APPENDIX A

Water Rights Certificates/Forms

Copies of Water Rights Held by City of Lebanon and Associated Relevant Documents

COUNT 1N—11-5

STATE OF OREGON

COUNTY OF LINN

CERTIFICATE OF WATER RIGHT

This Is to Certify, *That* CROWN ZELLERBACH CORPORATION, a Nevada Corporation *of* 1500 SW First Street, Portland, *State of* Oregon 97201, *has a right to the use of the waters of* South Santiam River *a tributary of* Santiam River *for the purpose of* manufacturing of pulp and paper

and that said right has been confirmed by decree of the Circuit Court of the State of Oregon for Linn *County, and the said decree entered of record at Salem, in the Order Record of the WATER RESOURCES DIRECTOR, in Volume* 18 *, at page* 15 *; that the priority of the right thereby confirmed dates from* 1890

that the amount of water to which such right is entitled, for the purposes aforesaid, is limited to an amount actually beneficially used for said purposes, and shall not exceed 10.0 cubic feet per second.

The point of diversion is located in the NW¼ NW¼ as projected within Cheadle DLC 55, Section 19, Township 12 South, Range 1 West, Willamette Meridian, being 1430 feet north and 1050 feet east from the W¼ corner Section 19.

A description of the place of use under the right, and to which such right is appurtenant, is as follows:

S½ SW¼ SW¼
as projected within Keese DLC 43
Section 2
T. 12 S., R. 2 W., W. M.

And said right shall be subject to all other conditions and limitations contained in said decree. The right to the use of the water for the purposes aforesaid is restricted to the lands or place of use herein described.

WITNESS the signature of the Water Resources Director, affixed this date 22nd August *,* 1980 .

James E. Sexson
Water Resources Director

Recorded in State Record of Water Right Certificates, Volume 43 *, page* 49335

STATE OF OREGON

COUNTY OF LINN

ORDER APPROVING A CHANGE IN USE AND PLACE OF USE

Pursuant to ORS 540.510 to 540.530, after notice was given and no objections were filed, and finding that no injury to existing water rights would result, this order approves, as conditioned or limited herein, TRANSFER 6110 submitted by

CITY OF LEBANON
925 MAIN STREET
LEBANON, OREGON 97355.

The right to be modified was confirmed by decree of the Circuit Court of the State of Oregon for LINN County as evidenced by Certificate 49335. The decree is recorded in the Order Record of the Water Resources Director in Volume 18, at Page 15. The date of priority is 1890.

The right allows the use of the SOUTH SANTIAM RIVER, a tributary of the SANTIAM RIVER, for MANUFACTURING OF PULP AND PAPER. The amount of water to which this right is entitled is limited to an amount actually beneficially used and shall not exceed 10.0 cubic foot per second, if available at the authorized point of diversion: NW¼ NW¼, as projected within CHEADLE DLC 55, SECTION 19, T 12 S, R 1 W, WM; 1430 FEET NORTH AND 1050 FEET EAST FROM THE W¼ CORNER, SECTION 19, or its equivalent in case of rotation, measured at the point of diversion from the source.

The authorized place of use is located as follows:

S½ SW¼ SW¼
as projected within KEESE DLC 43
SECTION 2
TOWNSHIP 12 SOUTH, RANGE 2 WEST, W.M.

The right to use water for the above purpose is restricted to beneficial use on the lands or place of use described and is subject to all other conditions and limitations contained in the decree.

The applicant proposes to change the use to MUNICIPAL USE and to change the place of use to:

SW¼
W½ SE¼
SECTION 2

NW¼ NE¼
S½ NE¼
NW¼
S½
SECTION 3

NE¼
N½ SE¼
SE¼
SECTION 4

E½
SE¼ NW¼
N½ SW¼
SECTION 9

ALL
SECTION 10

NW¼ NE¼
S½ NE¼
NW¼
S½
SECTION 11

SW¼
SW¼ SE¼
SECTION 12

W½
W½ NE¼
SECTION 13

ALL
SECTION 14

ALL
SECTION 15

E½
NE¼ NW¼
SECTION 16

SE¼ NE¼
E½ SE¼
SECTION 21

ALL
SECTION 22

ALL
SECTION 23

S½ NW¼
SW¼
W½ SE¼
SECTION 24

NW¼
SECTION 25

NE¼
N½ NW¼
SW¼ NW¼
N½ SE¼
SECTION 26

NE¼
SE¼ NW¼
SECTION 27

TOWNSHIP 12 SOUTH, RANGE 2 WEST, W.M.

THESE CHANGES TO AN EXISTING WATER RIGHT MAY BE MADE PROVIDED THE FOLLOWING CONDITIONS ARE MET BY THE WATER USER:

1. The proposed change shall be completed on or before October 1, 1998.

Certificate 49335 is cancelled. When satisfactory proof of the completed change is received, a new certificate confirming this water right will be issued.

WITNESS the signature of the Water Resources Director, affixed October 25, 1996.

G. Huntington (for)
Martha O. Pagel, Director

RECEIVED
APR 2 8 1997
WATER RESOURCES DEPT.
SALEM, OREGON

FINAL PROOF SURVEY & CLAIM OF BENEFICIAL USE

FILE No. T-6110

APPLICANT: **City of Lebanon**

925 Main Street

Lebanon, OR 97355

GENERAL:

The proposed transfer application transfers Water Right Certificate 49335 with a priority date of 1890 with use for manufacturing of pulp and paper to the City of Lebanon, Oregon for municipal use. The existing right has the following data:

1. Source: South Santiam River
2. Quantity: 10 cubic feet per second (cfs)
3. Use: Manufacturing of Pulp and Paper
4. Certificate No.: 49335

It is the City's intent to transfer the water right to municipal use and change the area of use to the area within the City's urban growth boundary. The point of diversion does not change, nor does the quantity of water to be withdrawn.

Beginning December 9, 1987, the City of Lebanon received the water right from James River Corporation via a Quitclaim Deed (Volume 43, Pg. 49335). The City then began the transfer process with the Transfer Application submitted to Water Resources February 8, 1988. The City received the Transfer Permit No. 6110 October 25, 1996 (See Appendix C).

SOURCE (S):

The source for Transfer T-6110 is the South Santiam River, a tributary of the Santiam River.

DIVERSION POINT(S):

The diversion point is located as the NW1/4 NW1/4, as projected within CHEADLE DLC 55, Section 19, T12S, R1W, WM; 1430 feet North and 1050 feet east from the W1/4 Corner, Section 19.

The diversion point is the same diversion point established to issue Water Right Certificate 49335 (the water right to be transferred). The diversion point is the headwork's for the Albany-Santiam Canal which also provides water service for the City of Albany's water treatment plant in Albany, Oregon.

The diversion point structure has a headgate system. The diversion point is shown in Appendix A consisting of two plans:

1. "Project Site Plan and Dam Section" as prepared by Harza Northwest dated June 1994.

2. "Details of Canal Head Works" as prepared by Byllesby Engineering and Management Corporation dated December 1, 1924.

USE(S):

The proposed use for the water right transfer is "municipal".

CALCULATIONS:

As previously stated the point of diversion is used not only for Transfer T-6110, but for the City of Albany. The City of Albany in 1994 had a "draft" Federal Energy Regulatory Commission License Application prepared. The report included a study of fish passage prepared by Harza Northwest, Inc. dated July 15, 1994. Harza's report (See Appendix B) indicates existing average flow of the Albany-Santiam Canal is 220 cfs, which indicates the point of diversion can easily pass the 10 cfs requested in Transfer T-6110.

All flow diverted is by gravity at the point of diversion, therefore, no pumps are used or needed.

Certification

The final proof survey and inspection of the use as found to be completed under the terms and conditions of Transfer T-6110 was completed by me on April 8, 1997, and the facts contained in this report and accompanying final proof map are correct to the best of my knowledge.

We, the City of Lebanon, agree to the findings of the CWRE and do submit this site report and map as my claim of Beneficial Use of the water as provided under the terms and conditions of Transfer T-6110.

City of Lebanon

925 Main Street

Lebanon, OR 97355

COURT 1M—11-75

STATE OF OREGON

COUNTY OF LINN

CERTIFICATE OF WATER RIGHT

This Is to Certify, *That* PACIFIC POWER AND LIGHT COMPANY, a Maine Corporation

of Public Service Building, Portland , *State of* Oregon 97204 , *has a right to the use of the waters of* South Santiam River

a tributary of Santiam River *for the purpose of* municipal use in and around the City of Lebanon

and that said right has been confirmed by decree of the Circuit Court of the State of Oregon for Linn *County, and the said decree entered of record at Salem, in the Order Record of the WATER RESOURCES DIRECTOR, in Volume* 18 *, at page* 15 *; that the priority of the right thereby confirmed dates from* 1900

that the amount of water to which such right is entitled, for the purposes aforesaid, is limited to an amount actually beneficially used for said purposes, and shall not exceed 9.0 cubic feet per second.

The point of diversion is located in the NW¼ NW¼ as projected within Cheadle DLC 55, Section 19, Township 12 South, Range 1 West, W. M., being 1430 feet north and 1050 feet east from the W¼ corner Section 19.

A description of the place of use under the right, and to which such right is appurtenant, is as follows:

SE¼ SW¼
E½ SE¼
Section 3

NE¼ SE¼
Section 9

NE¼
E½ NW¼
SW¼
SE¼
Section 10

SW¼ NE¼
NW¼
SW¼
SE¼
Section 11
T. 12 S., R. 2 W., W. M.

W½ SW¼
Section 12

W½ NE¼
NW¼
SW¼ SW¼
Section 14

NE¼
NE¼ NW¼
SE¼ SW¼
SE¼
Section 15

N½ NE¼
NE¼ NW¼
Section 22

NW¼ NW¼
Section 23
T. 12 S., R. 2 W., W. M.

And said right shall be subject to all other conditions and limitations contained in said decree. The right to the use of the water for the purposes aforesaid is restricted to the lands or place of use herein described.

WITNESS the signature of the Water Resources Director, affixed this date 22nd August , 1980 .

James E. Sexson
Water Resources Director

Recorded in State Record of Water Right Certificates, Volume 43 *, page* 49385

STATE OF OREGON

COUNTY OF LINN

CERTIFICATE OF WATER RIGHT

This Is to Certify, That CITY OF LEBANON

of 925 Main Street, Lebanon , State of Oregon , has made proof to the satisfaction of the STATE ENGINEER of Oregon, of a right to the use of the waters of A well

a tributary of South Santiam River for the purpose of irrigation of 5.5 acres

under Permit No. G-4350 of the State Engineer, and that said right to the use of said waters has been perfected in accordance with the laws of Oregon; that the priority of the right hereby confirmed dates from October 4, 1968

that the amount of water to which such right is entitled and hereby confirmed, for the purposes aforesaid, is limited to an amount actually beneficially used for said purposes, and shall not exceed 0.07 cubic foot per second

or its equivalent in case of rotation, measured at the point of diversion from the stream. The point of diversion is located in the SW¼ NE¼, as projected within Ralston DLC 49, Section 10, T. 12 S., R. 2 W., W. M. Well located: 2203 feet North and 5140 feet West from SE Corner, J. Ralston DLC 49,

The amount of water used for irrigation, together with the amount secured under any other right existing for the same lands, shall be limited to one-eightieth of one cubic foot per second per acre, or its equivalent for each acre irrigated and shall be further limited to a diversion of not to exceed 2½ acre feet per acre for each acre irrigated during the irrigation season of each year;

and shall conform to such reasonable rotation system as may be ordered by the proper state officer.

A description of the place of use under the right hereby confirmed, and to which such right is appurtenant, is as follows:

5.5 acres SW¼ NE¼ as projected within Ralston DLC 49
Section 10
T. 12 S., R. 2 W., W. M.

The right to the use of the water for the purposes aforesaid is restricted to the lands or place of use herein described.

WITNESS the signature of the State Engineer, affixed this date. October 5, 1971

CHRIS L. WHEELER
State Engineer

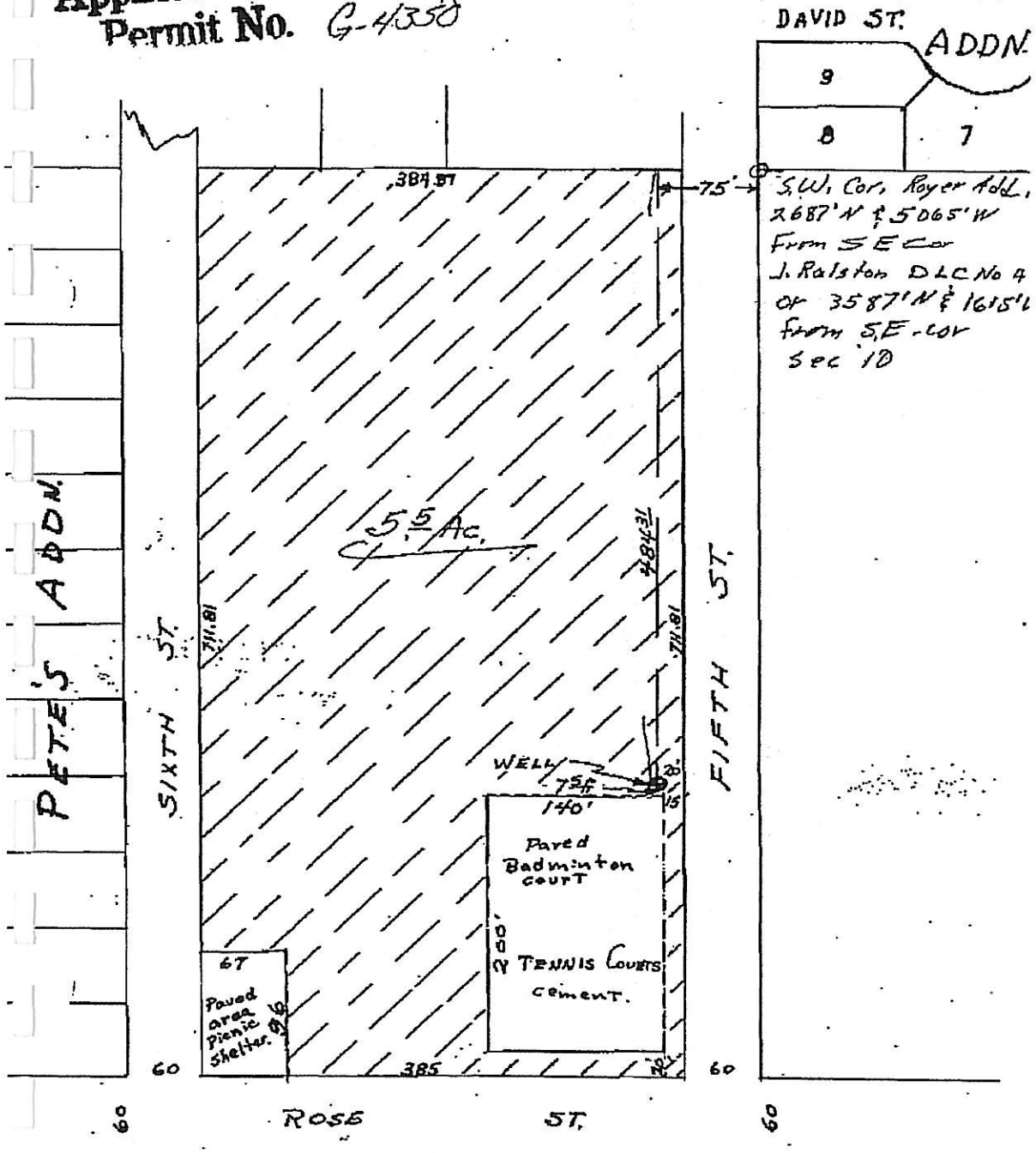
Recorded in State Record of Water Right Certificates, Volume 29 , page 37744

Water Right Application for
City of Lebanon
SW¼ of NE¼ of Sec. 10
T12S, R2W W.M.

5/18/67

BERT UDELL
City Engineer

Application No. G-4625
Permit No. G-4350



Application No. 58905 Permit No. 44389

STATE OF OREGON WATER RESOURCES DEPARTMENT

Application for Permit to Appropriate Surface Water

RECEIVED
JUL 13 1979
WATER RESOURCES DEPT
SALEM, OREGON

I, PACIFIC POWER & LIGHT COMPANY (Name of Applicant)

of 920 S. W. Sixth Avenue (Mailing Address), Portland (City)

State of Oregon, 97204 (Zip Code) Phone No. 243-1122 do hereby make application for a permit to appropriate the following described waters of the State of Oregon:

1. The source of the proposed appropriation is South Santiam River, a tributary of Santiam River

2. The point of diversion is to be located 1350 ft. S. (N. or S.) and 1150 ft. E. (E. or W.) from the NW corner of Section 19, T12S, R1W, W.M. (Public Land Survey Corner)

(If there is more than one point of diversion, each must be described)

being within the NW ¼ of the NW ¼ of Sec. 19 Tp. 12 South (N. or S.) R 1 West (E. or W.), W. M., in the county of Linn

3. Location of area to be irrigated, or place of use if other than irrigation. See attached No. 3

Township	Range	Section	List ¼ ¼ of Section	List use and/or number of acres to be irrigated

Form 690-1-0-1-77

PD-23-OR-12 (Lebanon)

ASSIGNED. See Misc. Rec., Vol. 6 Page 1659

4. *The amount of water which the applicant intends to apply to beneficial use is* 18 cfs

cubic feet per second

(If water is to be used from more than one source, give quantity from each)

5. *The use to which the water is to be applied is* for municipal use

6. *DESCRIPTION OF WORKS*

Include dimensions and type of construction of diversion dam and headgate, length and dimensions of supply ditch or pipeline, size and type of pump and motor, type of irrigation system to adequately describe the proposed distribution system.

Lebanon-Santiam Canal - Top width 35 feet; bottom width 25 feet; depth 5 feet; Grade or fall per 1000 feet is 1.4 feet.

If for domestic use state number of families to be supplied

7. *Construction work will begin on or before* Has Begun

8. *Construction work will be completed on or before* 2000

9. *The water will be completely applied to the proposed use on or before* 2000

Application No. 58905 *Permit No.* 44389

ATTACHMENT TO APPLICATION FOR PERMIT TO
APPROPRIATE SURFACE WATER
NO. 3

			NE¼				NW¼				SW¼				SE¼			
TWP	RANGE	SEC.	NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼
12S	2W	3												X	X			X
		9													X			X
		10	X	X	X	X	X			X	X	X	X	X	X	X	X	X
		11			X		X	X	X	X	X	X	X	X	X	X	X	X
		12										X	X					
		14		X	X		X	X	X	X		X	X					
		15	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		22	X	X	X	X	X			X	X			X	X	X	X	X
		23					X	X	X	X	X	X						
		16	X			X									X			X
		27	X	X	X	X	X			X								

Application No. 58905
Permit No. 44389

Remarks: This is a project use of water to meet the growth of the Town of Lebanon to year 2000 A.D.

PACIFIC POWER & LIGHT COMPANY

Jack L. Stokes
Signature of Applicant

Vice President

This is to certify that I have examined the foregoing application, together with the accompanying maps and data, and return the same for

In order to retain its priority, this application must be returned to the Water Resources Director with corrections on or before ....., 19.....

WITNESS my hand this ..... *day of* ....., 19.....

Water Resources Director

By .....

This instrument was first received in the office of the Water Resources Director at Salem, Oregon, on the 12th *day of* July, 19 79, *at* 11:00 *o'clock* A *M.*

Application No. 58905 *Permit No.* 44389

Application No. 58905 Permit No. 44389

Permit to Appropriate the Public Waters of the State of Oregon

This is to certify that I have examined the foregoing application and do hereby grant the same SUBJECT TO EXISTING RIGHTS INCLUDING THE EXISTING FLOW POLICIES ESTABLISHED BY THE WATER POLICY REVIEW BOARD and the following limitations and conditions:

The right herein granted is limited to the amount of water which can be applied to beneficial use and shall not exceed 18.0 *cubic feet per second measured at the point of diversion from the stream, or its equivalent in case of rotation with other water users, from* South Santiam River

The use to which this water is to be applied is municipal

If for irrigation, this appropriation shall be limited to ..... of one cubic foot per second or its equivalent for each acre irrigated.....

and shall be subject to such reasonable rotation system as may be ordered by the proper state officer.

The priority date of this permit is July 12, 1979

Actual construction work shall begin on or before September 27, 1980 *and shall thereafter be prosecuted with reasonable diligence and be completed on or before October 1, 19*81

Extended to Oct. 1, 1986 Extended to October 1, 1991, 10-1-96

*Complete application of the water to the proposed use shall be made on or before October 1, 19*82

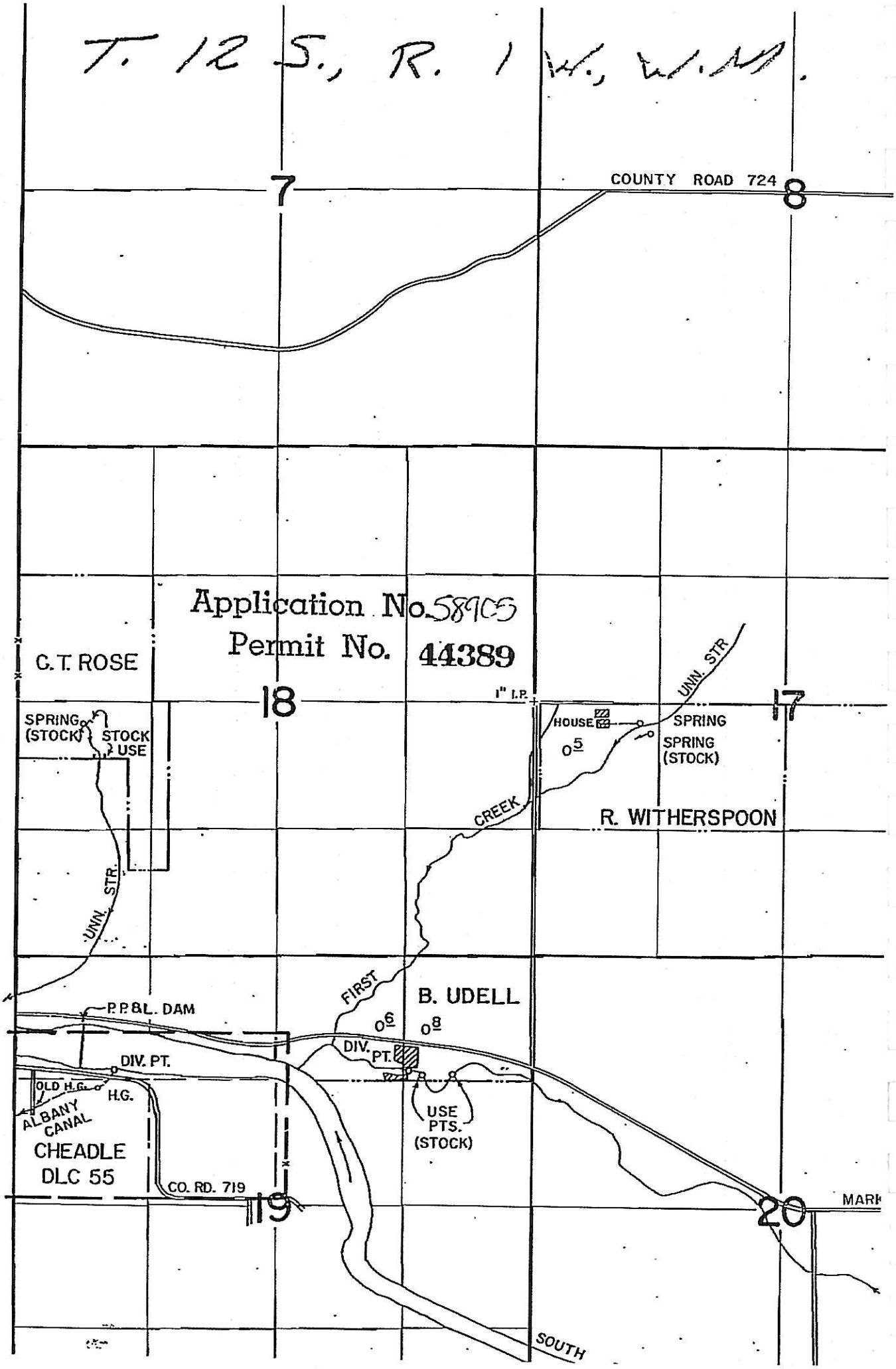
Extended to Oct. 1, 1986 Extended to October 1, 1991, 10-1-96

WITNESS my hand this 27th *day of* September, *19*79

James E. Sexton

Water Resources Director

L 10 C 2001


T. 12 S., R. 1 W., W.M.
7
COUNTY ROAD 724
8
Application No. 58905
Permit No. 44389
C.T. ROSE
18
1" I.P.
17
SPRING (STOCK)
STOCK USE
HOUSE
SPRING
SPRING (STOCK)
UNN. STR.
CREEK
R. WITHERSPOON
UNN. STR.
FIRST
B. UDELL
P.P.&L. DAM
DIV. PT.
DIV. PT.
OLD H.G.
H.G.
ALBANY CANAL
USE PTS. (STOCK)
CHEADLE DLC 55
CO. RD. 719
19
20
SOUTH

APPENDIX B

CPES Cost Analysis

C H2M HILL P arametric Cost E stimating S ystem (CPES)

WTP DESIGN & CONSTRUCTION COST MODULE

Project Name:	Water Master Plan
Project Number:	325678.A1.04
Project Manager:	Paul Berg
Estimator:	Ed Meyer
Project Description:	6 mgd membrane plant at existing site, with intake on canal at this site
Project Location (City):	Lebanon
Project Location (State):	Oregon
Project Location (Country):	USA
Construction Start Date:	Jun-05
Construction Duration (months):	1
Mid-Point of Construction:	Jul-05

Is This Facility Included in Project? (Yes or No)	SCOPE OF PROJECT	Cost
Yes	Raw Water Screening & Pump Station	$1,020,000
Yes	On-Site Sodium Hypochlorite Generation	$280,000
Yes	Steel Clearwell	$480,000
Yes	High Service Pump Station	$770,000
Yes	Sludge Drying Beds	$300,000
Yes	Gravity Thickener	$320,000
Yes	Pall Micro Filtration - Large Systems: Greater Than 5 mgd	$3,230,000
Yes	Demolition	$50,000

SUBTOTAL - PROJECT COST			$6,450,000
ADDITIONAL PROJECT COSTS:			
Demolition	0.00%		$0
Overall Sitework	2.00%		$130,000
Plant Computer System	2.00%		$130,000
Yard Electrical	3.00%		$190,000
Yard Piping	3.00%		$190,000
Constrained site--work around existing fa	5.00%		$320,000
SUBTOTAL with Additional Project Costs			$7,410,000
CONTRACTOR MARKUPS:			
Overhead	8.00%	$7,410,000	$590,000
Subtotal			$8,000,000
Profit	5.00%	$8,000,000	$400,000
Subtotal			$8,400,000
Mob/Bonds/Insurance	5.00%	$8,400,000	$420,000
Subtotal			$8,820,000
Contingency	20.00%	$8,820,000	$1,760,000
SUBTOTAL with Markups			$10,580,000
ESCALATION (to Mid-Point of Construction):	2.46%	$10,580,000	$260,000
SUBTOTAL with Escalation			$10,840,000
LOCATION ADJUSTMENT FACTOR	100.00%	$10,840,000	$10,840,000
SUBTOTAL - with Local Adjustment Factor			$10,840,000

RED FLAGS:				
1	Rock Excavation			
2	Pile Foundations			
3	Seismic Foundations			
4	Dewatering Conditions			
5	Wetlands Mitigation			
6	Weather Impacts			
7	Depth of Structures			
8	Local Building Code Restrictions			
9	Coatings or Finishes			
10	Building or Architectural Considerations			
11	Client Material Preferences			
12	Client Equipment Preferences			
13	Piping Galleries, Piping Trenches, Piping Racks			
14	Yard Piping Complexity			
15	Existing Site Utilities (New, Retrofit, and Complexity)			
16	I & C Automation (New or Retrofit)			
17	Electrical Feed (New or Retrofit)			
18	Electrical Distribution			
19	Shoring			
20	Contamination			
TOTAL - RED FLAGS				$0
SUBTOTAL - CONSTRUCTION COST with Red Flags				$10,840,000
Did a CH2M HILL Professional Estimator Review This Cost Estimate?			Yes	
If Yes, by whom?			Meyer	$10,840,000
MAXIMUM CONSTRUCTION COST				$10,840,000
NON-CONSTRUCTION COSTS:				$0
Permitting		0.50%	$10,840,000	$50,000
Engineering		8.00%	$10,840,000	$870,000
SDC		6.50%	$10,840,000	$700,000
Commissioning & Startup		0.50%	$10,840,000	$50,000
Land ROW		5.75%	$10,840,000	$620,000
Legal/Admin		0.00%	$10,840,000	$0
0		0.00%	$10,840,000	$0
SUBTOTAL - Non-Construction Costs				$2,290,000
TOTAL - CAPITAL COST				$13,130,000

C H2M HILL P arametric Cost E stimating S ystem (CPES)

WTP DESIGN & CONSTRUCTION COST MODULE

Project Name:	Water Master Plan
Project Number:	325678.A1.04
Project Manager:	Paul Berg
Estimator:	Ed Meyer
Project Description:	6 mgd membrane plant/intake at new site on canal: east of Cheadle Lk, TL207
Project Location (City):	Lebanon
Project Location (State):	Oregon
Project Location (Country):	USA
Construction Start Date:	Jun-05
Construction Duration (months):	1
Mid-Point of Construction:	Jul-05

Is This Facility Included in Project? (Yes or No)	SCOPE OF PROJECT	Cost
Yes	Raw Water Screening & Pump Station	$1,020,000
Yes	On-Site Sodium Hypochlorite Generation	$280,000
Yes	Steel Clearwell	$480,000
Yes	High Service Pump Station	$770,000
Yes	Sludge Drying Beds	$300,000
Yes	Gravity Thickener	$320,000
Yes	Pall Micro Filtration - Large Systems: Greater Than 5 mgd	$3,230,000
Yes	Demolition	$50,000

SUBTOTAL - PROJECT COST				$6,450,000
ADDITIONAL PROJECT COSTS:				
Demolition	0.00%			$0
Overall Sitework	4.00%			$260,000
Plant Computer System	2.00%			$130,000
Yard Electrical	3.00%			$190,000
Yard Piping	3.00%			$190,000
Constrained site--work around existing fa	0.00%			$0
FW pipe: 8200' - 20", 5100' - 16"				$1,200,000
SUBTOTAL with Additional Project Costs				$8,420,000
CONTRACTOR MARKUPS:				
Overhead	8.00%		$8,420,000	$670,000
Subtotal				$9,090,000
Profit	5.00%		$9,090,000	$450,000
Subtotal				$9,540,000
Mob/Bonds/Insurance	5.00%		$9,540,000	$480,000
Subtotal				$10,020,000
Contingency	20.00%		$10,020,000	$2,000,000
SUBTOTAL with Markups				$12,020,000
ESCALATION (to Mid-Point of Construction):	2.46%		$12,020,000	$300,000
SUBTOTAL with Escalation				$12,320,000
LOCATION ADJUSTMENT FACTOR	100.00%		$12,320,000	$12,320,000
SUBTOTAL - with Local Adjustment Factor				$12,320,000

RED FLAGS:				
1	*Rock Excavation*			
2	*Pile Foundations*			
3	*Seismic Foundations*			
4	*Dewatering Conditions*			
5	*Wetlands Mitigation*			
6	*Weather Impacts*			
7	*Depth of Structures*			
8	*Local Building Code Restrictions*			
9	*Coatings or Finishes*			
10	*Building or Architectural Considerations*			
11	*Client Material Preferences*			
12	*Client Equipment Preferences*			
13	*Piping Galleries, Piping Trenches, Piping Racks*			
14	*Yard Piping Complexity*			
15	*Existing Site Utilities (New, Retrofit, and Complexity)*			
16	*I & C Automation (New or Retrofit)*			
17	*Electrical Feed (New or Retrofit)*			
18	*Electrical Distribution*			
19	*Shoring*			
27	*User Defined Red Flag 7*			
TOTAL - RED FLAGS				$0
SUBTOTAL - CONSTRUCTION COST with Red Flags				$12,320,000
Did a CH2M HILL Professional Estimator Review This Cost Estimate?			Yes	
If Yes, by whom?			Meyer	$12,320,000
MAXIMUM CONSTRUCTION COST				$12,320,000
NON-CONSTRUCTION COSTS:				$0
Permitting		0.75%	$12,320,000	$90,000
Engineering		8.00%	$12,320,000	$990,000
SDC		6.50%	$12,320,000	$800,000
Commissioning & Startup		0.50%	$12,320,000	$60,000
Land ROW		0.97%	$12,320,000	$120,000
Legal/Admin		0.00%	$12,320,000	$0
0		0.00%	$12,320,000	$0
SUBTOTAL - Non-Construction Costs				$2,060,000
TOTAL - CAPITAL COST				$14,380,000

C H2M HILL P arametric Cost E stimating S ystem (CPES)

WTP DESIGN & CONSTRUCTION COST MODULE

Project Name:	Water Master Plan
Project Number:	325678.A1.04
Project Manager:	Paul Berg
Estimator:	Ed Meyer
Project Description:	6 mgd membrane plant and intake located at canal headworks
Project Location (City):	Lebanon
Project Location (State):	Oregon
Project Location (Country):	USA
Construction Start Date:	Jun-05
Construction Duration (months):	1
Mid-Point of Construction:	Jul-05

	Is This Facility Included in Project? (Yes or No)	SCOPE OF PROJECT		Cost
	Yes	Raw Water Screening & Pump Station		$1,020,000
	Yes	On-Site Sodium Hypochlorite Generation		$280,000
	Yes	Steel Clearwell		$480,000
	Yes	High Service Pump Station		$770,000
	Yes	Sludge Drying Beds		$300,000
	Yes	Gravity Thickener		$320,000
	Yes	Pall Micro Filtration - Large Systems: Greater Than 5 mgd		$3,230,000
	Yes	Demolition		$50,000
SUBTOTAL - PROJECT COST				$6,450,000
ADDITIONAL PROJECT COSTS:				
Demolition		0.00%		$0
Overall Sitework		4.00%		$260,000
Plant Computer System		2.00%		$130,000
Yard Electrical		3.00%		$190,000
Yard Piping		3.00%		$190,000
Constrained site--work around existing fa		0.00%		$0
FW Pipe, 9900' of 20", 5100' of 16"				$1,370,000
SUBTOTAL with Additional Project Costs				$8,590,000
CONTRACTOR MARKUPS:				
Overhead		8.00%	$8,590,000	$690,000
Subtotal				$9,280,000
Profit		5.00%	$9,280,000	$460,000
Subtotal				$9,740,000
Mob/Bonds/Insurance		5.00%	$9,740,000	$490,000
Subtotal				$10,230,000
Contingency		20.00%	$10,230,000	$2,050,000
SUBTOTAL with Markups				$12,280,000
ESCALATION (to Mid-Point of Construction):		2.46%	$12,280,000	$300,000
SUBTOTAL with Escalation				$12,580,000
LOCATION ADJUSTMENT FACTOR		100.00%	$12,580,000	$12,580,000
SUBTOTAL - with Local Adjustment Factor				$12,580,000

RED FLAGS:				
1	*Rock Excavation*			
2	*Pile Foundations*			
3	*Seismic Foundations*			
4	*Dewatering Conditions*			
5	*Wetlands Mitigation*			
6	*Weather Impacts*			
7	*Depth of Structures*			
8	*Local Building Code Restrictions*			
9	*Coatings or Finishes*			
10	*Building or Architectural Considerations*			
11	*Client Material Preferences*			
12	*Client Equipment Preferences*			
13	*Piping Galleries, Piping Trenches, Piping Racks*			
14	*Yard Piping Complexity*			
15	*Existing Site Utilities (New, Retrofit, and Complexity)*			
16	*I & C Automation (New or Retrofit)*			
17	*Electrical Feed (New or Retrofit)*			
18	*Electrical Distribution*			
19	*Shoring*			
27	*User Defined Red Flag 7*			
TOTAL - RED FLAGS				$0
SUBTOTAL - CONSTRUCTION COST with Red Flags				$12,580,000
Did a CH2M HILL Professional Estimator Review This Cost Estimate?			Yes	
If Yes, by whom?			Meyer	$12,580,000
MAXIMUM CONSTRUCTION COST				$12,580,000
NON-CONSTRUCTION COSTS:				$0
Permitting		1.00%	$12,580,000	$130,000
Engineering		8.00%	$12,580,000	$1,010,000
SDC		6.50%	$12,580,000	$820,000
Commissioning & Startup		0.50%	$12,580,000	$60,000
Land ROW		0.48%	$12,580,000	$60,000
Legal/Admin		0.00%	$12,580,000	$0
0		0.00%	$12,580,000	$0
SUBTOTAL - Non-Construction Costs				$2,080,000
TOTAL - CAPITAL COST				$14,660,000

C H2M HILL P arametric Cost E stimating S ystem (CPES)

WTP DESIGN & CONSTRUCTION COST MODULE

Project Name:	Water Master Plan
Project Number:	325678.A1.04
Project Manager:	Paul Berg
Estimator:	Ed Meyer
Project Description:	6 mgd membrane plant and intake located on river: east of Wheller St, TL 1701, 1703, and 1100
Project Location (City):	Lebanon
Project Location (State):	Oregon
Project Location (Country):	USA
Construction Start Date:	Jun-05
Construction Duration (months):	1
Mid-Point of Construction:	Jul-05

Is This Facility Included in Project? (Yes or No)	SCOPE OF PROJECT		Cost
Yes	Raw Water Screening & Pump Station		$1,720,000
Yes	On-Site Sodium Hypochlorite Generation		$280,000
Yes	Steel Clearwell		$480,000
Yes	High Service Pump Station		$770,000
Yes	Sludge Drying Beds		$300,000
Yes	Gravity Thickener		$320,000
Yes	Pall Micro Filtration - Large Systems: Greater Than 5 mgd		$3,230,000
Yes	Demolition		$50,000
SUBTOTAL - PROJECT COST			$7,150,000
ADDITIONAL PROJECT COSTS:			
Demolition	0.00%		$0
Overall Sitework	4.00%		$290,000
Plant Computer System	2.00%		$140,000
Yard Electrical	3.00%		$210,000
Yard Piping	3.00%		$210,000
Constrained site--work around existing fa	0.00%		$0
FW pipe: 8200' - 20", 5100' - 16"			$1,200,000
SUBTOTAL with Additional Project Costs			$9,200,000
CONTRACTOR MARKUPS:			
Overhead	8.00%	$9,200,000	$740,000
Subtotal			$9,940,000
Profit	5.00%	$9,940,000	$500,000
Subtotal			$10,440,000
Mob/Bonds/Insurance	5.00%	$10,440,000	$520,000
Subtotal			$10,960,000
Contingency	20.00%	$10,960,000	$2,190,000
SUBTOTAL with Markups			$13,150,000
ESCALATION (to Mid-Point of Construction):	2.46%	$13,150,000	$320,000
SUBTOTAL with Escalation			$13,470,000
LOCATION ADJUSTMENT FACTOR	100.00%	$13,470,000	$13,470,000
SUBTOTAL - with Local Adjustment Factor			$13,470,000

RED FLAGS:				
1	Rock Excavation			
2	Pile Foundations			
3	Seismic Foundations			
4	Dewatering Conditions			
5	Wetlands Mitigation			
6	Weather Impacts			
7	Depth of Structures			
8	Local Building Code Restrictions			
9	Coatings or Finishes			
10	Building or Architectural Considerations			
11	Client Material Preferences			
12	Client Equipment Preferences			
13	Piping Galleries, Piping Trenches, Piping Racks			
14	Yard Piping Complexity			
15	Existing Site Utilities (New, Retrofit, and Complexity)			
16	I & C Automation (New or Retrofit)			
17	Electrical Feed (New or Retrofit)			
18	Electrical Distribution			
19	Shoring			
27	User Defined Red Flag 7			
TOTAL - RED FLAGS				$0
SUBTOTAL - CONSTRUCTION COST with Red Flags				$13,470,000
Did a CH2M HILL Professional Estimator Review This Cost Estimate?			Yes	
If Yes, by whom?			Meyer	$13,470,000
MAXIMUM CONSTRUCTION COST				$13,470,000
NON-CONSTRUCTION COSTS:				$0
Permitting		2.00%	$13,470,000	$270,000
Engineering		8.00%	$13,470,000	$1,080,000
SDC		6.50%	$13,470,000	$880,000
Commissioning & Startup		0.50%	$13,470,000	$70,000
Land ROW		1.11%	$13,470,000	$150,000
Legal/Admin		0.00%	$13,470,000	$0
0		0.00%	$13,470,000	$0
SUBTOTAL - Non-Construction Costs				$2,450,000
TOTAL - CAPITAL COST				$15,920,000

C H2M HILL P arametric Cost E stimating S ystem (CPES)

WTP DESIGN & CONSTRUCTION COST MODULE

Project Name:	Water Master Plan
Project Number:	325678.A1.04
Project Manager:	Paul Berg
Estimator:	Ed Meyer
Project Description:	6 mgd river bank wells with disinfection
Project Location (City):	Lebanon
Project Location (State):	Oregon
Project Location (Country):	USA
Construction Start Date:	Jun-05
Construction Duration (months):	1
Mid-Point of Construction:	Jul-05

	Is This Facility Included in Project? (Yes or No)	SCOPE OF PROJECT		Cost
	Yes	On-Site Sodium Hypochlorite Generation		$280,000
	Yes	Steel Clearwell		$480,000
	Yes	High Service Pump Station		$770,000
	Yes	Demolition		$50,000
SUBTOTAL - PROJECT COST				$1,580,000
ADDITIONAL PROJECT COSTS:				
Demolition		0.00%		$0
Overall Sitework		4.00%		$60,000
Plant Computer System		2.00%		$30,000
Yard Electrical		3.00%		$50,000
Yard Piping		3.00%		$50,000
Constrained site--work around existing fa		0.00%		$0
FW pipe: 8200' - 20", 5100' - 16"				$1,200,000
SUBTOTAL with Additional Project Costs				$2,970,000
CONTRACTOR MARKUPS:				
Overhead		8.00%	$2,970,000	$240,000
Subtotal				$3,210,000
Profit		5.00%	$3,210,000	$160,000
Subtotal				$3,370,000
Mob/Bonds/Insurance		5.00%	$3,370,000	$170,000
Subtotal				$3,540,000
Contingency		20.00%	$3,540,000	$710,000
SUBTOTAL with Markups				$4,250,000
ESCALATION (to Mid-Point of Construction):		2.46%	$4,250,000	$100,000
SUBTOTAL with Escalation				$4,350,000
LOCATION ADJUSTMENT FACTOR		100.00%	$4,350,000	$4,350,000
SUBTOTAL - with Local Adjustment Factor				$4,350,000
RED FLAGS:				
1	Rock Excavation			
2	Pile Foundations			

3	Seismic Foundations			
4	Dewatering Conditions			
5	Wetlands Mitigation			
6	Weather Impacts			
7	Depth of Structures			
8	Local Building Code Restrictions			
9	Coatings or Finishes			
10	Building or Architectural Considerations			
11	Client Material Preferences			
12	Client Equipment Preferences			
13	Piping Galleries, Piping Trenches, Piping Racks			
14	Yard Piping Complexity			
15	Existing Site Utilities (New, Retrofit, and Complexity)			
16	I & C Automation (New or Retrofit)			
17	Electrical Feed (New or Retrofit)			
18	Electrical Distribution			
19	Shoring			
20	Contamination			
21	User Defined Red Flag 1			
22	User Defined Red Flag 2			
23	User Defined Red Flag 3			
Did a CH2M HILL Professional Estimator Review This Cost Estimate?			Yes	
If Yes, by whom?			Meyer	$4,350,000
MAXIMUM CONSTRUCTION COST				$4,350,000
NON-CONSTRUCTION COSTS:				$0
Permitting		2.76%	$4,350,000	$120,000
Engineering		8.00%	$4,350,000	$350,000
SDC		6.50%	$4,350,000	$280,000
Commissioning & Startup		0.50%	$4,350,000	$20,000
Land ROW		2.76%	$4,350,000	$120,000
Legal/Admin		0.00%	$4,350,000	$0
Well Development (6 mgd)		31.72%	$4,350,000	$1,380,000
SUBTOTAL - Non-Construction Costs				$2,270,000
TOTAL - CAPITAL COST				$6,620,000

C H2M HILL P arametric Cost E stimating S ystem (CPES)

WTP DESIGN & CONSTRUCTION COST MODULE

Project Name:	Water Master Plan
Project Number:	325678.A1.04
Project Manager:	Paul Berg
Estimator:	Ed Meyer
Project Description:	6 mgd river bank wells with membrane plant
Project Location (City):	Lebanon
Project Location (State):	Oregon
Project Location (Country):	USA
Construction Start Date:	Jun-05
Construction Duration (months):	1
Mid-Point of Construction:	Jul-05

Is This Facility Included in Project? (Yes or No)	SCOPE OF PROJECT	Cost
Yes	On-Site Sodium Hypochlorite Generation	$280,000
Yes	Steel Clearwell	$480,000
Yes	High Service Pump Station	$770,000
Yes	Sludge Drying Beds	$300,000
Yes	Gravity Thickener	$320,000
Yes	Pall Micro Filtration - Large Systems: Greater Than 5 mgd	$2,760,000
Yes	Demolition	$50,000

SUBTOTAL - PROJECT COST				$4,960,000
ADDITIONAL PROJECT COSTS:				
Demolition		0.00%		$0
Overall Sitework		4.00%		$200,000
Plant Computer System		2.00%		$100,000
Yard Electrical		3.00%		$150,000
Yard Piping		3.00%		$150,000
Constrained site--work around existing fa		0.00%		$0
FW pipe: 8200' - 20", 5100' - 16"				$1,200,000
SUBTOTAL with Additional Project Costs				$6,760,000
CONTRACTOR MARKUPS:				
Overhead		8.00%	$6,760,000	$540,000
Subtotal				$7,300,000
Profit		5.00%	$7,300,000	$370,000
Subtotal				$7,670,000
Mob/Bonds/Insurance		5.00%	$7,670,000	$380,000
Subtotal				$8,050,000
Contingency		20.00%	$8,050,000	$1,610,000
SUBTOTAL with Markups				$9,660,000
ESCALATION (to Mid-Point of Construction):		2.46%	$9,660,000	$240,000
SUBTOTAL with Escalation				$9,900,000
LOCATION ADJUSTMENT FACTOR		100.00%	$9,900,000	$9,900,000
SUBTOTAL - with Local Adjustment Factor				$9,900,000

RED FLAGS:				
1	Rock Excavation			
2	Pile Foundations			
3	Seismic Foundations			
4	Dewatering Conditions			
5	Wetlands Mitigation			
6	Weather Impacts			
7	Depth of Structures			
8	Local Building Code Restrictions			
9	Coatings or Finishes			
10	Building or Architectural Considerations			
11	Client Material Preferences			
12	Client Equipment Preferences			
13	Piping Galleries, Piping Trenches, Piping Racks			
14	Yard Piping Complexity			
15	Existing Site Utilities (New, Retrofit, and Complexity)			
16	I & C Automation (New or Retrofit)			
17	Electrical Feed (New or Retrofit)			
18	Electrical Distribution			
19	Shoring			
20	Contamination			
TOTAL - RED FLAGS				$0
SUBTOTAL - CONSTRUCTION COST with Red Flags				$9,900,000
Did a CH2M HILL Professional Estimator Review This Cost Estimate?			Yes	
If Yes, by whom?			Meyer	$9,900,000
MAXIMUM CONSTRUCTION COST				$9,900,000
NON-CONSTRUCTION COSTS:				
Permitting		1.21%	$9,900,000	$120,000
Engineering		8.00%	$9,900,000	$790,000
SDC		6.50%	$9,900,000	$640,000
Commissioning & Startup		0.50%	$9,900,000	$50,000
Land ROW		1.21%	$9,900,000	$120,000
Legal/Admin		0.00%	$9,900,000	$0
6 mgd Well Development		13.94%	$9,900,000	$1,380,000
SUBTOTAL - Non-Construction Costs				$3,100,000
TOTAL - CAPITAL COST				$13,000,000

APPENDIX C

Groundwatrer Evaluation (Golder and Associates Inc.

Golder Associates Inc.
4445 SW Barbur Boulevard, Suite 101
Portland, Oregon 97239
Telephone: (503) 241-9404
Fax: (503) 241-9403
www.golder.com

REVIEW DRAFT

Golder Associates

REGISTERED PROFESSIONAL GEOLOGIST
OREGON
PHILLIP A. BROWN
G1925

TECHNICAL MEMORANDUM

TO: Paul Berg/CH2M HILL
DATE: 12/29/05
FR: Phil Brown
OUR REF: 053-9745-000
RE: City of Lebanon Groundwater Development

1.0 BACKGROUND

The City of Lebanon is completing a water master planning project to develop water demand projections, and determine capital needs and potential alternatives to meet future demand. This memorandum consists of the groundwater development evaluation for the city's Water Master Plan.

1.1 Purpose

The purpose of this analysis is to provide the city with an evaluation of the potential to develop a supplemental groundwater supply to help meet peak summer demands and provide an emergency backup to the surface water supply. As an alternative, river bank wells were considered as a possible replacement to the city's existing supply on the Albany-Santiam Canal. Three major alternatives are considered:

- Develop groundwater supply wells at previously identified locations near the south and southwest portions of the service area (Shannon and Gill sites)
- Develop groundwater supply wells (river bank wells) that target higher permeability sediments near the South Santiam River.
- Develop an aquifer storage and recovery (ASR) system that utilizes the aquifer beneath the city to store treated drinking water delivered from the existing water treatment plant.

The target supply rate for a supplemental source is 1,200 gpm. This rate represents approximately two thirds of the average day demand (the likely curtailment demand) at the end of the planning period (2025).

1.2 Previous Work

In response to a recommendation included in the 1989 city of Lebanon Water Facility Study (KCM), work began in 1993 to evaluate the optimal number, location, and depth of the proposed new groundwater supply wells. Two sites were identified and investigated the Gill site (identified early as

the Stoltz Hill site), and the Shannon site (formerly known as the 5th and Vaughn site). Table 1 shows the chronological sequence of groundwater investigations, the objective of each, and the primary recommendations related to groundwater supply development.

Table 1

City of Lebanon, Groundwater Supply Development History

Project Name	Date	Objective	Actions	Recommendations
City of Lebanon Water Facility Study (KCM).	1989	Prepare Water System Plan.	Planning Study.	Develop groundwater supply to meet demand during WTP shutdown or surface source contamination events.
Preliminary Wellfield Evaluation (Golder Associates). Stoltz Hill (Gill) 5th /Vaughn (Shannon)	1993	Siting evaluation for potential wellfield development.	Comparison of hydrogeology, groundwater contamination potential, permitting, and development costs of several sites.	Install observation wells at Stoltz Hill site and 5th&Vaughn site to evaluate well yield and groundwater quality.
Monitoring Well COLMW-1 Report (Golder Associates). 5th /Vaughn (Shannon)	1995	Evaluate Aquifer Conditions and Groundwater Quality at 5th&Vaughn (aka Sbannon) Site.	Drill, sample, and test an observation well at the 5th &Vaughn site.	An individual well at this site could produce between 150 and 300 gpm. Groundwater quality is good, except manganese is present above the SMCL, and radon is present at concentrations greater than 500 pCi/l.
Monitoring Well COLMW-2 Report (Golder Associates) (Stoltz Hill (Gill))	1995	Evaluate aquifer conditions and groundwater quality at the Stoltz Hill Rd (aka Gill) site.	Drill, sample, and test an observation well at the Stoltz Hill Rd site.	An individual well drilled at this site could produce between 150 and 500 gpm. Permeability is higher than at 5tb&Vaughn. Manganese concentrations are lower, though still above the SMCL. Radon was not analyzed.
Assessment of Sites for Backup Well Project (Golder Associates).	August 2001	Update 1993 well site assessment with new information.	Evaluate new well log and water quality information prior to drilling program.	Develop groundwater supply systems at Gill and Sbannon sites.
Well Construction Site Plan (Golder Associates).	October 2001	Provide preliminary evaluation of site development costs.	Prepare schematic well completion design and cost estimates.	--
Backup Wells COL-1 and COL-2 Drilling and Testing (Golder Associates).	April 2002	Establish Feasibility of Developing a 500 gpm groundwater supply at Gill site.	Drilled, Sampled, and Tested 2 8-inch wells. The deep well (#1) = 150 gpm, has Mn>SMCL, though barely, and declining through the pumping period. Intermediate well (#2) = 100 gpm. Mn<SMCL in deep well.	Develop a 250 gpm system using both wells, blending water to reduce Mn < SMCL. Radon is present >500 pCi/l so stripper recommended.
Assessment of Sites for Lebanon Backup Well (Golder Associates).	July 2002	Evaluate the Shannon and Gill properties for groundwater development.	Evaluate new logs, water quality reports, DEQ files for known contaminated sites and releases, Heather Estates plat map.	Drill 2 additional wells at the Gill site: 1 intermediate and one deep to blend water to below the SMCL for Mn. Secure easements with both landowners.

The studies listed in Table 1 were focused on developing a 500 gpm groundwater supply, with the primary objectives of identifying locations that would:

- Provide a safe and reliable additional source of drinking water for the city; and
- Limit the potential for a Division 9 review to determine whether the pumping would create excessive interference with nearby surface water.

As a result, the locations for the wellfields were carefully selected in locations that appear to be upgradient of known groundwater contamination sources in downtown areas, and greater than 1-mile from the South Santiam river.

1.3 Approach and Methodology

Preliminary demand projections indicate that the city's maximum day demand (MDD) will increase from 3.5 to 5 MGD by 2025. It was determined in a May 18 2005 meeting with city staff that an appropriate target rate for groundwater pumping capacity would be approximately equivalent to two thirds of the average day demand (the likely curtailment demand) at the end of the planning period (2025), or 1,200 gpm.

This work relies on findings and recommendations of previous investigations, DEQ records of groundwater quality issues in the Lebanon vicinity, a review of WRD well logs, and available geologic and hydrogeologic information. The evaluations below were expanded from the original groundwater supply option to include river bank wells and aquifer storage and recovery. A more detailed description of each is provided below.

2.0 RESULTS

The supply rates, water quality issues, risks, permitting, and development approaches for each of the alternatives evaluated are described below.

2.1 Groundwater Supply Development: Shannon and Gill Sites

The previous investigations identified and evaluated two properties near the south and southwestern portion of the service area: the Shannon and Gill properties (Figure 1). These investigations indicated that a 500 gpm of groundwater supply could be developed, but would require both properties.

2.1.1 Supply Rate

Both sites appear capable of supplying approximately 250 to 300 gpm with 2 wells at each site. Each site would target wells in both the intermediate and deep zones to produce blended groundwaters to improve delivered quality (described below). At the Gill site, it appears that there is sufficient available space to add additional wells while maintaining site setback requirements, increasing the yield from this site above 250 gpm. Two additional wells could increase the site-capacity to approximately 500 gpm, resulting in 750 gpm total from both sites. Two production wells were previously installed at the Gill site, so an additional 4 wells (2 at Shannon, and 2 at Gill) are required to achieve this capacity. To meet the 1,200 gpm target for the groundwater supply option, at least one additional property with similar hydraulic characteristics would be required for development.

2.1.2 Water Quality

Groundwater quality is good at both the Gill and Shannon sites with the exception of elevated manganese concentrations and the presence of radon. The deeper zone at each location has manganese concentrations that slightly exceed the secondary MCL, while the intermediate zone concentrations are below the SMCL. At both locations it would be necessary to install two wells to blend water from both the intermediate and deep zones to achieve manganese concentrations below the SMCL. Because of the presence of radon above drinking water quality criteria, water produced from the two sites could not be added directly to the supply system. Instead, groundwater would be pumped directly through new delivery piping to either an existing or new tank/reservoir. At the reservoir, the water would be directed to a splash plate or baffle for aeration, removing the radon prior to delivery.

Groundwater plumes associated with chlorinated solvents have been identified in all zones (shallow, intermediate and deep) beneath downtown, and contaminated industrial sites are present farther to the north. DEQ maintains an Environmental Cleanup Site Information (ECSI) database that lists area of known groundwater contamination in the Lebanon area. Based on reported solvent releases from drycleaners in the central downtown area, DEQ initiated a "site" as Lebanon Area Groundwater Contamination based on solvent detections in the Century Park well. The study area is roughly bounded by Harrison Street to the north, 'D' Street to the south, Hiatt Street to the east, and 10th Street to the west. The ECSI database lists the site history as follows:

> *(1/15/2003 DH/SRS) In August 1990, perchloroethene (PCE) was found in groundwater from the City of Lebanon's Century Park well. Since that time 119 wells have been sampled for volatile organic compounds (VOCs). 48 wells are impacted by VOC contamination; 32 of those contain PCE at up to 232 ppb. The impacted wells cover an area of approximately 0.6 square miles. Shallow groundwater was investigated in December 1993 and April 1995 using a Geoprobe system. VOCs were discovered in shallow groundwater near the locations of several former and current dry-cleaning businesses. Ten monitoring wells were installed in four different locations around Lebanon in December 1994 and January 1995.*
>
> *1/15/2003 DH/SRS) Seven Preliminary Assessments (PAs) were initiated in the Fall of 1995 as a result of DEQ's investigations. Five PAs were performed by DEQ, and two by the potentially responsible parties (PRPs). PCE contamination was identified at six of the seven sites. Two of the sites (ECSI #1694, Poly Clean Center, and ECSI #1695, NuWay Cleaners II) were identified as high priorities, and one site (ECSI #1698, Union Cleaners I) was identified as a medium-high priority. Three sites (ECSI #1696, NuWay Cleaners I; ECSI #1697, Kwik Clean; and ECSI #1699, Union Cleaners II) were given medium-to-low priorities, and one site (ECSI #1613, City of Lebanon Public Works Maintenance Shop) was given an NFA. Investigation and cleanup work is currently ongoing at the Poly Clean Center and the NuWay Cleaners sites, and at Johannsen Cleaners (ECSI #1497). Additional monitoring wells were installed in the summer of 1998. Soil and groundwater sampling continues in the area. DEQ is continuing to identify additional sources of contamination in the area.*
>
> *Soil in the area generally consists of surficial alluvium down to six feet below ground surface (bgs), a "shallow" sand and gravel aquifer from about six to 40 ft bgs, a clay and silt confining layer between 40 and 70 ft bgs, and a "deep" sand and gravel aquifer from 70 to more than 100 ft bgs. Groundwater flow in both aquifers is generally to the north. Contamination in the shallow aquifer generally extends north from known sources (NuWay Cleaners, Johannsen Cleaners, etc.). There are two distinct deep groundwater plumes, one extending north from about 5th & Maple, the other from about Grove ST & Isabella ST.*

The closest of these contaminated sites (5th and Maple) is approximately 2.6 miles north/northeast of the Gill site, and 3.6 miles north of the Shannon site. Oregon law allows for environmental liability to

be assigned to a party that either knowingly or unknowingly influences the distribution of a pre-existing contamination by initiating pumping at a new well.

An assessment of the likely radius of influence of pumping was completed to evaluate the potential for pumping at the Shannon and Gill sites to influence the distribution of the contaminated groundwater identified beneath the downtown area. The Jacob-Theis Equation (1946) was used to estimate the radius of influence of a well in an aquifer with a transmissivity of 900 ft^2/d (average transmissivity defined by the previous site work), pumping at 200 gpm for 30-days. This method predicts a 3.6-mile radius of influence (the distance to less than 0.01 ft of drawdown). This suggests that either new well site has the potential to create a hydraulic influence at this distance downtown (roughly 2.5 miles away). However, it seems unlikely that a significant change in flow fields or contaminant distribution would result as the identified wellfield locations are upgradient. The most likely effect of pumping on the contaminant plumes would be to slow the downgradient migration of contaminated groundwater.

It should be noted that the capture zone of a well is typically much smaller than the radius of influence, and extends predominantly in the upgradient direction. Consequently, it is very unlikely that contaminants associated with the identified sites could be captured by the groundwater supply wells. Permitting agencies (WRD and DEQ) are likely to require a capture zone and influence analysis be completed with a simple analytical flow model to assess the potential hydraulic effects in the vicinity of the chlorinated solvent contamination downtown.

2.1.3 Water Rights

Both the Shannon and Gill sites are located at distances far enough from the South Santiam River that they are not eligible to be considered as additional points of diversion for surface water rights. Consequently, an application for new groundwater rights will be required. The radius of influence of pumping will encompass 2 small creeks in the vicinity of the Gill site, and one at the Shannon site. WRD will require a review to determine if pumping groundwater has the potential to impair flows at these locations and impact either aquatic habitat or senior water rights holders as part of the water right permitting effort. The nature of the new right as an emergency groundwater supply, and the intermittent nature of flow in Oak Creek may limit the potential for the Department to find that the pumping would impair an existing water right or flows in a surface water body. If such a finding did occur, it is possible that it could be addressed with a mitigation plan involving water rights transfers.

2.1.4 Recommendations for Groundwater Supply Development

To further develop the feasibility and costs associated with developing a 1,200 gpm groundwater supply, the following steps are recommended:

1. Assess current ownership of the Shannon and Gill sites. If access agreements or easements have expired in the interval since the last site work, or the properties have changed ownership, the feasibility of developing municipal wellfields at these sites may have changed.

2. Meet with DEQ to discuss the Department's requirements associated with developing a new municipal supply that encompasses areas of known solvent contamination.

3. Meet with WRD to discuss groundwater rights permitting issues in the two areas identified. Assess the water rights situation associated with Oak Creek, and determine whether flow is seasonal. Determine whether the Department considers groundwater appropriations in areas

tributary to the South Santiam River with the potential for significant interference to require mitigation for surface water flow impairment.

4. Discuss blending approach for manganese management with Oregon Health Division staff to evaluate the monitoring requirements, sampling protocol, and radon mitigation.

5. Pending a favorable outcome of the first three steps, develop a 500 gpm wellfield at the Gill site. This has the advantage of using the two wells already installed, and this larger site has the potential to allow additional wells while minimizing interference and maintaining prescribed setbacks.

6. Use the drilling program at the Gill site to explore the potential for additional zones of permeability beneath the base of the deep zone that could be exploited to expand the capacity of the wellfield at that site.

7. Drill, test, and develop two wells at the Shannon site to add an additional 250 to 400 gpm.

8. Identify additional well locations suitable for groundwater development in the event that:

    a. Property ownership has changed and easements/purchase are no longer available for the Shannon and Gill sites

    b. Interference analysis indicates site yields are limited, or pumping rates should be limited to avoid influencing areas on known groundwater contamination.

2.2 River Bank Wells

One groundwater supply alternative is to develop river bank wells near the South Santiam River with the intent of inducing flow from the surface water into groundwater.

2.2.1 Supply Rate

River bank wells completed near a surface water feature generally exhibit higher yields for two reasons:

1. Pumping induces flow from the nearby surface water feature providing a continuous supply of water to the aquifer, thereby limiting drawdown in the well.

2. The chances of encountering shallow higher permeability sand and gravel associated with stream channel deposits increases near the active channel.

River bank wells would be required to be relatively shallow; 50 to 100 feet. Wells screened beneath the clay confining layers are unlikely to be in sufficient hydraulic connection with the river to induce adequate flow to increase well yield.

To evaluate the potential for river bank wells to produce the target 1,200 gpm, well logs for the area south of Lebanon, near the Santiam River, between Cheadle Lake and the Albany-Santiam Canal diversion were collected and analyzed. The logs (available on-line from the Oregon Water Resources Department) encompassed Township 12, Ranges 1 and 2 West. There were 1,034 well records identified in this area with a reported well yield. Of those records, only 18 listed yields in excess of

200 gpm. The high yield wells (>200 gpm) were distributed through the area from downtown Lebanon just north of Cheadle Lake south to Sodaville. There is no apparent correlation between distance from the river and yield, or between depth and yield. Four of the five wells with reported yields of 500 gpm and greater were completed at depths between 50 and 100 feet. Most of these are near Sodaville, one is near the former Cascades Plywood plant near Cheadle Lake, and another is north of the river and completed in basalt.

The review of well logs does not identify a specific area or zone of high permeability sediments (other than near Sodaville) within the service area close to south Lebanon. While the River Mountain school area appears promising from a location standpoint, the well drilled for the school is relatively shallow, sited as far from the river as property boundaries will allow, and yields approximately 50 gpm. This provides little information that will allow an assessment of how a new well would perform closer to the river.

The variability of reported well yields reflects the variability of the stream deposits in the vicinity of the river. This review did not identify high yield wells in the area, and therefore does not allow an estimate of the maximum potential well yield on a particular site. The variable nature of the depositional environment will result in variable thicknesses of high permeability sands and gravels within a relatively small area. The maximum well yield on any near-river site in the Lebanon area will depend on the presence of high-permeability gravels in the shallow subsurface, and the hydraulic connection between those gravels and the river. To provide an estimate of well yield at a selected location, it would be necessary to evaluate permeability and hydraulic connection with the South Santiam River through a geophysical survey to identify the presence of gravels, followed by a drilling and testing program to assess the permeability of the gravels and their hydraulic connection with the river.

2.2.2 Water Quality

River bank wells are designed to induce water to flow into an aquifer from a nearby surface water feature. Studies have shown that river bank wells can remove a substantial percentage of particulates and pathogens from raw surface water.

A portion of the water captured by a river bank well will be groundwater from the aquifer system upgradient of the well. As a result, a well sited near the South Santiam River would capture some groundwater, possibly influenced by the radon and manganese concentrations present in the Lebanon area. However, the relative proportion of groundwater to infiltrated surface water should reach 1:4 or 1:5 after several days (or hours) of pumping, and the overall product should exhibit the primary characteristics of the surface water source. As a result, the water quality from a well source completed in good hydraulic connection with the South Santiam River would not differ markedly from the quality in the existing canal.

The infiltration induced from the nearby surface water feature limits the drawdown in a well, thereby increasing the production capacity. Because drawdown is limited at a given production rate, capture zones extending into the aquifer system away from the river tend to be limited, and the potential for capture of contaminated groundwater is diminished.

River bank wells can be effective in removing suspended material from surface water (turbidity, pathogens, color-causing particulate). In addition, some processes occur in the subsurface (adsorption, natural attenuation) that may reduce levels of dissolved organic compounds from infiltrated surface water.

To add water from a river bank well directly to the supply system (after disinfection), microparticulate analysis (MPA) would be required to demonstrate removal of surface water pathogens to Safe Drinking Water Act (SDWA) standards. The porosity and the length of the flow path (distance from the river), and time of travel (TOT) influence the filtration capacity of the aquifer. In general, finer-grained materials (sand and gravel) have greater filtration capacity than open-network clast-supported gravels. The relatively fine-grained matrix-supported sands and gravels noted in area well logs indicate that a well sited near the South Santiam River has good potential for favorable MPA results.

2.2.3 Water Rights

River bank wells near the South Santiam River would be designed with the intention of inducing flow from the South Santiam River into the aquifer and intentionally affecting river flows. Although the water would be withdrawn from groundwater supply wells, it would be considered (from a source perspective) to be surface water, and would require a surface water right. The likelihood of using the city's existing surface water rights to allow this withdrawal and the necessary actions to achieve this are discussed in Chapter 4.

2.2.3 Recommendations for River Bank Wells Development

To further address the supply capacity and water quality associated with developing river bank wells, the following steps are recommended:

1. Identify properties that have potential for use as a new city wellfield and evaluate ownership and the possibility of acquiring access for site testing.

2. Review the Oregon DEQ ECSI database to evaluate the presence of known releases in the site vicinity.

3. Complete a surface geophysical survey to identify the presence, depth, thickness, and extent of higher permeability gravels on the selected site(s).

4. If an existing well is available, evaluate the well log to assess well construction. If the well is completed in the target zones, develop a testing program using the existing well to assess hydraulic connection with the river and potential site yield.

5. If the geophysical survey indicates the presence of gravel layers or significant lenses beneath the site and no existing well is available, drill a small diameter test well at each selected location and complete site testing to evaluate permeability, hydraulic connection with the river, and likely well (and combined site) yield. Use results to develop a recommendation for installing a larger diameter production well.

6. Select a site; negotiate property acquisition or utility easements, drill, construct, and permit a high capacity well.

7. Complete an MPA testing program to confirm that the delivered water meets filtration requirements and can be disinfected and added to the city's supply system.

8. Perform the water rights actions as described in Chapter 4.

2.3 Aquifer Storage and Recovery

A description of the development pathway for an Aquifer Storage and Recovery (ASR) system is provided here. The city is unlikely to pursue this supply option unless water rights restrictions limit the preceding alternatives' feasibility. ASR is a water management approach that typically uses wells to store treated drinking water in a suitable aquifer system, and recover that water through the same wells at a later date. Aquifer storage displaces the native groundwater and effectively creates an underground reservoir of water than can be recovered for a wide variety of applications. ASR systems have been designed and operated to meet a wide range of objectives at sites with many different physical and hydrological conditions and water sources. The number of active ASR projects in Oregon has increased from 0 in 1995 to 10 in 2005, with at least 20 wells in use or in development.

ASR systems are usually operated to take advantage of available water treatment plant capacity during winter months to store treated water, and recover that water through wells during the summer months to help meet peak demands. In many cases, ASR systems can be designed to meet a primary objective as well as to provide several secondary benefits. In addition to providing a source option, the potential benefits of a Lebanon ASR system include:

- Water quality. Water recovered from an ASR well will primarily reflect the water produced by the water treatment plant. ASR could be utilized to mitigate the radon and manganese concentrations in native groundwater;

- Optimization of water treatment plant capacity, by using recovered water to meet peak demands and extend the length of time before water treatment facility expansion is required;

- Storage capacity can be added at locations within the water supply system where demand is increasing, where there is a benefit to enhancing chlorine residuals, or where there is a benefit to delivering water directly to different pressure zones;

- Creation of environmental benefits through reduction of stress on water-related habitats during dry periods.

2.3.1 Supply Rate

An ASR well will deliver water at the rate associated with any appropriately designed water supply well. The target aquifer systems are usually confined systems both to provide a groundwater protection benefit, and to limit the potential for the interaction with nearby shallow domestic wells and surface water features. Consequently, Lebanon-area ASR wells would have the same location targets and potential yields as the groundwater supply well options (Shannon and Gill sites) unless exploration for higher permeability sites identified better targets. ASR wells would be sited to avoid the locations preferred for river bank wells to avoid the potential for loss of stored water to the South Santiam River.

Based on the evaluation of the Shannon and Gill sites, the most likely yield of any new ASR well would be near 300 gpm. The well log review indicates that where wells encounter greater thickness of higher permeability gravels, well yields are substantially higher. Most of the higher yield wells in the Lebanon area are south and east of the service area. However, similar conditions are likely to exist closer to town. The locations where higher permeability layers are present is difficult to discern from available well logs. The vast majority of the wells drilled in the Lebanon area are relatively shallow wells drilled for domestic supply use, and consequently did not extend further into the aquifer system than was necessary to obtain 5 or 10 gpm.

Because recharge rates are typically held to 75% of the production rates, a 300 gpm production well would recharge in the vicinity of 225 gpm. Over a 6-month recharge period, approximately 58 MG would be stored in the subsurface. If 90% of this volume were recovered to the system with a single well, it would require approximately 4 months to recover.

2.3.2 Water Quality

Recovered water quality in most ASR systems generally reflects the source water, although some mixing with native groundwater does occur. Early in the recovery period the percentage of stored water returning to the well is highest, trending toward a greater proportion of native groundwater with additional pumping time. If necessary, the degree of mixing can be lessened with alternative storage zone development approaches. ASR could be used to mitigate the manganese and (with less certainty) radon concentrations in water supply wells in the Lebanon area.

ASR operations lessen the concern for the potential for pumping to interact with areas of known groundwater contamination because they do not induce movement continuously toward the wellfield. If the ASR system is operated annually to recover the stored water, it is easily demonstrated that the recharge and recovery operations create offsetting directional flow vectors at distance from the ASR facility, resulting in no net change in year-to-year groundwater movement. At distance, the amount of smearing is likely to be considered minor, but would still require an evaluation as part of the permitting process.

2.3.3 Water Rights

Groundwater rights are not required for ASR well operations. The permitting process requires a valid water right to appropriate the source water for storage, and an assessment of the potential for impacts to nearby groundwater users. Because ASR systems typically operate in a fashion that has no net impact on the annual groundwater budget, it is more likely that an ASR system would be viewed as having less impact on nearby surface water features (e.g. Oak Creek) and groundwater supplies than a groundwater extraction wellfield. Consequently, ASR permitting is likely to be less costly, require less stringent mitigation planning, and has a greater chance of success than obtaining a new groundwater right.

2.3.4 Recommendations for ASR Development

In order to evaluate the feasibility of developing an ASR operation to integrate with Lebanon's water supply system, the city should evaluate the following conditions:

1. Identify whether ASR development costs at the Shannon and Gill sites are higher or lower than the costs to build onsite reservoirs or dedicated piping to existing reservoirs for radon management.

2. Evaluate whether there are portions of the service area that could benefit from additional pressure, chlorine residual, or supply in addition to the benefit of having an additional source in the event of WTP shutdown or quality problems in the watershed.

3.0 CONCLUSIONS AND RECOMMENDATIONS

There are three groundwater-focused supply options identified for the City of Lebanon. The options and associated limitations to each are summarized Table 2.

The option of using new groundwater wells was investigated as a possible approach for obtaining a supplemental supply for the city. However, it is unlikely to yield the 1,200 gpm target capacity without identifying, testing, and developing sites in addition to the Shannon and Gill properties. Likewise, while ASR may provide several water management benefits, this option shares the disadvantage of likely requiring an additional wellfield location to meet the 1,200 gpm target capacity. No other favorable wellfield locations were identified in this analysis.

River bank wells may provide an alternative to replace the city's existing supply on the Santiam Canal. This may fit with the city's overall supply development and treatment goals as discussed in Chapter 6 of this report. River bank wells may be favorable because of the following advantages:

1. Relatively higher per-well yield, and therefore lower development costs
2. The greatest potential for high-quality delivered water
3. The least potential to interfere with contaminant issues in other areas

The city has identified two sites with the potential for river bank well development. The recommended approach for evaluating the best site is to rank them on the basis of site investigations to identify hydraulic and subsurface characteristics. Site investigations should include:

- Electrical resistivity surveys at each location to evaluate the presence of shallow bedrock and permeable gravels at depths likely to be in hydraulic connection with the South Santiam River.
- An evaluation of aquifer hydraulic properties using an existing onsite well (if available) or adjacent irrigation well (if available and access permits).
- If the geophysical surveys indicate positive stratigraphic relationships, a test well will be drilled at each location to confirm the subsurface stratigraphy, and to complete an aquifer test to assess
    - Aquifer hydraulics;
    - Hydraulic connection to the nearby river;
    - Likely yield of a production well;
    - Likely well interference, appropriate spacing, and wellfield capacity of a river bank well system installed at the selected site.

With this information, the city will be able to decide whether river bank wells are the best option for a backup water supply. If feasible, the site-specific information could then be used to design the river bank well system to provide the optimal well yield while maximizing the potential for sufficient removal for filtration credit. If achieving sufficient supply appears feasible, the city could complete an analysis that will lead to development of engineering, site acquisition and development, permitting, drilling, testing, and construction costs for the project.

APPENDIX D

Design and Operating Criteria

EXHIBIT D-1
Recommended Design and Operating Criteria

No.	Item	Applicable Regulations	Recommended Criteria	Basis for Recommendation	Discussion
1	Residential fire flows	Oregon Drinking Water Program (DWP): maintain 20 psi at all times	1,750 gpm (minimum) for 2 hours, at a minimum residual pressure of 20 psi, superimposed over maximum day demands.	ISO, the nation's leading source for ranking fire suppression effectiveness, downgrades a community's insurance rating unless: a) at least 1,000 gpm is available for 2 hours for houses situated such that the spacing between houses is 11 to 30 feet. b) at least 1,500 gpm is available for 2 hr if spacing is <=10 ft. c) at least 1,750 gpm for 2 hours for houses over 3600 sf.	*Recommended Standards for Water Works* ('Ten States Standards') indicates that fire flows shall meet ISO standards. California Administrative Code requires 750 gpm minimum for residential one story, single family dwellings on average sized lots, and 2,000 gpm for more densely built areas, apartments, and light commercial. Oregon has no flow requirements, but does require 20 psi at all times. ISO standards also call for residual pressure of 20 psi.
2	Residential fire storage volumes		210,000 gallons	Equal to 1,750 gpm for 2 hours, based on ISO criteria.	
3	Non-residential fire flows: schools, other habitational buildings, commercial, and industrial	Appendix B - 2004 Oregon Fire Code table (Section B106) for minimum fire flows at various type facilities.	3,500 gpm (minimum) for 3 hours, at a minimum residual pressure of 20 psi superimposed over maximum day demands (This is less than the value in the 1989 master plan, which was 5,000 gpm for 4 hours)	ISO downgrades a community's insurance rating unless at least 3,500 gpm is available for 3 hours for habitational buildings such as schools. This category also includes care centers and light commercial.	See discussion for residential fire flows. No Oregon requirements.
4	Non-residential fire storage volumes: schools, other habitational buildings, commercial, and industrial		630,000 gallons (or 1,200,000 gallons if 5000 gpm for 4 hours is used)	Equal to 3500 gpm for 3 hours	
5	Hydrant spacing		1,000 feet maximum	ISO credits hydrants for up to 1,000 gpm if located within 300 feet of structure, for 670 gpm if located 301 to 600 feet from structure, and for 250 gpm if located from 601 to 1000 feet from structure. A spacing of 1,000 feet maximum would ensure at least 1,000 gpm is available to each house.	No Oregon requirements
6	Hydrant type		Provide at least one large pumper outlet.	ISO downgrades fire hydrants that do not have at least one large pumper outlet.	
7	Residential piping: sizes and looping		12-inch-diameter outer loops (for <= 1-mile square), 8-inch-diameter internal grid, and 6-inch-diameter in cul-de-sacs or short sections (for <250 feet length). Limit velocities to approximately 6-8 fps for peak hour demands. Limit velocities to 10 fps for fire flows.	Follows Washington Administrative Code for sizing pipe networks, except that the Washington standards require a 6-inch minimum for cul-de-sacs. (Washington standards are silent on velocities.) In addition, the Ten States Standards requires a minimum of 6-inch-diameter mains. OARs only state that dead-end lines shall be minimized, but do not have other sizing requirements.	Several states require a minimum of 6-inch-diameter mains, and indicate that dead-end lines shall be minimized. Proliferation of cul-de-sacs means that the criterion of allowing 6-inch-diameter dead-end mains up to 250 feet in length may result in a system that is not well-looped. Therefore, it is critical to confirm acceptable of dead-end lines using hydraulic model.

EXHIBIT D-1
Recommended Design and Operating Criteria

No.	Item	Applicable Regulations	Recommended Criteria	Basis for Recommendation	Discussion
8	Transmission mains: sizing		Evaluate on a case-by-case basis, based on allowable head loss. Velocities up to 8-10 fps are acceptable for peak hour demands.	Peak hour demands are uncommon, and sizing a transmission main for velocities of 8-10 fps will result in lower velocities a large percentage of the time.	Washington Administrative Code states that transmission lines shall be designed to maintain >=35 psi, except when directly adjacent to storage tanks.
9	Operating pressures	Oregon: minimum is 20 psi	Normal (any time except during fire flows): 40 - 80 psi at the customer connections. Minimum for fire flows: 20 psi.	Oregon requires a minimum of 20 psi at all times, as do most states. The 40-80 psi normal range is a reasonable target, recognizing that it may be acceptable in some cases for the minimum to drop below 40 psi and still provide acceptable service. Pressures above 80 psi may require an individual PRV at the service connection.	Oregon is silent on pressure except for the 20 psi minimum. Washington requires 30-110 psi, California 25-125 psi, Texas >35 psi, and Pennsylvania 25-125 psi. Ten States Standards indicates that normal working pressures should be 60-80 psi, and not less than 35 psi.
10	Equalization storage volume		25% of maximum day demand	A typical value for community water systems.	Only general guidance is provided by states, indicating that equalization storage should consider daily use patterns.
11	Emergency storage volume		Two times the average day demand	A typical value for community water systems.	Washington regulations indicate that emergency storage may be reduced when there is a second independent supply; does not apply for Lebanon with only one source
12	Total storage		Sum of fire, equalization, and emergency storage volumes		Washington codes allow a system to provide the total of the equalization storage plus the larger of the emergency or fire volumes. This approach assumes that a fire will not occur concurrently with an emergency failure. (It may not be appropriate for a city such as Lebanon that has only a single source.)
13	Valve exercising		All valves every 3 years with the flushing program.	Annual valve exercising is commonly recommended for all valves; however, this is probably not practical. Lebanon should focus on critical valves.	States do not provide guidance on valve exercising.
14	Water age/chlorine residual/HPC		Measurable free chlorine residual; HPC counts < 100 cfu/mL	The critical water age is system-specific. EPA has a value for HPC as a non-regulated surrogate of 500 cfu/mL. A value of 100 cfu/mL is therefore considered conservative in protecting water quality. Together with maintaining a measurable chlorine residual, these are the best available practices for ensuring safe drinking water in the distribution system.	One further criterion that may be considered is to limit the maximum water age in the system, particularly if a long water age can be associated with low chlorine residuals or high HPC counts. Water age determinations require an extended period model. May be a need for summer and winter management policies.
15	Sizing for booster pump stations		Provide maximum day demand over 24 hours, with largest pump out of service	A typical value for community water systems.	
16	Number of pumps for booster pump stations		A minimum of three	A typical value for community water systems.	

EXHIBIT D-1
Recommended Design and Operating Criteria

No.	Item	Applicable Regulations	Recommended Criteria	Basis for Recommendation	Discussion
17	Pipe materials		Use ductile iron pipe as standard. May be reasonable to consider HDPE or steel for large transmission lines, with cathodic protection for steel lines.	Ductile iron pipe is the industry standard. City should consider other materials in addition to DI under special conditions; for example, HDPE for long transmission lines that have few fittings and connections, and particularly if located in corrosive soils. The availability of domestically produced DI or steel may also be a factor.	
18	Backflow prevention standards		Fulfill Oregon's rules: Service connections to premises that are identified by the Oregon DHS's table requiring premise isolation (health hazard situations) shall have either an air gap in the service or an approved reduced pressure principle type of assembly with no exceptions.	Oregon's backflow rules are comprehensive and defensible	
19	Water quality monitoring in distribution system		Monitor for chlorine residual using on-line instruments at locations prone to low residuals or high water age. Consider additional instruments for monitoring flows out of reservoirs.	More comprehensive sampling in distribution system helps to ensure that high quality water is delivered to all customers. In addition, it provides value from a water system security standpoint.	Base site selection on field data (locations with low chlorine residuals) or by using an extended period simulation model.
20	Water use record keeping	Oregon DWP has some record-keeping requirements	Track average day, maximum day, and monthly total demands. Document and summarize annually. Track within individual service levels to extent possible. Install meters to monitor flows entering and leaving service zones. Develop monthly and annual numbers for unaccounted water.	These data are very helpful for planning purposes, and are time-consuming or impossible to generate if not recorded on a regular basis.	
21	Main Flushing		Every 6 months for dead-end and problem areas; goal for entire system is once every 3 years.		Use flush end to get 5 fps: 4" for 6" line; 6" for 8" line.
22	Reservoir inspection/cleaning		Inspections once every 3 years using divers; cleaned only as inspection shows need		
23	Reservoir turnover in base level		Set goal as 3-5 days but realize that it may not be feasible to achieve this goal.	AWWA recommends complete turnover every 3-5 days	Depends on water quality and if problems have occurred in system.

EXHIBIT D-1
Recommended Design and Operating Criteria

No.	Item	Applicable Regulations	Recommended Criteria	Basis for Recommendation	Discussion
24	Use of closed-end pumping systems in place of reservoir storage		15 or fewer homes preferred on a dead-end; 30 homes max. Cost of running the pump station (energy, mtce., & general upkeep) should be determined and weighed against other options. Where there is no other benefit to existing water system customers, the true operating cost of the facility should be covered by the homeowners.	Although it is desirable to serve all customers with gravity storage, there may be an unacceptably high cost to serve small groups of homes with a reservoir, and using a reservoir for this application may result in water quality problems.	
25	Isolation valving		Maximum of 4 valves to close in order to isolate segment		
26	Number of services on an isolation segment		Not more than 20 homes max		
27	Poor quality water resulting from installing fire hydrants at the end of a dead-end line, often the result of installing a hydrant on the opposite side of the road from the water main.		Install dead-end hydrants as close as possible to pipeline	Good practice to reduce stagnant water	
28	Installation of flush ends on dead-end mains in cul-de-sacs.		Use flush ends for dead-end mains	Good practice to reduce stagnant water	
29	Provision of emergency generators for booster pump stations		Only provide for closed end pump stations (those serving an area without gravity storage)	Provides reliability for closed end systems; otherwise, storage tank provides needed reliability	
30	Pump stations: backup power connections		Provide as standard for new pump stations	Low cost to include in new pump station designs	
31	Reservoir design: inlet/outlet piping	DHS: "When 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 to prevent degradation of the water quality..." (OAR 333-061-0050 (7))	Provide separate inlet/outlet piping for all new reservoirs; include inlet riser pipe (keep top below normal operating level so as not introduce extra pumping head).		
32	Drinking water materials and additives	Comply with ANSI/NSF Standard 60 and 61	Comply with ANSI/NSF Standard 60 and 61	Meet Oregon drinking water regulations	
33	Master plan: update schedule		Annual minor updates; more significant review every 5 years; comprehensive review every 10 years		

EXHIBIT D-1
Recommended Design and Operating Criteria

No.	Item	Applicable Regulations	Recommended Criteria	Basis for Recommendation	Discussion
34	5-Year capital improvements plans (CIPs)		Proposed: Annual updates; ensure that 5-year plans follow general guidelines of the master plan. Plan shall be within financial guidelines of water division, and shall be balanced and prioritized so that rate increases are justified		

APPENDIX E

Financial Plan Data

EXHIBIT E-1
City of Lebanon
Water System Plan
Sources and Uses of Funds

Item	Proposed FY 2006-7	Forecast FY 2007-8	Forecast FY 2008-9	Forecast FY 2009-10	Forecast FY 2010-11	Forecast FY 2011-12	Forecast FY 2012-13	Forecast FY 2013-14	Forecast FY 2014-15	Forecast FY 2015-16
Water Utility (430)										
Sources of Funds										
Beginning Balance	$374,000	$101,688	$119,988	$131,593	$136,851	$234,427	$476,893	$883,917	$1,262,565	$1,368,521
Deposits Received	40,000	40,700	41,400	42,100	42,800	43,500	44,200	44,900	45,700	46,500
Water Fees	2,320,000	2,889,774	3,158,736	3,452,689	3,774,087	4,125,337	4,509,287	4,928,853	5,387,494	5,888,859
Credit Checks	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500
Interest on Investments	20,000	4,576	5,399	5,922	6,158	10,549	21,460	39,776	56,815	61,583
Misc Revenue	110,000	110,000	110,000	110,000	110,000	110,000	110,000	110,000	110,000	110,000
Net Bond Proceeds	-	1,250,000	1,800,000	1,500,000	-	1,000,000	-	6,100,000	6,000,000	5,000,000
Total Sources of Funds	*$2,865,500*	*$4,398,238*	*$5,237,023*	*$5,243,804*	*$4,071,396*	*$5,525,313*	*$5,163,341*	*$12,108,946*	*$12,864,075*	*$12,476,963*
Uses of Funds										
Personal Services	$860,342	$908,473	$959,695	$1,014,231	$1,072,321	$1,134,224	$1,200,219	$1,270,607	$1,345,712	$1,425,886
Materials & Services	534,226	539,979	573,201	608,662	646,533	686,987	730,221	776,437	825,869	878,762
Capital Outlay	69,592	44,148	45,782	47,476	49,232	51,054	52,943	54,902	56,933	59,040
Noncapital Transfers	682,302	716,263	750,377	786,275	825,589	866,868	910,212	955,722	1,003,508	1,053,684
Transfer to Eqpt Acq & Rep Fund	33,300	34,532	35,810	37,135	38,509	39,934	41,411	42,943	44,532	46,180
Transfer to Water CIP	-	1,250,000	1,800,000	1,500,000	-	1,000,000	-	6,100,000	6,000,000	5,500,000
Transfer to Small Wtr Line Replacment	456,000	*476,054*	*497,002*	*518,883*	*541,740*	*565,616*	*590,559*	*616,615*	*643,836*	*672,274*
Transfer to Water Bond	128,050	308,801	443,563	594,291	663,046	703,737	753,860	1,029,155	1,575,163	2,075,797
Unreserved Ending Fund Balance	-	9,544	15,140	14,018	104,743	339,937	739,237	1,109,681	1,206,920	594,473
Contingency	101,688	110,443	116,453	122,832	129,684	136,957	144,680	152,883	161,601	170,869
Total Uses of Funds	*$2,865,500*	*$4,398,238*	*$5,237,023*	*$5,243,804*	*$4,071,396*	*$5,525,313*	*$5,163,341*	*$12,108,946*	*$12,864,075*	*$12,476,963*
Water Utility CIP (435)										
Sources of Funds										
Beginning Balance	$676,086	$666,632	$2,202,351	$8,516	$733,692	$53,348	$777,489	$442,841	$112,008	$220,160
Interest on Investments	$10,000	29,998	99,106	383	33,016	2,401	34,987	19,928	5,040	9,907
Transfer from Water Fund	$0	$3,800,000	$110,000	$2,100,000	$325,000	$1,800,000	$750,000	$6,400,000	$6,500,000	$6,500,000
Total Sources of Funds	*$686,086*	*$4,496,630*	*$2,411,456*	*$2,108,900*	*$1,091,708*	*$1,855,748*	*$1,562,476*	*$6,862,768*	*$6,617,048*	*$6,730,067*
Uses of Funds										
Transfers	19,454	-	-	-	-	-	-	-	-	-
CIP	-	2,294,280	2,402,940	1,375,208	1,038,360	1,078,260	1,119,635	6,750,760	6,396,889	6,625,053
Ending Fund Balance	666,632	2,202,351	8,516	733,692	53,348	777,489	442,841	112,008	220,160	105,014
Total Uses of Funds	*$686,086*	*$4,496,630*	*$2,411,456*	*$2,108,900*	*$1,091,708*	*$1,855,748*	*$1,562,476*	*$6,862,768*	*$6,617,048*	*$6,730,067*

EXHIBIT E-1
City of Lebanon
Water System Plan
Sources and Uses of Funds

Item	Proposed FY 2006-7	Forecast FY 2007-8	Forecast FY 2008-9	Forecast FY 2009-10	Forecast FY 2010-11	Forecast FY 2011-12	Forecast FY 2012-13	Forecast FY 2013-14	Forecast FY 2014-15	Forecast FY 2015-16
Small Waterline Replacement Fund										
Sources of Funds										
Beginning Balance	63,000	65,000	67,925	70,982	74,176	77,514	81,002	84,647	88,456	92,437
Interest on Investments	$2,000	$2,925	$3,057	$3,194	$3,338	$3,488	$3,645	$3,809	$3,981	$4,160
Transfer from Water Fund	456,000	476,054	497,002	518,883	541,740	565,616	590,559	616,615	643,836	672,274
Total Sources of Funds	$521,000	$543,979	$567,983	$593,059	$619,253	$646,618	$675,206	$705,071	$736,272	$768,870
Uses of Funds										
Personal Services	$262,549	$273,051	$283,974	$295,332	$307,146	$319,432	$332,209	$345,497	$359,317	$373,690
Materials & Services	$158,996	$166,945	$175,293	$184,057	$193,260	$202,923	$213,069	$223,723	$234,909	$246,654
Capital Outlay	$9,246	$9,588	$9,943	$10,311	$10,692	$11,088	$11,498	$11,924	$12,365	$12,822
Transfers Out	$25,209	$26,469	$27,793	$29,182	$30,642	$32,174	$33,782	$35,471	$37,245	$39,107
Ending Fund Balance	62,393	67,925	70,982	74,176	77,514	81,002	84,647	88,456	92,437	96,596
Contingency	2,607									
Total Uses of Funds	$521,000	$543,979	$567,983	$593,059	$619,253	$646,618	$675,206	$705,071	$736,272	$768,870
SDC Funds (Combined Funds 892 & 893)										
Sources of Funds										
Beginning Balance	$441,000	$422,927	$229,268	$27,706	$7,888	$8,103	$9,515	$12,155	$16,052	$21,237
SDC Princ-Assess	31,000	36,870	38,234	39,648	41,115	42,637	44,214	45,850	47,547	49,306
SDC Principal	70,000	83,254	86,334	89,529	92,841	96,276	99,839	103,533	107,363	111,336
SDC Interest	620	737	765	793	822	853	884	917	951	986
Interest on Investments	9,500	19,032	10,317	1,247	462	842	1,252	1,695	2,172	2,685
Total Sources of Funds	$552,120	$562,820	$364,918	$158,923	$143,129	$148,711	$155,705	$164,150	$174,085	$185,550
Uses of Funds										
Personal Services	$49,756	$51,746	$53,816	$55,969	$58,207	$60,536	$62,957	$65,476	$68,095	$70,818
Materials & Svcs	55,291	31,806	33,396	35,066	36,819	38,660	40,593	42,622	44,754	46,991
Capital Outlay	20,000	250,000	250,000	60,000	40,000	40,000	40,000	40,000	40,000	50,000
Transfer to Info System Svc	3,846	-	-	-	-	-	-	-	-	-
Transfer to Equpt Acq & Rep Fund	300	-	-	-	-	-	-	-	-	-
Ending Fund Balance	300,000	229,268	27,706	7,888	8,103	9,515	12,155	16,052	21,237	17,740
Contingency	122,927	-	-	-	-	-	-	-	-	-
Total Uses of Funds	$552,120	$562,820	$364,918	$158,923	$143,129	$148,711	$155,705	$164,150	$174,085	$185,550

EXHIBIT E-2
City of Lebanon
Water System Plan
Projected Operating Results

			FY 2006-7	FY 2007-8	FY 2008-9	FY 2009-10	FY 2010-11	FY 2011-12	FY 2012-13	FY 2013-14	FY 2014-15	FY 2015-16
Beginning Balance			$374,000	$101,688	$119,988	$131,593	$136,851	$234,427	$476,893	$883,917	$1,262,565	$1,368,521
Sales Revenue (existing rates)			$2,320,000	$2,311,819	$2,350,687	$2,390,179	$2,430,393	$2,471,244	$2,512,786	$2,554,966	$2,597,871	$2,641,517
Additional Revenue from Rate Increase												
Year	*Percent*	*% of Initial FY Effec.*										
FY 2007-8	25.00%	100%		$577,955	$587,672	$597,545	$607,598	$617,811	$628,197	$638,741	$649,468	$660,379
FY 2008-9	7.50%	100%			$220,377	$224,079	$227,849	$231,679	$235,574	$239,528	$243,550	$247,642
FY 2009-10	7.50%	100%				$240,885	$244,938	$249,055	$253,242	$257,493	$261,817	$266,215
FY 2010-11	7.50%	100%					$263,308	$267,734	$272,235	$276,805	$281,453	$286,182
FY 2011-12	7.50%	100%						$287,814	$292,653	$297,565	$302,562	$307,645
FY 2012-13	7.50%	100%							$314,601	$319,882	$325,254	$330,719
FY 2013-14	7.50%	100%								$343,873	$349,648	$355,522
FY 2014-15	7.50%	100%									$375,872	$382,187
FY 2015-16	7.50%	100%										$410,851
Subtotal Additional Revenue			$0	$577,955	$808,049	$1,062,509	$1,343,694	$1,654,094	$1,996,501	$2,373,887	$2,789,623	$3,247,342
Total Sales Revenue			$2,320,000	$2,889,774	$3,158,736	$3,452,689	$3,774,087	$4,125,337	$4,509,287	$4,928,853	$5,387,494	$5,888,859
				24.6%	*9.3%*	*9.3%*	*9.3%*	*9.3%*	*9.3%*	*9.3%*	*9.3%*	*9.3%*
Other Revenue												
Deposits Received			40,000	40,700	41,400	42,100	42,800	43,500	44,200	44,900	45,700	46,500
Credit Checks			1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500
Interest on Investments			20,000	4,576	5,399	5,922	6,158	10,549	21,460	39,776	56,815	61,583
Misc Revenue			110,000	110,000	110,000	110,000	110,000	110,000	110,000	110,000	110,000	110,000
Total Resources			$2,491,500	$3,046,550	$3,317,035	$3,612,210	$3,934,546	$4,290,887	$4,686,448	$5,125,029	$5,601,510	$6,108,442
Revenue Requirements												
Personnel & M&S			$1,394,568	$1,448,452	$1,532,896	$1,622,893	$1,718,854	$1,821,211	$1,930,440	$2,047,044	$2,171,581	$2,304,648
Noncapital Transfers			682,302	716,263	750,377	786,275	825,589	866,868	910,212	955,722	1,003,508	1,053,684
Operation & Maintenance			$2,076,870	$2,164,715	$2,283,273	$2,409,168	$2,544,443	$2,688,079	$2,840,651	$3,002,766	$3,175,090	$3,358,332
Net Revenue Avail. For Debt Svc			$414,630	$881,835	$1,033,762	$1,203,042	$1,390,103	$1,602,807	$1,845,796	$2,122,264	$2,426,420	$2,750,111

EXHIBIT E-2
City of Lebanon
Water System Plan
Projected Operating Results

	FY 2006-7	FY 2007-8	FY 2008-9	FY 2009-10	FY 2010-11	FY 2011-12	FY 2012-13	FY 2013-14	FY 2014-15	FY 2015-16
Debt Service										
Future	$0	$56,484	$194,345	$343,504	$411,284	$456,471	$501,658	$777,590	$1,324,853	$1,822,327
Existing	$124,200	$252,318	$249,218	$250,788	$251,763	$247,266	$252,203	$251,565	$250,310	$253,470
Total Debt Service	$124,200	$308,801	$443,563	$594,291	$663,046	$703,737	$753,860	$1,029,155	$1,575,163	$2,075,797
Debt Service Coverage	*3.34*	*2.86*	*2.33*	*2.02*	*2.10*	*2.28*	*2.45*	*2.06*	*1.54*	*1.32*
Other Sources of Funds										
Bond Proceeds	$0	$1,250,000	$1,800,000	$1,500,000	$0	$1,000,000	$0	$6,100,000	$6,000,000	$5,000,000
Subtotal Other Sources of Funds	$0	$1,250,000	$1,800,000	$1,500,000	$0	$1,000,000	$0	$6,100,000	$6,000,000	$5,000,000
Other Expenditures										
Routine Capital Outlay	$69,592	$44,148	$45,782	$47,476	$49,232	$51,054	$52,943	$54,902	$56,933	$59,040
Transfers to Equip/Rep Fund	$33,300	$34,532	$35,810	$37,135	$38,509	$39,934	$41,411	$42,943	$44,532	$46,180
Rate Funded CIP	$456,000	$1,726,054	$2,297,002	$2,018,883	$541,740	$1,565,616	$590,559	$6,716,615	$6,643,836	$6,172,274
Total Other Expenditures	$558,892	$1,804,734	$2,378,594	$2,103,494	$629,480	$1,656,604	$684,913	$6,814,460	$6,745,301	$6,277,494
Total Requirements	$2,759,962	$4,278,250	$5,105,430	$5,106,953	$3,836,969	$5,048,420	$4,279,424	$10,846,381	$11,495,554	$11,711,622
Ending Operating Balance	$105,538	$119,988	$131,593	$136,850	$234,427	$476,893	$883,916	$1,262,565	$1,368,521	$765,341
Unreserved	$3,850	($61,562)	($59,836)	($65,066)	$21,248	$251,759	$646,087	$1,011,250	$1,102,875	$484,461
Reserved (Contingency)	101,688	181,550	191,429	201,916	213,179	225,134	237,830	251,315	265,646	280,880
Monthly Bill Resid Bill Winter*	$25.24	$31.55	$33.92	$36.46	$39.19	$42.13	$45.29	$48.69	$52.34	$56.27
Monthly Bill Resid Bill Summer*	$27.70	$34.63	$37.22	$40.01	$43.01	$46.24	$49.71	$53.44	$57.44	$61.75
*Based on 6/8 ccf winter/summer use; 3/4" meter		25.0%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%