

### Table 4.7
Cost Estimate
SCADA System WTP and Related Components
*(does not include VFD equipment & installation)*

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>Qty.</th>
<th>Unit Price</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preparation of Final Designs &amp; Specs</td>
<td></td>
<td></td>
<td></td>
<td>$20,260</td>
</tr>
<tr>
<td>Permitting and Mitigation</td>
<td></td>
<td></td>
<td></td>
<td>$0</td>
</tr>
<tr>
<td>Legal Fees</td>
<td></td>
<td></td>
<td></td>
<td>$0</td>
</tr>
<tr>
<td>Acquisition of Access &amp; ROW</td>
<td></td>
<td></td>
<td></td>
<td>$0</td>
</tr>
<tr>
<td><strong>Equipment Material Costs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Modify Existing Water Plant Control Panel - Hardware &amp; Software</td>
<td>LS</td>
<td>1</td>
<td>$30,000</td>
<td>$30,000</td>
</tr>
<tr>
<td>Inlet Flowmeter</td>
<td>EA</td>
<td>1</td>
<td>$7,000</td>
<td>$7,000</td>
</tr>
<tr>
<td>Raw Water Turbidimeter</td>
<td>EA</td>
<td>1</td>
<td>$5,000</td>
<td>$5,000</td>
</tr>
<tr>
<td>Streaming Current Detector</td>
<td>EA</td>
<td>1</td>
<td>$12,000</td>
<td>$12,000</td>
</tr>
<tr>
<td>Limit Switches</td>
<td>SET</td>
<td>1</td>
<td>$1,250</td>
<td>$1,250</td>
</tr>
<tr>
<td>Inlet Channel Level Transmitter</td>
<td>EA</td>
<td>1</td>
<td>$1,200</td>
<td>$1,200</td>
</tr>
<tr>
<td>Filter Effluent Turbidimeter</td>
<td>EA</td>
<td>4</td>
<td>$2,500</td>
<td>$10,000</td>
</tr>
<tr>
<td>Valve Position Limit Switch</td>
<td>SET</td>
<td>4</td>
<td>$3,000</td>
<td>$12,000</td>
</tr>
<tr>
<td>Filter Outlet Pressure</td>
<td>EA</td>
<td>4</td>
<td>$1,400</td>
<td>$5,600</td>
</tr>
<tr>
<td>Effluent Flowmeter</td>
<td>EA</td>
<td>1</td>
<td>$7,000</td>
<td>$7,000</td>
</tr>
<tr>
<td>Effluent Turbidimeter</td>
<td>EA</td>
<td>1</td>
<td>$3,000</td>
<td>$3,000</td>
</tr>
<tr>
<td>Residual Chlorine Analyzer</td>
<td>EA</td>
<td>1</td>
<td>$4,000</td>
<td>$4,000</td>
</tr>
<tr>
<td>Pump Control Switches</td>
<td>SET</td>
<td>1</td>
<td>$600</td>
<td>$600</td>
</tr>
<tr>
<td>Low/Low Instrument Air Pressure Alarm</td>
<td>EA</td>
<td>1</td>
<td>$450</td>
<td>$450</td>
</tr>
<tr>
<td>Chlorine Pacing Valve-Inlet Water</td>
<td>EA</td>
<td>1</td>
<td>$3,500</td>
<td>$3,500</td>
</tr>
<tr>
<td>Chlorine Pacing Valve-Effluent Water</td>
<td>EA</td>
<td>1</td>
<td>$3,500</td>
<td>$3,500</td>
</tr>
<tr>
<td>Chlorine Pacing Valve-Effluent Water</td>
<td>EA</td>
<td>1</td>
<td>$3,500</td>
<td>$3,500</td>
</tr>
<tr>
<td>SCADA Host</td>
<td>LS</td>
<td>1</td>
<td>$38,000</td>
<td>$38,000</td>
</tr>
<tr>
<td>Installation of Above Equipment (inc. conduit and wiring)</td>
<td>LS</td>
<td>1</td>
<td>$35,000</td>
<td>$35,000</td>
</tr>
<tr>
<td><strong>Construction Cost Subtotal</strong></td>
<td></td>
<td></td>
<td></td>
<td>$202,600</td>
</tr>
<tr>
<td>Engineering Costs @ 10%</td>
<td></td>
<td></td>
<td></td>
<td>$20,260</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td></td>
<td></td>
<td></td>
<td>$222,860</td>
</tr>
<tr>
<td>Contingency @ 15%</td>
<td></td>
<td></td>
<td></td>
<td>$33,429</td>
</tr>
<tr>
<td><strong>Construction Cost Total</strong></td>
<td></td>
<td></td>
<td></td>
<td>$256,289</td>
</tr>
<tr>
<td><strong>Project Cost Total</strong></td>
<td></td>
<td></td>
<td></td>
<td>$276,549</td>
</tr>
</tbody>
</table>
### SCADA Link between Pump Station and Tank

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>Qty.</th>
<th>Unit Cost</th>
<th>Cost</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preparation of Final Designs &amp; Specs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$3,234</td>
</tr>
<tr>
<td>Permitting and Mitigation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$0</td>
</tr>
<tr>
<td>Legal Fees</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$0</td>
</tr>
<tr>
<td>Acquisition of Access &amp; ROW</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$0</td>
</tr>
<tr>
<td>Existing Water Tank</td>
<td>LS</td>
<td>1</td>
<td>$9,000</td>
<td>$9,000</td>
<td></td>
</tr>
<tr>
<td>New Pump Station (includes SCADA Eqpt. Installation)</td>
<td>LS</td>
<td>1</td>
<td>$14,000</td>
<td>$14,000</td>
<td></td>
</tr>
<tr>
<td>Magnetic Flowmeter on Pump Station Discharge Main</td>
<td>EA</td>
<td>1</td>
<td>$7,000</td>
<td>$7,000</td>
<td></td>
</tr>
<tr>
<td>Fiber Cable - Station to Tank (Installed by Pipeline Contractor)</td>
<td>FT</td>
<td>3900</td>
<td>$0.60</td>
<td>$2,340</td>
<td></td>
</tr>
<tr>
<td>Construction Cost Subtotal</td>
<td></td>
<td></td>
<td></td>
<td>$32,340</td>
<td></td>
</tr>
<tr>
<td>Engineering Costs @10%</td>
<td></td>
<td></td>
<td></td>
<td>$3,234</td>
<td></td>
</tr>
<tr>
<td>Subtotal</td>
<td></td>
<td></td>
<td></td>
<td>$35,574</td>
<td></td>
</tr>
<tr>
<td>Contingency @15%</td>
<td></td>
<td></td>
<td></td>
<td>$5,336</td>
<td></td>
</tr>
<tr>
<td>Construction Cost Total</td>
<td></td>
<td></td>
<td></td>
<td>$40,910</td>
<td>$40,910</td>
</tr>
<tr>
<td>Project Cost Total</td>
<td></td>
<td></td>
<td></td>
<td>$44,144</td>
<td></td>
</tr>
</tbody>
</table>

### SCADA Link – Pump Station to Dayton Town Shop

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>Qty.</th>
<th>Unit Cost</th>
<th>Cost</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preparation of Final Designs &amp; Specs</td>
<td></td>
<td></td>
<td></td>
<td>$1,200</td>
<td></td>
</tr>
<tr>
<td>Permitting and Mitigation</td>
<td></td>
<td></td>
<td></td>
<td>$0</td>
<td></td>
</tr>
<tr>
<td>Legal Fees</td>
<td></td>
<td></td>
<td></td>
<td>$500</td>
<td></td>
</tr>
<tr>
<td>Acquisition of Access &amp; ROW</td>
<td></td>
<td></td>
<td></td>
<td>$500</td>
<td></td>
</tr>
<tr>
<td>Fiber Optic Cable - Pump Station to Town Shop</td>
<td>FT</td>
<td>1500</td>
<td>$8</td>
<td>$12,000</td>
<td></td>
</tr>
<tr>
<td>Construction Cost Subtotal</td>
<td></td>
<td></td>
<td></td>
<td>$12,000</td>
<td></td>
</tr>
<tr>
<td>Engineering Costs @10%</td>
<td></td>
<td></td>
<td></td>
<td>$1,200</td>
<td></td>
</tr>
<tr>
<td>Subtotal</td>
<td></td>
<td></td>
<td></td>
<td>$13,200</td>
<td></td>
</tr>
<tr>
<td>Contingency @15%</td>
<td></td>
<td></td>
<td></td>
<td>$1,980</td>
<td></td>
</tr>
<tr>
<td>Construction Cost Total</td>
<td></td>
<td></td>
<td></td>
<td>$15,180</td>
<td>$15,180</td>
</tr>
<tr>
<td>Project Cost Total</td>
<td></td>
<td></td>
<td></td>
<td>$17,380</td>
<td></td>
</tr>
</tbody>
</table>

### SCADA Link – WTP to Pump Station at Tongue River High School (in conjunction with 10” asbestos cement main pipeline replacement project slated for 2002)

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>Qty.</th>
<th>Unit Cost</th>
<th>Cost</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fiber Optic Cable - WTP to TRHS Pump Station</td>
<td>FT</td>
<td>11000</td>
<td>$0.60</td>
<td>$6,600</td>
<td></td>
</tr>
<tr>
<td>Construction Cost Subtotal</td>
<td></td>
<td></td>
<td></td>
<td>$6,600</td>
<td></td>
</tr>
<tr>
<td>Engineering Costs @10%</td>
<td></td>
<td></td>
<td></td>
<td>$660</td>
<td></td>
</tr>
<tr>
<td>Subtotal</td>
<td></td>
<td></td>
<td></td>
<td>$7,260</td>
<td></td>
</tr>
<tr>
<td>Contingency @15%</td>
<td></td>
<td></td>
<td></td>
<td>$1,089</td>
<td></td>
</tr>
<tr>
<td>Project Cost Total</td>
<td></td>
<td></td>
<td></td>
<td>$8,349</td>
<td>$8,349</td>
</tr>
</tbody>
</table>

* assumes negligible additional design costs
5. RECOMMENDED ALTERNATIVE

As portrayed in Sections 2 and 3, the primary diversion facility alternatives that would meet the objective of achieving a reduction in the periodic high raw water turbidity at the Dayton WTP can be summarized as follows.

- **(Alternative A, Schedule A-1):** Construct a new infiltration gallery (to replace the existing one) directly adjacent to the existing WTP site beneath the Tongue River. The infiltration gallery would be built to include water backwash capabilities but **without** the addition of air backwash capabilities. Estimated project cost = $187,036.

- **(Alternative A, Schedule A-2):** Construct an infiltration gallery (to replace the existing one) directly adjacent to the existing WTP site beneath the Tongue River. The infiltration gallery would be built to include both water and air backwash capabilities. Estimated project cost = $199,477.

- **(Alternative B, Schedule B-1):** Construct a pre-sedimentation basin on the existing WTP site and extend a 1,100' long pipe upstream to allow for gravity flow into the basin. This alternative would require the installation of an infiltration gallery at the upstream site with limited backwash capabilities. Estimated project cost = $297,758.

- **(Alternative B, Schedule B-2):** Construct a pre-sedimentation basin on the existing WTP site and install a new infiltration gallery and pump station directly adjacent to the site. The new infiltration gallery would have limited backwash capabilities. Estimated project cost = $264,775.

While the original scope for this study included the installation of VFD’s as part of Alternative A only, such installation costs are actually necessary for both Alternatives A and B. As such, these installation costs have been included in all of the costs outlined above.

The third alternative – Alternative C (membrane filtration) – requires not only the VFD installation, but also the installation of either Alternative A or B as a means to provide some level of pre-treatment prior to actual membrane filtration. Thus Alternative C cannot be considered as an actual alternative to the first two, but instead a method of enhancing Dayton’s ability to adequately provide safe drinking water to its public water supply customers.

Of these four alternatives discussed above, Alternative A, Schedule A-2 appears to be the best overall alternative to meet Dayton’s needs, and its implementation is recommended. This recommendation is made based upon the following reasons.

1. Alternative A, Schedule A-2 can provide a pre-treatment level at least as effective as the two Alternative B’s evaluated (Schedules B-1 and B-2), while being considerably less expensive.

2. Due to its air backwash capabilities in addition to water backwash capabilities, it will provide a much more effective means of maintaining an efficient infiltration gallery than one with only water backwash capabilities (as with Alternative A, Schedule A-1). This additional capability can be achieved for an additional project cost of $12,441 when compared to Schedule A-1.

3. The construction of both an intake system and a sedimentation basin (Alternative B, both schedules) is counterproductive to merely constructing an infiltration gallery capable of achieving the same net result.

4. Although overall operational costs were not compared, Alternative A, Schedule A-2 will have considerably less operational costs than either of the schedules proposed in
Alternative B. The two Alternative B schedules will require periodic solids removal from the pre-sedimentation basin. These solids will require development and implementation of a residuals management plan. Both Alternative B schedules require an infiltration gallery and some related backwashing responsibilities similar to either of the Alternative A schedules. Alternative B, Schedule B-2 also requires operational costs associated with the pumping station necessary to lift water from an infiltration gallery located beneath the Tongue River into the pre-sedimentation basin. This pumping station would be additional to the raw water pumps currently existing in the Dayton WTP.

5. Construction of a pre-sedimentation basin associated with either schedule of Alternative B would entail siting the basin within the very limited leased area currently available.

6. Establishment of a new water intake at a considerable distance upstream from the present WTP leased area (Alternative B, Schedule B-1) would be difficult and not cost-effective, requiring the installation of 1,100 feet of 15” pipe to reach the proposed new intake site. Although this would allow for gravity feed to the pre-sedimentation basin, the existing raw water pumps would be required with this as well as all alternatives.

7. Constructing the 1,100 feet length of pipeline would affect a large riparian area located adjacent to the Tongue River. A principal concern of the U.S. Fish & Wildlife Service in its preliminary environmental review of the project was the impact upon this existing riparian resource. (See Section 7 – Environmental Report)

In addition to addressing its immediate raw water turbidity issues, Dayton desires to focus on its long-term treatment obligations by installing a membrane filtration system. This system will greatly aid Dayton in meeting turbidity standards and other regulatory standards for bacteria and microorganisms, as well as for improving WTP efficiency and reducing chemical and labor costs. However, after discussing these costs with Dayton town officials, the cost for installing a membrane filtration unit, even if within the existing WTP building, may be too expensive for Dayton at this time. Dayton has only recently raised its water rates by 20%, and the 2001 funding request by Dayton to the Rural Utilities Service identified another rate increase, to likely be required in 2003. An additional rate increase additional to these is perceived to not be prudent at this time, if the WTP Phase 1 improvements can address Dayton’s immediate needs. It is therefore recommended that installation of a membrane filtration system be part of a possible future, or second, phase of WTP improvements. Meanwhile, any improvements made to the WTP at this time by construction of a new infiltration gallery and installation of VFD’s must focus on the need to be compatible with a future membrane filtration system.

Section 3 portrayed a proposed SCADA system for Dayton, which would provide automation and telemetry for all of the components of Dayton’s water system. Although certainly desirable, the estimated price of $276,549 and associated $17,380 for a direct connection to the Dayton town shop may also be too expensive for this small community at this time. This SCADA work may also best be performed as part of a future phase of construction to address Dayton’s WTP needs.

It is imperative, however, that the SCADA improvements to provide for the proposed new pump station to work in conjunction with the existing storage tank be constructed at the time that the new pump station and proposed 10” pipeline replacement are constructed. These costs are shown in Table 5.1 in an amount of $44,144. Additionally, due to the somewhat minimal cost ($8,349) of installing fiber optic cable in conjunction with pipeline construction, this cable should be laid within the trench required for the replacement of the existing 10” asbestos cement main scheduled for 2002.

Table 5.1 summarizes the recommended alternatives made in this section.

Recommended Alternative 5-2
<table>
<thead>
<tr>
<th>Phase</th>
<th>Description</th>
<th>Project Cost (2003 Costs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Alternative A, Schedule A-2</td>
<td>$199,477</td>
</tr>
<tr>
<td></td>
<td>Construct infiltration gallery w/ water &amp; air backwash capabilities, install VFD’s on existing raw water pumps</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Install SCADA link between new pump station at Tongue River High School &amp; tank</td>
<td>$44,144</td>
</tr>
<tr>
<td></td>
<td>Install fiber optic cable w/ 10” pipe replacement project for future SCADA link – WTP to new pump station</td>
<td>$8,349</td>
</tr>
<tr>
<td></td>
<td><strong>Total Phase 1</strong></td>
<td><strong>$251,970</strong></td>
</tr>
<tr>
<td>2</td>
<td>Install membrane filtration system upgrade at WTP</td>
<td>$1,502,175</td>
</tr>
<tr>
<td></td>
<td>Install SCADA system at WTP</td>
<td>$276,549</td>
</tr>
<tr>
<td></td>
<td>Install SCADA connection to Town Shop (from pump station)</td>
<td>$17,380</td>
</tr>
<tr>
<td></td>
<td><strong>Total Phase 2</strong></td>
<td><strong>$1,796,104</strong></td>
</tr>
</tbody>
</table>
6. ABILITY-TO-PAY ANALYSIS AND FINANCING PLAN

In order to assist the various funding agencies in determining a fair and equitable financing plan for the recommended improvements identified in Section 5, it is necessary to conduct an ability-to-pay analysis associated with a proposed financing plan. This analysis and plan must be adequate to address the needs of not only the WWDC, but also any other possible funding agency requirements.

6.1 POTENTIAL FUNDING SOURCES

There are many state and federal agencies that administer programs that fund water system improvements. The agencies from which grants and loans are typically requested by Wyoming cities and towns are described below. These agencies' funding programs represent possible revenue sources over and above merely increasing user fees to cover operating and debt service costs.

6.1.1 WWDC

This state agency provides grants and loans to be utilized for the development of water within the State of Wyoming. Funding for the WWDC originates from a tax placed upon extracted minerals, principally coal. Eligible projects include those associated with the development and transmission of water, but not the treatment or distribution of water.

Grants are usually available for 50% of the cost for project development, although sometimes – in cases of demonstrated hardship – higher percentages can be obtained. Loans for the non-grant share of project-eligible costs are available at a current rate of 7.25% and term of 30 years, but longer terms may be considered.

The WWDC is recommended to be a major contributor of funding for the aspects of this project not directly related to water treatment, such as diversion facilities and associated piping.

6.1.2 Rural Utilities Service (RUS)

The RUS provides grants and loans to be utilized for the development of water within rural communities and areas around the United States. As opposed to the WWDC, eligible projects can include those associated with the treatment and distribution of water, as well as transmission.

Grants are usually available for up to 50% of the cost for project development, although sometimes – in cases of demonstrated hardship – higher percentages can be obtained. Loans for the non-grant share of project-eligible costs are available at a current rate of 4 7/8% and term of up to 30 years. If a loan is necessary as part of the required funding package, RUS strongly prefers the recipient of RUS grant funds to also utilize its loan program; i.e., it does not look favorably upon providing grant funds but having loan funds come from other funding agencies.

The RUS could potentially be a major contributor of funding for this project.
6.1.3 **State of Wyoming Land and Investment Board (SLIB)**

This state agency provides grants and loans to be utilized for the development of infrastructure within communities and special districts around the State of Wyoming. The board of directors for the SLIB is comprised of the five state elected officials. Funding for SLIB-supplied grants and loans originates from federal mineral royalties that are placed upon extractable minerals within the State, a portion of which is returned to Wyoming. Eligible projects are not limited to, although of course can be, those associated with all aspects of the delivery of water, including treatment, transmission and distribution of water. Water and sewer projects, in fact, receive a higher priority for SLIB funding due to their importance to the health and safety of Wyoming citizenry.

Grants are usually available for up to 50% of the cost for project development, although sometimes – in very rare cases of demonstrated hardship – higher percentages can be obtained. Loans for the non-grant share of project-eligible costs are available at 7.25%. The rate is based upon the prime rate and thus fluctuates. An SLIB loan has a term of 30 years.

6.1.4 **WDEQ State Revolving Loan Fund**

The Wyoming Department of Environmental Quality (WDEQ) administers the State Revolving Loan Fund (SRF) for both water and sewer projects throughout Wyoming. Funding for the SRF originates from Congress-supplied monies to EPA, which in turn allocates a portion of these funds to each state.

WDEQ annually updates a ranking of projects eligible for the SRF. At this time, Dayton is not on the priority list for SRF funds. Should it desire to be placed on this list, it should contact WDEQ as soon as possible.

Loans for the non-grant share of project-eligible costs are available at a current rate of 4% and term of 20 years. No grant monies are available from this funding source.

6.1.5 **Wyoming Business Council (Community Development Block Grant)**

Wyoming accepted the administration of the Community Development Block Grant (CDGB) program from the U.S. Department of Housing and Urban Development (HUD) in 1982. The CDBG program is a federally-funded "pass through" grant program from HUD. The State has received an annual allocation for this program, from a low of $2.2 million to a high of $3.7 million. For the 2000 program, the State received just over $3.4 million.

A project funded with CDBG funds must meet one of three HUD-imposed national objectives. The three objectives are:

- providing benefit to low and moderate income families,
- eliminating slums and blight, and
- meeting an urgent community development need that poses a serious and immediate threat to the health or welfare of the community.

"Moderate income" is defined in the CDBG program as 80% of the median income, with an adjustment by family size. A study would have to be completed to determine if the Dayton
median income level falls below this level. Reports from the Wyoming Business Council indicate that current information identifies Dayton as being “on-the-bubble”, based upon the 1990 income survey. The median income level for Dayton as reported by the 2000 census is $23,194.

The Business Council works closely with SLIB in evaluating other funding that is being considered. Grant applications are generally only approved when the applicant shows some level of contribution to the project.

CDBG grant applications are due June 1st of each year, and decisions are made by October of that same year.

6.1.6 Capital Facilities Tax

Communities can take advantage of the statutory authority for countywide votes to be taken upon an additional 1% tax to fund capital facilities. Capital facilities taxes can be used to fund the types of improvements discussed in this study. However, in 1998, Sheridan County voters passed a capital facilities tax for various projects, including within Dayton. It is anticipated that it will be several years before the existing tax is retired, thus Dayton should not look to this funding alternative as an immediate source of funds.

6.2 POSSIBLE FUNDING SCENARIOS

As outlined in Section 5, discussions with Dayton town officials have led to the following recommendations.

- Phase 1 improvements dealing with construction of a new infiltration gallery and installation of VFD’s should be performed as soon as possible. The non-WWDC share of these costs can be funded via reserves currently in place within Dayton’s WTP reserve fund.
- As a telemetry system must be in place for the new pump station proposed for construction in 2002 to work in conjunction with the water level in Dayton’s storage tank, the first part of a SCADA system should be installed for this purpose. This work should also be performed in 2002, ideally as part of the 10” pipe replacement/pump station project.
- Phase 2 improvements (membrane filtration and SCADA system at the WTP, linkage of SCADA system to Town shop) should be postponed for a few years. Due to the fact that just recently Dayton had raised its water rates by 20%, and that another rate increase of approximately 12% will be required in Year 2003 the additional rate increases needed to fund the local share of the Phase 2 improvements should not be put in place at this time.

Table 6.1 portrays the costs associated with the Phase 1 improvements, allocating costs between a possible WWDC grant and Dayton’s WTP reserve fund. It is believed that all Phase 1 costs except for the fiber optic cable installation between the WTP and the proposed pump station (to be laid within the replacement pipe trench) are WWDC grant-eligible. As can be seen, Phase 1 improvements will require an expenditure of $130,159 of Dayton’s WTP reserve funds; however, no additional water rate increases are proposed to fund these improvements.
Despite the fact that it is likely that Dayton will not pursue the Phase 2 improvements at this time, Table 6.2 nonetheless portrays a possible funding scenario for these improvements, based upon 2003 costs. As these latter improvements are believed to not have components that are WWDC grant eligible, other sources of state and federal funds are portrayed. They include monies to be obtained from the State of Wyoming’s SLIB and the federal government’s RUS program. It is assumed that a SLIB grant will fund 50% of the project costs, and that the remaining 50% will be funded through a combination RUS grant/loan package, which will fund the remaining 50%. RUS bond issuance costs of $5,000 are included as a necessary cost in obtaining an RUS loan.

Based upon current RUS interest rates of 4 7/8% and a term of 30 years, the annual debt repayment amount for the $451,526 loan is $28,640.

The next several subsections of this report will identify the local costs to Dayton water customers to fund these Phase 2 improvements, even though Dayton is likely to not proceed forward with the Phase 2 improvements at this time.

### 6.3 DETERMINATION OF EQUIVALENT DWELLING UNITS

Many water service providers and funding agencies use the number of equivalent dwelling units (EDU’s) when determining the number of system users. An EDU is the level of service provided to a typical residential dwelling. For purposes of this study, one EDU is equivalent to one ¾” service line connection.
An inventory of current Dayton customers was conducted in September, 2001. The inventory included Dayton’s fire department personnel, whose water billings are paid by Dayton. Based upon this inventory, the number of EDU’s in Dayton is estimated to be 298, based upon the determinations made in Table 6.3.

Table 6.3
Equivalent Dwelling Units

<table>
<thead>
<tr>
<th>Size of Tap</th>
<th>Current # of Taps</th>
<th>EDU’s</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>¾”</td>
<td>284</td>
<td>1</td>
<td>284</td>
</tr>
<tr>
<td>2” ¹)</td>
<td>2</td>
<td>7.1</td>
<td>14.2</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>298.2</td>
</tr>
</tbody>
</table>

¹) 2” taps to Tongue River High School and Padlock Ranch

6.4 ANNUAL REVENUES, AND OPERATIONS AND MAINTENANCE EXPENSES

Listed in Table 6.4 are the estimated annual revenues and operations and maintenance (O&M) expenses for the year 2003. This year is utilized because it is anticipated that 2003 will be the first year that a debt payment will be required for the $224,400 loan obtained from the RUS for the pipeline replacement/pump station project scheduled for construction in 2002. Year 2003 is also the first year that a +/-12% water rate begins generating the revenue necessary for the annual RUS debt service payment required for the $224,400 loan. Costs are obtained from the February 2001 preliminary engineering report that accompanied Dayton’s funding application for the recently approved $224,400 loan and $224,400 grant. These projected Year 2003 costs have been somewhat modified from the 2001 preliminary engineering report based upon the following reasons.

- The cost for operators’ salaries has been decreased by an amount of $1,000 due to anticipated reduction in overtime hours. These personnel costs have historically been incurred during spring runoff, but should be reduced due to the proposed Phase 1 improvements anticipated to greatly reduce influent raw water turbidity.
- The cost for chemicals has been reduced by $1,400 due to the reduction in polymer anticipated as a result of the use of a membrane filtration system.
- The cost for utilities has been increased by an amount of $4,000 to cover additional power costs associated with the use of membrane filtration system.

Operators’ salaries shown are pro-rated for the time spent to operate and maintain the Dayton water system. These operators also work in other aspects of the services that Dayton provides to its residents, including solid waste collection, sewage collection and treatment, street maintenance, etc. Total water fund yearly expenses are shown in Table 6.4.
Table 6.4
Water Fund Estimated Operating Budget - Year 2003

<table>
<thead>
<tr>
<th>Operating Income</th>
<th>Estimated Budget</th>
</tr>
</thead>
<tbody>
<tr>
<td>User Charges</td>
<td>$82,469</td>
</tr>
<tr>
<td>Hookup Materials</td>
<td>$1,114</td>
</tr>
<tr>
<td>Plant Investment Fees (PIF)</td>
<td>$2,440</td>
</tr>
<tr>
<td>PIF – Interest</td>
<td>$2,652</td>
</tr>
<tr>
<td>Interest Income</td>
<td>$6,365</td>
</tr>
<tr>
<td><strong>Total Operating Income</strong></td>
<td><strong>$95,040</strong></td>
</tr>
<tr>
<td>Non-Operating Income</td>
<td></td>
</tr>
<tr>
<td>WRS Interest</td>
<td>$2,122</td>
</tr>
<tr>
<td><strong>Total Non-Operating Income</strong></td>
<td><strong>$2,122</strong></td>
</tr>
<tr>
<td>Operating Expenses and Debt Service (1)</td>
<td></td>
</tr>
<tr>
<td>Operators Salaries</td>
<td>$22,340</td>
</tr>
<tr>
<td>Employee Benefits</td>
<td>$5,835</td>
</tr>
<tr>
<td>Repairs &amp; Maintenance</td>
<td>$7,957</td>
</tr>
<tr>
<td>Building Insurance</td>
<td>$902</td>
</tr>
<tr>
<td>Materials &amp; Supplies</td>
<td>$3,925</td>
</tr>
<tr>
<td>Hookup Materials</td>
<td>$2,864</td>
</tr>
<tr>
<td>Supplies &amp; Postage</td>
<td>$350</td>
</tr>
<tr>
<td>Utilities</td>
<td>$11,957</td>
</tr>
<tr>
<td>Chemicals</td>
<td>$6,557</td>
</tr>
<tr>
<td>Water Tests</td>
<td>$1,273</td>
</tr>
<tr>
<td>Waterline Repairs</td>
<td>$5,305</td>
</tr>
<tr>
<td>Miscellaneous Expenses</td>
<td>$1,060</td>
</tr>
<tr>
<td>Capital Purchases</td>
<td>$0</td>
</tr>
<tr>
<td>Waterline Construction</td>
<td>$0</td>
</tr>
<tr>
<td>RUS Annual Debt Service Payment Expense (Pipeline Replacement/Pump Station Project)</td>
<td>$14,598</td>
</tr>
<tr>
<td>RUS Annual Debt Service Payment Expense (Phase 2 WTP Improvements)</td>
<td>$28,640</td>
</tr>
<tr>
<td>Reserve Account (10% of full RUS payment for 10 periods)</td>
<td>$4,324</td>
</tr>
<tr>
<td><strong>Total Operating Expenses and Debt Service</strong></td>
<td><strong>$117,887</strong></td>
</tr>
</tbody>
</table>

(1) Estimated Annual Depreciation Amount of $22,854 Not Included

As can be seen, the estimated operating expenses and debt service for the test year exceed the total operating and non-operating income by an amount of $20,725 (= $117,887 - $95,040 - $2,122). In order for this amount to be offset by user charges, water rates would have to increase by an amount of approximately 25%. Such an increase would be over and above the +/-12% rate increase required for implementation in 2003 to fund the $224,400 loan.

Based upon 298 EDU, this would mean that each EDU would be responsible for an additional $69.55 annually, or $5.80 per month per EDU, to offset the debt service associated with an RUS loan for the Phase 2 improvements in the amount of $451,528.

6.5 CURRENT FEES AND CHARGES

Dayton’s current monthly rates for water service are shown in Table 6.5. Dayton’s water rates were increased in FY99-00 to reach these listed values. This rate increase has provided for additional revenues totaling 20% above previous years.
Table 6.5
Dayton Water Rate Schedule - Existing

<table>
<thead>
<tr>
<th>CUSTOMER TYPE</th>
<th>USAGE/MONTH</th>
<th>MONTHLY RATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Unit</td>
<td>0-2,500 gal.</td>
<td>$12.40</td>
</tr>
<tr>
<td></td>
<td>&gt; 2,500 gal.</td>
<td>$0.75/1,000 gal.</td>
</tr>
<tr>
<td>Multi-complex (School &amp; Padlock Ranch)</td>
<td>0-11,250 gal.</td>
<td>$67.50</td>
</tr>
<tr>
<td></td>
<td>&gt; 11,250 gal.</td>
<td>$0.75/1,000 gal.</td>
</tr>
<tr>
<td>Outside Town Residential</td>
<td>0-2,500 gal.</td>
<td>$14.65</td>
</tr>
<tr>
<td></td>
<td>&gt; 2,500 gal.</td>
<td>$0.95/1,000 gal.</td>
</tr>
<tr>
<td>Existing Senior Citizens (1)</td>
<td></td>
<td>$6.75</td>
</tr>
</tbody>
</table>

(1) A total of ten (10) senior citizen accounts were given this rate at the time of the rate increase in early 2000. New senior citizen accounts are billed at the single unit rate.

Based upon the January 2001 preliminary engineering report submitted by Dayton to RUS, an additional rate increase is anticipated to be necessary to fund the pipeline replacement/pump station improvements identified in the Level I report that are slated for construction in 2002.

Plant investment and tapping fees are based upon the size of the meter, and are shown in Table 6.6.

Table 6.6
Dayton Plant Investment & Tapping Fees

<table>
<thead>
<tr>
<th>METER SIZE</th>
<th>FEE</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4&quot; x 5/8&quot;</td>
<td>$650.00</td>
</tr>
<tr>
<td>3/4&quot; x 3/4&quot;</td>
<td>$975.00</td>
</tr>
<tr>
<td>1&quot;</td>
<td>$1,220.00</td>
</tr>
<tr>
<td>2&quot;</td>
<td>$2,290.00</td>
</tr>
</tbody>
</table>

The most common meter sizes are listed above. Dayton provides larger meters up to 6" in size. New services are charged an additional $50.00 deposit that is refunded after two years of service. The customer is responsible for the cost of the meter and all material for the service.

6.6 PROPOSED RATE SCHEDULE

In order to fund the proposed Phase 2 improvements, an additional $5.80/month must be collected for each EDU receiving water service. This amount is over and above the additional amount of $2.27/month required by Year 2003 to offset the $224,400 RUS loan for the pipeline replacement/pump station project.

In order for Dayton to be assured that the necessary amount is collected, it is recommended that the rate increase required for the Phase 2 improvements be obtained merely be increasing the minimum monthly charge vs. increasing the cost for water. In this way, years of high precipitation (and thus lower water revenues) will not impact the ability of Dayton to collect the necessary revenues. Additionally, as the vast majority of the increase is needed for the debt service associated with retiring the loan in lieu of additional operating costs, the debt service is seen as a fixed vs. variable cost. Therefore, it makes good economic sense to use the base charge to fund such a fixed cost.
Table 6.7 depicts the proposed rate schedule for Dayton if the Phase 2 improvements are implemented along with the proposed pipeline replacement/pump station project slated for construction in 2002.

### Table 6.7

<table>
<thead>
<tr>
<th>Customer Type</th>
<th>Usage/Month</th>
<th>Monthly Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Unit</td>
<td>0-2,500 gal.</td>
<td>$20.47</td>
</tr>
<tr>
<td></td>
<td>&gt; 2,500 gal.</td>
<td>$0.75/1,000 gal.</td>
</tr>
<tr>
<td>Multi-complex (School &amp; Padlock Ranch)</td>
<td>0-11,250 gal.</td>
<td>$124.80</td>
</tr>
<tr>
<td></td>
<td>&gt; 11,250 gal.</td>
<td>$0.75/1,000 gal.</td>
</tr>
<tr>
<td>Outside Town Residential</td>
<td>0-2,500 gal.</td>
<td>$22.74</td>
</tr>
<tr>
<td></td>
<td>&gt; 2,500 gal.</td>
<td>$0.95/1,000 gal.</td>
</tr>
<tr>
<td>Existing Senior Citizens</td>
<td></td>
<td>$14.84</td>
</tr>
</tbody>
</table>

The WWDC 2000 water rate survey reports the average water bill in Wyoming to be $37.08, based upon a monthly use of 20,000 gallons. The January 2001 Preliminary Engineering Report prepared by EnTech for Dayton for the purpose of satisfying RUS requirements identified a usage amount within Dayton of 410 gal/day/EDU, or 12,470 gallons/month/EDU. Based upon the statewide usage of 20,000 gallons/month identified by the WWDC, a water bill for a Dayton customer at this monthly usage would be:

\[
$20.47 + (20,000 \text{ gal} - 2,500 \text{ gal}) \times 0.75/1000 \text{ gallons} = 33.60/\text{month}
\]

Using this comparison, a Dayton water customer using 20,000 gallons/month would pay $3.49 less than the state average even after the rate increase is implemented.

### 6.7 Comparison with Similar Communities

The Preliminary Engineering Report for Dayton dated January 2001 identified a usage amount within Dayton of 410 gal/day/EDU, or 12,470 gallons/month/EDU. Water rates from similar communities surrounding Dayton have been listed in Table 6.8 to provide for a comparison of rates.

### Table 6.8

<table>
<thead>
<tr>
<th>Community</th>
<th>Usage/Month</th>
<th>Monthly Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greybull</td>
<td>0-3,000 gal.</td>
<td>$19.95</td>
</tr>
<tr>
<td></td>
<td>&gt; 3,000 gal.</td>
<td>$0.50/1000 gal.</td>
</tr>
<tr>
<td>Basin</td>
<td>Base Rate</td>
<td>$20.50</td>
</tr>
<tr>
<td></td>
<td>&gt; 0 gal.</td>
<td>$0.75/1000 gal.</td>
</tr>
<tr>
<td>Buffalo</td>
<td>0-20,000 gal.</td>
<td>$17.80</td>
</tr>
<tr>
<td></td>
<td>&gt; 20,000 gal.</td>
<td>$0.35/1,000 gal.</td>
</tr>
<tr>
<td>Ranchester</td>
<td>0-2,000 gal.</td>
<td>$14.00</td>
</tr>
<tr>
<td></td>
<td>Varies based upon usage</td>
<td>Varies based upon usage</td>
</tr>
</tbody>
</table>
Table 6.9 provides a comparison of a typical Dayton monthly water bill with one in the communities listed in Table 6.8. Dayton’s average monthly water usage of 12,500 gallons was used for this comparison.

### Table 6.9
Typical Monthly Water Bill
Comparison between Communities
Assuming 12,500 Gallons/Month Usage

<table>
<thead>
<tr>
<th>COMMUNITY</th>
<th>TOTAL BILL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dayton (existing rates)</td>
<td>$19.90</td>
</tr>
<tr>
<td>Dayton (with proposed rate increases)</td>
<td>$27.97</td>
</tr>
<tr>
<td>Ranchester</td>
<td>$18.70</td>
</tr>
<tr>
<td>Buffalo</td>
<td>$17.80</td>
</tr>
<tr>
<td>Greybull</td>
<td>$24.70</td>
</tr>
<tr>
<td>Basin</td>
<td>$29.80</td>
</tr>
</tbody>
</table>
7. **ENVIRONMENTAL REPORT**

The RUS requires that an Environmental Report (ER) be prepared for all projects receiving federal funding. The ER is completed during the preliminary design phase of the project and includes a detailed analysis of the effects that the proposed project will have on the following environmental resources:

- Land Use/Important Farmland/Formally Classified Land
- Floodplains
- Wetlands
- Cultural Resources
- Biological Resources
- Water Quality Issues
- Socio-Economic Environmental Justice Issues.

The ER summarizes the influence on these factors and describes mitigation measures for all resources affected by the project.

In June, 2001, EnTech, with the assistance of the WWDC staff, submitted letters to various state and federal agencies, requesting their input on the proposed improvements at the Dayton WTP site. At the time that the letters were sent out, it was not specifically known if any improvements were to be constructed. As a result, the letter attempted to identify the broad area within which any improvements would be constructed.

Attached as Appendix E is the ER for this project. As stated in Section 6, at this time Dayton does not contemplate requesting funding from RUS for its Phase 1 improvements. Instead, Dayton plans to draw upon existing reserves within its WTP fund to fund the non-WWDC eligible components of the project. This amounts to $130,159. However, it is possible that Dayton may soon decide to implement Phase 2 of the proposed improvements, at which time it may be necessary to request RUS funding assistance. Additionally, Dayton may change its mind about requesting RUS funding for its Phase 1 improvements. In either event, and in order to be considered for RUS funding, RUS will require that issues raised by the state and federal agencies be successfully addressed. Indeed, it is assumed that most, if not all, of the issues raised will require successful mitigation, regardless of whether or not the RUS is a funding agency.

Assuming that a Nationwide 404 permit can be obtained from the USCOE, it appears that the most substantial item that must be addressed is the scheduling of the proposed improvements in the Tongue River associated with installation of the new infiltration gallery (part of the Phase 1 improvements). Such installation must be performed in conjunction with the dates for spawning of trout and migratory habits of eagles and migratory birds. Based upon letters received from the Wyoming Game & Fish Department and the U.S. Fish & Wildlife Service, it appears that such scheduling can be achieved without a great deal of difficulty or cost. There also must be notification provided to the Town of Ranchester’s WTP personnel during those construction periods when turbidity levels may temporarily rise in the Tongue River, or immediately after the infiltration gallery is backwashed.

Phase 2 improvements, being proposed essentially within the existing WTP building, should pose little or no environmental impact.
8. SUMMARY AND PATH FORWARD

Summary

The original scope of this study was to evaluate two diversion facility alternatives for the Dayton WTP, and to evaluate the applicability and cost associated with a SCADA system for the WTP and Dayton water system. This scope was expanded to include a review of the feasibility of installing a membrane filtration system at the Dayton WTP.

Results of this study can be summarized as follows.

1. Both Alternatives A (replace/reconstruct infiltration gallery) and B (construct pre-sedimentation basin) require the installation of VFD’s on the existing raw water pumps to be effective in WTP operations.

2. Alternative C (membrane filtration system) can provide a superior method of producing high quality water from the Dayton WTP. Its implementation can allow Dayton to meet future turbidity standards as required by the Safe Drinking Water Act, while at the same time reduce chemical and personnel-related overtime costs. This alternative, however, represents a significant additional capital expense to Dayton. It also requires the installation of either Alternative A or B, due to the need for pretreatment of water prior to use of the membrane filtration system.

3. The recommended alternative is Alternative A, Schedule A-2, which is the installation of a new infiltration gallery with both air and water backwash capabilities. This alternative includes the installation of VFD’s on the existing raw water pumps.

4. Alternative A, Schedule A-2 should be completed as part of Phase 1 improvements, which would also include:
   • the installation of a SCADA connection between the proposed new pump station and existing water storage tank, and
   • the installation of fiber optic cable with the proposed 10” pipe replacement project slated for 2002, with this fiber optic cable being installed from the WTP to the proposed new pump station.

5. Certain improvements should be completed at a later date as determined by Dayton. These improvements are defined as Phase 2, and include:
   • installation of a membrane filtration unit at the WTP;
   • installation of a SCADA system at the WTP; and
   • installation of a SCADA connection to the Dayton town shop from the proposed new pump station.

Path Forward

Based upon the above summary, the following items provide for a path forward.

1. Approach the WWDC immediately for a Level III grant for the amount of $121,811 to fund design and construction of WWDC-eligible Phase 1 project components. The Phase 1 improvements are identified in Table 8-1.
The objective should be to have this request considered by the 2002 State Legislature.

2. Utilize Dayton WTP reserve funds to finance the non-WWDC eligible, Phase 1 project components, estimated at $130,159.

3. Once WWDC funds are procured, and sometime after July 1, 2002, award a design contract for designing the Phase 1 project improvements.

4. After procurement of the necessary permits from the WDEQ and the USCOE, award a construction project to allow for construction of the Phase 1 improvements, to be performed in the winter of 2002-2003. The work should be performed in accordance with concerns of the Wyoming Game & Fish Department and U.S. Fish & Wildlife Service relating to fish spawning and critical habitat times.

5. Complete construction of these Phase 1 improvements prior to spring runoff in 2003.

6. At such time that Dayton believes that it is necessary, submit a grant application to the SLIB and a grant/loan application to the RUS to fund the Phase 2 improvements. In order to fund the local share of the improvements via repayment of the RUS loan, it will be necessary to increase water rates by an average amount of $5.80 per month over and above the rates slated for implementation in 2003 to offset added debt service costs associated with the proposed pipeline replacement/pump station project. The costs and funding agency allocation for these Phase 2 improvements are shown in Table 8.2.

Table 8.1  
Phase 1 Improvements

<table>
<thead>
<tr>
<th>Cost Item</th>
<th>WWDC Grant</th>
<th>Dayton WTP Reserves</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construct inf. gallery, VFD installation</td>
<td>$99,739</td>
<td>$99,738</td>
<td>$199,477</td>
</tr>
<tr>
<td>Install SCADA connection between new pump station and tank</td>
<td>$22,072</td>
<td>$22,072</td>
<td>$44,144</td>
</tr>
<tr>
<td>Install fiber optic cable w/ 10” pipe replacement project – WTP to pump station</td>
<td>$0</td>
<td>$8,349</td>
<td>$8,349</td>
</tr>
<tr>
<td><strong>TOTALS</strong></td>
<td><strong>$121,811</strong></td>
<td><strong>$130,159</strong></td>
<td><strong>$251,970</strong></td>
</tr>
</tbody>
</table>

Table 8.2  
Phase 2 Improvements

<table>
<thead>
<tr>
<th>Cost Item</th>
<th>SLIB Grant</th>
<th>RUS Grant</th>
<th>RUS Loan</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Install membrane filtration upgrade at WTP</td>
<td>$751,087</td>
<td>$375,544</td>
<td>$375,544</td>
<td>$1,502,175</td>
</tr>
<tr>
<td>Install SCADA system @ WTP</td>
<td>$138,275</td>
<td>$69,137</td>
<td>$69,137</td>
<td>$276,549</td>
</tr>
<tr>
<td>Install SCADA connection to Town shop (from pump station)</td>
<td>$8,690</td>
<td>$4,345</td>
<td>$4,345</td>
<td>$17,380</td>
</tr>
<tr>
<td>RUS Bond Issuance Costs</td>
<td>$2,500</td>
<td>$2,500</td>
<td>$2,500</td>
<td>$5,000</td>
</tr>
<tr>
<td><strong>TOTALS</strong></td>
<td><strong>$898,052</strong></td>
<td><strong>$451,526</strong></td>
<td><strong>$451,526</strong></td>
<td><strong>$1,801,104</strong></td>
</tr>
</tbody>
</table>
APPENDIX A

INFILTRATION GALLERY DESIGN CONSIDERATIONS
Infiltration Gallery Design Considerations

Regardless of choice of location, the overall design of the infiltration gallery will remain the same. To obtain a preliminary design typical stream placed infiltration gallery engineering practices were followed. The suggested typical infiltration design, tailored to Dayton’s flow needs and site conditions is as follows.

- Assume the desired influent rate to the WTP from the gallery is 1,050 gpm or 1.5 MGD, this provides a safety factor of 1.25 over the estimated peak hour 2020 need of 1.2 MGD. This safety factor will help to account for system line losses and plugging/silting of the screens over time.

- Assume 4 parallel screens are to be used, collecting a Q of 262 gpm each ( \( \frac{1050}{4} \) ). The radius of the screen will adhere to the formula

\[
V = \frac{2.228E^{-3} \cdot Q}{\pi \cdot r^2},
\]

where V equals the axial velocity inside the screen and should not exceed 3 ft/s. Solving the equation for r gives screen radius of 0.25 ft and subsequent diameter of 0.50 feet or 6 inches.

- The overall length (L) in feet of the screen required for the gallery can be determined from Q in gpm, d ( depth in feet to center of screen from bottom of stream, 3.5 feet is a typical design d ), r ( radius in feet as solved above ), K ( hydraulic conductivity of bedding material = washed course 10-20 sand ~ 11,000 gpd/ft² ), and H ( feet of head above center of screen, assume 0.5 feet in channel at low flow, 4.0 feet ) by

\[
L = \frac{528 \cdot Q \cdot \log \left( \frac{1.1 \cdot d}{r} \right)}{0.25 \cdot K \cdot H}.
\]

For the conditions assumed above L = 14.9 feet for each of the 4 screens used.

- Four six inch diameter, 15 foot 304SS screens will be placed perpendicular to the river channel 10 feet apart.
• Filter pack material is chosen based on the particle size of the fines to be filtered out of the influent water. A sample of the sediments collected in the Dayton WTP wet well responsible for the high turbidities was taken for analysis to Intermountain Labs (IML) in Sheridan. Results are shown in Table 1. From these results a filter pack material of 10-20 silica sand was chosen. A rule of thumb for infiltration gallery filter pack is to use material having a permeability of 2 to 5 \( \frac{gpm}{ft^2} \), and filter pack size 6 times the 70\% retained size.

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Size (inches)</th>
<th>weight</th>
<th>% retained</th>
<th>% passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sieve initial weight</td>
<td></td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#60</td>
<td>0.0097</td>
<td>34.7</td>
<td>34.7</td>
<td>65.3</td>
</tr>
<tr>
<td>#200</td>
<td>0.0029</td>
<td>56.0</td>
<td>56.0</td>
<td>9.3</td>
</tr>
<tr>
<td>#270</td>
<td>0.0021</td>
<td>5.6</td>
<td>5.6</td>
<td>3.7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>% of sample</th>
<th>&lt; size</th>
<th>Texture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sand</td>
<td>84</td>
<td>0.02</td>
</tr>
<tr>
<td>Silt</td>
<td>12</td>
<td>0.002</td>
</tr>
<tr>
<td>Clay</td>
<td>4</td>
<td>0.0002</td>
</tr>
</tbody>
</table>

- The screen slot size is chosen based on the necessary filter pack material and should be small enough to retain the filter pack. For 10-20 sand 0-10\% of the cumulative weight passes 0.0335 inches. A slot size of 30 slot (0.030 inches) would be appropriate for the screen.
- The screens will be extended with 6 inch steel piping on the WTP side of the river to the raw water intake at the WTP wet well.
- The screens should be valved independent of each other so that one screen can be backwashed while the three remaining screens produce
influent to the raw water pump. Backwashing should be done upstream to downstream to reduce suspended solids intake from backwashing into other functioning screens. Backwashing should be done using 500-1000 gpm per screen.

- The raw water pump could provide the necessary pumping for backwash to the screens, appropriate valving will need to be installed to allow this.
- Optionally with this design 2 inch PVC slotted air pipe could be laid one foot above each screen (approximately two feet below the stream bed within the filter pack) and used to aid backwash by circulating air in the filter pack during backwash pumping. This would entail appropriate manifolding and valving of the air line to a compressor station. The backwashing air rate should be around 400 cfm.
APPENDIX B

GRADATION ANALYSIS OF SEDIMENT IN RAW WATER WET WELL
### Sieve Analysis

**Client Project ID:** Sieve Analysis  
**Date Received:** 07/23/01  
**Report Date:** 07/27/01

<table>
<thead>
<tr>
<th>Lab Id</th>
<th>Sample Id</th>
<th>Sand</th>
<th>Silt</th>
<th>Clay</th>
<th>Texture</th>
</tr>
</thead>
<tbody>
<tr>
<td>0101S13322</td>
<td>Dayton Muck</td>
<td>84.0</td>
<td>12.0</td>
<td>4.0</td>
<td>LOAMY SAND</td>
</tr>
</tbody>
</table>

**Abbreviations for extractants:**  
PE = Saturated Paste Extract,  
H2OSol = Water soluble,  
AB-DTPA = Ammonium Bicarbonate-DTPA,  
AAO = Acid Ammonium Oxalate  

**Abbreviations used in acid base accounting:**  
T.S. = Total Sulfur,  
AB = Acid Base,  
ABP = Acid Base Potential,  
PyrS = Pyritic Sulfur,  
Pyr+Org = Pyritic Sulfur + Organic Sulfur,  
Neut. Pot. = Neutralization Potential  

**Miscellaneous Abbreviations:**  
SAR = Sodium Adsorption Ratio,  
CEC = Cation Exchange Capacity,  
ESP = Exchangeable Sodium Percentage  

**Reviewed By:**  
Joey Sheeley  
Soils Lab Supervisor
Client: Environmental Design Engineering
Project: Sieve Analysis
Sample ID: Dayton Muck
Lab ID: 0101S13322

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Initial Weight</th>
<th>Weight</th>
<th>% Retained</th>
<th>% Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sieve Initial Weight</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sieve - #60</td>
<td>34.7</td>
<td>34.7</td>
<td>65.3</td>
<td></td>
</tr>
<tr>
<td>Sieve - #200</td>
<td>56.0</td>
<td>56.0</td>
<td>9.3</td>
<td></td>
</tr>
<tr>
<td>Sieve - #270</td>
<td>5.63</td>
<td>5.6</td>
<td>3.7</td>
<td></td>
</tr>
</tbody>
</table>

Date Received: 07/23/01
Date Reported: 07/27/01
Date Sampled: 07/23/01

Reviewed By:  

1633 Terra Avenue  
Sheridan, WY 82801
APPENDIX C

TOTAL SUSPENDED SOLIDS ANALYSIS
ON RAW WATER SAMPLES
Client: Environmental Design Engineering
Project: Dayton WTP
Sample ID: WTP-5-13-01
Lab ID: 0101W13328
Matrix: Water
Condition: Cool/Intact

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Analytical Result</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Suspended Solids</td>
<td>128 SR</td>
<td>mg/L</td>
</tr>
</tbody>
</table>

SR - Sample received past holding time.


Reviewed By: Marv Simmons, Lab Manager
Client: Environmental Design Engineering
Project: Dayton WTP
Sample ID: WTP-5-14-01
Lab ID: 0101W13329
Matrix: Water
Condition: Cool/Intact

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Analytical Result</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Suspended Solids</td>
<td>280 SR</td>
<td>mg/L</td>
</tr>
</tbody>
</table>

SR - Sample received past holding time.


Reviewed By: [Signature]
Mary Simmons, Lab Manager
Client: Environmental Design Engineering
Project: Dayton WTP
Sample ID: WTP-5-15-01
Lab ID: 0101W13330
Matrix: Water
Condition: Cool/Intact

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Analytical Result</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Suspended Solids</td>
<td>480 SR</td>
<td>mg/L</td>
</tr>
</tbody>
</table>

SR - Sample received past holding time.

**Client:** Environmental Design Engineering  
**Project:** Dayton WTP  
**Sample ID:** WTP-5-16-01  
**Lab ID:** 0101W13331  
**Matrix:** Water  
**Condition:** Cool/Intact  

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Analytical Result</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Suspended Solids</td>
<td>28 SR</td>
<td>mg/L</td>
</tr>
</tbody>
</table>

SR - Sample received past holding time.


Reviewed By: [Signature]

Marv Simmons, Lab Manager
APPENDIX D

A&E SCADA REPORT AND PRELIMINARY DRAWINGS
TOWN OF DAYTON – SCADA SYSTEM

The existing Supervisory Control and Data Acquisition (SCADA) system operating at the Town of Dayton consists of two independent entities operating separately. Please find detailed below a brief description of the existing systems in Section I. In Section II, please find recommended upgrades and options.

Section I – Existing Systems

A) PLANT: The control system originally supplied with the water plant operates and controls four (4) operational sand bed filters and two non-operational filters. The system serves to monitor and maintain the level in a finished water clear well at the plant. The four filters can produce approximately 700 GPM. The existing control system is composed of equipment and components thought to be manufactured in the late 60s or early 70s. The system is operational, but has both functional problems and obsolete controls. Performance will likely degrade as time passes. In addition, increased maintenance and operator attendance will be required in the future.

The existing control system cannot be allowed to automatically backwash any or all of the six (6) filters, because the requirement to disallow the backwash of more than one filter at a time is not in place. Additionally the interface between the main control system and filters 5 and 6 has failed and is completely unreliable. These nuances, combined with the ability to meet current demand using only four (4) filters, have resulted in the retirement of Filters 5 and 6.

An automatic telephone dialer is currently in service. This unit alarms operations personnel upon events such as power loss or low clear well level.

B) EXISTING TANK LEVEL TRANSMITTER: A level transmitter is currently installed in a manhole near the town distribution storage tank. This transmitter provides a low voltage signal to an existing infrared transmitter mounted on the tank. Both the infrared transmitter and the tank level transmitter are powered via a solar cell. This sub-system is battery backed.

At the existing tank inlet pump station, the receiving end of the infrared transmitter is located above the vault. This device provides a low voltage signal to an existing control panel that cycles the pumps based upon tank level. The existing control system provides for pump alternation and protection.
There is no direct indication of the pump station status at the water plant via the existing system.

Section II – Recommendations and Options

A) Existing Water Plant

1) Control Panel

It is recommended that the existing mechanical relays and timers be upgraded to the current Programmable Logic Controller (PLC) technology now available. This can be accomplished by mounting the PLC in the existing control cabinet. There is ample room in the cabinet and existing field wiring will allow for removal of the old relays and timers without excessive demolition. The new PLC may be installed and connected to existing field wiring via the existing terminal blocks in the existing control panel. Some of the existing relays will be re-utilized for electrical protection of the PLC, some relay bases will be removed, and terminal blocks or other termination equipment will be installed in their place.

The new PLC will allow plant operations personnel much greater flexibility in the operation of the facility. Existing hardwired controls and timers that are very difficult to change may be easily modified to optimize plant operation with a few simple keystrokes.

A Man Machine Interface (MMI) must be installed in the door of the existing control panel. The MMI is a CRT based device used to provide local control and monitoring at the plant. From the MMI, the operator may adjust and control the system while he is on site at the plant.

This PLC will also communicate to a similar PLC provided with any new micro-filtration equipment that may possibly be installed. Communications between the two PLCs will be over a network that allows for complete operational monitoring and control through one small cable. Software interface between two PLCs will be required. This interface will require that a specification for required control be developed prior to construction at the plant or fabrication of any equipment. It is highly recommended that the PLC equipment controlling both the plant and any micro-filtration equipment be manufactured by the same company.

2) Existing Water Plant Instrumentation Upgrades

a) Raw Water Inlet Area - Please reference PID-1

The following new or upgraded equipment is recommended for the raw water inlet area:
1) Tag VFD-310 and VFD-320 - Replace existing across the line motor starters with Variable Frequency Drives (VFD) with bypass capability. The VFD will allow the operator to develop an automatic setpoint to maintain a desired control strategy. This may involve maintaining constant filter levels and/or maintaining constant clear well level. The VFDs may eliminate the need for an existing flow control valve (often requiring maintenance), and may also reduce the number of times the pumps currently start and stop. The VFDs will offer a cost savings with respect to long term energy consumptions, and will provide for longer life of the raw water pumps and motors.

Please note the existing plant operates well utilizing the existing level switches and controls, and the VFDs may be considered optional. The existing plant makes use of a level control valve which has been problematic, however.

As an aside, it is highly recommended that the incoming utility service be equipped with a Transient Voltage Surge Suppression (TVSS) device to protect the plant electronics.

2) Tag LIT-300 - Analog level transmitter installed in the raw water chamber to provide a continuous level signal of the raw water level.

3) Tag FQIT-300 – Inlet Flowmeter to provide continuous flow signal to new control system. Information will be utilized to pace any chemical additive.

4) Tag AIT-300 – Raw water turbidimeter information used to determine need for pre-filtration if micro-filtration is in place. Such information will also be used for trending and reports.

5) Tag ZSO-601,-606 and ZSC-601,-606 - Limit switches are proposed to be installed on existing valves to provide new control system with signal confirming Full Open (ZSO) or Full Closed (ZSC) status of valve. These signals will be used as a valuable tool to alarm a process sequence failure.

6) Tag LIT-601 – Inlet channel level transmitter to provide exact level of inlet channel to the four filters currently in service. This signal will be used for VFD control, and to alarm if the channel becomes out of bounds.

b) Filters 1-4. Please reference PID-2-5

Upgrades are identical for filters 1 through 4. The notation utilized on these drawing shows an asterisk “*” as the second digit of the three digit tag number, (ie AE-6*1). The asterisk represents the filter number. So replacing the asterisk with a 1 to make AE-611 would represent the specific turbidimeter for filter number 1, replacing the * with a 2 would represent the turbidimeter for filter number 2, etc.

1) Tag AE-6*1 Filter effluent turbidimeter. This device will be utilized to monitor the water exiting each filter, and confirm filter is operating correctly.

2) Tags ZSC-6*1,-6*2,-6*3 and ZSO-6*1,-6*2,-6*3. Valve position limit switches shall be mounted on existing effluent, backwash and filter to waste valves. These
existing valves are currently controlled by the local control system. The limit
switches will provide valve position information to the SCADA system. The
system and operator will know the status of each valve, open or closed.

3) TAG PIT-6*1 Filter Outlet Pressure. This signal, along with filter level, is utilized
with the inlet level transmitter to determine head loss. Head loss is used to infer
the permeability (cleanliness) of the filter media, and is used to determine whether
a backwash is required.

4) Please note that no modifications to Filters 5 and 6 are planned. We are advised
that these filters are currently not in use, and their current location may be used
for micro-filtration expansion that might occur in the future.


1) Tag FT-681 Effluent Flowmeter – Provides total flow from filters 1-4.
   Recommend to be replaced with a magnetic flow meter. This meter type supplies
   the best accuracy and does not create a discernable head loss.

2) Tag LIT- 700 Clear Well Level Transmitter. Provides analog signal to the control
   system to confirm storage volume. Provides alarm if Clear Well level becomes
   out of bounds. May be used as a demand side control strategy to determine inlet
   pump rates or run/no-run conditions.

3) Tag AIT-701 – Effluent Turbidimeter. This unit monitors the turbidity of water
   leaving the plant. Data obtained from this unit will also be utilized for monthly
   reporting requirements.

4) Tag AIT-702 – Residual Chlorine Analyzer. This device will monitor chlorine
   residual to ensure correct dosage as water leaves clear well. May be used to pace
   chlorine injection rates via residual trim control. Data will also be used in
   monthly reporting.

d) Sludge Systems. Please reference PID-9

1) Tags HSA-751,-761,-771 Pump Control Switches. Provide a new 3 position hand
   switch to allow for both local and remote control and provide input to the control
   system signaling responsibility for control. The existing pumps are controlled by
   level switches wired to the existing control panel. The SCADA system will have
   knowledge of both the run status of the pumps as well as their local or remote
   positions.

e) Instrument Air System. Please reference PID-10

1) Tag PSLL-951. Low/Low instrument air pressure alarm. This is a critical alarm
   that may be programmed to invoke any desired remedial measures, and may cause
   an emergency call out. The plant valves will not operate correctly if air supply is
   too low. Thus, the need for filter backwash cannot be accommodated, and
   returning a washed filter to an online state cannot be accommodated.

2) Tag LIT-700. Measures Clearwell level. Using the area of the clearwell, this may
   also be used to display the volume of finished water in gallons. It may be
desirable to abandon the existing bubbler system currently measuring the clearwell level if LIT-700 is installed. The existing bubbler is equipped to alarm if the level is too high or too low, but cannot advise the SCADA system of the instantaneous clearwell level.

f) Chlorination System. Please reference PID-8
   1) Tag FCV-801. Chlorine pacing valve-inlet water. Allows the flow rate of existing gaseous chlorine to be regulated based upon inlet water flow rate. The ability to pace the chlorine helps to prevent under or over-chlorination.
   2) Tag FCV-881. Chlorine pacing valve-effluent water. Allows the flow rate of existing gaseous chlorine to be regulated based upon effluent water flow rate. The ability to pace the chlorine helps to prevent under or over-chlorination.
   3) Tag FCV-882. Chlorine pacing valve-effluent water. Allows the flow rate of existing gaseous chlorine to be regulated based upon effluent water flow rate. The ability to pace the chlorine helps to prevent under or over-chlorination.

The new control system is sized to accept inputs from the existing Chlorine monitoring system.
NOTE: If future considerations determine a liquid sodium hypochlorite system is advantageous, the proposed control system is sufficiently sized to control such a system.

B) Existing Water Tank

The existing infrared device and level transmitter at the water tank will be removed and abandoned. This technology has been reported to be un-reliable during snow or frost conditions. The infrared technology cannot be utilized between the tank and the proposed new pump station to be located near the Tongue River High School.

A new level (hydrostatic head pressure) transmitter should be installed to replace the existing unit, since the existing device is aging and unreliable, and does not represent the newest technology available. A new isolation valve should also be installed to isolate the transmitter from the water line. This new transmitter should be installed in the flowing line and in a vault or in such a fashion such that freezing is prevented.

A new solar power system will be required to replace the existing semi-functional solar power system. This system will be sized to provide necessary power for 7 days during overcast skies in February. The solar system will provide necessary power at the tank for either fiber optic or radio communications method used between the tank and the new pump station. The system will also power the level transmitter.

C) New Pump Station

A new Remote Terminal Unit (RTU) is proposed for installation in the new pump station planned for construction on the northwest side of the high school. This RTU will accept the new level signal (radio or fiber optic) from the existing tank. This unit will also
control the alternation of the new tank supply pumps. The RTU will be supplied with a small MMI to allow a local operator at the pump station to view tank levels, modify pump run times, tank level setpoints, etc. Pumps will turn on/off based upon tank level.

If it would benefit operations personnel to know the flow rate leaving the pump station, a magnetic flow meter could be incorporated at the site. The RTU would monitor the flow meter and have this information available for local or remote display. The RTU would provide both instantaneous and totalized flow rates.

D) SCADA Host

A SCADA Host Computer will provide complete remote monitoring and control capabilities for operations personnel and will be located at the town shop. This SCADA host package will consist of the following:

- Pentium Based Computer with 19” Monitor
- Commercially Manufactured Operator Interface Software Package
- Report Generation Software Package
- Laser Printer
- Communications Hardware and Software
- Telephone Alarm Callout Hardware and Software
- Remote Access Hardware and Software Capability
- Uninterruptible Power Supply

The SCADA Host Software will be configured to allow for continuous monitoring and control of the Water Plant, New Pump Station, and/or Water Tank. Each location will be sequentially polled if a radio/telephone communications system is selected. Each station will become a “node” on a network if a fiber optic system is installed.

The SCADA Host will provide alarms and callout operators in an emergency. From the Host, the operator will be able to perform control functions such as pump START / STOP, valve OPEN / CLOSE, Backwash INITIATE, filter ONLINE / OFFLINE selection, as well as many other functions.

The SCADA Host will also store and develop any recurring reports that must be generated and provided to third parties. These reports may include information on turbidity, chlorine residual, flow rates or totals.

The remote access capability of the SCADA HOST will allow operators to interface to the Host via a remote portable or desktop computer from their homes or any other site. This function also allows service personnel from the SCADA supplier or Micro-filtration equipment manufacturer to remotely gain access for diagnostic or troubleshooting assistance.

E) Communications Alternatives
1) Water Tank to New Pump Station

Between the new pump station and the water tank there are two realistic communication choices: radio transmission or fiber optic cables. After review of the sites, the fiber optic is the preferred choice based upon operation, accuracy, speed, and reliability. Direct burial fiber optic cable may be installed 24”-30” below grade in the same trench carrying the new water line to the existing tank. Tank level information will be transmitted to the new pump station controls over this fiber line and provide a dedicated control loop between the tank and the pump station. The fiber is non-metallic and experiences little if any degradation due to soil or water contact. In addition, fiber will not provide any conducting path for lightning typically exhibited by metallic conductors.

Radio communications for this link is most likely also feasible. A site-specific physical radio survey would be required to confirm actual signal path characteristics. Visual inspection indicates an antenna would have to be installed on a mast either at the tank or on the hill adjacent to the tank. A second antenna would be installed on a mast at the pump station or on the high school near the pump station. Data transmission over a radio link would be much slower than fiber optics, and based upon experience, may require more long-term maintenance due to cable degradation, lightning or other power surges and equipment failures.

2) Water Plant to Pump Station

Two effective communications methods are available between the water plant and the proposed new pump station. These are fiber optic or a dedicated phone line leased from the local telephone service provider.

The fiber optic system is the again the system of choice. The direct burial fiber cable may be installed in the same pipe trench that will be opened between the water plant and the proposed new pump station when the proposed new 12” pipe between the two is upgraded. The advantages of the fiber are the same as those detailed in E.1. In addition, rural telephone circuits are often not capable of long term effective data transmission. This could effectively preclude the Town from taking full advantage of the capabilities of the new SCADA technology.

The one advantage to utilizing a dedicated phone line leased from the telephone company is the lower capital investment. If the telephone company can provide a leased circuit and has the actual wires to the plant, then initial installation costs will be much lower than the fiber system. There will be the much less efficient communications capability, however, and as discussed earlier, a monthly lease cost estimated at $200-$300/month.

3) Pump Station to Town Shop – Radio or Fiber Optics

The method(s) chosen above to communicate from the Tank to the new Pump Station and from the Water Plant to Town Shop will govern the choice of whether fiber optics or
It is theoretically possible to use radio communications from the proposed pump station to the Shop even if fiber is used in all other communications. As with the treatise above, a radio path must be surveyed before reliable radio communications may be assured. Similar to the above, the direct burial of fiber optics cabling seems to be the most reliable and provides the greatest data transfer capacity.

If elected, the fiber optic cable from the proposed new pump station will have to be routed to the town shop. This is a relatively short distance (approximately ¼ mile) and may require a combination of direct burial and overhead installation on existing poles (if the utility owning the poles will permit such an installation). Any overhead fiber should be installed on existing poles. The power and communications providers for the area should be contacted by the final design group to confirm the feasibility of utilizing existing poles for support of any overhead fiber. It is recommended that the fiber link between the proposed new pump station and the town shop be installed when the link between the tank and the proposed new pump station is installed. The contractor providing this service will probably have asphalt cutting and patching equipment and material on site; perhaps allowing for the realization of a cost savings for underground fiber runs.

Attached please find BUDGETARY estimates for equipment and installation. These estimates were developed based upon existing drawings and information provided by the owner. These estimates should be utilized for budget purposes only.
<table>
<thead>
<tr>
<th>Item No.</th>
<th>Tag / Description</th>
<th>Qty</th>
<th>Unit</th>
<th>Unit Price</th>
<th>Extended Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.1</td>
<td>Modify Existing Water Plant Control Panel - Hardware &amp; Software</td>
<td>1</td>
<td>lot</td>
<td>$45,000.00</td>
<td>$45,000.00</td>
</tr>
<tr>
<td>A.2.a.1</td>
<td>Tags VFD-310, 320</td>
<td>2</td>
<td>ea</td>
<td>$5,000.00</td>
<td>$10,000.00</td>
</tr>
<tr>
<td>A.2.a.2</td>
<td>Tag LIT-300 Analog Level Transmitter</td>
<td>1</td>
<td>ea</td>
<td>$1,200.00</td>
<td>$1,200.00</td>
</tr>
<tr>
<td>A.2.a.3</td>
<td>Tag FQIT-300 Inlet Flowmeter</td>
<td>1</td>
<td>ea</td>
<td>$7,000.00</td>
<td>$7,000.00</td>
</tr>
<tr>
<td>A.2.a.4</td>
<td>Tag AIT-300 Raw Water Turbidimeter</td>
<td>1</td>
<td>ea</td>
<td>$5,000.00</td>
<td>$5,000.00</td>
</tr>
<tr>
<td>A.2.a.5</td>
<td>Tag AIT-301 Streaming Current Detector</td>
<td>1</td>
<td>ea</td>
<td>$12,000.00</td>
<td>$12,000.00</td>
</tr>
<tr>
<td>A.2.a.6</td>
<td>Tags ZSO-601 &amp; ZSC-601 Limit Switches</td>
<td>1</td>
<td>set</td>
<td>$1,250.00</td>
<td>$1,250.00</td>
</tr>
<tr>
<td>A.2.a.7</td>
<td>Tag LIT-601 Inlet Channel Level Transmitter</td>
<td>1</td>
<td>ea</td>
<td>$1,200.00</td>
<td>$1,200.00</td>
</tr>
<tr>
<td>A.2.b.1</td>
<td>Tag AE-6*1 Filter Effluent Turbidimeter</td>
<td>4</td>
<td>ea</td>
<td>$2,500.00</td>
<td>$10,000.00</td>
</tr>
<tr>
<td>A.2.b.2</td>
<td>Tags ZSC-6<em>1, -6</em>2, -6<em>3 &amp; ZSC-6</em>1 Limit Switch</td>
<td>4</td>
<td>set</td>
<td>$3,000.00</td>
<td>$12,000.00</td>
</tr>
<tr>
<td>A.2.b.3</td>
<td>Tag PIT-6*1 Filter Outlet Pressure</td>
<td>4</td>
<td>ea</td>
<td>$1,400.00</td>
<td>$5,600.00</td>
</tr>
<tr>
<td>A.2.c.1</td>
<td>Tag FT-681 Effluent Flowmeter</td>
<td>1</td>
<td>ea</td>
<td>$7,000.00</td>
<td>$7,000.00</td>
</tr>
<tr>
<td>A.2.c.2</td>
<td>Tag LIT-700 Clear Well Level Transmitter</td>
<td>1</td>
<td>ea</td>
<td>$1,200.00</td>
<td>$1,200.00</td>
</tr>
<tr>
<td>A.2.c.3</td>
<td>Tag AIT-701 Effluent Turbidimeter</td>
<td>1</td>
<td>ea</td>
<td>$3,000.00</td>
<td>$3,000.00</td>
</tr>
<tr>
<td>A.2.c.4</td>
<td>Tag AIT-702 Residual Chlorine Analyzer</td>
<td>1</td>
<td>ea</td>
<td>$4,000.00</td>
<td>$4,000.00</td>
</tr>
<tr>
<td>A.2.d.1</td>
<td>Tags HAS-751, -761, -771 Pump Control Switches</td>
<td>1</td>
<td>set</td>
<td>$600.00</td>
<td>$600.00</td>
</tr>
<tr>
<td>A.2.e.1</td>
<td>Tag PSSL-951 Low/Low Instrument Air Pressure Alarm</td>
<td>1</td>
<td>ea</td>
<td>$450.00</td>
<td>$450.00</td>
</tr>
<tr>
<td>A.2.f.1</td>
<td>Tag FCV-801 Chlorine Pacing Valve-Inlet Water</td>
<td>1</td>
<td>ea</td>
<td>$3,500.00</td>
<td>$3,500.00</td>
</tr>
<tr>
<td>A.2.f.2</td>
<td>Tag FCV-881 Chlorine Pacing Valve-Effluent Water</td>
<td>1</td>
<td>ea</td>
<td>$3,500.00</td>
<td>$3,500.00</td>
</tr>
<tr>
<td>A.2.f.3</td>
<td>Tag FCV-882 Chlorine Pacing Valve-Effluent Water</td>
<td>1</td>
<td>ea</td>
<td>$3,500.00</td>
<td>$3,500.00</td>
</tr>
<tr>
<td>D</td>
<td>SCADA Host</td>
<td>1</td>
<td>lot</td>
<td>$38,000.00</td>
<td>$38,000.00</td>
</tr>
<tr>
<td>E</td>
<td>Fiber Cable (Installation by Excavating Contractor) WTP to Pump Station</td>
<td>11000</td>
<td>ft</td>
<td>$0.60</td>
<td>$6,600.00</td>
</tr>
</tbody>
</table>

**TOTAL** $181,600.00

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Tag / Description</th>
<th>Qty</th>
<th>Unit</th>
<th>Unit Price</th>
<th>Extended Price</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SCADA Equipment Installation - Conduit &amp; Wire</td>
<td>1</td>
<td>lot</td>
<td>$70,000.00</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>Existing Water Tank</td>
<td>1</td>
<td>ea</td>
<td>$9,000.00</td>
<td>$9,000.00</td>
</tr>
<tr>
<td>E</td>
<td>Fiber Cable (Installation by Excavating Contractor) Water Tank to Pump Station</td>
<td>3900</td>
<td>ft</td>
<td>$0.60</td>
<td>$2,340.00</td>
</tr>
<tr>
<td>E</td>
<td>Optional Radio Communications in lieu of fiber</td>
<td>1</td>
<td>lot</td>
<td>$7,500.00</td>
<td>$7,500.00</td>
</tr>
<tr>
<td>C</td>
<td>New Pump Station - Includes SCADA Equipment Installation</td>
<td>1</td>
<td>ea</td>
<td>$14,000.00</td>
<td>$14,000.00</td>
</tr>
<tr>
<td>C</td>
<td>Magnetic Flowmeter at Discharge &amp; Pump Station</td>
<td>1</td>
<td>ea</td>
<td>$7,000.00</td>
<td>$7,000.00</td>
</tr>
</tbody>
</table>

**Estimate - $8.00 ft. for fiber installed from New Pump Station to Town Shop - Overhead & Underground**

**Estimate - $1.00 per ft. for Fiber Optic Cable Installation by Excavating Contractor**
THIS DRAWING IS TO BE CONSIDERED PRELIMINARY AND IS NOT TO BE CONSIDERED FOR CONSTRUCTION USE.

EXISTING CONTROLS
THIS DRAWING IS TO BE CONSIDERED PRELIMINARY
AND IS NOT TO BE CONSIDERED FOR
CONSTRUCTION USE.

EXISTING CONTROLS

FILTERS 5 AND 6
PROCESS AND INSTRUMENT
DIAGRAM

AUTOMATION & ELECTRONICS, INC.
CITY OF DAYTON, WY
CITY OF DAYTON, WY

CUSTOMER

PID-6-7
PROPOSAL
NEW PLC

THIS DRAWING IS TO BE CONSIDERED PRELIMINARY AND IS NOT TO BE CONSIDERED FOR CONSTRUCTION USE.

EXISTING CONTROLS

FIELD

AIR COMPRESSOR (EXISTING)

EXISTING PRESSURE SWITCHES

EXISTING FILTERS

FIELD

INSTRUMENT AIR SYSTEM

PROCESS AND INSTRUMENT DIAGRAM

CUSTOMER: CITY OF DAYTON, WY

PHONE: (307) 234-9201
FAX: (307) 234-9438
WEBSITE: http://www.autoelect.com
EMAIL: sales@autoelect.com

AUTOMATION & ELECTRONICS, INC.

Casper, Wyoming

PID-10

HOLD IT MAY BE POSSIBLE TO RE-USE ONE OF THE EXISTING PRESSURE SWITCHES AS A LOW PRESSURE (AIR FAILURE) ALARM.
APPENDIX E

ENVIRONMENTAL REPORT
# TABLE OF CONTENTS

**Environmental Report**

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>E.1</td>
<td>PURPOSE AND NEED FOR PROJECT</td>
<td>E-1</td>
</tr>
<tr>
<td>E.1.1</td>
<td>Project Description</td>
<td>E-1</td>
</tr>
<tr>
<td>E.1.2</td>
<td>Purpose and Need for Project</td>
<td>E-1</td>
</tr>
<tr>
<td>E.2</td>
<td>ALTERNATIVES TO THE PROPOSED ACTION</td>
<td>E-2</td>
</tr>
<tr>
<td>E.3</td>
<td>AFFECTED ENVIRONMENT/ENVIRONMENTAL CONSEQUENCES</td>
<td>E-2</td>
</tr>
<tr>
<td>E.3.1</td>
<td>Land Use – General Use/Important Farmland, Prime Forest Land and Prime Rangeland/Formally Classified Lands</td>
<td>E-2</td>
</tr>
<tr>
<td>E.3.1.1</td>
<td>Affected Environment</td>
<td>E-3</td>
</tr>
<tr>
<td>E.3.1.2</td>
<td>Environmental Consequences</td>
<td>E-3</td>
</tr>
<tr>
<td>E.3.1.3</td>
<td>Mitigation</td>
<td>E-3</td>
</tr>
<tr>
<td>E.3.2</td>
<td>Flood Plains</td>
<td>E-3</td>
</tr>
<tr>
<td>E.3.2.1</td>
<td>Affected Environment</td>
<td>E-3</td>
</tr>
<tr>
<td>E.3.2.2</td>
<td>Environmental Consequences</td>
<td>E-4</td>
</tr>
<tr>
<td>E.3.2.3</td>
<td>Mitigation</td>
<td>E-4</td>
</tr>
<tr>
<td>E.3.3</td>
<td>Wetlands</td>
<td>E-4</td>
</tr>
<tr>
<td>E.3.3.1</td>
<td>Affected Environment</td>
<td>E-4</td>
</tr>
<tr>
<td>E.3.3.2</td>
<td>Environmental Consequences</td>
<td>E-4</td>
</tr>
<tr>
<td>E.3.3.3</td>
<td>Mitigation</td>
<td>E-5</td>
</tr>
<tr>
<td>E.3.4</td>
<td>Cultural Resources – Historic Property; Visual Aesthetics</td>
<td>E-5</td>
</tr>
<tr>
<td>E.3.4.1</td>
<td>Affected Environment</td>
<td>E-5</td>
</tr>
<tr>
<td>E.3.4.2</td>
<td>Environmental Consequences</td>
<td>E-5</td>
</tr>
<tr>
<td>E.3.4.3</td>
<td>Mitigation</td>
<td>E-5</td>
</tr>
<tr>
<td>E.3.5</td>
<td>Biological Resources – Threatened and Endangered Species; Fish and Wildlife; Vegetation</td>
<td>E-5</td>
</tr>
<tr>
<td>E.3.5.1</td>
<td>Affected Environment</td>
<td>E-5</td>
</tr>
<tr>
<td>E.3.5.2</td>
<td>Environmental Consequences</td>
<td>E-6</td>
</tr>
<tr>
<td>E.3.5.3</td>
<td>Mitigation</td>
<td>E-6</td>
</tr>
<tr>
<td>E.3.6</td>
<td>Water Quality Issues – Surface Water; Ground Water</td>
<td>E-6</td>
</tr>
<tr>
<td>E.3.6.1</td>
<td>Affected Environment</td>
<td>E-7</td>
</tr>
<tr>
<td>E.3.6.2</td>
<td>Environmental Consequences</td>
<td>E-7</td>
</tr>
<tr>
<td>E.3.6.3</td>
<td>Mitigation</td>
<td>E-7</td>
</tr>
<tr>
<td>E.3.7</td>
<td>Coastal Resources</td>
<td>E-8</td>
</tr>
<tr>
<td>E.3.8</td>
<td>Socio-economic Issues/Environmental Justice</td>
<td>E-8</td>
</tr>
<tr>
<td>E.3.8.1</td>
<td>Affected Environment</td>
<td>E-8</td>
</tr>
<tr>
<td>E.3.8.2</td>
<td>Environmental Consequences</td>
<td>E-8</td>
</tr>
<tr>
<td>E.3.8.3</td>
<td>Mitigation</td>
<td>E-8</td>
</tr>
<tr>
<td>E.3.9</td>
<td>Air Quality</td>
<td>E-8</td>
</tr>
<tr>
<td>E.3.9.1</td>
<td>Affected Environment</td>
<td>E-8</td>
</tr>
<tr>
<td>E.3.9.2</td>
<td>Environmental Consequences</td>
<td>E-9</td>
</tr>
<tr>
<td>E.3.9.3</td>
<td>Mitigation</td>
<td>E-9</td>
</tr>
<tr>
<td>E.3.10</td>
<td>Transportation</td>
<td>E-9</td>
</tr>
<tr>
<td>E.3.11</td>
<td>Noise</td>
<td>E-9</td>
</tr>
</tbody>
</table>
E.4 SUMMARY OF MITIGATION (FOR EACH RESOURCE)......................................................... E-9
  E.4.1 Land Use.................................................................................................................. E-9
  E.4.2 Flood Plains............................................................................................................. E-9
  E.4.3 Wetlands.................................................................................................................. E-9
  E.4.4 Cultural Resources – Historic Property; Visual Aesthetics.................................. E-10
  E.4.5 Biological Resources – Threatened and Endangered Species; Fish and Wildlife;
      Vegetation.................................................................................................................... E-10
  E.4.6 Water Quality Issues – Surface Water; Ground Water........................................... E-10
  E.4.7 Coastal Resources............................................................................................... E-10
  E.4.8 Socio-economic Issues/Environmental Justice....................................................... E-10
  E.4.9 Air Quality............................................................................................................. E-11
  E.4.10 Transportation....................................................................................................... E-11
  E.4.11 Noise..................................................................................................................... E-11

E.5 COST ANALYSIS OF MITIGATION REQUIREMENTS...................................................... E-11
E.6 CORRESPONDENCE....................................................................................................... E-11

**LIST OF FIGURES**

<table>
<thead>
<tr>
<th>FIGURE NO.</th>
<th>TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>LOCATION MAP</td>
</tr>
<tr>
<td>2</td>
<td>CROSS-SECTION OF INFILTRATION GALLERY AND FILTER PACK</td>
</tr>
<tr>
<td>3</td>
<td>PLAN VIEW OF INFILTRATION GALLERY AND PIPING</td>
</tr>
</tbody>
</table>
E.1 **Purpose and Need for Project**

E.1.1 **Project Description**

The Dayton Water Supply Project (the Project) is a project that would:

- improve the Town of Dayton’s (Dayton’s) ability to treat raw water from its source, the Tongue River, via construction of an infiltration gallery beneath the river (Phase 1 improvements) and installation of a membrane filtration unit within the existing water treatment plant (Phase 2); and
- improve Dayton’s ability to monitor and remotely operate the major components of Dayton’s water system via installation of a Supervisory Control and Data Acquisition (SCADA) system. Parts of the SCADA system are in both Phase 1 and Phase 2.

The Dayton water treatment plant (WTP) is located approximately two miles southwest of the Dayton town limits, within the SW1/4 of Section 1, T56N, R87W, Sheridan County, Wyoming. It is directly adjacent to the Tongue River (See Figure 1).

The proposed Phase 1 improvements (i.e., infiltration gallery installation) would be located beneath the Tongue River. A cross-section and plan view of the proposed infiltration gallery with respect to the current location of the WTP are depicted in Figures 2 and 3, respectively. As part of the Phase 1 improvements, the existing intake pipe and structure would also be replaced.

The Phase 2 improvements would be located entirely within the existing WTP building at the location shown in Figure 1.

E.1.2 **Purpose and Need for Project**

Raw water from the Tongue River during the spring runoff has elevated turbidity levels that oftentimes make treatment of this water very difficult and expensive. It is necessary to find a method to provide for pre-treatment of this water prior to entrance into the WTP. The Phase 1 improvements propose installation of the infiltration gallery to provide such pre-treatment. These improvements also include the installation of variable frequency drive units on the existing raw water pumps, as well as certain SCADA equipment needed for remote operation and monitoring of the existing water storage tank and the proposed new pump station.

Phase 2 improvements are proposed to address the increasingly stringent EPA Safe Drinking Water standards that will soon require the reduction of finished water turbidity to not exceed 0.3 NTU. This level compares to the current requirement of 0.5 NTU. In order to meet this more stringent standard, Phase 2 proposes to install the membrane filtration unit within the existing WTP building. Phase 2 will also provide for the installation of the SCADA system to allow communication among the components of both Dayton’s water distribution system as well as within the WTP itself.

The total cost to perform the Phase 1 improvements is estimated to be $251,970, of which the Wyoming Water Development Commission is being requested to fund $121,811. This work is anticipated to be performed during the late fall and wintertime period of late 2002 and early 2003.
The total cost to perform the Phase 2 improvements is estimated to be $1,801,104, of which it is anticipated that the Wyoming State Land and Investment Board would be requested to pay $898,052, and the U.S. Department of Agriculture’s Rural Utilities Service would be requested to provide both a $451,526 grant and $451,526 loan. Due to the relatively high cost associated with performing these Phase 2 improvements, there is no defined schedule for Dayton to move forward with the latter improvements.

E.2 Alternatives to the Proposed Action

The recommended Phase 1 improvements are necessary to alleviate existing raw water turbidity problems experienced by Dayton. The Dayton Water Supply Project – Level II Study performed by EnTech, Inc. of Sheridan, Wyoming and dated November 2001 evaluated an alternative to the installation of the infiltration gallery. This alternative proposed the construction of a presedimentation basin on the site of the existing WTP. This second alternative was not selected for the following reasons:

- The installation of the necessary facilities with this second alternative (pipelines upstream of the WTP or a second raw water pump station, and a new [but less extensive] infiltration gallery) were found to be more disruptive to the environment.
- There would be additional operation and maintenance costs required when compared to the infiltration gallery, including periodically cleaning the bottom of the presedimentation basin.
- The capital cost for installation of the second alternative is more expensive.

For the Phase 2 improvements, and assuming that Dayton would have to meet the Safe Drinking Water Act requirements, the alternative to the membrane filtration system would be to construct an entirely new WTP using treatment processes different than the current processes or membrane filtration system. Additionally, the alternative to constructing the Phase 2 SCADA system would be to not install such a system. This alternative would mean continued operational inefficiencies on the part of the Dayton WTP staff.

E.3 Affected Environment/Environmental Consequences

In June, 2001, EnTech, with the assistance of the WWDC staff, submitted letters to various state and federal agencies, requesting their input on the possible impacts due to proposed improvements at the Dayton WTP site. Correspondence received is discussed in this section, as well as the affected environment, any environmental consequences foreseen, and proposed mitigation for those consequences.

E.3.1 Land Use - General Land Use/Important Farmland, Prime Forest Land and Prime Rangeland/Formally Classified Lands

Correspondence was received from the National Resources Conservation Service (NRCS) indicating that “there are no prime farmlands located in the water treatment plant area...; therefore, the NRCS has no concerns regarding prime farmlands. We have no other concerns with this project.”
TONGUE RIVER WATER SURFACE, ELEVATION VARIES SEASONALLY

FLOW

RIVER CHANNEL BOTTOM SLOPE~0.006FT/FT

2'' AIR SCOUR DISTRIBUTION LINE

6'' 304SS 15' LONG, 30 SLOT

Native River Bottom Fill

RIVER ROCK RIP RAP
- \( D_{15} = 0.25' \)
- \( D_{50} = 0.59' \)
- \( D_{85} = 1.01' \)

RIP RAP FILTER BLANKET
- \( D_{15} = 0.025' \)
- \( D_{50} = 0.10' \)
- \( D_{85} = 0.30' \)

SCREEN FILTER PACK 10-20 SILICA SAND

FIGURE 2
CROSS SECTION OF INFILTRATION GALLERY AND FILTER PACK
SCALE: NONE
RIVER FLOW

FILTER PACK

15' 304SS SCREEN 30 SLOT

2' CMP BEVELED END TO CONFORM WITH SLOPE & CONCRETED IN PLACE

TRASH RACK/SCREEN

MANUAL SLIDE GATE

6" STANDPIPE IN T CONNECTION TO BACKWASH MANIFOLD

6" STEEL PIPE CONNECTED TO WET WELL WITH INVERT OF 6" PIPE AT INVERT OF OLD 2' CMP ELEVATION

72" DIA CONCRETE

VALVE TO OPEN OR CLOSE SCREEN INLET TO WET WELL

NEW 2' DIA. CMP REPLACING OLD INFILTRATION GALLERY CMP. INVERT OF NEW CMP AT INVERT OF OLD CMP AT WET WELL CONNECTION

EXISTING WET WELL

RAW WATER PUMPS

FIGURE 3

PLAN VIEW OF INFILTRATION GALLERY AND PIPING
SCALE: 1" = 80'

CONCRETE WALL

GABION

SCALE: 1
E.3.1.1 Affected Environment

Due to the current use of the WTP site being for water treatment purposes, and due to the fact that the infiltration gallery will be located beneath the Tongue River and thus not affect existing land use, there should be no environmental consequences associated with either the Phase 1 improvements or the Phase 2 improvements.

E.3.1.2 Environmental Consequences

None anticipated.

E.3.1.3 Mitigation

As there are no environmental consequences associated with land use, there is no mitigation proposed.

E.3.2 Flood Plains

Correspondence dated July 9, 2001 was received from the Sheridan County Planning Department with respect to the proposed improvements being within the flood plain of the Tongue River, as well as the County’s regulations if the improvements are within the flood plain. With the infiltration gallery proposed to be beneath the Tongue River, obviously this portion of the Phase 1 improvements is within the flood plain.

E.3.2.1 Affected Environment

Based upon the information received from the Sheridan County Planning Department, there is some question as to if the Dayton WTP is in fact within the flood plain. The Dayton WTP is the site of a small portion of the Phase 1 improvements (variable frequency drive units being placed on the existing raw water pumps and motors) and essentially all of the Phase 2 improvements (membrane filtration unit and SCADA system).

Assuming that the Dayton WTP is within the flood plain, then the County’s regulations would necessarily apply to both improvements slated within the WTP building as well as beneath the Tongue River. Those requirements are summarized as follows.

- A Sheridan County Floodplain Development Permit Application shall be submitted.
- Any structural components constructed within the flood plain shall be capable of resisting hydrostatic and hydrodynamic loads and effects of buoyancy.
- Any structural components shall be certified by a registered professional engineer or architect that the design and methods of construction are in accordance with accepted standards of practice for meeting the provisions of the County’s flood plain requirements.
- There shall be no new encroachments upon the flood plain, including fill, new construction, substantial improvements, or other development, unless certification by a registered professional engineer or architect is provided demonstrating that encroachments shall not result in any increase in flood levels during the occurrence of the base flood discharge.
E.3.2.2 Environmental Consequences

As the infiltration gallery is to be located beneath the Tongue River, it is anticipated that it will not result in any increase in flood levels during the occurrence of the base flood discharge. The replacement of the existing intake structure (also part of the Phase 1 improvements) will not create any additional encroachment, as it is a replacement to an existing facility that now has little if any impact.

The Phase 2 improvements, proposed to be within the existing WTP building, should not create any additional encroachment upon the flood plain.

E.3.2.3 Mitigation

All structures constructed within the flood plain will be constructed to resist hydrostatic and hydrodynamic loads and effects of buoyancy.

E.3.3 Wetlands

Correspondence dated July 12, 2001 was received from the U.S. Army Corps of Engineers (USCOE) with respect to this agency’s jurisdiction over “waters of the United States", which includes wetlands, as authorized by Section 404 of the Clean Water Act. There are no wetlands that exist in the area beneath the Tongue River where the proposed Phase 1 infiltration gallery is to be constructed, nor where the Dayton WTP’s existing intake structure is currently located and earmarked for replacement as part of the Phase 1 improvements. As the Phase 2 improvements are proposed to be within the existing WTP, there are no wetlands that would be affected due to this phase’s implementation.

E.3.3.1 Affected Environment

Although there are no wetlands in the area of the proposed disturbance, nonetheless the Tongue River falls within the definition of “waters of the United States”. Therefore, the Project falls within the jurisdiction of the USCOE.

According to the USCOE’s letter, installation of the new infiltration gallery may be authorized under Nationwide Permit 12, as it will not involve a change in the pre-construction contours of the Tongue River once the infiltration gallery is in place. It is likely that the installation of the infiltration gallery and replacement of the existing intake structure will require the construction of temporary cofferdams. Such temporary cofferdams should fall under the USCOE’s Nationwide Permit 33.

E.3.3.2 Environmental Consequences

As there are no wetlands in the area of potential Project impact, there will be no impacts to wetlands. The impacts to “waters of the United States” will be temporary and solely related to the Project’s construction.
E.3.3.3 Mitigation

The construction of the infiltration gallery and replacement intake structure will be done in strict accordance with the terms and conditions of the applicable USCOE nationwide permits.

E.3.4 Cultural Resources – Historic Property; Visual Aesthetics

E.3.4.1 Affected Environment

Correspondence dated July 23, 2001 was received from the Wyoming Department of State Parks & Cultural Resources State Historic Preservation Office. This correspondence indicated “no sites meeting the criteria of eligibility for the National Register of Historic Places will be affected by the project as planned”.

E.3.4.2 Environmental Consequences

None.

E.3.4.3 Mitigation

None required.

E.3.5 Biological Resources – Threatened and Endangered Species; Fish and Wildlife; Vegetation

Correspondence dated July 23, 2001 was received from the Wyoming Game & Fish Department (WG&FD) with respect to aquatic considerations. The WG&FD indicated in that letter that they had no concerns with respect to terrestrial wildlife. This letter requested that “no instream activities occur during the period of October 1 to November 30, and March 15 to July 31”.

Additionally, correspondence dated July 20, 2001 was received from the U.S. Fish and Wildlife Service (USF&WS) with respect to specific concerns regarding the bald eagle, a threatened species, that may be present in the Project area. The letter recommended a reconnaissance be performed within one mile of the Project area to determine the possible existence of nesting eagles and roost areas. If nesting eagles or roost areas are found, the USF&WS recommends that no work be performed in the area between February 15 and August 15.

E.3.5.1 Affected Environment

The concerns of the WG&FD centered on spawning activities of brown and rainbow trout, which could possibly be impacted by the Phase 1 improvements’ construction proposed within the Tongue River. Phase 2 improvements, being within the existing WTP building, should not impact these spawning activities.

As mentioned above, the USF&WS expressed concerns regarding the bald eagle. This threatened species may roost or nest in the general area.
E.3.5.2 Environmental Consequences

If there is no effort to address brown and rainbow trout spawning activities, the Phase 1 improvements’ construction could possibly negatively affect trout numbers in the future within the Tongue River.

If there is no effort to address the possibility of bald eagles roosting or nesting within the general area, the Phase 1 improvements' construction could possibly cause migration of these bald eagles from the area, or impact the birthing of baby bald eagles.

E.3.5.3 Mitigation

To address the concerns of both the WG&FD and USF&WS, the following mitigation is proposed.

- A reconnaissance survey will be performed by a trained biologist or similar professional to ascertain the existence of bald eagles and roost areas. If either is found, any construction contracts will be awarded on the condition that no work will be performed between February 15 and August 15.
- To accommodate brown and rainbow trout spawning activities, any construction contracts will be awarded on the condition that no work will be performed within the Tongue River between October 1 and November 30, nor between February 15 and August 15.

E.3.6 Water Quality Issues – Surface Water; Ground Water

Correspondence dated July 18, 2001 was received from the Wyoming Department of Environmental Quality (WDEQ) Water Quality Division. The correspondence indicated that two WDEQ permits would possibly be required for this Project’s implementation. These two permits are:

- a Permit to Construct, which is required whenever a public water system is constructed, installed, or modified; and
- a storm water permit, which is required anytime a project results in clearing, grading or otherwise disturbing five or more acres.

Since the date that the WDEQ letter was received, revisions to Chapter 1 of the WDEQ Water Quality Rules and Regulations have been adopted. Chapter 1 is entitled Wyoming Surface Water Quality Regulations. These regulations became effective on or around September 28, 2001. Section 23 of these regulations is entitled “Turbidity”, and this section addresses “the discharge of substances attributable to or influenced by the activities of man”. The section states that these activities cannot alter the water quality in a manner that would result in a turbidity increase of more than ten (10) NTU’s, unless short-term increases of turbidity are determined by the WDEQ administrator to have only a minimal effect on water uses. The WDEQ administrator shall make such determination on a case-by-case basis, “and shall be subject to whatever controls, monitoring, and best management practices are necessary to fully maintain and protect all water uses”.

In the case of the construction of the Project, Phase 1 improvements will likely temporarily increase downstream turbidities by an amount of more than 10 NTU’s, due to the disturbance that will occur in excavating the stream bottom to install the infiltration gallery. It will be
necessary to request the WDEQ administrator to make a determination that this temporary disturbance will in fact have only a minimal effect on downstream water uses. These downstream uses include the Ranchester WTP (located approximately seven miles downstream) and limited recreational fishing.

Once the Phase 1 improvements are constructed, occasionally the Dayton WTP operators will have to backwash the infiltration gallery in order to rid the granular material surrounding the pipe within the infiltration gallery of accumulated fine sediment. This backwashing procedure will restore the infiltration gallery's influent capacity. It is anticipated that the backwash procedure will occur less than five times per year, and will last approximately 5-10 minutes per event. As with during construction, it will be necessary to request the WDEQ administrator to make a determination that this temporary disturbance will in fact have only a minimal effect on downstream uses.

Although a letter requesting input was sent to both the Wyoming State Engineer’s Office Surface Water and Ground Water Divisions, no response was received. Due to the fact that the proposed Project does not anticipate diverting additional water from the Tongue River, it is not anticipated that surface water issues will become relevant. As there are no groundwater wells proposed as part of this Project, it is not anticipated that ground water issues will become relevant.

E.3.6.1 Affected Environment

In the case of the WDEQ storm water permit, the affected environment will be the lands immediately in the vicinity of the existing Dayton WTP, including the Tongue River directly adjacent to the WTP. In the case of the temporary increases in turbidity within the Tongue River (both during construction and during operations), the affected environment will be the Tongue River and its existing users.

E.3.6.2 Environmental Consequences

Due to the very limited area of disturbance (less than one acre), it is anticipated that concerns associated with a storm water permit will be negligible. In the case of the temporary increases in turbidity within the Tongue River, there should be no significant impacts associated with the temporary turbidity increases associated with construction or backwashing.

E.3.6.3 Mitigation

Proposed mitigation includes the following.

- There must be compliance with WDEQ’s requirement to obtain a Permit to Construct for both Phase 1 and Phase 2 improvements.
- A storm water permit must be obtained from WDEQ, or more likely, submittal of a Notice of Intent indicating that there will be compliance with the provisions of the general permit that has been established by WDEQ for this purpose.
- As the Ranchester WTP is located approximately seven miles downstream, and due to the fact that there are several other existing sources of turbidity between the Dayton WTP and the Ranchester WTP (as well as additional inflows), it is believed that the temporary impact to the Ranchester WTP will be minimal. Nonetheless, Dayton WTP operators will notify Ranchester WTP operators prior to any events during the infiltration gallery’s construction that would increase turbidity levels, and prior to each
time that the infiltration gallery is backwashed in the future. These procedures assume that the WDEQ administrator determines that the temporary turbidity increases will have minimal effects on the Tongue River’s existing users.

E.3.7 **Coastal Resources**

Not applicable.

E.3.8 **Socio-economic Issues/Environmental Justice**

**E.3.8.1 Affected Environment**

The Project is planned to improve the reliability of Dayton’s existing water system, and to improve the quality of the finished water delivered to Dayton’s customers. While rate increases will be necessary to implement the Phase 2 improvements, Dayton’s water rates would still be less than the state average, thus it does not appear that these increases will be an onerous burden upon the existing ratepayers.

Dayton’s water rates are implemented equitably, with no distinction as to the type of customer, with the exception of:

- Dayton’s Volunteer Fire Department staff (who do not pay for their water), and
- ten senior citizen accounts, who have been “grandfathered” with a lesser rate.

Additionally, the Phase 1 improvements will not be constructed in areas where there will be impacts upon adjacent property owners, and thus environmental justice issues are envisioned to not be a concern.

**E.3.8.2 Environmental Consequences**

The socio-economic effects due to the planned improvements, which will increase system reliability and water quality, will be beneficial. There are no foreseen environmental justice issues.

**E.3.8.3 Mitigation**

None proposed.

**E.3.9 Air Quality**

Although a letter requesting input was sent to the WDEQ’s Air Quality Division, no response was received.

**E.3.9.1 Affected Environment**

During construction, there will be emissions from vehicles and other construction equipment, and perhaps some limited fugitive dust from construction activities. Due to the Dayton WTP’s remote location, however, this temporary air quality should not constitute a problem.
E.3.9.2 **Environmental Consequences**

There doesn’t appear to be any significant environmental consequences due to these limited air quality impacts.

E.3.9.3 **Mitigation**

None proposed.

E.3.10 **Transportation**

The Project is located approximately one mile off of U.S. Highway 14. Construction traffic will proceed to the Project site via an established roadway through the IXL Ranch. This road is a one-way graveled road.

It will be necessary to coordinate the construction traffic with the IXL Ranch personnel and require the construction contractor to restore the road within the IXL Ranch to its pre-existing condition if his activities impact it.

E.3.11 **Noise**

During construction, there will be some additional noise due to the equipment required for excavation of the river channel and bank (Phase 1 improvements), and during installation of the Phase 2 improvement equipment. This noise, however, will be limited in duration. Additionally, Dayton WTP’s remote location should minimize any undue noise levels for the general public, with just the IXL Ranch and a home directly across the river possibly noticing additional noise.

Once the facilities are constructed, there should be no noise levels greater than existing ones, which are very limited.

E.4 **Summary of Mitigation (for each resource)**

The following is a summary of the mitigation efforts that will be performed for the Project.

E.4.1 **Land Use**

No mitigation proposed.

E.4.2 **Flood Plains**

All structures constructed within the flood plain will be constructed to resist hydrostatic and hydrodynamic loads and effects of buoyancy.

E.4.3 **Wetlands**

The construction of the infiltration gallery and replacement intake structure will be done in strict accordance with the terms and conditions of the applicable USCOE nationwide permits.
E.4.4 **Cultural Resources – Historic Property; Visual Aesthetics**

No mitigation proposed.

E.4.5 **Biological Resources – Threatened and Endangered Species; Fish and Wildlife; Vegetation**

1. A reconnaissance survey will be performed by a trained biologist or similar professional to ascertain the existence of bald eagles and roost areas within one mile of the Project area. If either is found, any construction contracts will be awarded on the condition that no work will be performed between February 15 and August 15.

2. To accommodate brown and rainbow trout spawning activities, any construction contracts will be awarded on the condition that no work will be performed within the Tongue River between October 1 and November 30.

E.4.6 **Water Quality Issues – Surface Water; Ground Water**

1. A Permit to Construct will be obtained from the WDEQ for both Phase 1 and Phase 2 improvements.

2. Attainment of a storm water permit will be obtained from WDEQ, or more likely, submittal of a Notice of Intent will be made to WDEQ indicating that there will be compliance with the provisions of the general permit that has been established by WDEQ for this purpose.

3. In the case of the construction of the Project, a request will be made to the WDEQ administrator that he determine that a temporary disturbance to the ambient water quality due to construction, increasing turbidity levels to an amount greater than 10 NTU’s above the existing level, will in fact have only a minimal effect on downstream water uses. These downstream uses include the Ranchester WTP (located approximately seven miles downstream) and limited recreational fishing.

4. Once the Phase 1 improvements are constructed, a request will be made to the WDEQ administrator that he determine that a temporary disturbance to the ambient water quality as a result of periodic backwashing events, increasing turbidity levels to an amount greater than 10 NTU’s above the existing level, will in fact have only a minimal effect on downstream water uses.

5. Assuming that the WDEQ administrator determines that both construction and subsequent backwashing events of the infiltration gallery have only a minimal effect on downstream water users, Dayton WTP operators will notify Ranchester WTP operators prior to any events that increase Tongue River turbidity levels during the infiltration gallery’s construction. Such notification will also occur prior to each time that the infiltration gallery is backwashed in the future.

E.4.7 **Coastal Resources**

No mitigation proposed.

E.4.8 **Socio-economic Issues/Environmental Justice**

No mitigation proposed.
E.4.9 **Air Quality**

No mitigation proposed.

E.4.10 **Transportation**

Construction traffic will be coordinated with the IXL Ranch personnel, and the construction contractor will be required to restore the road through the IXL Ranch leading to the WTP to its pre-existing condition if his activities impact it.

E.4.11 **Noise**

No mitigation proposed.

E.5 **Cost Analysis of Mitigation Requirements**

Based upon the summary of each resource, there will be some additional costs encountered for mitigation. These additional costs are anticipated to be the following.

1. There will be costs associated with applying for and procuring the necessary permits. At this time, it is foreseen that the conditions of these permits will not significantly add to the cost of implementation of the Project.
2. There will be costs associated with procuring the services of a trained biologist or similar professional to perform a reconnaissance of the area within one mile of the Project site to determine if bald eagle and/or roost areas exist.
3. There will be costs associated with notifying the Ranchester WTP both during construction and during future backwashing events of the infiltration gallery.

An amount of $5,000 has been placed in the Project budget to account for these permitting and mitigation requirements. The cost to notify the Ranchester WTP prior to each time that the infiltration gallery is backwashed in the future is assumed to be negligible.

E.6 **Correspondence**

Attached are copies of the responses received from the various state and federal regulatory agencies contacted.
David Engels P.E.  
Project Manager, EnTech, Inc.  
1949 Sugarland Drive, Suite 205  
Sheridan, Wyoming 82801

July 20, 2001

Dear Mr. Engels

I have received your letter dated June 26, 2001. There are no prime farmlands located in the water treatment plant area as shown in your drawing. The NRCS, therefore has no concerns regarding prime farmlands. We have no other concerns with this project.

Sincerely,

Dan Holden, NRCS  
Resource Conservationist

Cc: files
July 9, 2001

Dave Engels  
EnTech, Inc.  
1949 Sugarland Drive, Suite 205  
Sheridan, WY 82801

Dave:

Thanks for inquiring about Flood Plain regulations for the Town Of Dayton water intake project. After reviewing your letter and the drawing, it appears that all alternatives will require a Flood Plain Permit from the County.

There isn’t a scale on the drawing provided, so we are providing you and the Town of Dayton with measurements on how far the flood plain extends on both sides of the river for you. Tongue River is reflected by a single line on our flood maps, therefore, all measurements are from the centerline of the river channel. These sites correspond to the numbered X-sections on the attached map.

<table>
<thead>
<tr>
<th></th>
<th>WEST</th>
<th>EAST</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>150’</td>
<td>50’</td>
</tr>
<tr>
<td>2.</td>
<td>60’</td>
<td>160’</td>
</tr>
<tr>
<td>3.</td>
<td>160’</td>
<td>60’</td>
</tr>
<tr>
<td>4.</td>
<td>90’</td>
<td>160’</td>
</tr>
</tbody>
</table>

If any further information is required, feel free to contact us.

Stephen R. Bond  
County Inspector
NOTES

This map is for use in administering the National Flood Insurance Program; it does not necessarily identify all areas subject to flooding, particularly non-local drainage sources of small size, or all planimetric features outside Special Flood Hazard Areas. The community map repository should be consulted for more detailed data on BFEs, and for any information on floodway delineations, prior to use of this map for property purchase or construction purposes.

Areas of Special Flood Hazard (100-year flood) include Zones A, AE, A1-A30, AH, AO, V, VE and V1-V30. Certain areas in Special Flood Hazard Areas may be protected by flood control structures.

Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations in accordance with requirements of the Federal Emergency Management Agency.

Floodway widths in some areas may be too narrow to show to scale. Refer to Floodway Data Table where floodway width is shown at 100 ft.

Coastal base flood elevations apply only landward of 0.0 NGVD, and include the effects of wave action; these elevations may differ significantly from those developed by the National Weather Service for hurricane evacuation planning.

Corporate limits shown are correct as of the date of this map. The user should consult appropriate community officials to determine if corporate limits have changed subsequent to the issuance of this map.

For adjoining panels, see separately printed Map Index.

MAP REPOSITORY
SHERIDAN COUNTY ENGINEERING DEPARTMENT
224 SOUTH MAIN STREET
SHERIDAN, WYOMING

INITIAL IDENTIFICATION:
JULY 4, 1978

FLOOD HAZARD BOUNDARY MAP REVISION:

FLOOD INSURANCE RATE MAP EFFECTIVE:
AUGUST 1, 1986

FLOOD INSURANCE RATE MAP REVISION:
March 30, 1991, to add base flood elevations, to add Special Flood Hazard Areas, and to add roads and road names.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at (800) 475-9515.

APPROXIMATE SCALE IN FEET

2000

2000

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

SHERIDAN COUNTY,
WYOMING
(UNINCORPORATED AREAS)
FLOODPLAIN
SHERIDAN COUNTY, WYOMING

DEVELOPMENT PERMIT APPLICATION

Name of Applicant: __________________________ Date: ____________
Address: __________________________ Phone: ____________
Location of Proposed Development: __________________________
Legal Description: __________________________
___ New Building ___ Mobilehome Placement
___ Residential ___ On Single Lot
___ Non Residential ___ In Mobilehome Park
___ Addition/Alteration
___ Subdivision of Land ___ Fill ___ Watercourse Alteration
___ Other Estimate Cost: ________________

Attach the following information where applicable: Plans of the development to be undertaken including any filling and any watercourse or drainage way alteration.

Specifically, the following information is required: (1) Mean sea level (MSL) elevation of the lowest floor (including basement) of all proposed structures; (2) MSL elevation to which any proposed structure will be floodproofed; (3) certification by a registered professional engineer or architect that the floodproofing method meets the community floodproofing criteria; (4) a description of the extent to which any watercourse will be altered or relocated; and (5) base (100-year) flood elevation data for a development or subdivision greater than 50 lots or 5 acres.

The following is to be completed by the Local Administrator:
If available, the Base Flood Elevation of depth number at the development site is:

______________________________

Source Document: ____________ Effective Date ____________

Plan Review

MSL elevation or depth number to which the structure is to be elevated/floodproofed. ____________ feet.

Are necessary information, certificates, and other permits attached?  
___ Yes ___ No

Action

The proposed development is in conformance with applicable floodplain standards. PERMIT IS APPROVED.

The proposed development is not in conformance with applicable floodplain standards (explanation attached). PERMIT IS DENIED

County Engineer ____________ Date ____________
SHERIDAN COUNTY

FLOOD HAZARD RESOLUTION

Adopted June 20, 1989
Revised March 17, 1998

98FLD.HZD
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section No.</th>
<th>Subject</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Title</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Statutory Authority</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Statement of Purpose</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Abrogation and Greater Restrictions</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>Warning and Disclaimer of Liability</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>Permit Requirements</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>Applications</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>Review of Applications</td>
<td>3</td>
</tr>
<tr>
<td>9</td>
<td>Federal and/or State Permitting</td>
<td>3</td>
</tr>
<tr>
<td>10</td>
<td>New Construction and/or Substantial Improvements</td>
<td>3</td>
</tr>
<tr>
<td>11</td>
<td>Subdivisions and New Development</td>
<td>4</td>
</tr>
<tr>
<td>12</td>
<td>Water Systems</td>
<td>5</td>
</tr>
<tr>
<td>13</td>
<td>Sewage Systems</td>
<td>5</td>
</tr>
<tr>
<td>14</td>
<td>Flood Elevation Information</td>
<td>5</td>
</tr>
<tr>
<td>15</td>
<td>Riverine Situations</td>
<td>5</td>
</tr>
<tr>
<td>16</td>
<td>Manufactured Homes</td>
<td>6</td>
</tr>
<tr>
<td>17</td>
<td>Recreational Vehicles</td>
<td>6</td>
</tr>
<tr>
<td>18</td>
<td>FIRM Maps</td>
<td>7</td>
</tr>
<tr>
<td>19</td>
<td>Definitions</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Title</td>
<td>Page</td>
</tr>
<tr>
<td>---</td>
<td>-------------------------</td>
<td>------</td>
</tr>
<tr>
<td>20</td>
<td>Variance</td>
<td>9</td>
</tr>
<tr>
<td>21</td>
<td>Severability</td>
<td>11</td>
</tr>
<tr>
<td>22</td>
<td>Enforcement</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>Approval &amp; Adoption</td>
<td>12</td>
</tr>
</tbody>
</table>
SHERIDAN COUNTY
FLOOD HAZARD RESOLUTION

WHEREAS, Sheridan County wishes to establish eligibility in the National Flood Insurance Program and in order to do must meet the requirements of Part 60.3(b) of the National Flood Insurance Program (NFIP) Regulations.

NOW THEREFORE, the following measures shall be required within Zone A of the Flood Insurance Rate Map issued by the Federal Emergency Management Agency for this community.

SECTION 1. TITLE
This resolution shall be known, cited, and referred to as the “SHERIDAN COUNTY FLOOD HAZARD RESOLUTION.”

SECTION 2. STATUTORY AUTHORITY
This resolution is adopted pursuant to, and in accordance with, the authority vested in the Board of County Commissioners of Sheridan County by the statutes of the State of Wyoming.

SECTION 3. STATEMENT OF PURPOSE
It is the purpose of this resolution to promote the public health, safety, and general welfare, and to minimize public and private losses due to flood conditions to specific area by provisions designed:

1. To protect human life and health;
2. To minimize expenditure of public money for costly flood control projects;
3. To minimize the need for rescue and relief efforts associated with flooding and generally undertaken at the expense of the general public;
4. To minimize prolonged business interruptions.
5. To minimize damage to public facilities and utilities such as water and gas mains, electric, telephone and sewer lines, streets and bridges located in areas of special flood hazard;
6. To help maintain a stable tax base by providing for the sound use and development of areas of special flood hazard so as to minimize future flood blight areas;

7. To ensure that potential buyers are notified that property is in an area of special flood hazard; and,

8. To ensure that those who occupy the areas of special flood hazard assume responsibility for their actions.

SECTION 4. ABROGATION AND GREATER RESTRICTIONS

This resolution is not intended to repeal, abrogate, or impair any existing easements, covenants, or deed restrictions. However, where this resolution and another resolution, easement, covenant, or deed restriction conflict or overlap, whichever imposes the more stringent restrictions shall prevail.

SECTION 5. WARNING AND DISCLAIMER OF LIABILITY

The degree of flood protection required by this resolution is considered reasonable for regulatory purposes and is based on scientific and engineering considerations. Larger floods can and will occur on rare occasions. Flood heights may be increased by man-made or natural causes. This resolution does not imply that land outside the areas of special flood hazards or uses permitted within such areas of special flood hazards or uses permitted within such areas will be free from flooding or flood damages. This resolution shall not create liability on the part of Sheridan County, Wyoming, any officer or employee thereof, or the Federal Emergency Management Agency for any flood damages that result from reliance on this resolution or any administrative decision lawfully made thereunder.

SECTION 6. PERMIT REQUIREMENTS

No person shall erect, construct, enlarge, alter, repair, improve, move or demolish any building or structure without first obtaining a separate permit for each building or structure from the designated responsible person.

No man-made change to improved or unimproved real estate, including but not limited to buildings or other structures, mining, dredging, filling grading, paving, excavation or drilling operations, shall be commenced until a separate permit has been obtained from the designated responsible person for each change.

No manufactured home shall be placed on improved or unimproved real estate without first obtaining a separate permit for each manufactured home from the designated responsible person.
SECTION 7. APPLICATIONS

To obtain a permit, the applicant shall first file a permit application on a form furnished for that purpose. The form must be completed and submitted to the designated responsible person.

SECTION 8. REVIEW OF APPLICATIONS

The County Engineer, hereinafter referred to as the responsible person, is appointed as the "person" responsible for receiving applications and examining the plans and specifications for the proposed construction or development.

After reviewing the application, the responsible person shall require any additional measures which are necessary to meet the minimum requirements of this document.

SECTION 9. FEDERAL AND/OR STATE PERMITTING

The responsible person shall review proposed development to assure that all necessary permits have been received from those government agencies from which approval is required by Federal or State law, including Section 404 of the Federal Water Pollution Control Act Amendments of 1972, 33 U.S.C. 1334.

SECTION 10. NEW CONSTRUCTION AND/OR SUBSTANTIAL IMPROVEMENTS

The responsible person shall obtain, review and reasonably utilize any base flood elevations and floodway data available from a Federal, State or other source as criteria for requiring within Zone A the following:

A. New construction and substantial improvements of any residential structure shall have the lowest floor, including basement, elevated to or above the base flood elevation.

B. New construction and substantial improvement of any nonresidential structure shall either have the lowest floor, including basement, elevated to or above the base flood elevation, or together with attendant utility and sanitary facilities shall:

1. Be flood proofed that below the base flood elevation the structure is watertight with walls substantially impermeable to the passage of water,

2. Have structural components capable of resisting hydrostatic and hydrodynamic loads and effects of buoyancy, and
3. Be certified by a registered professional engineer or architect that the design and methods of construction are in accordance with accepted standards of practice for meeting the provisions or this paragraph.

C. Electrical, heating, ventilation, plumbing, and air conditioning equipment and other service facilities shall be designed and/or located so as to prevent water from entering or accumulating within the components during conditions of flooding.

D. Located within areas of special flood hazard established by this resolution are areas designated as floodways. Since the floodway is an extremely hazardous area due to the velocity of flood waters which carry debris, potential projectiles, and erosion potential, the following provisions apply:

1. Prohibit encroachments, including fill, new construction, substantial improvements, and other development unless certification by a registered professional engineer or architect is provided demonstrating that encroachments shall not result in any increase in flood levels during the occurrence of the base flood discharge.

2. If Section 10, paragraph D. 1. is satisfied, all new construction and substantial improvements shall comply with all applicable flood hazard reduction provisions of this resolution.

E. Openings in Enclosures Below the Lowest Floor. For all new construction and substantial improvements, fully enclosed areas below the lowest floor that are subject to flooding shall be designed to automatically equalize hydrostatic flood forces on exterior walls by allowing for the entry and exit of flood waters. Designs for meeting this requirements must either be certified by a registered professional engineer or architect or must meet or exceed the following minimum criteria:

1. A minimum of two openings having a total net area of not less than one square inch for every square foot of enclosed area subject to flooding shall be provided:

2. The bottom of all openings shall be no higher than one foot above grade;

3. Openings may be equipped with screens, louvers, or other coverings or devices provided that they permit the automatic entry and exit of flood waters.

SECTION 11. SUBDIVISIONS AND NEW DEVELOPMENT

The responsible person shall require that all subdivision proposals and other proposed new developments greater that 50 lots or 5 acres, whichever is the lesser, include within such proposals base flood elevation data.
The responsible person shall review subdivision proposals and other proposed new development to determine whether such proposals will be reasonable safe from flooding. If a subdivision proposal or other proposed new development is in a flood prone area, any such proposals shall be reviewed to assure that (i) all such proposals are consistent with the need to minimize flood damage within the flood prone area, (ii) all public utilities, such as sewer, gas, electrical, and water systems are located and constructed to minimize or eliminate flood damage, and (iii) adequate drainage is provided to reduce exposure to flood hazards.

SECTION 12. WATER SYSTEMS

The responsible person shall require within flood prone area new and replacement water supply systems to be designed to minimize or eliminate infiltration of flood waters into the system.

SECTION 13. SEWAGE SYSTEMS

The responsible person shall require within flood prone areas (i) new and replacement sanitary sewage system to be designed to minimize or eliminate infiltration of flood waters into the systems and discharges from the systems into flood waters and (ii) on-site waste disposal systems to be located to avoid impairment to them or contamination from them during flooding.

SECTION 14. FLOOD ELEVATION INFORMATION

Where base flood elevation information is available, within Zone A on the FIRM, the responsible person shall;

A. Obtain or require the applicant to furnish, the elevation (in relation the M.S.L.) of the lowest floor (including basement) or all new or substantially improved structures, and whether or not such structure contains a basement.

B. Obtain or require the applicant to furnish, is the structure has been flood proofed, the elevation (in relation to M.S.L.) to which the structure was flood proofed.

C. Maintain a record of all such information.

SECTION 15. RIVERINE SITUATIONS

The responsible person shall notify, in riverine situations, adjacent communities and the Wyoming Emergency Management Agency prior to any alteration or relocation of a watercourse, and submit copies of such notifications to the Federal Emergency Management Agency.
The responsible person shall assure that the flood carrying capacity within the altered or relocated portion of any watercourse is maintained.

SECTION 16. MANUFACTURED HOMES

The responsible person shall require that all manufactured homes to be placed within Zone A of the FIRM shall be installed using methods and practices which minimize flood damage. For the purpose of this requirement, manufactured homes must be elevated and anchored to resist flotation, collapse, or lateral movement. Methods of anchoring may include, but are not limited to, use of over-the-top or frame ties to ground anchors. This requirement is in addition to other applicable State and/or local anchoring requirements for resisting wind forces.

1. All manufactured homes or those to be substantially improved shall conform to the following requirements:

(a) Require that manufactured homes that are placed or substantially improved on a site (i) outside of a manufactured home park or subdivision, (ii) on a new manufactured home park or subdivision, (iii) in an expansion to an existing manufactured home park or subdivision, or (iv) in an existing manufactured home park or subdivision on which a manufactured home has incurred "substantial damage" as the result of a flood, be elevated on a permanent foundation such that the lowest floor of the manufactured home is elevated to or above the base flood elevation and be securely anchored to an adequately anchored foundation system to resist flotation, collapse and lateral movement.

(b) Required that manufactured homes to be placed or substantially improved on sites in existing manufactured home parks or subdivisions that are not subject to the provisions in (a) above be elevated so that either (i) the lowest floor of the manufactured home is at or above the base flood elevation, or (ii) the manufactured home chassis is supported by reinforced piers or other foundation elements that are no less than 36 inches in height above grade and be securely anchored to an adequately anchored foundation system to resist flotation, collapse, and lateral movement.

SECTION 17. RECREATIONAL VEHICLES

Require that recreational vehicles either (i) be on the site for fewer than 180 consecutive days, (ii) be fully licensed and ready for highway use, or (iii) meet the permit requirements and elevations and anchoring requirements for resisting wind forces.
SECTION 18. FIRM MAPS

The Flood Insurance Rate Maps (FIRM) issued by the Federal Emergency Management Agency for this community dated August 1, 1986 with Panel Numbers 3, 12, 13, 19, 20 and 26 and any officially published revisions to this map, is adopted as the official map for the enforcement of this document. Zone A on this map delineates the area within which the requirements of this document will be enforced.

SECTION 19. DEFINITIONS

Unless specifically defined below, words or phrases used in this document shall be interpreted so as to give them the same meaning as they have in common usage and so as to give this document its most reasonable application.

"Base Flood" means the flood having a one percent chance of being equaled or exceeded in any given year.

"Development" means any man-made change to improved or unimproved real estate, including but not limited to buildings or other structures, mining, dredging, filling, grading, paving, excavation or drilling operations.

"Existing manufactured home park or subdivision" means a manufactured home park for which the construction of facilities for servicing the lots on which the manufactured homes are to be affixed (including, at a minimum, the installation of utilities, the construction of streets and either final site grading or the pouring of concrete pads) are completed before the effective date of this resolution.

"Expansion to existing manufactured home park or subdivision" means the preparation of additional sites by the construction of facilities for servicing the lots on which the manufactured homes are to be affixed (including the installation of utilities, the construction of streets, and either final site grading or the pouring of concrete pads).

"Flood" or "Flooding" means a general and temporary condition of partial or complete inundation of normally dry land area from:

1. the overflow of inland or tidal waters.
2. the unusual and rapid accumulation or runoff of surface waters from any source.

"Flood Insurance Rate Map (FIRM)" means the official map on which the Federal Emergency Management Agency has delineated both the areas of special flood hazards and the risk premium zones.

"Flood Insurance Study" means the official report provided by the Federal Emergency Management Agency that includes flood profiles, the Flood Boundary-Floodway Map, and the water surface...
elevation of the base flood.

“Flood Plain” or “Flood Prone Area” means any land area susceptible to being inundated by water from any source (see definition of “Flood”).

“Flood Proofing” means any combination of structural or nonstructural additions, changes, or adjustments to structures which reduce or eliminate flood damage to real estate or improved real property, water and sanitary facilities, structures and their contents.

“Floodway” means the extremely hazardous area of the river channel and its adjacent land area, that due to the velocity of flood waters which carry debris, potential projectiles and erosion potential, must be reserved in order to discharge the base flood without cumulatively increasing the water surface more than one foot.

“Lowest Floor” means the lowest floor of the lowest enclosed area (including basement). An unfinished or flood resistant enclosure, building access or storage, in an area other than a basement area, is not considered a building’s lowest floor, provided that such enclosure is not built so as to render the structure in violation of the applicable non-elevation design requirements of this resolution.

“Manufactured Home” means a structure, transportable in one or more sections, which is built on a permanent chassis and designed to be used with or without a permanent foundation when connected to the required utilities. It does not include recreational vehicles or travel trailers. The term includes but is not limited to, the definition of “manufactured home” as set forth in regulations governing the Mobile Home Safety and Construction Standards Program (24 CFR 3282.7 (a)).

“New construction” means structures for which the “start of construction” commenced on or after the effective date of the original resolution, and includes any subsequent improvements to such structures.

“New manufactured home park or subdivision” means a manufactured home park or subdivision for which the construction of facilities for servicing the lots on which the manufactured homes are to be affixed (including at a minimum, the installation of utilities, the construction of streets, and either final site grading or the pouring of concrete pads) is completed on or after the effective date of these flood plain management regulations.

“Person” includes any individual or group of individuals, corporation, partnership, association, or any other entity, including State and local governments and agencies.

“Recreational vehicles” means a vehicle which is (1) built on a single chassis; (2) 400 square feet or less when measured at the largest horizontal projections; (3) designed to be self-propelled or permanently towable by a light duty truck; and (4) designed primarily not for use as a permanent dwelling but as temporary living quarters for recreational, camping, travel, or seasonal use.
“Riverine” means relating to, formed by, or resembling a river (including tributaries), stream, brook, etc.

“Structure” means, for flood plain management purposes, a walled and roofed building, including a gas or liquid storage tank, that is principally above ground, as well as a mobile home.

“Substantial Improvement” means any repair, reconstruction, or improvement of a structure, the cost of which equals or exceeds 50 percent of the market value of the structure either, (a) before the improvement or repair is started, or (b) if the structure has been damaged, and is being restored, before the damage occurred. For the purpose of this definition “substantial improvement” is considered to occur when the first alteration of any wall, ceiling, floor, or other structural part of the building commences, whether or not that alteration affects the external dimensions of the structure. The term does not, however, include either (1) any project for improvement of a structure to comply with existing state or local health, sanitary, or safety code specifications which are solely necessary to assure safe living conditions or (2) any alteration of a structure listed on the National Register of Historic Places or a State Inventory of Historic Places.

“Variance” means a grant of relief by a community from the terms of a flood plain management regulation.

SECTION 20. VARIANCE

A. Appeals Board

1. The Board of County Commissioners, as established by Sheridan County, Wyoming, shall hear and decide appeals and request for variances from the requirements of this resolution.

2. The Board of County Commissioners shall hear and decide appeals when it is alleged there is an error in any requirement, decision or determination made by the responsible person in the enforcement or administration of this resolution.

3. Those aggrieved by the decision of the Board of County Commissioners, or any taxpayer, may appeal such decisions to the District Court as provided in the statutes of the State of Wyoming.

4. In passing upon such applications, the Board of County Commissioners shall consider all technical evaluations, all relevant factors, standards specified in other sections of this resolution, and:

   (i) the danger that materials may be swept onto other lands to the injury of others;
(ii) the danger to life and property due to flooding or erosion damage;

(iii) the susceptibility of the proposed facility and its contents to flood damage and the effect of such damage on the individual owners;

(iv) the importance of the services provided by the proposed facility to the community;

(v) the necessity to the facility of a waterfront location, where applicable;

(vi) the availability of alternative locations for the proposed use which are not subject to flooding or erosion damage;

(vii) the compatibility of the proposed use with the existing and anticipated development;

(viii) the relationship of the proposed use to the comprehensive plan and floodplain management program for that area;

(ix) the safety of access to the property in times of flood for ordinary and emergency vehicles;

(x) the expected heights, velocity, duration, rate of rise and sediment transport of the flood waters and the effects of wave action, if applicable, expected at the site; and,

(xi) the costs of providing governmental services during and after flood conditions, including maintenance and repair of public utilities and facilities such as sewer, gas, electrical, and water systems streets and bridges.

5. Upon consideration of the factors of Section 19. A. 4, and the purposes of this resolution, the Board of County Commissioners may attach such conditions to the granting of variances as it deems necessary to further the purposes of this resolution.

6. The responsible person shall maintain the records of all appeal actions, including technical information, and report any variances to the Federal Emergency Management Agency.

B. Conditions for Variances

1. Generally, variances may be issued for new construction and substantial improvements to be erected on a lot of one-half acre or less in size contiguous to and surrounded by lots with existing structures constructed below the base flood level, providing items (i-xi) in Section 19. A. 4 have been fully considered. As the lot size
increases beyond the one-half acre, the technical justifications required for issuing the variance increases.

2. Variances may be issued for the reconstruction, rehabilitation or restoration of structures listed on the National Register of Historic Places or the State Inventory of Historic Places without regard to the procedures set forth in the remainder of this section.

3. Variances shall not be issued within any designated floodway if any increase in flood levels during the base flood discharge would result.

4. Variances shall only be issued upon a determination that the variance is the minimum necessary, considering the flood hazard, to afford relief.

5. Variances shall only be issued upon:
   (i) a showing of good and sufficient cause;
   (ii) a determination that failure to grant the variance would result in exceptional hardship to the applicant; and
   (iii) a determination that the granting of a variance will not result in increase flood heights, additional threats to public safety, extraordinary public expenses, create nuisances, cause fraud on or victimization of the public as identified in Section 19. A. 4 or conflict with existing local laws or resolutions.

6. Any applicant to whom a variance is granted shall be given written notice that the structure will be permitted to be built with a lowest floor below the base flood elevation and that the cost of flood insurance will be commensurate with the increased risk from the reduce lowest floor elevation.

SECTION 21. SEVERABILITY

If any section of this resolution is held to be unconstitutional or otherwise invalid by any court of competent jurisdiction, then such section shall be considered separately and apart from the remaining provisions of this resolution, said section to be completely severable from the remaining provisions of the resolution and the remaining provisions of this resolution shall remain in full force and effect.

SECTION 22. ENFORCEMENT

The provision of this resolution are enforceable for all appropriate legal remedies including, but not limited to, injunction relief or a writ of mandamus. Any person who willfully violates or fails or
refuses to comply with any provision of this resolution, including an officer or agent of a corporation or association who participates in or is an accessory to the violation, may be punished by a fine of not more than two hundred fifty dollars ($250.00) for each offense. Each day that a violation exists shall constitute a separate offense.

APPROVED:

BOARD OF COUNTY COMMISSIONERS
SHERIDAN COUNTY, WYOMING

Ronald L. Dailey, County Clerk
Kenneth D. Kerns, Chairman
Charles L. Whiton, Commissioner
B. Bradford Waters, Commissioner

THE STATE OF WYOMING )
County of Sheridan ) ss.

On this ___17th_____ day of March, 1998, before me personally appeared Kenneth D. Kerns, Charles L. Whiton and B. Bradford Waters to me personally know, who being by duly sworn, did say that they are the members of the Board of County Commissioners of Sheridan County, Wyoming, and that the seal affixed to said instrument is the seal of said County, and that said instrument was signed and sealed on behalf of said County by authority of its Board of commissioners and they acknowledge said instrument to be an act of said Board.

Clerk of District County

Dear Mr. Engels:

This letter is in response to your letter dated June 26, 2001 requesting our comments on the Town of Dayton's proposed improvements to its water treatment plant and existing water infiltration gallery located southwest of Dayton, Wyoming. The project site is located in approximately the southwest quarter, Section 1, Township 56 North, Range 87 West, Sheridan County, Wyoming.


The term "waters of the United States" has been broadly defined by statute, regulation, and judicial interpretation to include all waters that were, are, or could be used in interstate commerce such as rivers, streams (including ephemeral streams), reservoirs, and lakes as well as wetlands adjacent to those areas. Wetlands are defined as areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands are characterized by growth of vegetation such as bulrush, cattails, rushes, sedges, and willows. Wetlands not only provide wildlife habitat but also improve water quality by holding sediment and taking up nutrients. In many cases, wetlands decrease flooding by storing surface water and recharging ground water in flood plains.
In the case of Solid Waste Agency of Northern Cook County v. U.S. Army Corps of Engineers, No. 99-1178 (January 9, 2001) (SWANCC), the U.S. Supreme Court held that the Corps exceeded its statutory authority by asserting jurisdiction over "an abandoned sand and gravel pit in northern Illinois which provides habitat for migratory birds." Although the Court held that the Corps' application of § 328.3(a)(3) was invalid in SWANCC, the Court did not strike down §328.3(a)(3) or any other component of the regulations defining "waters of the United States." However, in light of the Court's ruling, the Corps will no longer rely on the use of waters or wetlands as habitat by migratory birds as the sole basis for the assertion of regulatory jurisdiction over isolated, non-navigable, intrastate waters.

Based on the information you provided, it has been determined that the proposed project may require authorization from this office. In response to the different proposals set forth in your letter, the following information is provided.

Replacement of any existing structure in the Tongue River, e.g., the infiltration gallery, may be authorized under Nationwide Permit (NWP) No. 3 if only minor changes are proposed to the existing structure. Installation of a new infiltration gallery may be authorized under NWP No. 12 if the installation will not involve a change in the pre-construction contours of the Tongue River. If it is necessary to construct a cofferdam in conjunction with either of these two options, the project may also proceed by combining the applicable nationwide permit authorization with the authorization set forth in NWP No. 33. Fact sheets describing the entire conditions and limitations of each of these authorizations are enclosed for your information and are also available on our web site described above. If the project involves the placement of fill into the Tongue River or adjacent wetlands and can not be done in compliance with the terms and conditions of the aforementioned NWPs it will be necessary to apply for an individual permit from this office.

The construction of a pre-sedimentation basin, a shallow well, or any other facilities associated with the project above the ordinary high waterline of the Tongue River and outside of any wetland areas adjacent to the river would not require authorization from the Corps of Engineers.

If you have any questions regarding this determination, please call me at (307) 772-2300 and reference file No. 200140171.

Sincerely,

Matthew A. Bilodeau
Program Manager
Wyoming Regulatory Office

Enclosures
July 23, 2001

Mr. David Engels, PE
EnTech, Inc.
1949 Sugarland Drive, Suite 205
Sheridan, WY 82801

RE: WWDC Dayton Water Supply Project, Level II; SHPO #0101SLF012

Dear Mr. Engels:

Sarah Farley of our staff has received information concerning the aforementioned project. Thank you for allowing us the opportunity to comment.

We have reviewed the project report and find the documentation meets the Secretary of the Interior's Standards for Archaeology and Historic Preservation (48 FR 44716-42). No sites meeting the criteria of eligibility for the National Register of Historic Places will be affected by the project as planned. We recommend the Rural Utilities Service (RUS) allow the project to proceed in accordance with state and federal laws subject to the following stipulation: if any cultural materials are discovered during construction, work in the area should halt immediately and the RUS staff and SHPO staff must be contacted. Work in the area may not resume until the materials have been evaluated and adequate measures for their protection have been taken.

This letter should be retained in your files as documentation of our determination of "No Historic Properties Affected" for this project.

Please refer to SHPO project control number #0101SLF012 on any future correspondence dealing with this project. If you have any questions, contact me at 307-777-6311.

Sincerely,

Judy K. Wolf
Review & Compliance Project Manager

Jim Geringer, Governor

John T. Keck, Director
July 23, 2001

WER 9920.01
EnTech, Inc.
Wyoming Water Development Commission
Town of Dayton Water Supply Project, Level II
Sheridan County

David Engers, PE
Project Manager
EnTech, Inc.
1949 Sugarland Drive, Suite 205
Sheridan, WY 82801

Dear Mr. Engers:

The staff of the Wyoming Game and Fish Department has reviewed the Town of Dayton Water Supply Level II project in Sheridan County. We offer the following comments for your consideration.

Terrestrial Considerations:

We do not anticipate any impacts to terrestrial wildlife from this project.

Aquatic Considerations:

We provided aquatic comments relative to the replacement of the water supply pipeline for the improvement project in February of this year. Many of those comments are applicable here as well and are repeated. Also, since it appears there are several undefined options being considered as part of this project, we would request that you discuss any preferred alternatives with local fisheries personnel. Please contact Mr. Bob McDowell, Regional Fisheries Supervisor, at (307) 672-7418 to discuss this.

The Tongue River supports wild rainbow trout, brown trout, and whitefish, and is utilized regularly by the local fishery between the treatment plant and town. To protect spawning activities of brown and rainbow trout, we request that no instream activities occur during the period of October 1 to November 30, and March 15 to July 31.

To properly protect the aquatic resources, we recommend the following general guidelines be followed:
1. Riparian canopy or stabilizing vegetation should not be removed if possible. Crushing or shearing streamside woody vegetation is preferable to complete removal. Any such vegetation that is removed should be reestablished immediately following completion of construction activities.

2. Riparian areas and floodplains should not be used as staging or refueling areas. All chemicals, solvents and fuels should be kept at least 150 feet away from streams and riparian areas.

3. The total area of land disturbed should be kept to a minimum. All disturbed lands should be revegetated as soon as possible following construction activities.

Thank you for the opportunity to comment.

Sincerely,

[Signature]

BILL WICHERS
DEPUTY DIRECTOR

BW:TC:as
cc: USFWS
July 18, 2001

David Engels
EnTech, Inc.
1949 Sugarland Drive, Suite 205
Sheridan, WY 82801

Re: Response to proposed WWDC Dayton Water Supply Project, Level II

Dear Mr. Engels:

There are three Water Quality Division (WQD) permits that may apply to the project. Any or all of them may apply depending on the eventual scope of the project.

- **Permit to Construct.** Any time a public water or waste water system is constructed, installed, or modified a permit to construct is required. The program is handled out of our Sheridan office for Sheridan County. Please contact Don McKenzie at 307-674-6457 for more detailed information.

- **Storm Water Associated with Construction Activities.** This permit is required any time a project results in clearing, grading, or otherwise disturbing five or more acres. The disturbed area does not need to be contiguous. The permit is required for surface disturbances associated with construction of the project, access roads, construction of wetland mitigation sites, borrow and stockpiling areas, equipment staging and maintenance areas and any other disturbed areas associated with construction. A general permit has been established for this purpose and either the project sponsor or general contractor is responsible for filing a Notice of Intent (NOI) and complying with the provisions of the general permit. The NOI should be filed no later than 30 days prior to the start of construction activity. Please contact Barb Sahl at 307-777-7570.

*These comments are reflective of a specific agency mission only. These comments defer to and are subordinate to the Official State Position.*
July 18, 2001
Page 2

Section 404. While not a state permit, this project will probably require a section 404 permit from the US Army Corps of Engineers. Any time work occurs within waters of the US a 404 permit may be required. Please contact the Corps (307-772-2300) for specific information regarding jurisdiction and requirements.

We appreciate the opportunity to comment on this project and look forward to working with you in the future. If you have any questions, please feel free to contact me at 307-777-7588.

Sincerely,

Jeremy Lyon
Environmental Senior Analyst
Department of Environmental Quality

JML/mad/11817-ltr

d:\spcwpd\misc\dayton_wtp.wpd

These comments are reflective of a specific agency mission only. These comments defer to and are subordinate to the Official State Position.
Mr. David Engels  
EnTech, Inc.  
1949 Sugarland Drive, Suite 205  
Sheridan, WY 82801

Dear Mr. Engels:

Thank you for your letter of June 26, 2001, regarding the Wyoming Water Development Commission (WWDC) Dayton water supply project in Sheridan County, Wyoming. In accordance with section 7(c) of the Endangered Species Act of 1973, as amended (Act), my staff has determined that the bald eagle, a threatened species, may be present in the project area.

The US Fish and Wildlife Service (Service) recommends the project area be surveyed for nesting eagles and roost areas. If any active nests or roost areas are identified within 1-mile of the proposed project, we recommend avoiding work in the area between February 15 and August 15 and avoiding impacts to any nests and roost areas. If timing and/or location of the work cannot be modified to avoid possible impacts you should contact this office to discuss consultation requirements pursuant to the Act.

Consultation
Section 7(c) of the Act requires that a biological assessment be prepared for any Federal action that is a major construction activity to determine the effects of the proposed action on listed and proposed species. If a biological assessment is not required (i.e., all other actions), the lead Federal agency is responsible for review of proposed activities to determine whether listed species will be affected. We would appreciate the opportunity to review any such determination document. If it is determined that the proposed activities may affect a listed species, you should contact this office to discuss consultation requirements. If it is determined that any Federal agency program or project “is likely to adversely affect” any listed species, formal consultation should be initiated with this office. Alternatively, informal consultation can be continued so we can work together to determine how the project could be modified to reduce impacts to listed species to the “not likely to adversely affect” threshold. If it is concluded that the project “is not
likely to adversely affect" listed species, we should be asked to review the assessment and concur with the determination of not likely to adversely affect.

For those actions where a biological assessment is necessary, it should be completed within 180 days of receipt of a species list, but can be extended by mutual agreement between the lead agency and the Service. If the assessment is not initiated within 90 days of receipt of a species list, the list of threatened and endangered species should be verified with me prior to initiation of the assessment. The biological assessment may be undertaken as part of the agency's compliance of section 102 of the National Environmental Policy Act (NEPA), and incorporated into the NEPA documents. The Service recommends that biological assessments include:

1. a description of the project;
2. a description of the specific area potentially affected by the action;
3. the current status, habitat use, and behavior of threatened and endangered species in the project area;
4. discussion of the methods used to determine the information in item 3;
5. direct and indirect impacts of the project to threatened and endangered species, including impacts of interrelated and interdependent actions;
6. an analysis of the effects of the action on listed and proposed species and their habitats including cumulative impacts from Federal, State, or private projects in the area;
7. measures that will reduce or eliminate adverse impacts to threatened and endangered species;
8. the expected status of threatened and endangered species in the future (short and long term) during and after project completion;
9. determination of "is likely to adversely affect" or "is not likely to adversely affect" for listed species;
10. determination of "is likely to jeopardize" or "is not likely to jeopardize" for proposed species;
11. Alternatives to the proposed action considered, a summary of how impacts of those alternatives on listed and proposed species would differ from the proposed action, and the reasons for not selecting those alternatives.
12. citation of literature and personal contacts used in the assessment.

A Federal agency may designate a non-Federal representative to conduct informal consultation or prepare biological assessments. However, the ultimate responsibility for section 7 compliance remains with the Federal agency, and written notice should be provided to the Service upon such a designation. We recommend that Federal agencies provide their non-Federal representatives with proper guidance and oversight during preparation of biological assessments and evaluation of potential impacts to listed species.

Section 7(d) of the Act requires that the Federal agency and permit or license applicant shall not make any irreversible or irretrievable commitment of resources which would preclude the
formulation of reasonable and prudent alternatives until consultation on listed species is completed.

We will work with the lead Federal agency in the section 7 consultation process. The analysis of project impacts must assess direct impacts of the project, as well as those impacts that are interrelated to or interdependent with the proposed action. Impacts to listed species on non-Federal lands must be evaluated along with such impacts on Federal lands. Any measures that are ultimately required to avoid or reduce impacts to listed species will apply to Federal as well as non-Federal lands.

**Migratory Birds**

Please recognize that consultation on listed species may not remove your obligation to protect the many species of birds, raptors, and eagles protected under the Migratory Bird Treaty Act (MBTA) and Bald and Golden Eagle Protection Act (BGEPA). The MBTA, 16 U.S.C. 703, enacted in 1918, prohibits the taking of any migratory birds, their parts, nests, or eggs except as permitted by regulations and does not require intent to be proven. Section 703 of the Act states, "Unless and except as permitted by regulations ... it shall be unlawful at any time, by any means or in any manner, to ... take, capture, kill, attempt to take, capture, or kill, or possess ... any migratory bird, any part, nest, or eggs of any such bird..." The BGEPA, 16 U.S.C. 668, prohibits knowingly taking, or taking with wanton disregard for the consequences of an activity, any bald or golden eagles or their body parts, nests, or eggs, which includes collection, molestation, disturbance, or killing.

Work that could lead to the take of a migratory bird or eagle, their young, eggs, or nests (for example, construction in the vicinity of a nest), should be coordinated with our office before any actions are taken. Removal or destruction of such nests, or causing abandonment of a nest could constitute violation of the above statutes. Removal of nests or nest trees is prohibited, but may be allowed once young have fledged and/or a permit has been issued. In either case, timing is a significant consideration and you need to allow for this in your project planning. We also recommend the project area be surveyed for raptor nests and roost areas.

To minimize effects on nesting raptors and the possibility of "take" under the Migratory Bird Treaty Act, protective/mitigation measures may be necessary. Any analysis of the project should address potential adverse impacts including habitat loss or degradation, nest abandonment, and electrocution/collision hazards to raptors and specifically outline all measures that will be implemented to minimize adverse effects to these species. Your planning document should describe proposed protective measures including, but not limited to: possible timing restrictions for construction, establishment of buffer zones around raptor nests, and proper raptor-proofing of power lines. Projects that create electrocution/collision hazards should include a monitoring program to detect problem areas.

**Wetlands/Riparian Areas:** The Service recommends measures be taken to avoid any wetland losses in accordance with Section 404 of the Clean Water Act, Executive Order 11990 (wetland
Engels

protection) and Executive Order 11988 (floodplain management) as well as the goal of "no net loss of wetlands." In evaluating construction of a presedimentation basin, you should address the impacts to wetland, location of the basin and size. Also, consider potential effects to wetlands along the Tongue River during construction of the infiltration gallery as well as any other construction that will occur along the river. If wetlands may be destroyed or degraded by the proposed action, those (wetlands) in the project area should be inventoried and fully described in terms of functions and values. Acreage of wetlands, by type, should be disclosed and specific actions outlined to minimize impacts and compensate for all unavoidable wetland impacts.

Riparian or streamside areas are a valuable natural resource and impacts to these areas should be avoided whenever possible. Riparian areas are the single most productive wildlife habitat type in North America. They support a greater variety of wildlife than any other habitat. Riparian vegetation plays an important role in protecting streams, reducing erosion and sedimentation as well as improving water quality, maintaining the water table, controlling flooding, and providing shade and cover. In view of their importance and relative scarcity, impacts to riparian areas should be avoided. Any potential, unavoidable encroachment into these areas should be minimized and quantitatively assessed in terms of functions and values, areas and vegetation type lost, potential effects on wildlife, and streams (bank stability and water quality). Measures to compensate for unavoidable losses of riparian areas should be developed and implemented as part of the project.

Plans for mitigating unavoidable impacts to wetland and riparian areas should include mitigation goals and objectives, methodologies, time frames for implementation, success criteria, and monitoring to determine if the mitigation is successful. The mitigation plan should also include a contingency plan to be implemented should the mitigation not be successful.

Thank you for the opportunity to review the proposed work. Please keep this office informed of any developments or decisions concerning this project. If you have any questions please contact Michelle Flenner of my staff at the letterhead address or phone (307) 772-2374 extension 37.

Sincerely,

Michael M. Long
Field Supervisor
Wyoming Field Office

cc:  Statewide Habitat Coordinator, WGFD, Cheyenne, WY
     Nongame Coordinator, WGFD, Lander, WY
July 6, 2001

Chris Abernathy
Project Manager
Wyoming Water Development Commission
Hershler Bldg., 4th West
122 West 25th St.
Cheyenne, WY 82002

RE: Environmental Review Sample Letter
WWDC Dayton Water Supply Project, Level II

Dear Chris:

Enclosed is a sample letter which was sent to the following list:

**John Barnes**, Administrator, Surface Water Division State Engineers Office
Hershler Bldg. 4-E, 122 West 25th ST., Cheyenne, WY 82002

**Dick Stockdale**, Administrator, Groundwater Division State Engineers Office
Hershler Bldg. 4-E, 122 West 25th St., Cheyenne, WY 82002

**Matt Bilodeau**, Cheyenne Regulatory Office, U.S. Army Corps of Engineers
2232 Dell Range Blvd. Suite 210, Cheyenne, WY 82009

**Steve Bond**, Sheridan County Inspector, 224 S. Main St. Suite B-8E, Sheridan, WY 82801

**Wendy Bredehoft**, Director of the Division of Cultural Resources, Wyoming State Historic Preservation Office, 2301 Central Ave., Barrett Bldg. 3rd Floor, Cheyenne, WY 82002

100 East B St. Room 3124, Casper, WY 82601

**Tom Collins**, Habitat Coordinator, Wyoming Game and Fish Dept., 5400 Bishop Blvd.,
Cheyenne, WY 82006

**Mike Long**, State Supervisor, U.S. Fish and Wildlife Service, Ecological Services
4000 Airport Parkway, Cheyenne, WY 82001

**Darla Potter**, DEQ/Air Quality Division, Hershler Bldg. 4-W, 122 West 25th St.,
Cheyenne, WY 82002

**Barbara Sahl**, DEQ/Water Quality Division, Hershler Bldg. 4-W, 122 West 25th St.,
Cheyenne, WY 82002

*Engineering Solutions Through Applied Technologies*
Sincerely,
EnTech, Inc.
by David Engels, PE

[Signature]
David Engels, PE
Project Manager

Encl: Sample Letter
Project Map

G:\00003p\01007_Dayton_LII\Correspondence\LtrAbernathyERletterlist.doc

*Engineering Solutions Through Applied Technologies*