Draft Report

Crowson II and Ashland Loop Road Reservoir Siting Study

for

City of Ashland

October 2006

Prepared for:
City of Ashland
Department of Public Works
20 East Main Street
Ashland, Oregon 97520

BROWN AND CALDWELL

BROWN AND CALDWELL

October 31, 2006 130825

Pieter Smeenk, P.E.
City of Ashland
Department of Public Works
20 East Main Street
Ashland, Oregon 97520

Subject: Crowson II Reservoir and Ashland Loop Road High Level Reservoir Siting Study

Dear Pieter:

Enclosed are eight copies of the City of Ashland, Crowson II Reservoir and Ashland Loop Road High Level Reservoir Siting Study Draft Report for your review. Per your request, I will also send the body of this report electronically in an email message. At the completion of the project, a Final Report will be prepared incorporating any comments received. Please feel free to contact me at 801-316-9800 with any questions. It has been our pleasure to work with you on this important project. We look forward to the opportunity to assist you during the next phase of this project.

Sincerely,

BROWN AND CALDWELL

Brandon Heidelberger, P.E.

CC: Ed Olson, P.E.
Bob Willis, P.E.

EXECUTIVE SUMMARY

The City of Ashland (City) plans to design and construct two new reservoirs to meet the current and long term growth and water demand requirements of its customers. A reservoir and storage study was conducted in 2005 which identified two potential storage projects for the City, the Ashland Loop Road Reservoir and the Crowson II Reservoir. The City retained Brown and Caldwell to perform a reservoir siting study for these two facilities. The study included the analysis of potential sites on City-owned property at an elevation to allow these reservoirs to be integrated into the existing water system and the preparation of conceptual level cost estimates and construction schedules.

ASHLAND LOOP ROAD RESERVOIR

The City currently provides water to approximately 80 higher-elevation residential customers located in the west hills close to the Ashland Loop Road. Water is supplied from two small continuous running pump stations. Customers are separated into two high-level pressure zones ranging in elevation from 2,450 feet to 2,680 feet.

Fire protection to the area is supplied by a 500 gallons per minute (gpm) electric pump located in the Crowson Pump Station. There is no stored water in either of these high level service zones to maintain fire protection or domestic supply, if the power supply is interrupted. These customers face higher than normal fire protection requirements since they are located in the City's forest/urban interface zone where forest fires could lead to catastrophic loss.

The best way to ensure adequate fire protection and a continuous water supply to the area is to install a water storage reservoir to serve it. City planning staff indicate that there is a maximum build out of approximately 130 single family residents in this area. The capacity of the proposed Ashland Loop Road reservoir needs to be 200,000 gallons to supply the minimum required fire protection of 1,000 gpm for a duration of 2 hours and still have adequate water to meet reserve and operational needs of the high-level water systems.

CROWSON II RESERVOIR

The Crowson II Reservoir will increase the base storage capacity of the entire Ashland water system to allow it to function safely and reliably as demands increase. The current estimate for its size is 2 million gallons. It will be placed at the same service elevation and located close to the existing Crowson Reservoir in order to assist the existing reservoir in handling the peak hour water demands being placed on the system. Even though it is a number of years away from being built, the City decided to include this facility in the siting study being conducted for the Ashland Loop Road Reservoir to identify an appropriate site as early as possible. This will hopefully avoid future conflicts with other uses for the selected reservoir site.

SITING STUDY RECOMMENDATIONS

Site Evaluation

The overflow elevation of the two reservoirs and steep topography of the property limits potential reservoir sites. Three sites were identified for the Ashland Loop Road Reservoir and one site was identified for the Crowson II Reservoir. The site evaluation included a survey to indicate the required overflow elevation, site reconnaissance of the area by the City and Brown and Caldwell staff to identify the most promising sites, and a preliminary geotechnical evaluation by The Galli Group. Although not included in this preliminary effort, a detailed soils analysis and boring analysis will be required prior to final design.

Based on the results of the preliminary evaluation, all four sites were found to be suitable for the proposed Ashland Loop Road Reservoir. Site A or Site B for the reservoir appear to have the most promise since they are located adjacent to the Ashland Loop Road and may offer the easiest access to the future reservoir with the least environmental/public perception concerns.

Crowson Pump Station Evaluation

In addition to the siting study, Brown and Caldwell was asked to evaluate the Ashland Loop Road high level service area to determine the Ashland Loop Road reservoir overflow elevation and review the Crowson Pump Station to determine modifications necessary to supply water to

the new reservoir. It was determined that the recommended overflow elevation should be 2,680 feet. However, this elevation could vary by 20 feet to meet the specific siting requirements of the reservoir.

Pump No. 1 and Pump No. 2 in the Crowson Pump Station do not generate sufficient head to pump water to the proposed new reservoir, and will need to be replaced. There may be an opportunity to replace only the impeller or just the pump in Pump No. 2. Pump No. 3, the fire pump, should remain in the station and can be used to augment the water supply in case of a fire even though it will not generate sufficient head to pump water to the new reservoir. The final design parameters of the new pumps will need to be determined after the final overflow elevation of the reservoir is determined.

Cost Estimate and Schedule

The estimated cost of the Crowson II Reservoir including site work, piping and mechanical, and electrical is $4.4 million. The estimated cost for the Ashland Loop Road Reservoir including site work, piping and mechanical, and electrical varies between $1.1 and $1.6 million depending on the type of reservoir constructed (steel or concrete). The schedule for the Ashland Loop Road Reservoir calls for design to start January 2007, bid and award in June of 2007 and construction to be completed by January 2008.

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1.0 INTRODUCTION

The purpose of this report is to relate the findings of a reservoir siting study for the City of Ashland, Crowson II Reservoir and Ashland Loop Road High Level Reservoir. The City of Ashland (City) has retained Brown and Caldwell to provide engineering services in evaluating potential locations for the reservoirs and designs for the reservoirs including conceptual level cost estimates and construction schedules. The project also includes an evaluation of the Crowson Reservoir Pump Station. Brown and Caldwell has completed the evaluation portion of the project. This report presents the findings of the site analysis including an evaluation of potential sites, conceptual designs, and recommendations of the pump station evaluation. At the completion of the project, a final report will be prepared comprised of this draft report including any modifications addressing review comments from the City.

This report is divided into sections that discuss the following:

Section 1.0 *Introduction* — This section provides relevant background to the project and an overview of Brown and Caldwell's approach.

Section 2.0 *Reservoir Siting Evaluation* — This section presents the initial site review and provides a summary of pertinent details from the geotechnical evaluation and Crowson Reservoir Pump Station evaluation.

Section 3.0 *Tank Option Evaluation* — This section presents a review of tank type alternatives for the two reservoirs and evaluates hydraulics and structural suitability of each alternative.

Section 4.0 *Conceptual Design* — This section discusses recommended design features for the new reservoirs including considerations for final design.

Section 5.0 *Permitting* — This section provides a description of the permitting process for the proposed reservoirs.

Section 6.0 *Cost Estimates and Scheduling* — This section provides a conceptual/planning level cost estimate and preliminary schedule for final design and construction of the proposed reservoirs.

1.1 PROJECT BACKGROUND

The City of Ashland intends to add to its distribution system reservoirs to address needs for additional system storage, improve operational efficiency, and add reliability. The existing Crowson Reservoir is a 2.2-million gallon (MG) reservoir and is the primary reservoir for the system. A proposed new 1.5- to 2-MG reservoir is to be located near the existing Crowson Reservoir and at the same service elevation. An additional 0.20-MG tank is proposed to be located on Ashland Loop Road to provide service to a limited number of higher elevation customers located directly above the existing Crowson Reservoir. Both proposed sites are in an open area used by the public, and the upper site will be near a popular nature trail. Supplying the upper tank will also require improvements to the Crowson Reservoir Pump Station.

The city intends to construct the upper 0.20 MG distribution system reservoir in the next year. To address this goal, the City has retained Brown and Caldwell to provide engineering services for a three phase project that will provide the needed new water storage. The three phases are: Phase 1 – Reservoir Siting Analysis, Phase 2 - Final Reservoir Design, and Phase 3 – Construction. This report addresses Phase 1 and includes preliminary recommendations for final design and construction.

1.2 PROJECT APPROACH

The purpose of the Crowson II and Ashland Loop Road Reservoir Siting Study is to evaluate the proposed tank sites and tank design alternatives for the two reservoirs in time to allow early 2007 construction. Brown and Caldwell followed a planned, phased approach to meet these objectives. The following activities were performed to complete Phase I of this project:

Task 1 – Data Gathering

Relevant information was collected from City staff and reviewed. A preliminary geotechnical analysis was performed on selected sites.

Task 2 – Two-Stage Site Review Process

An initial review narrowed the realistic sites for each tank to a minimum number. The Galli Group conducted a preliminary geotechnical evaluation of these sites and produced a technical

memorandum for that evaluation (see Appendix A). Brown and Caldwell reviewed and summarized pertinent design details for the report.

Task 3 - Evaluation of Tank Options

A wide range of tank types were considered for the project. The most appropriate alternatives are evaluated herein with regards to hydraulic and structural suitability to the proposed site. Aesthetic factors for tank construction were considered heavily in selecting the most appropriate design alternatives.

Task 4 – Conceptual Design

Based on the findings of the site and tank option evaluations the most favorable site and tank types were selected for further consideration. A conceptual design of the tanks was developed, including tank sizing, configuration, piping, and recommended design features.

Task 5 – Permitting

Necessary permits for the project were evaluated and reviewed with respect to schedule, permit requirements, cost, and potential issues.

Task 6 – Cost Estimates and Scheduling

Conceptual level cost estimates were produced for both reservoirs. A construction schedule with estimated timelines was also developed.

Task 7 – Crowson Reservoir Pump Station Evaluation

Brown and Caldwell staff performed a visual inspection of the pump station and documented that inspection with a photographic summary and written comments. A hydraulic analysis of the suitability of the existing pumps and piping systems to serve the new reservoir was performed. The Ashland Loop Road Reservoir overflow elevation has also been determined. A technical memorandum documenting this evaluation and associated recommendation has been created (see Appendix B).

Task 8 – Report Production

This report has been created and submitted to the City for review as part of this task. A final report will be generated including changes made to reflect City comments. Figures presenting preliminary renderings and layout views of the reservoir sites have also been created.

2.0 RESERVOIR SITING EVALUATION

The City of Ashland plans to design and construct potable water storage to meet the storage and hydraulic requirements of the City's water distribution system. The purpose of this section is to evaluate potential locations for siting the new distribution water storage reservoirs.

2.1 INITIAL SITE REVIEW

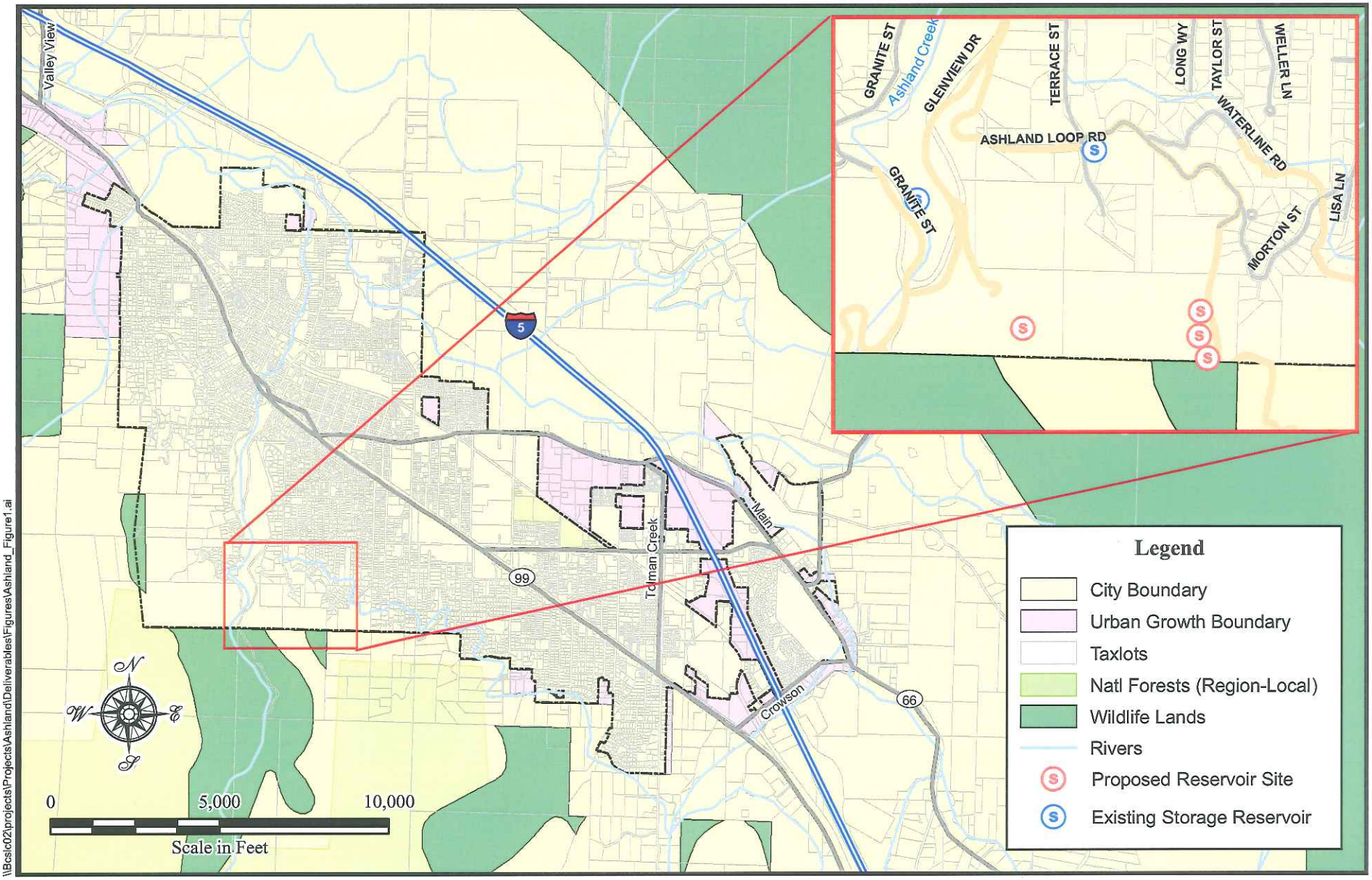
The focus area of this evaluation is presented in Figure 1. Proposed reservoir sites are located due south of downtown Ashland in the upper, west foothills. The area is characterized by steep terrain and dense vegetation. Nature trails and scenic canyon roads also run through the area. Existing City facilities including the Crowson Reservoir, Crowson Pump Station and waterlines are shown in Figure 2.

This area is ideal for construction of the new reservoirs based on hydraulic requirements of the system, water needs of nearby customers, fire protection requirements, and vicinity of nearby pumping facilities to fill the reservoir. In addition, the city owns property in the area making it an advantageous location for additional storage facilities. Locating the reservoirs on City owned property will help to minimize the overall cost of the project.

The proposed Crowson II Reservoir must be located at approximately the same elevation as the existing Crowson Reservoir to operate the reservoir efficiently. Hydraulic requirements associated with the proposed Ashland Loop Road Reservoir dictate a narrow range of allowable elevation for that reservoir to maintain desirable pressure to customers. These elevation constraints combined with the steep slopes in the area limited the number of feasible sites for the reservoirs. Only one site for the Crowson II Reservoir and three sites for the Ashland Loop Road Reservoir have been deemed viable.

2.2 SITING ALTERNATIVES

A description and detailed evaluation of each of the viable reservoir sites is provided below. The Galli Group was contracted to perform a preliminary geotechnical siting investigation as part of this project. Two reports, "Geotechnical and Geologic Siting Study – Crowson II Reservoir Site"



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CITY OF ASHLAND
Reservoir Siting Study Area

FIGURE 1

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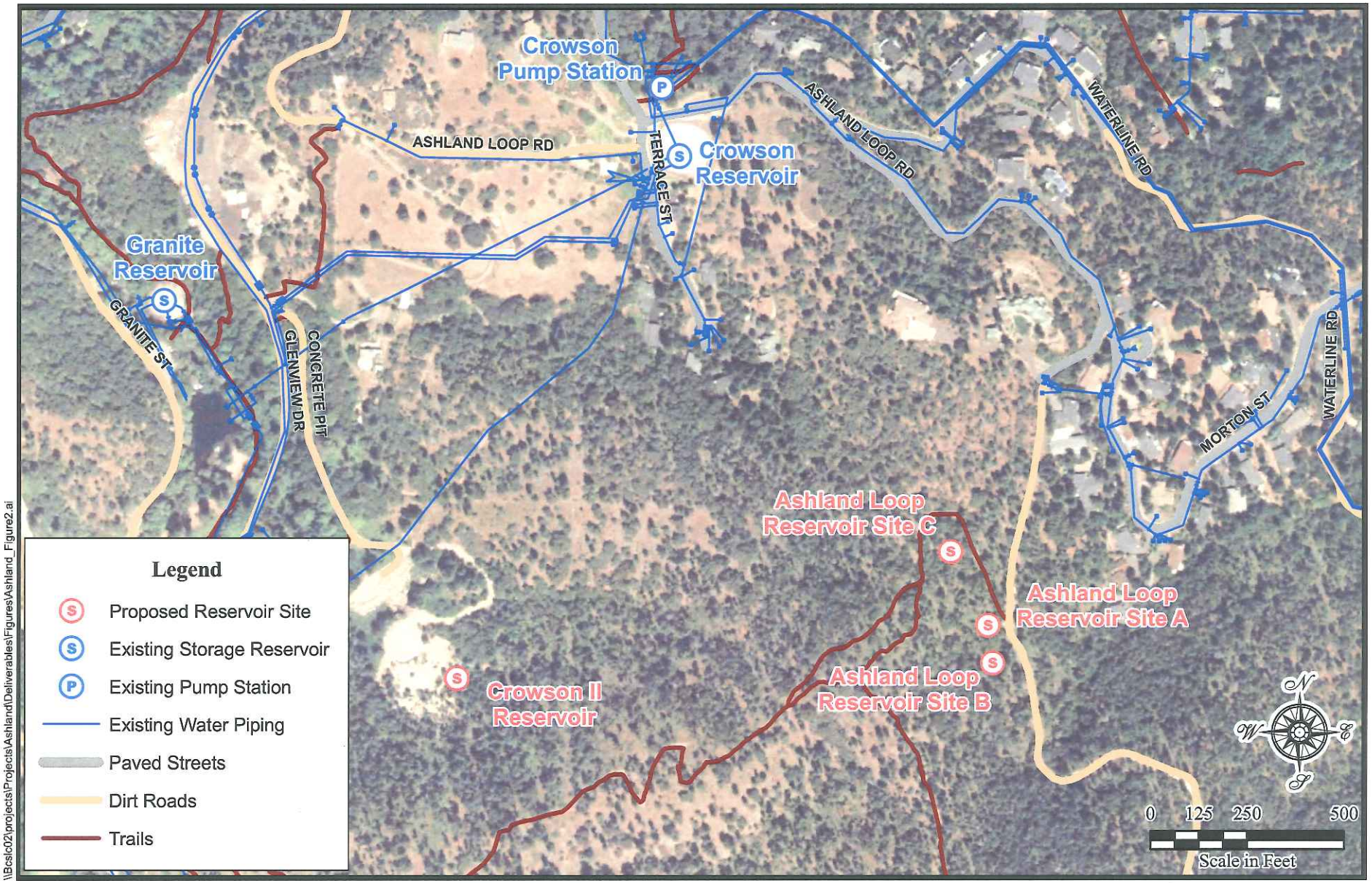

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CITY OF ASHLAND
Reservoir Siting Alternatives
FIGURE 2

CITY OF ASHLAND

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and "Geotechnical and Geologic Siting Study – Ashland Loop Road Reservoir Site", were provided documenting the findings and recommendations of the investigation. Those reports have been summarized in this section and can be found in Appendix A.

2.2.1 CROWSON II RESERVOIR SITE. The proposed Crowson II Reservoir site is located approximately 2 miles up the Ashland Creek basin from downtown Ashland and approximately ¼ mile south-southwest of the existing Crowson Reservoir. An existing quarry neighbors the proposed site downslope and to the west. Figure 3 presents the site location with respect to its surroundings.

The site sits on a northwest sloping mountain side at a relatively steep slope. Slopes range between 1.5H:1.0V to 2.0H:1.0V. The site is at the same elevation of the existing Crowson Reservoir. Vegetation on the site includes a moderately dense population of evergreen and deciduous trees, scattered brush and thick ground cover.

The Crowson II Reservoir will be a 1.5 to 2.0 MG tank, requiring a large footprint. The final site will require leveling areas for the tank, access roads up to and around the tank, parking, and maintenance areas.

Geotechnical Evaluation Summary

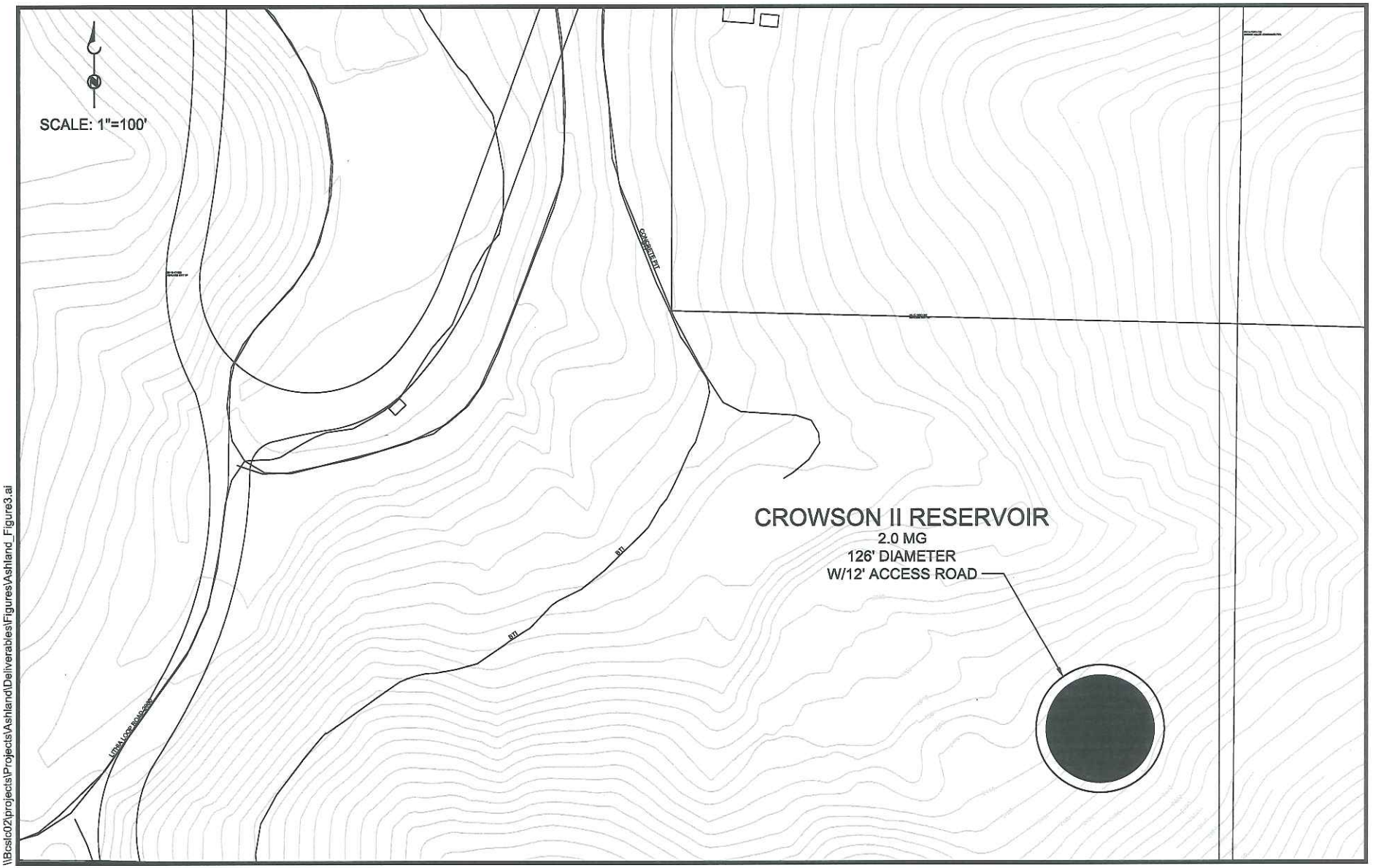
The surficial soils consist of sandy silts and slightly clayey, silty sands (decomposed granite). This is underlain by coarser and denser, weathered to decomposed granite and harder granite rock. At depths between 8- to 10-feet (ft) the granite rock appears to become relatively hard.

A 1.5- to 2.0-MG tank would require a level cut on the order of 120- to 150-ft, resulting in a total excavation height of 130- to 140-ft and a depth of 75- to 85-ft cut vertically from the ground surface. The engineers estimate an excavation in excess of 10,000 cubic yards would be required. Though the soil parameters indicate that blasting may be needed for excavation, it is not believed that extensive blasting will be required. Excavations as deep as 40-ft have been accomplished nearby by very large excavators equipped with the appropriate buckets for rock excavation. It is recommended that the quarry operators be consulted for specific excavation techniques that have proven successful. The on-site fractured granite rock excavated for the project should make good structural fill.

Groundwater level is more than 150-ft below the surface at this location and, therefore, does not effect the tank site. However, large amounts of surface and shallow subsurface runoff can be expected and will require adequate site drainage to protect the reservoir base. This includes proper drainage at all exterior foundations, embedded structures and retaining walls. Erosion control measures will also be needed. A detailed description of the recommended drainage and erosion control can be found in the geotechnical evaluation report.

Under seismic considerations the site has been given a mixed classification; Site Class D For areas over structural fill and Site Class C for all areas founded on weathered to hard granite rock (IBC; 2003).

Based on the evaluation, the soil and bedrock conditions at the proposed Crowson II Reservoir site are suitable for the reservoir project, provided the geotechnical recommendations contained in the report are incorporated in the design and construction of the project.



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CITY OF ASHLAND
Crowson II Reservoir Site

FIGURE 3

CITY OF ASHLAND

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2.2.2 ASHLAND LOOP ROAD RESERVOIR SITE. There are three viable sites for the proposed Ashland Loop Road Reservoir. The three alternatives are designated as Site A, Site B and Site C in this report. The sites are located approximately ¼ mile south-southeast of the existing Crowson Reservoir on the opposite side of a ridge above the reservoir. Specifically, Site A is located near the intersection of the nature trail and Ashland Loop Road, Site B is located at the back of a swale off Ashland Loop Road, and Site C is located on the hillside above Ashland Loop Road near the ridgeline. Sites A, B and C can be seen in Figure 4.

The sites are positioned on the north facing slope where slopes are moderately steep ranging between 3.0H:1.0V to 4.0H:1.0V. The target elevation for the base of the tank is 2,680-ft in order to provide adequate pressure to the intended service area. Vegetation on the area of the sites includes a moderately dense population of evergreen and deciduous trees, scattered brush and thick ground cover.

The proposed Ashland Loop Road Reservoir will be a 0.20 MG tank. The final site must provide adequate level area for the tank and for an access road up to and around the tank.

Geotechnical Evaluation Summary

Due to the close proximity of the three sites, the geotechnical considerations are generally the same for each alternative. The surficial soils consist of sandy silts and silty sands. This is underlain by coarser and denser, weathered to decomposed granite and harder granite rock. At depths between 10- to 15-feet (ft) the granite rock appears to become relatively hard.

A 0.20-MG tank would require a level cut on the order of 60- to 70-ft, and if the access road and parking areas are to be included on the site, a level cut of 80- to 90-ft wide would be required. Depending on which of the three sites, this would result in a total excavation height between 25- to 45-ft and a depth of 15- to 30-ft cut vertically from the ground surface. The engineers estimate an excavation in excess of 3,500 cubic yards would be required depending on the site. A more detailed discussion of the excavation requirements for each alternative can be found below.

Though the soil parameters indicate that blasting may be needed for excavation, it is not believed that extensive blasting will be required. Excavations as deep as 40-ft have been accomplished at site in the area by very large excavators equipped with the appropriate buckets for rock

excavation. It is recommended that the nearby quarry operators be consulted for specific excavation techniques that have proven successful. The on-site fractured granite rock excavated for the project should make good structural fill.

Groundwater level is more than 150-ft below the surface at this location and, therefore, does not effect the tank site. However, large amounts of surface and shallow subsurface runoff that can be produced in the area, so adequate site drainage is recommended. This includes proper drainage at all exterior foundations, embedded structures and retaining walls. Erosion control measures will also be needed. This is especially true for Site B, located in a natural swale. A detailed description of the recommended drainage and erosion control can be found in the geotechnical evaluation report.

Under seismic considerations the site has been given a mixed classification; Site Class D For areas over structural fill and Site Class C for all areas founded on weathered to hard granite rock (IBC; 2003). Of the potential geologic and seismic induced hazards only the moderate to severe ground shaking during a seismic event present a reasonable risk that could cause damage to the site.

The evaluation concluded that the soil and bedrock conditions at the proposed Ashland Loop Road Reservoir sites are suitable for the reservoir project, provided the recommendations contained in the report and highlighted in this section are incorporated in the design and construction of the project.

Additional Considerations

Each of the siting alternatives is located near existing residences and a popular nature trail off Ashland Loop Road. It is important that selected site and reservoir design have minimal impact on the surroundings and visibility from the nature trail.

Ashland Loop Road Reservoir – Site A

Site A is at the intersection of the trail and the Ashland Loop Road. This site is advantageous in terms of minimizing the impact on the surroundings and those using the trail. The tank would be accessed directly from the existing roadway, eliminating the additional disturbance related to

cutting an access road into the hillside. This location also keeps the disturbance next to the road, maintaining the serenity and natural views away from the road. Additional trailhead parking could also be included in the tank site construction, increasing usability of the trail.

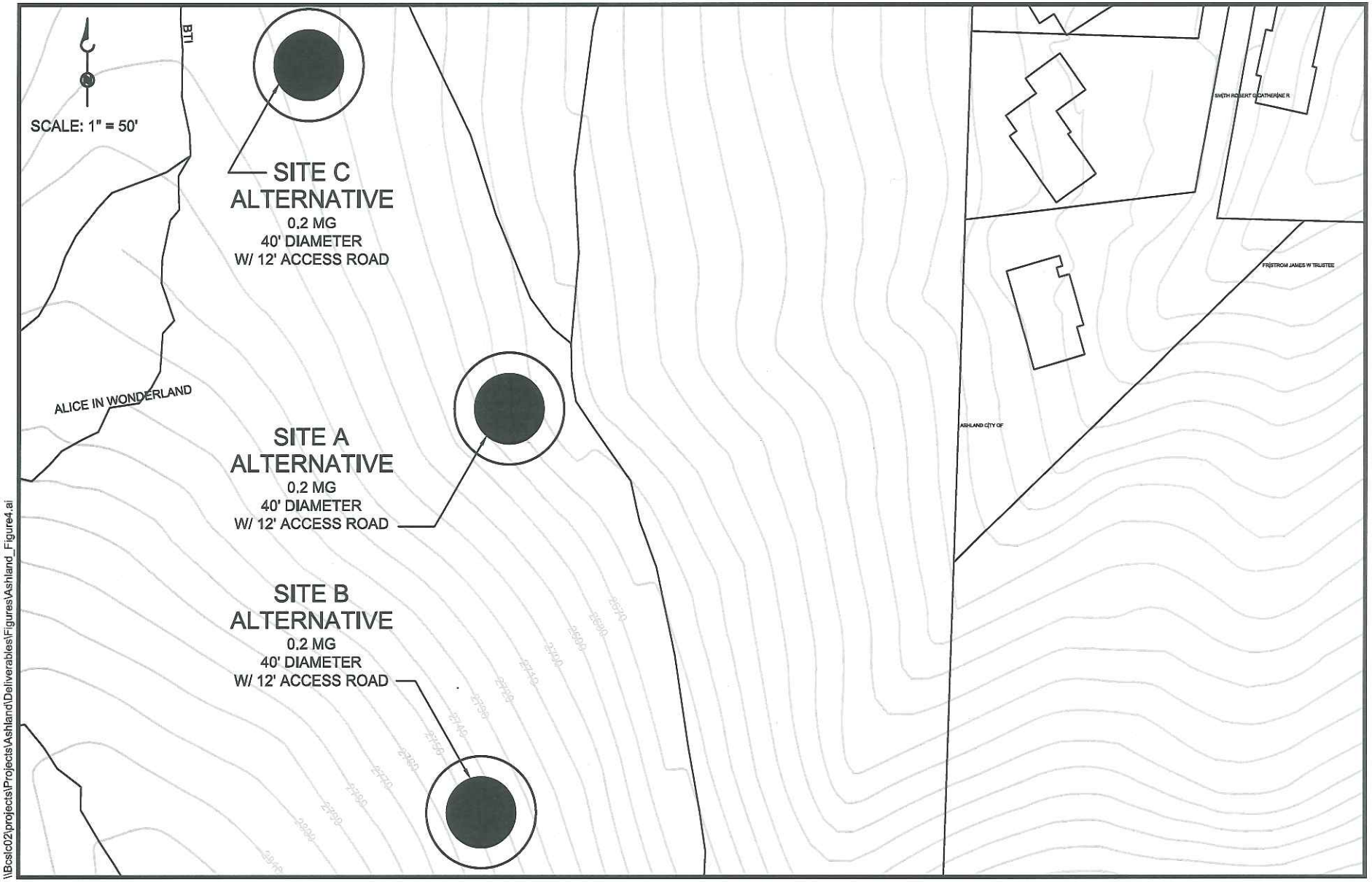
At this location the entire tank footprint and access road around the tank would have to be cut into the hillside. According to the geotechnical and geologic study excavation depth at the back of the excavation would be on the order of 45- to 50-ft.

Ashland Loop Road Reservoir – Site B

Site B positions the tank and associated facilities up a swale off of Ashland Loop Road. Again access would be right off of the existing roadway, eliminating the need for an access road to the tank. This site also has the advantage of maintaining the disturbances next to the road and off the trail. However, constructing the tank in a natural swale presents some additional complications. Doing so requires considerable effort to permanently divert any runoff down the swale around the site. Additionally, the geotechnical study reported that the soils in a portion of this site consist of colluvial deposits, which would have to be over excavated and replaced with structural rock fill. This could increase the construction costs for the tank over the site A costs.

Ashland Loop Road Reservoir – Site C

Located up on the hillside above the roadway, Site C offers the most hydraulically advantageous position for the tank. The higher elevation increases the potential service area of the tank. Also, constructing the tank near the ridgeline will most likely decrease the volume of material to be excavated. The engineers estimate from the geotechnical report was for an excavation depth of 25- to 35-ft. However, locating the tank near the ridge would require additional effort to minimize the visibility of the tank. Moreover, an access road to the tank would have to be constructed adding cost and increasing the impact on the surroundings.



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CITY OF ASHLAND
Ashland Loop Reservoir Site

FIGURE 4

CITY OF ASHLAND

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2.3 CROWSON RESERVOIR PUMP STATION EVALUATION

The purpose of this section of the report is to summarize pertinent design details with respect to the existing Crowson Reservoir Pump Station. A full write-up of this evaluation is presented in Appendix C.

As part of the siting study for the new reservoir, Brown and Caldwell was asked to evaluate the existing Crowson Reservoir Pump Station. This evaluation included the following:

1) Determine the overflow elevation of the new reservoir

2) Determine what if any changes will be needed to the pump station for it to be able to supply water to the new reservoir

3) Supply the City of Ashland with design conditions for any new pumps that may be needed in this station.

The preferred overflow elevation for the new Ashland Loop Reservoir is 2680 ft. However the overflow elevation can range from 2660 ft – 2680 ft and operate properly. The exact overflow elevation will be determined after the reservoir design is completed.

Two new pumps will be required in the Crowson Pump Station. They should have a design point of 130 gpm @ 265 TDH. The TDH requirements were determined based upon the new reservoir having an overflow of 2680 ft. If the overflow elevation changes as a result of the final design of the reservoir, the TDH will also need to change. The NPSH requirements for these new pumps should be checked to be sure low water level in the Crowson Reservoir does not impact their operation. Pump No. 3 should be left in the station as an emergency backup. An auxiliary power supply or, as a minimum, the ability to connect the station to an external auxiliary power supply should be added to enhance the reliability of the station.

The proposed pumps will require 15 hp motors. Since the proposed pumps are only slightly larger that the current pumps, piping and power supply should not be a significant issue in the replacement of these pumps. Staff should investigate the possibility of having Pump No. 2 retrofitted with a new impeller and/or pump to meet the new design conditions. Controls will be

needed between the new reservoir and the Crowson Pump Station to enable the pumps to operate on a water level signal from the new Ashland Loop Road reservoir.

3.0 TANK OPTION EVALUATION

The purpose of this section of the report is to evaluate reservoir construction alternatives for the new distribution water storage reservoirs. The following items are addressed in this section:

- Reservoir capacity
- Reservoir construction
- Preliminary reservoir design criteria

3.1 RESERVOIR CAPACITY

The new distribution water storage reservoirs must be capable of providing storage to meet the City's peak water demand including fire flows and emergency storage. Based on preliminary discussions, a desired storage capacity of 1.5 to 2.0 MG has been proposed for the Crowson II Reservoir and 0.2 MG for the Ashland Loop Road Reservoir. Although not included in the scope of this project, a water distribution system analysis will be conducted to determine the final capacity of the two reservoirs.

3.2 RESERVOIR CONSTRUCTION

The City desires to minimize visual impacts of the reservoir. The topography at the proposed sites allows for construction of a partially buried water storage tank. Figure 5 displays a representative graphic of the partially buried tank concept. The tank roof slab will be visible above grade and the walls buried to match existing slopes.

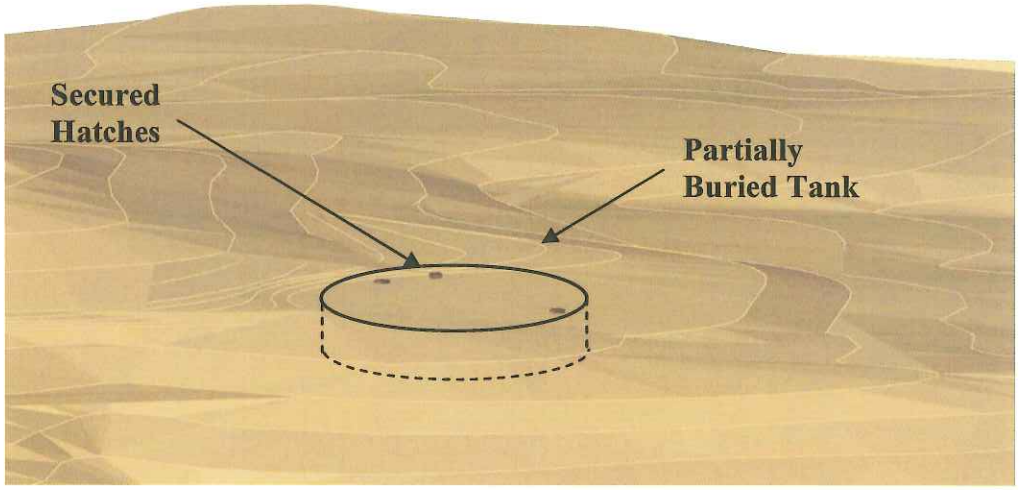


Figure 5 - Buried Tank Schematic

Several different tank configurations and materials are available for large capacity reservoirs. Based on the City's desire to partially or completely bury the reservoir, concrete tanks are required. For concrete tanks, several types warrant further evaluation and are as follows:

- Circular, prestressed internal tendon
- Circular, prestressed strand wrapped tank
- Circular, conventional reinforced tank

For economical comparison, a steel tank is also considered for the upper 0.20 MG reservoir.

Circular Pre-stressed Internal Tendon Tank

A circular, pre-stressed internal tendon tank configuration allows for compression of the floor slab, cylindrical wall, and the roof slab. In tendon tanks, high strength steel cables called tendons are inserted into horizontal ducts and then stressed to place the tank in compression. After the strands are tensioned, cement grout is injected into the ducts to displace any air and help provide corrosion protection.

Standards for the design and construction of pre-stressed internal tendon tanks are provided by the American Water Works Association (AWWA) D115 Manual.

Advantages to a circular pre-stressed reservoir are as follows:

- Most economical design for large water tanks.
- The proposed 2.0 MG reservoir is large enough to be in the economical size range.
- Good water-tightness due to compression of the floor slab, walls, and roof.
- Corrosion resistant design due to several layers of protection of the tendons by shotcrete, internal ducts, and grout.

Disdvantages to a circular pre-stressed reservoir are as follows:

- Only one major local manufacturer supplies the internal tendon and stressing materials. In order to ensure a competitive bid, both an internal tendon and strand wrapped tank system can be bid.

Circular Pre-stressed Strand Wrapped Tank

In a strand wrapped tank, a cast-in-place wall is externally, horizontally stressed (placed into compression) by wrapping high strength wire around the exterior of the concrete wall. A shotcrete coat is then applied over the wire to protect the wire from corrosion. In both an internal tendon and strand wrapped tank the compressive forces help to ensure that leakage resulting from concrete cracking is minimized or eliminated. When the wire-wrapping is completed several layers of shotcrete are applied to the entire wall surface in order to build up the shotcrete overcoat for corrosion protection of the wires.

Standards for the design and construction of pre-stressed internal tendon tanks are provided by the American Water Works Association (AWWA) D110 Manual.

Advantages to a circular pre-stressed reservoir are as follows:

- Generally less expensive than a conventional, poured in place tank in the moderate to large size range.
- Good water-tightness due to compression of the walls.

Disadvantages to a circular pre-stressed reservoir at this site are as follows:

- If the shotcrete is improperly applied, the wires can be prone to corrosion especially in buried applications.
- Normally only one manufacturer bids on this design. Competitively bidding against another design is beneficial in obtaining a competitive price.

Conventionally Reinforced Circular Tank

A conventionally reinforced circular tank resists internal and external forces by means of hooped reinforced steel. Due to economic considerations, the height of a conventionally reinforced circular tank is normally limited to approximately 25 feet. Standards for the design and construction of conventionally reinforced concrete water tanks are provided by the American Concrete Institute (ACI) 350 Manual.

Advantages to a conventionally reinforced circular reservoir are as follows:

- Economical in both small and very large sizes

- Ease of construction expands the opportunity to obtain multiple bids

Disadvantages to a conventionally reinforced circular reservoir are as follows:

- Economic considerations limit the height available.

A conventionally reinforced circular tank will be slightly more economical over the tendon tank at the Ashland Loop Reservoir due to its smaller size.

Steel Tank

Welded or bolted steel is commonly used as an economical material for above-ground reservoirs. For permanent installations, welded steel is usually preferred over bolted steel due to the typically lower maintenance costs and longer lifespan expectancy. Standards for the design and construction of steel water tanks are provided by the AWWA D100, Standard for Welded Steel Tanks for Water Storage, and AWWA D103.

Advantages to a steel tank include the following:

- Economical construction
- A variety of configurations are available to maximize hydraulic efficiency
- Smaller footprint associated with taller tank options

Disadvantages to a steel tank include the following:

- Steel tanks cannot be buried
- Aesthetic considerations (i.e., more noticeable and difficult to conceal)

3.3 SUMMARY AND CONCLUSIONS

A partially buried reservoir will lessen the visual impacts and improve security of the proposed tanks. Concrete tanks are required for a buried tank and may consist of a circular, prestressed internal tendon, strand wrapped or conventional reinforced tank. An internal tendon tank provides an economical means of construction for the Crowson II Reservoir while providing good water tightness and corrosion resistance. Pre-stressed strand wrapped design is also suitable for this application. We recommend that both options be bid for construction. For

purposes of this report, we have selected the internal tendon option on which to base the project estimate and schedule.

Due to the smaller size of the Ashland Loop Road Reservoir, a conventional reinforced concrete tank will be slightly more economical over the prestressed alternatives. If economic considerations preclude a buried tank, an above ground steel reservoir would be a viable alternative. Construction cost estimates will be developed for both alternatives in Section 6.

Recommended design criteria for the Crowson II Reservoir and Ashland Loop Road Reservoir are presented in Table 1 and Table 2 respectively. Alternative dimensions for an above ground steel water tank for the Ashland Loop Road Reservoir are presented in Table 3. With the steel option, a taller tank can be constructed that will minimize the required footprint. A taller tank will be more noticeable and difficult to conceal. Tank criteria listed are considered a "first look" at the project. Dimensions will likely change as the design matures.

TABLE 1- CROWSON II RESERVOIR PRELIMINARY DESIGN CRITERIA	
Element	Crowson II Reservoir
Type	Circular, Prestressed Internal Tendon Tank
Design Standard	AWWA D115, IBC 2003, ACI 350
Location	Below grade
Diameter (ft)	126
Water Depth (ft)	21.5
Sidewall Depth (ft)	24
Floor Elevation (ft)	2,403.5
Volume (MG)	2.0
Overflow Elevation (ft)	2,425

Table 2- Ashland Loop Road Reservoir Preliminary Design Criteria	
Element	Ashland Loop Road Reservoir
Type	Circular, Reinforced Concrete
Design Standard	AWWA, IBC 2003, ACI 350
Location	Below grade
Diameter (ft)	40
Water Depth (ft)	21.5
Sidewall Depth (ft)	24
Floor Elevation (ft)	2659
Volume (MG)	0.2
Overflow Elevation (ft)	2,680

Table 3- Ashland Loop Road Reservoir Preliminary Design Criteria (Steel Alternative)	
Element	Ashland Loop Road Reservoir
Type	Steel
Design Standard	AWWA D100, AWWA D103, IBC 2003
Location	Above grade
Diameter (ft)	38
Water Depth (ft)	24
Sidewall Depth (ft)	26
Floor Elevation (ft)	2,656
Volume (MG)	0.2
Overflow Elevation (ft)	2,680

4.0 CONCEPTUAL DESIGN

This section of the report presents conceptual design concepts based on the results of the preliminary site and tank evaluation.

4.1 RESERVOIR TYPE

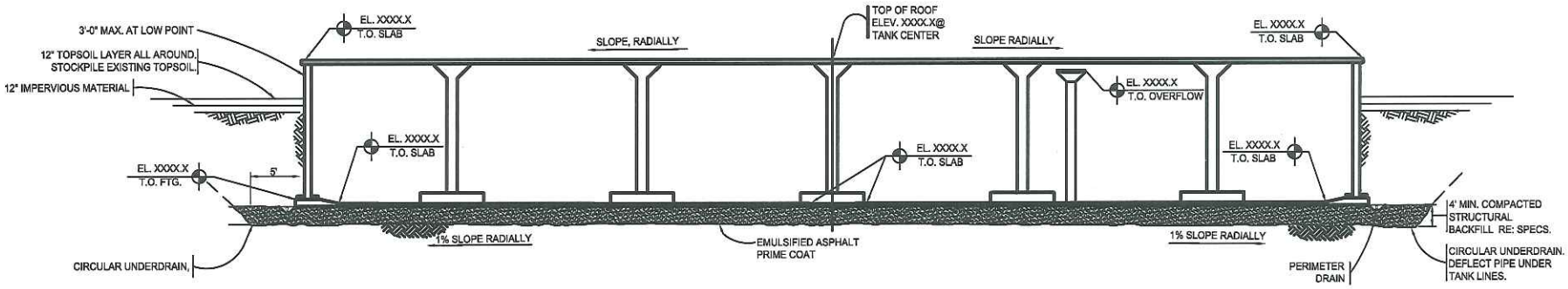
As discussed in the preceding section a desired storage capacity of 1.5 to 2.0 MG has been proposed for the Crowson II Reservoir and 0.2 MG for the Ashland Loop Road Reservoir. Representative sections for either a buried post tension concrete or conventional reinforced concrete reservoir are presented in Figure 6 and Figure 7 below. An above ground steel tank alternative for the Ashland Loop Road Reservoir is presented in Figure 8.

4.2 CROWSON II RESERVOIR INLET, OUTLET AND DRAIN PIPING

The tank will operate in tandem with the existing Crowson Reservoir. The tank will operate on a fill and draw manner with excess water (water not required within the distribution system at any given time) filling the tank and excess demand (water required within the distribution system) being withdrawn from the tank. Fill for the tank is expected to be through a 24-inch diameter line. The overflow pipe will be sized to handle a flow equivalent to the maximum fill rate of the tank. The drain piping system will be designed to allow the tank to be drained from full to empty in approximately 24 hours. This is equivalent to a drainage rate of approximately 1,389 gpm.

4.2.1 PIPING CONFIGURATION. For the purpose of developing cost data, pipeline diameters have been estimated in this section. Pipeline sizes will be evaluated further during final design. Both fill and draw water will be conveyed through a 24-inch diameter water line to the tank. The maximum water surface elevation within the tank will be 2425 feet above mean sea level. This is the elevation of the tank overflow weir.

Overflow from the tank, and water released from the tank when the tank is drained for cleaning or other maintenance, will be discharged through a 24-inch diameter line. These two lines will be connected at a point adjacent to the tank. A manually operated butterfly valve will be provided on the drain line just prior to where it connects to the overflow line. The combined overflow/drain line will then extend to a spillway.



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CITY OF ASHLAND
2.0 MG PT
TANK SECTION

FIGURE 6

CITY OF ASHLAND

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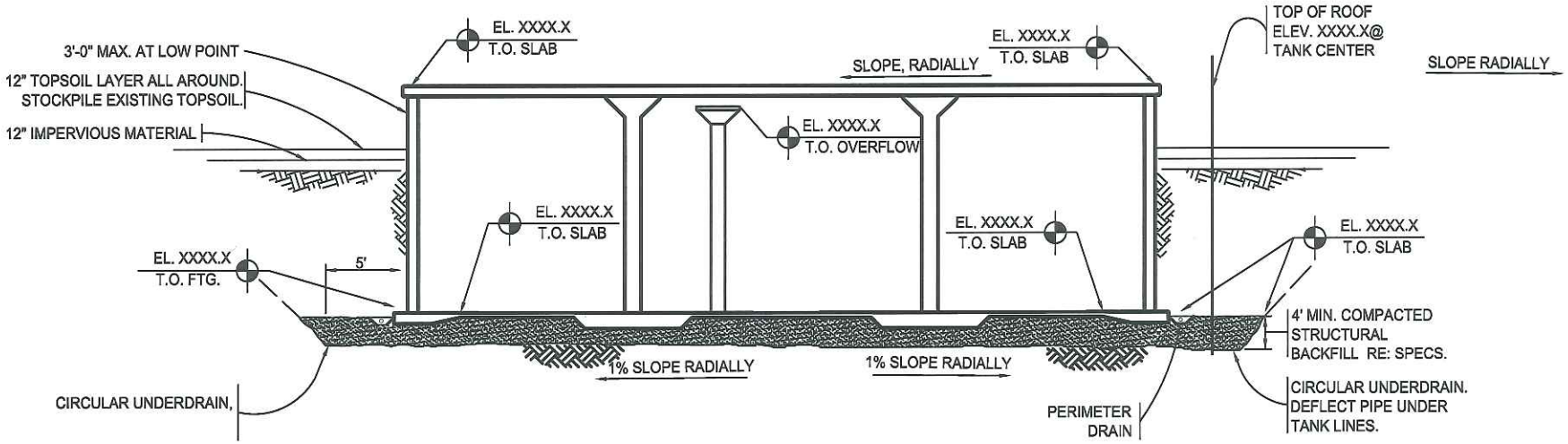

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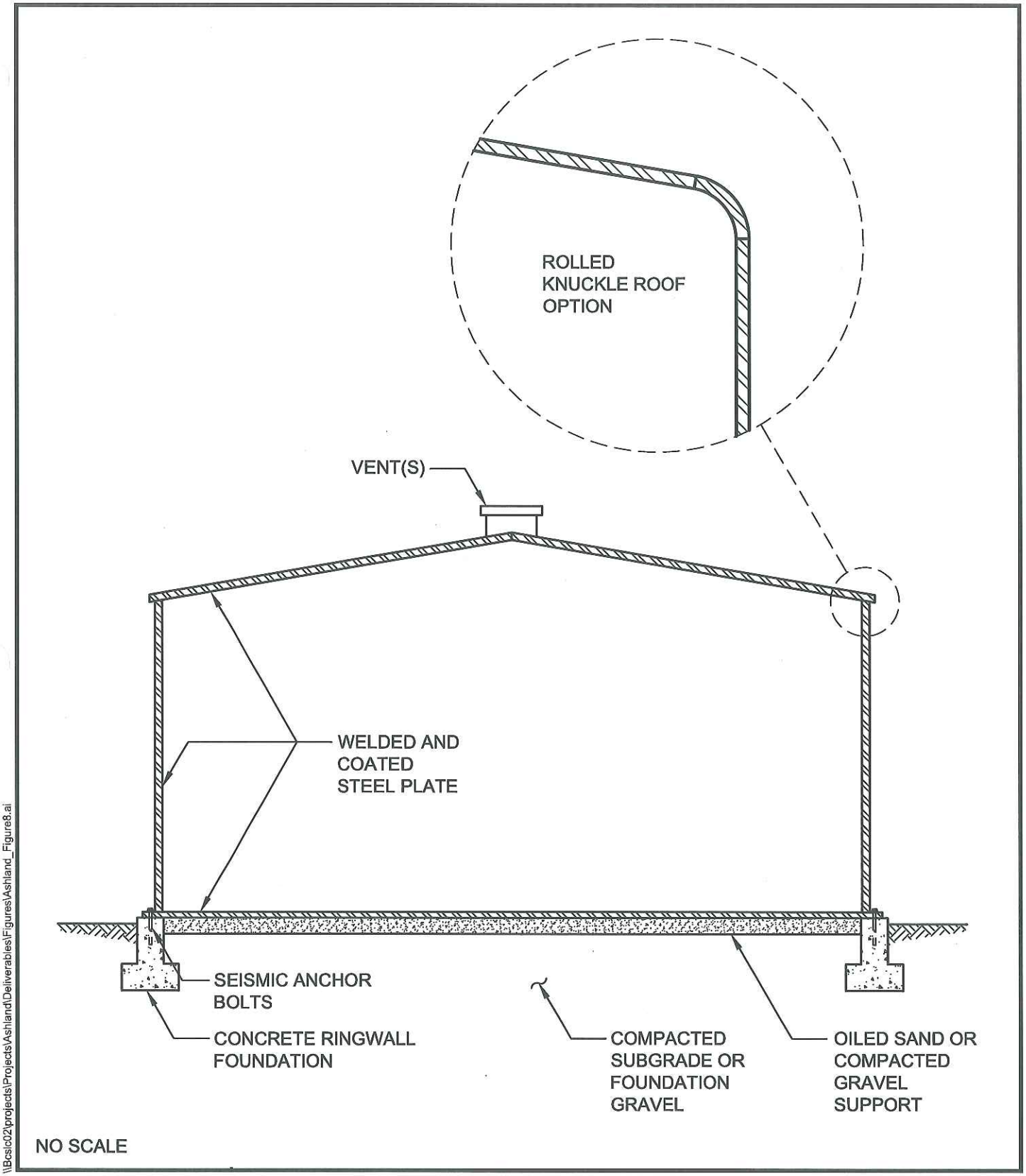
CITY OF ASHLAND
0.2 MG Reinforcement
TANK SECTION

FIGURE 7

CITY OF ASHLAND

BROWN AND CALDWELL

Environmental Engineers & Consultants



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CITY OF ASHLAND
0.2 MG Alternate
Above Ground Steel Tank
CROSS SECTION

FIGURE 8

CITY OF ASHLAND

BROWN AND CALDWELL
Environmental Engineers & Consultants

4.2.2 LEVEL CONTROL. The reservoir level ill "flout on the system" and fluctuate based on demand. Level will be monitored on the City's SCADA system, which will received a signal from a level monitor mounted within the tank.

4.3 ASHLAND LOOP ROAD RESERVOIR INLET, OUTLET, AND DRAIN PIPING

The tank will operate in conjunction with the existing Crowson Reservoir Pump Station. The pumps will automatically fill the tank based on operating levels in the tank. The fill and outlet for the tank is expected to be through a 12-inch diameter line. The overflow pipe will be sized to handle a flow equivalent to the maximum fill rate of the tank. The drain piping system will be designed to allow the tank to be drained from full to empty in approximately 24 hours. This is equivalent to a drainage rate of approximately 139 gpm.

4.3.1 PIPING CONFIGURATION. For the purpose of developing preliminary cost data, pipeline diameters have been estimated in this section. Pipeline sizes will be evaluated further during final design. Fill and draw water will be conveyed through a single 12-inch diameter water line. The maximum water surface elevation within the tank will be 2,680 feet above mean sea level. This is the elevation of the tank overflow weir.

Overflow from the tank, and water released from the tank when the tank is drained for cleaning or other maintenance, will be discharged through a 12-inch diameter line. These two lines will be connected at a point adjacent to the tank. A manually operated butterfly valve will be provided on the drain line just prior to where it connects to the overflow line. The combined overflow/drain line will then extend to a spillway.

4.3.2 LEVEL CONTROL

Level control will be provided by a level monitor mounted within the tank. Pumps located at the existing Crowson Pump Station will fill the tank based on level control in the tank.

4.4 PIPING MATERIALS

Water supply, drainage, and overflow piping will be made of ductile iron pipe (DIP). Tape wrapping will be deleted in the case of the piping directly under the tank, which will be encased

in concrete. Cathodic protection or other corrosion control measures will be evaluated during final design.

4.5 WATER QUALITY

The tank inlet piping will be fitted with reducers to direct the flow upward and outward to optimize mixing within the tank and minimize short-circuiting within the tank. The tank outlet will be located 180 degrees from the inlet.

4.6 RECOMMENDED DESIGN FEATURES

Recommended design features of the reservoirs are discussed below.

Vent and Overflow Screens. Screens meeting regulatory requirements to prevent entry of insects or animals are required.

Silt Stops. Shallow silt stops at the reservoir outlet will be provided to prevent movement of settled solids along the reservoir bottom from reaching the outlet pipe.

Reservoir Underdrain. A reservoir underdrain system will be provided. The underdrain will be designed to convey groundwater or leakage away form the bearing material under the base slab.

Washdown Water Supply. A conveniently located potable washwater supply will enhance operators' ability to maintain and clean the reservoir.

Entrance Stairs/Reservoir Access. Convenient access via permanent stairs with stainless steel handrails will enhance the ability of operators to enter and maintain the reservoir. Access will be provided at two locations spaced approximately 180 degrees apart. One access/opening should be sized to accommodate anticipated equipment with "Bilco" style type hatches.

Level Gage. An ultrasonic level sensor will be installed to improve management of reservoir volumes. A permanent staff gage (attached to a wall or column visible from the entrance hatch) will assist operators in calibrating the reservoir level sensor.

Secured Access. Access into the reservoir must be designed with a controlled, locked entry to protect the reservoir and water quality.

Vehicle Access. Vehicle access to and around the reservoirs will be required to facilitate maintenance and repair.

4.7 LANDSCAPE CONSIDERATIONS

Revegetation is required for the construction areas and temporary roads. It takes approximately 3 to 5 years for disturbed ground to be revegetated. Maintenance of weeds and temporary irrigation will be required during the revegetation period.

The landscape plan should include native plantings and shrubbery around the final grading of the site. Site grading will seek to minimize the visual impact of the tanks by careful design of grade transitions from existing ridge lines to the cuts and fill required for installation.

Landscape design will be closely integrated with site drainage. Best Management Practices (BMPs) for water quality and erosion control will serve as a foundation for landscape restoration. Landscape design will include plantings and shrubbery except where site drainage facilities will concentrate stormwater in a way that permits an expanded palette of plant material. For example, small-scale water quality BMPs tied to surface drainage may be planted with native sedges and grasses, shrubs and trees.

Plant Materials. Plant materials will be selected from a list of natives supplied by the City of Ashland.

Site Drainage. The stormwater management facilities will be designed to mitigate the effects of runoff from the 100-year storm event. Stormwater runoff from the project site will be managed to keep the runoff in the same drainage basin as the historical site runoff. Erosion control measures will be included in the construction contract and will follow the City's erosion control standards.

Retaining Walls. Due to the steep slopes in the proposed area, it is anticipated that retaining walls will be required. The retaining walls will be designed to maintain site grading and be designed with respect to aesthetic considerations..

4.8 SECURITY CONSIDERATIONS

Heightened sensitivity to security issues has prompted many utilities to expand and develop more effective security systems. Security for the new water storage reservoir at both the Crowson II Reservoir site and Ashland Loop Road Reservoir sites will match with existing systems and should include:

- Hatches with locks and intrusion alarms
- Vents and overflow ports which discourage the introduction of contaminants
- Lighting
- Perimeter fence protection for reservoir, access hatch and vent components

4.9 UTILITY CONFLICTS

Presently, there are no known utility conflicts in the proposed area. As part of the final design phase, a site survey will be conducted to help identify conflicts that may exist and connection points to existing utilities.

4.10 ELECTRICAL INSTRUMENTATION AND CONTROL

It is anticipated that a new service will be required to provide power to each site. A ductbank will follow the route of existing and proposed reservoir access roads. Pull boxes and branching ductbanks will be provided where necessary to carry power to the reservoir and valve vaults.

To provide for overall water system management, a remote monitoring (i.e., SCADA) system will be provided to ensure proper operation of the reservoirs at all times. Remote notification of alarms will allow operations staff to respond to failures in a timely manner.

The City maintains a wireless communications system for communications with remote facilities such as the Crowson II and Ashland Loop Road Reservoirs. The system provides an extended Ethernet wide area network (WAN) for SCADA communications across the utility. The reservoir valves and potentially other systems such as security and access control will connect to the WAN. The project will include Ethernet radio antennae, network switches, patch panels, etc., as required for final connection to the City's SCADA WAN.

5.0 PERMITTING

This section reviews the engineer's current understanding of required permits and review process required for construction of the storage tanks. Each requisite is shown in Table 4 with the governing agency, fees, anticipated process time and contact information. A summary of the application process and other details are discussed below. Careful attention should be given to the time needed to acquire the necessary permits. The same set of permits and reviews will be required for both tanks.

TABLE 4- REQUIRED PERMITS AND REVIEWS PRIOR TO TANK CONSTRUCTION

Permit/Review	Governing Agency	Fees	Process Time	Contact Information
Plan Review	Oregon State Department of Human Services – Drinking Water Program	$600.00	< 2 weeks	Scott Curry DHS – Drinking Water Program 2860 State Street Medford, OR 97504 Phone: (541) 776-6222
Construction Activities Permit (NPDES #1200-C)	Oregon State Department of Environmental Quality	$771.00	2-3 weeks	DEQ Western Region 750 Front St. NE, Suite 120 Salem, OR 97301-1039 Phone: (541) 378-8240
Conditional Use Permit	City of Ashland Community Development Department	$859.00 - $972.00	8-13 weeks	Community Development/Planning Division 20 East Main St. Ashland, OR 97520 Phone: (541) 488-5305
Physical and Environmental Constraints Permit	City of Ashland Community Development Department	$573.00	8-13 weeks	Community Development/Planning Division 20 East Main St. Ashland, OR 97520 Phone: (541) 488-5305
Building Permit	City of Ashland Community Development Department	TBD	4-6 weeks	Community Development/Building Division 20 East Main St. Ashland, OR 97520 Phone: (541) 488-5309
Excavation Permit	City of Ashland Public Works Department	$150.00	N/A	Public Works Department 20 East Main St. Ashland, OR 97520 Phone: (541) 488-5587

5.1 Department of Human Services Plan Review

Oregon state code requires that the construction drawings and specifications for the storage tanks be reviewed by Department of Human Services (DHS) – Drinking Water Program officials. There is no formal permit from DHS. The fee and plan set for the project should be sent to Scott Curry in the DHS Medford office. A signed letter of approval from Mr. Curry is all that is needed to meet this requirement.

5.2 Construction Activities Permit

Oregon state code requires a Construction Activities Permit for any construction site disturbing one acre or more of land. Both sites have the potential to disturb more than an acre of land. The State Department of Environmental Quality (DEQ) manages the permits. The permit number is the National Pollutant Discharge Elimination System (NPDES) #1200-C, and the appropriate application form has been included in Appendix D of this report. The primary requirement of the Construction Activities Permit is the Erosion and Sedimentation Control Plan (ESCP). A Land Use Compatibility Statement is also required. Forms and guidance for both of these requirements have also been included in Appendix D. Should either of the sites disturb less than an acre of land then only a stormwater management plan is required.

Permit fees consist of a one-time, $380.00, new application fee and a $391.00 annual fee. The annual fee is charged for every year the permit is in effect. The fee shown in Table 5 is based on the assumption that the project duration will be less than a year.

5.3 Conditional Use and Physical and Environmental Constraints Permits

The proposed tank sites will require both a Conditional Use Permit and a Physical and Environmental Constraints Permit following regulations in the Ashland City Municipal Code. The zoning of the proposed tank sites requires a Conditional Use Permit for this type of land use. Standards and criteria for the Conditional Use Permit can be found in Sections 18.104.040 and 18.104.050 of the code.

Section 18.62 of Ashland City Municipal Code lists several land classifications that require a Physical and Environmental Constraints Permit. Areas having a slope of 25% or greater are

classified as hillside lands. Areas having a slope of 35% or greater are classified as severe constraint lands. Both sites consist of slopes in these ranges. Sections 18.62.080 and 18.62.100 provide the development standards for projects in hillside and severe constraint land.

The application for these two permits is processed simultaneously through Ashland City Community Development Department. Project plans are reviewed by the City Staff to ensure that all standards of the municipal code are met. Typically, a Conditional Use Permit application requires a pre-application process, which can take 2-3 weeks and has a $113.00 fee. City Staff from Community Development indicated that, where Ashland City is the applicant, the pre-application process may not be required. The final application can take anywhere from 8-10 weeks. Sections 18.104 and 18.62, included in Appendix D, list all materials that must be submitted for the application.

5.4 BUILDING PERMIT

A building permit from the Ashland City Community Development Department is also required. This type of project falls on the commercial building permits. A checklist of documents that must be submitted for the application is included in Appendix D. The application process takes 4-6 weeks and can only be done after the Conditional Use and Physical and Environmental Constraints Permits have been granted.

Fees for the building permit are still to be determined. Many of the fees typically charged for a commercial building permit will likely be waved due to the nature of the project. A typical break down of the fees for a project of similar value has been included for reference in Appendix D.

5.5 EXCAVATION PERMIT

An excavation permit is required by the Ashland City Public Works Department for any excavating of city streets or alleys. Such excavation is necessary to connect the water tanks to the existing distribution system. The general contractor of construction is responsible for obtaining this permit.

5.6 CONCLUSIONS

In order to begin construction of the Ashland Loop Road tank in early 2007 it is recommended that the application process for permits listed be initiated immediately upon approval of Phase II. To obtain all necessary permits from the City will take approximately 12-19 weeks. The DHS plan review and approval and the Construction Activities Permit from DEQ should be obtained during that time.

6.0 COST ESTIMATES AND SCHEDULING

The purpose of this section of the report is to develop conceptual level construction cost estimates for reservoir alternatives developed in Sections 1 through 5. In addition, a preliminary project schedule will be developed based on the current understanding of the overall project.

6.1 BASIS FOR COST

The preliminary design construction cost estimates represent the engineer's opinion of probable construction costs only. Unit cost information has been obtained from published data, vendor quotes, cost curves, and general industry standards. Although attempts have been made to provide reliable information, the preliminary status of this project, fluctuating labor and equipment costs and unknown site conditions limit the level of accuracy obtainable.

The level of accuracy for construction cost estimates varies depending on the level of detail to which the project has been defined. Master planning and feasibility studies represent the lowest level of accuracy, while pre-bid estimates (based on 10 percent, 30 percent, 90 percent and 100 percent completed contract documents, i.e. detailed plans and specifications) represent the highest level. As the project becomes more defined, a higher degree of accuracy in estimating can be obtained. The American Association of Cost Engineers (AACE) guidelines for construction cost estimating were used for the cost estimates herein. The cost estimate for this report resides at the predesign stage. Hence, the actual cost can be expected to vary between 30 percent and 15 percent of the estimate.

There is a 30 percent contingency applied to the total construction costs for miscellaneous items, which can't be identified at this level of design.

6.2 ENGINEER'S COST OPINION

Construction cost estimates represent the anticipated expenditures needed to implement each alternative. Preliminary construction cost estimates for the reservoir alternatives are presented in Table 5. Detailed cost breakdowns are included in Appendix F.

TABLE 5- CONSTRUCTION COST ESTIMATE	
Element	**Cost (million)**
2.0 MG Crowson II Reservoir and Appurtenances	$4.4
0.2 MG Ashland Loop Road Reservoir and Appurtenances (Buried, Concrete)	$1.7
0.2 MG Ashland Loop Road Reservoir and Appurtenances (Above Ground, Steel Alternative)	$1.1
Crowson Pump Station Modifications	$0.1

6.3 PRELIMINARY PROJECT SCHEDULE

Based on discussions with City staff, it is the Engineer's understanding that construction of the Ashland Loop Road Reservoir is desired to start June, 2007. Construction of the Crowson II Reservoir may not start until 2016 depending on findings from the City's hydraulic model evaluation, future water needs and the possibility of connection to new sources. The preliminary project schedule for the Ashland Loop Road Reservoir includes the following tasks required for design and construction of the reservoir for :

- Final design
- Permit and easements
- Bid and award of contract
- Reservoir excavation
- Reservoir construction
- Pipeline installation
- Site grading and revegetation
- Testing and closeout

Important milestones are as indicated on the Preliminary Project Schedule and will include project submittals, backfill, testing, and filling of reservoir. A preliminary project schedule for the proposed Ashland Loop Road Reservoir is presented in Figure 9.

6.4 SUMMARY AND CONCLUSIONS

The construction is expected to span approximately six months with a midpoint of construction in September 2007. The schedule assumes a project start date of December 2006 for final design of the Ashland Loop Road Reservoir. Selection between site alternatives A, B and C should take place during final design, after a detailed survey of the area. Once the optimum site for construction has been identified, a final geotechnical analysis of the site should be performed. This will include a minimum of three borings and a detailed soil analysis of the selected site. Public outreach and information services should be conducted at this time to facilitate final site selection.

CITY OF ASHLAND
Ashland Loop Road
Reservoir Siting Project

FIGURE 9

CITY OF ASHLAND

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ID	Task Name
1	**Ashland Loop Road Reservoir Projec**
2	**Project Kick-Off**
3	**Final Design**
4	30% Preliminary Design
5	50% Design
6	90% Design
7	Submit Final Plans For Review
8	Public Outreach
9	Permits
10	Bid and Award of Contract
11	Notice to Proceed
12	**Construction**
13	Neighborhood outreach and public information
14	Excavation
15	Reservoir Construction
16	Pipeline Installation
17	Site Grading and Revegetation
18	Testing and Closeout

APPENDIX A. GEOTECHNICAL AND GEOLOGICAL SITING STUDY ASHLAND LOOP ROAD RESERVOIR SITE

GEOTECHNICAL AND GEOLOGIC SITING STUDY
ASHLAND LOOP ROAD RESERVOIR SITE
ASHLAND, OREGON

For: Bob Willis
Brown & Caldwell Engineers
6500 SW Macadam, Ste. 200
Portland, OR 97239

By: **THE GALLI GROUP**
612 NW Third Street
Grants Pass, OR 97526
(541) 955-1611

02-3760-ALR
September 20, 2006

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FIGURES

GEOTECHNICAL AND GEOLOGIC SITING STUDY ASHLAND LOOP ROAD RESERVOIR SITE ASHLAND, OREGON

1.0 INTRODUCTION

The City of Ashland proposes to add two new water storage reservoirs to their water supply system. The existing Crowson Reservoir is a 2.2 MG reservoir, which is the primary reservoir for the system. One new reservoir (Ashland Loop Road Reservoir) is expected to be a 0.15 MG tank. It will serve a limited number of high level services located directly above the existing Crowson Reservoir. The target elevation for the base is 2,680 feet.

The purpose of this study was to observe the proposed reservoir site and provide a geotechnical and geologic evaluation of its suitability for the proposed reservoir. It also includes providing general design recommendations for preliminary design and construction estimating for the project.

2.0 SITE AND PROJECT DESCRIPTION

2.1 SITE DESCRIPTION

The subject site of the proposed new Ashland Loop Road Reservoir is just below a moderately steep north sloping ridgeline about 1½ miles up from downtown Ashland. Please see Figure 1, Vicinity Map for a more precise site location. This site is upslope of the existing Ashland Loop Road as it wraps around this ridgeline. The roadway has 8 to 15 foot cuts that expose the dense, native granite soils and weathered rock.

The subject hillside ranges in slope between 1.75H to 3.5H:1.0V with the ridgeline sloping off at 3.0H to 4.0H:1.0V. It is covered with a moderately dense stand of evergreen and deciduous trees, scattered brush and thick ground cover.

The surficial soils consist of sandy silts and slightly clayey, silty Sands (decomposed granite). This is underlain by coarser and more dense, weathered to decomposed granite and harder jointed granite rock.

2.2 PROJECT DESCRIPTION

We understand the project to consist of constructing a new 0.15 MG reservoir structure, ring road around the tank and possibly an access road and parking. The tank should be on

the order of 60 to 70 feet in diameter and would have an access road around it for construction and maintenance. A parking area, maintenance shed, pump house and access road to the site, as well as all fresh water and treated water distribution lines could also be included.

The tank, access road around the tank and parking and maintenance areas will require a moderately wide excavation into the hillside. It appears a level site on the order of 80 to 90 feet wide would be needed. This will require a moderately large amount of soil and rock removal.

3.0 SITE INVESTIGATION

3.1 GENERAL

In August of 2006, William Galli, P.E., G.E., Principal Engineer, and Ed Busby, C.E.G., Senior Engineering Geologist, visited the subject site. The hillside areas of three separate potential tank locations in the site locale were observed and studied on foot. No test pits or exploratory borings were accomplished for this siting study.

3.2 ALTERNATE TANK LOCATIONS

We understand that three alternate tank locations could be considered at the Ashland Loop Road site. These locations were observed to be as follows:

Location A: At the intersection of a popular biking trail and Ashland Loop Road. The entire tank footprint and access road around the tank would be cut back into the hillside. Access would be directly off the existing roadway. Excavation depth at the back of the excavation would be on the order of 45 to 50 feet. The cut would be made into the dense granite soil and progressively harder rock.

Location B: Located back up a swale area off of Ashland Loop Road. Access would be directly off Ashland Loop Road. The invert of the swale runs back upslope at between 3H to 4H:1V. The excavation would be through the dense colluvium in the base of the swale and weathered rock on the side slopes. The rear portion would be into the upper portion of the harder rock. The maximum cut height should be on the order of 40 to 45 feet. Site development will have to deal with water flowing down the swale. It must be intercepted prior to flowing beneath the tank. The colluvial deposits in the swale nearer the road may have to be overexcavated beneath the tank subgrade and replaced by structural rock fill.

Location C: Located up on the hillside above the roadway, 50 to 60 feet in elevation. This location will cut into the top of the ridgeline. Therefore, total excavation depth will range from 25 to 35 feet or less. The excavation will be into the weathered and harder rock. This location will require an access road up to near the ridgeline.

4.0 SUBSURFACE CONDITIONS

4.1 SOIL

The site has a surficial zone of silty sand and sandy silt content. This is underlain at 2 to 3 feet (deeper in the swale) by dense silty Sand and gravelly Sand (decomposed granite). The materials become denser and less weathered with depth. At depths between 10 and 15 feet the granite rock appears to become relatively hard.

Borings and seismic refraction lines performed for other projects lower on this mountain have found these granite soils and the granite rock to become very dense and hard at shallow depth. The weathered materials had SPT N-values of 30 to 50 within three (3) feet of the surface. The N-values exceeded 50/3" at depths of five (5) feet. Seismic refraction lines indicated that rock at depths as shallow as 15 to 20 feet had shear wave velocities of between 7,000 and 9,000 feet per second. This indicated that blasting might have been required. In reality, a 40-foot deep excavation was accomplished by very large excavators equipped with narrow buckets and three very sharp, hardened rock teeth. These tank locations appear to have somewhat less dense/more weathered rock conditions in the upper 10 to 15 feet.

4.2 GROUNDWATER

Small amounts of perched water could be present on top of the dense, weathered granite rock and within shallow rock joints. Otherwise the local groundwater level should be on the order of 150 to 200 feet or more below the site surface.

Abundant runoff from the rock areas upslope can produce large amounts of surface and shallow subsurface water. Therefore, good site drainage and tank subdrains are recommended.

5.0 SITE GEOLOGY

5.1 REGIONAL GEOLOGIC SETTING

The project site is located in the southern portion of Ashland, Oregon. The site is within the Ashland Pluton, a regionally extensive Jurassic age intrusive, which is exposed over nearly 150 square miles in southern Oregon and northern California. This granitic body (KJg) is described as: "Mostly tonalite and quartz diorite but including lesser amounts of other granitoid rocks" (Walker and MacLeod, 1991). Quartz monzonite and granodirorite also comprise the Mount Ashland Pluton.

No Holocene or Quaternary faults are shown in the project area on published geologic mapping (Walker and MacLeod, 1991), Earthquake Hazards Maps for Oregon (Madin and Mabey, 1996), or the Quaternary Fault and Fold Database (USGS; 2006a).

5.2 TECTONIC SETTING

The project site is in proximity to several zones of active seismicity. The site is affected by the Cascadia Subduction Zone, an active subduction zone off the Oregon coast, considered capable of producing Magnitude 8.5 or greater earthquakes. The surface expression of this zone, at the base of the continental slope, is approximately 200 kilometers from the project site. Average recurrence intervals for such great earthquakes, as determined by recent investigations, range between 300-600 years. The last "great" earthquake was interpreted to be approximately 300 years ago.

Relatively deep focus intraplate (depths of 40-60 km within the subducted Juan de Fuca plate) earthquakes of Magnitude 7.5 are considered possible within the subducted plate beneath western Oregon and Washington. The recurrence interval is not established, but the devastating earthquakes in Puget Sound (M7.1, 1949; M6.5, 1965; and M6.8, 2001) occurred in this seismic zone. Based on the historic seismic record, intraplate earthquakes are rare in southern Oregon.

Relatively shallow crustal earthquakes up to Magnitude 6.5 can occur in the upper plate at depths of 5-25 km. This zone generally produces most of the earthquakes in Western Oregon, and in the project region. Such earthquakes occur once every one to two decades, and historically have not exceeded M 6.0 within an 80-kilometer radius of the project area.

A list of seismic events greater than M 4.5 having epicenters within an 80-kilometer radius of the project site is provided in Table 1.

5.3 HISTORIC SEISMICITY OF AREA

Within a radius of approximately 80 kilometers (50 miles) of the project area, eight earthquake epicenters with a magnitude equal to or greater than M 4.5 have been reported since 1833 (Johnson & Others, 1993; ANSS, 2006). The Klamath Falls earthquake of 1993 contributed three events to this listing, including the M5.9 and M6.0 main shocks, and one smaller aftershock occurring within the next several months.

Some of these earthquakes were not recorded by instruments, but were reported by Mercalli Intensities. Magnitudes were then estimated from calculations made on the intensity data. Following is the list of recorded earthquakes in the project region:

Table 1

Date	Latitude	Longitude	Magnitude	Depth (Km)	Reference
9/2/1931	41.8000	-123.000	4.5	-	Johnson & others, 1993/ANSS
6/12/1978	41.450	-121.850	4.6	2.0	Johnson & others, 1993
8/1/1978	41.4298	-121.8505	4.67	2.0	Johnson & others, 1993/ANSS
8/19/1978	41.450	-121.850	4.7	2.0	Johnson & others, 1993
1/10/1981	41.550	-121.867	4.5	5.0	Johnson & others, 1993
9/21/1993	42.3575	-122.0583	6.0	10.30	Johnson & others, 1993/ANSS
9/21/1993	42.3877	-122.0508	4.3	0.02	Johnson & others, 1993/ANSS
12/4/1993	42.2915	-122.0087	5.1	6.53	ANSS

Three of the four largest seismic events in Oregon's recorded history have occurred near southwestern Oregon.

The 1873 Port Orford, considered Oregon's largest earthquake, is estimated to be M 7.0 (Johnson, 1993) to M 7.3 (USGS, 2006b). Some researchers place this event east-southeast of Brookings near the Oregon/California border, and refer to it as the Crescent City earthquake. Chimneys were toppled in Grants Pass and Jacksonville during this event, indicating Modified Mercalli Intensities of VI and VII in the Rogue Valley area. The quake was felt as far north as Portland, and in San Francisco to the south. This event had an epicenter distance of approximately 100 kilometers from the project area.

Most recently, the September 20, 1993 Klamath Falls quakes (M5.9 and M6.0) are the third and fourth largest events reported in Oregon. Mercalli Intensities of VII were experienced in the Klamath Falls area; effects of this earthquake were felt in Medford as Mercalli Intensity V. In the Grants Pass and Roseburg areas Mercalli Intensities of IV and V were reported. The focus of the M6 event is immediately east of Lake of the Woods, on a normal fault system extending from the Basin and Range province. The quake had a focal depth of 12 km, and epicenter distance from the project site of approximately 50 kilometers.

5.4 2003 IBC DESIGN EARTHQUAKE

The design earthquake for the project area is based upon established values and methodologies in the International Building Code (IBC; 2003).

The maximum considered earthquake and spectral response accelerations were established as set forth in Section 1615.1.

The site has a mapped Maximum Considered Earthquake (MCE) spectral response acceleration at 0.2 seconds for Site Class B (Ss) from Figure 1615-1 (IBC, 2003) of:

S_s=0.624g. The site has a mapped Maximum Considered Earthquake (MCE) spectral response acceleration at 1.0 second for Site Class B (S1) from Figure 1615-2 (IBC, 2003) of: S_1= 0.292g.

The Site Class was determined from Table 1615.1.1 (IBC, 2003), combined with data obtained during our field investigation. A Site Class of C was established for the project site, when founded in the weathered to hard rock.

Spectral Parameter for Site Class C is:
0.2 sec Period-- S_{MS}=FaSs, Fa=1.15 **S_{MS}=0.718g**
1.0 sec Period—S_{M1}=FvS1, Fv=1.51 **S_{M1}=0.440g**

A Site Class of D was established for the project site for areas over structural fill and dense, decomposed granite soil.

Spectral Parameter for Site Class D is:
0.2 sec Period-- S_{MS}=FaSs, Fa=1.30 **S_{MS}=0.812g**
1.0 sec Period—S_{M1}=FvS1, Fv=1.82 **S_{M1}=0.531g**

As reference information only, the expected peak horizontal bedrock acceleration at the project site, due to all earthquake hazards for an event with frequency of occurrence of once in 2500 years (2% chance of occurrence in any 50-year period.), is 0.24g (USGS, 2002). For an event with a frequency of occurrence of once in 500 years (10% chance of occurrence in any 50-year period) the expected peak horizontal bedrock acceleration is 0.12g USGS, 2002).

5.5 GEOLOGIC OR SEISMIC INDUCED HAZARDS

Slope Stability. Review of aerial photos of the sites (BLM, 2001; Jackson County GIS, 2001), and a reconnaissance check of site geology was completed as part of this report.

The site geology consists of weathered granitic bedrock which is part of the Mount Ashland Pluton. Regional field data gathered on the granite bedrock from several sites on this mountain indicates that, in general, it has a hardness of R3 (Medium hard) to R4 (Hard), and joint-sets are typically N10W, vertical; N55-65W, vertical; N30E, vertical; E-W, vertical. Joints are moderately close spaced (1 to 3 feet) to widely spaced (3 to 10 feet), ranging from "open" to closed (hairline trace). Joints appear to be "slightly continuous" (5 to 10 feet) along strike.

No active or recent evidence of significant slope instability was observed during the photo review or site reconnaissance. No published geologic mapping indicates slope instability in the project area. Colluvially placed decomposed granite will likely be present in the swale site (Location B).

Recommendations for site grading and proper methods of cut-and-fill construction are provided in our geotechnical report, and it is essential these recommendations be followed closely in order to minimize slope instability both during and after construction. In-progress grading inspections should be made during construction to note any adverse joints or shear zones, which could negatively affect cut slopes. **Note:** At two sites lower on this hillside, moderate to massive rockfall events occurred during construction due to adverse bedding planes exiting steep construction excavations.

The "Relative Earthquake Hazard Maps for selected urban areas in western Oregon" (Madin and Wang,1999) publication indicates the project area, including steeper slopes, are Zone D (lowest hazard) with regard to earthquake induced landslides, liquefaction potential, and ground amplification of seismic waves.

Liquefaction. The proposed tank site will be underlain by dense, weathered granite or granitic bedrock of the Mount Ashland Pluton. Liquefaction is not a potential hazard for the proposed site.

The "Relative Earthquake Hazard Maps for selected urban areas in western Oregon" (Madin and Wang, 1999) publication indicates the project area is Zone D (lowest hazard) with regard to liquefaction potential.

Seismic Ground Amplification or Resonance. No hazardous amplification or resonance effects from seismic waves have been associated with soil/bedrock subsurface conditions in the project area. An IBC Site Class of C was established for the site, when foundations are placed directly on weathered granitic bedrock. If structural fills are placed beneath the tank foundations or if foundations are founded in dense granitic soils, a Site Class of D should be used. We feel the Site Class designations will properly compensate for any ground amplification that would occur at the project site.

The "Relative Earthquake Hazard Maps for selected urban areas in western Oregon" (Madin and Wang, 1999) publication indicates the project area is Zone D (lowest hazard) with regard to ground amplification of seismic waves.

Tsunami/Seiche Hazard. The project site is not located adjacent to any large lake or body of water, and therefore no seismically induced seiche hazard exists for the project. No large reservoirs are located in a drainage area upslope from the project site. The site is not within the Hostler Dam "failure inundation zone". Therefore, no hazard to the project site exists due to seismically induced reservoir failure.

Surface Rupture. No Quaternary or Holocene faults are shown in the project area on published geologic mapping (Walker and MacLeod, 1991; Madin and Mabey, 1996; USGS; 2006a), and no evidence of recent or active faulting was observed during the field investigation or air-photo review of the site area. The hazard of surface rupture at the site is very low.

Summary. Therefore, other than the moderate to severe ground shaking anticipated during the design seismic event, in our opinion, there are no other geologic hazards of reasonable risk that could cause damage to the site.

6.0 CONCLUSIONS

In our professional opinion, based on our field investigation and office review, the soil and bedrock conditions at the site are suitable for the proposed project, provided the recommendations of our report are incorporated in the design and construction of the project. The following sections provide geotechnical recommendations for preliminary design of the planned improvements.

7.0 PRELIMINARY GEOTECHNICAL RECOMMENDATIONS

The following recommendations are based on our surface reconnaissance and geologic study of the subject site. These may be used for site evaluation and preliminary design purposes. These recommendations must be reviewed and updated based on subsurface investigation in a Final Geotechnical Design Report, prior to final project design.

7.1 SITE EXCAVATION

As discussed earlier, this site is underlain at moderate depth by increasing harder granite rock. This rock tends to have several joint sets that make removal easier than monolithic rock masses. At depths up to 15 or 20 feet the rock is very weathered and jointed. Seismic refraction testing on other sites indicate the deeper granite rock could have shear wave velocities as high as 9,000 feet per second. This would normally indicate that blasting could be required. This means that below a depth of 20 to 30 feet ripping with large equipment could be difficult. However, given the number of fracture/joint sets normally seen, ripping with a single tooth on very large dozers (D-8 to D-9) may work reasonably well, even though it could be a bit slow.

The volume of excavation and depth of excavation below the surface will be moderately large to place a 0.15 MG tank on this site. If the access road and parking areas are constructed over structural fill placed on the slope, a level cut on the order of 80 to 90 feet wide would be required. This would result in a total excavation height on the order of 40 to 45 feet (assumes average site slope of 2.0H:1V and cut slope between 0.75H to 1.0H:1V). **Note:** Tank location C on top of the ridge may have shallower cuts (total height of 25 to 35 feet). Depth of cut vertically from the ground surface would be between 15 and 30 feet at various sites. It appears an excavation in excess of 3,500 cubic yards would be required to create the tank pad at this site. Additional site subsurface

investigation will be required to verify information regarding rock hardness and rock jointing that dictate the ability of the rock to be removed by large excavators and by ripping at these three locations.

Trench Excavation. Excavation of trenches into the site materials will vary depending upon where the trench is located. In the upper 10 to 20 feet (below original ground surface), the trenches will likely be able to be excavated by large excavators with narrow buckets and rock teeth. At greater depths below the original surface, trenching with excavators could be very difficult.

7.2 SITE PREPARATION

All areas proposed for structures, roads and parking, should be cleared and grubbed of all trees, stumps, brush and other debris and/or deleterious materials. The site should then be stripped and cleared of all vegetation, sod and organic topsoil. It appears that a stripping depth of from 2 to 3 inches would be required on areas not already graded. The stripped materials should be hauled from the site or stockpiled for use in landscape areas only. This material should not be used in structural fill, trench backfill or footing backfill on this project. **Note:** Vegetation should not be buried below any portion of the fills planned for the site or under other impromptu fills created by the contractor.

Holes or depressions resulting from the removal of underground obstructions, old ditches and excavations that extend below the finish subgrade and will be beneath structures or roadways shall be cleared of all loose or soft material and dished to provide access for compaction equipment. These areas shall then be backfilled and compacted to grade with structural fill, as described later in this report.

7.3 STRUCTURAL FILL PLACEMENT AND COMPACTION

7.3.1 Beneath Structures

Structural fill is defined as any fill placed and compacted to specified densities and used in areas that will be under structures, roadways, fills, pavements, parking areas, sidewalks and other load-bearing areas or be used for wall backfill. At this time it appears that small to large fills will be required for the roadway, access road and parking areas.

Structural Fill Materials. Ideally, and particularly for wet weather construction, structural fill should consist of a free-draining granular material (non-expansive) with a maximum particle size of six inches. The material should be reasonably well-graded with less than 5 percent fines (silt and clay size passing the No. 200 mesh sieve). During dry weather, any organic-free, non-expansive, compactable granular material, free of debris and other deleterious materials, meeting the maximum size criteria, is acceptable for this purpose. The excavated sandy weathered granitic material and granitic rock should perform well as structural fill (not the surficial, slightly clayey DG). Locally available

crushed rock and good quality jaw-run crushed shale have also performed adequately for most applications of structural fill.

The on-site fractured granite rock should make good structural fill. The weathered rock, in the upper portion of the excavation, will most likely break down into 4-inch to 6-inch minus material during excavation and movement of this material. Rock from the deeper portions of the excavation may need to be pulverized by blasting techniques for it to be adequate for structural fill. These granitic materials should work well for creating fill zones for parking and access roads. They would also make good structural fill beneath a portion of the tank if potential differential settlement is not a problem for the proposed tank.

Structural Fill Placement. Structural fill should normally be placed in horizontal lifts not exceeding 8 inches loose thickness (less, if necessary to obtain proper compaction) for heavy compaction equipment and four inches or less for light and hand-operated equipment. If large equipment is available, thicker lifts may be acceptable when 6-inch or 8-inch minus rock (or larger) is used. Each lift should be compacted to a minimum of 95 percent of the maximum dry density for roads and 98% beneath structures, as determined by ASTM Test Method D-698 (Standard Proctor).

Structural fill placed beneath footings or other structural elements must extend beyond all sides of such elements a distance equal to at least ½ the total depth of the structural fill beneath the structural element in question for vertical support. Where fill is placed to build up the area on the low side of the site for foundation or vehicle support, we recommend the structural fill extend beyond the footing or roadway paved surface area at least 5 feet horizontally, then slope away at no steeper than 1.7H:1V with a compacted fill slope surface when anchored on the slope. **Note:** Where moderate to large fills are intended to be placed on the slope, we should review these for global stability. Fill slope inclinations are provided in a later section of this report.

To facilitate the earthwork and compaction process, the earthwork contractor should place and compact fill materials at or slightly above their optimum moisture content. If fill soils are on the wet side of optimum, they can be dried by continuous windrowing and aeration or by intermixing lime or Portland Cement to absorb excess moisture and improve soil properties. If soils become dry during the summer months, a water truck should be available to help keep the moisture content at or near optimum during compaction operations.

Note: Proper fill placement and compaction is critical to the proper long-term performance of the project. Site preparation, fill material type, moisture content, lift thickness and mechanical effort by the proper compaction equipment all play a critical part in attaining properly constructed fills. Therefore, we recommend the general contractor and subcontractors read and understand the content and intent of the Final Geotechnical Design Report prior to construction on the site.

Fill Placement Observation and Testing Methods. The required construction monitoring of the structural fill utilizing standard nuclear density gage testing and standard laboratory compaction curves (ASTM D-698 specified) is not applicable to larger jaw run shale or larger crushed rock. The high percentage of rock particles greater than ¾" in these materials causes laboratory and field density test results to be erratic and does not provide an accurate representation of the density achieved. Therefore, construction specifications for this type of material typically specify method of placement and compaction coupled with visual observation during the placement and compaction operations.

For these larger rock materials (such as 4-inch minus crushed rock or jaw-run "shale"), we recommend the 8-inch lift be compacted by a minimum of three (3) passes with a heavy vibratory roller. One "pass" is defined as the roller moving across an area once in both directions. The placement and compaction of these materials should be observed by our representative. After compaction, as specified above, is completed the entire area should be proofrolled with a loaded dump truck to verify density has been achieved. All areas which exhibit movement or compression of the rock material under proofrolling should be reworked or removed and replaced as specified above.

When larger "pit run" type material is used for structural fill, 12 to 16 inch stones preclude the use of an 8-inch lift thickness. In these instances the lifts must be increased somewhat but should be kept at 12 inches or less. These thicker lifts must have the larger rock "worked" into place by repeated tracking of the dozer prior to several passes of the heavy vibratory roller. In these areas our personnel must observe the placement and compaction to verify the materials are being placed properly.

Field density testing by "nuclear" methods would be adequate for verifying compaction of 2-inch to ¾-inch minus crushed base rock, decomposed granite and other materials 2-inches or smaller in size. Therefore, typical verification specifications as listed earlier would suffice.

7.3.2 Utility Trench Backfill

Utility lines of various types may be buried across the project. These need to be adequately supported and the trenches need to be backfilled and compacted properly to prevent subsidence of the surface or damage to the utility lines or pavement section.

In our experience, utility trench backfill has been the source of the majority of post-construction fill settlement problems in paved areas. These areas cause early pavement failure due to inadequate subgrade support. Poor trench compaction across sloped landscape areas can also result in significant surface erosion.

We strongly recommend that all utility trench backfill be placed and compacted in the same manner as described for structural fill above. The on-site decomposed granite, free of organics, or jaw-run shale and crushed rock, should make reasonable trench backfill in reasonably dry weather. However, if placed in trenches on the slope the decomposed granite can wash out easily. Therefore, rock fill or slurry would be a better choice for trenches on slopes. Trench backfill beneath structures should be placed and compacted in accordance with the section on Structural Fill, earlier in this report. Trench backfill beneath asphalt pavements but not under structures should be compacted to at least 95 percent of the maximum dry density, as determined by ASTM Test Method D-698 (Standard Proctor) for the upper 36 inches. Below 36 inches the trench backfill should be compacted to between 93 and 95 percent of the maximum dry density. Trench backfill in landscape areas, that is not part of a cut or fill slope, may be compacted to between 90 and 93 percent of the maximum dry density per ASTM D-698.

We recommend our personnel periodically observe and/or test trench backfill to verify compliance with project plans and specifications.

Preventing Shallow Groundwater Movement. Where utility trenches will lead upslope or downslope we recommend any granular backfill, which can channel seepage, be blocked by a lean concrete or clayey soil "check dam" (at least 24" wide) the full depth of the trenches. We recommend these checkdams be placed at 100 foot intervals in all trenches to minimize movement of shallow groundwater through the trench backfill. On steeper portions of roads these should be placed at 50-foot spacing. Allowing groundwater to migrate through "porous" trench backfill can create slope stability problems lower on the hill when the channeled groundwater emerges from the trench. Alternately, trenches should be backfilled with a low permeability backfill. Well-compacted, silty, decomposed granite, compacted at 2% to 3% above optimum moisture content would be acceptable.

7.3.3 Non-Structural Fill

Any waste soil, organic strippings, soft, clayey silt or other deleterious soil would be considered non-structural fill. These soils must be removed from the site or used in a thin layer as "topsoil". They should not be placed as structural fills on this sloping site. They could be placed as landscape berms with slopes no steeper than 3.5H:1.0V. They should be compacted to at least 90%.

7.4 CUT AND FILL SLOPES

Cut and fill slopes will be required in order to create the tank site and roadways for the proposed project. Cuts ranging from 5 to 50 feet may be required for construction of the tank. Fills between 5 and 10 feet may be required for the access roadway and parking. Cuts and fills should be designed and constructed as described below.

7.4.1 Cut Slopes

All permanent cut slopes should be constructed at no steeper than 1.75H:1V in the upper soil, and between 1.1H to 1.2H:1V in the denser, underlying, weathered, fractured rock. Harder rock with tight fractures may be cut at between 0.75H and 1H:1V depending on its condition. Some sloughing and/or raveling of the slope surface could be expected in wet weather and extremely dry weather until they become fully vegetated. Therefore, periodic benches in the cut may be required. Temporary cut slopes of ½H to ¾H:1V may be constructed during the construction of the project. The "temporary" cut slopes must be backsloped or backfilled against. These must also be cut back for roadways to the permanent inclination when not backfilled against. **Note:** Care must be taken due to the possibility of rock fall off these steep cut slopes. It should be noted that some excavations on this ridge may have rockfall due to adverse fracture planes dipping into the excavation. *Therefore, our geologist must observe all excavations during construction in order to verify the presence or absence of such conditions.* Where adverse bedding planes exist, the slopes must be cut back to a flatter inclination. **Note:** Workmen must be protected at all times in or adjacent to excavations. The contractor is at all times responsible for job site safety including trench safety. The geotechnical engineer is not responsible for job site safety.

7.4.2 Fill Slopes

We have assumed that fill embankments and slopes will be utilized to construct parts of the roadways and parking. We estimate that fills up to 10 feet high could be used. Where fill slopes are required the following provides guidelines for their construction.

Fills may be constructed of imported rock or shale fill, the excavated weathered granite or sandy, decomposed granite soils. The upper topsoil zone and upper silty soils should not be used in the structural fill. We recommend maximum slope angles of fill of 2.0H:1V for sandy, decomposed granite and 1.75H:1.0V for compacted crushed rock or clean crushed shale. All materials should be placed and compacted as structural fill, described above. "Keying in" the toe of fills on slopes is critical to long-term stability. We recommend, in order to decrease sloughing and erosion of the fill slope, that all fills be overbuilt laterally and that the face be cut back to a compacted fill face. This would not be required of slopes constructed of rock fill materials. It is critical to decrease long-term settlements beneath portions of the project that these fills be placed and compacted properly. We recommend that all site preparation and structural fill placement recommendations be observed and that systematic density testing of all fills be accomplished as they are being built. Density testing on only the top lift is not adequate.

7.4.3 Fill Placed on Sloping Sites

Fill placed on sloping areas of the site (slope angle of underlying native slope 10% or greater) must incorporate additional precautionary measures. To assure that these fills

remain in place or do not fail due to gravity, seismic loads or hydrostatic pressure of trapped water, we recommend the following:

Key Trench. The toe of all fills placed on slopes must be keyed into the slope by use of a key trench. The depth of embedment should be 2 feet into the undisturbed, native soils for fill slopes up to 10 feet high, 3 feet for fills up to 20 feet high. The key trench should be wide enough to accommodate excavation and compaction equipment (10 to 12 feet minimum) and have the base flat or sloped back into the hillside somewhat (see Figure 2). The key trench generally runs along the contours at the base of the proposed fill slope.

Benching. The native slope underlying the proposed fill should be benched into flat benches back up the slope above the key trench prior to placement of fill on the slope. These benches should be flat or tipped back slightly into the hillside. They should run parallel to the contours. Please see Figure 2 for graphic representation of these details.

Drainage. All noticeable seepage or wet zones observed during the keying and benching excavation process should be provided with subdrains. Figure 3, Bench Drain Detail, provides fill subdrain details. At the discretion of the geotechnical engineer (at a minimum), the key trench would require a subdrain section. Where wet conditions exist the benches may also require subdrain sections to remove subsurface flow from behind the new fill or to intercept seepage prior to it moving beneath the fill. Please note that compacted fills placed on slopes have a much lower lateral permeability than the native soils. Therefore, seepage through the native soil can become trapped behind these fills causing fill slope stability problems.

This is particularly important in areas where fills may cross shallow swales leading down the slope. These swales tend to carry small to moderate amounts of surface flow and also shallow groundwater. A way must be provided to intercept the surface flow and shallow groundwater (and convey it to below the fill zone) before it can saturate and possibly destabilize the fill mass. A combination of shallow French Drain and catch basin entrance to the cross culverts at these locations could help mitigate this potential problem.

7.5 FOUNDATIONS

7.5.1 Tank Foundations

The subject tank would most likely have an 18 to 24-inch wide ring footing beneath the tank wall and have numerous isolated spread footings on the interior to support the roof.

All footings founded in the hard granite rock may be designed for a bearing pressure of 4,500 pounds per square foot. Footings located in the dense decomposed granite or over compacted structural fill may be designed for a bearing pressure 3,000 pounds per square foot. We recommend against placing footings on the surficial silty soil zones. Minimum embedment depth would be 18 inches for frost protection and lateral restraint.

7.5.2 Structural Foundations

Pump house and maintenance structures may be part of the project. For these buildings all footings may be designed for a bearing pressure of 3,000 pounds per square foot (with no footings founded in the silty surface soils). Minimum embedment depth should be 18 inches.

All footings must be poured "neat" against the undisturbed, cleaned off, dense, decomposed or weathered granites. All loose rock, soil and rock fines must be removed prior to placing rebar and pouring concrete. If footing subgrades are very irregular, and causing difficulty for workmen, they may be leveled off with a two-sack lean mix. This should be "roughened" somewhat on the surface such that frictional resistance between the lean mix and the footing base will be maintained. We recommend our firm be contacted when the contractor begins footing excavations in order to verify subgrade conditions prior to placement of rebar and concrete.

After completion of footings they should be backfilled against with compacted structural fill to maintain the minimum embedment recommended above.

7.6 LATERAL LOAD RESISTANCE

7.6.1 General

Lateral loads can be resisted by passive pressure acting on buried portions of the foundation and other buried structures, and by friction between the bottom of concrete elements of the foundations and the underlying dense granitics. We recommend the use of passive equivalent fluid pressures of the following values for portions of the structure and foundations embedded into the native soils, dense fills or granite.

- Medium-dense, Decomposed Granite 350 pcf
- Dense, weathered Granite Rock 600 pcf
- Hard Granite Rock 700 pcf
- Dense, compacted Structural Rock Fill 500 pcf

The value of the shear strength of much of the weathered rock under lateral load will actually be greater than the equivalent fluid pressure given above. However, the likelihood of partially continuous and angled fracture planes, which can compromise the global strength, does not allow us to provide a blanket recommendation of higher values. However, in specific locations we can evaluate the soft and hard rock if higher values would be advantageous to design of a structure.

We also recommend that the first ½ foot below the ground surface (in the soil) be ignored when computing the passive resistance. A coefficient of friction of 0.45 can be used for

elements poured neat against structural rock fill, sandy, decomposed granite and weathered, fractured granite. This should be reduced to 0.20 for slabs over plastic vapor barriers. Frictional resistance should be reduced by a multiplier of 0.85.

7.6.2 Global Lateral Resistance

The parameters provided in this report for lateral earth pressures and lateral resistance are to be used to design retaining walls and other retaining structures. While these loads provide the anticipated load each wall component must resist, global lateral stability of any fill and structure combination may require a greater amount of resistance. This is especially true where "stacked" walls are considered, which can cause global instability on the face of a slope.

We recommend that we be allowed to review the final project design (when all methods of structural support and construction have been determined) to verify global stability meets typically required factors of safety against failure under 2,500 year seismic loading (FS = 1.15 to 1.20).

7.7 RETAINING WALL DESIGN

Lateral earth pressures will be imposed on all below ground and backfilled structures or walls, including foundations which do not have uniform heights of fill on both sides. The following recommendations are provided for design and construction of retaining walls:

- We recommend walls which are free to rotate at the top (unrestrained), be designed for an equivalent fluid pressure of at least 40 pcf.
- Walls that are fixed at the top (restrained) should be designed for an equivalent fluid pressure of at least 60 pcf.
- These values are for properly compacted, non-expansive, free-draining granular soils (such as crushed rock, drain rock or jaw run shale), free of organics and other debris or for imported granular backfill. Organic topsoil and silty soils should not be used for wall backfill materials.
- These design values assume the wall or structure is fully drained (see Figure 4 for drainage recommendations), has a flat backfill and has no surcharge loads from traffic or other structures. The structural designer should include surcharge loading from traffic and building loads.
- We recommend designing retaining walls to resist seismic loading. A peak horizontal ground acceleration of 0.24g is given for the 2,500-year event. Therefore, a horizontal component of at least 0.18g should be applied to the mass of an enlarged active wedge of soil behind the walls and utilized in a pseudo-static analysis. The wedge length back from the wall along the ground surface may be taken as approximately 0.8H, where H is the height of the wall. This relates to a uniform load on the back of the wall equal to approximately 10 psf for each foot of backfill behind the wall, for walls up to 10 feet tall.

- The backfill should be placed in lifts at near the optimum moisture content and compacted to between 93 and 95 percent of the maximum dry density as determined by laboratory procedure ASTM D-698 (Standard Proctor).
- Backfill and compaction against walls or embedded structures should be accomplished with lighter hand-operated equipment within a distance of 1/2h (h being the vertical distance from the level being compacted down to the surface on the opposite side of the wall). Outside this distance, normal compaction equipment may be used.

While proper compaction of wall backfill is critical to the proper performance of the walls, care should be taken to not overcompact the backfill materials. Overcompaction can induce greater lateral loads on the wall or structure than the design pressures given above.

7.8 FOOTING DRAINS, WALL DRAINS AND FLOOR SUBDRAINS

All exterior foundations, embedded structures and retaining walls should have proper drainage.

Footing Drains. Drainage should consist of a rigid, smooth interior perforated drain pipe (capable of being cleaned by a roto-rooter type apparatus), typically resting adjacent to the footing near the base of the footing, provided this level is below the drain rock layer under any floor slabs and at least 6 inches below the crawl space. The perforated pipe should be surrounded (sides and above) by a minimum of 8 inches of clean drain rock or pea gravel. The drain rock envelope should be wrapped in a non-woven geotextile designed as a filter fabric (AMOCO 4546 or equivalent). We recommend the fabric be covered with a 2-inch layer of sand to protect it against damage during backfilling operations and potential partial plugging from soil fines over the life of the structure. Figure 5 provides a typical foundation drain for a water tank. Please see Figure 6 for typical foundation drain detail for a structure with a slab-on-grade floor.

Wall Drains. Wall drains should also have a minimum 12-inch wide drainage zone of drain rock wrapped in non-woven filter fabric immediately behind the wall extending up from the drainage section to within 12 to 18 inches of the surface. A preformed, fabric-wrapped, polymer sheet drain, such as Linq Drain, Enkamat or Amerdrain may be used in lieu of the vertical drainage zone, provided this is backfilled with clean, free draining granular material. Exterior wall drains, which will not be sealed on top by asphalt or concrete, should have the upper 12 to 18 inches backfilled with compacted on-site silt and clay soils (with a layer of filter fabric over the rock) to minimize intrusion of surface waters into the wall drain system. Please see Figure 4 for details of wall drainage methods.

Floor Subdrains. The tank floor may require a subdrain system to relieve potential hydrostatic pressure. One method to drain this water is to include a series of subdrains at

the bottom of a drain rock layer beneath the floor slab. The drain rock section should be thickened to at least 8 inches. The subdrain lines typically consist of 3-inch diameter, smooth interior, solid wall, perforated pipe at spacing of 20 feet (or less) across the tank (and around the interior perimeter). The perforated pipe is placed at the bottom of the drain layer as shown on Figure 7. The pipes are sloped to drain and collected by a tightline which leads to the stormwater disposal system. We recommend we be allowed to review the subdrain system design prior to final plan submittal or construction bidding.

7.9 EROSION CONTROL

The subject site has surficial soils that when disturbed can be subject to very large erosion. Therefore, proper construction practices and good erosion control must be accomplished from the very beginning of the project. In general, erosion control methods are intended to reduce flow concentration, reduce flow velocities and allow silt and sand particles to settle out of the runoff before it leaves the site. The following are several items that should be incorporated into the project to decrease erosion and off-site erosion impacts.

1. Ring the low side of the site with a silt fence installed as shown on Figure 7 (in figure it is incorporated into a settling pond).
2. Cover at least the first 100 feet of the entrance road to the site with crushed rock to prevent mud tracking onto City streets.
3. Grade the site to promote sheet flow.
4. Control concentrated runoff such that it flows into prepared ditches and/or settling ponds.
5. All ditches must be lined with angular rock and have periodic rock "check dams" to decrease flow velocities and prevent invert scouring.
6. One or more settling ponds will be needed at all points where runoff could exit the site.
7. All settling ponds must be constructed with silt fence backed hay bales, and have an outflow high enough to allow for silt and sand buildup (see Figure 8).
8. All runoff must be disposed of at an approved stormwater discharge location.
9. All disturbed soils must be revegetated at the end of construction.

The erosion control measures must be incorporated into a construction and a long-term erosion control plan, prior to construction. These measures must then be implemented, maintained and augmented to meet suspended solids concentration limits in site runoff.

8.0 ADDITIONAL SERVICES AND LIMITATIONS

8.1 ADDITIONAL SERVICES

Additional services by the geotechnical engineer are recommended to help verify the preliminary design recommendations are finalized by site investigation prior to final project design and to help monitor compliance with project specifications during the construction process. For this project we anticipate additional services could include the following:

1) Site subsurface investigation, possible laboratory testing and Final Geotechnical Investigation and Design Report.
2) Review of final cut and fill plans and global stability issues.
3) Review of final foundation plans, retaining wall plans and subdrain systems for compliance with geotechnical recommendations.
4) Observation of all cuts for adverse fracture planes.
5) Observation and verification of all roadway and site drainage items.
6) Observation and verification of key trenches, benching and slope drainage for fills placed on the slope.
7) Observation and density testing of all fill placement.
8) Observation of all footing excavations prior to pouring concrete or slurry.
9) Observations of retaining wall footing subgrades and drainage, structural fill placement, compaction and density testing of structural fill.
10) Periodic construction field reports, as requested by the client and/or required by the City, including final project verification letter.
11) Other geotechnically related items requested by the client.

We would provide these additional services on a time-and-expense basis in accordance with our current Fee Schedule and terms and conditions already in place for this project. If we are not retained to provide these services we cannot be held responsible for design, design review and decisions of others for unverified items. The owner, designer and contractor will then accept all responsibility for these items.

8.2 LIMITATIONS

The analyses, conclusions and preliminary recommendations contained in this report are based on site conditions and proposed development plans as they existed at the time of the study, and assume soils and groundwater conditions exposed and observed at the site are representative of soils, and groundwater conditions throughout the site. No subsurface exploration was accomplished for this report. Site subsurface investigation and a final design report must be accomplished for this project. If during construction, subsurface conditions or assumed design information is found to be different, we should be advised at once so that we can review this report and reconsider our recommendations

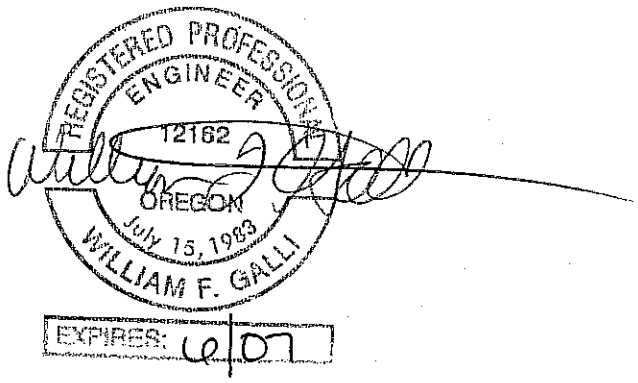
in light of the changed conditions. If there is a significant lapse of time between submission of this report and the start of work at the site, if the proposed project is changed significantly, or if conditions have changed due to acts of God or construction at or adjacent to the site, it is recommended that this report be reviewed in light of the changed conditions and/or time lapse.

This report was prepared for the use of the owner and his design team for use in the tank siting and preliminary design of the subject project if this site is selected for use. It should be made available to others for information and factual data only. This report should not be used for contractual purposes as a warranty of site subsurface conditions. It should also not be used for final design of the project, at other sites or for projects other than the one intended.

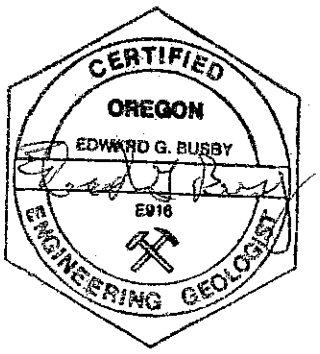
We have performed these services in accordance with generally accepted engineering geology and geotechnical engineering practices in southern Oregon, at the time the study was accomplished. No other warranties, either expressed or implied, are provided.

THE GALLI GROUP
GEOTECHNICAL CONSULTING

William F. Galli, P.E.
Principal Engineer



Edward Busby, C.E.G.
Senior Engineering Geologist



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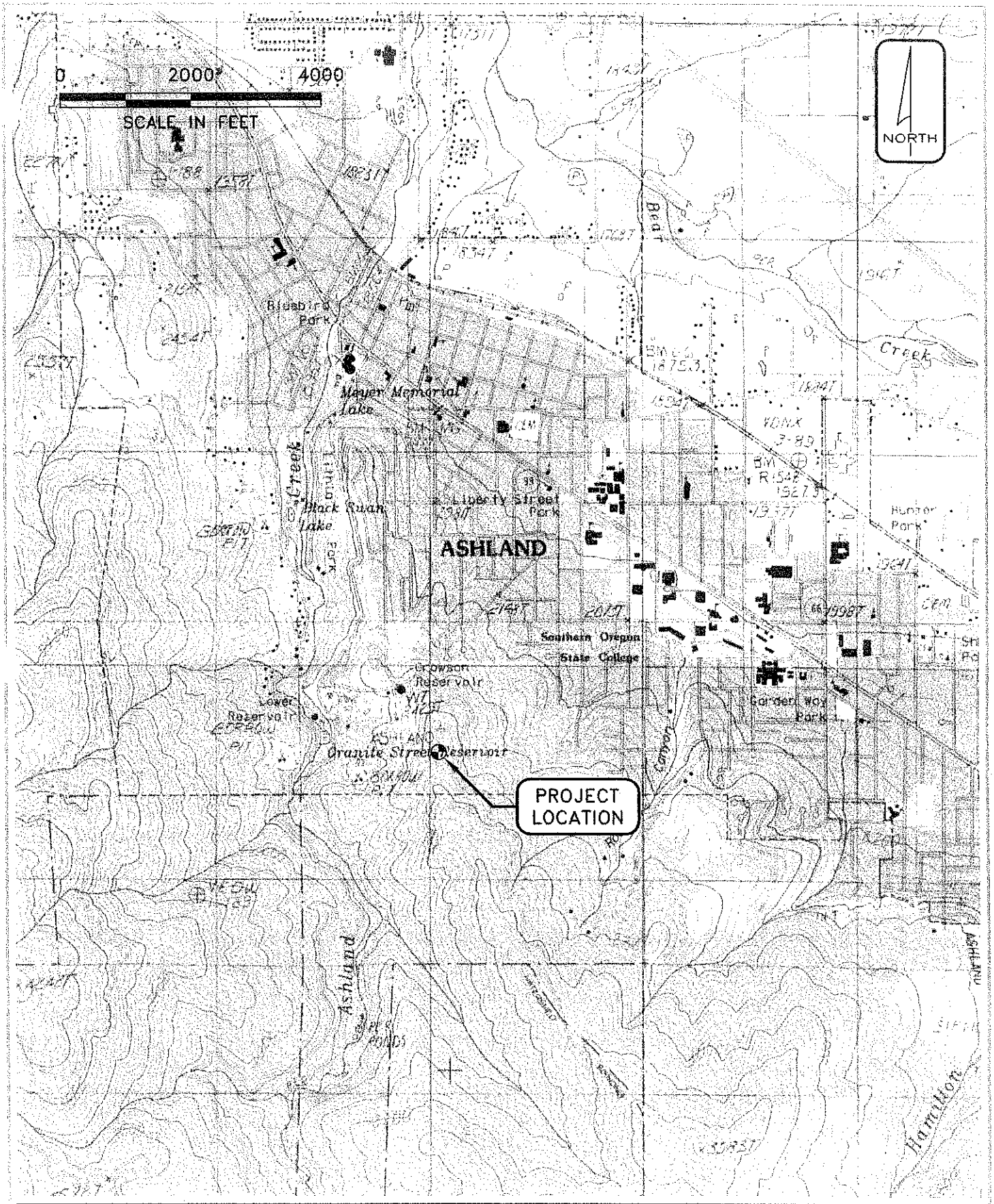

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612 NW 3rd Street
Grants Pass, OR 97526

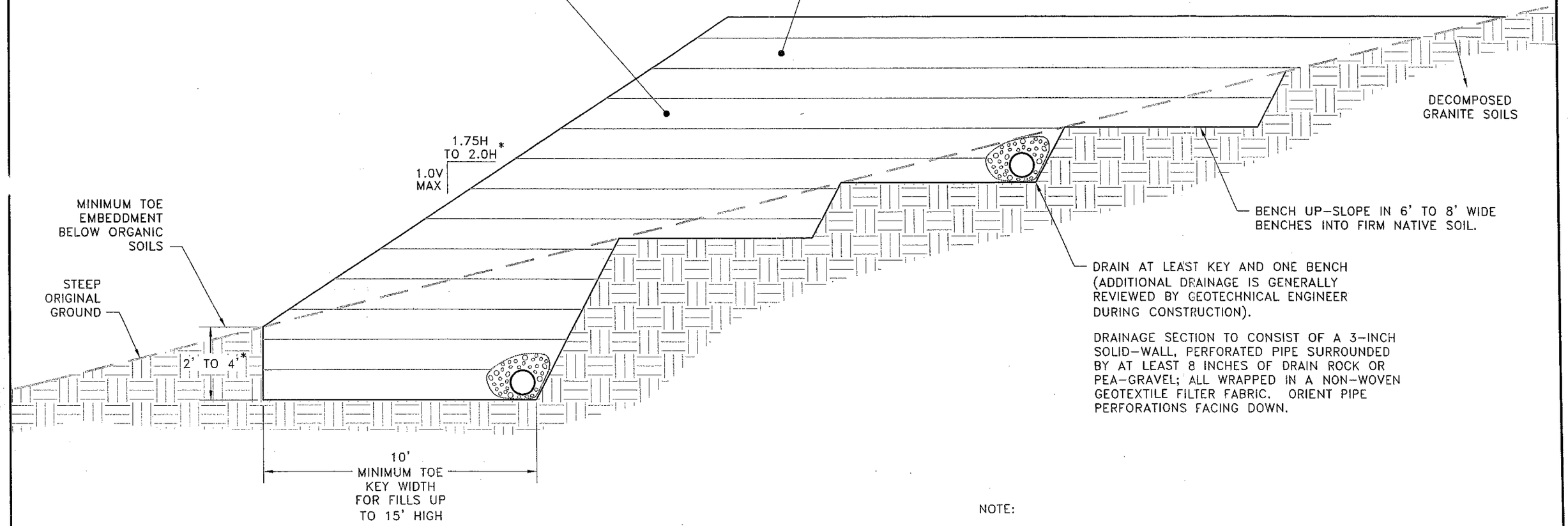
VICINITY MAP

ASHLAND LOOP ROAD RESERVOIR
ASHLAND, OREGON

DATE: SEPTEMBER 2006	FIGURE:
JOB NO: 02-3760-ALR	1
REV: MP01-092006A	
PREPARED BY: TJ	
3760 Ashland WT-VICINITY.dwg	

STRUCTURAL FILL MATERIALS TO CONSIST OF APPROVED EXCAVATED SOILS AND ROCK (MAXIMUM SLOPE OF 1.75H TO 2H:1V). IN NO CASE SHOULD THE ORGANIC TOPSOIL SOILS OR OTHER ORGANIC DEBRIS BE USED FOR STRUCTURAL FILL. PLEASE SEE FILL SLOPE RECOMMENDATIONS IN OUR DESIGN REPORT FOR RECOMMENDED FILL SLOPE ANGLES.

FOR AREAS BENEATH STRUCTURES AND ROADWAYS, COMPACT TO AT LEAST 98% OF THE MAXIMUM DRY DENSITY PER ASTM D-698.*

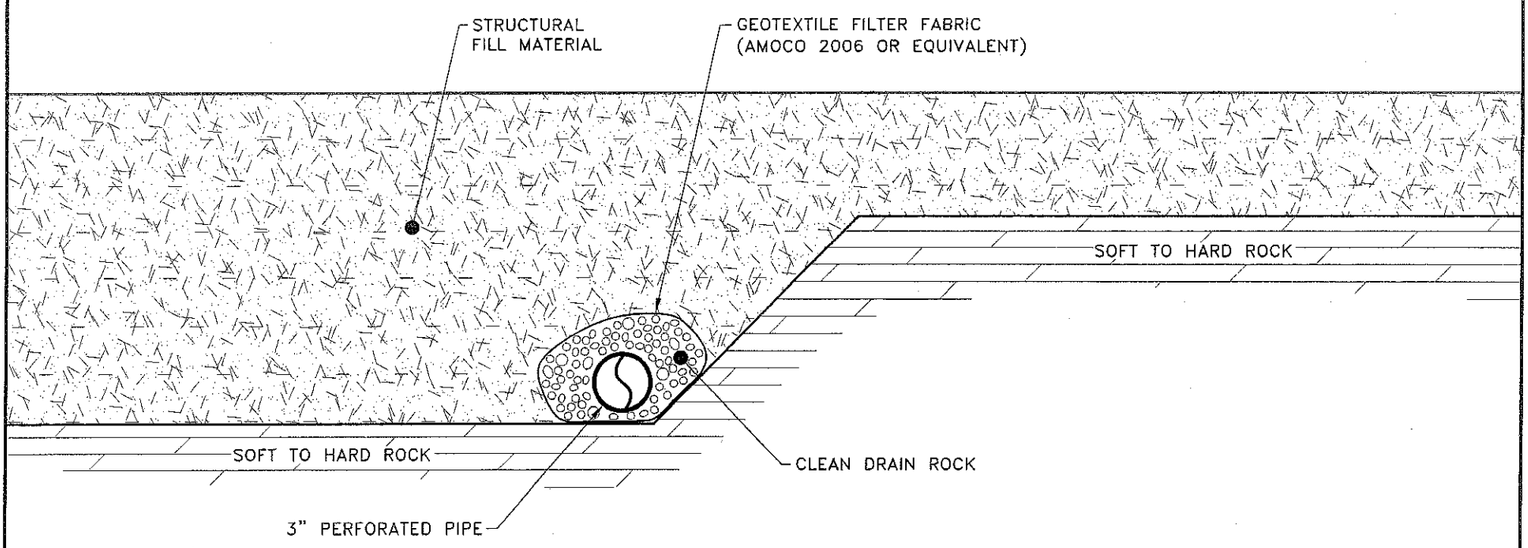


NOTE:

THIS IS A GENERAL CROSS-SECTION FOR FILL PLACED ON SLOPES. IT IS NOT INTENDED AS A SPECIFIC DESIGN FOR THIS PROJECT.

FOR ILLUSTRATION PURPOSES ONLY
NOT TO SCALE

THE GALLI GROUP GEOTECHNICAL CONSULTING 612 NW 3rd Street Grants Pass, OR 97526	FILL ON STEEP SLOPE CROSS-SECTION ASHLAND LOOP ROAD RESERVOIR ASHLAND, OREGON	DATE: SEPTEMBER 2006 JOB NO: 02-3760-ALR REV: SL01-092006A PREPARED BY: TJ 3760 Ashland WT-FILL.dwg	FIGURE: 2



THE GALLI GROUP GEOTECHNICAL CONSULTING 612 NW 3rd Street Grants Pass, OR 97526	BENCH DRAIN DETAIL ASHLAND LOOP ROAD RESERVOIR ASHLAND, OREGON	DATE: SEPTEMBER 2006 JOB NO: 02-3760-ALR REV: 092006A PREPARED BY: TJ 3760 Ashland WT-BENCH.dwg	FIGURE: 3

TYPICAL RETAINING WALL CROSS-SECTION

NOTE: MAT DRAIN MAY BE REPLACED BY TWO COATS OF A HIGH QUALITY WALL SEALER. FLEXIBLE BITUMEN-BASED, ROLLED OR TROWELED-ON MATERIALS TEND TO WORK WELL, AS DO BENTONITE PANELS AND STICKY-BACKED MEMBRANES PROVIDED THAT A WASHED, FREE-DRAINING ROCK, PROTECTED AGAINST ALL SOIL BY AN APPROVED FILTER FABRIC, IS USED FOR ENTIRE WALL BACKFILL.

WALLS WHICH HAVE DRY LIVING SPACE INSIDE SHOULD HAVE THE OUTSIDE COATED WITH 2 COATS OF A HIGH QUALITY WALL SEALER AND HAVE THE MAT DRAIN ADJACENT TO FREE-DRAINING BACKFILL

NOTES: DRAINAGE OF THE RETAINING WALL IS A CRITICAL ITEM IN ITS PROPER LONG-TERM PERFORMANCE. ANY COMPROMISE IN MATERIALS OR CONSTRUCTION QUALITY CAN HAVE VERY SIGNIFICANT (DISASTROUS) ADVERSE AFFECTS.

THESE WALL SECTIONS ASSUME FULLY DRAINED CONDITIONS FOR THE LIFE OF THE STRUCTURE.

IN NO CASE SHOULD WEEP HOLES BE SUBSTITUTED FOR THIS DRAINAGE SECTION.

BEVELED MORTAR TO SHED WATER

12" SOIL COVER OVER FOOTING

12" MIN

12" MIN.

UNDISTURBED NATIVE SOIL SUBGRADE OR SPECIFIED STRUCTURAL ROCK FILL

WATER STOP (OPTIONAL)

BEVELED MORTAR TO SHED WATER

BACKSLOPE EXTERIOR SURFACES AT LEAST 2% TO 5% FOR A MINIMUM OF 6 FEET

CLAYEY SOIL SEAL OR PLASTIC SHEETING ON TOP OF DRAIN ROCK

COMPACTED FREE-DRAINING GRANULAR BACKFILL (SUCH AS PEA GRAVEL OR CLEAN CRUSHED ROCK) IF WALL DRAINAGE MAT IS NOT USED

IN LIEU OF FABRIC WRAPPED WALL DRAIN, USE A FABRIC COVERED POLYMER COMPOSITE MAT DRAIN - SUCH AS ENKAMAT OR LINQ DRAIN, PROVIDED ALL BACKFILL IS WASHED, FREE DRAINING MATERIAL AND MEETS FILTER REQUIREMENTS AGAINST NATIVE SOILS. ATTACH WITH THE PERMEABLE FABRIC SIDE AWAY FROM THE RETAINING WALL.

WALL DRAIN CONSISTING OF 12" WIDE WASHED DRAIN ROCK WRAPPED IN A NON-WOVEN GEOTEXTILE FABRIC SUCH AS AMOCO 4546 OR EQUIVALENT; TO WITHIN 12" OF SURFACE AND MUST EXTEND DOWN TO FABRIC WRAPPED BASE DRAINAGE SECTION.

ALTERNATE FOOTING DRAIN LOCATION WITH SOMEWHAT LESS EFFECTIVENESS.

NOTE: 2" CLEAN SAND OVER THE FABRIC PROTECTS IT DURING BACKFILL OPERATIONS.

CLEAN 1"--1½" WASHED DRAIN ROCK AT LEAST 8" AROUND THE PIPE ON ALL SIDES (NOT BELOW PIPE).

NON-WOVEN GEOTEXTILE FILTER FABRIC SUCH AS AMOCO 4546 (5 OZ. PER SQUARE FOOT) FABRIC. OVERLAP AND SECURE.

4" DIAMETER RIGID, SMOOTH WALL PERFORATED PIPE. SLOPE FOR POSITIVE DRAINAGE AND WITH CLEAN-OUTS AT BOTH ENDS FOR LONG-TERM MAINTENANCE.

IMPERMEABLE MEMBRANE

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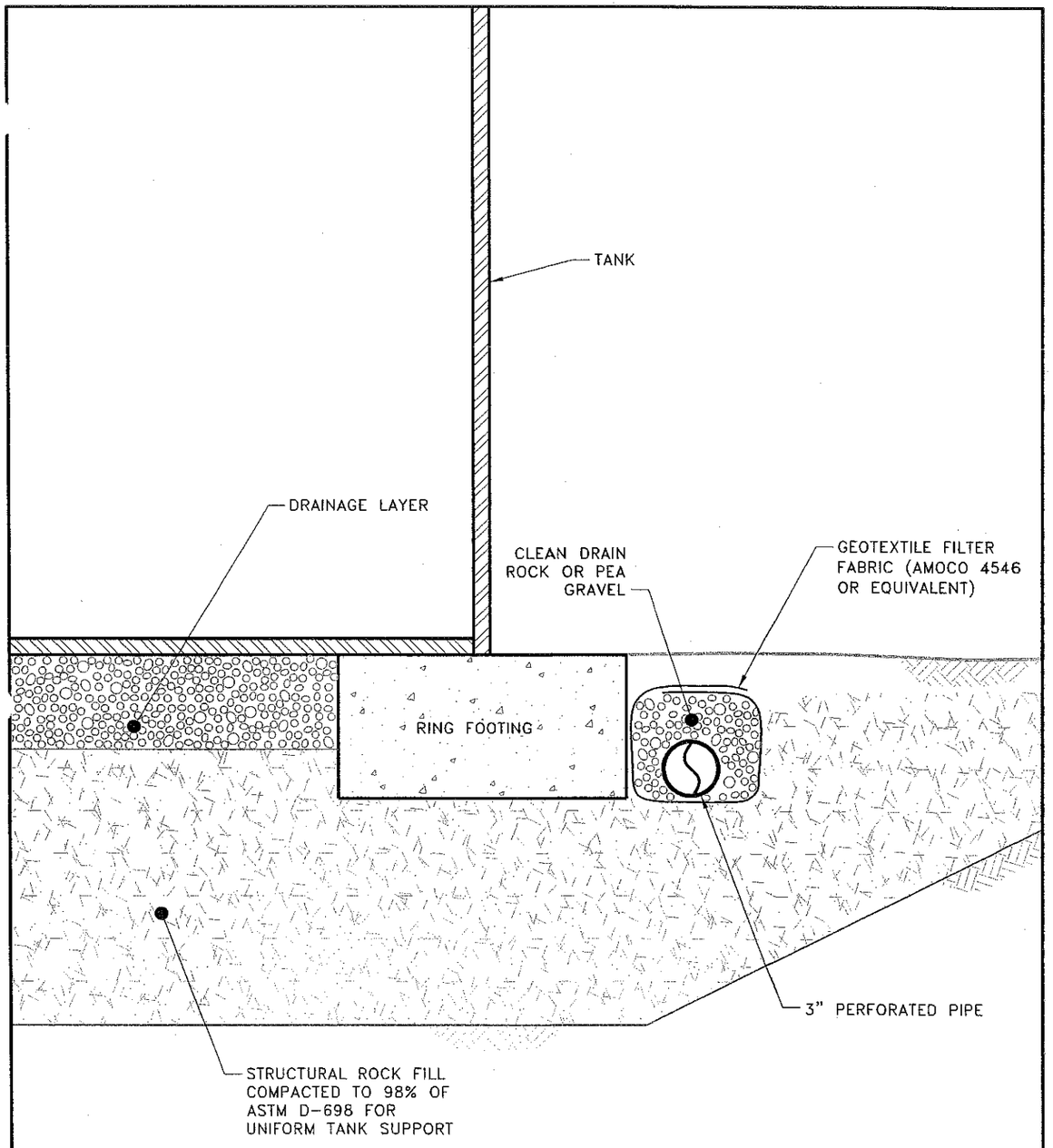
612 NW 3rd Street
Grants Pass, OR 97526

EXTERIOR RETAINING WALL DRAINAGE CROSS-SECTION

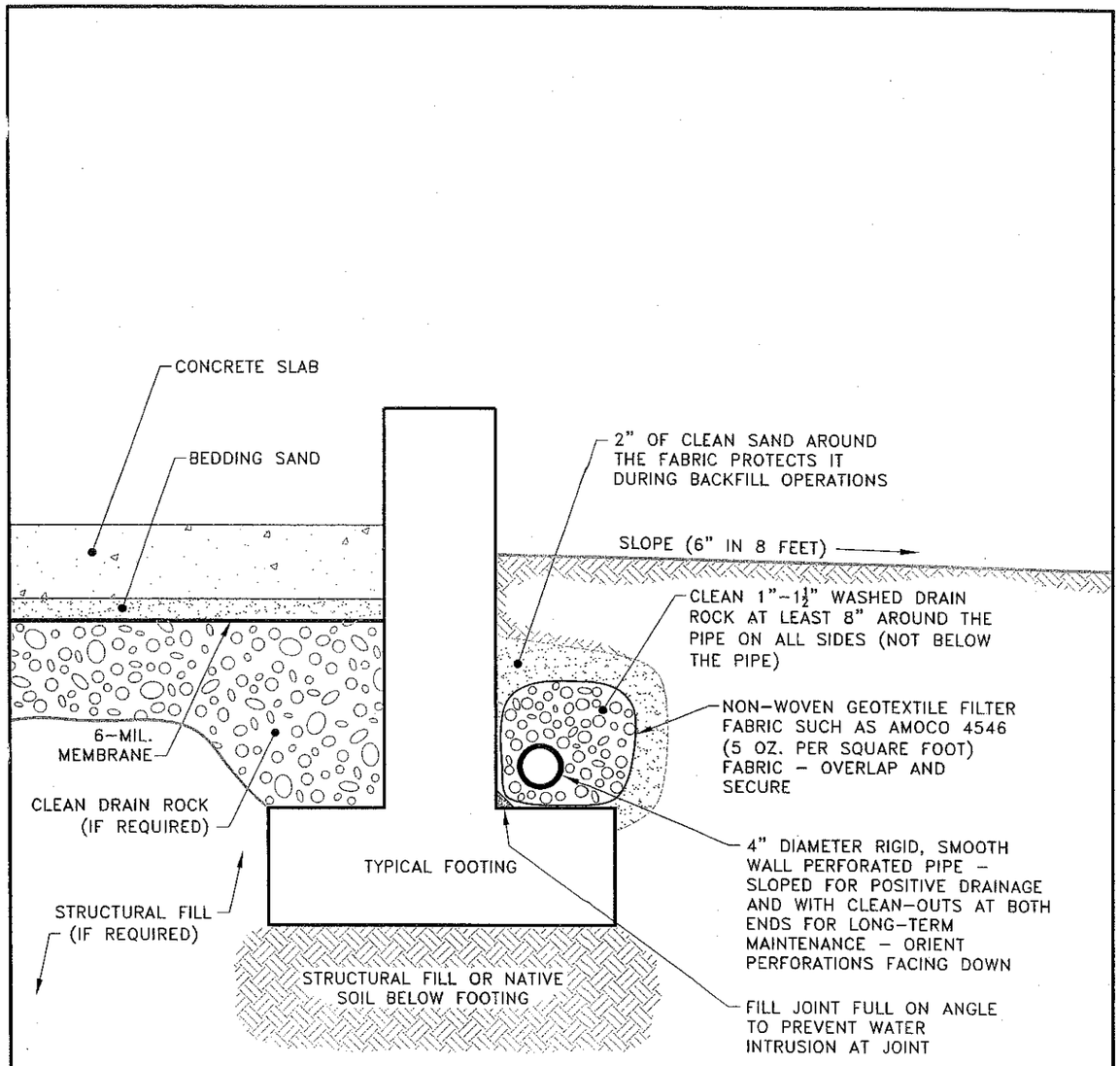
ASHLAND LOOP ROAD RESERVOIR
ASHLAND, OREGON

DATE: SEPTEMBER 2006
JOB NO: 02-3760-ALR
REV: RW03-092006A
PREPARED BY: TJ
3760 Ashland WT-RETWALL.dwg

FIGURE: 4

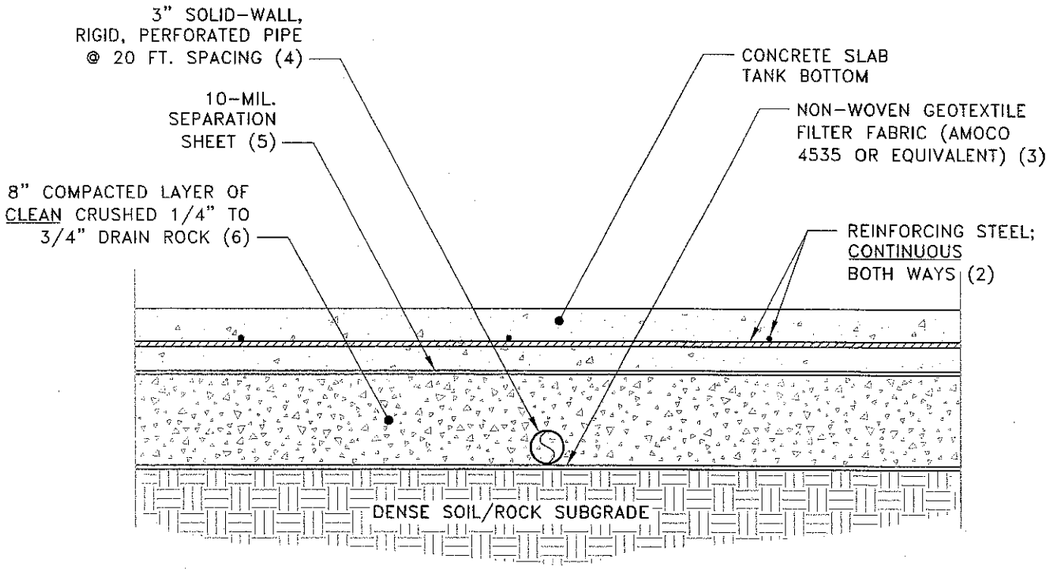


THE GALLI GROUP GEOTECHNICAL CONSULTING 612 NW 3rd Street Grants Pass, OR 97526	TANK FOUNDATION DRAIN ASHLAND LOOP ROAD RESERVOIR ASHLAND, OREGON	DATE: SEPTEMBER 2006 JOB NO: 02-3760-ALR REV: 092006A PREPARED BY: TJ 3760 Ashland WT-FOOT.dwg	FIGURE: 5



FOR ILLUSTRATION PURPOSES ONLY
NOT TO SCALE

THE GALLI GROUP GEOTECHNICAL CONSULTING 612 NW 3rd Street Grants Pass, OR 97526	TYPICAL FOUNDATION DRAIN SLAB ON GRADE FLOOR ASHLAND LOOP ROAD RESERVOIR ASHLAND, OREGON	DATE: SEPTEMBER 2006 JOB NO: 02–3760–ALR REV: FD01–092006A PREPARED BY: TJ 3760 Ashland WT–FOUND.dwg	FIGURE: 6



NOTES:

(1) CONCRETE MIX DESIGN SHOULD INCREASE SURFACE TOUGHNESS AND MINIMIZE SHRINKAGE AND CRACKING.

(2) MINIMUM REINFORCEMENT SHOULD BE NO. 3 REBAR @ 16" O.C. BOTH WAYS, @ THE SLAB MID HEIGHT; EXTEND ACROSS ALL JOINTS (CONSULT STRUCTURAL ENGINEER).

(3) ONLY REQUIRED IF DECOMPOSED GRANITE OR OTHER FINE SOIL MIGHT CONTAMINATE THE DRAIN ROCK LAYER.

(4) SIZE AND SPACING OF SUBDRAINS MAY VARY.

(5) 10-MIL MEMBRANE KEEPS CONCRETE OUT OF DRAINAGE LAYER.

(6) THICKNESS OF LAYER MAY VARY; DO NOT DAMAGE SUBDRAINS WITH COMPACTION EFFORT.

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NOT TO SCALE

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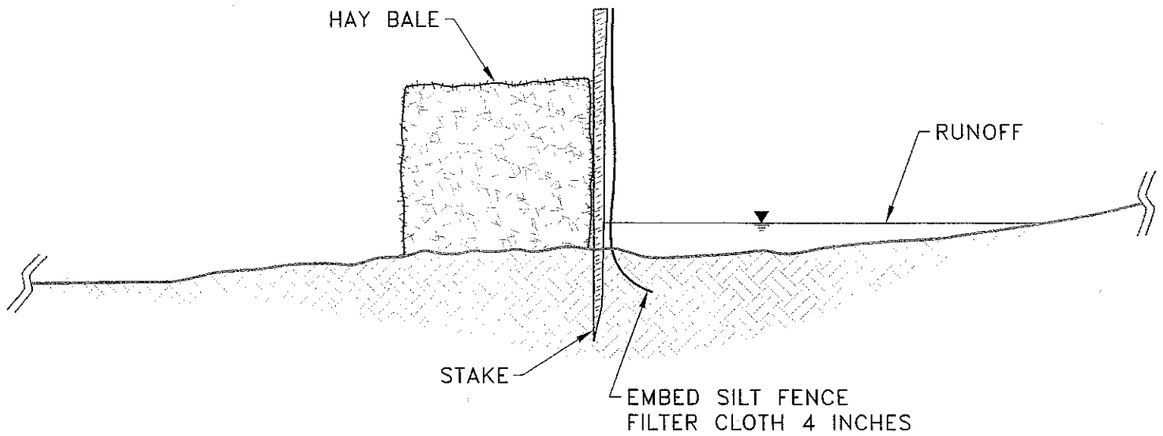
612 NW 3rd Street
Grants Pass, OR 97526

TANK FLOOR SECTION WITH SUBDRAINS

ASHLAND LOOP ROAD RESERVOIR
ASHLAND, OREGON

DATE: SEPTEMBER 2006
JOB NO: 02-3760-ALR
REV: SD02-092006A
PREPARED BY: TJ
3760 Ashland WT-SUBDRAIN.dwg

FIGURE: 7



SETTLING POND
CROSS-SECTION

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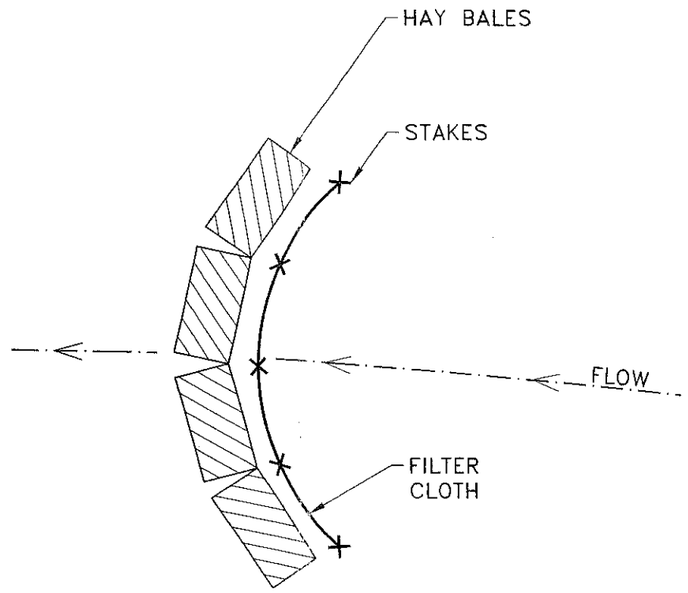
NOT TO SCALE



SETTLING POND
PLAN VIEW

THE GALLI GROUP GEOTECHNICAL CONSULTING 612 NW 3rd Street Grants Pass, OR 97526	EROSION CONTROL DETAILS ASHLAND LOOP ROAD RESERVOIR ASHLAND, OREGON	DATE: SEPTEMBER 2006 JOB NO: 02-3760-ALR REV: EC01-092006A PREPARED BY: TJ 3760 Ashland WT-POND.dwg	FIGURE: 8

APPENDIX B. GEOTECHNICAL AND GEOLOGICAL SITING STUDY CROWSON II RESERVOIR SITE

GEOTECHNICAL AND GEOLOGIC SITING STUDY
CROWSON II RESERVOIR SITE
GRANTS PASS, OREGON

For: Bob Willis
Brown & Caldwell Engineers
6500 SW Macadam, Ste. 200
Portland, OR 97239

By: **THE GALLI GROUP**
612 NW Third Street
Grants Pass, OR 97526
(541) 955-1611

02-3760-CII
September 20, 2006

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FIGURES

GEOTECHNICAL AND GEOLOGIC SITING STUDY CROWSON II RESERVOIR SITE GRANTS PASS, OREGON

1.0 INTRODUCTION

The City of Ashland proposes to add two new water storage reservoirs to their water supply system. The existing Crowson Reservoir is a 2.2 MG reservoir, which is the primary reservoir for the system. One new reservoir (Crowson II Reservoir) is expected to be a prestressed concrete structure with a capacity of 1.5 to 2.0 MG. The target elevations will be close to those of the existing reservoir, which has an overflow elevation of 2,425 feet and a ground elevation of 2,400 feet.

The purpose of this study was to observe the proposed reservoir site and provide a geotechnical and geologic evaluation of its suitability for the proposed reservoir. It also includes providing general design recommendations for preliminary design and construction estimating for the project.

2.0 SITE AND PROJECT DESCRIPTION

2.1 SITE DESCRIPTION

The subject site of the proposed new Crowson II Reservoir is a relatively steep northwest sloping mountainside about two miles up the Ashland Creek basin from downtown Ashland. Please see Figure 1, Vicinity Map for a more precise site location. This site is upslope of an existing quarry site. The quarry area has large level areas as a result of removing the hard granite rock over many decades.

The subject hillside ranges in slope between 1.5H to 2.0 H:1.0V. It is covered with a moderately dense stand of evergreen and deciduous trees, scattered to abundant brush and thick ground cover.

The surficial soils consist of sandy silts and slightly clayey, silty Sands (decomposed granite). This is underlain by coarser and more dense, weathered to decomposed granite and harder granite rock.

2.2 PROJECT DESCRIPTION

We understand the project to consist of constructing a new 1.5 to 2.0 MG reservoir structure. The tank should be on the order of 100 to 125 feet in diameter and would have

an access road around the tank for construction and maintenance. A parking area, maintenance shed, pump house and access road to the site, as well as all fresh water and treated water distribution lines could also be included.

The tank, access road around the tank and parking and maintenance areas will require a wide excavation into the hillside. It appears a level site on the order of 120 to 150 feet wide would be needed. This will require a massive amount of soil and rock removal.

3.0 SITE INVESTIGATION

In August of 2006, William Galli, P.E., G.E., Principal Engineer, and Ed Busby, C.E.G., Senior Engineering Geologist, visited the subject site. The hillside and quarry areas were observed and studied on foot. No test pits or exploratory borings were accomplished for this siting study.

4.0 SUBSURFACE CONDITIONS

4.1 SOIL

The site has a surficial zone of silty sand and sandy silt, some areas with slight clay content. This is underlain at 1 to 2 feet by dense silty Sand and gravelly Sand (decomposed granite). The materials become denser and less weathered with depth. At depths between 8 and 10 feet the granite rock appears to become relatively hard.

Borings and seismic refraction lines performed for other projects lower on this mountain have found these granite soils and the granite rock to become very dense and hard at shallow depth. The weathered materials had SPT N-values of 30 to 50 within three (3) feet of the surface. The N-values exceeded 50/3" at depths of five (5) feet. Seismic refraction lines indicated that rock at depths as shallow as 15 to 20 feet had shear wave velocities of between 7,000 and 9,000 feet per second. This indicated that blasting might have been required. In reality, a 40-foot deep excavation was accomplished by very large excavators equipped with narrow buckets and three very sharp, hardened rock teeth. Discussions with local quarry operators should reveal if any of the hard granite rock exposed was blasted out to be removed. At this time we understand this rock was removed by large excavation equipment and not by blasting.

4.2 GROUNDWATER

Small amounts of perched water could be present on top of the dense, weathered granite rock and within shallow rock joints. Otherwise the local groundwater level should be on the order of 150 to 200 feet or more below the site surface.

Abundant runoff from the rock areas upslope can produce large amounts of surface and shallow subsurface water. Therefore, good site drainage and tank subdrains are recommended.

5.0 SITE GEOLOGY

5.1 REGIONAL GEOLOGIC SETTING

The project site is located in the southern portion of Ashland, Oregon. The site is within the Ashland Pluton, a regionally extensive Jurassic age intrusive, which is exposed over nearly 150 square miles in southern Oregon and northern California. This granitic body (KJg) is described as: "Mostly tonalite and quartz diorite but including lesser amounts of other granitoid rocks" (Walker and MacLeod, 1991). Quartz monzonite and granodirorite also comprise the Mount Ashland Pluton.

No Holocene or Quaternary faults are shown in the project area on published geologic mapping (Walker and MacLeod, 1991), Earthquake Hazards Maps for Oregon (Madin and Mabey, 1996), or the Quaternary Fault and Fold Database (USGS; 2006a).

5.2 TECTONIC SETTING

The project site is in proximity to several zones of active seismicity. The site is affected by the Cascadia Subduction Zone, an active subduction zone off the Oregon coast, considered capable of producing Magnitude 8.5 or greater earthquakes. The surface expression of this zone, at the base of the continental slope, is approximately 200 kilometers from the project site. Average recurrence intervals for such great earthquakes, as determined by recent investigations, range between 300-600 years. The last "great" earthquake was interpreted to be approximately 300 years ago.

Relatively deep focus intraplate (depths of 40-60 km within the subducted Juan de Fuca plate) earthquakes of Magnitude 7.5 are considered possible within the subducted plate beneath western Oregon and Washington. The recurrence interval is not established, but the devastating earthquakes in Puget Sound (M7.1, 1949; M6.5, 1965; and M6.8, 2001) occurred in this seismic zone. Based on the historic seismic record, intraplate earthquakes are rare in southern Oregon.

Relatively shallow crustal earthquakes up to Magnitude 6.5 can occur in the upper plate at depths of 5-25 km. This zone generally produces most of the earthquakes in Western Oregon, and in the project region. Such earthquakes occur once every one to two decades, and historically have not exceeded M 6.0 within an 80-kilometer radius of the project area.

A list of seismic events greater than M 4.5 having epicenters within an 80-kilometer radius of the project site is provided in Table 1.

5.3 HISTORIC SEISMICITY OF AREA

Within a radius of approximately 80 kilometers (50 miles) of the project area, eight earthquake epicenters with a magnitude equal to or greater than M 4.5 have been reported since 1833 (Johnson & Others, 1993; ANSS, 2006). The Klamath Falls earthquake of 1993 contributed three events to this listing, including the M5.9 and M6.0 main shocks, and one smaller aftershock occurring within the next several months.

Some of these earthquakes were not recorded by instruments, but were reported by Mercalli Intensities. Magnitudes were then estimated from calculations made on the intensity data. Following is the list of recorded earthquakes in the project region:

Table 1

Date	Latitude	Longitude	Magnitude	Depth (Km)	Reference
9/2/1931	41.8000	-123.000	4.5	-	Johnson & others, 1993/ANSS
6/12/1978	41.450	-121.850	4.6	2.0	Johnson & others, 1993
8/1/1978	41.4298	-121.8505	4.67	2.0	Johnson & others, 1993/ANSS
8/19/1978	41.450	-121.850	4.7	2.0	Johnson & others, 1993
1/10/1981	41.550	-121.867	4.5	5.0	Johnson & others, 1993
9/21/1993	42.3575	-122.0583	6.0	10.30	Johnson & others, 1993/ANSS
9/21/1993	42.3877	-122.0508	4.3	0.02	Johnson & others, 1993/ANSS
12/4/1993	42.2915	-122.0087	5.1	6.53	ANSS

Three of the four largest seismic events in Oregon's recorded history have occurred near southwestern Oregon.

The 1873 Port Orford, considered Oregon's largest earthquake, is estimated to be M 7.0 (Johnson, 1993) to M 7.3 (USGS, 2006b). Some researchers place this event east-southeast of Brookings near the Oregon/California border, and refer to it as the Crescent City earthquake. Chimneys were toppled in Grants Pass and Jacksonville during this event, indicating Modified Mercalli Intensities of VI and VII in the Rogue Valley area. The quake was felt as far north as Portland, and in San Francisco to the south. This event had an epicenter distance of approximately 100 kilometers from the project area.

Most recently, the September 20, 1993 Klamath Falls quakes (M5.9 and M6.0) are the third and fourth largest events reported in Oregon. Mercalli Intensities of VII were experienced in the Klamath Falls area; effects of this earthquake were felt in Medford as

Mercalli Intensity V. In the Grants Pass and Roseburg areas Mercalli Intensities of IV and V were reported. The focus of the M6 event is immediately east of Lake of the Woods, on a normal fault system extending from the Basin and Range province. The quake had a focal depth of 12 km, and epicenter distance from the project site of approximately 50 kilometers.

5.4 2003 IBC DESIGN EARTHQUAKE

The design earthquake for the project area is based upon established values and methodologies in the International Building Code (IBC; 2003).

The maximum considered earthquake and spectral response accelerations were established as set forth in Section 1615.1.

The site has a mapped Maximum Considered Earthquake (MCE) spectral response acceleration at 0.2 seconds for Site Class B (Ss) from Figure 1615-1 (IBC, 2003) of: S_s=0.624g. The site has a mapped Maximum Considered Earthquake (MCE) spectral response acceleration at 1.0 second for Site Class B (S1) from Figure 1615-2 (IBC, 2003) of: S_1= 0.292g.

The Site Class was determined from Table 1615.1.1 (IBC, 2003), combined with data obtained during our field investigation. A Site Class of C was established for the project site, for all areas founded on weathered to hard granite rock.

Spectral Parameter for Site Class C is:
0.2 sec Period-- S_{MS}=FaSs, Fa=1.15 **S_{MS}=0.718g**
1.0 sec Period—S_{M1}=FvS1, Fv=1.51 **S_{M1}=0.440g**

A Site Class of D was established for the project site for areas over structural fill.

Spectral Parameter for Site Class D is:
0.2 sec Period-- S_{MS}=FaSs, Fa=1.30 **S_{MS}=0.812g**
1.0 sec Period—S_{M1}=FvS1, Fv=1.82 **S_{M1}=0.531g**

As reference information only, the expected peak horizontal bedrock acceleration at the project site, due to all earthquake hazards for an event with frequency of occurrence of once in 2500 years (2% chance of occurrence in any 50-year period.), is 0.24g (USGS, 2002). For an event with a frequency of occurrence of once in 500 years (10% chance of occurrence in any 50-year period) the expected peak horizontal bedrock acceleration is 0.12g USGS, 2002).

5.5 GEOLOGIC OR SEISMIC INDUCED HAZARDS

Slope Stability. Review of aerial photos of the sites (BLM, 2001; Jackson County GIS, 2001), and a reconnaissance check of site geology was completed as part of this report.

The site geology consists of weathered granitic bedrock which is part of the Mount Ashland Pluton. Regional field data gathered on the granite bedrock indicates it has a hardness of R3 (Medium hard) to R4 (Hard), and joint-sets are typically N10W, vertical; N55-65W, vertical; N30E, vertical; E-W, vertical. Joints are moderately close spaced (1 to 3 feet) to widely spaced (3 to 10 feet), ranging from "open" to closed (hairline trace). Joints appear to be "slightly continuous" (5 to 10 feet) along strike.

No active or recent evidence of significant slope instability was observed during the photo review or site reconnaissance. No published geologic mapping indicates slope instability in the project area. A relatively small deposit of granitic debris-slide material is likely present at the proposed Crowson II site. This potential deposit will be evaluated during the drilling phase of the project. If such deposits are present, they could be removed during excavation of the tank foundation.

Recommendations for site grading and proper methods of cut-and-fill construction are provided in our geotechnical report, and it is essential these recommendations be followed closely in order to minimize slope instability both during and after construction. In-progress grading inspections should be made during construction to note any adverse joints or shear zones, which could negatively affect cut slopes. **Note:** At two sites lower on this hillside, moderate to massive rockfall events occurred during construction due to adverse bedding planes exiting steep construction excavations.

The "Relative Earthquake Hazard Maps for selected urban areas in western Oregon" (Madin and Wang,1999) publication indicates the project area, including steeper slopes, are Zone D (lowest hazard) with regard to earthquake induced landslides, liquefaction potential, and ground amplification of seismic waves.

Liquefaction. The proposed tank site is underlain by granitic bedrock of the Mount Ashland Pluton. Liquefaction is not a potential hazard for the proposed site.

The "Relative Earthquake Hazard Maps for selected urban areas in western Oregon" (Madin and Wang, 1999) publication indicates the project area is Zone D (lowest hazard) with regard to liquefaction potential.

Seismic Ground Amplification or Resonance. No hazardous amplification or resonance effects from seismic waves have been associated with soil/bedrock subsurface conditions in the project area. An IBC Site Class of C was established for the site, when foundations are placed directly on weathered granitic bedrock. If structural fills are placed beneath the tank foundations, a Site Class of D should be used. We feel the Site

Class designations will properly compensate for any ground amplification that would occur at the project site.

The "Relative Earthquake Hazard Maps for selected urban areas in western Oregon" (Madin and Wang, 1999) publication indicates the project area is Zone D (lowest hazard) with regard to ground amplification of seismic waves.

Tsunami/Seiche Hazard. The project site is not located adjacent to any large lake or body of water, and therefore no seismically induced seiche hazard exists for the project. No large reservoirs are located in a drainage area upslope from the project site. The site is not within the Hostler Dam "failure inundation zone". Therefore, no hazard to the project site exists due to seismically induced reservoir failure.

Surface Rupture. No Quaternary or Holocene faults are shown in the project area on published geologic mapping (Walker and MacLeod, 1991; Madin and Mabey, 1996; USGS; 2006a), and no evidence of recent or active faulting was observed during the field investigation or air-photo review of the site area. The hazard of surface rupture at the site is very low.

Summary. Therefore, other than the moderate to severe ground shaking anticipated during the design seismic event, in our opinion, there are no other geologic hazards of reasonable risk that could cause damage to the site.

6.0 CONCLUSIONS

In our professional opinion, based on our field investigation and office review, the soil and bedrock conditions at the site are suitable for the proposed project, provided the recommendations of our report are incorporated in the design and construction of the project. The following sections provide geotechnical recommendations for preliminary design of the planned improvements.

7.0 PRELIMINARY GEOTECHNICAL RECOMMENDATIONS

The following recommendations are based on our surface reconnaissance and geologic study of the subject site. These may be used for site evaluation and preliminary design purposes. These recommendations must be reviewed and updated based on subsurface investigation in a Final Geotechnical Design Report, prior to final project design.

7.1 SITE EXCAVATION

As discussed earlier, this site is underlain at relatively shallow depth by increasing harder granite rock. This rock tends to have several joint sets that make removal easier than monolithic rock masses. Seismic refraction testing on other sites indicate this granite rock could have shear wave velocities as high as 10,000 feet per second. This would normally indicate that blasting could be required. This means that below a depth of 15 to 20 feet ripping with large equipment could be difficult. However, given the number of fracture/joint sets, ripping with a single tooth on very large dozers (D-8 to D-9) may work reasonably well, even though it could be a bit slow.

The volume of excavation and depth of excavation below the surface will be very large to place a 1.5 to 2.0 MG tank on this site. If the access road and parking areas are constructed over structural fill placed on the slope, a level cut on the order of 120 to 125 feet wide would be required. This would result in a total excavation height on the order of 130 to 140 feet (assumes average site slope of 1.75H:1V and cut slope between 0.75H to 1.0H:1V). Depth of cut vertically from the ground surface would be between 75 and 85 feet. It appears an excavation in excess of 10,000 cubic yards would be required to create the tank pad on this site. Additional site subsurface investigation will be required to verify information regarding rock hardness and rock jointing that dictate the ability of the rock to be removed by large excavators and by ripping (or by blasting).

Trench Excavation. Excavation of trenches into the site materials will vary depending upon where the trench is located. In the upper 10 to 15 feet (below original ground surface), the trenches will likely be able to be excavated by large excavators with narrow buckets and rock teeth. At greater depths below the original surface, trenching with excavators could be very difficult.

7.2 SITE PREPARATION

All areas proposed for structures, roads and parking, should be cleared and grubbed of all trees, stumps, brush and other debris and/or deleterious materials. The site should then be stripped and cleared of all vegetation, sod and organic topsoil. It appears that a stripping depth of from 2 to 4 inches would be required on areas not already graded. The stripped materials should be hauled from the site or stockpiled for use in landscape areas only. This material should not be used in structural fill, trench backfill or footing backfill on this project. **Note:** Vegetation should not be buried below any portion of the fills planned for the site or under other impromptu fills created by the contractor.

Holes or depressions resulting from the removal of underground obstructions, old ditches and excavations that extend below the finish subgrade and will be beneath structures or roadways shall be cleared of all loose or soft material and dished to provide access for compaction equipment. These areas shall then be backfilled and compacted to grade with structural fill, as described later in this report.

7.3 STRUCTURAL FILL PLACEMENT AND COMPACTION

7.3.1 Beneath Structures

Structural fill is defined as any fill placed and compacted to specified densities and used in areas that will be under structures, roadways, fills, pavements, parking areas, sidewalks and other load-bearing areas or be used for wall backfill. At this time it appears that small to large fills will be required for the roadway, access road and parking areas.

Structural Fill Materials. Ideally, and particularly for wet weather construction, structural fill should consist of a free-draining granular material (non-expansive) with a maximum particle size of six inches. The material should be reasonably well-graded with less than 5 percent fines (silt and clay size passing the No. 200 mesh sieve). During dry weather, any organic-free, non-expansive, compactable granular material, free of debris and other deleterious materials, meeting the maximum size criteria, is acceptable for this purpose. The excavated sandy weathered granitic material and granitic rock should perform well as structural fill (not the surficial, slightly clayey DG). Locally available crushed rock and good quality jaw-run crushed shale have also performed adequately for most applications of structural fill.

The on-site fractured granite rock should make good structural fill. The weathered rock, in the upper portion of the excavation, will most likely break down into 4-inch to 8-inch minus material during excavation and movement of this material. Rock from the deeper portions of the excavation may need to be pulverized by blasting techniques for it to be adequate for structural fill. These granitic materials should work well for creating fill zones for parking and access roads. They would also make good structural fill beneath a portion of the tank if potential differential settlement is not a problem for the proposed tank.

Structural Fill Placement. Structural fill should normally be placed in horizontal lifts not exceeding 8 inches loose thickness (less, if necessary to obtain proper compaction) for heavy compaction equipment and four inches or less for light and hand-operated equipment. If large equipment is available, thicker lifts may be acceptable when 6-inch or 8-inch minus rock (or larger) is used. Each lift should be compacted to a minimum of 95 percent of the maximum dry density for roads and 98% beneath structures, as determined by ASTM Test Method D-698 (Standard Proctor).

Structural fill placed beneath footings or other structural elements must extend beyond all sides of such elements a distance equal to at least ½ the total depth of the structural fill beneath the structural element in question for vertical support. Where fill is placed to build up the area on the low side of the site for foundation or vehicle support, we recommend the structural fill extend beyond the footing or roadway paved surface area at least 5 feet horizontally, then slope away at no steeper than 1.7H:1V with a compacted fill slope surface when anchored on the slope. **Note:** Where moderate to large fills are

intended to be placed on the slope, we should review these for global stability. Fill slope inclinations are provided in a later section of this report.

To facilitate the earthwork and compaction process, the earthwork contractor should place and compact fill materials at or slightly above their optimum moisture content. If fill soils are on the wet side of optimum, they can be dried by continuous windrowing and aeration or by intermixing lime or Portland Cement to absorb excess moisture and improve soil properties. If soils become dry during the summer months, a water truck should be available to help keep the moisture content at or near optimum during compaction operations.

Note: Proper fill placement and compaction is critical to the proper long-term performance of the project. Site preparation, fill material type, moisture content, lift thickness and mechanical effort by the proper compaction equipment all play a critical part in attaining properly constructed fills. Therefore, we recommend the general contractor and subcontractors read and understand the content and intent of the Final Geotechnical Design Report prior to construction on the site.

Fill Placement Observation and Testing Methods. The required construction monitoring of the structural fill utilizing standard nuclear density gage testing and standard laboratory compaction curves (ASTM D-698 specified) is not applicable to larger jaw run shale or larger crushed rock. The high percentage of rock particles greater than ¾" in these materials causes laboratory and field density test results to be erratic and does not provide an accurate representation of the density achieved. Therefore, construction specifications for this type of material typically specify method of placement and compaction coupled with visual observation during the placement and compaction operations.

For these larger rock materials (such as 4-inch minus crushed rock or jaw-run "shale"), we recommend the 8-inch lift be compacted by a minimum of three (3) passes with a heavy vibratory roller. One "pass" is defined as the roller moving across an area once in both directions. The placement and compaction of these materials should be observed by our representative. After compaction, as specified above, is completed the entire area should be proofrolled with a loaded dump truck to verify density has been achieved. All areas which exhibit movement or compression of the rock material under proofrolling should be reworked or removed and replaced as specified above.

When larger "pit run" type material is used for structural fill, 12 to 16 inch stones preclude the use of an 8-inch lift thickness. In these instances the lifts must be increased somewhat but should be kept at 12 inches or less. These thicker lifts must have the larger rock "worked" into place by repeated tracking of the dozer prior to several passes of the heavy vibratory roller. In these areas our personnel must observe the placement and compaction to verify the materials are being placed properly.

Field density testing by "nuclear" methods would be adequate for verifying compaction of 2-inch to ¾-inch minus crushed base rock, decomposed granite and other materials 2-inches or smaller in size. Therefore, typical verification specifications as listed earlier would suffice.

7.3.2 Utility Trench Backfill

Utility lines of various types may be buried across the project. These need to be adequately supported and the trenches need to be backfilled and compacted properly to prevent subsidence of the surface or damage to the utility lines or pavement section.

In our experience, utility trench backfill has been the source of the majority of post-construction fill settlement problems in paved areas. These areas cause early pavement failure due to inadequate subgrade support. Poor trench compaction across sloped landscape areas can also result in significant surface erosion.

We strongly recommend that all utility trench backfill be placed and compacted in the same manner as described for structural fill above. The on-site decomposed granite, free of organics, or jaw-run shale and crushed rock, should make reasonable trench backfill in reasonably dry weather. However, if placed in trenches on the slope the decomposed granite can wash out easily. Therefore, rock fill or slurry would be a better choice for trenches on slopes. Trench backfill beneath structures should be placed and compacted in accordance with the section on Structural Fill, earlier in this report. Trench backfill beneath asphalt pavements but not under structures should be compacted to at least 95 percent of the maximum dry density, as determined by ASTM Test Method D-698 (Standard Proctor) for the upper 36 inches. Below 36 inches the trench backfill should be compacted to between 93 and 95 percent of the maximum dry density. Trench backfill in landscape areas, that is not part of a cut or fill slope, may be compacted to between 90 and 93 percent of the maximum dry density per ASTM D-698.

We recommend our personnel periodically observe and/or test trench backfill to verify compliance with project plans and specifications.

Preventing Shallow Groundwater Movement. Where utility trenches will lead upslope or downslope we recommend any granular backfill, which can channel seepage, be blocked by a lean concrete or clayey soil "check dam" (at least 24" wide) the full depth of the trenches. We recommend these checkdams be placed at 100 foot intervals in <u>all</u> trenches to minimize movement of shallow groundwater through the trench backfill. On steeper portions of roads these should be placed at 50-foot spacing. Allowing groundwater to migrate through "porous" trench backfill can create slope stability problems lower on the hill when the channeled groundwater emerges from the trench. Alternately, trenches should be backfilled with a low permeability backfill. Well-compacted, <u>silty</u>, decomposed granite, compacted at 2% to 3% above optimum moisture content would be acceptable.

7.3.3 Non-Structural Fill

Any waste soil, organic strippings, soft, clayey silt or other deleterious soil would be considered non-structural fill. These soils must be removed from the site or used in a thin layer as "topsoil". They should not be placed as structural fills on this sloping site. They could be placed as landscape berms with slopes no steeper than 3.5H:1.0V. They should be compacted to at least 90%.

7.4 CUT AND FILL SLOPES

Cut and fill slopes will be required in order to create the tank site and roadways for the proposed project. Cuts ranging from 5 to 150 feet may be required for construction of the tank. Fills between 5 and 20 feet may be required for the access roadways and parking. Cuts and fills should be designed and constructed as described below.

7.4.1 Cut Slopes

All permanent cut slopes should be constructed at no steeper than 1.75H:1V in the upper soil, and between 1.1H to 1.2H:1V in the denser, underlying, weathered, fractured rock. Harder rock with tight fractures may be cut at between 0.75H and 1H:1V depending on its condition. Some sloughing and/or raveling of the slope surface could be expected in wet weather and extremely dry weather until they become fully vegetated. Therefore, periodic benches in the cut may be required. Temporary cut slopes of ½H to ¾H:1V may be constructed during the construction of the project. The "temporary" cut slopes must be backsloped or backfilled against. These must also be cut back for roadways to the permanent inclination when not backfilled against. **Note:** Care must be taken due to the possibility of rock fall off these steep cut slopes. It should be noted that some excavations on this ridge may have rockfall due to adverse fracture planes dipping into the excavation. *Therefore, our geologist must observe all excavations during construction in order to verify the presence or absence of such conditions.* Where adverse bedding planes exist, the slopes must be cut back to a flatter inclination. **Note:** Workmen must be protected at all times in or adjacent to excavations. The contractor is at all times responsible for job site safety including trench safety. The geotechnical engineer is not responsible for job site safety.

7.4.2 Fill Slopes

We have assumed that fill embankments and slopes will be utilized to construct parts of the roadways and parking. We estimate that fills up to 20 to 25 feet high could be used. Where fill slopes are required the following provides guidelines for their construction.

Fills may be constructed of imported rock or shale fill, the excavated weathered granite or sandy, decomposed granite soils. The upper topsoil zone and upper silty soils should not

be used in the structural fill. We recommend maximum slope angles of fill of 2.0H:1V for sandy, decomposed granite and 1.75H:1.0V for compacted crushed rock or clean crushed shale. All materials should be placed and compacted as structural fill, described above. "Keying in" the toe of fills on slopes is critical to long-term stability. We recommend, in order to decrease sloughing and erosion of the fill slope, that all fills be overbuilt laterally and that the face be cut back to a compacted fill face. This would not be required of slopes constructed of rock fill materials. It is critical to decrease long-term settlements beneath portions of the project that these fills be placed and compacted properly. We recommend that all site preparation and structural fill placement recommendations be observed and that systematic density testing of all fills be accomplished as they are being built. Density testing on only the top lift is not adequate.

7.4.3 Fill Placed on Sloping Sites

Fill placed on sloping areas of the site (slope angle of underlying native slope 10% or greater) must incorporate additional precautionary measures. To assure that these fills remain in place or do not fail due to gravity, seismic loads or hydrostatic pressure of trapped water, we recommend the following:

Key Trench. The toe of all fills placed on slopes must be keyed into the slope by use of a key trench. The depth of embedment should be 2 feet into the undisturbed, native soils for fill slopes up to 10 feet high, 3 feet for fills up to 20 feet high and 4 feet for fills up to 30 feet. The key trench should be wide enough to accommodate excavation and compaction equipment (10 to 12 feet minimum) and have the base flat or sloped back into the hillside somewhat (see Figure 2). The key trench generally runs along the contours at the base of the proposed fill slope.

Benching. The native slope underlying the proposed fill should be benched into flat benches back up the slope above the key trench prior to placement of fill on the slope. These benches should be flat or tipped back slightly into the hillside. They should run parallel to the contours. Please see Figure 2 for graphic representation of these details.

Drainage. All noticeable seepage or wet zones observed during the keying and benching excavation process should be provided with subdrains. Figure 3, Bench Drain Detail, provides fill subdrain details. At the discretion of the geotechnical engineer (at a minimum), the key trench would require a subdrain section. Where wet conditions exist the benches may also require subdrain sections to remove subsurface flow from behind the new fill or to intercept seepage prior to it moving beneath the fill. Please note that compacted fills placed on slopes have a much lower lateral permeability than the native soils. Therefore, seepage through the native soil can become trapped behind these fills causing fill slope stability problems.

This is particularly important in areas where fills may cross shallow swales leading down the slope. These swales tend to carry small to moderate amounts of surface flow and also

shallow groundwater. A way must be provided to intercept the surface flow and shallow groundwater (and convey it to below the fill zone) before it can saturate and possibly destabilize the fill mass. A combination of shallow French Drain and catch basin entrance to the cross culverts at these locations could help mitigate this potential problem.

7.5 FOUNDATIONS

7.5.1 Tank Foundations

The subject tank would most likely have a 24 to 30-inch wide ring footing beneath the tank wall and have numerous isolated spread footings on the interior to support the roof.

All footings founded in the hard granite rock may be designed for a bearing pressure of 4,500 pounds per square foot. Footings located in the dense decomposed granite or over compacted structural fill may be designed for a bearing pressure 3,000 pounds per square foot. We recommend against placing footings on the surficial silty soil zones. Minimum embedment depth would be 18 inches for frost protection and lateral restraint.

7.5.2 Structural Foundations

Pump house and maintenance structures may be part of the project. For these buildings all footings may be designed for a bearing pressure of 3,000 pounds per square foot (with no footings founded in the silty surface soils). Minimum embedment depth should be 18 inches.

All footings must be poured "neat" against the undisturbed, cleaned off, dense, decomposed or weathered granites. All loose rock, soil and rock fines must be removed prior to placing rebar and pouring concrete. If footing subgrades are very irregular, and causing difficulty for workmen, they may be leveled off with a two-sack lean mix. This should be "roughened" somewhat on the surface such that frictional resistance between the lean mix and the footing base will be maintained. We recommend our firm be contacted when the contractor begins footing excavations in order to verify subgrade conditions prior to placement of rebar and concrete.

After completion of footings they should be backfilled against with compacted structural fill to maintain the minimum embedment recommended above.

7.6 LATERAL LOAD RESISTANCE

7.6.1 General

Lateral loads can be resisted by passive pressure acting on buried portions of the foundation and other buried structures, and by friction between the bottom of concrete elements of the foundations and the underlying dense granitics. We recommend the use

of passive equivalent fluid pressures of the following values for portions of the structure and foundations embedded into the native soils, dense fills or granite.

- Medium-dense, Decomposed Granite 350 pcf
- Dense, weathered Granite Rock 600 pcf
- Hard Granite Rock 700 pcf
- Dense, compacted Structural Rock Fill 500 pcf

The value of the shear strength of much of the weathered rock under lateral load will actually be greater than the equivalent fluid pressure given above. However, the likelihood of partially continuous and angled fracture planes, which can compromise the global strength, does not allow us to provide a blanket recommendation of higher values. However, in specific locations we can evaluate the soft and hard rock if higher values would be advantageous to design of a structure.

We also recommend that the first ½ foot below the ground surface (in the soil) be ignored when computing the passive resistance. A coefficient of friction of 0.45 can be used for elements poured neat against structural rock fill, sandy, decomposed granite and weathered, fractured granite. This should be reduced to 0.20 for slabs over plastic vapor barriers. Frictional resistance should be reduced by a multiplier of 0.85.

7.6.2 Global Lateral Resistance

The parameters provided in this report for lateral earth pressures and lateral resistance are to be used to design retaining walls and other retaining structures. While these loads provide the anticipated load each wall component must resist, global lateral stability of any fill and structure combination may require a greater amount of resistance. This is especially true where "stacked" walls are considered, which can cause global instability on the face of a slope.

We recommend that we be allowed to review the final project design (when all methods of structural support and construction have been determined) to verify global stability meets typically required factors of safety against failure under 2,500 year seismic loading (FS = 1.15 to 1.20).

7.7 RETAINING WALL DESIGN

Lateral earth pressures will be imposed on all below ground and backfilled structures or walls, including foundations which do not have uniform heights of fill on both sides. The following recommendations are provided for design and construction of retaining walls:

- We recommend walls which are free to rotate at the top (unrestrained), be designed for an equivalent fluid pressure of at least 40 pcf.

- Walls that are fixed at the top (restrained) should be designed for an equivalent fluid pressure of at least 60 pcf.
- These values are for properly compacted, non-expansive, free-draining granular soils (such as crushed rock, drain rock or jaw run shale), free of organics and other debris or for imported granular backfill. Organic topsoil and silty soils should not be used for wall backfill materials.
- These design values assume the wall or structure is fully drained (see Figure 4 for drainage recommendations), has a flat backfill and has no surcharge loads from traffic or other structures. The structural designer should include surcharge loading from traffic and building loads.
- We recommend designing retaining walls to resist seismic loading. A peak horizontal ground acceleration of 0.24g is given for the 2,500-year event. Therefore, a horizontal component of at least 0.18g should be applied to the mass of an enlarged active wedge of soil behind the walls and utilized in a pseudo-static analysis. The wedge length back from the wall along the ground surface may be taken as approximately 0.8H, where H is the height of the wall. This relates to a uniform load on the back of the wall equal to approximately 10 psf for each foot of backfill behind the wall, for walls up to 10 feet tall.
- The backfill should be placed in lifts at near the optimum moisture content and compacted to between 93 and 95 percent of the maximum dry density as determined by laboratory procedure ASTM D-698 (Standard Proctor).
- Backfill and compaction against walls or embedded structures should be accomplished with lighter hand-operated equipment within a distance of 1/2h (h being the vertical distance from the level being compacted down to the surface on the opposite side of the wall). Outside this distance, normal compaction equipment may be used.

While proper compaction of wall backfill is critical to the proper performance of the walls, care should be taken to not overcompact the backfill materials. Overcompaction can induce greater lateral loads on the wall or structure than the design pressures given above.

7.8 FOOTING DRAINS, WALL DRAINS AND FLOOR SUBDRAINS

All exterior foundations, embedded structures and retaining walls should have proper drainage.

Footing Drains. Drainage should consist of a rigid, smooth interior perforated drain pipe (capable of being cleaned by a roto-rooter type apparatus), typically resting adjacent to the footing near the base of the footing, provided this level is below the drain rock layer under any floor slabs and at least 6 inches below the crawl space. The perforated pipe should be surrounded (sides and above) by a minimum of 8 inches of clean drain rock or pea gravel. The drain rock envelope should be wrapped in a non-woven

geotextile designed as a filter fabric (AMOCO 4546 or equivalent). We recommend the fabric be covered with a 2-inch layer of sand to protect it against damage during backfilling operations and potential partial plugging from soil fines over the life of the structure. Figure 5 provides a typical foundation drain for a water tank. Please see Figure 6 for typical foundation drain detail for a structure with a slab-on-grade floor.

Wall Drains. Wall drains should also have a minimum 12-inch wide drainage zone of drain rock wrapped in non-woven filter fabric immediately behind the wall extending up from the drainage section to within 12 to 18 inches of the surface. A preformed, fabric-wrapped, polymer sheet drain, such as Linq Drain, Enkamat or Amerdrain may be used in lieu of the vertical drainage zone, provided this is backfilled with clean, free draining granular material. Exterior wall drains, which will not be sealed on top by asphalt or concrete, should have the upper 12 to 18 inches backfilled with compacted on-site silt and clay soils (with a layer of filter fabric over the rock) to minimize intrusion of surface waters into the wall drain system. Please see Figure 4 for details of wall drainage methods.

Floor Subdrains. The tank floor may require a subdrain system to relieve potential hydrostatic pressure. One method to drain this water is to include a series of subdrains at the bottom of a drain rock layer beneath the floor slab. The drain rock section should be thickened to at least 8 inches. The subdrain lines typically consist of 3-inch diameter, smooth interior, solid wall, perforated pipe at spacing of 20 feet (or less) across the tank (and around the interior perimeter). The perforated pipe is placed at the bottom of the drain layer as shown on Figure 7. The pipes are sloped to drain and collected by a tightline which leads to the stormwater disposal system. We recommend we be allowed to review the subdrain system design prior to final plan submittal or construction bidding.

7.9 EROSION CONTROL

The subject site has surficial soils that when disturbed can be subject to very large erosion. Therefore, proper construction practices and good erosion control must be accomplished from the very beginning of the project. In general, erosion control methods are intended to reduce flow concentration, reduce flow velocities and allow silt and sand particles to settle out of the runoff before it leaves the site. The following are several items that should be incorporated into the project to decrease erosion and off-site erosion impacts.

1. Ring the low side of the site with a silt fence installed as shown on Figure 7 (in figure it is incorporated into a settling pond).
2. Cover at least the first 100 feet of the entrance road to the site with crushed rock to prevent mud tracking onto City streets.
3. Grade the site to promote sheet flow.
4. Control concentrated runoff such that it flows into prepared ditches and/or settling ponds.

5. All ditches must be lined with angular rock and have periodic rock "check dams" to decrease flow velocities and prevent invert scouring.
6. One or more settling ponds will be needed at all points where runoff could exit the site.
7. All settling ponds must be constructed with silt fence backed hay bales, and have an outflow high enough to allow for silt and sand buildup (see Figure 8).
8. All runoff must be disposed of at an approved stormwater discharge location.
9. All disturbed soils must be revegetated at the end of construction.

The erosion control measures must be incorporated into a construction and a long-term erosion control plan, prior to construction. These measures must then be implemented, maintained and augmented to meet suspended solids concentration limits in site runoff.

8.0 ADDITIONAL SERVICES AND LIMITATIONS

8.1 ADDITIONAL SERVICES

Additional services by the geotechnical engineer are recommended to help verify the preliminary design recommendations are finalized by site investigation prior to final project design and to help monitor compliance with project specifications during the construction process. For this project we anticipate additional services could include the following:

1) Site subsurface investigation, possible laboratory testing and Final Geotechnical Investigation and Design Report.
2) Review of final cut and fill plans and global stability issues.
3) Review of final foundation plans, retaining wall plans and subdrain systems for compliance with geotechnical recommendations.
4) Observation of all cuts for adverse fracture planes.
5) Observation and verification of all roadway and site drainage items.
6) Observation and verification of key trenches, benching and slope drainage for fills placed on the slope.
7) Observation and density testing of all fill placement.
8) Observation of all footing excavations prior to pouring concrete or slurry.
9) Observations of retaining wall footing subgrades and drainage, structural fill placement, compaction and density testing of structural fill.
10) Periodic construction field reports, as requested by the client and/or required by the City, including final project verification letter.
11) Other geotechnically related items requested by the client.

We would provide these additional services on a time-and-expense basis in accordance with our current Fee Schedule and terms and conditions already in place for this project.

If we are not retained to provide these services we cannot be held responsible for design, design review and decisions of others for unverified items. The owner, designer and contractor will then accept all responsibility for these items.

8.2 LIMITATIONS

The analyses, conclusions and preliminary recommendations contained in this report are based on site conditions and proposed development plans as they existed at the time of the study, and assume soils and groundwater conditions exposed and observed at the site are representative of soils, and groundwater conditions throughout the site. No subsurface exploration was accomplished for this report. Site subsurface investigation and a final design report must be accomplished for this project. If during construction, subsurface conditions or assumed design information is found to be different, we should be advised at once so that we can review this report and reconsider our recommendations in light of the changed conditions. If there is a significant lapse of time between submission of this report and the start of work at the site, if the proposed project is changed significantly, or if conditions have changed due to acts of God or construction at or adjacent to the site, it is recommended that this report be reviewed in light of the changed conditions and/or time lapse.

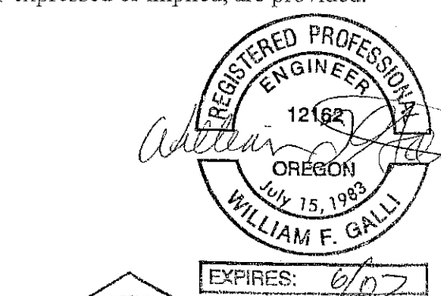
This report was prepared for the use of the owner and his design team for use in the tank siting and preliminary design of the subject project if this site is selected for use. It should be made available to others for information and factual data only. This report should not be used for contractual purposes as a warranty of site subsurface conditions. It should also not be used for final design of the project, at other sites or for projects other than the one intended.

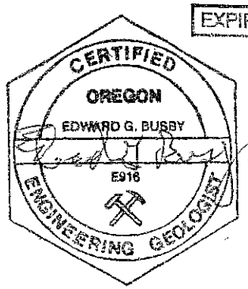
We have performed these services in accordance with generally accepted engineering geology and geotechnical engineering practices in southern Oregon, at the time the study was accomplished. No other warranties, either expressed or implied, are provided.

THE GALLI GROUP
GEOTECHNICAL CONSULTING

William F. Galli, P.E.
Principal Engineer

Edward Busby, C.E.G.
Senior Engineering Geologist





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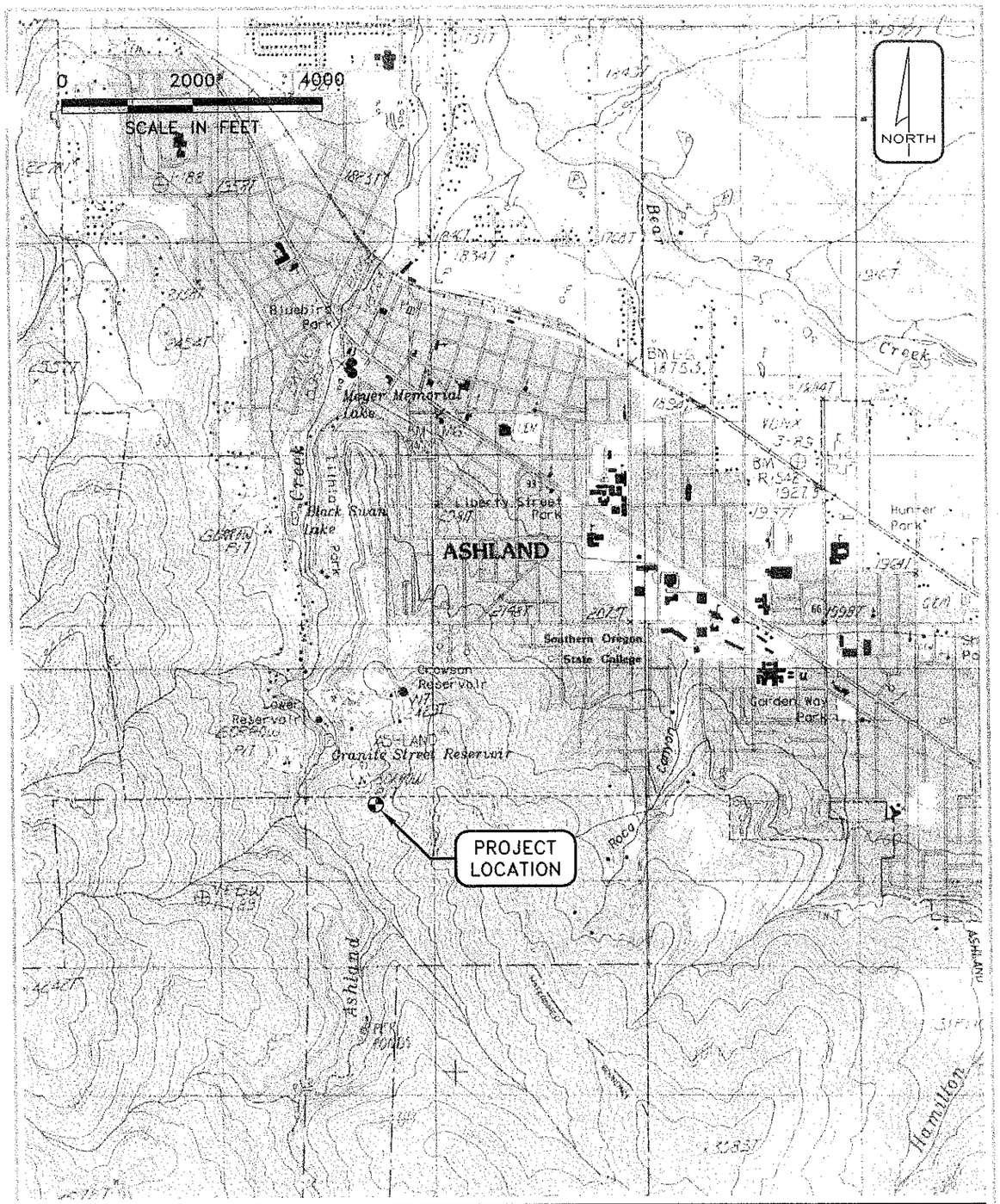
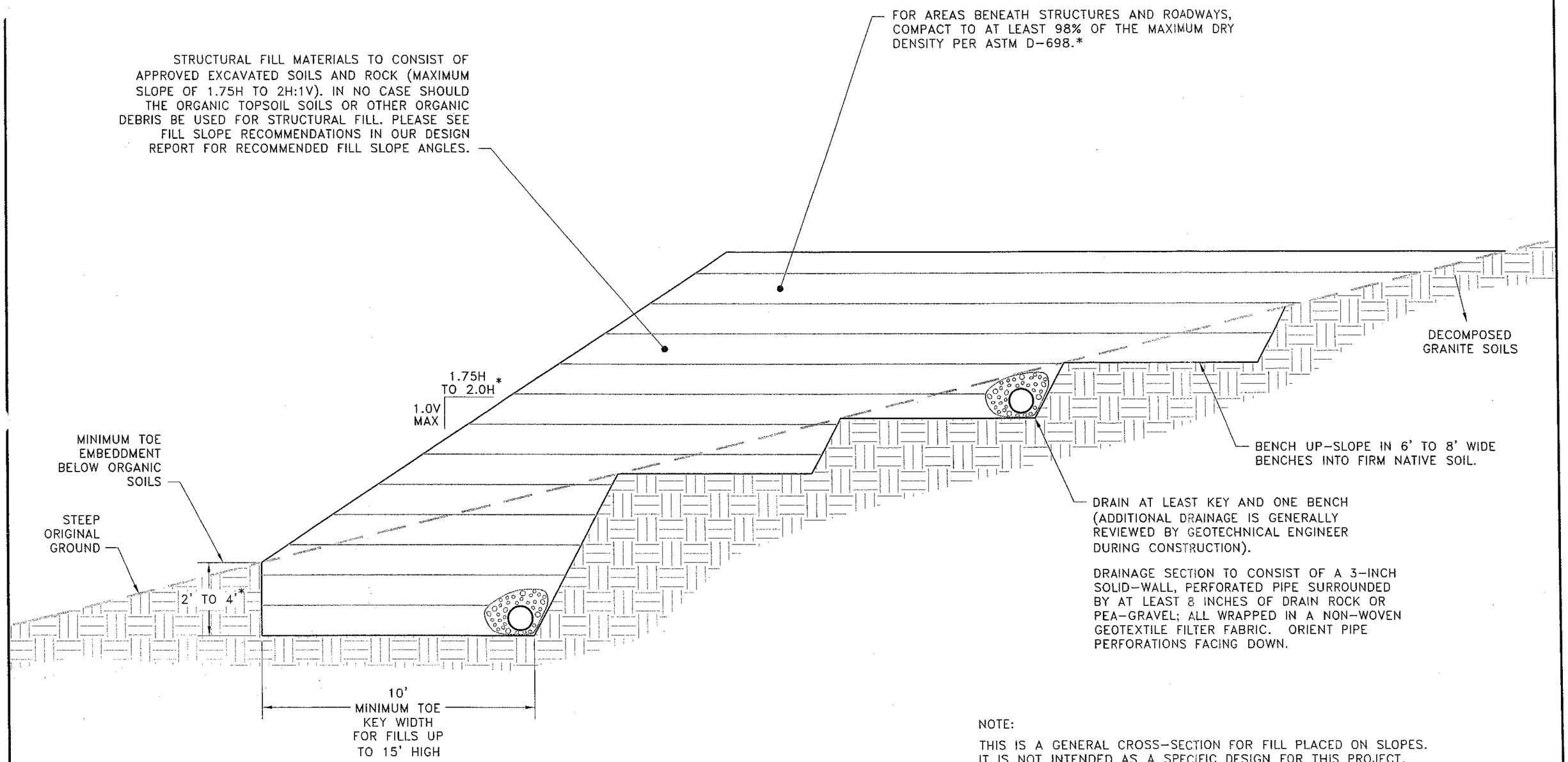


THE GALLI GROUP GEOTECHNICAL CONSULTING 612 NW 3rd Street Grants Pass, OR 97526	VICINITY MAP CROWSON II RESERVOIR ASHLAND, OREGON	DATE: SEPTEMBER 2006 JOB NO: 02-3760-CII REV: MP01-091906A PREPARED BY: TJ 3760 Ashland WT-VICINITY.dwg	FIGURE: 1



NOTE:

THIS IS A GENERAL CROSS-SECTION FOR FILL PLACED ON SLOPES. IT IS NOT INTENDED AS A SPECIFIC DESIGN FOR THIS PROJECT.

*SEE GEOTECHNICAL DESIGN REPORT FOR SPECIFICS.

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Grants Pass, OR 97526

FILL ON STEEP SLOPE
CROSS-SECTION

CROWSON II RESERVOIR
ASHLAND, OREGON

DATE: SEPTEMBER 2006
JOB NO: 02-3760-CII
REV: SL01-092006A
PREPARED BY: TJ
3760 Ashland WT-FILL.dwg

FIGURE: 2

TYPICAL RETAINING WALL CROSS-SECTION

NOTE: MAT DRAIN MAY BE REPLACED BY TWO COATS OF A HIGH QUALITY WALL SEALER. FLEXIBLE BITUMEN-BASED, ROLLED OR TROWELED-ON MATERIALS TEND TO WORK WELL, AS DO BENTONITE PANELS AND STICKY-BACKED MEMBRANES PROVIDED THAT A WASHED, FREE-DRAINING ROCK, PROTECTED AGAINST ALL SOIL BY AN APPROVED FILTER FABRIC, IS USED FOR ENTIRE WALL BACKFILL.

WALLS WHICH HAVE DRY LIVING SPACE INSIDE SHOULD HAVE THE OUTSIDE COATED WITH 2 COATS OF A HIGH QUALITY WALL SEALER AND HAVE THE MAT DRAIN ADJACENT TO FREE-DRAINING BACKFILL

NOTES: DRAINAGE OF THE RETAINING WALL IS A CRITICAL ITEM IN ITS PROPER LONG-TERM PERFORMANCE. ANY COMPROMISE IN MATERIALS OR CONSTRUCTION QUALITY CAN HAVE VERY SIGNIFICANT (DISASTROUS) ADVERSE AFFECTS.

THESE WALL SECTIONS ASSUME FULLY DRAINED CONDITIONS FOR THE LIFE OF THE STRUCTURE.

IN NO CASE SHOULD WEEP HOLES BE SUBSTITUTED FOR THIS DRAINAGE SECTION.

BEVELED MORTAR TO SHED WATER

12" SOIL COVER OVER FOOTING

12" MIN

12" MIN.

UNDISTURBED NATIVE SOIL SUBGRADE OR SPECIFIED STRUCTURAL ROCK FILL

WATER STOP (OPTIONAL)

BEVELED MORTAR TO SHED WATER

BACKSLOPE EXTERIOR SURFACES AT LEAST 2% TO 5% FOR A MINIMUM OF 6 FEET

CLAYEY SOIL SEAL OR PLASTIC SHEETING ON TOP OF DRAIN ROCK

COMPACTED FREE-DRAINING GRANULAR BACKFILL (SUCH AS PEA GRAVEL OR CLEAN CRUSHED ROCK) IF WALL DRAINAGE MAT IS NOT USED

IN LIEU OF FABRIC WRAPPED WALL DRAIN, USE A FABRIC COVERED POLYMER COMPOSITE MAT DRAIN - SUCH AS ENKAMAT OR LINQ DRAIN, PROVIDED ALL BACKFILL IS WASHED, FREE DRAINING MATERIAL AND MEETS FILTER REQUIREMENTS AGAINST NATIVE SOILS. ATTACH WITH THE PERMEABLE FABRIC SIDE AWAY FROM THE RETAINING WALL.

WALL DRAIN CONSISTING OF 12" WIDE WASHED DRAIN ROCK WRAPPED IN A NON-WOVEN GEOTEXTILE FABRIC SUCH AS AMOCO 4546 OR EQUIVALENT; TO WITHIN 12" OF SURFACE AND MUST EXTEND DOWN TO FABRIC WRAPPED BASE DRAINAGE SECTION.

ALTERNATE FOOTING DRAIN LOCATION WITH SOMEWHAT LESS EFFECTIVENESS.

NOTE: 2" CLEAN SAND OVER THE FABRIC PROTECTS IT DURING BACKFILL OPERATIONS.

CLEAN 1"-1½" WASHED DRAIN ROCK AT LEAST 8" AROUND THE PIPE ON ALL SIDES (NOT BELOW PIPE).

NON-WOVEN GEOTEXTILE FILTER FABRIC SUCH AS AMOCO 4546 (5 OZ. PER SQUARE FOOT) FABRIC. OVERLAP AND SECURE.

4" DIAMETER RIGID, SMOOTH WALL PERFORATED PIPE. SLOPE FOR POSITIVE DRAINAGE AND WITH CLEAN-OUTS AT BOTH ENDS FOR LONG-TERM MAINTENANCE.

IMPERMEABLE MEMBRANE

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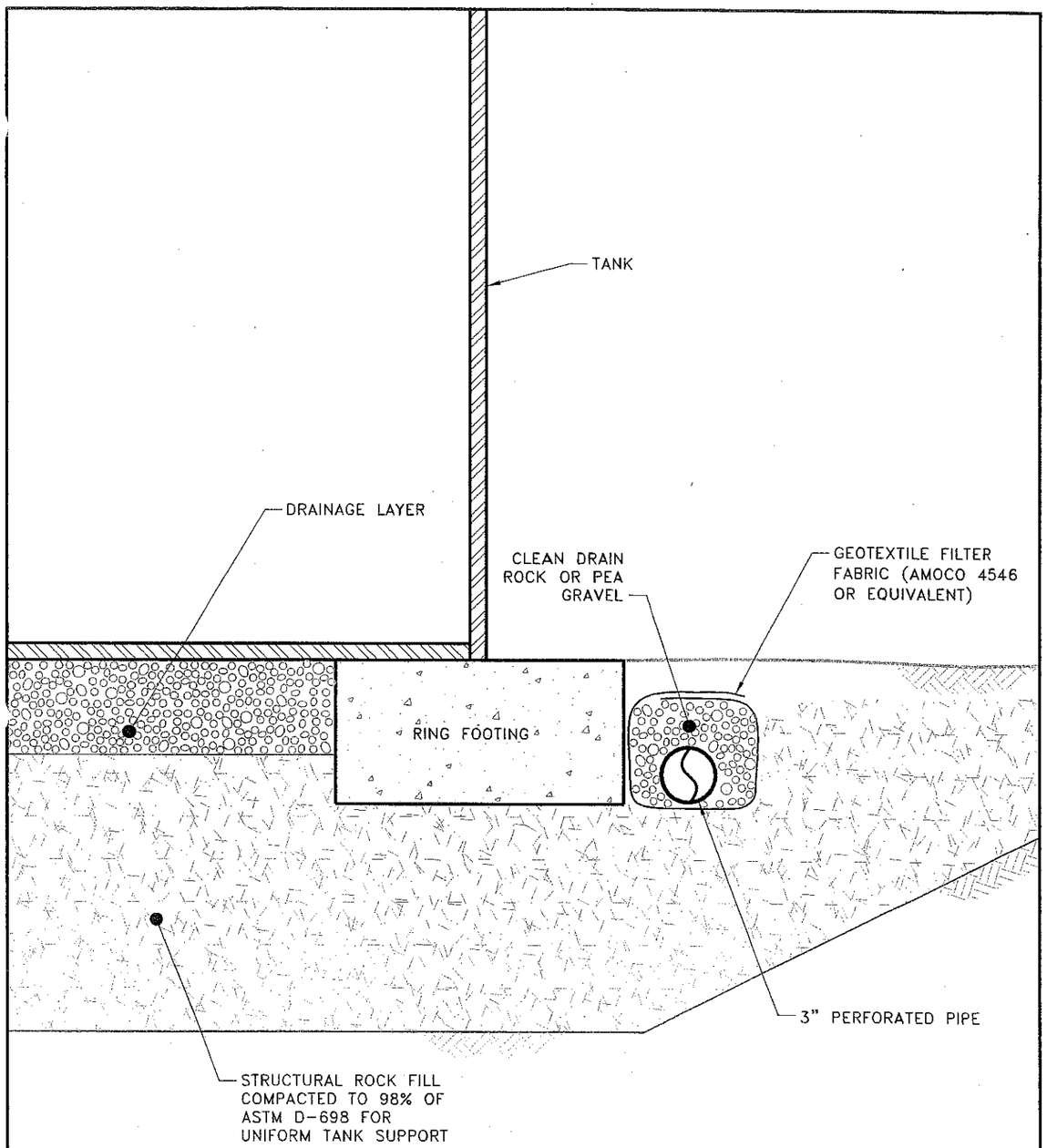
EXTERIOR RETAINING WALL DRAINAGE CROSS-SECTION

CROWSON II RESERVOIR
ASHLAND, OREGON

DATE: SEPTEMBER 2006
JOB NO: 02-3760-CII
REV: RW03-092006A
PREPARED BY: TJ
3760 Ashland WT-RETWALL.dwg

FIGURE: 4



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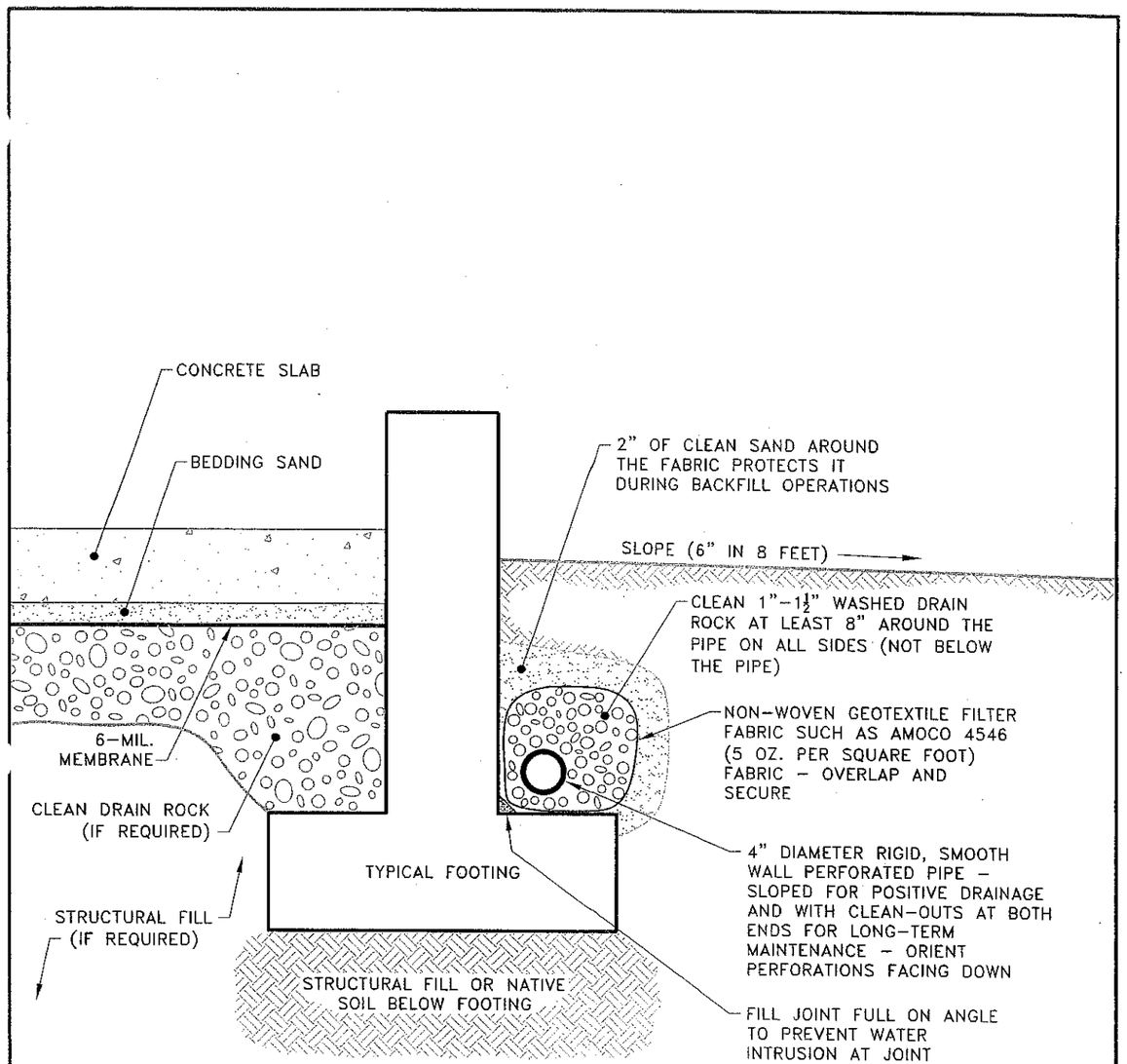
Grants Pass, OR 97526

TANK FOUNDATION DRAIN

CROWSON II RESERVOIR
ASHLAND, OREGON

DATE: SEPTEMBER 2006
JOB NO: 02-3760-CII
REV: 092006A
PREPARED BY: TJ
3760 Ashland WT-FOOT.dwg

FIGURE: 5



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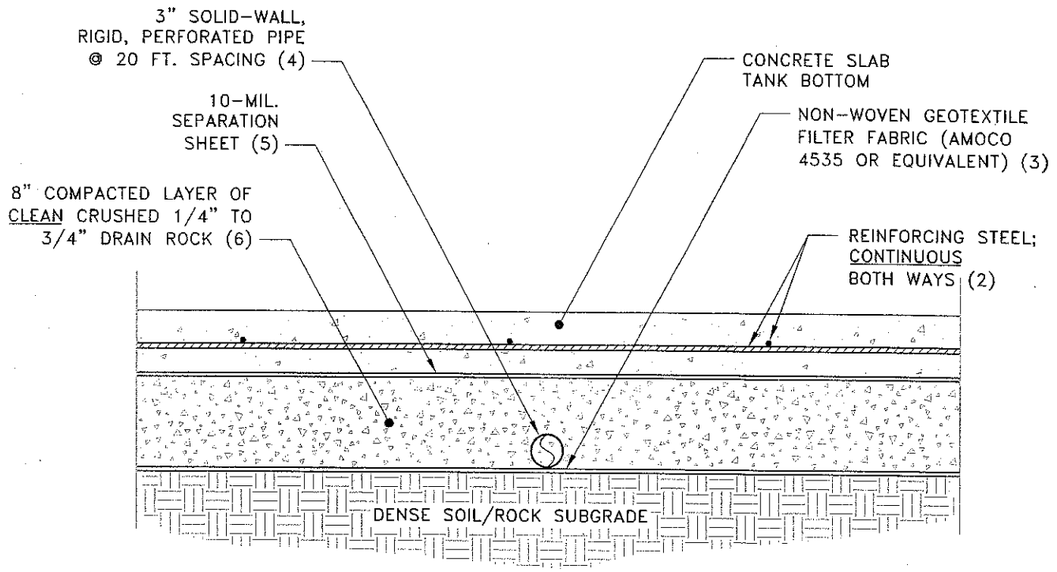
Grants Pass, OR 97526

TYPICAL FOUNDATION DRAIN SLAB ON GRADE FLOOR

CROWSON II RESERVOIR
ASHLAND, OREGON

DATE: SEPTEMBER 2006
JOB NO: 02-3760-CII
REV: FD01-092006A
PREPARED BY: TJ
3760 Ashland WT-FOUND.dwg

FIGURE: 6



NOTES:

(1) CONCRETE MIX DESIGN SHOULD INCREASE SURFACE TOUGHNESS AND MINIMIZE SHRINKAGE AND CRACKING.

(2) MINIMUM REINFORCEMENT SHOULD BE NO. 3 REBAR @ 16" O.C. BOTH WAYS, @ THE SLAB MID HEIGHT; EXTEND ACROSS ALL JOINTS (CONSULT STRUCTURAL ENGINEER).

(3) ONLY REQUIRED IF DECOMPOSED GRANITE OR OTHER FINE SOIL MIGHT CONTAMINATE THE DRAIN ROCK LAYER.

(4) SIZE AND SPACING OF SUBDRAINS MAY VARY.

(5) 10-MIL MEMBRANE KEEPS CONCRETE OUT OF DRAINAGE LAYER.

(6) THICKNESS OF LAYER MAY VARY; DO NOT DAMAGE SUBDRAINS WITH COMPACTION EFFORT.

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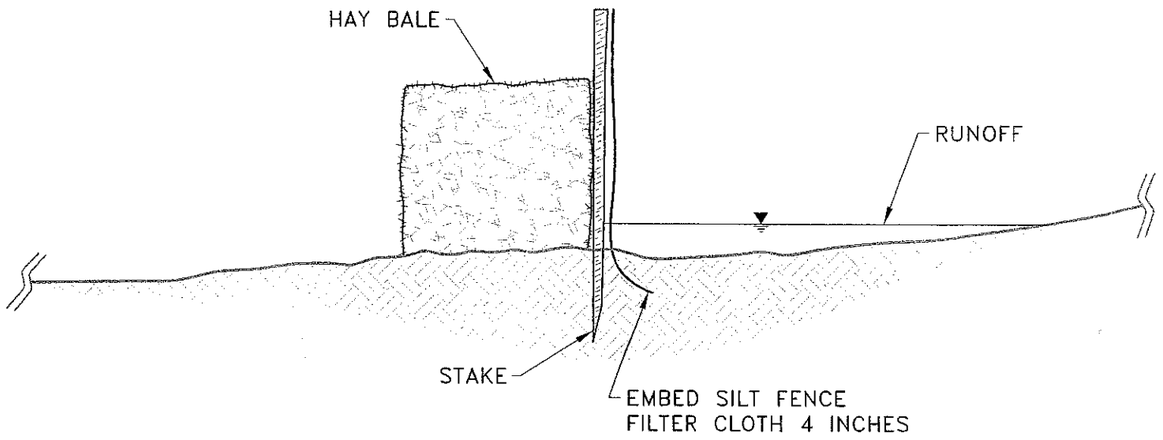
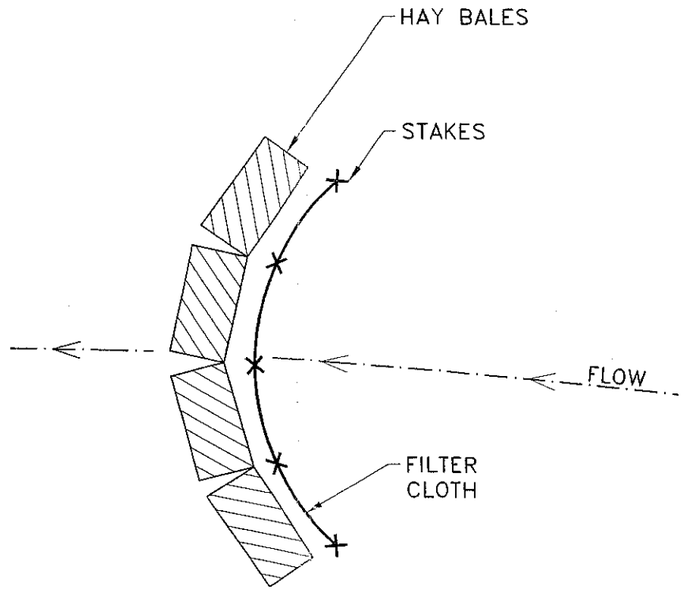
NOT TO SCALE

THE GALLI GROUP GEOTECHNICAL CONSULTING 612 NW 3rd Street Grants Pass, OR 97526	TANK FLOOR SECTION WITH SUBDRAINS CROWSON II RESERVOIR ASHLAND, OREGON	DATE: SEPTEMBER 2006 JOB NO: 02-3760-CII REV: SD02-092006A PREPARED BY: TJ 3760 Ashland WT-SUBDRAIN.dwg	FIGURE: 7



SETTLING POND
CROSS-SECTION



SETTLING POND
PLAN VIEW

FOR ILLUSTRATION PURPOSES ONLY
NOT TO SCALE

THE GALLI GROUP GEOTECHNICAL CONSULTING 612 NW 3rd Street Grants Pass, OR 97526	EROSION CONTROL DETAILS CROWSON II RESERVOIR ASHLAND, OREGON	DATE: SEPTEMBER 2006 JOB NO: 02-3760-CII REV: EC01-092006A PREPARED BY: TJ 3760 Ashland WT-POND.dwg	FIGURE: 8

APPENDIX C. EXISTING CROWSON PUMP STATION EVALUATION MEMORANDUM

TECHNICAL MEMORANDUM

TO: **Pieter Smeenk**

FROM: **Ed Olson**

SUBJECT: **Ashland Siting Study for Crowson II and Ashland Loop Road Reservoirs - Crowson Reservoir Pump Station Evaluation**

Introduction

The Crowson Reservoir Pump Station supplies water to a high level pressure zone (2600' – 2350') which lies above the Crowson Reservoir. Water to the entire zone is supplied by one or more of the 3 continuous running pumps housed in this station. Demands within the zone control the number of pumps operating in the station. Pump No. 1 is a 50 gpm @ 240'TDH with a 10 hp motor; Pump No 2, a 100 gpm @ 240' TDH with a 15 hp motor and Pump No. 3 is a 500 gpm @ 240' TDH with a 50 hp motor. Pump No 1 operates continuously. If demands increase and Pump No. 1 cannot keep up, the water pressure drops in the system and Pump No. 2 is started. If the pressure continues to fall, Pump No. 3 is started. Pump No. 3 normally operates only when a fire hydrant is the system is opened.

The City of Ashland is planning on installing a new reservoir to serve this high level service area. The new reservoir will be located on City owned property located off from Ashland Loop Road. It will be installed at an elevation sufficient to meet the needs of the existing and future customers in this high level pressure zone. Future plans also call for this new high level water system to be connected to Ivy Lane and replace another continuous pump station located in that area. The City of Ashland has determined that a total of 130 single family residents (current and future) will be served by this facility.

As part of a siting study for the new reservoir, Brown and Caldwell was asked to evaluate the existing Crowson Reservoir Pump Station. This evaluation included the following: 1) Determine the overflow elevation of the new reservoir; 2) Determine what if any changes will be needed to the pump station for it to be able to supply water to the new reservoir, and 3) Supplying the City of Ashland with design condition for any new pumps that may be needed in this station.

Ashland Loop Road Reservoir Overflow Elevation

The highest customer (future or existing) in this high level zone (Crowson or existing customers on Ivy Ln.) is a new house currently being constructed on Ashland Loop Road near the west City limit. This house will have a main floor elevation of 2680'. The current water system cannot supply water directly to this high of an elevation and therefore this house and three others in this area have their own holding tank and pressure system. It appears impractical to set the new reservoir elevation at an elevation to supply water directly to this customer. The minimum overflow elevation would have to be 2750' and would lead to excessive pressure to customes lower in this service area. As an example, the static pressure at the Crowson Pump station would be 150 psi. The current pressure at this station varies from 108 – 121 psi with an average

pressure of 114 psi. The future reservoir overflow needs to designed so as to not significantly increase the pressure on existing customers. If 120 psi is the maximum static pressure at the Crowson Pump Station, the maximum overflow of the Crowson Reservoir would be 2684'.

Fire protection is a critical element to be considered in determining the overflow of the new reservoir. The highest fire hydrant in the areas is located on Ashland Loop Road and has an elevation of 2580'. Fire flow standards call for a minimum of 1000 gpm @ 20 psi residual for residential areas. If the supply line to the reservoir is 12" and the reservoir is located approximately 1000' from this critical fire hydrant, the minimum overflow elevation of the reservoir will need to be 2631'. If the line is 8", the overflow elevation will need to be 2650'. If we wanted to maintain 35 psi static pressure at the fire hydrant when the reservoir is full the overflow would need to be 2660'.

Based upon these factors the reservoir overflow will need to be between 2660' and 2680'. ***We would recommend that the City use the higher elevation 2680'*** in order to insure as much fire protection as possible for this forest lands/urban interface area. However due to topography and other geotechnical issues, the reservoir can have an overflow elevation of 2660' – 2680 and function properly. The exact overflow elevation will be determined after the reservoir has been designed.

Crowson Pump Station

As stated earlier, the existing station contains three pumps and is located adjacent to the Crowson Reservoir. The pumps set at an elevation of 2407' and are feed directly from the Crowson Reservoir which has an overflow elevation of 2425' and a floor elevation of 2407'. The suction pressure on the pumps normally varies from 9 psi to 5 psi depending on the reservoirs water level and station pumping rate. There has been a general concern by City Staff that the pumps in this station will have difficulty starting if the water level in the Crowson Reservoir fall below 6'. Staff does all it can to maintain water levels in the Crowson Reservoir above 6'. In discussion with Keith Marshall, who maintains this station, he indicated that he has not experienced any failure at this station due to low water levels in Crowson Reservoir. In our field investigation, we did not attempt to start the large fire pump with the Crowson Reservoir at below 6' to verify this concern. A review of the pump curves review that all three pumps should operate properly with a NPSH of approximately 10' which should be available with the water level at 6' in Crowson Reservoir.

The new Crowson Pump Station will need to supply maximum day demands to this high level service area. Peck hour demands will be supplied by the new reservoir. The pumping rate for this station should be sized to supply the maximum day demand over a 21 hour period with the largest pump out of service. The future service area will have approximately 130 single family residents. If we use a maximum day demand rate of 1200 gallons per day per single family resident, than the maximum day demand of the system will be 156,000 gallon per day or 110 gpm. ***The pumping rate will need to be approximately 130 gpm.*** Due to the small size of this pumping system, we would recommend that the City install two pumps of identical size so that the either one can be out of service and still meet the maximum day demands of the service area.

There is approximately 2300' of 8" water line between the pump station and existing fire hydrant (end of existing water system on Ashland Loop Road) and approximately 1000' of 12" will be installed between the existing fire hydrant and future reservoir. Assuming that the new Ashland Loop Road Reservoir has an overflow of 2680' and assuming that the Crowson Reservoir is a minimum elevation of 2413' (6' of water in reservoir), ***the TDH required for these two pumps will be 265'***. The maximum shut off head for the existing pumps No. 1 and No. 2 is approximately 260', therefore the existing pumps do not have sufficient TDH to pump to the new reservoir. Pump No. 3 is a fire pump (500 gpm) and has a shut off head of 270' and could supply some water to this reservoir. However is would be running at a very inefficient point on its operating curve.

The maximum overflow elevation that Pump No. 2 can supply is 2650' at its design point of 100 gpm at 240' TDH. However, the 15 hp motor is sufficient to meet the new design point if the pump or impeller were to be replaced.

The new low pumping rate in the station needed to supply only maximum day demands will insure low piping losses and should eliminate any concern related to operating this station with Crowson Reservoir below 6'.

Summary

The preferred overflow elevation for the new Ashland Loop Reservoir is 2680'. However the overflow elevation can range for 2660' – 2680' and operate properly. The exact overflow elevation will be determined after the reservoir design is completed.

Two new pumps will be required in the Crowson Pump Station. They should have a design point of 130 gpm @ 265; TDH. The TDH requirements were determined based upon the new reservoir having an overflow of 2680'. If the overflow elevation changes as a result of the final design of the reservoir, the TDH will also need to change. The NPSH requirements for these new pumps should be checked to be sure low water level in the Crowson Reservoir does not impact their operation. Pump No. 3 should be left in the station as an emergency backup. An auxiliary power supply or, as a minimum, the ability to connect the station to an external power supply should be added to enhance the reliability of the station.

The proposed pumps will require 15 hp motors. Since the proposed pumps are only slightly larger that the current pumps, piping and power supply should not be a significant issue in the replacement of these pumps. Staff should investigate the possibility of having Pump No. 2 retrofitted with a new impeller and/or pump to meet the new design conditions. Controls will be needed between the new reservoir and the Crowson Pump Station to enable the pumps to operate on a water level signal from the reservoir.

APPENDIX D. PERMIT FORMS AND GUIDANCE

B. Permit Application Guidance

Who Needs to Apply for Permit?

The "operator" needs to apply for permit. The operator is the person or entity that has operational control over the construction plans or day-to-day activities that are necessary to implement erosion and sediment control measures and other Best Management Practices (BMPs). On some sites, several entities may meet the definition of operator and all must apply for permit.

Operators may include:

- Owners
- General contractors
- Subcontractors
- Local government entity

It is the responsibility of the operator(s) to develop and implement an Erosion and Sediment Control Plan (ESCP) and maintain all BMPs during each stage of the project when the site has unstable soil that may erode and discharge turbid or sediment laden stormwater runoff to surface waters of the State (Schedule A.4.a.). Note: If permit conditions are violated, DEQ may take enforcement action against the permit applicant (Schedule A.5.a.).

Obtaining a Permit Application

You must complete the application form provided in Appendix I, or go to DEQ's Web site: http://www.deq.state.or.us/wq/stormwater/swpconstr.htm to obtain permit coverage. Instructions are provided with the form.

Application Steps

Note: DEQ has contracted with several local jurisdictions known as "Agents" to make it easier for developers and builders to apply for a permit. If your project is located in one of the areas (see Figure A-2, p. v), please contact the Agent for their application forms, fees, and procedures.

These jurisdictions have chosen to act as DEQ's Agent and issue the 1200-C permit to make it easier for developers and builders to comply with the regulations. In most cases, the Agent will be using DEQ's application form (Appendix I), but please check with them first. Please note that the Service District or County may or may not cover the municipalities within their boundaries and may cover multiple counties in the case of Service Districts. Please check with the County or Service District before submitting the application materials to them to verify where the materials should be sent.

1. Read the 1200-C Construction Stormwater General Permit and local government construction regulations. For a copy of the permit, contact DEQ (Figure A-1, p. iv.) or visit DEQ's website at: http://www.deq.state.or.us/wq/wqpermit/genpermits/npdes1200c/npdes1200cpermit.pdf

2. Develop an Erosion and Sediment Control Plan (ESCP) for your construction project/site.

3. Complete the following forms provided in this packet:
   - DEQ NPDES #1200-C Permit Application Form, (Appendix I)
   - DEQ Land Use Compatibility Statement (LUCS), (Appendix II)
   - DEQ Erosion and Sediment Control Plan Form, Parts I-III (including site maps)

4. Submit the DEQ forms and the permit application fee to the appropriate DEQ regional office for the county where your project is located (Figure A-1, p. iv.).
   - Make checks payable to the Department of Environmental Quality or appropriate Agent.
   - *Note:* You will be invoiced for an annual permit fee even if your project is finished unless you notify DEQ. Please see *Section C, Transfer or Termination of Permit Coverage*, p. 7, for more information on terminating your permit so you do not receive this invoice.

Permit Fees

You must submit the appropriate permit fees to DEQ or its Agent at the time you apply for a new permit or renew an existing permit.

If you are applying for a new permit, you must pay **$771**, which includes a $380 fee for a new permit application and a $391 first year annual fee.

If you send your application to a DEQ Agent, you must pay the specific application fee charged by the Agent. Please contact the Agent to determine the fee.

Submitting a Complete Application

For your application to be accepted, you need to submit the following:

☐ Completed Application Form
☐ Land Use Compatibility Statement (LUCS)
☐ Erosion and Sediment Control Plan (ESCP), Parts I-III
☐ Fees

At least thirty (30) days before beginning any soil disturbance, please submit a complete application to DEQ or DEQ Agent office (see Figures A-1 and A-2)

Processing the Application

Once you submit the application packet (application form, Land Use Compatibility Statement, Erosion and Sediment Control Plan Parts I-III, fees), DEQ or its Agent will review the forms to make sure the application is complete. DEQ or its Agent will return any incomplete application with a list of missing information.

Is My Project Subject to Public Review?

All projects disturbing five (5) or more acres are subject to public review starting **June 1, 2006**. A public review period of 14-calendar days will begin after DEQ or its Agent has determined that your application is complete. (Note: DEQ estimates that 40% of new permit registrants are disturbing five or more acres of land. This group of 40% accounts for over 80% of the disturbed land from construction projects covered by this permit.)

What is the Public Review Process?

DEQ will post a notification on its Web site that the application and ESCP are available for public review at a DEQ regional office or Agent office depending on where the project is located. The public will have 14 calendar days to submit comments to DEQ about the application and plan.

After the public comment period, DEQ will review the comments and determine if the ESCP is adequate and whether the project should be covered by this permit or should be covered by an individual NPDES Permit. Based on public comments received, DEQ or its Agent may request you to change the ESCP or apply for an individual permit.

Note: Comments regarding local land use issues should be addressed in a local land use public notice and hearing and are outside the jurisdiction of DEQ. The public comment period is intended to address potential water quality issues as they related to construction phase. Any public comment to address specific post-construction concerns should be submitted to the local land use agencies during the development permit review phase.

Tracking Application Status

You may track your application status at: http://www.deq.state.or.us/permittracker/ or contact DEQ (Figure A-1, p. iv.). You can search by using your permit's Facility Number (DEQ File #) or the Facility Name (Common Name of the site), or by project name.

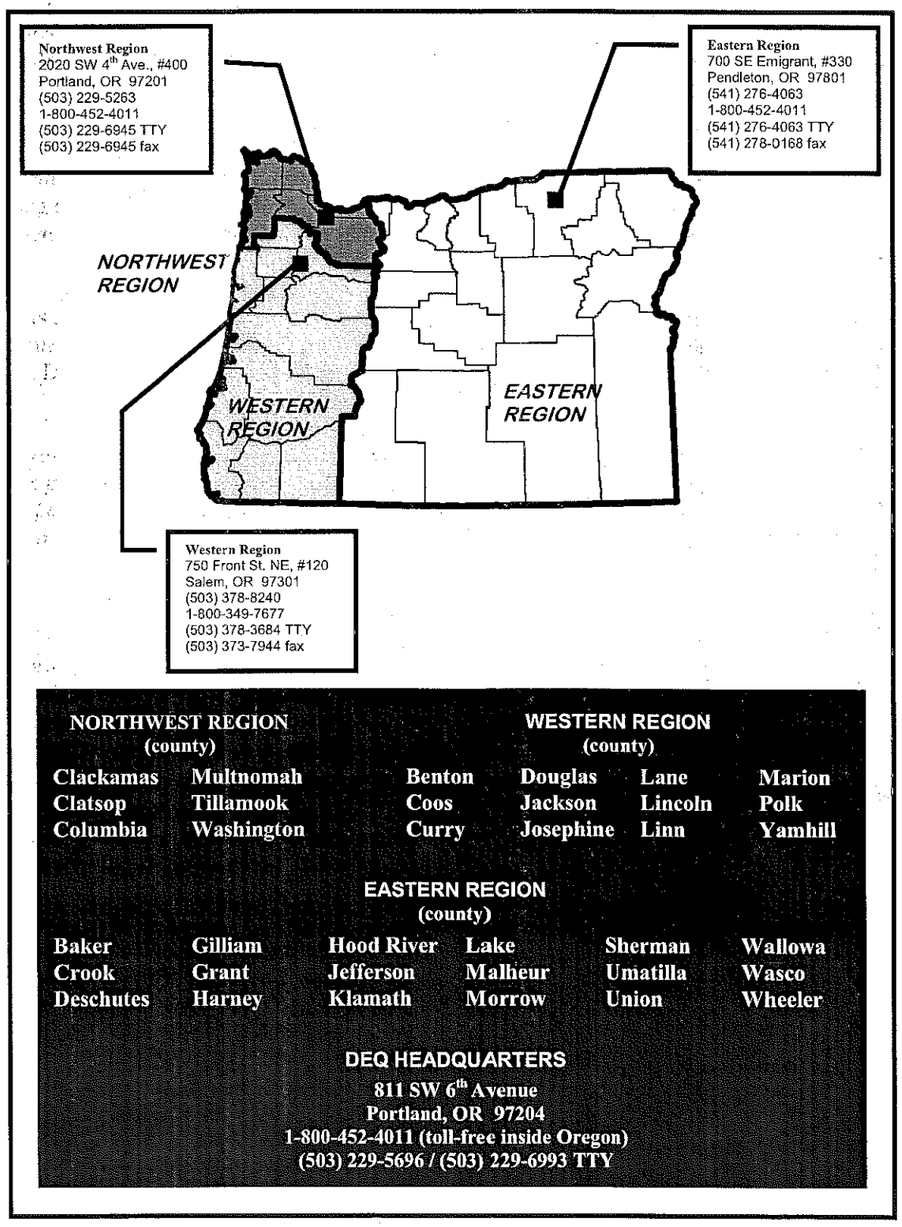
How do I Maintain Permit Coverage if My Project will Extend Past the November 30, 2010 Expiration Date of the 1200-C Permit?

Prior to permit expiration, DEQ will notify you of the appropriate procedures, including submitting a permit renewal application and a revised ESCP, if applicable to continue permit coverage.

Contacts for Questions

If you have any questions regarding the information provided here, please contact the appropriate Regional DEQ Office or DEQ Headquarters (Figure A-1) or DEQ Agent (Figure A-2) and ask for stormwater staff.

Figure A-1: Department of Environmental Quality (DEQ) Main Regional Offices



If your project is located in one of the jurisdictions below, you must submit the application packet to the Department of Environmental Quality (DEQ) Agent.

Figure A-2: Cities or Districts Acting as DEQ Agent

CITY / DISTRICT	CONTACT NAME & TELEPHONE	ADDRESS
Eugene	Ginger Perales 541-682-5249 ginger.m.perales@ci.eugene.or.us	858 Pearl Street Eugene, OR 97401
Hermiston	Mike Ward 541-667-5025 mward@hermiston.or.us	215 East Gladys Ave. Hermiston, OR 97838
Lake Oswego	Delynn Clark 503-675-3991 mdclark@ci.oswego.or.us	380 A Ave. P.O. Box 369 Lake Oswego, OR 97034
Myrtle Creek	Steve Johnson 541-863-3171 sjohnson@ci.myrtle-creek.or.us	P.O. Box 940 Myrtle Creek, OR 97457
Troutdale	Jack Hanna 503-674-7270 jhanna@ci.troutdale.or.us	104 S.E. Kibling Troutdale, OR 97060
Clean Water Services (Cities within CWS District)	Jackie Humphreys 503-681-5101 humphreysj@cleanwaterservices.org	Clean Water Services 2550 SW Hillsboro Highway Hillsboro, OR 97123
Clackamas County Water Environmental Services (Outside of incorporated cities except Gladstone and Rivergrove)	John Nagy 503-353-4594 johnnagy@co.clackamas.or.us	Dept. of Water Environment Services 9101 S.E. Sunnybrook Blvd., Ste. 441 Clackamas, OR 97015

Oregon Department of Environmental Quality
NPDES #1200-C Permit Application Form

For stormwater discharges to surface waters from construction activities disturbing 1 acre or more.

Please answer all questions. No line may be left blank. An incomplete application will not be processed and will be returned. If the information requested is not applicable or not yet available, please indicate as such.

A. PROJECT INFORMATION

1. _____
Applicant (Owner, Developer, or General Contractor)

_____
Contact Name

_____
Address

_____ _____ _____
City State Zip

_____ _____
Telephone E-Mail Address

2. If fee invoicing is different than Applicant, provide contact info:

_____
Invoice Name

_____
Address

_____ _____ _____
City State Zip

_____ _____
Telephone E-Mail Address

3. _____
Architect/Engineering Firm (Erosion & Sediment Control Plan)

_____
Project Manager

_____ _____
Telephone E-Mail Address

4. _____
Applicant's Designated Erosion and Sediment Control Inspector

_____
Contact Name

_____ _____
Telephone E-Mail Address

5. _____
Name of Project

_____
Address or Cross Street

_____ _____ _____
City State Zip

_____
County

6. Nature of the Construction Activity

- ☐ Single Family (SIC Code 1521)
- ☐ Multi-Family Residential (SIC Code 1522)
- ☐ Commercial (SIC Code 1542)
- ☐ Industrial (SIC Code 1541)
- ☐ Highway (SIC Code 1611)
- ☐ Utilities (SIC Code 1623): _____
- ☐ Other: _____

7. Site Location by Latitude and Longitude:

Latitude: ____ / ____ / ____
Degrees Minutes Seconds

Longitude: ____ / ____ / ____
Degrees Minutes Seconds

8. Project Size:

Total Site Acreage (acres): _____

Total Construction Area (acres): _____

Disturbed Area for this phase, if multiple phases: _____

Total Number of Lots: _____

DEQ USE ONLY

App. #: _____ File #: _____ LLID #: _____ River Mile: _____
Date Received: _____ Amount: _____ Check Name: _____
Check #: _____ Deposit #: _____ Receipt #: _____ Legal Name Confirmed: ☐

A. PROJECT INFORMATION Continued

9. Runoff from proposed construction activities goes to:

☐ Creek/Stream: _____ ☐ Ditch: _____

☐ Municipal Storm Sewer or Drainage System ☐ Other: _____

☐ Infiltration device

10. ☐ Proposed site runoff discharges directly to, or into a storm sewer or drainage system that discharges to, a Total Maximum Daily Load (TMDL) or 303(d) listed water body for turbidity or sedimentation *(if applicable)*. A map and table identifying "impaired" water bodies and affected river miles for sediment or turbidity is available on DEQ's web site at: http://www.deq.state.or.us/wq/stormwater/docs/tmdl303dsedturblist.pdf.

B. LAND USE COMPATIBILITY STATEMENT

Attach the *original* and complete Land Use Compatibility Statement (LUCS) signed by the local land use planning official. The application will not be processed unless the local land use authority approves it and it meets statewide planning goals. (See Appendix II in the 1200-C Application and ESCP Guidance Document (Guidance Document) for the LUCS statement, available at http://www.deq.state.or.us/wq/stormwater/swpconstrapp.htm.

C. SIGNATURE OF LEGALLY AUTHORIZED REPRESENTATIVE

The legally authorized representative *must* sign the application. The following are authorized to sign the document:

- **Corporation** — president, secretary, treasurer, vice-president, or any person who performs principal business functions; or a manager of one or more facilities employing more than 250 persons or having gross annual sales or expenditures exceeding $25 million that is assigned or delegated in accordance to corporate procedure to sign such documents.
- **Partnership** — General partner
- **Sole Proprietorship** — Owner. If more than one person is the sole proprietor, each person must sign the form.
- **City, County, State, Federal, or other Public Facility** — Principal executive officer or ranking elected official.
- **Limited Liability Company** — Member.
- **Trusts**— Acting trustee.

Please see 40 CFR 122.22 for more detail, if needed.

I hereby certify that the information contained in this application is true and correct to the best of my knowledge and belief. In addition, I agree to pay all permit fees required by Oregon Administrative Rules 340-045. This includes a renewal application fee to renew the permit and a compliance determination fee invoiced annually by the Department of Environmental Quality (DEQ) to maintain the permit.

Name of Legally Authorized Representative (Type or Print)	**Title**
Signature of Legally Authorized Representative	**Date**

In order to authorize permit registration, the following must be completed and submitted to the DEQ office listed below or to a DEQ Agent (see Figure A-1 in the Guidance Document for list of Agents):

☐ Signed Application form.

☐ Land Use Compatibility Statement with signature of the local land use planning official.

☐ Erosion and Sediment Control Plan and Drawings, Parts I-III.

☐ $771 fee (includes $380 for new permit application and $391 for first year annual fee) to the appropriate DEQ regional office and make the check payable to DEQ. If you are sending your application to a DEQ Agent, check with the DEQ Agent for the appropriate fees and make check payable to the DEQ Agent.

DEQ Northwest Region	**DEQ Western Region**	**DEQ Eastern Region**
2020 SW 4th Ave., Suite 400	750 Front St. NE, Suite 120	700 SE Emigrant, Suite 330
Portland, OR 97201-4987	Salem, OR 97301-1039	Pendleton, OR 97801
503-229-5263 or 1-800-452-4011	503-378-8240 or 1-800-349-7677	541-276-4063 or 1-800-452-4011

DEQ AGENT

(Note: See Figure A-2 in Guidance Document for appropriate local Agent contact information.)

NPDES General Permit 1200-C Application Instructions For Construction Activities

A. PROJECT INFORMATION

A1 Enter the legal name of the applicant. Permit coverage will be issued to this entity. This is the person, business, public organization, or other entity responsible for assuring that erosion and sediment controls are in place and in working order through the life of the project. This must be the **legal** Oregon name (i.e., Acme Products, Inc.) or the **legal** representative of the company if it operates under an assumed business name (i.e., John Smith, dba Acme Products). The name must be a legal, active name registered with the Oregon Department of Commerce, Corporation Division in Salem at 503-378-4752 or http://egov.sos.state.or.us/br/pkg_web_name_srch_inq.login, unless otherwise exempted by their rules. If the name of the applicant is not registered with the Corporation Division and the applicant is a partnership or doing business as a corporate entity, attach legal documents that verify the entity's existence with the application. The applicant may not be an assumed business name.

To streamline administration and provide continuous permit coverage, the permit may be transferred from one party to another. For example, if a contractor feels that they will not be able to get a permit before the projected start date, the developer may apply for a permit and then transfer the permit over to the contractor. The transfer fee is $60. Transfer forms are available from DEQ or at http://www.deq.state.or.us/wq/wqpermit/forms/PmtTfrAppl.pdf.

A2 Enter invoicing information for annual fee billing if different from the Applicant in A1 (e.g., "Invoice To: Business Office – Accounts Payable"). Provide permanent address or P.O. Box, if applicable.

A3 Provide the contact information for the Architect or Consulting Engineer who designed the Erosion and Sediment Control Plan (ESCP) so that they may be contacted should questions arise concerning the ESCP Drawings (Part III), Narrative (Part I), or BMPs Rational with Implementation Schedule Table (Part II).

A4 Provide information on the Erosion and Sediment Control Inspector. This person works for the applicant. If the inspector has not been selected yet, please provide the name of consultant who prepared the ESCP. Upon designating an inspector(s), submit to the DEQ or the Agent an Action Plan (The Action Plan form is available in Appendix V of the Guidance Document), which is an addendum to the ESCP, that identifies their name(s), contact information and training and experience as required in Schedule A, condition 4(c) of the permit.

A5 Provide the common name of the site. What is it to be called? Provide the location of the site with respect to cross roads in the area or a street address if appropriate.

A6 Place a check mark in the box that best describes the use for which the site is being constructed. If other is selected, describe the use.

A7 Enter the latitude and longitude of the approximate center of the facility or site in degrees/minutes/seconds to the nearest 15 seconds. Latitude and longitude can be obtained from United States Geological Survey (USGS) quadrangle topographic maps by calling toll-free at 1-888-ASK-USGS (1-888-275-8747) or by using DEQ's location finder web site at http://deq12.deq.state.or.us/website/findLoc/data.asp. In using DEQ's location finder web site, if you do not know your address, go to "locate place" on the left side of the page and click on "latitude and longitude" and then click on "map it." To get the longitude and latitude to appear you may have to zoom in and re-center until you find the area. You may want to turn off DEQ interests to eliminate the yellow dots and you may want to turn on the Aerial Photos to help you locate the site. The latitude and longitude will be indicated on the left side of the page. Instructions for obtaining latitude and longitude from topographic maps may be obtained at http://www.deq.state.or.us/wq/wqpermit/LatLongInstr.pdf.

A8 Provide property size information. What is the total acreage of the site? Provide an estimate, in the case of a multi-phased project, or if all of the property has not yet been purchased.

A9 Indicate where the runoff goes after leaving the site during construction. If it goes in to the City storm drain system, provide best estimate of the receiving stream in addition to checking the Municipal Storm Sewer box.

A10 Indicate whether stormwater runoff will be discharging directly to, or into a storm sewer or drainage system that discharges to "impaired" waters listed on the 303(d) list or are covered by a Total Maximum Daily Load (TMDL) for sediment or turbidity. A map and table identifying "impaired" water bodies and affected river miles for sediment or turbidity is available on DEQ's web site at: http://www.deq.state.or.us/wq/stormwater/docs/tmdl303dsedturblist.pdf.

B. LAND USE COMPATIBILITY STATEMENT

Land Use Compatibility Statement (LUCS) must be signed by local planning official. If there are any conditions placed on the land use approval, the findings must be included. The LUCS form may be obtained from DEQ at: http://www.deq.state.or.us/pubs/permithandbook/lucs.htm.

C. SIGNATURE

The legally authorized representative for the applicant must sign the application. The following are authorized to sign the document:

- **Corporation** — president, secretary, treasurer, vice-president, or any person who performs principal business functions; or a manager of one or more facilities employing more than 250 persons or having gross annual sales or expenditures exceeding $25 million that is assigned or delegated in accordance to corporate procedure to sign such documents.
- **Partnership** — General partner.
- **Sole Proprietorship** — Owner. If more than one person is the sole proprietor, each person must sign the form.
- **City, County, State, Federal, or other Public Facility** — Principal executive officer or ranking elected official.
- **Limited Liability Company** — Member
- **Trusts**— Acting trustee

APPLICATION SUBMITTAL AND FEES

If you have a DEQ Agent in the area where your project is located, send the application to the DEQ Agent (See the DEQ Agent list in the Guidance Document, Figure A-1). Otherwise, send the application to the DEQ office in your area (See DEQ office locations in the Guidance Document, Figure B-1).

The permit application fee is **$771**, which includes a $380 new permit application fee, and $391 first year annual fee. The permittee will also be billed an annual fee for every year the permit is in effect. If you have a DEQ Agent in the area, where your project is located contact them and verify fees. (See Figure A-1 for list of Agents)

In order to authorize permit registration, the following must be completed and submitted to DEQ office or a DEQ Agent (See Figure A-1 for list of Agents):

- ☐ Application form with original signature.
- ☐ Land Use Compatibility Statement with original signature of the local land use planning official.
- ☐ Erosion and Sediment Control Plan and Drawings, Parts I-III.
- ☐ $771 fee (includes $380 for new permit application and $391 for first year annual fee) to the appropriate DEQ regional office and make the check payable to the Department of Environmental Quality. If you are sending your application to a DEQ Agent, check with the Agent for the appropriate fees.

Department of Environmental Quality
LAND USE COMPATIBILITY STATEMENT (LUCS)

State of Oregon Department of Environmental Quality

WHAT IS A LUCS? The Land Use Compatibility Statement is the process used by the DEQ to determine whether DEQ permits and other approvals affecting land use are consistent with local government comprehensive plans.

WHY IS A LUCS REQUIRED? Oregon law requires state agency activities that impact land use be consistent with local comprehensive plans. DEQ Oregon Administrative Rules (OAR) Chapter 340, Division 18 identifies agency activities or programs that significantly affect land use and must have a process for determining local plan consistency.

WHEN IS A LUCS REQUIRED? A LUCS is required for nearly all DEQ permits and certain approvals of plans or related activities that affect land use. These permits and activities are listed on p. 2 of this form. A single LUCS can be used if more than one DEQ permit/approval is being applied for concurrently.

A permit modification requires a LUCS when any of the following applies:

1. Physical expansion on the property or proposed use of additional land;
2. A significant increase in discharges to water;
3. A relocation of an outfall outside of the source property; or
4. Any physical change or change of operation of an air pollutant source that results in a net significant emission rate increase as defined in OAR 340-200-0020.

A permit renewal requires a LUCS if one has not previously been submitted, or if any of the above modification factors apply.

HOW TO COMPLETE A LUCS:

Step	Who Does It	What Happens
1	Applicant	Completes Section 1 of the LUCS and submits it to the appropriate city or county planning office.
2	City or County Planning Office	Completes Section 2 of the LUCS by determining if the activity or use meets all local planning requirements, and returns to the applicant the signed and dated LUCS form **with findings of fact for any local reviews or necessary planning approvals**.
3	Applicant	Includes the completed LUCS with **findings of fact** with the DEQ permit or approval submittal application to the DEQ.

WHERE TO GET HELP: For questions about the LUCS process, contact the DEQ staff responsible for processing the permit/approval. Headquarters and regional staff may be reached using DEQ's toll-free telephone number 1-800-452-4011. For general questions, please contact DEQ land use staff listed at: www.deq.state.or.us/pubs/permithandbook/lucs.htm.

***CULTURAL RESOURCES PROTECTION LAWS**: Applicants involved in ground-disturbing activities should be aware of federal and state cultural resources protection laws. ORS 358.920 prohibits the excavation, injury, destruction, or alteration of an archeological site or object, or removal of archeological objects from public and private lands without an archeological permit issued by the State Historic Preservation Office. 16 USC 470, Section 106, National Historic Preservation Act of 1966 requires a federal agency, prior to any undertaking, to take into account the effect of the undertaking that is included on or eligible for inclusion in the National Register. For further information, contact the State Historic Preservation Office at 503-378-4168, extension 232.*

SECTION 1 - TO BE COMPLETED BY APPLICANT

A. Applicant Name: _____
Contact Name: _____
Mailing Address: _____
City, State, Zip: _____
Telephone: _____
Tax Account No.: _____

B. Project Name: _____
Physical Address: _____
City, State, Zip: _____
Tax Lot No.: _____
Township: ____ **Range:** ____ **Section:** ____
Latitude: _____
Longitude: _____

*For latitude/longitude, use the **DEQ Location** Finder at http://deq12.deq.state.or.us/website/findloc.*

C. Describe the type of business or facility and services or products provided:

_____

SECTION 1 - TO BE COMPLETED BY APPLICANT (Continued)

Applicant Name: _____

Project Name: _____

D. Check the type of DEQ permit(s) or approval(s) being applied for at this time.

☐ Air Notice of Construction	☐ Pollution Control Bond Request
☐ Air Discharge Permit *(excludes portable facility permits)*	☐ Hazardous Waste Treatment, Storage, or Disposal Permit
☐ Title V Air Permit	☐ Clean Water State Revolving Fund Loan Request
☐ Parking/Traffic Circulation Plan	☐ Wastewater/Sewer Construction Plan/Specifications *(includes review of plan changes that require use of new land)*
☐ Air Indirect Source Permit	☐ Water Quality NPDES Individual Permit
☐ Solid Waste Disposal Permit	☐ Water Quality WPCF Individual Permit *(for onsite construction-installation permits use DEQ's Onsite LUCS form)*
☐ Solid Waste Treatment Permit	☐ Water Quality NPDES Stormwater General Permit *(1200-A, 1200-C, 1200-CA, 1200-COLS, and 1200-Z)*
☐ Solid Waste Compost Registration or Permit	☐ Water Quality General Permit *(all general permits, except 600, 700-PM, 1700-A, and 1700-B when they are mobile.)*
☐ Solid Waste Letter Authorization Permit	☐ Water Quality 401 Certification for federal permit
☐ Solid Waste Material Recovery Facility Permit	
☐ Solid Waste Transfer Station Permit	
☐ Solid Waste Tire Storage Permit	

E. This application is for: ☐ permit renewal ☐ new permit ☐ permit modification ☐ other: _____

SECTION 2 - TO BE COMPLETED BY CITY OR COUNTY PLANNING OFFICIAL

Please Note: A LUCS approval cannot be accepted by DEQ until all local requirements have been met. Written findings of fact for all local decisions addressed under Item C below are required. Written findings for an activity or use addressed by the acknowledged comprehensive plan in accordance with OAR 660-031-0020 may simply reference the specific plan policies, criteria, or standards that were relied upon in rendering the decision and indicate why the decision is justified based on the plan policies, criteria, or standards.

A. The facility proposal is located: ☐ inside city limits ☐ inside UGB ☐ outside UGB

B. Name of the city or county that has land use jurisdiction *(the legal entity responsible for land use decisions for the subject property or land use)*:

C. Does the activity or use comply with all applicable local land use requirements *(as required by OAR Chapter 660, Division 31)*?

☐ **YES,** you must complete below or attach findings to support the affirmative compliance decision

i) Relevant specific plan policies, criteria, or standards:

_____

ii) Provide the reasons for the decision:

_____

☐ **NO,** you must complete below or attach findings for noncompliance, and identify requirements the applicant must comply with before LUCS compatibility can be determined.

i) Relevant specific plan policies, criteria, or standards:

_____

ii) Provide the reasons for the decision:

_____

D. Planning Official Signature: _____ **Title:** _____

Print Name: _____ **Telephone No.:** _____ **Date:** _____

E. ***If necessary, depending upon city/county agreement on jurisdiction outside city limits but within UGB:***

Planning Official Signature: _____ **Title:** _____

Print Name: _____ **Telephone No.:** _____ **Date:** _____

ESCP PARTS I - III FORMS AND SET OF EXAMPLE DRAWINGS

The information that is required in ***Part I, ESCP Narrative Form*** could also be included on the required ***ESCP Drawings in Part III***. However, all of the BMPs selected for your project in ***Part II, BMPs with Rationale and ESCP Implementation Schedule Form*** must be included on the required ***ESCP Drawings in Part III***. All of the information in both ***Part III. 1., Information Required on ESCP Drawings*** and ***Part III. 2. Required ESCP Drawing Standard Notes*** must be included on the ***ESCP Drawings***. The set of ***ESCP Drawings*** are provided as an example to help you prepare your project specific drawings.

If an applicant only submits the ***ESCP Drawings***, all information in Parts I – III must be included on the drawings including a rationale for the BMPs in Part II that were not selected for your project.

PART I: ESCP NARRATIVE FORM

1. Permit Registration Information

Date: _____

Project Name: _____

Prepared By: _____

Company Name: _____

E-mail Address: _____

Please answer the following questions as indicated. If needed, additional space is provided for you at the end of this form. You may also attach any information you feel is pertinent to the project.

2. **Oregon Registered Professional Engineer Information and Stamp (for projects over 20 acres)**

Is your Erosion and Sediment Control Plan (ESCP) for an activity that covers 20 acres or more of disturbed land? (Schedule A.4.b.i)

☐ YES ☐ NO

Does your Erosion and Sediment Control Plan require engineered facilities such as settling basins and/or diversion structures? (Schedule A.4.b.ii)

☐ YES ☐ NO

If you answered "YES" to question #1 or #2 the plan must be prepared by an Oregon Registered Professional Engineer, Oregon Registered Landscape Architect, or Certified Professional in Erosion and Sediment Control (Soil and Water Conservation Society). Please provide the following information and use the space provided to imprint your seal.

Name: _____

Address: _____

_____

Telephone: _____ ***Imprint Seal Above***

3. **Inspector Qualifications Information**

Provide the following information on the Erosion and Sediment Control Inspector. This is a person that works for the applicant and not a government employee. If the inspector has not been selected yet, please provide the name of the consultant, general contractor, project manager, or person who prepared the ESCP. Upon designating an inspector(s), submit to DEQ or Agent an Action Plan, which is an addendum to the ESCP, that identifies their name(s), contact information and training and experience as required in (Schedule A.6.b.i-ii) of the permit.

The inspector is a person with training and experience in erosion prevention and sediment controls and best management practices and should have one of the following levels of skill. A copy of a certification, training, or level/hours of experience should be provided to DEQ or Agent in the form below:

a. Certified Professional in Erosion and Sediment Control (CPESC); or

b. Washington Department of Ecology's Contractor Erosion and Spill Control Lead (CESCL) Certification; or

c. An alternative, certification/training program designed for persons involved in any phase of erosion and sediment control work. Areas covered must include information on soils, the erosion process, sedimentation process, standards and specifications for vegetative and structural erosion control practices, laws, regulations, construction inspection and field investigation requirements experience; or

d. Have at least 200 hours of on the job experience associated with installation, maintenance, and monitoring of erosion and sediment control work as outlined in #3 above.

Name: _____ Telephone: _____

Address: _____ E-Mail: _____

Certification: _____

_____

Training: _____

_____

Experience: _____

_____

_____

4. Local Government Requirements

The ESCP must include any procedures necessary to meet applicable local government erosion and sediment control or stormwater management requirements and should include updates to the ESCP as necessary to reflect any revisions to applicable local requirements for soil and erosion control. (Schedule A.6.a)

Is the project located within a city, town, county or service district that has a local erosion and sediment control or stormwater ordinance or development standards that require the development of and implementation of an erosion and sediment control plan?

☐ YES ☐ NO

5. **Narrative Site Description**

a. **Describe the nature of the construction activity and the final use of the site (Schedule A.6.c.i):** _____

_____

_____

b. **Describe the origin and nature of fill material to be used (Schedule A.6.c.iii):** _____

_____

_____

_____

_____

c. **Describe the soils present on the site and erosion potential of the soils (Schedule A.6.c.iii):**

1) **Soil type(s):** _____

_____

_____

2) **Erosion Potential:** _____

_____

_____

6. **303(d)/TMDL Requirements: Selected Option Description (Starts Oct. 1, 2006)**

Effective October 1, 2006, there are more stringent requirements for construction projects that have the potential to discharge sediment or turbid water into water bodies that are listed for turbidity or sedimentation on the most recently EPA-approved Oregon 303(d) list or that have an established Total Maximum Daily Load (TMDL) for sedimentation or turbidity, (go to DEQ website for a map and list: http://www.deq.state.or.us/wq/stormwater/docs/tmdl303dsedturblist.pdf. Currently, this will directly affect 1% of the total universe of 1200-C permit registrants. Of the active 1200-C permitted sites affected by these requirements, nearly all of them are located in the Eagle Point area of Jackson County (Eagle Point is located adjacent to a Little Butte Creek, which is on the 303(d) list for sedimentation). **(Schedule A.2.)**

If your project is located within a 303(d)/TMDL listed watershed listed for sedimentation or turbidity, an applicant is required to indicate which option is chosen to be implemented:

- ☐ **Option #1: Will collect and analyze samples for turbidity in stormwater runoff from the construction site and compare the results to the benchmark value of 160 Nephelometric Turbidity Units (NTUs).** If any stormwater sample exceeds the benchmark, then the permit registrant must evaluate the best management practices (BMPs) and the adequacy of the ESCP and take corrective actions. If after such actions have been implemented and sample results still exceed the 160 NTU benchmark, the requirements of Option #2 below must be followed, and the permit registrant must submit an Action Plan to DEQ identifying the selected BMP(s) that will be implemented and the rationale for choosing the selected BMP(s).

- ☐ **Option #2: Will implement one or more of the following BMPs to control and treat sediment and turbidity:**
  - **i. Compost berms, compost blankets, or compost socks;**
  - **ii. Erosion control mats (rolled or blown);**
  - **iii. Tackifiers used in combination with perimeter sediment control BMPs;**
  - **iv. Established vegetated buffers sized at 50 feet plus 25 feet per 5 degrees of slope;**
  - **v. Water treatment by electro-coagulation, chemical flocculation, filtration; or**
  - **vi. Other substantially equivalent sediment or turbidity BMP approved by DEQ.**

The selected BMP(s) must be specifically identified in the ESCP as addressing this condition of the permit, and the rationale for choosing the selected BMP(s) must be provided.

PART II: BMPS WITH RATIONALE AND ESCP IMPLEMENTATION SCHEDULE FORM

The following controls and practices (BMPs), if appropriate for the site, are required in the ESCP and on the Part III ESCP Drawings and must be implemented according to the schedule in the ESCP. If the permit registrant determines that any of these BMPs is not appropriate, the rationale for the change must be provided in the ESCP (Permit Condition Schedule A.7). An example of acceptable rationale is: "***(Identify BMP) was not included in the ESCP because _____ makes its use inappropriate."***

The following note can be placed on your ESCP Drawings in addition to or as an alternative to submitting Part II: BMPs with Rationale and ESCP Implementation Schedule Form:

"A comprehensive list of available Best Management Practices (BMP) options based on DEQ's 1200-C Permit Application and ESCP Guidance Document has been reviewed to complete this Erosion and Sediment Control Plan. Some of the above listed BMPs were not chosen because they were determined to not effectively manage erosion prevention and sediment control for this project based on specific site conditions, including soil conditions, topographic constraints, accessibility to the site, and other related conditions. As the project progresses and there is a need to revise the ESCP, an Action Plan will be submitted."

Best Management Practices (BMPs) Table with Rationale and ESCP Implementation Schedule

BMPs	YES (Place on Drawings)	NO	If NO, Provide Rationale — YEAR: / MONTH:												
RUNOFF CONTROLS															
Stabilize stream banks/construct primary runoff control measures															
Pipe Slope Drains															
Energy Dissipaters															
Run-on Diversion															
Temporary Diversion Dikes															
Grass-lined Channel (Turf Reinforcement Mats)															
Trench Drains (Collected Runoff to Treatment BMP)															
Drop Inlets															
Check Dams															
CLEARING & GRADING PRACTICES															
Top-soiling															
Temporary Seeding and Planting															
Permanent Seeding and Planting															
Mycorrhizae/ Biofertilizers															
Mulches															
Compost Blankets															
Erosion Control Blankets and Mats															
Soil Binders															
Soil Tackifiers															
Sodding Vegetative Buffer Strips															
Protection of trees with construction fences															
VEGETATIVE EROSION CONTROLS															
Live Staking (stabilization practice)															
Live Fascines/Brush Wattles (stabilization)															
Stabilization Mats (stabilization practice)															
Pole Planting (stream bank stabilization)															
Brush Box (stream bank stabilization)															
Fascines with Sub-drains (stream bank stabilization)															
Live Pole Drains (stream bank stabilization) (may have to be removed															

Best Management Practices (BMPs) Table with Rationale and ESCP Implementation Schedule																										
			YEAR:																							
BMPs	**YES (Place on Drawings)**	**NO**	**If NO, Provide Rationale** MONTH:																							
for stabilization)																										
Brush Packing (stream bank stabilization)																										
Live Gully Fill Repair (stream bank stabilization)																										
EROSION CONTROL PRACTICES																										
Sediment Fencing																										
Sand Bag Barrier																										
Gravel Bag Berm (With Compost Berm)																										
Earth Dikes (Stabilized)																										
Drainage Swales																										
Subsurface Drains Which Daylight to the Surface																										
Rock Outlet Protection																										
Sediment Trap																										
Rock & Brush Filters (stream bank stabilization)																										
Compost Berm/ Compost Sock																										
Fiber Rolls/Straw Wattles																										
Storm Drain Inlet Protection																										
Temporary or Permanent Sedimentation Basins																										
Unpaved roads graveled or other BMP on the road or down gradient.																										
Dewatering and Ponded Water Management																										
Paving Operations Controls																										
Temporary Equipment Bridge																										
BMPs to Prevent Illicit Connection																										
BMPs to Prevent Illegal Discharge																										
Reuse and Recycle Construction Wastes																										

PART III: REQUIRED ELEMENTS of ESCP DRAWINGS

1. Information Required on ESCP Drawings

INFORMATION REQUIRED ON ESCP DRAWINGS	YES	NO	NOT APPL.*
a. Identify, mark, and protect (by fencing off or other means) critical riparian areas and vegetation including important trees and associated rooting zones and vegetation areas to be preserved. (Sch. A.5.b.i.(1))			
b. Identify vegetative buffer zones between the site and sensitive areas (e.g., wetlands), and other areas to be preserved, especially in perimeter areas. (Schedule A.5.b.i.(2))			
c. Site access areas (graveled and paved construction entrances, exits, roadways, equipment parking areas, etc.). (Schedule A.5.b.ii.(1))			
d. Location of any proposed fuel storage and fuel areas and other hazard materials and wastes including concrete truck and other concrete equipment washout areas and other non-stormwater controls prior to start of construction activities. (Schedule A.5.b.ii.(3))			
e. Identify soil types including erosion potential. (Schedule A.6.c.iii)			
f. Site location map. The site map must show sufficient roads and features to locate and access the site. (Can be separate from drawings.) (Schedule A.6.d.ii)			
g. Total property boundary including surface area of development. (Schedule A.6.d.iii)			
h. Location, size, and type of all soil disturbances (including, but not limited to, cut and fill areas and pre and post development elevation contours). (Schedule A.6.d.iv)			
i. Drainage patterns of pre- and post-development are clearly indicated by contours or drainage flow direction-arrows. (Schedule A.6.d.v)			
j. Location, size, and type of stormwater discharge points to receiving water(s) or stormwater conveyance systems. (Schedule A.6.d.vi) & (Schedule A.6.d.xiii)			
k. Location of areas used for the storage of soils or wastes. (Schedule A.6.d.vii)			
l. Location of areas where vegetative erosion control practices are to be implemented. (Schedule A.6.d.viii)			
m. Location of all erosion and sediment control measures or structures. (Schedule A.6.d.ix)			
n. Location of impervious structures post-construction (Include buildings, roads, parking lots, outdoor storage areas, etc., as applicable.). (Schedule A.6.d.x)			
o. Location of springs, wetlands and other surface waters adjacent to and on-site. (Schedule A.6.d.xi)			
p. Boundaries of 100-year floodplains if determined and easily available. (Schedule A.6.d.xii)			
q. Location of stormwater discharge points to receiving water(s) or stormwater conveyance systems if applicable. (Schedule A.6.d.xiii)			
r. Location of storm drain catch basins and the location of catch basins with inlet protection and a description of the type of catch basins used (e.g., curb inlet, field inlet, grated drain, combination, etc.). (Sch. A.6.d.xiv)			
s. Location of septic drain fields. (Schedule A.6.d.xv)			
t. Location of existing or proposed drywells or other UICs. (Schedule A.6.d.xvi)			
u. Location of drinking water wells. (Schedule A.6.d.vii)			
v. Details of sediment and erosion controls including installation techniques. (Schedule A.6.d.xviii)			
w. Details of temporary or permanent sedimentation basins, detention ponds, storm drain piping, inflow and outflow details. (Schedule A.6.d.xix)			
x. Verify that Standard Drawing Notes are provided on drawing and are correct.			

* Not Applicable

2. Required ESCP Drawing Standard Notes

INFORMATION REQUIRED ON ESCP DRAWINGS

1. Hold a pre-construction meeting of project construction personnel that includes the inspector to discuss erosion and sediment control measures and construction limits. (Schedule A.5.b.i.(3))
2. The ESCP must be kept onsite and all erosion and sediment control measures shown on the plan must be installed in such a manner to ensure that sediment or sediment laden water that enters or is likely to enter surface waters or conveyance systems leading to surface water, roadway, or other properties does not occur. (Schedule A.3.a.) and (Schedule B.3.b.)
3. The implementation of the ESCP and construction, maintenance, replacement, and upgrading of the erosion and sediment control measures is the responsibility of the permit registrant until all construction is completed and approved by the local development agency and vegetation/landscaping is established. The permit registrant shall be responsible for maintenance after the lots are approved, until the lots are sold and the 1200-C permit is terminated. (Schedule A.4.a.) and (Schedule D.3.)
4. The permit registrant must be responsible for proper installation and maintenance of all erosion and sediment control measures, in accordance with local, state, or federal regulations. (Schedule A.5.a.) and (Schedule A. 6.a.)
5. Erosion and sediment control measures including perimeter sediment control must be in place before vegetation is disturbed and must remain in place and be maintained, repaired, and promptly implemented following procedures established for the duration of construction, including protection for active storm drain inlets and catch basins and appropriate non-stormwater pollution controls. (Schedule A.5.b.ii.(2)), (Schedule A.5.b.ii.(7)), (Schedule A.7.d.i.(2)) & (Schedule A.7.f.)
6. Begin land clearing, excavation, trenching, cutting or grading and earthwork-surface roughing after installing applicable sediment, erosion prevention and runoff control measures not in the direct path of work. (Schedule A.5.b.ii.(5)(a)), (Schedule A.7.c.i.(1)) and (Schedule A.7.c.ii.(1))
7. Apply temporary and/or permanent soil stabilization measures immediately on all disturbed areas as grading progresses and for all roadways including gravel roadways. (Schedule A.5.b.ii.(5).(b), (Schedule A.5.b.ii.(5)(c) & Schedule A.5.b.ii.(6).)
8. Wet Weather BMPs: Construction activities must avoid or minimize excavation and creation of bare ground on slopes greater than five (5) percent from October 1 through May 31 each year. (Schedule A.7.a.i.)
9. Wet Weather BMPs: Temporary stabilization of the site must be installed at the end of the shift before a holiday or weekend or at the end of each workday if rainfall is forecast in the next 24 hours and each weekend and holiday. (Schedule A.7.a.ii.)
10. Identify, mark, and protect (by fencing off or other means) critical riparian areas and vegetation including important trees and associated rooting zones and vegetation areas to be preserved. Identify vegetative buffer zones between the site and sensitive areas (e.g., wetlands), and other areas to be preserved, especially in perimeter areas. Preserve existing vegetation and re-vegetate open areas when practicable before and after grading or construction. (Schedule A.5.b.i.(1) & (2)) and (Schedule A.7.c.iii.(1))
11. Provide permanent erosion prevention measures on all exposed areas to prevent from becoming a source of erosion and remove all temporary control measures, unless local ordinances require otherwise, as areas are stabilized. (Schedule A.5.b.ii.(8)) and (Schedule A.7.c.ii.(2))
12. All temporary sediment controls must remain in place until permanent vegetation or other permanent covering of exposed soil is established. Identify the type of vegetative seed mix used. (Schedule A.7.c.iii.(3)) & (Schedule A.7.c.iii.(4))
13. Sediment controls must be installed and maintained along the site perimeter on all down gradient sides of the construction site and at all active and operational internal storm drain inlets at all times during construction. (Schedule A.7.d.i.(1) - (2))
14. Prior to any land disturbing activities each site must have graveled, paved, or constructed entrances, exits and parking areas with exit tire wash to reduce the tracking of sediment onto public or private roads. (Schedule A.7.d.iii.(1))
15. When trucking saturated soils from the site, either water-tight trucks must be used or loads must be drained on-site until dripping has been reduced to minimize spillage on roads. (Schedule A.7.d.iii(3))
16. Temporary stabilization or covering of soil stockpiles and protection of stockpile located away from construction activity must occur at the end of each workday or other BMPs, such as diversion of uncontaminated flows and

installation of sediment fences around stockpiles, must be implemented to prevent turbid discharges to surface waters. (Schedule A.7.e.i.(1)) & (Schedule A.7.e.ii.(1) – (3))

17. BMPs that will be used to prevent or minimize stormwater from being exposed to pollutants from spills, no discharge of concrete truck wash water, vehicle and equipment cleaning, vehicle and equipment fueling, maintenance, and storage, other cleaning and maintenance activities, and waste handling activities. These pollutants include fuel, hydraulic fluid, and other oils from vehicles and machinery, as well as debris, leftover paints, solvents, and glues from construction operations. (Schedule A.7.e.i.(2))
18. Any use of toxic or other hazardous materials must include proper storage, application, and disposal. (Schedule A.7.e.iii.(2))
19. Solid Waste and Hazardous Materials Management. Follow project written spill prevention and response procedures, employee training on spill prevention and proper disposal procedures; regular maintenance schedule for vehicles and machinery; and material delivery and storage controls, training and signage, material use, covered storage areas for waste and supplies. (Schedule A.7.e.iii(3))
20. The permittee must properly manage hazardous wastes, used oils, contaminated soils, concrete waste, sanitary waste, liquid waste, or other toxic substances discovered or generated during construction and meet all state and federal regulations and approvals. (Schedule A.7.e.iii.(4))
21. The ESCP measures shown on this plan are minimum requirements for anticipated site conditions. During the construction period, these measures must be upgraded as needed to comply with all applicable local, state, and federal erosion and sediment control regulations. Changes to the ESCP must also be submitted in the form of an Action Plan to DEQ or its Agent for approval. (Schedule A.7.f.)
22. Significant amounts of sediment, which leaves the site, must be cleaned up within 24 hours and placed back on the site and stabilized or properly disposed. The cause of the sediment release must be found and prevented from causing a recurrence of the discharge within the same 24 hours. Any in-stream clean up of sediment shall be performed according to the Oregon Division of State Lands required time frame. (Schedule A.7.f.i.(1))
23. Vacuuming or dry sweeping must be used to clean-up released sediment and must not be intentionally washed into storm sewers, drainage ways, or water bodies. (Schedule A.7.f.i.(2))
24. The application rate of fertilizers used to reestablish vegetation must follow manufacturer's recommendations to minimize nutrient releases to surface waters. Time release fertilizers should be used with care within any water way riparian zone. (Schedule A.7.f.i.(3))
25. Sediment must be removed from behind a Sediment Fence when it has reached a height of 1/3 the height of the fence aboveground and before fence removal. (Schedule A.7.f.ii.(1))
26. Sediment must be removed from behind Bio Bags and other barriers it has reached a height of two (2) inches and before BMP removal. (Schedule A.7.f.ii.(2))
27. Removal of trapped sediment in a Sediment Basin or Sediment Trap or Catch Basins must occur when the sediment retention capacity has been reduced by fifty (50)% and at completion of project. (Schedule A.7.f.ii.(3) & (4))
28. DEQ must approve of any treatment system and operational plan that may be necessary to treat contaminated construction dewatering or sediment and turbidity in stormwater runoff. (Schedule A.7.f.iii.)
29. Should all construction activities cease for thirty days or more, the entire site must be temporarily stabilized using vegetation or a heavy mulch layer, temporary seeding, or other method. (Schedule A.8.a.)
30. Should construction activities cease for fifteen (15) days or more on any significant portion of a construction site temporary stabilization is required for that portion of the site with straw, compost, or other tackified covering that prevent soil or wind erosion until work resumes on that portion of the site. (Schedule A.8.b.)
31. Daily inspections when rainfall and runoff occurs of the BMPs and discharge outfalls must be the project ESCP Inspector. These inspections and observations must be recorded in a log that is available on site. (Schedule A.6.b.i.) & (Schedule B.1.b(1))
32. BMPs must be inspected before, during, and after significant storm events. (Schedule A.7.f.)
33. All ESCP controls and practices must be inspected visually once to ensure that BMPs are in working order prior to the site becoming inactive or in anticipation of site inaccessibility and must be inspected visually once every two (2) weeks during inactive periods greater than seven (7) consecutive calendar days. (Schedule B.1.b.(2)-(3))
34. If practical, inspections must occur daily at a relevant and accessible discharge point or downstream location during periods which the site is inaccessible due to inclement weather. (Schedule B.1.b.(4))

CITY OF ASHLAND MUNICIPAL CODE – CONDITIONAL USE PERMIT STANDARDS AND CRITERIA

18.104 Conditional Use Permits

18.104.010 Conditional Use Permits Generally

Certain uses are permitted in each zoning district only as conditional uses. This chapter provides substantive approval criteria by which applications for conditional use permits are to be evaluated and describes applicable procedures. No conditionally permitted use may be established, enlarged or altered unless the city first issues a conditional use permit in accordance with the provisions of this chapter.

18.104.020 Definitions

The following are definitions for use in this chapter.
A. "Impact Area" - That area which is immediately surrounding a use, and which may be impacted by it. All land which is within the applicable notice area for a use is included in the impact area. In addition, any lot beyond the notice area, if the hearing authority finds that it may be materially affected by the proposed use, is also included in the impact area.
B. "Target Use" - The basic permitted use in the zone, as defined below. 1. WR (Woodland Residential) and RR (Rural Residential) zones:
1. Residential use complying with all ordinance requirements, developed at the density permitted by Section 18.88.040.
2. R-1 (Single Family Residential) zones: Residential use complying with all ordinance requirements, developed at the density permitted by Section 18.88.040.
3. R-2 and R-3 Zones: Residential use complying with all ordinance requirements, developed at the density permitted by the zone.
4. C-1. The general retail commercial uses listed in 18.32.020 B., developed at an intensity of .35 gross floor to area ratio, complying with all ordinance requirements.
5. C-1D. The general retail commercial uses listed in 18.32.020 B., developed at an intensity of 1.00 gross floor to area ratio, complying with all ordinance requirements.
6. E-1. The general office uses listed in 18.40.020 A., developed at an intensity of .35 gross floor to area ratio, complying with all ordinance requirements.
7. M-1. The general light industrial uses listed in 18.40.020 E., complying with all ordinance requirements.
8. SO. Educational uses at the college level, complying with all ordinance requirements.

18.104.030 Procedure

An application for a conditional use permit shall be submitted by the owner of the subject property or authorized agent on a form prescribed by the city and accompanied by the required filing fee. The application shall include a plan or drawing meeting the requirements of Section 18.104.040 and shall be processed as provided in Chapter 18.108 of this Title.

18.104.040 Plan Requirements

A. The plan or drawing accompanying the application shall include the following information:
1. Vicinity map.
2. North arrow.
3. Depiction and names of all streets abutting the subject property.
4. Depiction of the subject property, including the dimensions of all lot lines.
5. Location and use of all buildings existing and proposed on the subject property and schematic architectural elevations of all proposed structures.
6. Location of all parking areas, parking spaces, and ingress, egress and traffic circulation for the subject property.
7. Schematic landscaping plan showing area and type of landscaping proposed.
8. A topographic map of the site showing contour intervals of five feet or less.
9. Approximate location of all existing natural features in areas which are planned to be disturbed, including, but not limited to, all existing trees of greater than six inch dbh, any

natural drainage ways, ponds or wetlands, and any substantial outcroppings of rocks or boulders.
B. An application for a conditional use permit may, but need not be, made concurrently with any required application for site design approval under Chapter 18.72. The provisions of paragraph (1) above are not intended to alter the detailed site plan requirements of Section 18.72.040 for site design approval.

18.104.050 Approval Criteria

A conditional use permit shall be granted if the approval authority finds that the proposed use conforms, or can be made to conform through the imposition of conditions, with the following approval criteria.
A. That the use would be in conformance with all standards within the zoning district in which the use is proposed to be located, and in conformance with relevant Comprehensive plan policies that are not implemented by any City, State, or Federal law or program.
B. That adequate capacity of City facilities for water, sewer, paved access to and through the development, electricity, urban storm drainage, and adequate transportation can and will be provided to and through the subject property.
C. That the conditional use will have no greater adverse material effect on the livability of the impact area when compared to the development of the subject lot with the target use of the zone. When evaluating the effect of the proposed use on the impact area, the following factors of livability of the impact area shall be considered in relation to the target use of the zone:
1. Similarity in scale, bulk, and coverage.
2. Generation of traffic and effects on surrounding streets. Increases in pedestrian, bicycle, and mass transit use are considered beneficial regardless of capacity of facilities.
3. Architectural compatibility with the impact area.
4. Air quality, including the generation of dust, odors, or other environmental pollutants.
5. Generation of noise, light, and glare.
6. The development of adjacent properties as envisioned in the Comprehensive Plan.
7. Other factors found to be relevant by the Hearing Authority for review of the proposed use.

18.104.060 Conditions

The conditions which the approval authority may impose include, but are not limited to the following:
A. Regulation and limitation of uses.
B. Special yards, spaces.
C. Fences and walls.
D. Dedications, including the present or future construction of streets and sidewalks and bonds for such construction or irrevocable consent improvement petitions for such improvements.
E. Regulation of points of vehicular and pedestrian ingress and egress.
F. Regulation of signs.
G. Regulation of building materials, textures, colors and architectural features.
H. Landscaping, including screening and buffering where necessary to increase compatibility with adjoining uses.
I. Regulation of noise, vibration, dust, odors or similar nuisances.
J. Regulation of hours of operation and the conduct of certain activities.
K. The period of time within which the proposed use shall be developed.
L. Duration of use.
M. Preservation of natural vegetative growth and open space.
N. Any condition permitted by Section 18.72, Site Design.
O. Such other conditions as will make possible the development of the city in a orderly and efficient manner and in accordance with the provisions of this Title.

18.104.070 Revocation; Abandonment

Unless a longer period is specifically allowed by the approval authority, any conditional use permit approved under this section, including any declared phase, shall be deemed revoked if

the proposed use or phase is not commenced within one year of the date of approval. A use or phase shall not be considered commenced until the permittee has actually obtained a building permit and commenced construction or has actually commenced the conditional use on the premises. If the permit requires site design approval under Chapter 18.72, the permit shall be deemed revoked if the use or phase is not developed within one year of the date of site design approval. A conditional use is deemed void if discontinued or abandoned for a period of six consecutive months.(Ord. 2228, 1982; Ord. 2656, 1991; Ord. 2775. 1996)

18.62 Physical & Environmental Constraints

18.62.010 Purpose and Intent

The purpose of this Chapter is to provide for safe, orderly and beneficial development of districts characterized by diversity of physiographic conditions and significant natural features; to limit alteration of topography and reduce encroachment upon, or alteration of, any natural environment and; to provide for sensitive development in areas that are constrained by various natural features. Physiographic conditions and significant natural features can be considered to include, but are not limited to: slope of the land, natural drainage ways, wetlands, soil characteristics, potential landslide areas, natural and wildlife habitats, forested areas, significant trees, and significant natural vegetation.
(Ord 2808, Added, 12/02/1997)

18.62.020 Regulations

The type of regulation applicable to he land depends upon the classification in which the land is placed, as provided in Section 18.62.050. If those regulations conflict with other regulations of the City of Ashland's Municipal Code, the more stringent of the two regulations shall govern.
(Ord 2808, Added, 12/02/1997)

18.62.030 Definitions

The following terms are hereby defined as they apply to this Chapter:
A. Architect - An architect licensed by the State of Oregon.
B. Average slope - average slope for a parcel of land or for an entire project, for the purposes of determining the area to remain in a natural state shall be calculated before grading using the following formula:
S = .00229(I)(L)
A
where "S" is the average percent of slope; ".00229" is the conversion factor for square feet; "I" is the contour interval in feet; "L" is the summation of length of the contour lines in scale feet; and "A" is the area of the parcel or project in acres.
C. Buildable area - That portion of an existing or proposed lot that is free of building restrictions. For the purpose of this ordinance, a buildable area cannot contain any setback areas, easements, and similar building restrictions, and cannot contain any land that is identified as Flood plain Corridor Lands, or any land that is greater than 35% slope.
D. Cohesive Soils - Residual or transported soils, usually originating from parent rock which contains significant quantities of minerals which weather to clay. Cohesive soils have a Plasticity Index of ten or more, based on laboratory testing according to AASHTO methods, or a site-specific scientific analysis of a particular soil material.
E. Development - Alteration of the land surface by:
1. Earth-moving activities such as grading, filling, stripping, or cutting involving more than 20 cubic yards on any lot, or earth-moving activity disturbing a surface area greater than 1000 sq. ft. on any lot;
2. Construction of a building, road, driveway, parking area, or other structure; except that additions to existing buildings of less than 300 sq. ft. to the existing building footprint shall not be considered development for section 18.62.080.
3. Culverting or diversion of any stream designated by this chapter.
F. Designer - a person not registered as an architect or engineer, approved to plan and design single family homes and other buildings defined as exempt by the building code.
G. Engineer - A registered professional engineer licensed by the State of Oregon.
H. Engineering Geologist - A registered professional engineering geologist licensed by the State of Oregon.
I. Floodway Channel - The floodway channel as defined by ordinance.
J. Geotechnical Expert - An engineering geologist or an engineer with demonstrable expertise in geologic hazards evaluation and geotechnical engineering.
K. Gully - A drainage incision, commonly caused by erosion, which does not experience regular

or seasonal stream flow, but does act as a channel for runoff during periods of high rainfall.
L. Landscape Professional - arborist certified by the International Society of Arboriculture, landscape architect licensed by the State of Oregon, or other expert with demonstrable expertise in tree and erosion control vegetation maintenance, and erosion control vegetation methods.
M. Natural Grade - the elevation of the ground level in its natural state, before construction, filling, or excavation. (see graphic)

N. Natural State - all land and water that remains undeveloped and undisturbed. This means that grading, excavating, filling and/or the construction of roadways, driveways, parking areas, and structures are prohibited. Incidental minor grading for hiking trails, bicycle paths, picnic areas and planting and landscaping which is in addition to and enhances the natural environment is permitted. Incidental brush removal for lot maintenance and ecosystem health is permitted. Further, vegetation removal for the purposes of wildfire control in conjunction with an approved fire prevention and control plan shall also be permitted.
O. Non-cohesive Soils - Residual or transported soils containing no or very little clay, usually from crystalline granitic parent rock. Non-cohesive soils have a Plasticity Index of less than ten, based on laboratory testing according to AASHTO methods, or a published scientific analysis of a particular soil type.
P. Professional Arborist - arborist certified by the International Society of Arboriculture and licensed by the State of Oregon State Landscape Contractors Board or Construction Contractors Board, or landscape architect licensed by the State of Oregon.
Q. Riparian - That area associated with a natural water course including its wildlife and vegetation.
R. Slope - The deviation of a surface from the horizontal, usually expressed in percent. (see graphic)

S. Stripping - Any activity which significantly disturbs vegetated or otherwise stabilized soil surface, including clearing and grubbing operations.
T. Tree Removal - the following activities are defined as tree removal:
1. The removal of three or more living trees of over six inches diameter at breast height (d.b.h.), or the removal of five percent of the total number of living (or dead trees) over six inches d.b.h., whichever is greater, on any lot within five year period, or any form of commercial logging;
2. The removal of one or more living conifers greater than two feet d.b.h., or living broadleaf trees greater than one foot d.b.h.;
U. Wildfire - Fire caused by combustion of native vegetation, commonly referred to as forest fire or brush fire.
(Ord 2808, Added, 12/02/1997)

18.62.040 Approval and Permit Required

A Physical Constraints Review Permit is required for the following activities:
A. Development, as defined in 18.62.030.D, in areas identified as Flood plain Corridor Land, Riparian Preserve, Hillside Land, or Severe Constraint land.
B. Tree removal, as defined in 18.62.030.RT., in areas identified as Flood plain Corridor Land and Riparian Preserve.
C. Commercial logging, in areas identified as Flood plain Corridor Land, Riparian Preserve, Hillside Land, or Severe Constraint Land.
D. Tree removal, in areas identified as Hillside Land and Severe Constraint Land, except that a permit need not be obtained for tree removal that is not associated with development, and done for the purposes of wildfire management and carried out in accord with a Fire Prevention and Control Plan approved by the Fire Chief.
E. If a development is part of a Site Review, Performance Standards Development, Conditional Use Permit, Subdivision, Partition, or other Planning Action, then the Review shall be conducted simultaneously with the Planning Action.
F. If a development is exclusive of any other Planning Action, as noted in Subsection B, then the Physical Constraints Review shall be processed as a Staff Permit.
G. Where it appears that the proposal is part of a more extensive development that would require a master site plan, or other planning action, the Staff Advisor shall require that all

necessary applications be filed simultaneously.
H. Plans Required. The following plans shall be required for any development requiring a Physical Constraints Review:
1. The plans shall contain the following:
a. Project name.
b. Vicinity map.
c. Scale (the scale shall be at least one inch equals 50 feet or larger) utilizing the largest scale that fits on 22" x 34" paper. Multiple plans or layers shall be prepared at the same scale, excluding detail drawings.
d. North arrow.
e. Date.
f. Street names and locations of all existing and proposed streets within or on the boundary of the proposed development.
g. Lot layout with dimensions for all lot lines.
h. Location and use of all proposed and existing buildings, fences and structures within the proposed development. Indicate which buildings are to remain and which are to be removed.
i. Location and size of all public utilities affected by the proposed development.
j. Location of drainage ways or public utility easements in and adjacent to the proposed development. Location of all other easements.
A topographic map of the site at a contour interval of not less than two feet nor greater than five feet. The topographic map shall also include a slope analysis, indicating buildable areas, as shown in the graphic.

l. Location of all parking areas and spaces, ingress and egress on the site, and on-site circulation.
m Accurate locations of all existing natural features including, but not limited to, all trees as required in 18.62.080.D.1, including those of a caliper equal to or greater than six inches d.b.h., native shrub masses with a diameter of ten feet or greater, natural drainage, swales, wetlands, ponds, springs, or creeks on the site, and outcroppings of rocks, boulders, etc. Natural features on adjacent properties potentially impacted by the proposed development shall also be included, such as trees with driplines extending across property lines. In forested areas, it is necessary to identify only those trees which will be affected or removed by the proposed development. Indicate any contemplated modifications to a natural feature.
n. The proposed method of erosion control, water runoff control, and tree protection for the development as required by this chapter.
o. Building envelopes for all existing and proposed new parcels that contain only buildable area, as defined by this Chapter.
p. Location of all irrigation canals and major irrigation lines.
q. Location of all areas of land disturbance, including cuts, fills, driveways, building sites, and other construction areas. Indicate total area of disturbance, total percentage of project site proposed for disturbance, and maximum depths and heights of cuts and fill.
r. Location for storage or disposal of all excess materials resulting from cuts associated with the proposed development.
s. Applicant name, firm preparing plans, person responsible for plan preparation, and plan preparation dates shall be indicated on all plans.
t. Proposed timeline for development based on estimated date of approval, including completion dates for specific tasks.
2. Additional plans and studies as required in Sections 18.62.070, 18.62.080, 18.62.090 and 18.62.100 of this Chapter.
I. Criteria for approval. A Physical Constraints Review Permit shall be issued by the Staff Advisor when the Applicant demonstrates the following:
1. Through the application of the development standards of this chapter, the potential impacts to the property and nearby areas have been considered, and adverse impacts have been minimized.
2. That the applicant has considered the potential hazards that the development may create and implemented measures to mitigate the potential hazards caused by the development.
3. That the applicant has taken all reasonable steps to reduce the adverse impact on the environment. Irreversible actions shall be considered more seriously than reversible actions.
The Staff Advisor or Planning Commission shall consider the existing development of the surrounding area, and the maximum permitted development permitted by the Land Use Ordinance. (Ord 2834 S1, 1998)

(Ord. 2834, Amended, 11/03/1998, Section 18.62.040 J "deleted"; Ord 2808, Added, 12/02/1997)

18.62.050 Land Classifications

The following factors shall be used to determine the classifications of various lands and their constraints to building and development on them:
A. Flood plain Corridor Lands - Lands with potential stream flow and flood hazard. The following lands are classified as Flood plain Corridor lands:
1. All land contained within the 100 year Flood plain as defined by the Federal Emergency Management Agency, in maps adopted by Chapter 15.10 of the Ashland Municipal Code.
2. All land within the area defined as Flood plain Corridor land in maps adopted by the Council as provided for in section 18.62.060.
3. All lands which have physical or historical evidence of flooding in the historical past.
4. All areas within 20 feet (horizontal distance) of any creek designated for Riparian Preservation in 18.62.050.B and depicted as such on maps adopted by the Council as provided for in section 18.62.060.
5. All areas within ten feet (horizontal distance) of any drainage channel depicted on maps adopted by the Council but not designated as Riparian Preservation.
B. Riparian Preservation - The following Flood plain Corridor Lands are also designated for Riparian Preservation for the purposes of this section and as listed on the Physical and Environmental Constraints Overlay Maps: Tolman, Hamilton, Clay, Bear, Kitchen, Ashland, Neil and Wrights Creeks.
C. Hillside Lands - Hillside Lands are lands which are subject to damage from erosion and slope failure, and include areas which are highly visible from other portions of the city. The following lands are classified as Hillside Lands:
1. All areas defined as Hillside Lands on the Physical Constraints Overlay map and which have a slope of 25 percent or greater.
D. Wildfire Lands - Lands with potential of wildfire. The following lands are classified as Wildfire Lands:
1. All areas defined as wildfire lands on the Physical Constraints Overlay map.
E. Severe Constraint Lands - Lands with severe development characteristics which generally limit normal development. The following lands are classified as Severe Constraint Lands:
1. All areas which are within the floodway channels, as defined in Chapter 15.10.
2. All lands with a slope greater than 35 percent.
F. Classifications Cumulative. The above classifications are cumulative in their effect and, if a parcel of land falls under two or more classifications, it shall be subject to the regulations of each classification. Those restrictions applied shall pertain only to those portions of the land being developed and not necessarily to the whole parcel.
(Ord 2808, Added, 12/02/1997)

18.62.060 Official Maps

A. The City Council shall adopt official maps denoting the above identified areas. Substantial amendments of these maps shall be a Type 3 procedure.
B. Minor amendments of the maps to correct mapping errors when the amendments are intended to more accurately reflect the mapping criteria contained in this chapter or in the findings of the Council in adopting an official map may be processed as a Type 1 procedure.
(Ord 2808, Added, 12/02/1997)

18.62.070 Development Standards for Flood plain Corridor Lands

For all land use actions which could result in development of the Flood plain Corridor, the following is required in addition to any requirements of Chapter 15.10:
A. Standards for fill in Flood plain Corridor lands:
1. Fill shall be designed as required by the Uniform Building Code, Chapter 70, where

applicable.
2. The toe of the fill shall be kept at least ten feet outside of floodway channels, as defined in section 15.10, and the fill shall not exceed the angle of repose of the material used for fill.
3. The amount of fill in the Flood plain Corridor shall be kept to a minimum. Fill and other material imported from off the lot that could displace floodwater shall be limited to the following:
a. Poured concrete and other materials necessary to build permitted structures on the lot.
b. Aggregate base and paving materials, and fill associated with approved public and private street and driveway construction.
c. Plants and other landscaping and agricultural material.
d. A total of 50 cubic yards of other imported fill material.
e. The above limits on fill shall be measured from April 1989, and shall not exceed the above amounts. These amounts are the maximum cumulative fill that can be imported onto the site, regardless of the number of permits issued.
4. If additional fill is necessary beyond the permitted amounts in (3) above, then fill materials must be obtained on the lot from cutting or excavation only to the extent necessary to create an elevated site for permitted development. All additional fill material shall be obtained from the portion of the lot in the Flood plain Corridor.
5. Adequate drainage shall be provided for the stability of the fill.
6. Fill to raise elevations for a building site shall be located as close to the outside edge of the Flood plain Corridor as feasible.
B. Culverting or bridging of any waterway or creek identified on the official maps adopted pursuant to section 18.62.060 must be designed by an engineer. Stream crossings shall be designed to the standards of Chapter 15.10, or where no floodway has been identified, to pass a one hundred (100) year flood without any increase in the upstream flood height elevation. The engineer shall consider in the design the probability that the culvert will be blocked by debris in a severe flood, and accommodate expected overflow. Fill for culverting and bridging shall be kept to the minimum necessary to achieve property access, but is exempt from the limitations in section (A) above. Culverting or bridging of streams identified as Riparian Preservation are subject to the requirements of 18.62.075.
C. Non-residential structures shall be flood-proof to the standards in Chapter 15.10 to one foot above the elevation contained in the maps adopted by chapter 15.10, or up to the elevation contained in the official maps adopted by section 18.62.060, whichever height is greater. Where no specific elevations exist, then they must be floodproofed to an elevation of ten feet above the creek channel on Ashland, Bear or Neil Creek; to five feet above the creek channel on all other Riparian Preserve creeks defined in section 18.62.050.B; and three feet above the stream channel on all other drainage ways identified on the official maps.
D. All residential structures shall be elevated so that the lowest habitable floor shall be raised to one foot above the elevation contained in the maps adopted in chapter 15.10, or to the elevation contained in the official maps adopted by section 18.62.060, whichever height is greater. Where no specific elevations exist, then they must be constructed at an elevation of ten feet above the creek channel on Ashland, Bear, or Neil Creek; to five feet above the creek channel on all other Riparian Preserve creeks defined in section 18.62.050.B; and three feet above the stream channel on all other drainage ways identified on the official maps, or one foot above visible evidence of high flood water flow, whichever is greater. The elevation of the finished lowest habitable floor shall be certified to the city by an engineer or surveyor prior to issuance of a certificate of occupancy for the structure.
E. To the maximum extent feasible, structures shall be placed on other than Flood plain Corridor Lands. In the case where development is permitted in the Flood plain corridor area, then development shall be limited to that area which would have the shallowest flooding.
F. Existing lots with buildable land outside the Flood plain Corridor shall locate all residential structures outside the Corridor land, unless 50% or more of the lot is within the Flood plain Corridor. For residential uses proposed for existing lots that have more than 50% of the lot in Corridor land, structures may be located on that portion of the Flood plain corridor that is two feet or less below the flood elevations on the official maps, but in no case closer than 20 feet to the channel of a Riparian Preservation Creek. Construction shall be subject to the requirements in paragraph D above.
G. New non-residential uses may be located on that portion of Flood plain Corridor lands that equal to or above the flood elevations on the official maps adopted in section 18.62.060. Second story construction may be cantilevered over the Flood plain corridor for a distance of 20 feet if the clearance from finished grade is at least ten feet in height, and is supported by pillars

that will have minimal impact on the flow of floodwaters. The finished floor elevation may not be more than two feet below the flood corridor elevations.
H. All lots modified by lot line adjustments, or new lots created from lots which contain Flood plain Corridor land must contain a building envelope on all lot(s) which contain(s) buildable area of a sufficient size to accommodate the uses permitted in the underling zone, unless the action is for open space or conservation purposes. This section shall apply even if the effect is to prohibit further division of lots that are larger than the minimum size permitted in the zoning ordinance.
I. Basements.
1. Habitable basements are not permitted for new or existing structures or additions located within the Flood plain Corridor.
2. Non-habitable basements, used for storage, parking, and similar uses are permitted for residential structures but must be flood-proofed to the standards of Chapter 15.10.
J. Storage of petroleum products, pesticides, or other hazardous or toxic chemicals is not permitted in Flood plain Corridor lands.
K. Fences constructed within 20 feet of any Riparian Preservation Creek designated by this chapter shall be limited to wire or electric fence, or similar fence that will not collect debris or obstruct flood waters, but not including wire mesh or chain link fencing. Fences shall not be constructed across any identified riparian drainage or riparian preservation creek. Fences shall not be constructed within any designated floodway.
L. Decks and structures other than buildings, if constructed on Flood plain Corridor Lands and at or below the levels specified in section 18.62.070.C and D, shall be flood-proofed to the standards contained in Chapter 15.10.
M. Local streets and utility connections to developments in and adjacent to the Flood plain Corridor shall be located outside of the Flood plain Corridor, except for crossing the Corridor, and except in the Bear Creek Flood plain corridor as outlined below:
1. Public street construction may be allowed within the Bear Creek Flood plain corridor as part of development following the adopted North Mountain Neighborhood Plan. This exception shall only be permitted for that section of the Bear Creek Flood plain corridor between North Mountain Avenue and the Nevada Street right-of-way. The new street shall be constructed in the general location as indicated on the neighborhood plan map, and in the area generally described as having the shallowest potential for flooding within the corridor.
2. Proposed development that is not in accord with the North Mountain Neighborhood Plan shall not be permitted to utilize this exception.
(Ord 2808, Added, 12/02/1997)

18.62.075 Development Standards for Riparian Preservation lands

A. All development in areas indicated for Riparian Preservation, as defined in section 18.62.050 (B), shall comply with the following standards:
1. Development shall be subject to all Development Standards for Flood plain Corridor Lands (18.62.070)
2. Any tree over six inches d.b.h. shall be retained to the greatest extent feasible.
3. Fill and Culverting shall be permitted only for streets, access, or utilities. The crossing shall be at right angles to the creek channel to the greatest extent possible. Fill shall be kept to a minimum.
4. The general topography of Riparian Preservation lands shall be retained.
(Ord 2808, Added, 12/02/1997)

18.62.080 Development Standards for Hillside Lands

It is the purpose of the Development Standards for Hillside Lands to provide supplementary development regulations to underlying zones to ensure that development occurs in such a manner as to protect the natural and topographic character and identity of these areas, environmental resources, the aesthetic qualities and restorative value of lands, and the public health, safety, and general welfare by insuring that development does not create soil erosion, sedimentation of lower slopes, slide damage, flooding problems, and severe cutting or scarring.

It is the intent of these development standards to encourage a sensitive form of development and to allow for a reasonable use that complements the natural and visual character of the city.

A. General Requirements. The following general requirements shall apply in Hillside Lands:

1. All development shall occur on lands defined as having buildable area. Slopes greater than 35% shall be considered unbuildable except as allowed below. Variances may be granted to this requirement only as provided in section 18.62.080.H.

a. Existing parcels without adequate buildable area less than or equal to 35% shall be considered buildable for one unit.

b. Existing parcels without adequate buildable area less than or equal to 35% cannot be subdivided or partitioned.

2. All newly created lots either by subdivision or partition shall contain a building envelope with a slope of 35% or less.

3. New streets, flag drives, and driveways shall be constructed on lands of less than or equal to 35% slope with the following exceptions:

a. The street is indicated on the City's Transportation Plan Map - Street Dedications.

b. The portion of the street, flag drive, or driveway on land greater than 35% slope does not exceed a length of 100 feet.

4. Geotechnical Studies. For all applications on Hillside Lands involving subdivisions or partitions, the following additional information is required:

A geotechnical study prepared by a geotechnical expert indicating that the site is stable for the proposed use and development. The study shall include the following information:

a. Index map.

b. Project description to include location, topography, drainage, vegetation, discussion of previous work and discussion of field exploration methods.

c. Site geology, based on a surficial survey, to include site geologic maps, description of bedrock and surficial materials, including artificial fill, locations of any faults, folds, etc..., and structural data including bedding, jointing and shear zones, soil depth and soil structure.

d. Discussion of any off-site geologic conditions that may pose a potential hazard to the site, or that may be affected by on-site development.

e. Suitability of site for proposed development from a geologic standpoint.

f. Specific recommendations for cut and fill slope stability, seepage and drainage control or other design criteria to mitigate geologic hazards.

g. If deemed necessary by the engineer or geologist to establish whether an area to be affected by the proposed development is stable, additional studies and supportive data shall include cross-sections showing subsurface structure, graphic logs with subsurface exploration, results of laboratory test and references.

h. Signature and registration number of the engineer and/or geologist.

i. Additional information or analyses as necessary to evaluate the site.

j. Inspection schedule for the project as required in 18.62.080.B.9.

k. Location of all irrigation canals and major irrigation pipelines.

B. Hillside Grading and Erosion Control. All development on lands classified as hillside shall provide plans conforming with the following items:

1. All grading, retaining wall design, drainage, and erosion control plans for development on Hillside Lands shall be designed by a geotechnical expert. All cuts, grading or fills shall conform to Chapter 70 of the Uniform Building Code. Erosion control measures on the development site shall be required to minimize the solids in runoff from disturbed areas.

2. For development other than single family homes on individual lots, all grading, drainage improvements, or other land disturbances shall only occur from May 1 to October 31. Excavation shall not occur during the remaining wet months of the year. Erosion control measures shall be installed and functional by October 31. Up to 30 day modifications to the October 31 date, and 45 day modification to the May 1 date may be made by the Planning Director, based upon weather conditions and in consultation with the project geotechnical expert. The modification of dates shall be the minimum necessary, based upon evidence provided by the applicant, to accomplish the necessary project goals.

3. Retention in natural state. On all projects on Hillside Lands involving partitions and subdivisions, and existing lots with an area greater than one-half acre, an area equal to 25% of the total project area, plus the percentage figure of the average slope of the total project area, shall be retained in a natural state. Lands to be retained in a natural state shall be protected from damage through the use of temporary construction fencing or the functional equivalent.

For example, on a 25,000 sq. ft. lot with an average slope of 29%, 25%+29%=54% of the total lot area shall be retained in a natural state.

The retention in a natural state of areas greater than the minimum percentage required here is encouraged.

4. Grading - cuts. On all cut slopes on areas classified as Hillside lands, the following standards shall apply:

a. Cut slope angles shall be determined in relationship to the type of materials of which they are composed. Where the soil permits, limit the total area exposed to precipitation and erosion. Steep cut slopes shall be retained with stacked rock, retaining walls, or functional equivalent to control erosion and provide slope stability when necessary. Where cut slopes are required to be laid back (1:1 or less steep), the slope shall be protected with erosion control getting or structural equivalent installed per manufacturers specifications, and revegetated.

b. Exposed cut slopes, such as those for streets, driveway accesses, or yard areas, greater than seven feet in height shall be terraced. Cut faces on a terraced section shall not exceed a maximum height of five feet. Terrace widths shall be a minimum of three feet to allow for the introduction of vegetation for erosion control. Total cut slopes shall not exceed a maximum vertical height of 15 feet. (See Graphic)

The top of cut slopes not utilizing structural retaining walls shall be located a minimum setback of one-half the height of the cut slope from the nearest property line.
Cut slopes for structure foundations encouraging the reduction of effective visual bulk, such as split pad or stepped footings shall be exempted from the height limitations of this section. (See Graphic)

c. Revegetation of cut slope terraces shall include the provision of a planting plan, introduction of top soil where necessary, and the use of irrigation if necessary. The vegetation used for these areas shall be native or species similar in resource value which will survive, help reduce the visual impact of the cut slope, and assist in providing long term slope stabilization. Trees, bush-type plantings and cascading vine-type plantings may be appropriate.

5. Grading - fills. On all fill slopes on lands classified as Hillside Lands, the following standards shall apply:
a. Fill slopes shall not exceed a total vertical height of 20 feet. The toe of the fill slope area not

utilizing structural retaining shall be a minimum of six feet from the nearest property line.(Ord 2834 S6, 1998)

b. Fill slopes shall be protected with an erosion control netting, blanket or functional equivalent. Netting or blankets shall only be used in conjunction with an organic mulch such as straw or wood fiber. The blanket must be applied so that it is in complete contact with the soil so that erosion does not occur beneath it. Erosion netting or blankets shall be securely anchored to the slope in accordance with manufacturer's recommendations.

c. Utilities. Whenever possible, utilities shall not be located or installed on or in fill slopes. When determined that it necessary to install utilities on fill slopes, all plans shall be designed by a geotechnical expert.

d. Revegetation of fill slopes shall utilize native vegetation or vegetation similar in resource value and which will survive and stabilize the surface. Irrigation may be provided to ensure growth if necessary. Evidence shall be required indicating long-term viability of the proposed vegetation for the purposes of erosion control on disturbed areas.

6. Revegetation requirements. Where required by this chapter, all required revegetation of cut and fill slopes shall be installed prior to the issuance of a certificate of occupancy, signature of a required survey plat, or other time as determined by the hearing authority. Vegetation shall be installed in such a manner as to be substantially established within one year of installation.

7. Maintenance, Security, and Penalties for Erosion Control Measures.

a. Maintenance. All measures installed for the purposes of long-term erosion control, including but not limited to vegetative cover, rock walls, and landscaping, shall be maintained in perpetuity on all areas which have been disturbed, including public rights-of-way. The applicant shall provide evidence indicating the mechanisms in place to ensure maintenance of measures.

b. Security. Except for individual lots existing prior to January 1, 1998, after an Erosion Control Plan is approved by the hearing authority and prior to construction, the applicant shall provide a performance bond or other financial guarantees in the amount of 120% of the value of the erosion control measures necessary to stabilize the site. Any financial guarantee instrument proposed other than a performance bond shall be approved by the City Attorney. The financial guarantee instrument shall be in effect for a period of at least one year, and shall be released when the Planning Director and Public Works Director determine, jointly, that the site has been stabilized. All or a portion of the security retained by the City may be withheld for a period up to five years beyond the one year maintenance period if it has been determined by the City that the site has not been sufficiently stabilized against erosion.

8. Site Grading. The grading of a site on Hillside Lands shall be reviewed considering the following factors:

a. No terracing shall be allowed except for the purposes of developing a level building pad and for providing vehicular access to the pad.

b. Avoid hazardous or unstable portions of the site.(Ord 2834,S2 1998)

c. Avoid hazardous or unstable portions of the site.

d. Building pads should be of minimum size to accommodate the structure and a reasonable amount of yard space. Pads for tennis courts, swimming pools and large lawns are discouraged. As much of the remaining lot area as possible should be kept in the natural state of the original slope.

9. Inspections and Final Report. Prior to the acceptance of a subdivision by the City, signature of the final survey plat on partitions, or issuance of a certificate of occupancy for individual structures, the project geotechnical expert shall provide a final report indicating that the approved grading, drainage, and erosion control measures were installed as per the approved plans, and that all scheduled inspections, as per 18.62.080.A.4.j were conducted by the project

geotechnical expert periodically throughout the project.

C. Surface and Groundwater Drainage. All development on Hillside Lands shall conform to the following standards:

1. All facilities for the collection of stormwater runoff shall be required to be constructed on the site and according to the following requirements:

a. Stormwater facilities shall include storm drain systems associated with street construction, facilities for accommodating drainage from driveways, parking areas and other impervious surfaces, and roof drainage systems.

b. Stormwater facilities, when part of the overall site improvements, shall be, to the greatest extent feasible, the first improvements constructed on the development site.

c. Stormwater facilities shall be designed to divert surface water away from cut faces or sloping surfaces of a fill.

d. Existing natural drainage systems shall be utilized, as much as possible, in their natural state, recognizing the erosion potential from increased storm drainage..

e. Flow-retarding devices, such as detention ponds and recharge berms, shall be used where practical to minimize increases in runoff volume and peak flow rate due to development. Each facility shall consider the needs for an emergency overflow system to safely carry any overflow water to an acceptable disposal point.

f. Stormwater facilities shall be designed, constructed and maintained in a manner that will avoid erosion on-site and to adjacent and downstream properties.

g. Alternate stormwater systems, such as dry well systems, detention ponds, and leach fields, shall be designed by a registered engineer or geotechnical expert and approved by the City's Public Works Department or City Building Official.

D. Tree Conservation, Protection and Removal. All development on Hillside Lands shall conform to the following requirements:

1. Inventory of Existing Trees. A tree survey at the same scale as the project site plan shall be prepared, which locates all trees greater than six inches d.b.h., identified by d.b.h., species, approximate extent of tree canopy. In addition, for areas proposed to be disturbed, existing tree base elevations shall be provided. Dead or diseased trees shall be identified. Groups of trees in close proximity (i.e. those within five feet of each other) may be designated as a clump of trees, with the predominant species, estimated number and average diameter indicated. All tree surveys shall have an accuracy of plus or minus two feet. The name, signature, and address of the site surveyor responsible for the accuracy of the survey shall be provided on the tree survey.

Portions of the lot or project area not proposed to be disturbed by development need not be included in the inventory.

2. Evaluation of Suitability for Conservation. All trees indicated on the inventory of existing trees shall also be identified as to their suitability for conservation. When required by the hearing authority, the evaluation shall be conducted by a landscape professional. Factors included in this determination shall include:

a. Tree health. Healthy trees can better withstand the rigors of development than non-vigorous trees.

b. Tree Structure. Trees with severe decay or substantial defects are more likely to result in damage to people and property.

c. Species. Species vary in their ability to tolerate impacts and damage to their environment.

d. Potential longevity.

e. Variety. A variety of native tree species and ages.

f. Size. Large trees provide a greater protection for erosion and shade than smaller trees.

3. Tree Conservation in Project Design. Significant trees (2' d.b.h. or greater conifers and 1' d.b.h. or greater broadleaf) shall be protected and incorporated into the project design whenever possible.

a. Streets, driveways, buildings, utilities, parking areas, and other site disturbances shall be located such that the maximum number of existing trees on the site are preserved, while recognizing and following the standards for fuel reduction if the development is located in Wildfire Lands.

b. Building envelopes shall be located and sized to preserve the maximum number of trees on site while recognizing and following the standards for fuel reduction if the development is located in Wildfire Lands.

c. Layout of the project site utility and grading plan shall avoid disturbance of tree protection areas.

4. Tree Protection. On all properties where trees are required to be preserved during the course of development, the developer shall follow the following tree protection standards:

a. All trees designated for conservation shall be clearly marked on the project site. Prior to the start of any clearing, stripping, stockpiling, trenching, grading, compaction, paving or change in ground elevation, the applicant shall install fencing at the drip line of all trees to be preserved adjacent to or in the area to be altered. Temporary fencing shall be established at the perimeter of the dripline. Prior to grading or issuance of any permits, the fences may be inspected and their location approved by the Staff Advisor. (see graphic)

b. Construction site activities, including but not limited to parking, material storage, soil compaction and concrete washout, shall be arranged so as to prevent disturbances within tree protection areas.

c. No grading, stripping, compaction, or significant change in ground elevation shall be permitted within the drip line of trees designated for conservation unless indicated on the grading plans, as approved by the City, and landscape professional. If grading or construction is approved within the dripline, a landscape professional may be required to be present during grading operations, and shall have authority to require protective measures to protect the roots.

d. Changes in soil hydrology and site drainage within tree protection areas shall be minimized. Excessive site run-off shall be directed to appropriate storm drain facilities and away from trees designated for conservation.

e. Should encroachment into a tree protection area occur which causes irreparable damage, as determined by a landscape professional, to trees, the project plan shall be revised to compensate for the loss. Under no circumstances shall the developer be relieved of responsibility for compliance with the provisions of this chapter.

5. Tree Removal. Development shall be designed to preserve the maximum number of trees on a site. The development shall follow the standards for fuel reduction if the development is located in Wildfire Lands. When justified by findings of fact, the hearing authority may approve the removal of trees for one or more of the following conditions:(Ord 2834 S3, 1998)

a. The tree is located within the building envelope.

b. The tree is located within a proposed street, driveway, or parking area.

c. The tree is located within a water, sewer, or other public utility easement.

d. The tree is determined by a landscape professional to be dead or diseased, or it constitutes an unacceptable hazard to life or property when evaluated by the standards in 18.62.080.D.2.

e. The tree is located within or adjacent to areas of cuts or fills that are deemed threatening to the life of the tree, as determined by a landscape professional.

6. Tree Replacement. Trees approved for removal, with the exception of trees removed because they were determined to be diseased, dead, or a hazard, shall be replaced in compliance with the following standards:

a. Replacement trees shall be indicated on a tree replanting plan. The replanting plan shall include all locations for replacement trees, and shall also indicate tree planting details.(Ord 2834 S4, 1998)

b. Replacement trees shall be planted such that the trees will in time result in canopy equal to or greater than the tree canopy present prior to development of the property. The canopy shall be designed to mitigate of the impact of paved and developed areas, reduce surface erosion and increase slope stability.. Replacement tree locations shall consider impact on the wildfire prevention and control plan. The hearing authority shall have the discretion to adjust the proposed replacement tree canopy based upon site-specific evidence and testimony.

c. Maintenance of replacement trees shall be the responsibility of the property owner. Required replacement trees shall be continuously maintained in a healthy manner. Trees that die within the first five years after initial planting must be replaced in kind, after which a new five year replacement period shall begin. Replanting must occur within 30 days of notification unless otherwise noted. (Ord 2834 S5, 1998)

7. Enforcement.

a. All tree removal shall be done in accord with the approved tree removal and replacement plan. No trees designated for conservation shall be removed without prior approval of the City of Ashland.

b. Should the developer or developer's agent remove or destroy any tree that has been designated for conservation, the developer may be fined up to three times the current appraised value of the replacement trees and cost of replacement or up to three times the current market value, as established by a professional arborist, whichever is greater.

c. Should the developer or developer's agent damage any tree that has been designated for protection and conservation, the developer shall be penalized $50.00 per scar. If necessary, a professional arborist's report, prepared at the developer's expense, may be required to determine the extent of the damage. Should the damage result in loss of appraised value greater than determined above, the higher of the two values shall be used.

E. Building Location and Design Standards. All buildings and buildable areas proposed for Hillside Lands shall be designed and constructed in compliance with the following standards:

1. Building Envelopes. All newly created lots, either by subdivision or partition, shall contain building envelopes conforming to the following standards:

a. The building envelope shall contain a buildable area with a slope of 35% or less.

b. Building envelopes and lot design shall address the retention of a percentage of the lot in a natural state as required in 18.62.080.B.3.

c. Building envelopes shall be designed and located to maximize tree conservation as required in 18.62.080.D.3. while recognizing and following the standards for fuel reduction if the development is located in Wildfire Lands

d. It is recommended that building envelope locations should be located to avoid ridgeline exposures, and designed such that the roofline of a building within the envelope does not project above the ridgeline.

2. Building Design. To reduce hillside disturbance through the use of slope responsive design techniques, buildings on Hillside Lands, excepting those lands within the designated Historic District, shall incorporate the following into the building design and indicate features on required building permits:

a. Hillside Building Height. The height of all structures shall be measured vertically from the natural grade to the uppermost point of the roof edge or peak, wall, parapet, mansard, or other feature perpendicular to that grade. Maximum Hillside Building Height shall be 35 feet. (graphics available on original ordinance)

b. Cut buildings into hillsides to reduce effective visual bulk.

(1). Split pad or stepped footings shall be incorporated into building design to allow the structure to more closely follow the slope.
(2). Reduce building mass by utilizing below grade rooms cut into the natural slope.

c. A building stepback shall be required on all downhill building walls greater than 20 feet in height, as measured above natural grade. Stepbacks shall be a minimum of six feet. No vertical walls on the downhill elevations of new buildings shall exceed a maximum height of 20 feet above natural grade. (see graphic)

d. Continuous horizontal building planes shall not exceed a maximum length of 36 feet. Planes longer than 36 feet shall include a minimum offset of six feet. (graphic available on original ordinance)

e. It is recommended that roof forms and roof lines for new structures be broken into a series of smaller building components to reflect the irregular forms of the surrounding hillside. Long, linear unbroken roof lines are discouraged. Large gable ends on downhill elevations should be avoided, however smaller gables may be permitted. (graphic available on original ordinance)

f. It is recommended that roofs of lower floor levels be used to provide deck or outdoor space for upper floor levels. The use of overhanging decks with vertical supports in excess of 12 feet on downhill elevations should be avoided.

g. It is recommended that color selection for new structures be coordinated with the predominant colors of the surrounding landscape to minimize contrast between the structure and the natural environment

F. All structures on Hillside Lands shall have foundations which have been designed by an engineer or architect with demonstrable geotechnical design experience. A designer, as defined, shall not complete working drawings without having foundations designed by an engineer.

G. All newly created lots or lots modified by a lot line adjustment must include a building envelope on all lots that contains a buildable area less than 35% slope of sufficient size to accommodate the uses permitted in the underlying zone, unless the division or lot line adjustment is for open space or conservation purposes.

H. Administrative Variance From Development Standards for Hillside Lands - 18.62.080. A variance under this section is not subject to the variance requirements of section 18.100 and may be granted with respect to the development standards for Hillside Lands if all of the following circumstances are found to exist:

1. There is demonstrable difficulty in meeting the specific requirements of this chapter due to a unique or unusual aspect of the site or proposed use of the site;

2. The variance will result in equal or greater protection of the resources protected under this chapter;

3. The variance is the minimum necessary to alleviate the difficulty; and

4. The variance is consistent with the stated Purpose and Intent of the Physical and Environmental Constraints Chapter and section 18.62.080.
Appeals of decisions involving administrative variances shall be processed as outlined in 18.108.070.

(Ord 2808, Added, 12/02/1997)

18.62.090 Development Standards for Wildfire Lands

A. Requirements for Subdivisions, Performance Standards Developments, or Partitions.
1. A Fire Prevention and Control Plan shall be required with the submission of any application for an outline plan approval of a Performance Standards Development, preliminary plat of a subdivision, or application to partition land which contained areas designated Wildfire Hazard areas.
2. The Staff Advisor shall forward the Fire Prevention and Control Plan to the Fire Chief within 3 days of the receipt of a completed application. The Fire Chief shall review the Fire Prevention and Control Plan, and submit a written report to the Staff Advisor no less than 7 days before the scheduled hearing. The Fire Chief's report shall be a part of the record of the Planning Action.
3. The Fire Prevention and Control Plan, prepared at the same scale as the development plans, shall include the following items:
a. An analysis of the fire hazards on the site from wildfire, as influenced by existing vegetation and topography.
b. A map showing the areas that are to be cleared of dead, dying, or severely diseased vegetation.
c. A map of the areas that are to be thinned to reduce the interlocking canopy of trees.
d. A tree management plan showing the location of all trees that are to be preserved and removed on each lot. In the case of heavily forested parcels, only trees scheduled for removal shall be shown.
e. The areas of Primary and Secondary Fuel Breaks that are required to be installed around each structure, as required by 18.62.090 B.
f. Roads and driveways sufficient for emergency vehicle access and fire suppression activities, including the slope of all roads and driveways within the Wildfire Lands area.
4. Criterion for Approval. The hearing authority shall approve the Fire Prevention and Control Plan when, in addition to the findings required by this chapter, the additional finding is made that the wildfire hazards present on the property have been reduced to a reasonable degree, balanced with the need to preserve and/or plant a sufficient number of trees and plants for erosion prevention, wildlife habitat, and aesthetics.
5. The hearing authority may require, through the imposition of conditions attached to the approval, the following requirements as deemed appropriate for the development of the property:
a. Delineation of areas of heavy vegetation to be thinned and a formal plan for such thinning.
b. Clearing of sufficient vegetation to reduce fuel load.
c. Removal of all dead and dying trees.
d. Relocation of structures and roads to reduce the risks of wildfire and improve the chances of successful fire suppression.
6. The Fire Prevention and Control Plan shall be implemented during the public improvements required of a subdivision or Performance Standards Development, and shall be considered part of the subdivider's obligations for land development. The Plan shall be implemented prior to the issuance of any building permit for structures to be located on lots created by partitions and for subdivisions or Performance Standards developments not requiring public improvements. The Fire Chief, or designee, shall inspect and approve the implementation of the Fire Prevention and Control Plan, and the Plan shall not be considered fully implemented until the Fire Chief has given written notice to the Staff Advisor that the Plan was completed as approved by the hearing authority.
7. In subdivisions or Performance Standards Developments, provisions for the maintenance of the Fire Prevention and Control Plan shall be included in the covenants, conditions and restrictions for the development, and the City of Ashland shall be named as a beneficiary of

such covenants, restrictions, and conditions.
8. On lots created by partitions, the property owner shall be responsible for maintaining the property in accord with the requirements of the Fire Prevention and Control Plan approved by the hearing authority.
B. Requirements for construction of all structures.
1. All new construction and any construction expanding the size of an existing structure, shall have a "fuel break" as defined below.
2. A "fuel break" is defined as an area which is free of dead or dying vegetation, and has native, fast-burning species sufficiently thinned so that there is no interlocking canopy of this type of vegetation. Where necessary for erosion control or aesthetic purposes, the fuel break may be planted in slow-burning species. Establishment of a fuel break does not involve stripping the ground of all native vegetation. "Fuel Breaks" may include structures, and shall not limit distance between structures and residences beyond that required by other sections of this title.
3. Primary Fuel Break - A primary fuel break will be installed, maintained and shall extend a minimum of 30 feet, or to the property line, whichever is less, in all directions around structures, excluding fences, on the property. The goal within this area is to remove ground cover that will produce flame lengths in excess of one foot. Such a fuel break shall be increased by ten feet for each 10% increase in slope over 10%. Adjacent property owners are encouraged to cooperate on the development of primary fuel breaks.
4. Secondary Fuel Break - A secondary fuel break will be installed, maintained and shall extend a minimum of 100 feet beyond the primary fuel break where surrounding landscape is owned and under the control of the property owner during construction. The goal of the secondary fuel break is to reduce fuels so that the overall intensity of any wildfire is reduced through fuels control.
5. All structures shall be constructed or re-roofed with Class B or better non-wood roof coverings, as determined by the Oregon Structural Specialty Code. All re-roofing of existing structures in the Wildfire Lands area for which at least 50% of the roofing area requires re-roofing shall be done under approval of a zoning permit. No structure shall be constructed or re-roofed with wooden shingles, shakes, wood-product material or other combustible roofing material, as defined in the City's building code.
C. Fuel breaks in areas which are also Erosive or Slope Failure Lands shall be included in the erosion control measures outlined in section 18.62.080.
D. Implementation.
1. For land which have been subdivided and required to comply with A. (6) above, all requirements of the Plan shall be complied with prior to the commencement of construction with combustible materials.
2. For all other structures, the vegetation control requirements of section (B) above shall be complied with before the commencement of construction with combustible materials on the lot. (Ord. 2657, 1991)
3. As of November 1, 1994, existing residences in subdivisions developed outside of the Wildfire Lands Zone, but later included due to amendments to the zone boundaries shall be exempt from the requirements of this zone, with the exception of section 18.62.090 B.5. above. All new residences shall comply with all standards for new construction in section 18.62.090 B.
4. Subdivisions developed outside of the wildfire lands zone prior to November 1, 1994, but later included as part of the zone boundary amendment, shall not be required to prepare or implement Fire Prevention and Control Plans outlined in section 18.62.090 A. (Ord 2747, 1994) (Ord 2808, Added, 12/02/1997)

18.62.100 Development Standards for Severe Constraint Lands

A. Severe Constraint Lands are extremely sensitive to development, grading, filling, or vegetation removal and, whenever possible, alternative development should be considered.
B. Development of floodways is not permitted except for bridges and road crossings. Such crossings shall be designed to pass the 100 year flood without raising the upstream flood height more than six inches.
C. Development on lands greater than 35% slope shall meet all requirements of section 18.62.080 in addition to the requirements of this section.
D. Development of land or approval for a planning action shall be allowed only when the following study has been accomplished. An engineering geologic study approved by the City's Public Works Director and Planning Director establishes that the site is stable for the proposed

use and development. The study shall include the following:
1. Index map.
2. Project description to include location, topography, drainage, vegetation, discussion of previous work and discussion of field exploration methods.
3. Site geology, based on a surficial survey, to include site geologic maps, description of bedrock and surficial materials, including artificial fill, locations of any faults, folds, etc., and structural data including bedding, jointing and shear zones, soil depth and soil structure.
4. Discussion of any off-site geologic conditions that may pose a potential hazard to the site, or that may be affected by on-site development.
5. Suitability of site for proposed development from a geologic standpoint.
6. Specific recommendations for cut slope stability, seepage and drainage control or other design criteria to mitigate geologic hazards.
7. If deemed necessary by the engineer or geologist to establish whether an area to be affected by the proposed development is stable, additional studies and supportive data shall include cross-sections showing subsurface structure, graphic logs with subsurface exploration, results of laboratory test and references.
8. Signature and registration number of the engineer and/or geologist.
9. Additional information or analyses as necessary to evaluate the site.
(Ord 2808, Added, 12/02/1997)

18.62.110 Density Transfer

Density may be transferred out of unbuildable areas to buildable areas of a lot provided the following standards are met:
A. Partitions and subdivisions involving density transfer shall be processed under Performance Standards, Chapter 18.88 of the Ashland Municipal Code.
B. A map shall be submitted showing the net buildable area to which the density will be transferred.
C. A covenant shall be recorded limiting development on the area from which density is transferred.
D. Density may not be transferred from one ownership to another but only within the lot(s) owned by the same person.
E. Density may be transferred only on contiguous lots under common ownership.
F. The density of the buildable area may not be increased to more than two (2) times the permitted density of the underlying zone. Fractional units are to be rounded down to the next whole number. (Ord. 2528, 1989)
(Ord 2808, Added, 12/02/1997)

18.62.130 Penalties

The following sections are in addition to the enforcement actions that may be taken and penalties which may be imposed in chapter 18.112 for a violation of this chapter:
A. Whenever any work is being done contrary to the provisions of this chapter or whenever erosion control measures, tree protection measures, wildfire control measures, or Flood plain corridor development measures are not being properly maintained or are not functioning properly due to faulty installation or neglect, the director of community development or the director's designee, may order the work stopped by notice in writing served on any persons engaged in the doing or causing of such work to be done, and any such persons shall immediately stop work until authorized by the director or designee to proceed with the work.
B. All development under this chapter and all work or construction for which a permit is required under this chapter shall be subject to inspection by the director of community development or the director's designee. When an inspection is made under this section or when it is necessary to make an inspection to enforce this code, or when the director or designee has reasonable cause to believe that there exists upon Hillside Lands a condition which is contrary to or in violation of this chapter which makes the premises unsafe, dangerous or hazardous, the director or designee may enter the premises at reasonable times to inspect or to perform the duties imposed by this chapter. The director or designee shall first make a reasonable effort to locate the owner or other person having charge of the premises and request entry.
C. The City may refuse to accept any development permit application, may revoke or suspend

any development or building permit, or may deny occupancy on the property until erosion control measures, tree protection measures, wildfire control measures, or Flood plain corridor development measures have been installed properly and are maintained in accordance with the requirements of this chapter.
D. The owner of the property from which erosion occurs due to failure or neglect of erosion control measures, together with any person or parties who cause such erosion shall be responsible to mitigate the impacts of the erosion and prevent future erosion.
(Ord 2808, Added, 12/02/1997)

CITY OF ASHLAND BUILDING PERMIT APPLICATION CHECKLIST AND EXAMPLE FEE ESTIMATE

CITY OF
ASHLAND

TO: Jacob Young

FROM: Rosemary Harvey, Building Department

Phone: 541-552-2072

RE: Commercial Building Application Checklist

DATE: 10/19//2006

Building Permit fees for structural only (based on $500,000 valuation) = $12,296.56.
Other fees not included are plumbing, mechanical, electrical, connect fees and the attached lists. **Note: Sewer & Water SDC's will be changing in 30-60 days.** Feel free to call me if you have any further questions.

Building Department
51 Winburn Way
Ashland, Oregon 97520
www.ashland.or.us

Tel: 541-488-5309
Fax: 541-488-6006
TTY: 800-735-2900

COMMERCIAL BUILDING PERMIT APPLICATION CHECKLIST

CITY OF ASHLAND - BUILDING DIVISION

Location: Applicant:

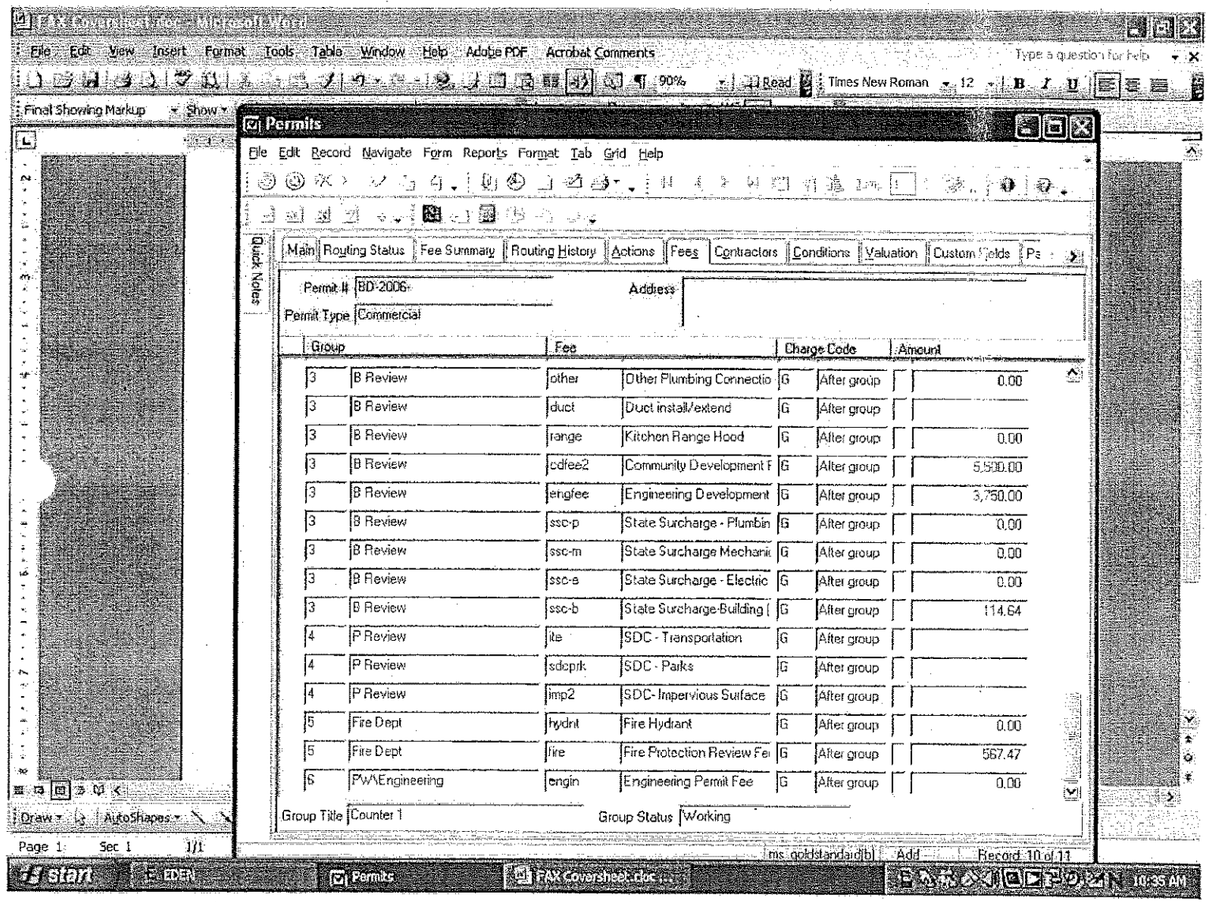
Yes	No	N/A	
			General Information:
			Project name and location
			Design professional, architect and /or engineer(s) name and phone #
			Three (3) sets of plans
			Names, addresses and phone #'s of all owners and contractors w/ license #
			Total square footage of inpervious surfaces
			Gross square footage
			Demolished structures information
			Remodels: Total # of plumbing fixtures being removed, relocated or added
			Any conditions imposed as part of an approved planning action shall be shown
			Structural design loads shown on plans (snow load, wind & exposure)
			Plot plan
			Show all proposed and existing buildings
			Direction indicator (show north)
			Easement location, public & private. All maintenance agreements for common areas.
			Distances to property lines and buildings
			Location of storm drains, sanitary sewer, water service connection and electric service panel
			Foundation Plan
			Elevation of footing and foundation details (including hold downs and their locations)
			Floor Plan
			Show each floor and use of all rooms and other areas
			If remodel / addition show existing floor plan.
			Framing cross section & details
			Show coverings for all surfaces (roofing, ceilings interior, exterior and projections)
			Elevations
			Show all sides of building
			Roof Plan
			Engineered Trusses (Deferred)
			Electrical Plan
			One line drawings
			Mechanical Plan
			Show all heating, ventilation and A/C equipment and location of each
			Gas line schematic diagram w/ BTU requirements of each fixture (appliance)
			Plumbing Plan
			Show riser diagram with all pipe sizes for DWV system and water system
			Show back flow devices
			Drainage System
			Show spot elevations to determine direction of runoff to storm sewer
			Landscape System
			Include sprinkler and low voltabe electrical
			Energy Forms
			Building Shell - Sec. 3 (Frame type, Insulation, Windows, Doors & skylights)
			HVAC System - Sec. 4
			Lighting System - Sec. 5
			Excavation Permit Requirements
			Location of Retaining walls and corresponding engineering
			Topography of Site
			Easements/Rights of Way - Label for roads and utility locations
			PW Permit City Engineer Signature
			Electric Utility distribution plan w/stamp
			Preliminary Plat
			Engineering grading plan (show elevations for cuts and fills with total cubic yardage)
			Soils report

Signiture of applicant submitting plans Inspector Date

* This list does not constitute a plan review.

CITY OF ASHLAND

checklist, com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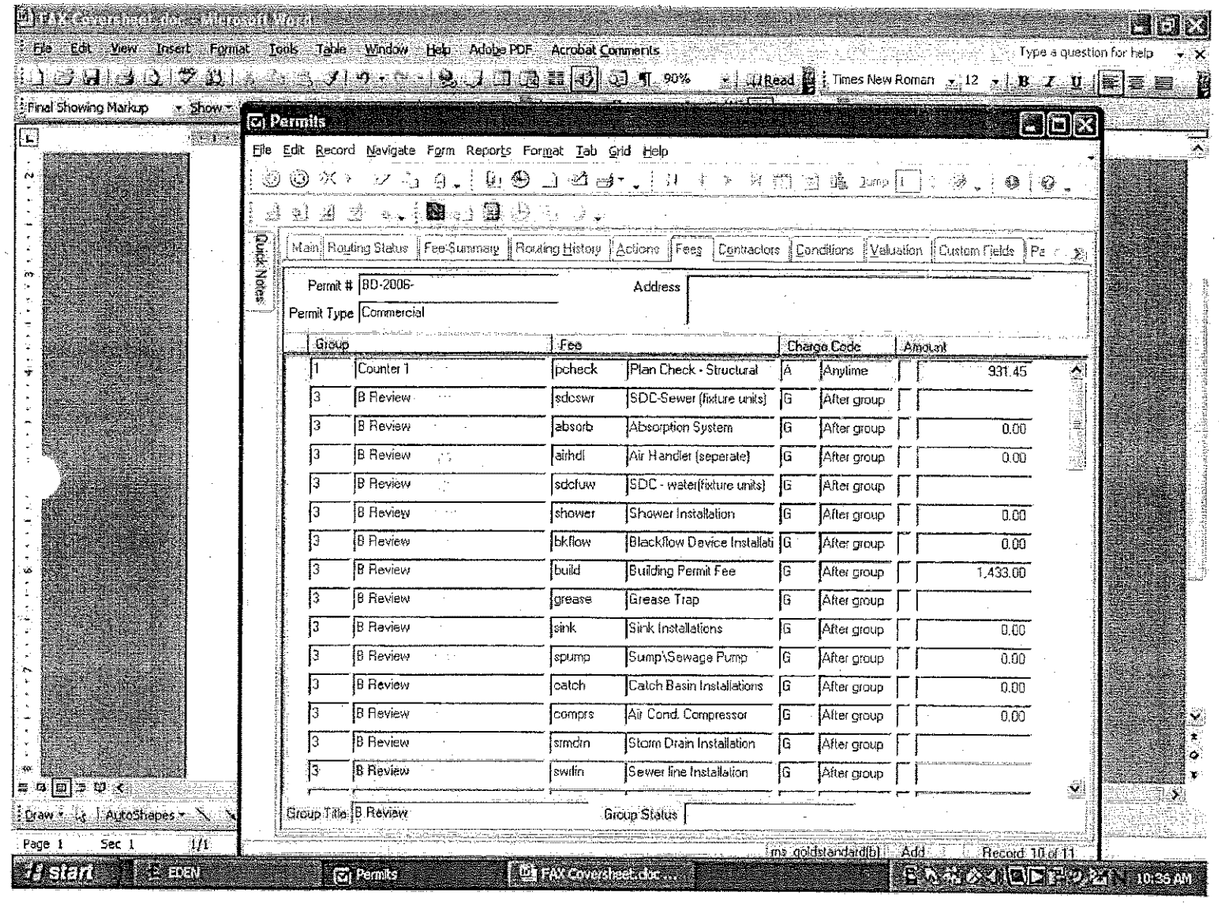
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3 B Review bkflow Blackflow Device Installati G After group 0.00
3 B Review build Building Permit Fee G After group 1,433.00
3 B Review grease Grease Trap G After group
3 B Review sink Sink Installations G After group 0.00
3 B Review spump Sump\Sewage Pump G After group 0.00
3 B Review catch Catch Basin Installations G After group 0.00
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CITY OF
ASHLAND

COMMERCIAL

SYSTEMS DEVELOPMENT CHARGES
(SDCs)

Systems development charges (SDCs) are fees collected to help pay for growth related improvements in the following areas: water distribution\treatment\collection, sewer collection\treatment, transportation, storm water collection, and parks and recreation\open space acquisition.

If you are building a new structure or adding onto an existing one, the following fees will be assessed along with standard building permit fees:

WATER SDC

Based on number of fixture units. To calculate, see the attached sheet to determine the number of plumbing fixture units and multiply the total number of fixture units by the price per fixture unit. You will be credited for any existing fixtures. Please note on your plans any existing fixtures so they can be credited accordingly.

Tourist Accommodation Room	**$247.60/fixture unit**
Commercial/Retail Building	**$149.02/fixture unit**

SANITARY SEWER SDC

Based on fixture units. To calculate, see the attached sheet to determine the number of plumbing fixture units and multiply the total number of fixture units by the price per fixture unit. You will be credited for any existing fixtures. Please note on your plans any existing fixtures so they can be credited accordingly.

Tourist Accommodation Room	**$223.40/fixture unit**
Commercial/Retail Building	**$109.81/fixture unit**

STORM SEWER SDC

If you are adding roof area, driveway or any other impervious surface, you will be assessed for storm water collection. To calculate, ***multiply $0.1689 by the total square footage of the impervious surfaces.***

PARK AND RECREATION SDC

Tourist Accommodation Room	**$748.00**

TRANSPORTATION SDC

Based on the land use category for each project. Average vehicle trips for each use is multiplied by the trip cost, which is based on the Ashland Transportation System Plan. To calculate, **see the attached listing and multiply the unit measurement by cost per unit.**

CITY OF ASHLAND
DEPT OF COMMUNITY DEVELOPMENT
20 EAST MAIN ST
ASHLAND, OR 97520

541-488-5305
541-488-5311 (FAX)
www.ashland.or.us

2000 Oregon State Plumbing Specialty Code
Water Supply Fixture Units (WSFU)

Individual Fixtures	General Use	Heavy-Use Assembly
Bar Sink	2.0	
Bathtub or Comb. Bath/Shower	4.0	
Clinic Sink	8.0	
Washing Machine	4.0	
Dental Unit, cuspidor	1.0	
Dishwasher	1.5	
Drinking Fountain (ea. Head)	0.5	0.75
Kitchen Sink	1.5	
Laundry Sink	2.0	
Lavatory	1.0	1.0
Salon Sink	2.0	
Service Sink or Mop Basin	3.0	
Shower	2.0	
Urinal 1.0 GPF	4.0	5.0
Washup Sink, each set of faucets	2.0	
Water closet, 1.6 GPF gravity tank	2.5	4.0
Water Closet, 1.6 GPF Flushometer Tank	2.5	3.5
Water Closet, 1.6 GPF Flushometer Valve	5.0	8.0
Whirlpool Bath or Comb. Bath/ Shower	4.0	

Note:
"General Use" applies to business, commercial, industrial, and assembly occupancies other than those defined under "Heavy Use." Included are public and common areas in hotels, motels, and multi-dwelling buildings.
"Heavy-use Assembly" applies to toilet facilities in occupancies which place a heavy, but intermittent, time based demand on the water supply system, such as schools, auditoriums, stadiums, race courses, transportation terminals, theaters, and similar occupancies where queuing is likely to occur during periods of peak use.

ITE Trip Generation Rates &
ELNDT Adjustment Factors

ITE Land Use	Notes	ITE Land Use Code	Average Weekday ITE Trip Rate		Equivalent Length New Daily Trip & ELNDT Adjustment Factors		Cost Per Unit
			Rate	Unit(*)	Trip Length	Linked Trip	$214
RESIDENTIAL							
Single Family		210	9.55	Dwelling Unit	1.00	1.0	2,043.70
Multi-Family		220	6.47	Dwelling Unit	0.97	1.0	1,343.04
Residential Condominium		230	5.86	Dwelling Unit	0.97	1.0	1,216.42
Manufactured Housing		240	4.81	Occupied Dwelling Unit	0.97	1.0	998.40
Recreational Home/Condo		260	3.16	Dwelling Unit	1.00	1.0	676.24
INSTITUTIONAL							
Truck Terminals	1	30	9.85	1,000 sf GFA	1.12	1.0	2,360.85
Bus Depot	5		25	1000 sf GFA	1.00	1.0	5,350.00
Park	1	411	2.23	Acres	0.90	1.0	429.50
City (developed)	5		50	Acres	0.90	1.0	9,630.00
Neighborhood (undeveloped)	5		5	Acres	0.90	1.0	963.00
Amusement (Theme)	5		80	Acres	0.90	1.0	15,408.00
Golf Course	2	430	37.59	Holes	0.91	1.0	7,320.26
Movie Theatre	1	443	1.76	Seats	0.46	1.0	173.25
Racquet Club	2	492	17.14	1,000 sf GFA	0.51	1.0	1,870.66
Racquetball	5		40	1,000 sf GFA	0.51	1.0	4,365.60
Tennis	5		30	Court	0.51	1.0	3,274.20
Military Base		501	1.78	Employee	1.00	1.0	380.92
Elementary School		520	1.09	Student	1.08	1.0	251.92
Junior High School	4		1.20	Student	1.08	1.0	277.34
High School		530	1.38	Student	1.08	1.0	318.95
Junior/Community College	1, 3	540	1.33	Student	1.08	1.0	307.39
Church		560	9.32	1,000 sf GFA	1.08	1.0	2,154.04
Day Care Center/Preschool	2	565	4.65	Student	0.23	1.0	228.87
Library	1	590	45.50	1,000 sf GFA	0.49	1.0	4,771.13
Hospital		610	16.78	1,000 sf GFA	0.95	1.0	3,411.37
Nursing Home		620	2.60	Occupied Bed	0.95	1.0	528.58
BUSINESS & COMMERCIAL							
Hotel/Motel		310	8.70	Occupied Room	0.69	0.75	963.48
Building Materials/Lumber		812	30.56	1,000 sf GFA	0.49	0.75	2,403.39
Specialty Retail Center	1	814	40.67	1,000 sf GFA	0.49	0.75	3,198.49
Discount Stores		815	70.13	1,000 sf GFA	0.49	0.75	5,515.37
Hardware/Paint Stores	1	816	51.29	1,000 sf GFA	0.49	0.75	4,033.70
Nursery-Retail	2	817	36.08	1,000 sf GFA	0.49	0.75	2,837.51
Shopping Center		820					
(under 50,000 sf GFA)		820	167.59	1,000 sf GFA	0.31	0.28	3,113.02
(50,000 - 99,999 sf GFA)		820	91.65	1,000 sf GFA	0.33	0.50	3,236.16
(100,000 - 199,999 sf GFA)		820	70.67	1,000 sf GFA	0.40	0.61	3,690.10
(200,000 - 299,999 sf GFA)		820	54.50	1,000 sf GFA	0.49	0.67	3,828.90
(300,000 - 399,999 sf GFA)		820	46.81	1,000 sf GFA	0.49	0.71	3,485.03
(400,000 - 499,999 sf GFA)		820	42.02	1,000 sf GFA	0.49	0.73	3,216.54
(500,000 - 599,999 sf GFA)		820	38.65	1,000 sf GFA	0.49	0.80	3,242.27
High Turnover Sit-Down Restaurant	1	832	205.36	1,000 sf GFA	0.19	0.75	6,262.46
Fast Food Restaurant		833	786.22	1,000 sf GFA	0.09	0.51	7,722.72
New Car Sales		841	47.91	1,000 sf GFA	0.60	0.75	4,613.73
Service Station	1, 3	844	142.54	Gasoline Pump	0.07	0.77	1,644.14
Supermarket	1	850	87.82	Employee	0.14	0.46	1,210.30
Convenience Market	2	851	737.99	1,000 sf GFA	0.08	0.35	4,422.04
Convenience Market w/ Gas Pump	3, 5	853	194.34	Gasoline Pump	0.32	0.22	2,927.85
Apparel Store	3	870	31.27	1,000 sf GFA	0.49	0.75	2,459.23
Furniture Store	2	890	4.34	1,000 sf GFA	0.49	0.75	341.32
Bank/Savings: Walk-in	1	911	140.61	1,000 sf GFA	0.17	0.75	3,836.54
Bank/Savings: Drive-in	2	912	265.21	1,000 sf GFA	0.17	0.55	5,306.58

ITE Trip Generation Rates & ELNDT Adjustment Factors

ITE Land Use	Notes	ITE Land Use Code	Average Weekday ITE Trip Rate		Equivalent Length New Daily Trip & ELNDT Adjustment Factors		Cost Per Unit
			Rate	Unit(*)	Trip Length	Linked Trip	$214
OFFICE							
Clinic	1	630	23.79	1,000 sf GFA	0.53	1.0	2,698.26
General Office		710					0.00
(Under 100,000 sf GFA)		710	16.58	1,000 sf GFA	0.65	1.0	2,306.28
(100,000-199,999 sf GFA)		710	14.03	1,000 sf GFA	0.65	1.0	1,951.57
(200,000 sf GFA and over)		710	11.85	1,000 sf GFA	0.65	1.0	1,648.34
Medical Office Building		720	34.17	1,000 sf GFA	0.53	1.0	3,875.56
Government Office Bldg.	1	730	68.93	1,000 sf GFA	0.96	1.0	14,160.98
State Motor Vehicles Dept		731	166.02	1,000 sf GFA	0.96	1.0	34,107.15
U.S. Post Office	2	732	87.12	1,000 sf GFA	0.96	1.0	17,897.93
Research Center		760	7.70	1,000 sf GFA	0.67	1.0	1,104.03
Business Park		770	14.37	1,000 sf GFA	0.67	1.0	2,060.37
INDUSTRIAL							
General Light Industrial		110	6.97	1,000 sf GFA	1.12	1.0	1,670.57
General Heavy Industrial	1	120	1.50	1,000 sf GFA	1.12	1.0	359.52
Industrial Park	2	130	6.97	1,000 sf GFA	1.12	1.0	1,670.57
Manufacturing		140	3.85	1,000 sf GFA	1.12	1.0	922.77
Warehouse		150	4.88	1,000 sf GFA	1.12	1.0	1,169.64
Mini-Warehouse		151	2.61	1,000 sf GFA	0.47	1.0	262.51
Utilities	1	170	1.06	Employees	1.00	1.0	226.84
Wholesale	1	860	6.73	1,000 sf GFA	0.49	1.0	705.71

* Abbreviations include: GFA = Gross Floor Area and sf = square feet.

The ratio between GFA and gross leasable area (GLA), as cited for shopping center in ITE Trip Generation is 1.5 : 1.
The ITE Trip Generation rates are factored up by 14% to derive GFA weekday rates.

Notes:

(1) The ITE Trip Generation has less than 5 studies supporting this average rate. Applicants are strongly encouraged to conduct, at their own expense, independent trip generation studies in support of their application.

(2) The fitted relationship between the number of units and the average weekday trip generation as noted in ITE Trip Generation has a coefficient of correlation (R2) of less than 0.70. Applicants are strongly encouraged to conduct, at their own expense, independent trip generation studies in support of their application.

(3) The rate shown has been approximated from the published p.m. peak hour trip generation rate. Applicants are strongly encouraged to conduct, at their own expense, independent trip generation studies in support of their application.

(4) Average of elementary and high school trip generation rates.

(5) San Diego Traffic Generators, San Diego Association of Governments, March 1993.

CITY OF
ASHLAND

COMMERCIAL FEE ESTIMATE WORKSHEET

It is extremely difficult to give an accurate estimate of permit fees without conducting a complete plan review. To get a rough idea of estimated fees for your project, please complete items 1-5 below and be prepared to provide specific details of all work (location, use and specific structural, plumbing, mechanical and electrical work) to be done.

1) PROJECT VALUATION (Labor & Materials):_____
2) SQUARE FOOTAGE (Gross square footage of floor area):_____
3) SQUARE FOOTAGE (Total Impervious square footage):_____
4) FIXTURE UNIT COUNT (Based on 2000 Oregon State Plumbing Code sheet, attached):_____
5) INTENDED USE OF BUILDING (Medical, office, warehouse, etc.)_____

A) BUILDING PERMIT FEE Based on valuation_____
B) PLAN REVIEW FEE 65% of Building Permit Fee (A) = _____
C) PLUMBING PERMIT FEE Based on actual plumbing work being done _____
D) MECHANICAL PERMIT FEE Based on actual mechanical work being done _____
E) ELECTRICAL PERMIT FEE Based on actual electrical work being done _____
F) STATE SURCHARGE 7% of total permit fees A,C,D, & E = _____
G) UTILITY FEES
Contact the applicable utility departments - Electric, Water, Sewer, & Public Works/Engineering - and Avista for Natural Gas _____
H) SDC – WATER & SEWER Fixture Units (4) x Per Fixture Unit Cost = _____
I) SDC - STORM SEWER $0.1398 x Impervious Square Footage (3) = _____
J) SDC – PARKS (*If applicable*) _____
K) SDC – TRANSPORTATION *Number of units x per unit cost, from ITE chart* = _____
L) COMM DEV FEE *0.009 x the project value (1)* = _____
M) ENGINEERING FEE *0.0075 x the project value (1)* = _____

TOTAL OF A-M ABOVE IS YOUR ESTIMATED PERMIT FEE _____

You must have all planning approvals prior to building permit issuance. This estimate does not include any planning fees that may apply.

Actual permit fees are determined during plan review, which may take 4-6 weeks depending on your project specifics.

REMEMBER that all commercial work must be done by a licensed contractor. A property owner can not work on their own commercial property unless they are licensed as a contractor by the State of Oregon.

CITY OF ASHLAND
DEPT OF COMMUNITY DEVELOPMENT
20 EAST MAIN ST
ASHLAND, OR 97520

541-488-5305
541-488-5311 (FAX)
www.ashland.or.us

APPENDIX E. STATE ADMINISTRATIVE CODE – DRINKING WATER

OAR CHAPTER 333
DIVISION 061
PUBLIC WATER SYSTEMS
Effective 10-21-04

333-061-0050 Construction Standards

(1) General:

(a) These standards shall apply to the construction of new public water systems and to major additions or modifications to existing public water systems and are intended to assure that the system facilities, when constructed, will be free of public health hazards and will be capable of producing water which consistently complies with the maximum contaminant levels;

(b) Public water systems which may not comply fully with these construction standards, shall be allowed to continue in operation and shall not be required to undertake alterations to existing facilities, unless the standard is listed as a significant deficiency as prescribed in OAR 333-061-0076(3) or maximum contaminant levels are being exceeded. Existing facilities are:

(A) Facilities at public water systems constructed or installed prior to August 21, 1981; and

(B) Facilities at public water systems which have been in continual use in or as a public water system and not inoperative for more than 1 year.

(c) Non-public water systems that are converted to public water systems shall be modified as necessary to conform to the requirements of this rule.

(d) Facilities at public water systems shall be designed and constructed in a manner such that contamination will be effectively excluded, and the structures and piping will be capable of safely withstanding external and internal forces acting upon them;

(e) Only materials designed for potable water service and meeting National Sanitation Foundation Standard 61, Section 9 - Drinking Water System Components - Health Effects (Revised September, 1994) or equivalent shall be used in those elements of the water system which are in contact with potable water;

(f) New tanks, pumps, equipment, pipe valves and fittings shall be used in the construction of new public water systems, major additions or major modifications to existing water systems. The Department may permit the use of used items when it can be demonstrated that they have been renovated and are suitable for use in public water systems;

(g) Prior to construction of new facilities, the water supplier shall submit plans to the Department for approval as specified in OAR 333-061-0060(1)(a).

(h) Construction may deviate from the requirements of this section provided that documentation is submitted, to the satisfaction of the Department, that the deviation is equal to or superior to the requirements of this section as specified in OAR 333-061-0055 (variances from construction standards).

(i) A public water system or other Responsible Management Authority using groundwater, or groundwater under the direct influence of surface water, derived from springs, confined or unconfined wells that wish to have a state certified wellhead protection program shall comply with the requirements as specified in OAR 333-061-0057, 0060, and 0065, as well as OAR 340-040-0140 through 0200. Additional technical information is available in the **Oregon Wellhead Protection Guidance Manual.**

(j) All new groundwater sources are subject to consideration for potential direct influence of surface water as prescribed in OAR 333-061-0032(7).

(2) Groundwater:

(a) Wells:

(A) For the purpose of this rule, wells are defined as holes or other excavations that are drilled, dug or otherwise constructed for the purpose of capturing groundwater or groundwater in hydraulic connection with surface water as a source of public drinking water.

(B) The area within 100 feet of the well shall be owned by the water supplier, or a perpetual restrictive easement shall be obtained by the water supplier for all land (with the exception of public rights-of-way) within 100 feet of the well. The easement shall be recorded with the county in which the well is located and with the recorded deed to the property. A certified true copy shall be filed with the Department;

(C) Not withstanding paragraph (2)(a)(A) of this rule, wells located on land owned by a public entity, (Federal, State, County, Municipality) which is not the water supplier, a permit issued by the public entity to the water supplier shall suffice in lieu of an easement. Said permit shall state that no existing or potential public health hazard shall be permitted within a minimum of 100 feet of a well site;

(D) Not withstanding paragraph (2)(a)(A) of this rule, in those areas served by community gravity sanitary sewers, the area of ownership or control may be reduced to 50 feet;

(E) Public or private roadways may be allowed within 100 feet of a confined well, provided the well is protected against contamination from surface runoff or hazardous liquids which

may be spilled on the roadway and is protected from unauthorized access;

(F) The following sanitary hazards are not allowed within 100 feet of a well which serves a public water system unless waived by the Department: any existing or proposed pit privy, subsurface sewage disposal drain field; cesspool; solid waste disposal site; pressure sewer line; buried fuel storage tank; animal yard, feedlot or animal waste storage; untreated storm water or gray water disposal; chemical (including solvents, pesticides and fertilizers) storage, usage or application; fuel transfer or storage; mineral resource extraction, vehicle or machinery maintenance or long term storage; junk/auto/scrap yard; cemetery; unapproved well; well that has not been properly abandoned or of unknown or suspect construction; source of pathogenic organisms or any other similar public health hazards. No gravity sewer line or septic tank shall be permitted within 50 feet of a well which serves a public water system. Clearances greater than indicated above shall be provided when it is determined by the Department that the aquifer sensitivity and degree of hazard require a greater degree of protection. Above-ground fuel storage tanks provided for emergency water pumping equipment may be exempted from this requirement by the Department provided that a secondary containment system is in place that will accommodate 125% of the fuel tank storage;

(G) Wells shall not be located at sites which are prone to flooding. In cases where the site is subject to flooding, the area around the well shall be mounded, and the top of the well casing shall be extended at least 2 feet above the anticipated 100-year (1%) flood level;

(H) Except as otherwise provided herein, wells shall be constructed in accordance with the general standards for the construction and maintenance of water wells in Oregon as prescribed in OAR Chapter 690, Departments 200 through 220;

(I) Wells as defined in paragraph (2)(a)(A) of this rule that are less than 12 feet in depth must be constructed so as to be cased and sealed from the surface to a minimum of three feet above the bottom of the well. The casing may consist of concrete or metal culvert pipe or other pre-approved materials. The seal shall be watertight, be a minimum of four inches in thickness and may consist of cement, bentonite or concrete (see concrete requirements prescribed in OAR 690-210-315). The construction and placement of these wells must comply with all requirements of this rule.

(J) Before a well is placed into operation as the source of supply at a public water system, laboratory reports as required by OAR rule 333-061-0036 shall be submitted by the water supplier;

(K) Water obtained from wells which exceed the maximum contaminant levels shall be treated as outlined in section (4) of this rule;

(L) The pump installation, piping arrangements, other appurtenances, and well house details at wells which serve as the source of supply for a public water system, shall meet the following requirements:

(i) The line shaft bearings of turbine pumps shall be water-lubricated, except that bearings lubricated with non-toxic approved food-grade lubricants may be permitted in wells where water-lubricated bearings are not feasible due to depth to the water;

(ii) Where turbine pumps are installed, the top of the casing shall be sealed into the pump motor. Where submersible pumps are installed, the top of the casing shall be provided with a watertight sanitary seal;

(iii) A casing vent shall be provided and shall be fitted with a screened return bend;

(iv) Provisions shall be made for determining the depth to water surface in the well under pumping and static conditions;

(v) A sampling tap shall be provided on the pump discharge line;

(vi) Piping arrangements shall include provisions for pumping the total flow from the well to waste;

(vii) A method of determining the total output of each well shall be provided. This requirement may be waived by the Department at confined wells which serve as the source of supply for Transient NonCommunity water systems;

(viii) A reinforced concrete slab shall be poured around the well casing at ground surface. The slab shall be sloped to drain away from the casing;

(ix) The ground surface around the well slab shall be graded so that drainage is away from the well;

(x) The top of the well casing shall extend at least 12 inches above the concrete slab;

(xi) Provisions shall be made for protecting pump controls and other above-ground appurtenances at the well head. Where a wellhouse is installed for this purpose, it shall meet applicable building codes and shall be insulated,

heated and provided with lights, except that where the wellhouse consists of a small removable box-like structure the requirement for lights may be waived by the Department;

(xii) The wellhouse shall be constructed so that the well pump can be removed.

(xiii) Wells equipped with pitless adaptors or units are not required to meet the requirements of paragraphs (L)(iii), (viii) and (xii) of this subsection.

(M) The area in the vicinity of a well, particularly the area uphill or upstream, shall be surveyed by the water supplier to determine the location and nature of any existing or potential public health hazards;

(N) The requirements with respect to land ownership, clearances from public health hazards, and protection against flooding for wells in an unconfined aquifer shall be the same or more restrictive than those prescribed for wells in confined aquifers, as determined by the Department.

(O) Before a well is placed into operation as the source of supply for a public water system, the following documents shall be submitted by the water supplier:

(i) Reports on pumping tests for yield and drawdown for unconfined wells;

(ii) Reports of laboratory analyses on contaminants in the water as required by OAR 333-061-0036;

(iii) Performance data on the pumps and other equipment;

(iv) Proposals for disinfection as required by section (5) of this rule, if applicable.

(v) Reports on determination of potential direct influence by surface water into groundwater source as prescribed in section (3) of this rule.

(b) Springs:

(A) In addition to those requirements under subsection (2)(a) of this rule, construction of spring supplies shall meet the following requirements:

(i) An intercepting ditch shall be provided above the spring to effectively divert surface water;

(ii) A fence shall be installed around the spring area unless other provisions are made to effectively prevent access by animals and unauthorized persons;

(iii) The springbox shall be constructed of concrete or other impervious durable material and shall be installed so that surface water is excluded;

(iv) The springbox shall be provided with a screened overflow which discharges to daylight, an outlet pipe provided with a shutoff valve, a bottom drain, an access manhole with a tightly fitting cover, and a curb around the manhole.

(v) Spring collection facilities that meet the definition of well in paragraph (2)(a)(A) of this rule must comply with construction requirements specified in paragraph (2)(a)(I) of this rule.

(B) Reports on flow tests shall be provided to establish the yield of springs.

(3) Surface water and groundwater under direct surface water influence source facilities:

(a) In selecting a site for an infiltration gallery, or for a direct intake from a stream, lake, or impounding reservoir, consideration shall be given to land use in the watershed. A sanitary survey of the watershed shall be made by the water supplier to evaluate natural and man-made factors which may affect water quality and investigations shall also be made of seasonal variations in water quality and quantity. A report giving the results of this survey shall be submitted for review and approval by the Department.

(b) A determination shall be made as to the status of water rights, and this information shall be submitted to the Department for review.

(c) Impounding reservoirs shall be designed and constructed so that they include the following features:

(A) The capacity shall be sufficient to meet projected demands during drought conditions;

(B) Outlet piping shall be arranged so that water can be withdrawn from various depths;

(C) Facilities shall be provided for releasing undesirable water.

(d) Direct intake structures shall be designed and constructed so that they include the following features:

(A) Screens shall be provided to prevent fish, leaves and debris from entering the system;

(B) Provisions shall be made for cleaning the screens, or self-cleaning screens shall be installed;

(C) Motors and electrical controls shall be located above flood level;

(D) Provisions shall be made to restrict swimming and boating in the vicinity of the intake;

(E) Valves or sluice gates shall be installed at the intake to provide for the exclusion of undesirable water when required.

(4) Water treatment facilities (other than disinfection):

(a) General

(A) Water treatment facilities shall be capable of producing water which consistently does not exceed maximum contaminant levels. The type of treatment shall depend on the raw water quality. The Department shall make determinations of treatment capabilities based upon recommendations in the **USEPA SWTR Guidance Manual**.

(B) Investigations shall be undertaken by the water supplier prior to the selection or installation of treatment facilities to determine the physical, chemical and microbiological characteristics of the raw water as appropriate. These investigations shall include a determination of the seasonal variations in water quality, as well as a survey to identify potential sources of contamination which may affect the quality of the raw water.

(C) Water obtained from wells constructed in conformance with the requirements of these rules and which is found not to exceed the maximum contaminant levels, may be used without treatment at public water systems;

(D) Laboratory equipment shall be provided so that the water supplier can perform analyses necessary to monitor and control the treatment processes.

(b) Best Available Technology

(A) Pilot studies or other supporting data shall be used to demonstrate the effectiveness of any treatment method other than that defined as best available technology. Pilot study protocol shall be approved beforehand by the Department. When point-of-use (POU) or point-of-entry (POE) devices are used for compliance, programs to ensure proper long-term operation, maintenance, and monitoring shall be provided by the water system to ensure adequate performance.

(B) The Department identifies the following as the best available technology, treatment techniques, or other means available for achieving compliance with the maximum contaminant levels for volatile organic chemicals:

(i) Central treatment using packed tower aeration for all these chemicals.

(ii) Central treatment using granular activated carbon for all these chemicals except vinyl chloride.

(C) The Department identifies the following as the best available technology, treatment techniques or other means generally available for achieving compliance with the Maximum Contaminant Level for fluoride.

(i) Activated alumina absorption, centrally applied.

(ii) Reverse osmosis, centrally applied.

(D) The Department identifies the following as the best available technology, treatment techniques, or other means available for achieving compliance with the maximum contaminant level for total coliforms.

(i) Protection of wells from contamination by coliforms by appropriate placement and construction;

(ii) Maintenance of a disinfectant residual throughout the distribution system;

(iii) Proper maintenance of the distribution system including appropriate pipe replacement and repair procedures, main flushing programs, proper operation and maintenance of storage tanks and reservoirs, and maintaining a minimum pressure of 20 psi at all service connections.

(iv) Filtration treatment and/or disinfection of surface water or groundwater under the direct influence of surface water, or disinfection of groundwater using strong oxidants such as chlorine, chlorine dioxide, or ozone; and

(v) For systems using groundwater, compliance with the requirements of a Department-approved wellhead protection program.

(E) The Department identifies the following as the best available technology, treatment techniques, or other means available for achieving compliance with the maximum contaminant levels for organic chemicals.

(i) Central treatment using packed tower aeration for Dibromochloropropane, Ethylene Dibromide, Hexachlorocyclopentadiene and Di(2-ethylhexyl)adipate.

(ii) Central treatment using granular activated carbon for all these chemicals except Trihalomethanes and Glyphosate.

(iii) Central treatment using oxidation (chlorination or ozonation) for Glyphosate.

(F) The Department identifies the following as the best available technology, treatment techniques, or other means available for achieving compliance with the maximum contaminant levels for inorganic chemicals. Preoxidation may be required to convert Arsenic III to Arsenic V.

(i) Central treatment using coagulation/filtration for systems with 500 or more service connections for Antimony, Arsenic V (for systems with populations 501-10,000), Asbestos, Beryllium, Cadmium, Chromium, Mercury (influent concentration $\geq$ 10ug/L), and Selenium (Selenium IV only).

(ii) Central treatment using direct and diatomite filtration for Asbestos.

(iii) Central treatment using granular activated carbon for Mercury.
(iv) Central treatment using activated alumina for Arsenic V (for systems with populations 10,000 or less), Beryllium, Selenium and Thallium.
(v) Central treatment using ion exchange for Arsenic V (for systems with populations 10,000 or less), Barium, Beryllium, Cadmium, Chromium, Cyanide, Nickel, Nitrate, Nitrite and Thallium.
(vi) Central treatment using lime softening for systems with 500 or more service connections for Arsenic V (for systems with populations of 501-10,000), Barium, Beryllium, Cadmium, Chromium (Chromium III only), Mercury (influent concentration ≥ 10ug/L), Nickel and Selenium.
(vii) Central treatment using reverse osmosis for Antimony, Arsenic V (for systems with populations of 501-10,000), Barium, Beryllium, Cadmium, Chromium, Cyanide, Mercury (influent concentration ≥ 10ug/L), Nickel, Nitrate, Nitrite, and Selenium.
(viii) Central treatment using corrosion control for Asbestos and Lead and Copper.
(ix) Central treatment using electrodialysis for Arsenic V (for systems with populations of 501-10,000), Barium, Nitrate, and Selenium.
(x) Central treatment using alkaline chlorination (pH≥8.5) for
Cyanide.
(xi) Central treatment using coagulation-assisted microfiltration for Arsenic V (for systems with populations 501-10,000).
(xii) Central treatment using oxidation/filtration for Arsenic V (to obtain high removals, iron to Arsenic ratio must be at least 20:1).
(xiii) Point-of-use treatment using activated alumina for Arsenic V (for systems with populations 10,000 or less).
(xiv) Point-of-use treatment using reverse osmosis for Arsenic V (for systems with populations 10,000 or less).

(G) The Department identifies the following as the best technology, treatment techniques, or other means available for achieving compliance with the maximum contaminant levels for disinfection byproducts:

(i) Enhanced coagulation or enhanced softening or GAC10, with chlorine as the primary and residual disinfectant for total trihalomethanes.
(ii) Enhanced coagulation or enhanced softening or GAC10, with chlorine as the primary and residual disinfectant for HAA5s.
(iii) Control of ozone treatment process to reduce production of bromate for bromate concentrations.
(iv) Control of treatment processes to reduce disinfectant demand and control of disinfection treatment processes to reduce disinfectant levels for chlorite.

(H) The Department identifies the following as the best technology, treatment techniques, or other means available for achieving compliance with the maximum residual disinfectant levels: Control of treatment processes to reduce disinfectant demand and control of disinfection treatment processes to reduce disinfectant levels.

(I) The Department identifies the following as the best available technology, treatment techniques, or other means available for achieving compliance with the MCLs for radionuclides.
(i) Central treatment using ion exchange for combined radium-226/228, beta particle/photon activity and uranium.
(ii) Central treatment using reverse osmosis for combined radium-226/228, gross alpha particle activity, beta particle/photon activity, and uranium (for systems with populations 501-10,000).
(iii) Central treatment using lime softening for combined radium-226/228, and uranium (for systems with populations 501-10,000).
(iv) Central treatment using enhanced coagulation/filtration for uranium.
(v) Central treatment using activated alumina for uranium (for systems with populations of 10,000 or less).
(vi) Central treatment using greensand filtration for combined radium-226/228.
(vii) Central treatment using electrodialysis for combined radium-226/228.
(viii) Central treatment using pre-formed hydrous manganese oxide filtration for combined radium-226/228.
(ix) Central treatment using co-precipitation with barium for combined radium-226/228.

(x) Point-of-use treatment using ion exchange for combined radium-226/228, beta particle/photon activity, and uranium.

(xi) Point-of use treatment using reverse osmosis for combined radium-226/228, gross alpha particle activity, beta particle/ photon activity, and uranium (for systems with populations of 10,000 or less).

(c) Filtration of Surface Water Sources and Groundwater Sources Under the Direct Influence of Surface Water

(A) All water systems using surface water or groundwater sources under the direct influence of surface water that fail to meet the criteria for avoiding filtration prescribed in OAR 33-061-0032(2) and (3) must meet all requirements of this subsection for installing filtration treatment.

(B) There are four standard filtration methods: conventional filtration, direct filtration, slow sand, and diatomaceous earth. Other filtration technologies are only acceptable if their efficiency at removing target organisms and contaminants can be demonstrated to be equal to or more efficient than these. The assumed log removals credited to filtration of *Giardia lamblia* and viruses will be based on recommendations in the **USEPA SWTR Guidance Manual**. For membrane filtration, removal credits shall be 2.5 log for *Giardia* and 2.0 for *Cryptosporidium*, as long as removal has been verified by a third party. The combination of filtration and disinfection must meet the inactivation levels prescribed in OAR 333-061-0032(1). Any water system wishing to challenge the assumed log removal credits must conduct demonstration studies based on the recommendations in the **USEPA SWTR Guidance Manual** and have the study protocol approved by the Department.

(C) Pilot studies shall be conducted by the water supplier to demonstrate the effectiveness of any filtration method other than conventional filtration. Pilot study protocol shall be approved in advance by the Department. Results of the pilot study shall be submitted to the Department for review and approval.

(D) Regardless of the filtration method used, the water system must achieve a minimum of 0.5-log reduction of *Giardia lamblia* and a 1.0-log reduction of viruses from disinfection alone after filtration treatment.

(E) All filtration systems shall be designed and operated so as to meet the requirements prescribed in OAR 333-061-0032(4) and (5). Design of the filtration system must be in keeping with

accepted standard engineering references acknowledged by the Department such as the **Great Lakes Upper Mississippi River "Recommended Standards for Water Works" technical reports by the International Reference Center for Community Water Supply and Sanitation**, or publications from the **World Health Organization**. A list of additional references is available from the Department upon request.

(F) Systems that employ multiple filters shall be designed such that turbidity measurements are monitored for each filter independently of the other filter(s). Each filter shall have a provision to discharge effluent water as waste.

(G) Additional requirements for membrane filtration. Each membrane filter system must have a particle counter or laser turbidimeter installed after filtration for continuous integrity monitoring. Once operating, physical integrity testing must be done on each filter canister at least weekly, using pressure hold, diffusive air flow, bubble point, or sonic sensing testing. The operation and maintenance manual must include a diagnosis and repair plan such that the ability to remove pathogens is not compromised.

(d) Criteria and procedures for public water systems using point-of-entry devices.

(A) Public water systems may use point-of-entry devices to comply with maximum contaminant levels only if they meet the requirements of this section.

(B) It is the responsibility of the public water system to operate and maintain the point-of-entry treatment system.

(C) The public water system must develop and obtain Department approval for a monitoring plan before point-of-entry devices are installed for compliance. Under the plan approved by the Department, point-of-entry devices must provide health protection equivalent to central water treatment. "Equivalent" means that the water would meet all Maximum Contaminant Levels as prescribed in OAR 333-061-0030 and would be of acceptable quality similar to water distributed by a well-operated central treatment plant. Monitoring must include contaminant removal efficacy, physical measurements and observations such as total flow treated and mechanical condition of the treatment equipment.

(D) Effective technology must be properly applied under a plan approved by the Department and the microbiological safety of the water must be maintained.

(i) The water supplier must submit adequate certification of performance, field testing, and, if not included in the

certification process, a rigorous engineering design review of the point-of-entry devices.

(ii) The design and application of the point-of-entry devices must consider the tendency for increase in heterotrophic bacteria concentrations in water treated with activated carbon. It may be necessary to use frequent backwashing, post-contractor disinfection, and Heterotrophic Plate Count monitoring to ensure that the microbiological safety of the water is not compromised.

(iii) The point-of-entry device must be evaluated to assure that the device will not cause increased corrosion of lead and copper bearing materials located between the device and the tap that could increase contaminant levels of lead and copper at the tap.

(E) All consumers shall be protected. Every building connected to the system must have a point-of-entry device installed, maintained, and adequately monitored. The Department must be assured that every building is subject to treatment and monitoring, and that the rights and responsibilities of the public water system customer convey with title upon sale of property.

(5) Facilities for continuous disinfection:

(a) Water obtained from surface sources or groundwater sources under the direct influence of surface water shall, as a minimum, be provided with continuous disinfection before such water may be used as a source of supply for a public water system. Water obtained from wells constructed in conformance with the requirements of these rules and which is found not to exceed microbiological maximum contaminant levels, may be used without treatment at public water systems;

(b) Water obtained from wells or springs shall be considered groundwater unless determined otherwise by the Department. Wells and springs may be utilized without continuous disinfection if the construction requirements of section (2) of this rule are met and analyses indicate that the water consistently meets microbiological standards. A well or spring that is inadequately constructed and shows a history of microbiological contamination shall first be upgraded to meet current construction standards, and if microbiological contamination still persists, then continuous disinfection shall be provided prior to use in public water systems.

(c) In public water systems where continuous disinfection is required as the sole form of treatment, or as one component of more extensive treatment to meet the requirements prescribed in OAR 333-061-0032(1), the facilities shall be designed so that:

(A) The disinfectant applied shall be capable of effectively destroying pathogenic organisms; and

(B) The disinfectant is applied in proportion to flow; and
(C) Disinfectants, other than ultraviolet light disinfection treatment, shall be capable of leaving a residual in the water which can be readily measured and which continues to serve as an active disinfectant; and
(D) Sufficient contact time shall be provided to achieve "CT" values capable of the inactivations required by OAR 333-061-0032(1) For ultraviolet light disinfection treatment, sufficient irradiance expressed in milliWatts per square centimenter (mW/cm^2) and exposure time expressed in seconds (s) shall be provided to achieve UV dose levels expressed as (mW/cm^2) or milli-Joules per square centimeter (mJ/cm^2) capable of the inactivations required by OAR 333-061-0032(1).

(d) When continuous disinfection, other than ultraviolet light disinfection, is required for reasons other than the treatment of surface water sources or groundwater sources under the direct influence of surface water, in addition to the requirements of paragraphs (5)(c)(A) through (C) of this rule, the facilities shall be designed so that:
(A) The primary disinfection treatment is sufficient to ensure at least 99.99 percent (4-log) inactivation and/or removal of viruses as determined by the Department, or;
(B) There is sufficient contact time provided to achieve disinfection under all flow conditions between the point of disinfectant application and the point of first water use:
(i) When chlorine is used as the primary disinfectant, the system shall be constructed to achieve a free chlorine residual of 0.2 mg/l after 30 minutes contact time under all flow conditions before first water use;
(ii) When ammonia is added to the water with the chlorine to form a chloramine as the disinfectant, the system shall be constructed to achieve a combined chlorine residual of at least 2.0 mg/l after 3 hours contact time under all flow conditions before first water use;

(e) Provisions shall be made to alert the water supplier before the chlorine supply is exhausted.
(f) Provisions shall be made for sampling the water before and after chlorination;
(g) Testing equipment shall be provided to determine the chlorine residual;
(h) Chlorinator piping shall be designed to prevent the contamination of the potable water system by backflow of untreated water or water having excessive concentrations of chlorine;
(i) Chlorine gas feeders and chlorine gas storage areas shall:
(A) Be enclosed and separated from other operating areas;

(B) Chlorine cylinders shall be restrained in position to prevent upset by chaining 100 and 150 pound cylinders two-thirds of their height up from the floor and by double chocking one ton cylinders;

(C) The room housing the feeders and cylinders shall be above ground surface, shall have doors which open outward and to the outside and shall be ventilated by mechanical means at floor level and shall have an air intake located higher than the exhaust ventilation;

(D) Be located so that chlorine gas, if released, will not flow into the building ventilation systems;

(E) Have corrosion resistant lighting and ventilation switches located outside the enclosure, adjacent to the door;

(F) Be provided with a platform or hydraulic scale for measuring the weight of the chlorine cylinders;

(G) Be provided with a gas mask or self contained breathing apparatus approved by the **National Institute of Occupational Safety and Health (NIOSH)** for protection against chlorine gas and kept in good working condition. Storage of such equipment shall be in an area adjoining the chlorine room and shall be readily available. (Also see the Oregon Occupational Health and Safety regulations contained in OAR Chapter 437.)

(j) When continuous disinfection treatment is provided through ultraviolet light disinfection, the facilities shall be designed to meet the requirements of this subsection:

(A) Ultraviolet light may be used as the sole disinfectant for non-community systems serving groundwater with minimal distribution systems, as determined by the Department;

(B) Ultraviolet systems must meet the specifications of a Class A UV system under the National Sanitation Foundation (NSF) Standard 55;

(C) The ultraviolet light failsafe dosage set point shall be equivalent to 38 mWs/cm^2 (38 mJ/cm^2) with a wavelength between 200 and 300 nanometers;

(D) Ultraviolet lamps are insulated from direct contact with the influent water and are removable from the lamp housing;

(E) The treatment unit must have a fixed flow rate control that prevents flows exceeding the manufacturer's maximum rated flow rate, an ultraviolet light sensor that monitors light intensity through the water during operation, and a visual and audible alarm with an

automatic water flow shut-off if the ultraviolet light intensity drops below the failsafe set point;

(F) There must be a visual means to verify operation of all ultraviolet lamps;

(G) The lamps, lamp sleeves, housings and other equipment must be able to withstand a working pressure of at least 100 psig (689 kPa);

(H) The treatment facility must be sheltered from the weather and accessible for routine maintenance as well as routine cleaning and replacement of the lamp sleeves and cleaning of the sensor windows/lenses;

(I) The lamps must be changed as per the manufacturer's recommendation, or at least annually; and

(J) The treatment unit must be connected into the main water line at the source with the shut-off valves at both the inlet side and the outlet side of the treatment unit. There shall be no bypass piping around the treatment unit.

(6) Finished water storage:

(a) Distribution reservoirs and treatment plant storage facilities for finished water shall be constructed to meet the following requirements:

(A) They shall be constructed of concrete, steel, wood or other durable material capable of withstanding external and internal forces which may act upon the structure;

(B) Ground-level reservoirs shall be constructed on undisturbed soil, bedrock or other stable foundation material capable of supporting the structure when full;

(C) Steel reservoirs, standpipes and elevated tanks shall be constructed in conformance with the **AWWA Standards D100 and D103**;

(D) Concrete reservoirs shall be provided with sufficient reinforcing to prevent the formation of cracks, and waterstops and dowels shall be placed at construction joints. Poured-in-place wall castings shall be provided where pipes pass through the concrete;

(E) Wooden reservoirs shall be redwood or other equally durable wood and shall be installed on a reinforced concrete base. Where redwood reservoirs are used, separate inlet and outlet pipes are required and the water entering the reservoir must be continuously disinfected so as to result in a residual in the water leaving the reservoir in accordance with paragraph (5)(c)(D)(i) of this rule;

(F) Start-up procedures for new redwood tanks shall consist of filling the tank with a solution of water containing a minimum

of 2 pounds of sodium carbonate per 1,000 gallons of water and retaining this solution in the tank a minimum of seven days before flushing;

(G) Where ground-level reservoirs are located partially below ground, he bottom shall be above the ground water table and footing drains discharging to daylight shall be provided to carry away ground water which may accumulate around the perimeter of the structure;

(H) The finished water storage capacity shall be increased to accommodate fire flows when fire hydrants are provided;

(I) Finished water storage facilities shall have watertight roofs;

(J) An access manhole shall be provided to permit entry to the interior for cleaning and maintenance. When the access manhole is on the roof of the reservoir there shall be a curbing around the opening and a lockable watertight cover that overlaps the curbing;

(K) Internal ladders of durable material, shall be provided where the only access manhole is located on the roof;

(L) Screened vents shall be provided above the highest water level to permit circulation of air above the water in finished water storage facilities;

(M) A drain shall be provided at the lowest point in the bottom, and an overflow of sufficient diameter to handle the maximum flow into the tank shall be provided at or near the top of the sidewall. The outlet ends of the drain and overflow shall be fitted with angle-flap valves and shall discharge with an airgap to a watercourse or storm drain capable of accommodating the flow;

(N) A silt stop shall be provided at the outlet pipe;

(O) Where a single inlet/outlet pipe is installed and the reservoir floats on the system, provisions shall be made to insure an adequate exchange of water and to prevent degradation of the water quality and to assure the disinfection levels required in paragraph (5)(c)(D)(i) of this rule;

(P) A fence or other method of vandal deterrence shall be provided around distribution reservoirs;

(Q) When interior surfaces of finished water storage tanks are provided with a protective coating, the coating shall meet the requirements of **National Sanitation Foundation Standard 61, Section 9 - Drinking Water System Components - Health Effects (Revised September 1994)** or equivalent.

(R) Reservoirs and clearwells that are to be used as disinfection contact time shall use a tracer study to determine the actual contact time. The Department must approve procedures and protocols for the tracer study prior to the initiation of the study.

The Department recommends the **USEPA SWTR Guidance Manual** for tracer study procedure and protocol.

(S) Reservoirs and clearwells that are to be used for disinfection contact time shall have a means to adequately determine the flow rate on the effluent line.

(b) Pressure tanks for finished water shall meet the following requirements:

(A) Pressure tanks shall be installed above normal ground surface;

(B) Bypass piping around the pressure tank shall be provided to permit operation of the system while the tank is being maintained or repaired;

(C) Pressure tanks greater than 1,000 gallons shall be provided with an access manhole and a water sight-glass.

(D) All pressure tanks shall be provided with a drain, a pressure gauge, an air blow-off valve, means for adding air and pressure switches for controlling the operation of the pump(s);

(E) Pressure tanks shall be constructed of steel and shall be designed for pressure at least 50% greater than the maximum system pressure anticipated.

(7) Pumping facilities:

(a) Wherever possible, booster pumps shall take suction from tanks and reservoirs to avoid the potential for negative pressures on the suction line which result when the pump suction is directly connected to a distribution main;

(b) Pumps which take suction from distribution mains for the purpose of serving areas of higher elevation shall be provided with a low pressure cut-off switch on the suction side set at no less than 20 psi;

(c) Suction lift at pumping stations shall be avoided as far as possible, and pumps shall be installed so that the suction line is under a positive head. If suction lift cannot be avoided, provision shall be made for priming with water which does not exceed maximum contaminant levels;

(d) Pumping stations shall be located above maximum anticipated 100-year (1%) flood level, and the area around the pumping station shall be graded so that surface drainage is away from the station;

(e) Pumping stations shall be of durable construction so as to protect the equipment from the elements. The door to the pumping station shall be lockable, and facilities for heating and lighting shall be provided. The floor of the pumping station shall be sloped to provide adequate drainage.

(8) Distribution systems:

(a) Wherever possible, distribution pipelines shall be located on public property. Where pipelines are required to pass through private

property, easements shall be obtained from the property owner and shall be recorded with the county clerk;

(b) Pipe, pipe fittings, valves and other appurtenances utilized at Community water systems shall be manufactured, installed and tested in conformance with the latest standards of the American Water Works Association, National Sanitation Foundation or other equivalent standards acceptable to the Department;

(c) In Community water systems, distribution mains located in public roadways or easements, and the portion of the service connections from the distribution main to the customer's property line or service meter where provided are subject to the requirements of these rules. The piping from the customer's property line, or the meter where provided, to the point of water use (the building supply line) is subject to the requirements of the State Plumbing Code;

(d) In all Public Water Systems where the system facilities and the premises being served are both on the same parcel of property, requirements relating to pipe materials and pipe installation shall comply with the State Plumbing Code;

(e) Distribution piping shall be designed and installed so that the pressure measured at the property line in the case of Community water systems, or at the furthest point of water use, in the case of a Transient Non-Community water system of the type described in subsection (d) of this section, shall not be reduced below 20 psi;

(f) Distribution piping shall be carefully bedded and fully supported in material free from rocks and shall be provided with a cover of at least 30 inches. Select backfill material shall be tamped in layers around and over the pipe to support and protect it. Large rocks or boulders shall not be used as backfill over the pipe;

(g) Provision shall be made at all bends, tees, plugs, and hydrants to prevent movement of the pipe or fitting;

(h) Wherever possible, dead ends shall be minimized by looping. Where dead ends are installed, or low points exist, blow-offs of adequate size shall be provided for flushing;

(i) Air-relief valves shall be installed at high points where air can accumulate. The breather tube on air-relief valves shall be extended above ground surface and provided with a screened, downward facing elbow;

(j) Yarn, oakum, lead or other material which may impair water quality shall not be used where it will be in contact with potable water;

(k) Nonconductive water pipe (plastic or other material) that is not encased in conductive pipe or casing must have an electrically conductive wire or other approved conductor for locating the pipe when the pipeline is underground. The wire shall be No. 18 AWG (minimum) solid copper with blue colored insulation. Ends of wire

shall be accessible in water meter boxes, valve boxes or casings, or outside the foundation of buildings where the pipeline enters the building. The distance between tracer lead access locations shall not be more than 1,000 feet. Joints or splices in wire shall be waterproof.

(l) Piping that is to be used for disinfection contact time shall be verified by plug flow calculations under maximum flow conditions.

(9) Crossings-Sanitary sewers and water lines:

(a) All reference to sewers in this section shall mean sanitary sewers;

(b) In situations involving a water line parallel to a sewer main or sewer lateral, the separation between the two shall be as indicated in Figure 1;

(c) In situations where a water line and a sewer main or sewer lateral cross, the separation between the two shall be as follows:

(A) Wherever possible, the bottom of the water line shall be 1.5 feet or more above the top of the sewer line and one full length of the water line shall be centered at the crossing;

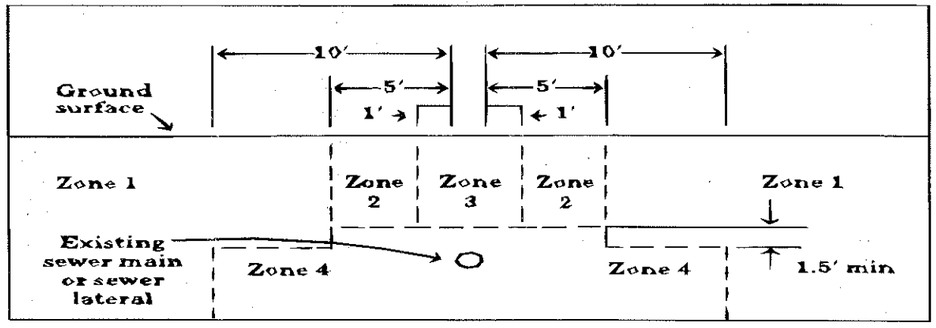
(B) Where the water line crosses over the sewer line but with a clearance of less than 1.5 feet, the sewer line shall be exposed to the sewer line joints on both sides of the crossing to permit examination of the sewer pipe. If the sewer pipe is in good condition and there is no evidence of leakage from the sewer line, the 1.5-foot separation may be reduced. However, in this situation, the water supplier must center one length of the water line at the crossing and must prepare a written report of the findings and indicating the reasons for reducing the separation. If the water supplier determines that the conditions are not favorable or finds evidence of leakage from the sewer line, the sewer line shall be replaced with a full length of pipe centered at the crossing point, of PVC pressure pipe (**ASTM D-2241, SDR 32.5**), high-density PE pipe (Drisco pipe 1000), ductile-iron Class 50 (**AWWA C-51**), or other acceptable pipe; or the sewer shall be encased in a reinforced concrete jacket for a distance of 10 feet on both sides of the crossing.

(C) Where the water line crosses under the sewer line, the water supplier shall expose the sewer line and examine it as indicated in paragraph (9)(c)(B) of this rule. If conditions are favorable and there is no evidence of leakage from the sewer line, the sewer line may be left in place but must be supported with a steel or reinforced concrete beam or other means of preventing settlement when it spans the water line trench, and special precautions must be taken to assure that the backfill material over the water line in the vicinity of the crossing is thoroughly tamped in order to prevent settlement which could result in the leakage of sewage. In this situation, the water supplier must

center one length of the water line at the crossing and must prepare a written report recording the manner in which the sewer line was supported at the crossing and the material and methods used in backfilling and tamping to prevent settlement of the sewer. If the water supplier determines that conditions are not favorable or finds evidence of leakage from the sewer line, the provisions of paragraph (9)(c)(B) of this rule apply.

(d) When a water main is installed under a stream or other watercourse, a minimum cover of 30 inches shall be provided over the pipe. Where the watercourse is more than 15 feet wide, the pipe shall be of special construction with flexible watertight joints, valves shall be provided on both sides of the crossing so that the section can be isolated for testing or repair, and test cocks shall be provided at the valves.

Figure 1: Water Line-Sewer Line Separation



Zone 1: Only crossing restrictions apply
Zone 2: Case-by-case determination
Zone 3: Parallel water line prohibited
Zone 4: Parallel water line prohibited

(10) Disinfection of facilities:

(a) Following completion of new facilities and repairs to existing facilities, those portions of the facilities which will be in contact with the water delivered to users shall be disinfected with chlorine before they are placed into service. Other disinfectants may be used if it is demonstrated that they can also achieve the same result as chlorine;

(b) Prior to disinfection, the facilities shall be cleaned and flushed with potable water according to **AWWA Standards C651 through C654**;

(c) For wells, valves, pumps, water mains and service connections, disinfection by chlorination shall be accomplished according to **AWWA standards C651 through C654** which includes, but is not limited to, the introduction of a chlorine solution with a free chlorine residual of 25 mg/l into the system in a manner which will result in a thorough wetting of all surfaces and the discharge of all trapped air. The solution shall remain in place for 24 hours. After the 24-hour period, the free chlorine residual shall be checked, and if it is found to

be 10 mg/l or more, the chlorine solution shall be drained, the facility flushed with potable water and a minimum of one sample shall be collected from the facility for microbiological analysis. If the results of the analysis indicate that the water is free of coliform organisms, the facility may be put into service. If the check measurement taken after the 24-hour contact period indicates a free chlorine residual of less than 10 mg/l, the facilities shall be flushed, rechlorinated and rechecked until a final residual of 10 mg/l or more is achieved. Likewise, if the microbiological analysis indicates the presence of coliform organisms, the flushing and disinfection must be repeated until a sample free of coliform organisms is obtained;

(d) For reservoirs and tanks, disinfection by chlorination shall be accomplished according to **AWWA Standard C652** which includes, but is not limited to, the following methods:

(A) Filling the reservoir or tank and maintaining a free chlorine residual of not less than 10 mg/l for the appropriate 6 or 24 hour retention period; or

(B) Filling the reservoir or tank with a 50 mg/l chlorine solution and leaving for 6 hours; or

(C) Directly applying by spraying or brushing a 200 mg/l solution to all surfaces of the storage facility in contact with water if the facility were full to the overflow elevation.

(e) When the procedures described in paragraphs (10)(d)(A) and (B) of this rule are followed, the reservoir or tank shall be drained after the prescribed contact period and refilled with potable water, and a sample taken for microbiological analysis. If the results of the analysis indicate that the water is free of coliform organisms, the facility may be put into service. If not, the procedure shall be repeated until a sample free of coliform organisms is obtained;

(f) When the procedure described in paragraph (10)(d)(C) of this rule is followed, the reservoir or tank shall be filled with potable water and a sample taken for microbiological analysis. It will not be necessary to flush the reservoir or tank after the chlorine solution is applied by spraying or brushing. Microbiological analysis shall indicate that the water is free of coliform organisms before the facility can be put into service;

(g) When a reservoir is chlorinated following routine maintenance, inspection, or repair, it may be put back into service prior to receiving the report on the microbiological analysis provided the water leaving the reservoir has a free chlorine residual of at least 0.4 mg/l or a combined chlorine residual of at least 2.0 mg/l.

(h) Underwater divers used for routine maintenance, inspection, or repair of reservoirs shall use a full body dry suit with hardhat scuba and an external air supply. The diver shall be disinfected by spraying a 200

mg/l solution of chlorine on all surfaces that will come into contact with drinking water.

(i) A water line may be returned to service, following repairs or routine maintenance, prior to receiving a report on the microbiological analysis if the following procedures have been completed. The trench shall be liberally treated with hypochlorites, the interior of all pipes and fittings shall be swabbed or sprayed with a 1% hypochlorite solution, and the line shall be thoroughly flushed. Where practical, the repaired line shall be disinfected with a 100 mg/l chlorine solution for 3 hours or a 300 mg/l chlorine solution for 15 minutes then the line shall be flushed thoroughly.

APPENDIX F. CONSTRUCTION COST ESTIMATE BREAKDOWNS

BROWN AND CALDWELL

DETAILED COST ESTIMATE

PROJECT STATUS : Conceptual

PROJECT : Ashland Reservoir Siting Study

JOB # : 130825 **DATE :** 10/24/2006

LOCATION : City of Ashland, Oregon **BY :** BH

ELEMENT : Croswon II 2.0 MG Post Tensioned Reservoir **REVIEWED BY:** EO

SPEC. NO.	DESCRIPTION	QUAN	UNIT	UNIT COST	SUBTOTAL	TOTAL
02000	**SITEWORK**					
	Access Road	1	LS	$ 75,000	$ 75,000	
	Fencing and Security	1	LS	$ 15,000	$ 15,000	
	Landscaping	1	LS	$ 25,000	$ 25,000	
	Subtotal Sitework					$ 115,000
03000	**CONCRETE**					
	Valve Vault	1	EA	$ 25,000	$ 25,000	
	2.0 MG Circular Reservoir, Including:	1	EA	$ 1,840,000	$ 1,840,000	
	excavation					
	backfill					
	tank related piping to within 10-ft					
	appurtenances (ladders, hatches, etc.)					
	Subtotal Concrete					$ 1,865,000
15000	**MECHANICAL**					
	24" DIP Inlet/Outlet	1,500	LF	$ 205	$ 307,500	
	24" DIP Drain/Overflow	1,500	LF	$ 205	$ 307,500	
	24" BF Valve Isolation	1	EA	$ 7,200	$ 7,200	
	Misc. Valve & piping	1	LS	$ 50,000	$ 50,000	
	Subtotal Mechanical					$ 672,200
16000/17000	**ELECTRICAL I&C (@10% OF TDC)**					$ 265,200
	TOTAL DIRECT COST					**$ 2,917,400**
	Construction Contingency			30%		$ 875,200
	SUBTOTAL					**$ 3,792,600**
	Engineering and SDC			15%		$ 568,900
	SUBTOTAL					**$ 4,361,500**
	Permits					$ 30,000
	TOTAL CONSTRUCTION COST					**$ 4,391,500**

Note:
The cost estimate herein is based on our perception of current conditions in the project location. The estimate reflects our professional opinion of accurate costs at this time and is subject to change. Engineer has no control over variances in the cost of labor, materials, equipment, services provided by others, contractor' s method of determining prices, competitive bidding or market conditions, practices, or bidding strategies. Engineer cannot and does not warrant or guarantee that proposals, bids or actual construction costs will not vary from the costs presented herein.

BROWN AND CALDWELL

DETAILED COST ESTIMATE

PROJECT STATUS : Conceptual

PROJECT : Ashland Reservoir Siting Study

JOB # : 130825 **DATE :** 10/24/2006

LOCATION : City of Ashland, Oregon **BY :** BH

ELEMENT : Ashland Loop Road 0.2 MG Reservoir (Buried Concrete) **REVIEWED BY:** EO

SPEC. NO.	DESCRIPTION	QUAN	UNIT	UNIT COST	SUBTOTAL	TOTAL
02000	**SITEWORK**					
	Access Road and Parking	1	LS	$ 50,000	$ 50,000	
	Fencing and Security	1	LS	$ 10,000	$ 10,000	
	Landscaping	1	LS	$ 20,000	$ 20,000	
	Subtotal Sitework					$ 80,000
03000	**CONCRETE**					
	Dechlor. Valve Vault	1	EA	$ 15,000	$ 15,000	
	0.2 MG Circular Reservoir, Including:	1	EA	$ 780,000	$ 780,000	
	excavation					
	backfill					
	tank related piping to within 10-ft					
	appurtenances (ladders, hatches, etc.)					
	Subtotal Concrete					$ 795,000
15000	**MECHANICAL**					
	12" DI Inlet/Outlet	1,000	LF	$ 100	$ 100,000	
	12" DIP Drain/Overflow	1,000	LF	$ 60	$ 60,000	
	12" BF Valve Isolation	1	EA	$ 4,300	$ 4,300	
	Misc. Valve & piping	1	LS	$ 10,000	$ 10,000	
	Subtotal Mechanical					$ 174,300
16000/17000	**ELECTRICAL I&C**					$ 50,000
	TOTAL DIRECT COST					**$ 1,099,300**
	Contingency			30%		$ 329,800
	SUBTOTAL					**$ 1,429,100**
	Engineering and SDC			15%		$ 214,400
	SUBTOTAL					**$ 1,643,500**
	Permits					$ 20,000
	TOTAL CONSTRUCTION COST					**$ 1,663,500**

Note:
The cost estimate herein is based on our perception of current conditions in the project location. The estimate reflects our professional opinion of accurate costs at this time and is subject to change. Engineer has no control over variances in the cost of labor, materials, equipment, services provided by others, contractor' s method of determining prices, competitive bidding or market conditions, practices, or bidding strategies. Engineer cannot and does not warrant or guarantee that proposals, bids or actual construction costs will not vary from the costs presented herein.

BROWN AND CALDWELL

DETAILED COST ESTIMATE

PROJECT STATUS : Conceptual

PROJECT : Ashland Reservoir Siting Study

JOB # : 130825 **DATE :** 10/24/2006

LOCATION : City of Ashland, Oregon **BY :** BH

ELEMENT : Ashland Loop Road 0.2 MG Reservoir (Above-ground Steel Alternative) **REVIEWED BY:** EO

SPEC. NO.	DESCRIPTION	QUAN.	UNIT	UNIT COST	SUBTOTAL	TOTAL
02000	**SITEWORK**					
	Access Road	1	LS	$ 50,000	$ 50,000	
	Fencing and Security	1	LS	$ 10,000	$ 10,000	
	Landscaping	1	LS	$ 20,000	$ 20,000	
	Subtotal Sitework					$ 80,000
03000	**CONCRETE**					
	Dechlor. Valve Vault	1	EA	$ 15,000	$ 15,000	
	Subtotal Concrete					$ 15,000
05000	**METALS**					
	0.2 MG Circular Reservoir, Including:	1	EA	$ 420,000	$ 420,000	
	excavation					
	foundation					
	coatings and paint					
	tank related piping to within 10-ft					
	appurtenances (ladders, hatches, etc.)					
	Subtotal Metals					$ 420,000
15000	**MECHANICAL**					
	12" DI Inlet/Outlet	1,000	LF	$ 100	$ 100,000	
	12" DIP Drain/Overflow	1,000	LF	$ 60	$ 60,000	
	12" BF Valve Isolation	1	EA	$ 4,300	$ 4,300	
	Misc. Valve & piping	1	LS	$ 10,000	$ 10,000	
	Subtotal Mechanical					$ 174,300
16000/17000	**ELECTRICAL I&C**					$ 50,000
	TOTAL DIRECT COST					**$ 739,300**
	Contingency			30%		$ 221,800
	SUBTOTAL					**$ 961,100**
	Engineering and SDC			15%		$ 144,200
	SUBTOTAL					**$ 1,105,300**
	Permits					$ 20,000
	TOTAL CONSTRUCTION COST					**$ 1,125,300**

Note:
The cost estimate herein is based on our perception of current conditions in the project location. The estimate reflects our professional opinion of accurate costs at this time and is subject to change. Engineer has no control over variances in the cost of labor, materials, equipment, services provided by others, contractor' s method of determining prices, competitive bidding or market conditions, practices, or bidding strategies. Engineer cannot and does not warrant or guarantee that proposals, bids or actual construction costs will not vary from the costs presented herein.

BROWN AND CALDWELL

DETAILED COST ESTIMATE

PROJECT STATUS : Conceptual

PROJECT : Ashland Reservoir Siting Study

JOB # : 130825 **DATE :** 10/24/2006

LOCATION : City of Ashland, Oregon **BY :** BH

ELEMENT : Crowson Pump Station Modifications **REVIEWED BY:** EO

SPEC. NO.	DESCRIPTION	QUAN	UNIT	UNIT COST	SUBTOTAL	TOTAL
13000	**EQUIPMENT**					
	15 HP Pumps	2	EA	$ 20,000	$ 40,000	
	Subtotal Equipment					$ 40,000
15000	**MECHANICAL**					
	Misc. Piping and Valves	1	LS	$ 15,000	$ 15,000	
	Subtotal Mechanical					$ 15,000
16000/17000	**ELECTRICAL I&C (@20% OF TDC)**					$ 11,000
	TOTAL DIRECT COST					**$ 66,000**
	Contingency			30%		$ 19,800
	SUBTOTAL					**$ 85,800**
	Engineering and SDC			15%		$ 12,900
	SUBTOTAL					**$ 98,700**
	TOTAL CONSTRUCTION COST					**$ 98,700**

Note:

The cost estimate herein is based on our perception of current conditions in the project location. The estimate reflects our professional opinion of accurate costs at this time and is subject to change. Engineer has no control over variances in the cost of labor, materials, equipment, services provided by others, contractor' s method of determining prices, competitive bidding or market conditions, practices, or bidding strategies. Engineer cannot and does not warrant or guarantee that proposals, bids or actual construction costs will not vary from the costs presented herein.