City

274 - 0715

92-27776

SEWER AND WATER MASTER PLAN AGREEMENT

The CITY OF BEND, an Oregon municipal corporation, hereinafter called "CITY" and BROKEN TOP LIMITED PARTNERSHIP, hereinafter called "DEVELOPER" agree as follows:

1. DEVELOPER has received, read and understands CITY'S sewer and water policy which is incorporated as a part of this Master Plan Agreement. The terms used in this agreement have the meanings assigned to them by CITY'S water and sewer policies unless specifically provided otherwise.

2. DEVELOPER desires sewer and water service to the property described on Exhibit "A" which is attached to and made a part of this agreement.

SCOPE OF PROJECT

DEVELOPER is proposing to construct a development named Broken Top. Broken Top will be a phased, minimum 675 dwelling unit, planned unit development. Most of the dwelling units are single family homes, however 173 dwelling units will be developed as multi-family units. The Broken Top subdivision also includes an 18 hole golf course, club house, administration buildings, maintenance facilities as well as related recreational amenities.

The Broken Top property is currently outside of the Bend City limits and portions of the golf course are outside the urban growth boundary.

The DEVELOPER originally obtained land use permits from Deschutes County. The DEVELOPER has received tentative approval from the City Commissioners for connection to City sewer and water pending completion of this master plan and other standard agreements.

The Broken Top development does not have any domestic or fire protection water supply located on site at this time. The DEVELOPER will be required to construct a domestic well, a reservoir, transmission and distribution mains which will be owned and operated by the City of Bend. The construction of these water facilities will be phased.

Sewer facilities do not exist on the Broken Top site at this time. DEVELOPER will be required to construct on-site and off-site collection systems and the details of such are further described within this agreement. The capacity of the off-site sewer mains is

adequate for the Broken Top subdivision. However, additional development in adjacent areas may exceed capacity and require the installation of larger sewer mains.

The DEVELOPER is constructing one private well for irrigation of the golf course and other limited areas. This irrigation system is a separate private system and will not be connected to any public water facility.

The DEVELOPER has submitted a sewer and water master plan text. This text provides both general and specific criteria related to sizing, density of development, phasing and adjacent property development. The CITY regards this text as a framework for development of the Broken Top development. This text may need to be revised from time to time in order to accurately reflect actual phasing and potential changes to CITY Policy and Construction Standards. This text is described as Exhibit "B".

The CITY and DEVELOPER agree as follows:

DEVELOPMENT OF WATER FACILITIES

3. DEVELOPER agrees to develop and install at DEVELOPER'S expense, a water system including a domestic well, reservoir, transmission, distribution and interim connection according to City Standards and Specifications as follows:

3.1 DEVELOPER shall begin development of the water facility with Phase One Section C and D (see map included in Exhibit "C") and construct an interim connection to the Bridge Creek Aqueduct. DEVELOPER shall also construct a connection between the Broken Top water system and the existing line in Knoll Avenue. The actual connection points will be at the discretion of the City Engineer. The interim connection to the Bridge Creek Aqueduct shall be terminated at CITY'S discretion.

3.2 DEVELOPER shall construct a distribution system using water from Knoll Avenue. The Fire Department will require the hydrants to be functioning prior to framing the structures. This system shall not serve more than 50 dwelling units within Phase until the reservoir and Bridge Creek transmission main are complete. The reservoir and transmission requirements are described below.

3.3 DEVELOPER shall construct (upon the Outback Reservoir site, actual location to be determined by City Engineer) a 1 million gallon capacity reservoir. This reservoir is required to have an overflow elevation not exceeding 4010 feet above

mean sea level and this shall be constructed completely as part of the Phase One Section C and D development and coordinated with City of Bend.

3.4 DEVELOPER agrees no additional dwelling units shall be connected to the distribution system until the reservoir is complete and connected to the Outback Reservoir site facilities and accepted by the City of Bend.

3.5 DEVELOPER shall construct a well and all required appurtenances including but not limited to the control building and yard piping, and the Bridge Creek and Skyliner Road transmission mains and complete distribution systems prior to issuance of building permits for Phase Two. The well shall be constructed to meet CITY and other applicable regulations. DEVELOPER shall apply for the appropriate permits, transfers and water rights for groundwater prior to the construction of the well. The City of Bend will assist DEVELOPER with this task. No building permits will be issued for Phase Two until said facilities and documentation are approved and accepted by the City of Bend.

3.6 DEVELOPER shall install pressure reducing valves at locations approved by the City Engineer. These valves enable pressure level 3 water to be delivered to pressure level 4 areas within the Broken Top development.

3.7 DEVELOPER shall develop the remaining phases of Broken Top with distribution mains and these shall be constructed with specific City approval and completion of additional water service agreements.

DEVELOPMENT OF SEWER FACILITIES

4. DEVELOPER agrees to develop and install at DEVELOPER'S expense, a sewer system including trunk mains, distribution mains, temporary and permanent pump stations according to City Standards and Specifications as follows:

4.1 DEVELOPER shall construct an on site gravity sewer collection system to serve the entire Broken Top subdivision except for the specific areas described below.

4.2 DEVELOPER shall construct an off site gravity sewer main to transport sewage from the on site collection system to the trunk line located at the intersection of Simpson and 14th Streets.

4.3 DEVELOPER has identified specific areas and elevations

that may require the use of sewage lift stations. The CITY regards sewage lift stations as a temporary solution. DEVELOPER agrees if lift stations are necessary, every attempt will be made with subsequent development or phases to provide gravity service to those lots using lift stations and abandon those lift stations. However, DEVELOPER has identified one 12 unit multi-family area where the permanent sewer service utilizes a lift station. CITY will allow this lift station on the condition that the DEVELOPER agrees to install a single lift station, owned and operated by a homeowner's association or other responsible entity which meets DEQ requirements to serve this specific area.

4.4 DEVELOPER agrees that actual design of the sewer facilities will be reviewed when the construction plans for each phase of development are submitted and in accordance with the City of Bend Sewer and Water Masterplan.

OTHER REQUIREMENTS

5. DEVELOPER shall construct the irrigation well and irrigation distribution system for the sole purpose of golf course and common area irrigation only. This well shall be developed, operated and maintained by DEVELOPER at DEVELOPER'S expense and in conformance with all applicable local, state and federal laws, rules and regulations. No other wells shall be constructed within the Broken Top property without the written consent of the CITY.

5.1 DEVELOPER shall comply with CITY to implement any measure necessary to protect the irrigation well and the aquifer which is the source of the well water. These requirements are described within Exhibit "C".

5.2 DEVELOPER shall not use the irrigation well for domestic purposes or connect any irrigation lines to domestic service lines or distribution mains. Oregon State Health division requires a minimum separation of 10 feet between potable and non-potable water lines.

5.3 DEVELOPER shall submit documentation accurately mapping all of the private wells irrigation distribution lines and other components of the irrigation system.

5.4 DEVELOPER shall not reduce the ultimate development potential of the Broken Top subdivision below 675 dwelling units.

5.5 The DEVELOPER shall receive the applicable credit and/or

recovery provided by City laws, rules and regulations for the following facilities constructed by DEVELOPER:

1. 1 MG reservoir approved and accepted by City of Bend.
2. 1 well approved and accepted by City of Bend.
3. 1 transmission main approved and accepted by City of Bend.
4. Any distribution line that is determined to be oversized, approved and accepted by City of Bend.

STANDARD CONDITIONS

6. The following standard conditions shall apply to DEVELOPER'S sewer and water service.

6.1 DEVELOPER hereby consents to annexation of the Broken Top Development property described by Exhibit "A". DEVELOPER shall also forthwith sign a separate, perpetual consent document.

6.2 DEVELOPER understands that the Broken Top development will be annexed to the City of Bend at a time determined by CITY. Until annexation, the development shall comply with all City laws, rules, regulations and policies the same as if the development were within the City limits.

6.3 Service shall be supplied only through sewer and water facilities constructed and installed to CITY standards and specifications. CITY'S Standards and Specifications may be obtained from the Engineering Department. All sewer and water facilities except DEVELOPER'S service connection lines shall be the property of CITY (upon CITY'S acceptance in writing if they are installed by someone other than CITY) and shall be installed within public ways or CITY easements, which shall be free and clear of all encumbrances and liens.

6.4 DEVELOPER shall promptly pay all charges for CITY sewer and water service when due. Charges shall be as prescribed by the appropriate schedule, and charges may be changed from time to time.

6.5 No other use of CITY sewer and water services or facilities except as provided in this agreement shall be permitted without express consent of CITY.

6.6 DEVELOPER shall comply with all applicable governmental laws, rules and regulations including but not limited to CITY ordinances, resolutions and the provisions of CITY water and sewer policies as they now exist and as they may be changed from time to time.

6.7 The person or firm doing the work shall maintain, during the life of the contract, Construction Liability Insurance. The coverage shall be in the amount of a one million dollar combined single limit for bodily injury liability and property damage. The coverage shall apply to this work and that of any subcontractor who perform work under this contract. DEVELOPER shall hold CITY harmless from any liability of any kind resulting from this sewer and water master plan agreement.

6.8 Upon completion of the project DEVELOPER agrees to submit to the CITY a statement of all costs incurred on the project for record keeping purposes.

6.9 CITY will perform inspections only. DEVELOPER is required to provide City approved contractors to do testing, chlorination and flushing. Overhead will be charged to DEVELOPER on all labor and material performed by City that is not covered by engineering fees.

6.10 DEVELOPER agrees to pay applicable Sewer and Water General Benefit, Engineering and inspection fees in accordance with City Sewer and Water Policies and Ordinances. No service connection will be permitted until all applicable fees are paid and additional service agreements are completed.

6.11 Applicant agrees to call 388-5540 and schedule a preconstruction meeting with City construction inspectors. 24-hour notice is required. No construction shall occur prior to this meeting.

6.12 This sewer and water service agreement and sewer and water service may be terminated by CITY for any failure to comply with the terms and conditions of this agreement or the CITY'S Sewer and Water Policy.

6.13 This agreement shall be binding upon DEVELOPER and DEVELOPER'S heirs, successors and assigns and shall be a covenant running with the land.

DATED this 22 day of July, 1992.

BROKEN TOP LIMITED PARTNERSHIP
BY: BROKEN TOP, INC.

BY: William T. Cridwell
PRESIDENT

STATE OF OREGON)
)SS.
County of Deschutes)

This instrument was acknowledged before me on July 22, 1992 by William T. Cridwell as President of Broken Top Limited Partnership.

DEBORAH S. McMAHON
NOTARY PUBLIC – OREGON
My Commission Expires 12-20-93

CITY OF BEND

BY: Deborah S. McMahon
DEVELOPMENT SERVICES MANAGER

EXHIBIT 'A'

CHDX/42

BROKEN TOP BOUNDARY 27 - 0722

A parcel in Section 1 and the southeast quarter of the northeast quarter of Section 2 and the northwest quarter of the northeast quarter and the northeast quarter of the northwest quarter of Section 12 in Township 18 South and Range 11 East of the Willamette Meridian, Deschutes County, Oregon as shown on the attached Exhibit A and fully described as follows:

Commencing at the northwest corner of said Section 1; thence South 89°38'58" East 2200.06 feet along the north line of said Section 1 to the point of beginning; thence South 89°38'58" East 443.91 feet to a brass cap at the quarter corner between Section 36 and said Section 1; thence South 89°46'53" East 1403.40 feet; thence leaving said north line 1945.25 feet along the arc of a 1230.00 foot radius curve right (the long chord of which bears South 44°28'28" East 1748.77 feet) to the east line of said Section 1; thence South 00°49'56" West 81.71 feet along said east line to an aluminum cap at the north sixteenth corner between said Section 1 and Section 6; thence South 00°49'44" West 1325.07 feet to a brass cap at the quarter corner between said Section 1 and said Section 6; thence South 00°30'37" West 874.95 feet; thence leaving said east line 304.48 feet along the arc of a 1170.00 foot radius curve right (the long chord of which bears North 26°08'16" West 303.62 feet); thence 209.60 feet along the arc of a 340.00 foot radius curve right (the long chord of which bears North 85°58'48" West 206.30 feet); thence South 666.43 feet; thence South 16°49'21" East 389.51 feet; thence South 06°06'26" East 333.46 feet; thence South 58°58'58" West 662.58 feet; thence South 79°56'20" West 589.34 feet; thence South 80°34'09" West 324.54 feet; thence South 14°24'17" East 164.90 feet; thence South 73°53'36" West 848.36 feet; thence North 70°41'26" West 1197.32 feet; thence 1019.41 feet along the arc of a 1305.00 foot radius curve left (the long chord of which bears North 25°58'51" West 993.69 feet); thence North 48°21'33" West 394.54 feet; thence North 38°17'25" East 20.03 feet; thence North 48°21'33" West 61.52 feet; thence 1167.43 feet along the arc of a 2326.00 foot radius curve right (the long chord of which bears North 33°58'50" West 1155.21 feet); thence 997.41 feet along the arc of a 2680.00 foot radius curve left (the long chord of which bears North 30°15'49" West 991.66 feet); thence North 14°18'05" East 290.00 feet; thence North 56°10'22" East 1104.96 feet; thence North 76°33'34" East 704.07 feet; thence 619.24 feet along the arc of a 551.00 foot radius curve right (the long chord of which bears North 42°24'35" East 587.16 feet); thence North 74°36'20" East 128.81 feet; thence 248.27 feet along the arc of a 455.00 foot radius curve left (the long chord of which bears North 58°58'26" East 245.20 feet); thence North 03°06'41" East 438.31 feet to the point of beginning. Contains 498.87 acres.

REGISTERED
PROFESSIONAL
LAND SURVEYOR

OREGON
JULY 18, 1980
JERRY C. POWELL
1919

DAVID EVANS AND ASSOCIATES, INC.
ENGINEERS, SURVEYORS, PLANNERS, LANDSCAPE ARCHITECTS
OFFICES IN OREGON, WASHINGTON AND CALIFORNIA
709 N.W. WALL STREET, SUITE 102
BEND, OREGON 97701-2712
(503) 389-7614

December 4, 1991
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EXHIBIT "C"
274 - 0723

July 3, 1992

CHDX14/11.3

To: Deborah McMahon, City of Bend Development Services

From: Dave Alden DAA

Subject: Broken Top Well Protection

In response to your request, I've enclosed a copy of the April 15 letter from me to Jack Wanichek on well protection, as referenced in my memorandum of July 2. Please call if you have any questions.

DEA

Enclosure as noted

DAVID EVANS AND ASSOCIATES, INC.
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BEND, OREGON 97701-2712
(503) 389-7614

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274 - 0724

April 15, 1992

CHDX14/11.3

Mr. Jack Wanichek
City of Bend Public Works
1375 Forbes Road
Bend, OR 97701

Subject: Broken Top Golf Course Wellhead Protection

Dear Jack:

The Broken Top Limited Partnership has researched the issue of wellhead protection. Based on that research, Broken Top has agreed that protection of the Broken Top Golf Course irrigation well is a reasonable expectation for the City. However, Broken Top believes that wellhead protection can be provided effectively by Broken Top. Therefore, the following plan for wellhead protection has been prepared and will be implemented.

1) The wellhead will be enclosed in a secure building to prevent unauthorized entry.

2) The well-house floor will be a concrete slab with a water-tight seal around the well-casing.

3) The well-house floor will drain to a sump.

4) The well pump will have an air-vacuum break valve located a minimum of three feet above the floor.

5) There will be no potential contamination sources (PCS) within 100 feet of the well.

6) The ground around the well-house will be graded to drain away from the well-house.

7) A French-drain will be installed around the well-house. This drain will convey potential flows into the irrigation lake.

8) No paved surfaces will be permitted within 100 feet of the well-house.

9) The irrigation lake will be lined to limit leakage.

DAVID EVANS AND ASSOCIATES, INC.
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10) The well will be constructed to applicable state standards for irrigation wells.

11) The well will not be used for potable water.

12) The City will be allowed access to review compliance with this plan.

I expect this plan to be acceptable to the City. Please call if you have any questions.

Sincerely,

DAVID EVANS AND ASSOCIATES, INC.

David A. Alden, P.E.
Project Manager

copy: Paul Eisenberg

BROKEN TOP
PLANNED UNIT DEVELOPMENT

WATER AND SEWER
MASTER PLAN

274 - 0726

EXHIBIT "B"

June 1992

PREPARED FOR:

BROKEN TOP LIMITED PARTNERSHIP
225 N.W. FRANKLIN, SUITE B
BEND, OREGON 97701

PREPARED BY:

DAVID EVANS AND ASSOCIATES, INC.
709 N.W. WALL STREET, SUITE 102
BEND, OREGON 97701
TELEPHONE: (503) 389-7614

274 - 0727

Broken Top Planned Unit Development
Water and Sewer Master Plan

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Broken Top Planned Unit Developm nt
Water and Sewer Master Plan

List of Tables, Figures, and Exhibits

Broken Top Planned Unit Development
Water and Sewer Master Plan
Section 1 - Introduction

General

The Broken Top Planned Unit Development will be a residential development near Bend, Oregon. The location is approximately two miles west of downtown Bend. The development will include 502 single-family homes sites and 173 multi-family units, for a total of 675 dwelling units. The development will also include an 18-hole golf course, golf clubhouse, administration building, golf maintenance facilities, and other recreational amenities. Broken Top is being developed by the Broken Top Limited Partnership, with Cascade Highlands, Inc. as the general partner.

The Broken Top site adjoins a segment of the Bend City limits. Most of the property is located within the Bend Urban Growth Boundary (UGB). (The only exception is a portion of the golf course.) Eventual annexation of the site by the City is expected. Therefore, integration of the Broken Top water and sewer facilities with City facilities is appropriate and anticipated.

Proposed Land Use

Broken Top will be a Planned Unit Development (PUD). Several land-use permits have been issued under the ordinances of Deschutes County. These permits include conditional use approvals for the golf course and PUD master plan, comprehensive plan amendment approvals for relocation of the UGB, Mt. Washington Drive, an industrial park reserve, and a park reserve, an associated zone change approval, and tentative plat approval. The tentative plat approval and approval of a revision to the master plan were approved by Deschutes County Community Development on February 20, 1992.

Broken Top construction began with clearing of the golf course and roads during March 1992. Construction of the on-site water and sewer facilities and the off-site sewer trunk should begin during June 1992. Construction of the Outback reservoir should begin during August 1992. Construction of the Outback well and transmission main should begin during the winter of 1993.

Broken Top will be constructed in six phases over five years. This water and sewer master plan considers development both of Broken Top and of the adjoining lands as described below.

Adjoining Lands

The undeveloped areas surrounding Broken Top were evaluated to determine which areas had water or sewer needs that should be met with facilities developed for Broken Top. There were seven areas that were considered. These areas are shown on Figure 1

after this section. The areas, and the extent to which it was determined that each should be integrated with Broken Top, are described below:

- The first area is a small triangular-shaped area of approximately 7.6 acres northeast of Broken Top. The area is owned by the Broken Top Limited Partnership, but is separated from the Broken Top PUD by Mt. Washington Drive. The parcel has been named Parcel Z. The zoning is RS.

  It was determined from the topography of the parcel that both water and sewer facilities for Broken Top should consider the eventual development of this property. The elevation of the property places it within City Pressure Zone 3. The City is currently unable to serve Zone 3 in the vicinity of the site. The first facilities to serve Zone 3 will be the Broken Top facilities. Therefore, the transmission line, at City direction, will be sized at 16 inches to accommodate this area. However, the initial sizing of the well and reservoir will not include this area. As the topography of the property slopes toward Broken Top, sewer sizing will include this area.

  Due to several factors, it was expected that this area would be developed to the minimum allowable density. These factors include the zoning, the moderately steep topography of the site, and the general development pattern of the area. Consistent with the City's direction on density calculations from the April 6, 1992 memorandum from Mike Byers, the expected number of single-family units was calculated to be 17.

- The second area is a portion of the parcel, formerly owned by William Miller, north of Broken Top. This parcel is bounded by Broken Top on the south and Skyliners Road on the north, and is described here as "North Miller". Considered here is the eastern portion of North Miller, which is within the UGB and zoned RS. This area contains 128 acres. Through a recent transaction, this land is now owned by a corporation affiliated with Cascade Highlands, Inc.

  It was determined from the topography of the parcel that both water and sewer facilities for Broken Top should consider a portion of the development of this property. The elevation of this area makes it almost entirely within City Pressure Zone 3. (A small area is within Zone 4, and an even smaller area is within Zone 2. However, the Zone 2 area is close in elevation to the upper limit of Zone 3 and it was assumed that it will be served from Zone 3.) Therefore, the transmission line , at City direction, will be sized at 16 inches to accommodate this area. However, the initial sizing of the well and reservoir will not include this area. The area drains partially toward Broken Top, with the larger area draining toward the west and north. This latter drainage is into an area targeted by the City for the Skyliner Interceptor sewer. It was estimated that one-third of the area slopes toward Broken Top.

Due to the moderate to steep topography of the site, it was expected that this area would be developed to the minimum allowable density. Consistent with the City's direction on density calculations, the expected number of single-family units was calculated to be 294. This number of units was considered in the Broken Top water master plan. Under the estimate that one-third of the site drains toward Broken Top, it was assumed that 98 dwelling units would have sewer flow directed through the Broken Top facilities.

- The third area is the remainder of Miller North. This area, which contains 45 acres, is zoned UAR-10 and is primarily outside of the UGB. It is expected that the development of this area will be integrated with the development of the Cascade Highlands Remainder parcel. The development of Cascade Highlands Remainder, and the extent to which that parcel will be integrated with the Broken Top water and sewer facilities, is described below.

- The fourth area is a parcel of approximately 18 acres east of Parcel Z. The zoning for this parcel is also RS. The parcel is owned by Daniel Altman, who has previously made application for a development named Golden Butte. The application was denied because of a concern over street access to the site. However, Altman is attempting to secure alternative site access through negotiations with the Broken Top Limited Partnership. Therefore, the Golden Butte applications may be resubmitted soon.

  It was determined from the topography of the parcel that the water facilities, but not the sewer facilities, for Broken Top should consider the eventual development of Golden Butte. The elevation of the property places it within City Pressure Zone 3. The City is currently unable to serve Zone 3 in the vicinity of the site. The first facilities to serve Zone 3 will be the Broken Top facilities. Therefore, the transmission line , at City direction, will be sized at 16 inches to accommodate this area. However, the initial sizing of the well and reservoir will not include this area. The topography of the parcel slopes toward the Overturf Butte subdivision. Overturf Butte has City sewer services, and has additional sewer capacity available. Therefore, the Golden Butte sewer should not connect with Broken Top.

  In the previous application, Golden Butte contained 64 single-family units. It is expected that this number would again be used for a Golden Butte re-application. This number of units was considered in the Broken Top water master plan.

- The fifth area is a portion of the original Cascade Highlands, Inc. parcel that remained after Broken Top and Parcel Z were conveyed to the Broken Top Limited Partnership. This parcel has been named Cascade Highlands Remainder. The portion considered here is the area zoned RS located southwest of Broken Top. The area contains 22 acres.

It was determined from the topography of the parcel that the water facilities for Broken Top should consider the eventual development of this property. The elevation of this area places it within City Pressure Zones 3 and 4. The Zone 4 area could be served by the City with existing reservoirs. However, the area is at a distance from any existing City facilities. Therefore, the transmission line , at City direction, will be sized at 16 inches to accommodate this area. However, the initial sizing of the well and reservoir will not include this area.

It was also determined that sewer service could be provided from facilities constructed for Broken Top, but not passing through Broken Top. Specifically, a sewer line extended south on Mt. Washington Drive, and used to convey sewer flows from the southern portion of Broken Top could be extended to pass south of Broken Top and serve this area. This sewer would lie with a proposed roadway from Mt. Washington Drive to this area, passing between Skyline Park and the Broken Top Golf Course. The Broken Top sewer master plan allows capacity for this eventual extension.

Due to several factors, it was expected that this area would be developed to the minimum allowable density. These factors included the zoning, the moderately steep topography of the site, and the general development pattern of the area. Consistent with the City's direction on density calculations, the expected number of single-family units was calculated to be 51. This number of units was considered in the Broken Top water master plan. These units were included in the Broken Top sewer master plan.

- The sixth area is the remaining area of Cascade Highlands Remainder. This area, which contains 1,175 acres, is zoned UAR-10 and is outside of the UGB. (Including the 45 acres of UAR-10 zoning from the Miller North parcel, the total area to be considered is 1,220 acres.) At present, the allowable density on this property is low (one dwelling unit per ten acres). Also, the City is not allowed to provide service to areas outside the UGB. However, eventual development of the area to a greater density is likely, as is the inclusion of the area within the UGB. Therefore, potential provision of water and sewer services to the area was considered.

  With regard to water, it was noted that the parcel lies significantly nearer the Outback parcel that does Broken Top. Due to this proximity, and the uncertainty in the eventual development density, it was decided that the water needs of this area could be better served by a new water system developed at the time the area is developed. This later system could be interconnected with the Broken Top water system. Therefore, no units in the Cascade Highlands Remainder area were included in the Broken Top water master plan.

With regard to sewer, approximately 475 acres lie northwest of a ridge that bisects the area in a northeast-southwest direction. The area northwest of the ridge will drain into the Skyliner Interceptor proposed by the City and therefore would not be integrated with the Broken Top sewer system. The remainder of the area, approximately 745 acres in size, could be served by sewer facilities through Broken Top. At the minimum density as mandated by the City, the minimum density on the total area would be 2,806 dwelling units. Assuming that the dwelling unit density would be uniform over the parcel 1,714 dwelling units would be located within the same drainage basin as Broken Top. For this master plan, it is assumed that sewer service for this area would be provided through the line to be extended south of Broken Top.

- The seventh area is the parcel, formerly owned by William Miller, south of Broken Top. This parcel is bounded by Cascade Highlands Remainder on the north and west, the First-on-the-Hill subdivision on the south, and Cascade Junior High School on the east. It is described here as "South Miller". This area contains 75 acres and is zone RS. Through a recent transaction, this land is now owned by a corporation affiliated with Cascade Highlands, Inc.

  It was determined from the topography of the parcel that the water facilities for Broken Top should consider the eventual development of this property. As with the portion of Cascade Highlands Remainder zoned RS, the elevation of this area places it within City Pressure Zones 3 and 4. The Zone 4 area could be served by the City with existing reservoirs. However, the area is at a distance from existing City facilities. Therefore, the transmission line , at City direction, will be sized at 16 inches to accommodate this area. However, the initial sizing of the well and reservoir will not include this area.

  For this master plan, it is assumed that sewer service for this area would be provided through the line to be extended south of Broken Top.

  Due to the zoning and topography of the site, it was expected that this area would be developed to the minimum allowable density. Consistent with the City's direction on density, the expected number of single-family units was calculated to be 173. This number of units was considered in the Broken Top water and sewer master plan.

Summing the dwelling unit counts described above, a total of 599 dwelling units beyond Broken Top are addressed in the water master plan. However, only the transmission capacity is provided for these units. (The capacity is provided by the 16-inch main to be provided at City direction.) The tentative sizing of the well and reservoir will not accommodate any units beyond Broken Top. For the sewer master plan, the additional units considered are 2,053.

The assumptions regarding the number of units that should be accommodated through the Broken Top water and sewer facilities are summarized in the table below.

Scope of Study

This master plan assesses the needs for new water and sewer facilities to serve both Broken Top and the additional dwelling units described above.

In considering the potential water facilities, the total anticipated usage of Broken Top was calculated. This expected usage was used to estimate water supply needs relative to source capacity, reservoir capacity, and transmission and distribution capacity for domestic, fire, and emergency needs.

Golf course irrigation will be provided by a separate well and distribution system. The well already has a state groundwater permit and is being constructed. The golf course irrigation system will not be incorporated with the domestic water system and will also serve to irrigate limited areas of common landscaping adjoining the golf course.

In considering the potential sewer facilities, the total anticipated sewer effluent from Broken Top and the appropriate surrounding areas was calculated. This expected usage was used to estimate sewer system needs for internal collection system, new off-site facilities, and capacity of existing off-site facilities.

The preferred configuration of the new facilities needed to serve Broken Top was assessed. These facilities will include a new well and reservoir west of Broken Top on a parcel which the city has acquired, a water transmission line from the new reservoir to Broken Top, a new water distribution system within Broken Top, a sewer collection system within Broken Top, and an off-site sewer trunk to convey the collected effluent into existing city facilities.

The study is prepared under the water and sewer planning guidelines established by the City of Bend Utility Systems Master Plan, which is in final draft form and is expected to be completed in July 1992.

Broken Top Water and Sewer Master Plan
Section 1 - Introduction (cont'd)

Table 1 - Assumptions on Adjoining Areas

Area	Total Number of Dwelling Units	Comments	Number of Units Considered in Broken Top Water Master Plan	Comments	Number of Units Accommodated in Broken Top Sewer Master Plan	Comments
Broken Top	502 SF 173 MF	--	502 SF 173 MF	--	502 SF 173 MF	--
Parcel Z	17 SF	Minimum density	17 SF *	--	17 SF	--
North Miller with RS Zoning	294 SF	Minimum density	294 SF *	--	96 SF	Approximately 1/3 of parcel drains toward Broken Top
North Miller with UAR-10 Zoning	Combined with Cascade Highlands Remainder zoned UAR-10	--	--	--	--	--
Golden Butte	64 SF	Based on developer's previous application	64 SF *	--	0 SF	Parcel drains toward Overturf Butte subdivision
Cascade Highlands Remainder Zoned RS	51 SF	Minimum density	51 SF *	--	51 SF	Sewer capability can be provided through Broken Top or through alternative alignment. This study assumes Broken Top, but may be reconsidered in future.
Cascade Highlands Remainder Zoned UAR-10	2,806 SF	Includes Miller North Zoned UAR-10.	--	Only units allowed under current zoning are included. Additional density can be served more flexibly by new facilities from Outback parcel.	1,714 SF	Based on conceptual plan. Sewer capability can be provided through Broken Top or through alternative alignment. This study assumes Broken Top, but may be reconsidered in future.
South Miller	173 SF	Minimum density	173 SF *	--	173 SF	Sewer capability can be provided through Broken Top or through alternative alignment. This study assumes Broken Top, but may be reconsidered in future.
TOTAL	3,907 SF 173 MF	--	1,101 SF 173 MF	--	2,555 SF 173 MF	--

* - Units are accommodated for transmission only. Additional source and storage will be required above the tentative volumes calculated in the master plan.
SF - Single-Family, MF - Multi-Family

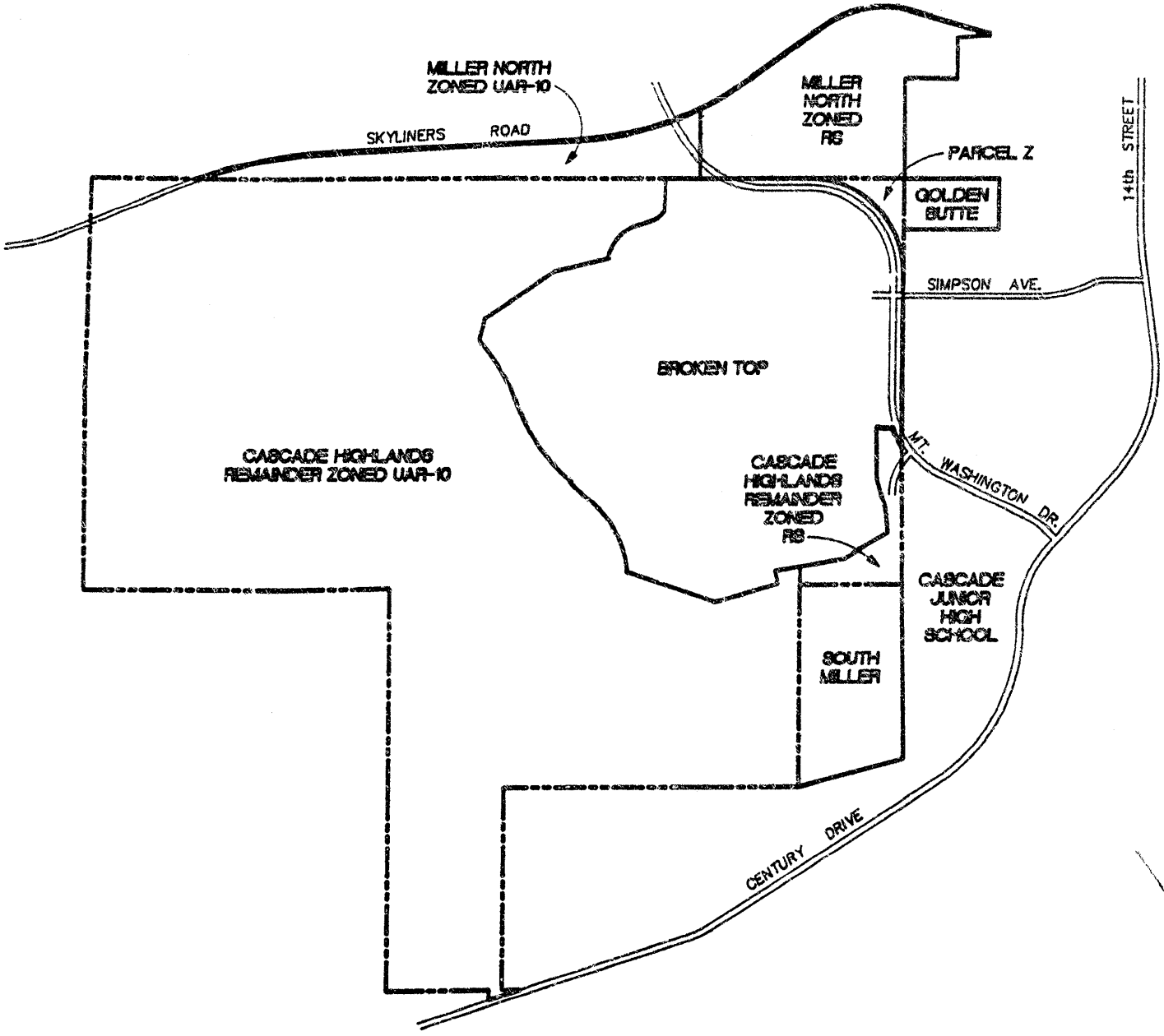

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FIGURE 1
AREAS ADJOINING BROKEN TOP

Broken Top Planned Unit Development
Water and Sewer System Master Plan
Section 2 - Water System

General

The development of the property owned by the Broken Top Limited Partnership, and adjoining parcels, will require off-site facilities. These facilities will include three components of water systems; source, storage, and transmission.

The City of Bend has stated that current City sources are inadequate to serve Broken Top. Furthermore, much of Broken Top is within City Pressure Level 3 and the existing City system cannot provide gravity service to Pressure Level 3 in the area of Broken Top. Therefore, the City Public Works staff has proposed, and the Broken Top Limited Partnership has generally concurred, that Broken Top develop new facilities, including water source, storage, and transmission, to produce additional water supply and to provide gravity service within Pressure Zone 3. The City has anticipated, and Broken Top Limited Partnership has concurred, that the new source will be groundwater. The City has identified and procured a parcel approximately 1.9 miles west of the northwest corner of Broken Top. This parcel is called the Outback parcel and is shown on the master plan drawing following this section. The City has directed that the new well and reservoir be located on the Outback parcel. A transmission line would convey the water from that parcel to the Broken Top property and then to existing City facilities.

In analyzing the need for new facilities, three cases were considered. The first case was the development of the first phase of Broken Top, which will consist of 145 dwelling units (109 single-family units and 36 multi-family units), and the clubhouse and administration building. This is described as Broken Top Phase 1 Development. The second case was the Broken Top Complete Development. This will consist of the complete development of Broken Top, which is an additional 530 dwelling units (393 single-family units and 137 multi-family units) beyond the Phase 1 units. The third case was the development of the additional properties that adjoin Broken Top and will share transmission capacity as described in Section 1.

The Broken Top Limited Partnership will construct a water system that complies with existing City of Bend standards. The system will be designed and constructed to integrate with existing and planned City facilities. The Broken Top Limited Partnership intends to transfer ownership of the new facilities to the City after construction. The City is expected to maintain and to operate the facilities as a part of the City water system.

The new water source will not be used for golf course irrigation or irrigation of common landscape features adjoining the golf course. Cascade Highlands, Inc. has received a permit from the Oregon Water Resources Department for a new well to be located within the Broken Top property which will be used for these irrigation purposes.

Broken Top Water and Sewer Master Plan
Section 2 - Water System (cont'd)

Summary

The Broken Top Complete Development can be served effectively by a system consisting of a new well and reservoir at the Outback site, with a transmission main from the Outback reservoir to the Overturf Butte Reservoirs.

Previous Studies

There are numerous previous studies of the City of Bend water systems. Coincident with this report, David Evans and Associates, Inc. is preparing an updated water system master plan. This updated master plan, which is referred to as the City Master Plan, is scheduled for completion in July 1992.

Preparation of the City Master Plan and the Broken Top Water Master Plan have been coordinated. However, many of the density assumptions differ between the two reports. The differences are due to the additional site specific considerations that were included in the Broken Top land-use master plan. The land-use master plan densities will be used for the Broken Top water master plan.

Design Criteria

The design criteria used for this Master Plan follow standard engineering practice and the City Master Plan. Many of the criteria in the City Master Plan and the Broken Top Master Plan are identical. As described in the City Master Plan, the criteria were established with consideration to Insurance Services Office (I.S.O.) requirements and historical consumption data for Bend. The design criteria are as follows:

1. As irrigation of the golf course and limited common-area landscaping will be provided by a private system owned by the developer, these flows were disregarded in facility sizing.

2. Maximum day consumption will equal 1,990 gallons per day per dwelling unit (gpd/du) for single-family homes and 1,420 gpd/du for multi-family units. (These rates are from the City Master Plan. For the single-family units, the daily rate represents approximately 750 gallons per capita per day (gpcd) for an average occupancy of 2.65 persons per unit. For the multi-family units, the daily rate represents a typical use of 750 gpcd for an average occupancy of 1.9 persons per unit.)

3. Within Broken Top, the dwelling units will be assumed as 502 single-family units and 173 multi-family units, as presented in the Land-Use Master Plan. In the adjoining areas, all of the units are assumed to be single-family.

4. Maximum fireflow within the Cascade Highlands Ultimate Development will be 2,000 gallons per minute (gpm). This flow is based on a single fire at the clubhouse. (Alternative assumptions for dwelling units fires would result in lower fireflows.) The design duration of the clubhouse fire is two hours.

5. On the maximum day, the peak flow rate is 40 percent greater than the average rate.

6. The maximum velocity in the water mains will be 6 feet per second (fps), based on peak rates during maximum day usage, except during fireflows, when velocities up to 8 fps are acceptable, based on fireflow plus average rate on maximum day usage.

7. Storage capacity will consist of peaking, emergency, and fireflow storage.

8. Peaking storage will be based on four hours of demand at the difference between the peak rate and average rate on the maximum use day.

9. Emergency storage will be based on 400 gpd/du for one day.

10. At City direction, a storage requirement of 1,700 gallons per single-family dwelling unit and 1,360 gallons per multi-family dwelling unit will used in lieu of the above criteria.

11. Storage and source requirements will be based only on the 675 dwelling units within Broken Top plus other uses within Broken Top. However, the City directed that transmission be sized in accordance with the City Utility Master Plan.

12. Source capacity will be such that the reservoirs will be refilled at the maximum day flow rate.

Existing Facilities and Connection Points

The water system facilities constructed for the Broken Top Project will connect with existing City of Bend facilities at two points during the development of Broken Top. A third connection is anticipated during the development of the adjoining properties. The first connection will be at the Outback Reservoir site. A connection, the configuration of which will be determined during design, will allow water being conveyed in the Bridge Creek Aqueduct system to be delivered into the Outback Reservoir. This interconnection will allow Bridge Creek water to be utilized within Broken Top when the flow of the Bridge Creek Aqueduct is not fully required within the present City service areas. It is not expected that water from the Broken Top well will be conveyed into the Bridge Creek Aqueduct system.

The second connection will be between the Pressure Zone 4 system within Broken Top and the Pressure Zone 4 facilities in the adjoining Overturf Butte subdivision. This connection will reinforce deliveries within Overturf Butte and will prevent the Broken Top Pressure Zone 4 system from being a dead-end system.

One final connection into the existing City facilities is anticipated during development of the adjoining properties. Capacity will be provided in the southern Broken Top water main to provide eventual service to the parcel described as South Miller. It is anticipated that the South Miller system will be interconnected with the existing City facilities within the West Ridge subdivision during development of the South Miller parcel.

Finally, if the Cascade Highlands Remainder parcel west and south of Broken Top is developed with City water, that system would include interconnections with the Broken Top system.

Water Facility Construction Phasing

The Broken Top Limited Partnership has concurred that the Broken Top Complete Development will require the off-site facilities generally described above. However, the Partnership has noted that the estimated construction cost of these facilities is a major expenditure in addition to the off-site sewer and road costs required by the City and Deschutes County.

Therefore, the Partnership proposes that water service to Broken Top Phase I be provided from the Bridge Creek Aqueduct. The Partnership would provide the storage capacity calculated below with the construction of Phase I. The additional storage would allow the more efficient use of the Bridge Creek Aqueduct, allowing service to Phase I without detriment to other City customers. In addition to the reservoir, the Partnership would construct the segment of the off-site transmission line from Broken Top to the existing Bridge Creek Aqueduct.

The Partnership proposes that up to fifty building permits can be issued within Broken Top Phase I prior to the completion of the reservoir and aqueduct connection. The reservoir and aqueduct would be complete before the fifty-first building permit is issued. The Partnership expects to provide assurances, presumably through bonding, that the other off-site water facilities will be constructed with Phase II.

The Partnership proposes that all other off-site water facilities required for the Broken Top Complete Development would be constructed at the initial development of the Phase II areas within Broken Top and that no building permits within Phase II be issued until the improvements are complete.

Within the boundaries of Broken Top, it is expected that water mains will be constructed as the individual residential phases are developed. However, it is expected that negotiations with the City will be pursued to determine which facilities will be required as each phase is developed.

Water Service Pressure Levels

The Broken Top project, and all adjoining properties with one small exception, are in areas defined by the City Pressure Zones 3 and 4. (The only exception is a small area within North Miller that is a few feet above the upper limit of Pressure Zone 3. However, this area is anticipated to be occupied by no more than one or two homes. It is expected that the City will approve service to these homes from Pressure Zone 3 facilities.)

The water delivered from the Outback Reservoir will be at Pressure Zone 3 pressures. Therefore, the entire property can be served without a booster pump system. Several pressure reducing stations, as shown on the water master plan drawing, will be required to serve the areas within Pressure Zone 4. With the exception of the connection into the Overturf Butte subdivision, the connections between the Broken Top water system and existing City water facilities will be at Pressure Zone 3 pressure levels.

Facility Sizing

Sizing of the Outback to Overturf transmission main, the Outback Reservoir, and the Outback well will be as described below:

Transmission Main

Maximum Day Use (Broken Top Complete Development) = (502 S.F. DU's x 1,990 gpd/du) + ((173 MF DU's x 1,360 gpd/du) = 1.23 millions gallons per day (MGD)

Equivalent Flow for Maximum Day Use = 1.23 MGD ÷ 24 hours/day ÷ 60 minutes/hour = 850 gpm

Peak Rate on Maximum Day = 1.40 x 850 gpm = 1,190 gpm = 2.65 cfs

At 6 fps, Pipe Area = 2.65 cfs ÷ 6 fps = 0.442 ft^2

Pipe Diameter = $(4 \times \text{Area} \div \pi)^{1/2}$ = $(4 \times 0.442\ ft^2 \div \pi)^{1/2}$ = 0.75 ft = 9.0 in

Pipe Diameter = 10 inches

Equivalent Flow for Maximum Day Use Plus Fireflow = 850 gpm + 2,000 gpm = 2,850 gpm = 6.35 cfs

At 8 fps, Pipe Area = 6.35 cfs ÷ 8 fps = 0.794 ft^2

Pipe Diameter = $(4 \times \text{Area} \div \pi)^{1/2}$ = $(4 \times 0.794\ ft^2 \div \pi)^{1/2}$ = 1.005 ft = 12.06 in

Pipe Diameter = 12 inches

Select a 12-inch main. However, at City direction, a 16-inch main is to be constructed to be consistent with the City Master Plan, with a recovery agreement for the incremental cost above the 12-inch main. The additional

diameter adds approximately 80 percent to the pipe cross-sectional area, and therefore approximately 80 percent to the flow capacity. Depending on the configuration of the adjoining property, the additional capacity will likely be sufficient for the adjoining property. This tentative conclusion should be checked when the adjoining configuration is established.

Storage

Total Storage = 502 S.F. DU's x 1,700 gallons + 173 M.F. DU's x 1,360 gallons = 1,088,000 gallons.

Select a reservoir of 1.0 MGD

(Note: If the Partnership chooses to provide a reservoir with capacity greater than 1.0 MGD, the additional capacity shall be applied to other developments, under the same criteria as used here. The developments to which the additional storage should apply will be determined by the Partnership.)

Source

Source = 1,000,000 gallons ÷ 24 hours ÷ 60 minutes/hour = 695 gpm.

(Note: As above, if the Partnership chooses to provide a source with greater capacity, the additional capacity shall be applied to other developments, under the same criteria as used here. The developments to which the additional storage should apply will be determined by the Partnership.)

Source Pumping Facilities

Under the ultimate development of the Broken Top water system, the only anticipated pump will be the well pump. That pump will be sized to deliver the 695 gpm well flow calculated above to the Outback Reservoir. No other pumps will be required within the system.

Storage

Storage of the ultimate development of Broken Top will be provided by a single bolted-steel reservoir located on the Outback parcel. As calculated above, the anticipated capacity of that reservoir will be 1.0 million gallons. Details of the reservoir construction and location will be determined during design.

The maximum elevation within the Outback parcel is approximately 3,980 feet. It also noted that the target overflow elevation for a reservoir serving City Pressure Zone 3 is 4,010 feet. It is agreed by the Partnership that the overflow elevation will be met.

Transmission Main

The Broken Top transmission main will convey water from the Outback Reservoir to Broken Top. The City has directed that the transmission main be located in the

Skyliners Road right-of-way, outside of the pavement section, to the intersection of Skyliners and Mt. Washington Drive. From that intersection, the main would be constructed under the Mt. Washington Drive pavement to the intersection of Mt. Washington Drive and Simpson Avenue. The Broken Top water system will connect to the transmission main at two points. The first is near the point at which the transmission main enters the Broken Top property from the north. The second is at the termination of the main.

The transmission main will be of ductile iron construction and will have a diameter of 16 inches as directed by the City. Construction details will be determined during design.

Distribution Mains

Consistent with City policies, the distribution within Broken Top will be comprised of primary loops of 12 inch diameter ductile iron pipe, with secondary loops of 10-inch ductile iron pipe and short segments of 8-inch and 6-inch ductile iron pipe as noted on the master plan drawing. Construction will be according to City of Bend policies. Construction details and exact routing of water mains will be determined during design.

As noted previously, three pressure reducing stations will be required to serve the Pressure Zone 4 areas within Broken Top. The pressure reducing stations will be constructed according to City policies and will be located as shown on the master plan drawing.

City of Bend Water System Policies

The Broken Top Limited Partnership will comply with all relevant City of Bend water system policies. It is expected that the City will assist in the application for the water right for the groundwater source at the Outback site.

City of Bend Responsibilities

The Partnership, with assistance from the City of Bend, will be responsible for procuring all necessary rights-of-way and easements for the off-site facilities and for securing a groundwater permit from the State of Oregon. The City will attempt to transfer a groundwater permit from another site to the Outback site.

Broken Top Planned Unit Development
Water and Sewer Master Plan
Section 3 - Sewer System

General

Sewer flows from Broken Top will be produced by 675 on-site dwelling units, by the common facilities within Broken Top, including the clubhouse and administration building, and by 2,053 off-site dwelling units and common facilities that will be located on land adjoining Broken Top. The sewer flows will be delivered into existing City of Bend sewer facilities for conveyance to the City wastewater treatment plant. In accordance with City policy and to the extent possible, sewer collection is to be by gravity line.

Summary

Most of the Broken Top site can be served by a single off-site main, located in the Simpson Avenue right-of-way between the Broken Top property line and 14th Street. (As described below, a small area near the northern boundary of Broken Top can be more effectively served by a connection to the proposed Skyliner Interceptor.) This Simpson Avenue off-site sewer main, which will be 18 inches in diameter, will connect to the existing City sewer system at a manhole on the east side of 14th Street at the intersection with Simpson Avenue.

Based on a review of the analyses in the draft City of Bend Utility Systems Master Plan, the capacity of existing City sewer facilities will not be overloaded by the addition of the Broken Top flows. (The City has concurred with this analysis.) Therefore, no modifications are required to existing facilities during the development of Broken Top. However, the development of the areas adjoining Broken Top will provide additional load on the existing mains, which may require system improvements. The capacity of the existing system should be re-evaluated when the development configuration of the adjoining parcels is more fully known.

Within Broken Top, virtually all areas can be served by gravity sewer. Many of the sewer lines can be 8-inch lines, with an 18-inch line in Simpson Avenue and Mt. Washington Drive, and one short segment of 10-inch line. Based on preliminary calculations, the results of which are shown on the Sewer Master Plan map, much of Broken Top can be served by gravity sewer lines buried at depths of less than 15 feet. However, a segment of line along Flynn Loop will require burial of up to 20 feet.

Two areas cannot be served by gravity sewer. The first is a multi-family area near the east boundary of Broken Top. This area is up to 15 feet lower in elevation than the proposed invert of the Simpson Avenue sewer at the Broken Top boundary. Lowering of the sewer to serve the multi-family area by gravity would require sewer excavations of up to 30 feet. It was therefore decided that lift station service for this multi-family area would be the reasonable engineering solution. Based on preliminary concepts, this area is estimated to contain up to 12 dwelling units. It is expected that a single lift station,

owned and operated by a homeowners association would be required. The City has concurred with this lift station.

The second area requiring a lift station is the area near the north boundary of Broken Top described above. If the Skyliner Interceptor is not completed prior to development of this area, a temporary lift station will be required to deliver the sewer flow into a gravity line.

Previous Studies

The previous study that was most pertinent to this master plan was the soon-to-be-completed City of Bend Utility Systems Master Plan. This report is referenced below as the City Master Plan.

Design Criteria

The design for the sewer facilities will be based on the recommended design parameters presented in the City Master Plan. The City Master Plan has amended the previous design criteria found in the Phase II Sewer Study to reflect historical sewer flows in Bend. These amended design criteria are as follows:

$$\text{Total Design Flow} = Q_t = Q_d + Q_n + Q_p + Q_i$$

where, Q_d = Domestic flow
Q_n = Non-domestic flow
Q_p = Point source flow
Q_i = Infiltration/Inflow allowance

The components of the Total Design Flow are further evaluated as follows:

- Domestic flow is estimated as 125 gallons per capita per day (gpcd). The average dwelling is estimated to have 2.3 occupants. Both values are from the City Master Plan.
- There will be no non-domestic flow within Broken Top.
- The only sources of point source waste will be the clubhouse, administration building, golf course restrooms, and golf maintenance building. The anticipated sewer flows from these facilities are calculated according to design standards from the Oregon Department of Environmental Quality (DEQ).
- Infiltration/inflow is estimated to be 225 gallons per acre per day (gpad). This value is from the City Master Plan.

The calculated average sewer flows are converted to design flows by application of a peaking factor to domestic flows, using the following formula from the City Master Plan.

- Peaking factor = $2.89/(x)^{0.16} \leq 3.0$, where x = Average domestic flow in million gallons per day (mgd)

Design Flow Calculations

The proposed sewer collection system for Broken Top is shown in the Sewer Master Plan map. The system consists of two major basins which flow together at the intersection of Mt. Washington Drive and Simpson Avenue.

The smaller of these two basins, which is named Basin A, serves the central and northern portions of Broken Top, and the 115 off-site dwellings on North Miller and Parcel Z. The sewer main that will serve Basin A will continue west on Simpson Avenue from the Mt. Washington Drive - Simpson Avenue intersection. Approximately 350 feet west of Mt. Washington Drive, Sub-Basin A1 enters from the north. Sub-Basin A1 conveys the sewer flows from the eastern segment of Tillinghast Loop and from some of the off-site dwelling units that will contribute to the Broken Top sewer basin.

A second major sub-basin, Sub-Basin A2, is located west of Sub-Basin A1. This sub-basin A2 serves the remainder of the off-site dwellings and the central segment of Tillinghast Loop. This area will be most efficiently served to the north, to the proposed Skyliner Interceptor. However, this interceptor may not be constructed by the time that Sub-Basin A2 is developed. Therefore, an interim approach for A2 would be a temporary lift station to convey the sewer flows into a gravity line within Sub-Basin A1. The sewer line size calculations below include this possibility.

The remainder of Basin A, named Sub-Basin A3, continues along Broken Top Drive, eventually collecting sewer flows for all other areas north of Broken Top Drive, most areas within 500 feet south of Broken Top Drive, most of the multi-family areas, and the golf course restrooms.

The larger of the two basins, which is named Basin B, will serve the remainder of Broken Top and most of the off-site dwelling units. The main that will convey flows from Basin B will continue south on Mt. Washington Drive from the Mt. Washington Drive - Simpson Avenue intersection. This main will collect the sewer flows from the multi-family area adjoining Mt. Washington Drive, including the units that will be served by a lift station. South of Broken Top Drive, the intended sewer line will leave Mt. Washington Drive. The primary demand on this line will be the off-site dwelling units south and west of Broken Top. These off-site areas are called Sub-Basin B3. A sewer that passes south of Broken Top will serve Sub-Basin B3. However, a smaller sewer line into the main line will drain two Broken Top sub-basins, B1 and B2, which will serve the northern and southern areas of southern Broken Top. These sewer alignments are shown on the Sewer Master Plan map.

Broken Top Water and Sewer Master Plan
Section 3 - Sewer System (cont'd)

For design flows in the sub-basins, the following data applies:

Table 2 - Sewer Design Parameters

	Sub-Basin A1	Sub-Basin A2	Sub-Basin A3	Sub-Basin B1	Sub-Basin B2	Sub-Basin B3	Total
Broken Top Dwelling Units	40	107	337	66	125	--	675
Off-Site Dwelling Units	69	46	--	--	--	1,938	2,053
Broken Top Area (acres)	36	34	264	79	64	--	477
Off-Site Area (acres)	30	20	--	--	--	842	892
Point Sources							
Clubhouse (gpd)	--	--	15,500	--	--	15,500	31,000
Administration And Maintenance Buildings	--	--	--	650	--	650	1,300
Golf Course Restrooms (gpd)	--	--	3,000	--	--	3,000	6,000

Comments regarding this data are as follows:

- On-site dwellings - The Broken Top master plan is used to calculate the number of on-site dwellings. Where a residential phase falls into multiple sewer basins, the dwellings according to expected lot lines.
- On-site areas - The on-site areas total less than the project total of 499 acres as two areas, the area draining toward the clubhouse lake and the area draining toward the fill on Mt. Washington Drive east of the eighteenth fairway are considered non-contributory. However, the total area considered for inflow and infiltration is likely high as the entire remainder of Broken Top is included in the contributory area, including golf course areas that are outside the UGB and at a distance of up to 600 feet from shallow sewer lines.
- Off-site areas - The off-site areas were estimated based on the available topography.
- Clubhouse - Following DEQ standards, the daily clubhouse sewer flow was estimated as 300 golfers at 25 gallons per person and 200 restaurant customers at 40 gallons per customer.
- Administration and Maintenance Buildings - Following DEQ standards, the administration building was estimated to have eight to ten employees, at 15 gpd per employee and the maintenance building was estimated to have ten employees, at 50 gpd per employee.
- Golf Course Restrooms - Following DEQ standards, each restrooms was estimated as a picnic park without a shower, at 5 gpd per golfer.
- Cascade Highlands Remainder Point Sources - In the absence of firm planning for the Cascade Highlands Remainder area, it was assumed that all of the point sources within Broken Top would be repeated in the area zoned UAR-10.

Broken Top Water and Sewer Master Plan
Section 3 - Sewer System (cont'd)

The daily sewer flows for each of the basins and sub-basins are calculated below. Also, the daily flows are converted to average flow rates and design flow rates. For each basin, the daily flow was sufficiently small that the peaking factor computed to 3.0.

Sub-Basin A1	
Broken Top Dwellings (40 dwellings x 2.3 people per dwelling x 125 gallons per day)	11,500 gpd
Off-Site Dwellings (69 dwellings x 2.3 people per dwelling x 125 gallons per day)	19,800 gpd
SUBTOTAL	31,300 gpd
Average Flow Rate (31,300 gpd ÷ 24 hours ÷ 60 minutes)	21.7 gpm
Design Flow Rate (21.7 gpm x 3.0)	65.1 gpm
Broken Top Area (36 acres x 225 gpad ÷ 24 hours ÷ 60 minutes)	5.6 gpm
Off-Site Area (30 acres x 225 gpad ÷ 24 hours ÷ 60 minutes)	4.7 gpm
TOTAL	75.4 gpm
Sub-Basin A2	
Broken Top Dwellings (107 dwellings x 2.3 people per dwelling x 125 gallons per day)	30,800 gpd
Off-Site Dwellings (46 dwellings x 2.3 people per dwelling x 125 gallons per day)	13,200 gpd
SUBTOTAL	44,000 gpd
Average Flow Rate (44,000 gpd ÷ 24 hours ÷ 60 minutes)	30.6 gpm
Design Flow Rate (30.6 gpm x 3.0)	91.8 gpm
Broken Top Area (34 acres x 225 gpad ÷ 24 hours ÷ 60 minutes)	5.3 gpm
Off-Site Area (20 acres x 225 gpad ÷ 24 hours ÷ 60 minutes)	3.1 gpm
TOTAL	100 gpm
Sub-Basin A3	
Broken Top Dwellings (337 dwellings x 2.3 people per dwelling x 125 gallons per day)	96,900 gpd
Clubhouse	15,500 gpd
Golf Course Restrooms	3,000 gpd
SUBTOTAL	115,400 gpd
Average Flow Rate (115,400 gpd ÷ 24 hours ÷ 60 minutes)	80.1 gpm
Design Flow Rate (80.1 gpm x 3.0)	240 gpm
Broken Top Area (264 acres x 225 gpad ÷ 24 hours ÷ 60 minutes)	41.2 gpm
TOTAL	281 gpm

Broken Top Water and Sewer Master Plan
Section 3 - Sewer System (cont'd)

Sub-Basin B1	
Broken Top Dwellings (66 dwellings x 2.3 people per dwelling x 125 gallons per day)	19,000 gpd
Administration and Maintenance Buildings	650 gpd
SUBTOTAL	19,600 gpd
Average Flow Rate (19,600 gpd ÷ 24 hours ÷ 60 minutes)	13.6 gpm
Design Flow Rate (13.6 gpm x 3.0)	40.8 gpm
Broken Top Area (79 acres x 225 gpad ÷ 24 hours ÷ 60 minutes)	12.3 gpm
TOTAL	53.1 gpm
Sub-Basin B2	
Broken Top Dwellings (125 dwellings x 2.3 people per dwelling x 125 gallons per day)	35,900 gpd
SUBTOTAL	35,900 gpd
Average Flow Rate (35,900 gpd ÷ 24 hours ÷ 60 minutes)	24.9 gpm
Design Flow Rate (24.9 gpm x 3.0)	74.7 gpm
Broken Top Area (64 acres x 225 gpad ÷ 24 hours ÷ 60 minutes)	10.0 gpm
TOTAL	84.7 gpm
Sub-Basin B3	
Off-Site Dwellings (1,938 dwellings x 2.3 people per dwelling x 125 gallons per day)	557,000 gpd
Clubhouse	15,500 gpd
Golf Course Restrooms	3,000 gpm
Administration and Maintenance Buildings	650 gpd
SUBTOTAL	576,000 gpd
Average Flow Rate (576,000 gpd ÷ 24 hours ÷ 60 minutes)	400 gpm
Design Flow Rate (400 gpm x 3.0)	1,200 gpm
Off-Site Area (842 acres x 225 gpad ÷ 24 hours ÷ 60 minutes)	131.6 gpm
TOTAL	1,331 gpm

Combined Flows

For the purpose of main sizing, the following combined flows apply:

- A3 = 281 gpm
- A1 + A3 = 355 gpm
- A1 + A2 + A3 = 455 gpm
- B1 + B2 = 138 gpm
- B1 + B2 + B3 = 1,469 gpm
- A + B = 1,924 gpm

Facility Sizing

From the City Master Plan, the smallest allowable sewer main size is eight inches. At the minimum grade of 0.4 percent, the flow capacity of an eight-inch line is 343 gpm. Therefore, the total flow from each of the individual sub-basins except B3 can be accommodated with eight-inch sewer mains. However, larger mains will be required for combinations of sub-basins, as described below.

In Basin A, the combined flows of Sub-Basins A3 and A2 is 355 gpm. This flow is greater than the allowable flow in eight-inch mains at minimum grades. Therefore, the main that carries this combined flow should be ten inches in diameter. This length of ten-inch sewer line will only be approximately 350 feet. With the possible addition of the sewer flow from Sub-Basin A1, the combined flow will be 455 gpm, which is still within the allowable flow in a ten-inch main at minimum grade of 520 gpm. Therefore, no increase in sewer sizing is required to accommodate the possible conveyance of Sub-Basin A2 through Basin A.

Within Basin B, the combined flow of B1 and B2 will be well within the limit of an eight-inch main. However, the flow from Sub-Basin B3 will require an eighteen-inch main, for which the allowable capacity at minimum grade is 1,633 gpm. An 18-inch main will be adequate for the remainder of Basin B to the intersection of Mt. Washington Drive and Simpson Avenue.

For the off-site sewer, the design flow of 1,924 gpm exceeds the capacity of a 18-inch sewer main at minimum grade. However, the average grade of Simpson Avenue between Mt. Washington Drive and 14th Street is slightly greater than 2.5 percent, therefore a greater sewer main slope can be accommodated. At a slope of 0.2 percent, the capacity of a 18-inch main increases to 2,108 gpm. This segment will therefore be designed with a 18-inch sewer on a minimum grade of 0.2 percent.

A preliminary plan of the sewer routing and estimated depth of excavation is presented on the Sewer Master Plan map. Depths of excavation were based on minimum grades as described above. The assumptions were also made that the average spacing between manholes would be 200 to 300 feet and that the difference between the inflow and outflow inverts at each manhole would be at least 0.10 feet.

Existing Facilities and Connection Points

The proposed Broken Top sewer will connect with the City of Bend system at a manhole located on the east side of the Simpson Avenue - 14th Street intersection. Based on the design flows from Broken Top, the existing City facilities downstream of this connection point will not require improvements to convey the additional flows. However, the development of the Cascade Highlands Remainder may require improvements of existing facilities.

Site Design Criteria

With Broken Top, minimum floor elevations will be required have generally been assumed to be at existing grade. In many areas, facilities below grade would require individual lift stations.

City of Bend Sewer System Policies

The Broken Top Limited Partnership will comply with all existing City of Bend sewer system policies.

STATE OF OREGON)
COUNTY OF DESCHUTES) SS.

I, MARY SUE PENHOLLOW, COUNTY CLERK AND RECORDER OF CONVEYANCES, IN AND FOR SAID COUNTY, DO HEREBY CERTIFY THAT THE WITHIN INSTRUMENT WAS RECORDED THIS DAY:

92 AUG 24 PM 1:36

MARY SUE PENHOLLOW
COUNTY CLERK

BY. MJ Bartko DEPUTY

NO. 92-27776 FEE 18.00

DESCHUTES COUNTY OFFICIAL RECORDS

92-27777 214 - 0752

AWBREY GLEN SEWER MASTER PLAN AGREEMENT

The City of Bend, an Oregon municipal corporation, hereinafter called "CITY" and BROOKS RESOURCES CORPORATION, hereinafter called "DEVELOPER" agree as follows:

1. DEVELOPER has received, read and understands CITY'S sewer and water policy which is incorporated as part of this Master Plan Agreement. The terms used in this agreement have the meanings assigned to them by City's sewer policy unless specifically provided otherwise.

2. DEVELOPER desires sewer service to the property described by Exhibit "A" which is attached to and made part of this agreement.

3. DEVELOPER has prepared a written report describing the development and infrastructure of the Awbrey Glen Subdivision. This text is described as Exhibit "B".

CITY and DEVELOPER agree as follows:

Development of Sewer Facilities

4. DEVELOPER agrees to develop and install at DEVELOPER'S expense a phased sewer system including a pump station, pressure and gravity sewer mains according to City Standards and Specifications as follows:

4.1 DEVELOPER agrees to facilitate gravity sewer flows from City Master Plan Drainage area 22 through Awbrey Glen drainage area 2, by using available capacity in the sewer main located between fairway 5 and fairway 6 as shown on Exhibit "B".

4.2 DEVELOPER shall provide gravity sewer service to each platted lot. Temporary private pump stations will be permitted until a permanent gravity service can be provided through subsequent phases or other development.

4.3 DEVELOPER shall provide paved access to those manholes that are not located in streets in accordance with City Standards and Specifications. These paved access ways may be used as cartpaths and shall be of sufficient width for the CITY rodder unit and have adequate turnarounds or be looped.

4.4 DEVELOPER shall submit for approval the construction plans for the proposed Awbrey Glen pump station. DEVELOPER understands that no building permits can be issued since the DEVELOPER is constructing the sewer mains prior to the pump station and these mains can not function until the entire sewage system is complete and approved by CITY.

4.5 DEVELOPER shall control hydrogen sulfide buildup within the sewer mains by means of compressed air injection. Back draining of the sewer mains will not be permitted.

4.6 DEVELOPER shall provide electrical lines to service CITY owned pump stations. CITY will provide the alarm telemetry system for the pump station. DEVELOPER shall reimburse CITY for this device.

4.7 DEVELOPER shall comply with the requirements of the Newport Interceptor Agreement. This agreement is identified as Exhibit "C" and attached to this agreement.

4.8 DEVELOPER shall resize the appropriate portions of the Valhalla sewer system if those portions are incapable of transmitting the additional sewer flows from Awbrey Glen to the Newport Interceptor.

4.9 DEVELOPER shall agree to participate in the resizing of the Wyndemere pump station for transmission of sewage away from the Newport Interceptor in conformance with the requirements of Exhibit "C".

4.10 DEVELOPER shall receive the applicable credit and/or recovery provided by City laws, rules and regulations for the following facilities constructed by DEVELOPER:

a. Awbrey Glen sewage lift station, approved and accepted by City of Bend.
b. Sewer mains as appropriate, approved and accepted by City of Bend.
c. Other capital improvements that may be eligible as determined by the City of Bend.

Standard Conditions

5. Service shall be supplied only through sewer facilities constructed and installed to CITY'S standards and specifications. CITY'S Standards and Specifications may be obtained from the Engineering Department. All sewer facilities except service connection lines shall be the property of CITY and shall be installed within public ways or CITY easements. DEVELOPER shall not hook up to CITY'S sewer facilities until CITY accepts sewer facilities installed by DEVELOPER in writing.

5.1 DEVELOPER shall promptly pay all applicable charges in connection with CITY sewer service as they become due. Charges shall be prescribed by an appropriate schedule, and charges may be changed from time to time.

5.2 No other use of CITY sewer service or CITY sewer facilities except as provided in this agreement shall be permitted without express consent of CITY.

5.3 DEVELOPER shall comply with all applicable governmental laws, rules and regulations, including but not limited to CITY ordinances, resolutions and the provisions of CITY sewer and water policies as they now exist and as they may be changed from time to time.

5.4 If the DEVELOPER'S property is outside the City, DEVELOPER hereby consents to the annexation of DEVELOPER'S property when annexation shall be deemed appropriate by the CITY. A separate Consent to Annexation Agreement is attached to this agreement.

5.5 Overhead shall be charge for all labor and materials that are not covered by engineering fees.

5.6 When required by CITY, DEVELOPER agrees to deliver to CITY "As Built" reproducible drawings of the completed work ,signed by an Oregon Professional Engineer prior to acceptance of the work by CITY.

5.7 Upon completion of the project, statement of all expenses must be submitted to CITY for record keeping purposes.

5.8 No service connection will be permitted until all applicable fees are paid and additional service agreements are competed. General Benefit Fees will be collected with building permits.

5.9 This agreement and the sewer service may be terminated by CITY for any failure to comply with the terms and conditions of this agreement, the CITY'S sewer policy or any other agreements with the CITY affecting this property.

5.10 This agreement shall be binding upon DEVELOPER and DEVELOPER'S heirs, successors and assigns and shall be a covenant running with the land.

DATED this 21ST day of JULY, 19 92.

DEVELOPER BROOKS RESOURCES CORPORATION

BY: Paul H. Buchanan, VICE PRESIDENT
Natalie Barss, SECRETARY

STATE OF OREGON)
)ss
County of Deschutes)

Personally appeared the above named PAUL H. BUCHANAN, VICE PRESIDENT, NATALIE BARSS, SECRETARY and acknowledged the foregoing instrument to be _____ voluntary act before me this _____day of _____19_____.

_____
NOTARY PUBLIC FOR OREGON
My Commission Expires: _____

CITY

Deborah S. McMahon
Development Services

STATE OF OREGON)
) ss
County of Deschutes)

This instrument was acknowledged before me on July 21, 1992 by Paul H. Buchanan, Vice President and Natalie Barss, Secretary of Brooks Resources Corporation, an Oregon corporation, on behalf of the corporation.

OFFICIAL SEAL
TERRY BYRUM
NOTARY PUBLIC-OREGON
COMMISSION NO. 011479
MY COMMISSION EXPIRES DEC. 5, 1995

Before Me:

Terry Byrum
Notary Public for Oregon
My Commission Expires 12/05/95